HOW TO KEEP YOUR DATSUN L-SERIES/Z-SERIES NISSAN ALIVE

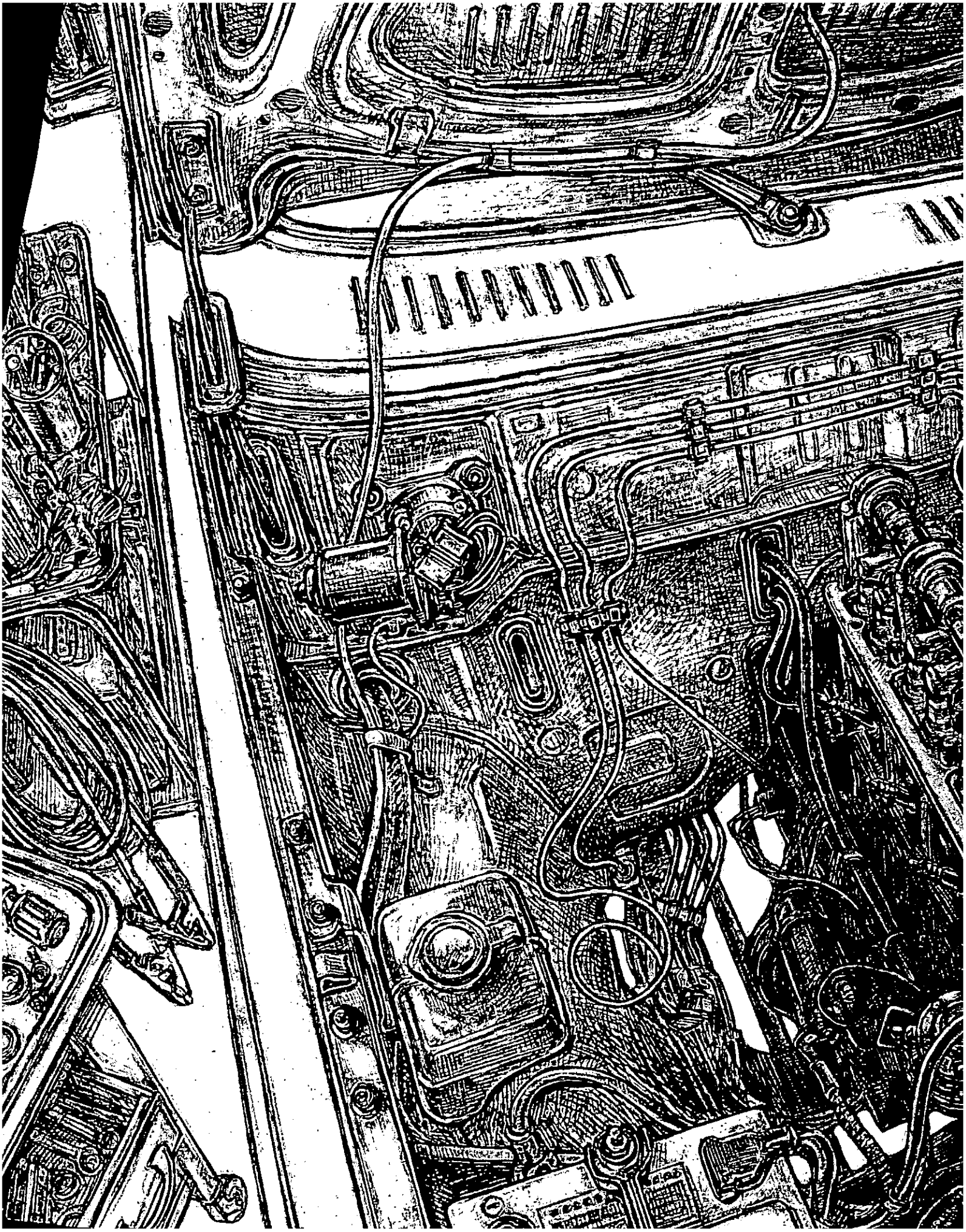
MAINTENANCE & REPAIR 1968-1986

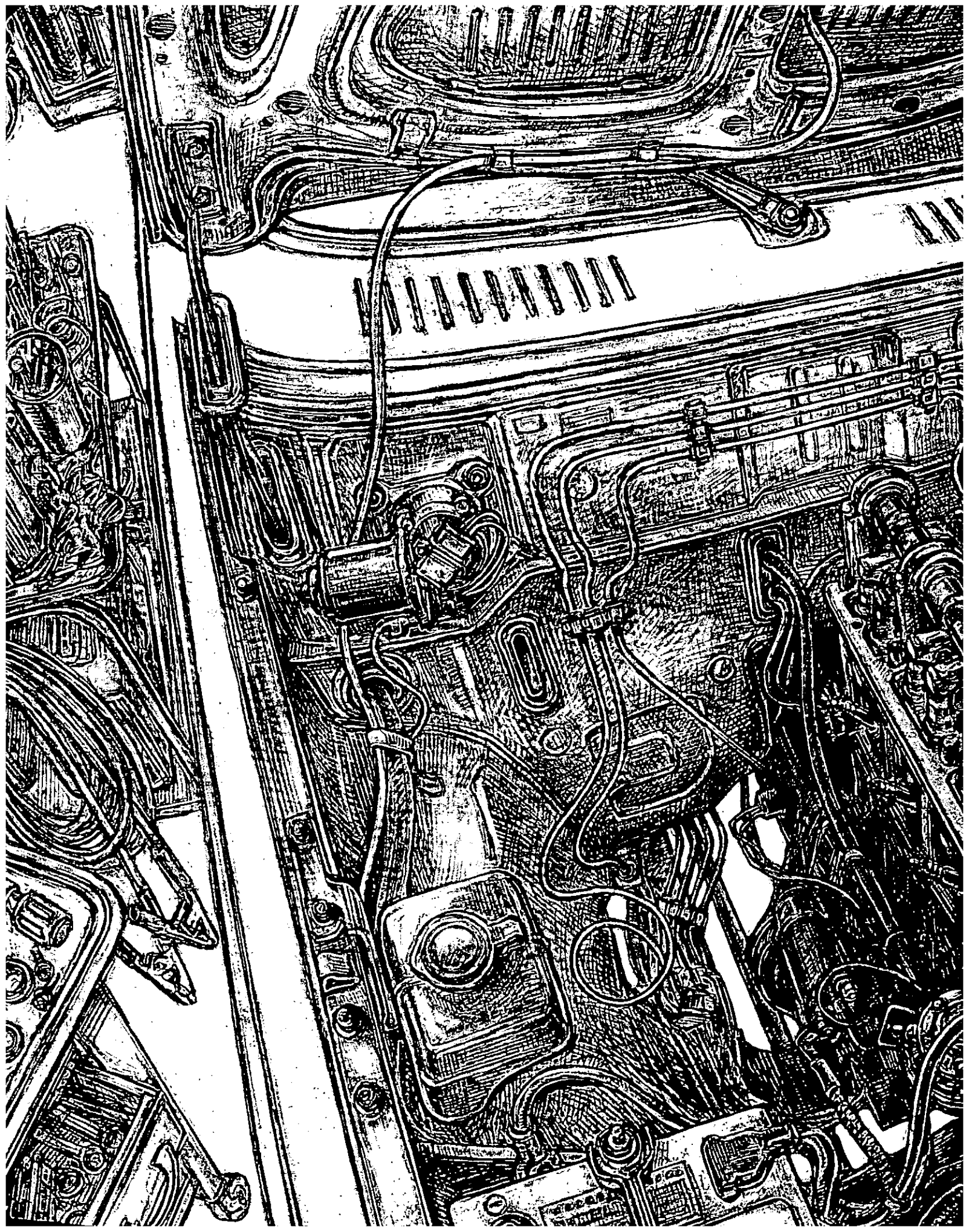
510·610·710
521·620·720

CARS & TRUCKS

BY COLIN MESSER

JOHN MUIR PUBLICATIONS





HOW TO KEEP YOUR DATSUN NISSAN

L-SERIES • Z-SERIES

Alive

For

1968–1986

510 · 610 · 710
521 · 620 · 720

Cars & Trucks

by

COLIN MESSER

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John Muir PUBLICATIONS
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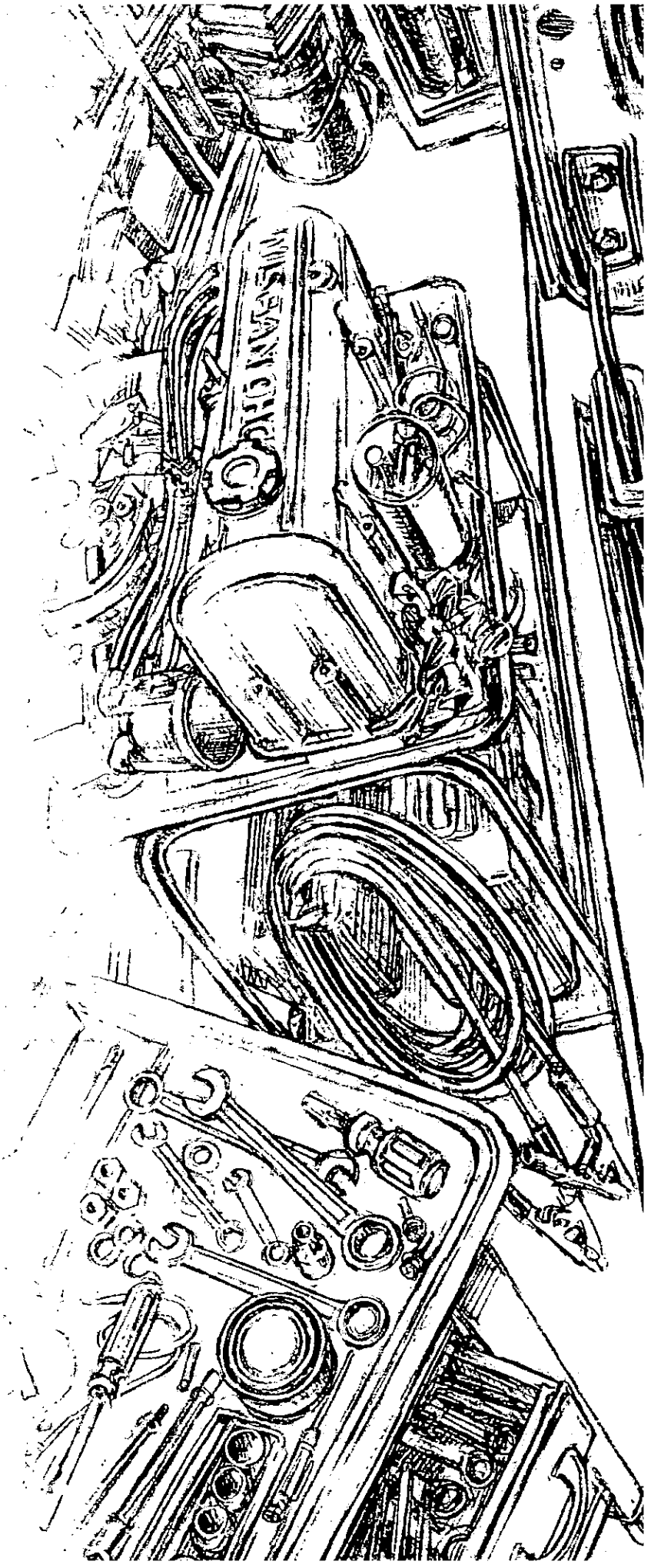

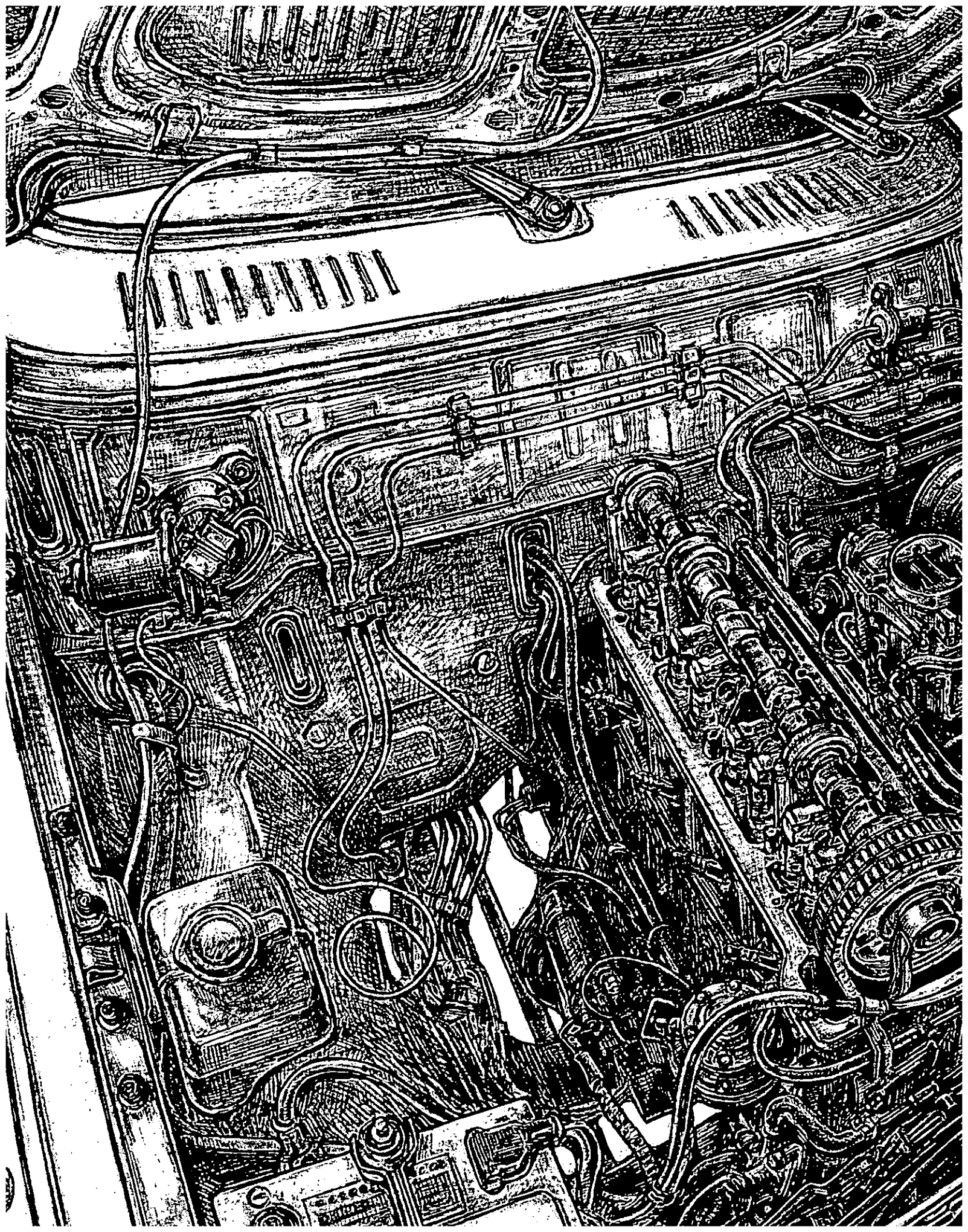

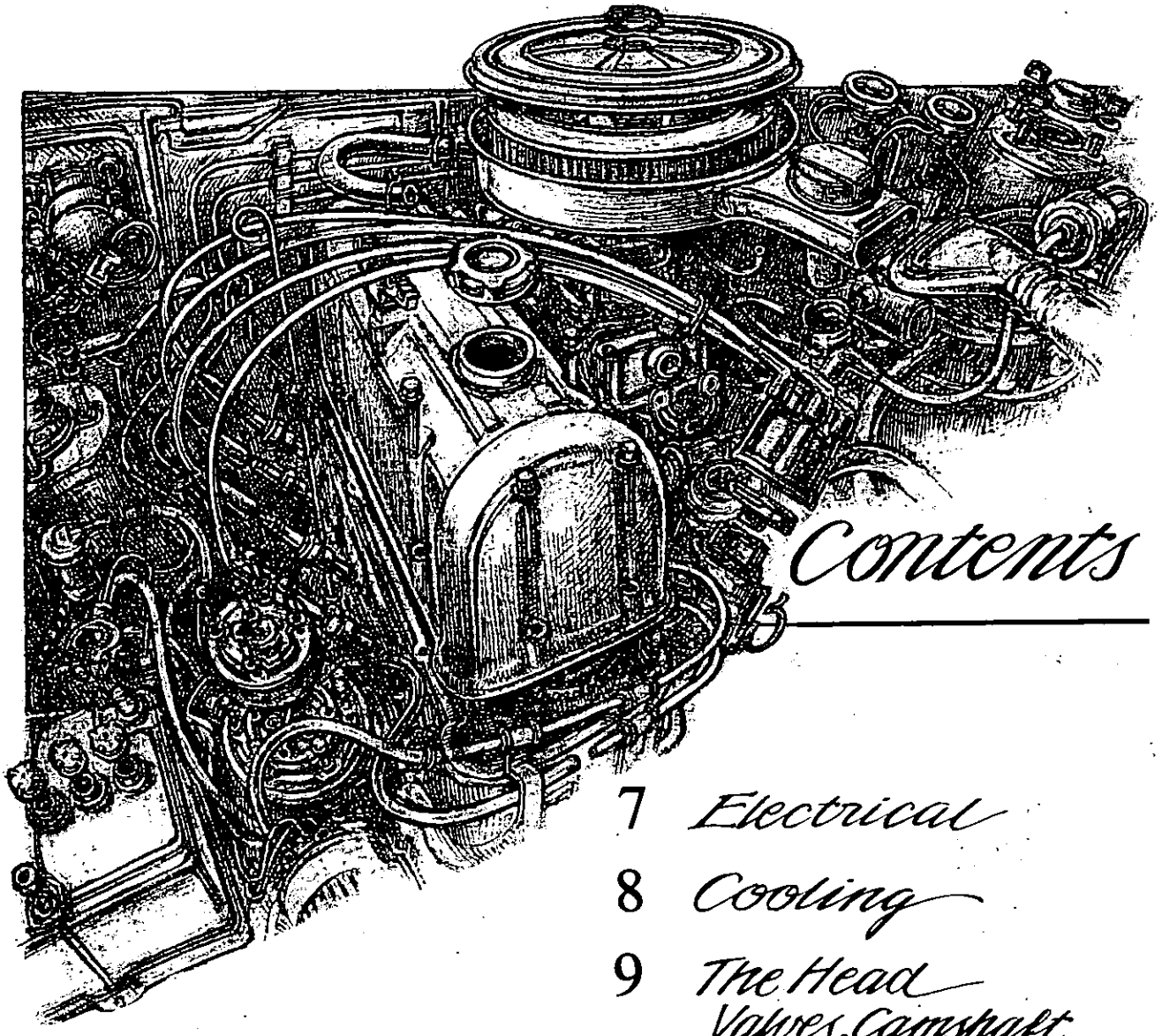

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PLEASE NOTE:

The repair and maintenance procedures in this book are based on the training, personal experiences and research of the author, and on recommendations of responsible automotive professionals. If you follow all the directions specifically, you should be able to complete the procedures in this book successfully and safely.

Please understand that the recommendations and warnings herein cannot cover all conceivable ways in which service procedures may be done, or every possible hazard and risk involved. The author, illustrator and publisher are not responsible for any adverse consequences that may occur in connection with the procedures explained in this book. Please do not use the book unless you are willing to assume the risk of adverse consequences. We urge you to consult with a qualified mechanic before using any procedure where there is any question as to its completeness or appropriateness.

We especially advise you to heed all **WARNINGS** and **Cautions**, to use all recommended safety precautions called for throughout the book—and to use common sense. Thanks.

This book is dedicated to my parents, Nickie and Peter Messer, whose ceaseless love and encouragement powered this project to its conclusion

ACKNOWLEDGMENTS:

I did not write this book alone; many loyal friends and warm-hearted strangers supported the effort. The production spanned many miles. I wrote the first draft at John and Eve Muir's farm in Oregon and finished the book in New Mexico.

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And finally to Barbara Daniels of Owl Editing, whose personal and professional friendship brought new blood to a fading task—gracias; and to Gail Budd, the owl's assistant, I tip my hat.

Introduction

A large pale blue automobile was standing at the curb. At the sight of it, I was suddenly overcome by enormous merriment. What complacency, what an absurd self-satisfaction beamed from those bulging surfaces of glossiest enamel! Man had created the thing in his own image. . .

—Aldous Huxley
The Doors of Perception

It took me nine years to write this book. And I did it with the mechanically inexperienced reader in mind.

There are no untried procedures in this manual. Mechanics' tricks? Yes. Gimmicks? No. My intent from the start has been to write a book that's honest and one that anyone willing and able to read English could understand and use to repair the Datsun/Nissan vehicles covered in this book. My words are supported by the imaginative and revealing drawings of Peter Aschwanden. He too knows the fix-it-yourself game as a player and coach.

In doing this project we shared countless hours in, around, and under many cars and trucks. Our endeavor, we hope, will make fixing your vehicle as painless and successful as possible. This isn't to say we'll jump from the pages, wrenches in hand, eager to fix your car. But while doing the work you should know that we have been there too, many times, and we understand how infuriating it is to use auto repair manuals that lead the reader into a job only to abandon him or her confused and greasy-handed with the familiar line—"installation is the reverse of removal."

John Muir inspired me to write this book in 1977, shortly before his death. His well-known treatise, *How to Keep Your Volkswagen Alive: A Manual of Step by Step Procedures for the Compleat Idiot*, is the prototype.

I first read the Volkswagen "Idiot" Book in 1970 while working at the Cherry Street Free People's Garage in Philadelphia. The book changed my life. In those days, the Volkswagen held counterculture status because of its economical and practical design. John Muir understood all this, and served the people admirably with his VW cult classic. The idea still holds excitement for me after all these years. The Idiot Book is more than a repair manual: It's a practical and entertaining ally in an alienating world of automotive technology and repair.

Even before I met John, his personality came through the pages, creating a human link between owner and vehicle. Many like myself used that book to pole-vault into the auto repair business. John's efforts were a brave and successful attempt to demystify the automobile.

Our times are different, but the subject is pretty much the same. Instead of the European air-cooled Volkswagen, many of us now drive Japanese vehicles and (because of modern economic austerities) we are motivated to try and keep them running ourselves. They're still cars, and they still need care from time to time. If you recognize yourself here, it's up to you to exploit this book for all it's worth.

The Datsun/Nissan is an easy car (or truck) to work on. Although it's different from your old VW's 40 hp, or Chrysler's "slant-six," the Datsun/Nissan L and Z series engines are equally stout workers. I don't cover *all* Datsun/Nissan cars and trucks. There are simply too many models produced by Nissan Motor Company to discuss in one book.

If you own one of the cars or trucks listed below, this book is for *you*—whether you work on the vehicle yourself, need to deal with a mechanic or simply want to carry a "security blanket" in the car with you. The vehicles covered by this book are all equipped with **L-1600, L-1800, L-2000B, Z-2000, Z-2200**, or **Z-2400** engines. There are no E, G, J, R, P or A series pushrod engines in these vehicles. Nor do I cover U, CA, CS, E, VG, EG or 6-cylinder overhead cam engines. Here are the specific models covered:

•**510 sedans and station wagons**, 1968—73 (L-16 engine).
•**610 sedans and station wagons**, 1973—76 (L-18 and L-20B engines).
•**710 sedans and station wagons**, 1974—77 (L-18 and L-20B engines).
•**521 pickup trucks**, 1970—72 (L-16 engine).
•**620 pickup trucks**, 1972—79 (L-16, L-18, L-20B engines).
•**720 trucks**, 1980-1986½ (L-20B, Z-20, Z-22 and Z-24).
•**510 sedans, hatchbacks and wagons**, 1978-1982 (L-20B and Z-20 engine).

The models *not* covered in this book are all cars earlier than 1968 (e.g., the 311, 411) and all sports cars or later models (e.g., the B-1200, B-210, 210, 310, F-10, Sentra, Stanza, Pulsar and Maxima, Z-cars and 200SX models). As for the trucks, 1200, 520, and earlier trucks (pre-1600 overhead cam models) and D-21 (1986½ on) are not discussed. Nor are diesel or 720 sport trucks (4/85 on).

How to identify your model and year: Nothing irritates a parts person more than a customer who asks something vague like, "I want a gasket for my blue Datsun." For the benefit of both of you, approach the parts counter with the model number and year ready to roll off your tongue. After establishing that you may need to tell the person the vehicle's production date (month and year), engine series and size, and maybe transmission type. When you know this information commit it to memory—like your shoe size.

Your model number may already be obvious by an emblem stuck on the side of the body. If it's not there, open the hood and look in the engine compartment for a small square plate, rivetted to the firewall behind the engine or along the fender wall either on the RIGHT or LEFT side. (On 720 trucks the plate is in the far RIGHT rear fender wall near the corner of the engine compartment.)

The model number is really three numbers preceded by or stuck between a group of letters, e.g., PL510, HL620, or KNLGY720STV. The letters mean something to the Datsun/Nissan dealer but usually aren't useful to other parts suppliers.

You may also need to tell the supplier the body style: sedan, hatchback or station wagon. Or if you have a truck: 2-wheel drive (2WD) or 4WD, short or long bed, regular or king cab. NOTE: Heavy duty or cab and chassis model trucks aren't covered specifically in this book, but have many parts in common with other trucks.

Something basic you should know is that the model year is different from the calender year. The model year begins in July, August, or September of the previous year. Half years begin in November, December, or January. So if you have a 1975 620, it was probably built after July 1974. If your truck was built after January 1983, it's a 1983½ or later 720 (with NISSAN on the tailgate).

To clarify this find your production date. Except on a few early model 510 and 521s, there's a plate on the door jamb (driver's side) just below the striker plate. On late model 720s there may be a paper sticker instead of a plate.

If you have a metal plate, find the dates printed on or stamped into it. On trucks there may be two dates. The earlier date (stamped and printed) indicates when the truck was built. The date above it (if there) is when the bed was installed, I think. Trucks are shipped in the U.S. bedless for quota reasons.

The date stamped on this plate is the one you want to memorize and use to buy parts. Remember, if the month falls between July (7) and December (12) chances are it's really the next year's model, e.g., 11/74 is a 1975 model year.

There may be other stickers in the engine compartment that give you clues about the model year. Also check the owner's handbook or your registration for telltale dates.

To identify the engine: This book covers all 4-cylinder L and Z-series engines except 200SX models. To determine which you have, look at the air cleaner housing—that big round blue thing with a snout that's on top of the engine. If the housing mounts on the LEFT (driver's) side of the engine, you have an L-series engine. If it's on the RIGHT (passenger) side of the engine, you have a Z-series engine.

A more exact way of telling is by looking at the engine model and serial number. On L-series engines these are stamped on the engine block next to the crankcase oil dipstick, below and between the rear two spark plugs.

On Z-series engines the numbers are on the LEFT (driver's) side of the engine block, visible by looking between the branches of the exhaust manifold at the top center of the block.

The model number is preceded by a letter L or Z, e.g., L-16, 18, or 20B or Z-20, 22, or 24. The numbers

that follow are serial numbers that you'll only need to determine if the engine is original or a replacement. For positive identification and more about serial numbers consult your local Datsun/Nissan agency.

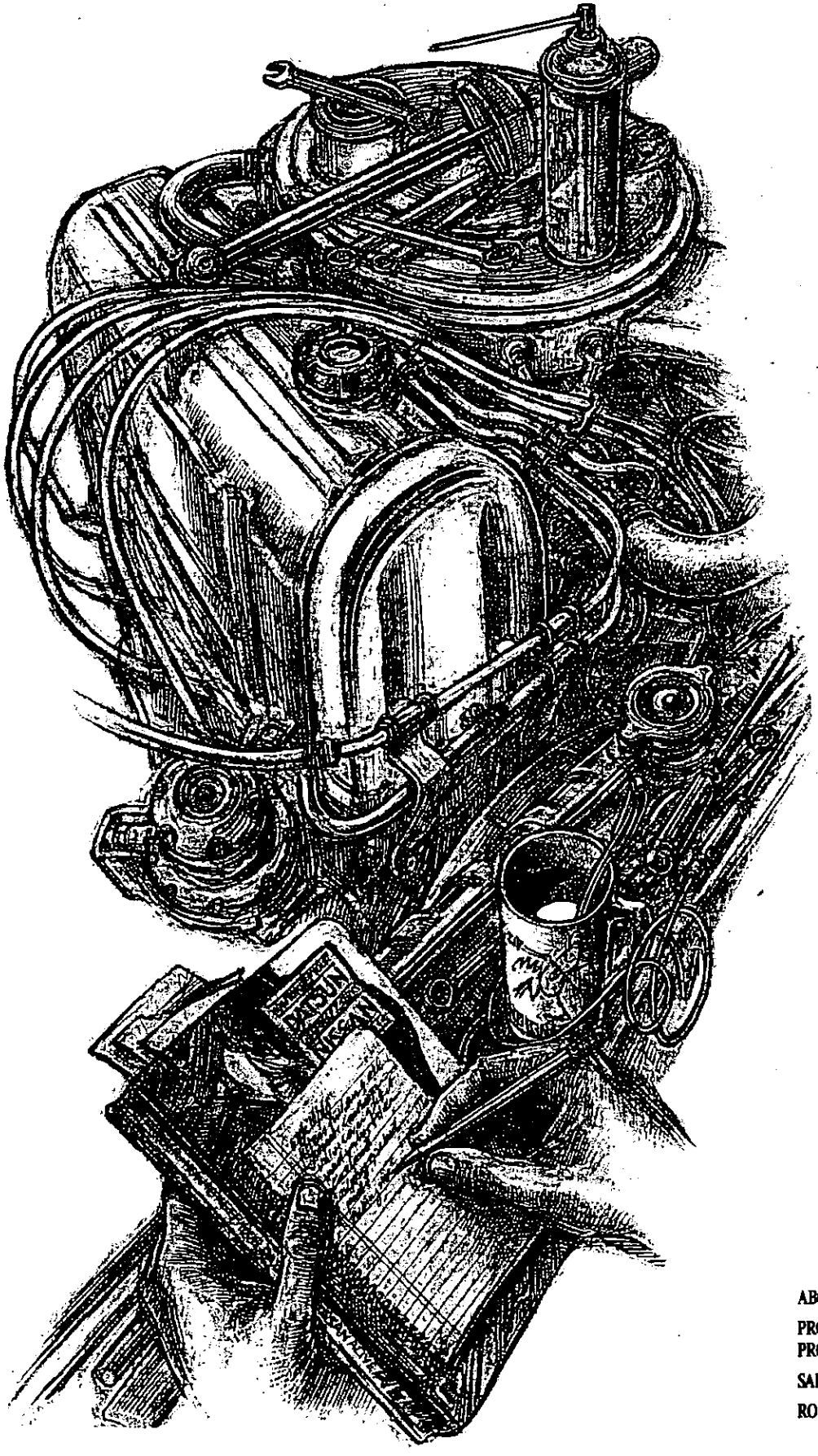
The final bit of information helpful for parts purchasing is the transmission type. Those covered in this book are 4- or 5-speed manual and automatic transmissions.

The instructions I offer are drawn from years of operating an auto repair business specializing in Datsuns and Nissans. If you have any questions, comments or suggestions (no rotten eggs please) that arise while using this book, feel free to contact me through John Muir Publications, P.O. Box 613, Santa Fe, New Mexico 87504.

Knowledge is money, and in the world of automobiles the more you know about these four-wheeled wonders the less you're likely to pay. This book is devoted to that enduring truth. May the (Velvet) Monkey Wrench be with you!

Colin Messer
Santa Fe, New Mexico
May 25, 1987

How to use this book



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CHAPTER 1
HOW TO USE THIS BOOK

For whatever reasons you put out good money for this book, let's make your purchase worthwhile. Read this book and you should gain at least enough information and pleasure to satisfy your investment. Before you start fixing anything I suggest you first read this and Chapter 2, then the Introduction and Procedure 1 of the chapter you're interested in, skipping the "hands on" details and absorbing the pieces of information that interest or immediately relate to you.

I have tried to cover as many bases as possible without alienating or mystifying readers as so many other auto repair manuals do. I presume you know nothing about the operation of your Datsun/Nissan. Some of you may, of course, but this book's for everyone. And it is a *use* book. You could try putting it under your pillow, hoping to absorb the book's contents as you sleep. But the only way this'll work is if you read some, and *then* sleep on it.

You'll have to get your hands dirty if you plan to relate with your vehicle immediately. Knowing how things work is only a third of learning mechanics; practice and feel are the other two-thirds. Tools are your medium and in time will become your friends. There is great similarity in many mechanisms, you will find. When a certain level of communication is reached with your machine, the walls of alienation disappear, and the art becomes yours.

Don't let rash emotions interfere with your understanding of the machine's needs. Yes, it has needs—gasoline, oil, maintenance, and tolerance. Although your Datsun's or Nissan's needs may not be those of a human, no matter how vexing the machine might be, try not to forget that it was created by humans. The more you know and accept about your car, the more you will understand its forms of expression.

I think this is important, yet we still hear it too infrequently: Automobiles, computers, spaceships and all our time- and trouble-saving devices have threatened to remove us from an essential link with the earth. I try not to let a moment pass without realizing that the earth is the source of these wonders; human beings merely rearrange the resources and put them to use. Remember this fact, and you'll be giving your car or truck the respect it rightly deserves. It's a resource, a magic carpet, a lesson in thermodynamics, and a constant transformer of energy and a political phenomenon. Conserving energy is much more than simply watching the amount of fuel we consume driving. The automobile itself is a form of matter and energy that can be abused, inefficiently used, or respected and maintained. Do right by it and it will conserve energy for you on all levels.

Absorb, work, and love—you are qualified to excel. I think John Muir said that. Don't let your machine send you to the looney bin or the poorhouse. Accept it for what it is—simply a tool made from parts of the earth, and a fascinating one at that.

ABOUT THE PROCEDURES

There are three types of procedures: *theoretical/diagnostic, maintenance,* and *repair.* Occasionally the procedures intertwine.

Theoretical/Diagnostic Procedures will explain the system's working and help you determine what is wrong with your vehicle. For instance, you may find your symptom (problem) described in Troubleshooting (Ch. 4), which tells you to go to a given Chapter 10, Procedure 1 (Ch. 10, Proc. 1) to learn about the system and diagnose the problem. From this point you'll be directed to the appropriate repair procedures.

Maintenance Procedures tell you the most important parts of your vehicle to which to keep your senses tuned, such as fluid levels, wear points, and other vital functions of the vehicle, and how to keep these parts adjusted and healthy.

Repair Procedures tell you how to remedy the sundry things that break or wear out. These make up the banker's share of the book.

I've covered in this book both cars and trucks. I have attempted to tie the truck and car procedures together as much as possible to save time and space. As I noted in the Introduction, vehicles with the L or Z-series engines are included. They're all 4-cylinder (chain driven) overhead camshaft engines. These engines are alike with the big differences in the L and Z series cylinder heads. Let's say they are siblings.

Here is a guide to the use of the procedures, given in the form of the Procedures in the book. Read it before attempting any work.

PROCEDURE A: HOW TO DO THE PROCEDURES

Condition: You are here to get something done. You were sent here from somewhere else in the book.

Tools and Materials: Your ability to read, the necessary hand tools and parts for the job.

Remarks: The procedures are designed to give step-by-step instructions for the successful completion of the job at hand. You are expected to use common sense and safety at all times. I've tried to include every contingency, but you must keep your eyes open and your brain in gear. The procedures may occasionally sound like gibberish in the living room in front of the fire, but will come clear as you work directly with the parts on the vehicle and the tools in your hands.

When I identify a fastener as a 10mm, 12mm, or say 14mm nut or bolt, this refers to the size of wrench or socket you'll need to remove or install it—the distance between the flats of its sides (see Ch. 13, Pt. 2 for more).

Step 1: Analyze the Whole Procedure.

Read the procedure you need completely before actually beginning the work. Scope out the situation, tools, and instructions so that it's as clear to you as possible. Ready to channel your energies into doing the procedure successfully? There is a lot of cross referencing throughout this book; for example, "see Ch. 11, Pt. 1, Proc. 1 (4)" means Chapter 11, Part 1, Procedure 1, Step 4. OK?

Step 2: Preparing to Work.

Plan ahead. Organize your work space. Sweep up the area. Locate all the tools you'll need, plus rags, jackstands, and hand cleaner. Park the vehicle where it'll be safe for a few days, if necessary. Figure out where you'll buy parts, and how you'll get around. (Now might be the time to fix that flat on your bicycle.) Enlist the help of a willing friend for the procedures that call for one.

Step 3: Take It Easy on Yourself.

Although not necessary, it helps to have an assistant read the instructions to you as you work, hand you tools, and share your frustration. You can imagine how hard it is to read while lying under a car. Besides, two heads are frequently better than one.

Double-check everything. Read and reread the steps to make sure you did everything right.

Have a pencil and paper on hand to write down notes on things to check as well as any parts you need.

Take your time. Breath and stretch and keep your mind and body in touch with what they're doing. This is important. Most accidents happen when the connection between worker and work or worker and worker is broken. Calmness of thought is important in successfully doing just what the steps say.

Wear the right clothes for grubbing around in the grease. Keep rags handy; they'll help keep your hands clean and your frustrations in check.

I clean and put away tools as soon as five or six accumulate. This way the tool I need is easy to find and my work space stays uncluttered. This is part of the art's skill and technique.

Step 4: Goofing Up.

When you strip a thread, break a bolt, or lose something in the bowels of the engine, relax, Ch. 13, Pt. 2, Proc. 1 deals with these things.

Step 5: Keeping Things Clean and Organized.

A secret to good work is having a clear view of your operations. Clean every part you intend to replace. If you thoroughly clean the innards of the machine, it'll reward you for it. Wipe off tools each time you use them. They, too, respond to shiny upkeep. And keep yourself as clean as possible: coveralls (a monkey suit) are great because they peel off fast, allowing you to step out of car mechanic persona to normalcy.

Keep track of parts with a marking pen, labels (masking tape), baggies, and boxes. Don't waste your time trying to remember what goes where now, or whether you have it anymore.

Step 6: Not to Worry.

Keep in mind that it's an object you're working on and that it doesn't have emotions as you do. Now and then, step away from a problem and relax your mind. A little later—after a walk, meditation, or whatever you do to recharge—you'll be amazed how often things right themselves.

Step 7: Loving.

"This is a tough one, and will make or break you. You must do this work with love, or you fail. You don't have to think, but you must love. This is one of the reasons I have nice tools. If I get hung up with maybe a busted knuckle or a busted stud, I feel my tools, like art objects or lovely feelies, until the rage subsides and sense and love return. Try it. It works."

—*John Muir.*

I struggle daily with this one. At least love yourself, but don't get kinky, John may be watching. Thank you, John, for making those thousands of jobs more satisfying than they ever could have been without you.

SAFETY

Here is the most important section in this book, taking care of your physical well-being. If you can stay calm and alert while working you should be able to avoid seriously hurting yourself. Small cuts and finger-bangers are inevitable in this type of work. However, common sense and forethought can minimize even these. Be prudent and keep a few bandages handy.

•**Danger:** Don't jack up the vehicle before reading Ch. 13, Pt. 1, Proc. 1. And no matter how safely you think the car or truck is supported, always double check it!

•**Sleep and Stress:** Do not work when you're tired, emotionally frazzled or physically ill. Try to avoid working when your concentration is poor. We've all noticed how pressure causes stress and loss of control. Unless you know the procedure like your birthdate and have done it many times before, don't jump into a job with unrealistic expectations. Pace yourself, allowing room for the unexpected. Give yourself options like an alternate form of transportation. Theoretically speaking, you should be in control.

•**Clutter:** Keep your surroundings clear and orderly. Use sawdust or clay cat litter to soak up water, oil, or brake fluid as soon as it hits the floor. Use a stiff broom to sweep it up. (For those of you without a floor, working on the dirt, this is your only advantage, I think.)

•**Eyes:** Wear safety glasses to protect your eyes from *all* hazardous liquids like gasoline, brake fluid, and caustic battery acid, as well as from metal chips. Being nearsighted, I always wear glasses. They have saved my eyes time after careless time.

•**Fire:** Watch out for fire hazards. Fire can do a lot of damage fast. The slightest spark in the presence of even gasoline *vapors* will ignite. Keep oil and gas soaked rags in a covered, fireproof container. Don't lay metal objects on the battery. Don't smoke around an open engine compartment. Those electrical and fuel systems can turn on you if you're not careful. I once let a fuel pump fall between the starter solenoid's positive wire and the car body. Fortunately a fire extinguisher was at hand. You should have one too—a good one, in working order.

Don't use naked light bulbs or open flames for close up work on your car or truck. A sturdy, caged drop (trouble) light is the best. Absolutely no open flames or naked light bulbs.

•**Acid:** Beware of battery acid—it's very corrosive and under some conditions explosive. Don't lean or rest things on the battery. The acid will burn your body and clothes. Neutralize spilled battery acid with water. Do not smoke around a charging battery.

•**Health:** The automobile is a rolling circus of poisons. There are lots of things unhealthy about the beast, no matter how pretty it looks. None of its ingredients belongs in your mouth or eyes. *Never* run the engine in a closed or partly enclosed garage. Automobile exhaust is insidious. Diluted it's a slow killer; concentrated it kills rapidly. Please don't use your teeth as pliers or suck on hoses that contain fuel or its vapors. Two drops of gasoline in a human lung can kill.

Keep your bare hands away from cleaning solvents and gasoline. These substances can enter the bloodstream through the skin and over time may cause chronic health problems. Wear solvent-proof rubber gloves when cleaning parts.

To complement your safety outfit wear a dust mask when working with brake and clutch friction parts; they contain carcinogenic asbestos.

•**Tools, Cuts, and Bruises:** Use your smarts when handling tools. If used properly, they'll protect you from injury. Used carelessly, they can cause painful injury. Balance yourself before starting an operation. When you pull or push on a wrench, watch where your hand will fly if the wrench slips. In spite of the fact that grease is relatively bacteria free, keep any cuts clean and protected.

•**Clothing:** Working around engine-driven parts is hazardous. Watch out for whirling fan blades and belts. Careless hands, hair and baggy sleeves are easily caught, with often disasterous consequences. Wear a wool watch cap or beenie to keep your hair out of the works and grime out of your hair. Also, get into the habit of covering the sharp hood latch with a rag to protect your head. This is especially important with truck hoods. Mechanics wear coveralls and easily-cleaned uniforms for good reasons. Resist the temptation to do mechanics in your jazzercise suit or whatever you've got on. It may be the last time you'll want to wear that favorite guarabara shirt.

•**Timing:** It's a good idea to work on a job consistently without letting days or weeks lapse between start and finish. This way the details (no matter how ugly) remain fresh and clear in your mind. Allow more time than you think necessary to do the procedure—especially the first time.

•**The Procedure:** Again, I urge you to read the procedure at hand through completely before starting the job. Familiarize yourself as well with the system(s) involved. Do not fear the work, but approach it informed. One missed word or sentence could cost you dearly in time and/or money. Please pay attention. Ignorance is rarely bliss in doing mechanics.

•**Specific Directions:** When something about your specific model and/or engine is identified in a section of the text it will be flagged like these examples: **1968-1973 (early) 510**, or **L-series People (only)**, or **L and Z-series People**, or **1983½ 720 4WD People**, or **Everyone**.

You will soon become accustomed to spotting your model or engine type as you work through a procedure, that is if you don't skip sections and steps.

Often there are references to Federal (Fed), Canada (Can), and California (Calif) vehicles, usually in discussions of emissions control and fuel systems. You can identify which you are by looking at your serial number; the next to last letter in the series is the key one, e.g., V = California, U = Federal (Non-Calif), N = Canada. California vehicles were sold in all the United States. Other ways of telling are by reading the decals in your engine compartment and door jamb for California or Federal emissions regulation compliance.

ROUGH SPOTS

•**Stuck Bolts and Nuts:** These objects are usually the victims of rust. But sometimes fasteners are immovable because they're being turned the wrong direction. Nearly all nuts and bolts are removed by turning *counterclockwise* as you look straight at their heads. Anytime you're unscrewing something that isn't directly in front of you, pause to think about which way it goes. Imagine you're facing that nut or bolt head-on to determine which way is counterclockwise. Rusted fasteners should be squirted thoroughly with penetrating oil and allowed to sit. Then try again. (More on this can be found in Chapter 13, Pt. 2.) Don't force things unless you're

sure that force is the only alternative, and then use it with prudence.

•**Stuck You:** There might be times during a job when the book, your imagination, and experience seem useless. Take a break to let your mind and body sort themselves out. Be easy on yourself. Trust your own good sense. Often a knowledgeable or visionary friend can help. Or a different tool. If a problem arises after you've worked on the vehicle, suspect the work you just completed no matter how unrelated the symptoms may seem. When in doubt, reread and retrace your steps.

•**Up Against the Wall:** Sooner or later we all reach a point when nothing works and we desperately step out into the street wishing a passing motor freak would stop and deftly solve the dilemma. I frequently get telephone calls from people driven to such places by service manuals that leave them hanging or from others unwilling to face the $30 per hour plus shop rates charged by professional mechanics. (In passing I might add that many shops have stern phone policies. After all, a mechanic's time is the same on the telephone as under the car.) People tell me that the best contact they've made when moving to a new community is with a trustworthy mechanic. If you must take your problem to a professional, give him or her the straight facts (symptoms) without a lot of speculation.

Please respect a good mechanic as a utilitarian artist. Approach him or her with a positive attitude. Mechanical work is taxing. It's easy to get severely burned-out doing mechanics. It's the most physically and emotionally difficult profession I know of. It's common for mechanics to be alcoholic and get lung, blood, skin, or osteopathic disorders. A competent professional deserves all the money he or she earns.

It is common to find that those who have mastered the art hire less skilled mechanics to do the wrench busting for them. Many a shop's reputation, built on the owner's good work, is damaged by a helper's sloppy habits. For those times when you need a pro's help, use this book as a reference. Don't be intimidated. Realize that there is as much deception and hype in the automotive world as in lingerie, cosmetics or politics. Analyze what you're told and ask plenty of questions.

And if you do find a competent mechanic, try to nurture the relationship by taking him or her cookies, beer, or whatever. Don't take advantage of a helpful attitude. Offer to pay him or her straight away or maybe trade your skills (cleaning the shop or running errands) for information.

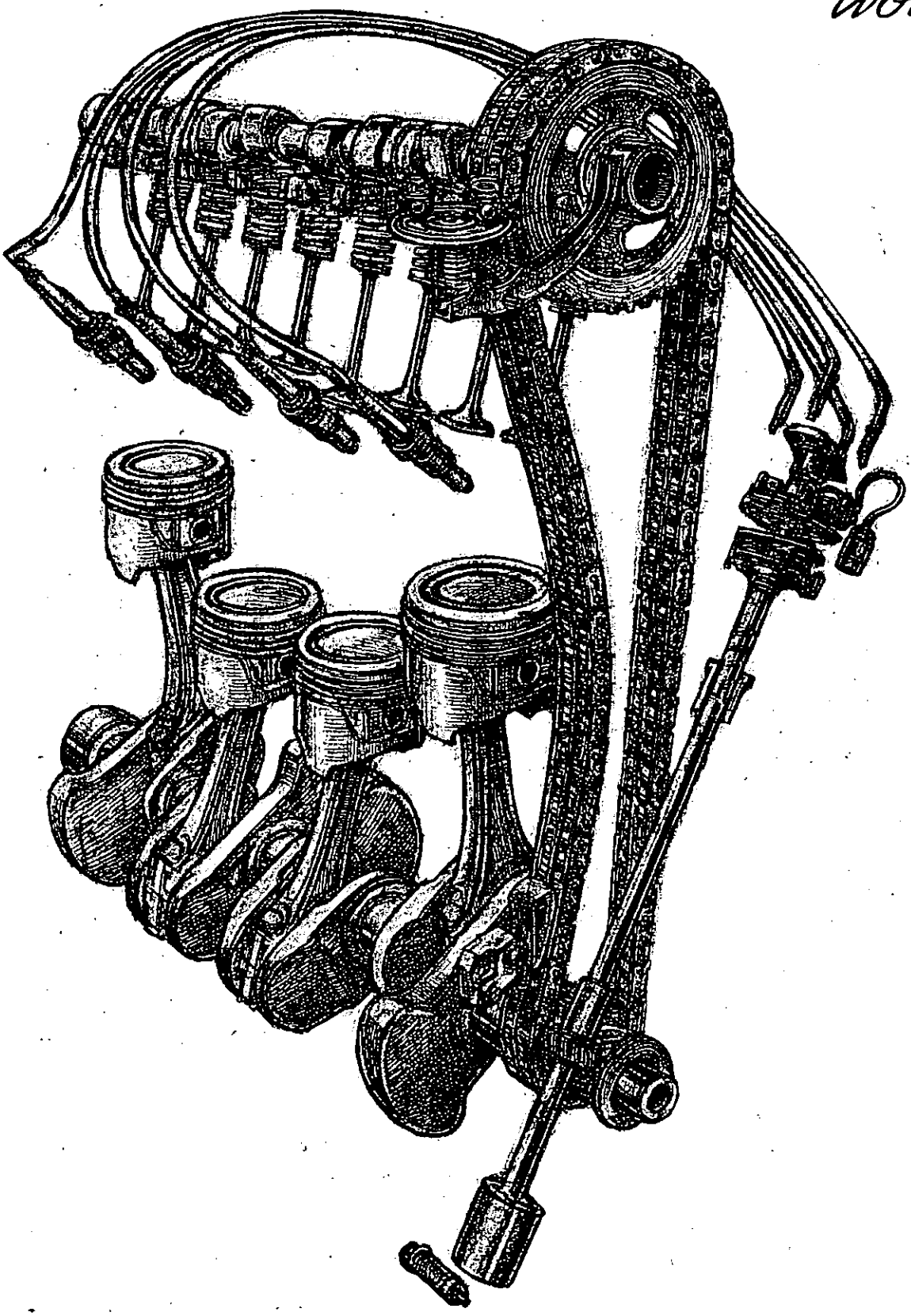
If you reach the point where you can't do the repair or diagnosis yourself, you'll need to take it to a pro. Tell the mechanic what you've done, what you think's wrong, and exactly what you want done. The more familiar you are with the system, the more likely you are to be satisfied.

Then there are those old timers who have been wrenching since Day One. These guys are loaded with knowledge and in their retirement might love to help you out. Although they claim to know nothing about the aluminum cylinder head overhead cam "veehickles" like yours and "never touch those foreign jobs," they may know how to get you around that blind spot in your skills—so ask.

Beware of hearsay advice, however. There are more automotive myths floating around than pennies in circulation. Double-check stray information with someone in the know.

Before we get into the procedures, let's take a few minutes to tour through the innards of your car or truck. In Chapter 2 I'll explain briefly how the vehicle works and familiarize you with some of the key parts.

How your Datsun/Nissan works



CHAPTER 2
HOW YOUR DATSUN DOES WHAT IT DOES

"It does seem true that Indians accept snakes the way that most Americans accept autos: potentially lethal but an inherent part of daily life."

—Anonymous

The automobile is a paradox. We love it, depend upon it, and it can kill us. If the fuel supply to the American motorist were cut off tomorrow, people would no doubt riot, chaos would prevail and our economy would collapse. In this respect we are helpless. To run our cherished cars and trucks, we are dependent on the fuel and raw materials that keep them going, and these resources diminish permanently every day. American lifestyle and national security are directly affected by the oil companies' (and the government's) ability to obtain crude oil. Our automobiles consume about ⅓ of the oil sold in the United States. The supply is not infinite, nor is it certain. Imagine our entire nation held hostage by its thirst for gasoline. And, without adequate public transportation as an alternative, this automotive "freedom" seems just inches away from petro dictatorship.

The humor and irony of our dependent relationship with the car is most evident when the damn thing breaks down. At this point the master/slave roles reverse; we are at our inanimate machine's mercy. This is where the mechanic's power lies. To those who view the underhood world as alien, the auto mechanic is a wizard capable of making the internal combustion magic carpet run again.

Lesson 1: Every part of the automobile originated from the earth as a raw material and passed through the hands of many workers before it reached the showroom floor. To further understand the mysteries of your Datsun/Nissan, consider a few of its multiple origins—an assembly line in Japan or Tennessee, a chromium mine in South Africa, a rubber plantation in Malaysia. For now, let's bypass these important details and look instead at the finished product. But please keep them in mind. Being aware of your vehicle's origins and workings makes for an interesting and useful shift in consciousness.

Lesson 2: A little history and pep talk. The first Datsun was built in 1911, not long after the automobile made its grand premiere in the U.S; however, none was marketed in this country until 1960. The car maker's popularity has grown ever since. It's no secret that the Japanese build reliable and innovative automobiles. Datsun/Nissan vehicles are economically and sensibly designed. The cars and trucks I cover in this book can be maintained and repaired by anyone with the desire to do it. With a few tools, the will to learn, and this book, you are one step closer to keeping your car alive. But the Nissan Corporation doesn't just build automobiles; it's an international conglomerate—manufacturing textiles, rockets, industrial machinery, ships, and who knows what else.

Still, it's your single (or plural) Datsun/Nissan vehicle that we're concerned with here, so let's get down to it.

Lesson 3: The workings: We'll start from the ground up with the wheels. You've got four of them, five with the spare. On the 510 (early) and 610 sedans all four wheels are *independently suspended* (they move up and down independently of one another). On the wagons, 510 (1978 on) and 710 sedans, and pickups, the front wheels are independently suspended and the rear wheels are designed with a solid axle and leaf springs. All models have *MacPherson strut* front suspension except the pickups. This means you have a *shock absorber* mounted within a *coil spring* at each front wheel. (The strut system is also part of the steering system.) The coil springs and shock absorbers control and dampen up and down movements over bumps and around curves for safety and comfort.

The wheels are bolted to *hubs* which turn on bearings that are mounted on spindles or axles. The greased

bearings minimize friction as the wheels roll you down the highway.

The steering wheel is connected by a long shaft to the *steering box*, which attaches to the car's frame. When you turn the *steering wheel*, gears in the steering box move the rods under the car that control the direction of the front wheels. A *steering gear arm* connects the movement from the steering gear box to the steering rods, which attach to swivel points called *ball joints* or *king pins*. Your front wheels pivot in unison because all the rods and joints, etc., are connected.

Two types of brakes are used on Datsuns. All models except pre-1978 pickups have *disc brakes* on the front and *drum brakes* on the rear. 1969-77 pickups have drum style brakes all around. When you apply pressure to the brake pedal, you force a piston within the *master cylinder* to push fluid through brake lines to a similar piston at each wheel. The pistons are forced outward by the fluid and are attached to *shoes* or *pads* that are then forced against the *drums* or *rotors* that turn along with the wheels. The friction of the shoes and pads against the turning drums or rotors slows the wheels and stops the vehicle.

The *emergency brake handle* is connected to the rear brake shoes by cables. When the emergency brake is engaged, the shoes are pulled out against the drums and the vehicle is prevented from rolling.

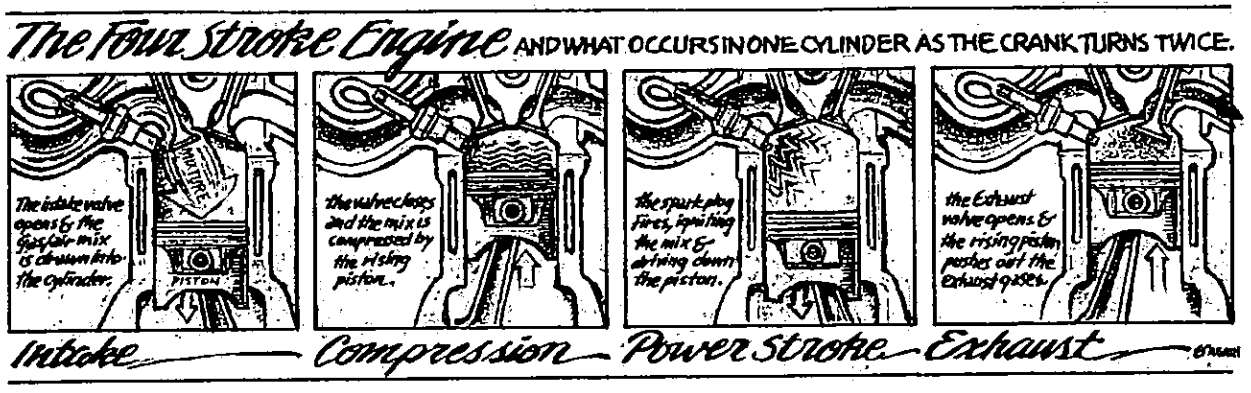
Now to the front of the vehicle and the prime mover: the engine. All models in this book are rear wheel driven. This means the engine's power is transferred from the engine to the rear wheels.

To get more specific, power (from the engine) is transmitted through the *clutch* to the *transmission*. The transmission is composed of a series of shafts with gears on them. The shafts turn and transmit the engine's turning force, or torque, to the driveshaft, which is connected to the *differential* or "rear end." Another set of gears in the differential directs the power at right angles via axles to the rear wheels. OK, back to the engine for some important details.

The Datsun/Nissans covered in this book are powered by L or Z-series overhead engines. These are classified as *overhead cam* engines. This has to do with the different way their valves are operated. Both L and Z-series engines are 4-cylinder, four stroke, internal combustion piston engines. The combustion of fuel is used to force the four pistons downwards at alternate times, much as your leg forces your bicycle pedal downward. This force is transferred into rotary motion by the *crankshaft*.

Remember, your four cylinders make four strokes each. What's a stroke? It's the movement of a *piston* up or down in its cylinder. Why four strokes? We'll get to that. Inside each cylinder is a piston. The piston fits tightly within the cylinder; to improve this fit there are three *rings* fitted in grooves around each piston, which make a better, more leakproof seal. As the pistons travel up and down within the cylinders, they operate the rest of the engine's moving parts. More on this later. The cylinders are capped off, sealed at the top by the cylinder head. Fitted into the head, atop each cylinder, there are valves that open and close at specific times as the engine goes through its strokes. There are two valves for each cylinder, one is called the *intake valve* and the other is called the *exhaust valve*. There are eight valves in all, four intake and four exhaust. So we now have four cylinders, four pistons with three rings each and eight valves (two per cylinder). But for the moment, let's look at one cylinder (one piston, its three rings and two valves).

OK, imagine the engine is running. You put your foot on the accelerator, which opens a flap (the throttle)



in the *carburetor* permitting a mixture of fuel and air to pass through the *intake manifold* and into the cylinder head. When the piston travels downward, on its first stroke the intake valve opens and the suction created by the descending piston draws the fuel-air mixture from the carburetor through the intake manifold into the cylinder. This is called the *intake stroke*. As the piston reaches the bottom of this stroke, the cylinder is filled with fuel/air molecules.

The intake valve now closes, making the cylinder a sealed container as the piston begins to move upward. As this happens the fuel/air molecules are compressed. This upward (second) stroke of the piston is called the *compression stroke*. As the piston nears the top of the cylinder, the fuel/air mixture is squeezed—compressed—into an extremely volatile state. The top of the cylinder, where the valves are located, is called the *combustion chamber*. Screwed into the head near the valves and also in the combustion chamber, is a *spark plug*.

NOTE: Most Z-series engines have two spark plugs per cylinder. Just before the piston reaches the top of the cylinder the spark plug(s) ignites the fuel-air mixture—**BOOM!**—and the combustion spreads like wild fire through the mixture's molecules.

The explosion forces the piston downward. This is the beginning of the third stroke of the cycle—the *power stroke*. The energy released during combustion is what runs the engine. Keep in mind that this happens in each of the four cylinders one at a time in a *firing order* (1, 3, 4, 2) very rapidly.

At the end of the power stroke the other valve, the exhaust valve, begins to open and all the burned gases left after combustion get pushed out of the cylinder by the upward or *exhaust stroke* of the piston. Out goes pollution through the exhaust manifold and pipe (muffler). The exhaust stroke finishes the four cycles and the first (intake) stroke begins again. For every complete set of four strokes the *crankshaft* turns around twice. Down = intake, up = compression, down = power, up = exhaust. Get it?

Each piston is attached to a *connecting rod* that's also connected to the crankshaft. It works like this: imagine the center of your bicycle's front chain sprocket as the center of the crankshaft and the pedal as the *throws* of the crankshaft where the connecting rods attach. Your leg is like the connecting rod, which links the piston to the crankshaft; the top of your knee is like the piston. Remember that the piston travels straight up and down in the cylinder like your knee(s) travels up and down as you pedal. Pushing down on the bicycle pedal is very similar to what happens on the power stroke. The up-and-down power is converted to rotary motion by the crankshaft, just as pedaling makes the chain sprocket turn. This is about as far as we can take the bicycle analogy, so let's park it and carry on.

The crankshaft is held in place in the engine block (crankcase) by five *main bearings*. The connecting rods attach to the crankshaft by connecting rod bearings and caps.

How do the intake and exhaust valves open and close? The *camshaft* makes it possible. The crankshaft runs the camshaft by a long chain at the front of the engine—the *timing chain*. So as the crankshaft turns so does the camshaft. The camshaft fits and rotates on top of the cylinder head, just above the valves. Precisely placed along the camshaft are eight *cams* (egg-shaped bumps) one for each valve. The high points of the cams are called *lobes*. The lobes come around and push on levers called *rocker arms*. Each rocker arm depresses a *valve stem* (a part of the valve), which opens the valve. Fitted around each valve are springs. These *valve springs* keep the valves closed when they're not being depressed by the cam lobe and rocker arm. The crankshaft is geared (timed) to turn the camshaft so that the valves open and close exactly when the piston is in the correct position of the intake and exhaust strokes. The timing chain keeps the crank and cam shafts in time; the number of chain links between the crank and cam gears remains constant. The camshaft turns *once* for every *two* rotations of the crankshaft.

All 4-cylinder internal combustion overhead cam engines work pretty much the same way; each cylinder fires at a different time, supplying continuous power to run the car. One key element we haven't dissected yet is the creation of the spark that ignites the fuel.

The spark comes from electrical energy generated by the engine as it turns. Backing up a bit, the engine cycles are started by the *starter (cranking) motor*, which is powered by electricity stored in the *battery*. The battery is charged by an *alternator*, an electricity-producing device that's run by a belt and pulleys turned by the engine.

Electricity does amazing things and nobody really knows exactly how or why. When rigged in certain ways, electrical voltage (its strength) can be increased by making currents or flows of electricity interact with mag-

netism. Sounds magical, and it almost is. A wire carrying battery voltage is wrapped round an iron core inside a part called the *ignition coil*.

NOTE: Z-series engines with eight spark plugs have two ignition coils.

A curious thing happens when the current in this circuit is interrupted. A high voltage surge is created within the coil, strong enough to jump a gap (a space between two electrodes) on the spark plug and ignite the fuel/air mixture in each cylinder's combustion chamber.

The *contact points* inside the *distributor* open and close (conventional ignition) or pass each other (electronic ignition) as the engine turns, alternately completing and interrupting the circuit through the coil; this is called the *primary ignition circuit.* When the electrical circuit's interrupted, it creates the high voltage surge within the ignition coil which is led via a well-insulated, black wire to the *rotor* that is inside the *distributor cap*. Each time the contact points separate or pass each other and create a high voltage surge in the coil, the rotor makes contact with one (or two) of four (or eight) wires coming out of the distributor cap. Each wire leads to a spark plug, one (or two) for each cylinder. The electrical surge fires each plug (or both plugs) as that cylinder's piston reaches the top of its compression stroke; this is called the *secondary ignition circuit*.

All these things happen very rapidly, and over and over again as the engine runs. When you set the engine's "ignition timing" you adjust the time when the points open or pass each other so the ignition occurs at a precise moment, just before the piston nears the top of its compression stroke. Correct ignition timing is crucial to maintain a properly tuned engine, and you'll learn how to do it in Chapter 3. If you find this timing and electrical stuff a little confusing, don't let it scare you. Theory and practice go hand in hand. You need not understand how it works to use this book. But before you run for the wrenches, here's a little more theory.

As the engine runs, heat is created by all that friction, sparkin' and boomin'. Heat causes wear, but we need a certain level of heat for the engine to run efficiently. It's best to get the engine temperature up to operating level as quickly as practical and then keep it within safe limits. The *thermostat*, *radiator*, and *fan*, all parts of the engine's cooling system, are designed to keep the operating temperature within the correct range.

Coolant (water plus antifreeze) is pumped through the radiator, rubber hoses, and cavities inside the engine and out again by the water pump. The pump draws coolant into the engine from the bottom of the radiator through a large black hose. The temperature of the coolant decreases as it flows from top to bottom. The fan draws air through metal fins in the radiator; air picks up the excess engine heat on these fins as it passes over them and carries it off. The coolant is then passed back through the passages in the engine to pick up more excess heat. The thermostat is positioned within the flow of the circulating coolant. It's closed when the engine is cold and gradually opens as the engine warms, sending more coolant through the radiator. It acts as a valve, allowing the engine to warm up fast, then opens to help maintain the correct operating temperature.

Meanwhile, the engine's oil pump circulates engine oil through and around the various moving parts. (The oil pump and distributor are driven by the same shaft, which is driven by the crankshaft.) Engine oil also acts as a coolant, but its primary use is to lubricate all the moving parts inside the engine. An *oil filter* screens particles and dirt from the oil. The filter and the oil should be changed at frequent intervals because of contamination from combustion and external matter as well as fatigue to the oil—that's also part of your regular maintenance covered in Chapter 3.

OK, we've finished analyzing your engine. Let's look at what happens to the power, or *torque*, the engine develops and how it gets you rolling down the road. Bolted at the back of the *crankshaft* there's the *flywheel*. As the crankshaft turns, so does the flywheel. Bolted to the flywheel is the *clutch assembly* or, on automatic transmission models, the *torque converter.*

One side note about the flywheel. Around the edge of the flywheel is a ring of teeth called the *ring gear.* When you turn the key to start the car, the starter motor turns this gear, which engages with and turns the flywheel, crankshaft and all the vital components of the engine. Fuel, air and spark are added, and the engine starts.

OK, the engine's alive, but you're still sitting still. When you engage the clutch (pedal up)—or the engine turns fast enough to lock up the fluid in the torque converter (selector in Drive)—the *transmission* hooks up with the turning engine. The wedding with the wheels is soon to follow. This important link is explained in detail in Ch. 11, Pt. 1, Proc. 1.

In the transmission are shafts around which different sized gears are fitted. As you shift, the gears mesh in different combinations to vary the speed and power potential of the turning force that goes to the wheels. Your power needs change as you accelerate, go up hills, etc. Therefore, the transmission with its choice of gears allows you to choose the right power and speed you need at any moment.

A *driveshaft* connects the transmission to the *differential* and *rear axles*. The differential transmits the turning force that comes from the engine via the drivetrain at right angles, to drive the two rear wheels. The real magic of the differential comes in when the car is steered to right or left. When you make a turn, the outside wheel(s) turns faster and moves farther than the inside wheel(s); a marvelous gear setup inside the differential permits power to go to both wheels, even while one wheel travels faster than the other in a turn. Beveled "spider gears" are part of the secret. As power from the driveshaft enters the differential, a "pinion gear" turns a "ring gear" that is bolted to the spider gear assembly, which in turn transmits power to the right and left wheels. All this goes on inside the large round housing located between the two rear wheels.

At last the turning force within the engine reaches the road through the two rear axles and wheels. You're on your way.

Contrary to what the automotive buffs may tell you, nothing too revolutionary has been done to change the internal combustion engine in a hundred years. The beast still pollutes our atmosphere as it did when it first ran. Advances and retreats have been made in material quality durability, but the parts and principles are pretty much the same. All of today's passenger car and truck engines are covered with antipollution (emissions) devices to help them run cleaner. The later your model the more complex and efficient the system is. Some of these emissions controls are quite ingenious and very effective, but all fall short of a really positive solution to our automotive pollution dilemma—an alternative to the internal combustion engine. (See Ch. 6, Pt. 2, for an explanation of the ins and outs of this technology.)

Basically, you now know how your Datsun/Nissan does what it does. You'll become more familiar with its individual systems as you work on them and read the rest of the book. As you drive, try to imagine what each system is doing and how it all interacts. Use your senses including common sense. Soon you'll find that the more you learn about your car's mysteries, the easier it is to understand and diagnose its needs and aliments as well as be able to prescribe its treatment. Good luck!

Maintenance

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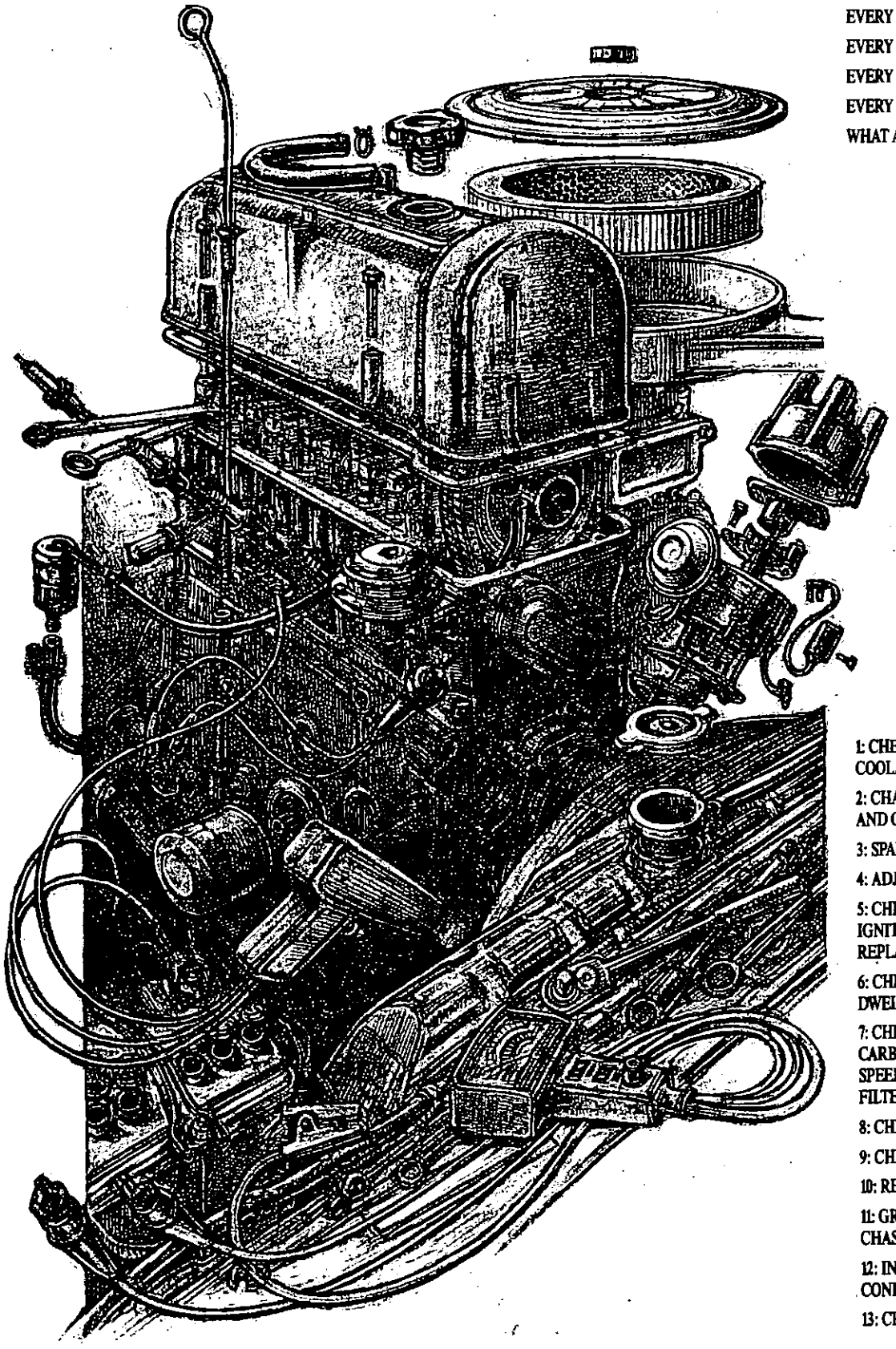

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CHAPTER 3
MAINTENANCE

Maintenance means upkeep. It's doing those little things that keep your car or truck running right with minimum wear.

You'll get closer to your vehicle by performing these regular check-and-refresh procedures, and you'll begin to get a grip on what mechanics do and motor heads talk about. We're slaves to our machines only as long as they remain mysterious to us. Doing regular maintenance will go a long way toward establishing real consciousness between you and your vehicle.

Most maintenance is done under the hood. There you can check the oil and water, battery condition, and look at the fluid levels of the brake and clutch systems. Digging just a little deeper, you can adjust critical parts in and around the engine, change all the fluids (such as motor oil), and test general engine condition for problems that might pop up in the future. By checking under the hood regularly, you will be lessening the chances of an unexpected breakdown some dark and steamy summer night.

A number of these activities were once lumped together as a "tune up," but with modern cars the language is changing. Maintenance is a better word. Competent mechanics look at the entire vehicle rather than just the engine; so the routine (ritual) becomes a holistic art.

Once you begin to get the feel of the whole vehicle and its maintenance needs, you'll find yourself automatically scanning the 'data' the car sends you as you drive. You'll learn to read it, to sense what's going on, and whether something might be amiss.

If you recently bought this vehicle, *assume nothing* about its recent maintenance—even if the previous owner swore on his or her stamp collection that everything has been done up-to-date. Start from scratch: if the car or truck is new to you, do everything.

As you go through these basic procedures, keep in mind something John Muir said: "Translating words into actions is easy when you do it one step at a time. You are not going to intellectualize, you are going to *do* them, and that's different. The idea to grasp well here is one of *Return*. You are going to return the car to a position of well-being by adjusting certain things that have worn, been used up or been bounced out of alignment. As the *I Ching* says, 'Perseverance furthers'—and that is your thing. Take time to do each step completely before going on. . . ."(V.W. Idiot book 1969).

In discussing these procedures I presume that you may never have opened your automobile's hood. I'll tell you just what to do. But please be aware and act safely. To keep the orientation straight, remember that *front* means toward the front of the car, *rear* is the rear, *left* is the driver's side, and *right* is the passenger side.

Here's the order in which both the factory and I recommend doing basic maintenance chores. I will start with the weekly/daily chores. (If you're on a trip, you ought to do them daily.) Most checks and adjustments should be done at specific intervals of miles; try to get them as close to the numbers as you can.

The mileage intervals on the maintenance chart are figures based on my own experience; some are the same as what the factory recommends and others are more frequent.

NOTE: If you drive on rough roads, through high water, deep mud, or in dusty areas, you ought to check the filters, change the oil, check brakes, and look at steering, suspension, and fluid levels more often than recommended. If you live in an extremely hot, cold, or dry place, it's wise to check rubber parts like 4WD front axle boots, flexible brake lines, and steering ball joint boots frequently. In humid climates, brake fluid should be flushed annually. And if you haul heavy loads or pull a trailer a lot, change your transmission and gear box oils at less than 30,000 mile intervals. If you drive on salted roads, everything under and around the outside of your

vehicle will rust and corrode faster; washing with clean water helps neutralize this effect. Driving for repeated short distances without fully warming-up the engine contaminates the engine oil, accelerates exhaust system corrosion, and often increases brake wear.

With all this in mind, Happy Motoring!

DAILY OR WEEKLY MAINTENANCE CHECKS (depending on how much or how hard your vehicle is driven):

Under the Hood:

Oil Level: Proc. 1 (2) in this chapter.

Coolant Level: Proc. 1 (1) in this chapter.

Battery Electrolyte: Ch. 7, Proc. 4.

Hoses, etc.: Check routing of the hoses and condition of cooling system parts (Ch. 8, Proc. 1). Check routing of the coolant hoses and condition of cooling system parts (Ch. 8, Proc. 1).

Brake and Clutch Fluid Levels: Proc. 2(7) in this chapter.

Power Steering People: Check the pump's fluid level (Ch. 12, Proc. 13).

Around the Vehicle:

Tire Pressure: Refer to the manufacturer's instructions or your owner's manual. Tire pressure generally does not exceed 34 psi. Don't forget the spare! Always check pressures cold, with the same gauge, and add whatever you need when you get to an air compressor or hand pump.

Tire Condition: Examine all four tires on the ground as well as the spare for wear, damage, and proper inflation.

Lights, etc.: Check that the headlights, taillights, turn signals, and backup and brake lights work properly. At the same time, check operation of the horn, windshield wipers, and washers (add washer solvent as needed—see your owner's manual).

Steering and Brakes: Drive the vehicle with particular attention to steering and braking (Ch. 12, Proc. 1 and Ch. 5, Proc. 1).

Automatics: Check automatic transmission fluid level (Ch. 11, Pt. 1, Proc. 4).

Leaks: Oil, fuel, coolant, transmission, rear axle, and brake fluid leaks can usually be seen under the vehicle after it has been running and then stopped or it has remained in one spot for a while. Get into the habit of looking under your car or truck often. Most leaks appear under the engine (Proc. 13 in this chapter).

EVERY 2,500 TO 3,500 MILES:

- Perform the Daily/Weekly checks.
- Change engine oil and oil filter (unless synthetic is used).
- Check fan belt and air pump belt tension and condition (Proc. 8 in this chapter).
- Check spark plug gap.*
- Check ignition point gap and timing.*
- Check automatic choke operation.*

*These last three checks can be done at 6,000 to 7,500 miles instead. I list them here for optimal performance, especially in older vehicles.

EVERY 6,000 TO 7,500 MILES:

- Perform Daily/Weekly and 2,500-3,500 mile checks.
- Clean battery terminals and examine the battery cables to starter solenoid and ground (Ch. 7, Proc. 1).
- Check condition of vacuum hoses (Ch. 6, Pt. 2, Proc. 1).
- Check and adjust valve clearances (Proc. 4).

•Check, adjust and replace (if necessary) ignition points, condenser, spark plugs, cap and rotor (Proc. 5 and 6 in this chapter).

•Test spark plug wires for resistance (Ch. 7. Proc. 12).

•Inspect air filter and PCV filter (Ch. 3, Proc. 7 [5] and Ch. 6, Pt. 2, Proc. 2, Step 2 [2]).

•Examine front drive axle boots 4WD (Ch. 11, Pt. 1, Proc. 1 and 5).

•Perform tire maintenance and rotation as recommended by the tire manufacturer or tire dealer.

EVERY 12,000 TO 15,000 MILES:

•Perform Daily/Weekly, and 2,500-3,000 and 6,000-7,000 mile checkouts. Replace the ignition points and condenser, and the spark plugs if necessary. Inspect the distributor cap and rotor. On many electronic ignition engines, especially NAPS-Z with dual spark plugs, the rotor, distributor cap, and spark plugs last up to 30,000 miles (Proc. 3 and 5).

•Test cylinder compression after adjusting valve clearances (Proc. 4 and 9).

•Examine the emission control system and filters (Ch. 6, Pt. 2, Proc. 1-6).

•Check exhaust system for condition and leaks (Proc. 12).

•Adjust brake and clutch systems (Ch. 5, Proc. 2 and Ch. 11, Pt. 1, Proc. 2).

•Replace fuel filter (Proc. 10).

•Check coolant and replace if necessary. Have coolant quality and cooling system pressure checked (Ch. 8, Proc. 1, 2 and 3).

•Inspect drivetrain (Ch. 11, Pt. 1, Pt. 1, Proc. 1).

•Adjust front wheel bearings (Ch. 12, Proc. 3).

•Lubricate 1969-76 truck king pins (Proc. 11). King pin lubrication is crucial on these trucks.

•Vehicles under heavy service (rough roads, etc.). Grease all lubrication points at this interval (Proc. 11).

EVERY 24,000 TO 30,000 MILES:

•Perform all of the services recommended at previous intervals.

•Replace manual transmission and differential oil (Pt. 1, Proc. 3 and Ch. 11, Pt. 2, Proc. 7).

•Replace automatic transmission fluid (Ch. 11, Pt. 1, Proc. 4).

•Examine and repack front wheel bearings (Ch. 12, Proc. 3).

•Flush Brake and Clutch Hydraulic systems (Ch. 5, Proc. 2 and Ch. 11, Pt. 1, Proc. 2).

•Grease all lubrication points (Proc. 11).

•Drain radiator and engine and replace antifreeze/coolant and perhaps the thermostat and hoses (Ch. 8, Proc. 1-3, and 6).

•**4WD People:** Change transfer and front differential gear oils (Ch. 11, Pt. 1, Proc. 16 and 17).

WHAT ABOUT OIL AND FILTERS?

There is much controversy about oil. And since we can't personally watch its molecules under duress in the engine, we are left to myth, advertising hype, and hearsay. I've heard the highest class brands of oil slandered for wearing out timing chains, and I've seen cars run well over one hundred thousand miles on two or three oil changes.

To begin with, oil has a wicked job lubricating an engine. Operating in gasoline engines, petroleum becomes contaminated with unburned gasoline, soot, resins and varnishes, nitrogen and sulfur acids, lead salts, and other inorganic acids. Even large quantities of water, a natural product of combustion, are evaporated out of engine oil. It gets quite complex, and unless you are an oil engineer you have to take someone's word for it. Without the contamination, oil could last a long time. In my opinion, it is wise to change the oil often. If the engine leaks or burns a lot, regular changing isn't so important. However, if it is an oil leaker, the leaks should be fixed; if it's a burner, save everyone's lungs and overhaul or junk it. In addition, it isn't generally recommended to mix weights and brands of oil, but you can in a pinch with no damage done.

Two catagories of oil are now generally available. They are *petroleum* and *synthetic* oils. Petroleum oil is fine and less expensive to buy, but the synthetic is less likely to break down from contamination. Petroleum oils come with or without detergents. All have a classification of "weight" or viscosity: a measure of the oil's ability to pour at various temperatures. The average "weight" sold for North America is SAE 30. In the winter in a climate with varying temperatures, a multi-viscosity oil (such as 10W30 or 10W40) is often used. In the summer, where temperatures are often very high, one might use 20W50 oil. There are also single 20, 30, 40, and 50 weight oils available if the temperatures and conditions in your area are relatively stable. You will see other letters on the top of the can, which relate to oil use standards. Most high quality oils are classified HD (high detergent) SAE (Society of Automotive Engineers) followed by the weight number. The letters "API services SF, SE/CC, SF and SE" is what concerns you. They mean that the oil meets standards developed in 1972.

I recommend using a good quality detergent oil. And, if it is petroleum based, change it at least every three thousand miles. Popular oils I often use are *Valvoline*, *Quaker State*, and the more expensive *Castrol*. Racing type oils are unnecessary unless you race or are racy. I suggest using a cheaper detergent oil for older oil-users and crankcase flushouts, (after there has been coolant in the oil). Many mechanics use non-detergent oil in newly rebuilt engines (as discussed in Ch. 10).

Synthetic oils are worth discussing. They are more costly, but can be run longer (25,000 miles between changes) since they do not react with the combustion residues as petroleum oils do. Some of the benefits of their use are easier cold starting and cooler running. Synthetic oil is not for older engines that leak or burn oil and many do not recommend it as an engine break-in oil. It does keep your engine's innards clean by reducing varnish resin, and minimizes acid deterioration of bearings and pistons; additionally, synthetic oil has a lower pour point temperature, which facilitates cold weather starting. Synthetic oil comes in the same weights (e.g., 20W50) as petroleum oil. I suppose the bottom line is the cost, and whether or not you change your oil as often as you should with petroleum oils. There are also mixes of synthetic and petroleum oils available. Check your area for *Amsoil* or *Lubrichem* distributors, who will give you information about their synthetic oil products.

Another variation is a petroleum-based oil containing graphite. I don't know how this oil works in the long run, but I do know that I don't like to work on the insides of an engine coated with graphite because of its messy nature.

And then there are all of the wonder additives on the market from *Motor Honey* to *Slick Fifty*. The sellers of these products are often zealous and therefore it is advisable to be skeptical.

As for filters, buy good quality ones. In many cases a big name company manufactures the filter on which a chain store puts its name. This goes for oil, air, and fuel filters. I suppose you can trust any well-known brand name. I prefer Datsun/Nissan oil filters. They have lots of pleats which means more surface area for effective filtering. Datsun/Nissan also has a premium filter and one that's shorter and easier to install on Z-series engines. *Always* change your filter when changing the oil. And be careful how you dispose of used oil and filters, and other automotive wastes—most are poisonous and serious contributors to pollution. Service stations and oil recyclers accept used oil. (Synthetic oil makers suggest changing filters but not oil during the recommended oil-use period, so read the product literature.)

PROCEDURE 1: CHECK CONDITION OF OIL AND COOLANT

Condition: Regular maintenance, or a quick look at the two most vital fluids in the engine. The engine should be cool enough to kiss. The vehicle should be parked, engine off, on a level piece of ground.

Tools and Materials: A clean rag, motor oil and/or antifreeze (coolant), if necessary. *Optional:* flashlight.

Remarks: I begin all engine maintenance with a coolant and oil check to determine if there is any leakage between the two systems.

Step 1: Check Water/Coolant Level and Condition.

Make sure the engine's cool. Raise the hood and be careful not to injure your head on the exposed hood

latch. Wrap a rag around the latch. Remove the **radiator cap** by covering it with a rag and gently pressing down on it with the palm of your hand while turning it counterclockwise one quarter turn. If the cap has a **lever** on the top, flip it up first and turn it with your fingers. Once turned, the cap should lift up and off of the radiator lip with some light wiggling.

Peer down into the filler hole. The coolant level should be within 2in of the top of the radiator tank and cover the cooling fins inside. If the fins are exposed to the air, there has been some coolant loss, which may indicate a problem to track down (Ch. 8). If you have trouble seeing clearly, use a flashlight.

If there's oil in the cooling system, a film or oily beads will be seen floating on top of the coolant or the coolant will be slimy to the touch. Some sliminess is normal in antifreeze, but oil will collect on the inside of the radiator and on top of the fluid. Wipe around inside the radiator and then rub your fingers together.

To be effective, antifreeze/coolant should be bright green or blue in color. If the fluid looks clear like water, I suggest you drain the system and refill it with a proper mix of antifreeze and water (Ch. 8.)

If the coolant has a tint of brown, oxidation has taken place and further examination should be done. See Ch. 8, Proc. 1, for a full description of the system, its ins-and-outs, and how to check the radiator cap.

Replace the radiator cap by aligning the tabs on it with the slots in the radiator neck, press down on the cap and turn it clockwise until seated.

Step 2: Check Level and Condition of Engine Oil.

Locate the *dipstick*. **L-series engines (except 4WD):** It's on the right (passenger) side of the engine block directly below the #3 (third from the front) or #2 spark plug. **NAPS-Z and L-20B 4WD:** Your dipstick is on the left (driver) side of the engine behind the exhaust manifold. The curved handle of the dipstick makes it easy to remove. Pull out the dipstick and look at its tip. You'll see two marks for indicating engine oil level. A sample of the oil should cling to the stick.

Usually the oil will be dark and thick unless it is new, in which case it'll be clear brown, unless the oil you use contains graphite or synthetic oil. If the oil is contaminated with water it will take on a tan or milky look. Oh, woe! This means that coolant has entered the crankcase through the head gasket or a crack elsewhere in the engine. If you're faced with this, do not run the motor before reading what to do in Ch. 9, Pt. 1, Introduction.

Occasionally a little water or condensation creeps down the dipstick and will give you a false scare. But you'll be able to tell once you wipe off the stick and try it again.

Wipe the oil off the dipstick with a clean rag. Reinsert the dipstick into its tube in the crankcase. All the way. Pull the stick out again and read the level marks. If the oil line is between the two marks, you're OK. If the level is below the low mark and an oil change is not due, add enough oil to bring the level up to the full mark (Proc. 2[5]). *Do not overfill.* If you're changing the oil and filter at this time, note in your records the amount of oil the engine has been burning or leaking. You can determine this roughly by noting the mileage since you last topped up the oil. Oil consumption will vary. If very little or no oil at all clings to the end of the stick, check it again, and make sure you add enough to keep the level in the safe range before driving.

It's unlikely, but sometimes oil will become contaminated with gasoline. In this case the level will be overfull and the consistency of the oil will be very thin and will smell like gasoline. This is an indication of a bad **fuel pump** or excessive flooding (Ch. 6, Pt. 1, Proc. 9).

Step 3: What Next?

There's no sense in pursuing a tune-up if major engine problems are present; that's why I had you look for those ominous telltale signs in the water and oil. Chances are, of course, they are OK.

For more complete oil-in-the-water and/or water-in-the-oil information, refer to Chapter 9, Pt. 1, and/or Chapter 8.

If your engine runs rough or you question whether it's even worth tuning, perform a compression test to determine its condition before going on (Proc. 9).

PROCEDURE 2: CHANGE OIL AND FILTER, AND CHECK HYDRAULIC FLUID LEVELS

Condition: Regular maintenance, every 2,500 to 3,000 miles.

Tools and Materials: Drain pan (5 qt.), large size (3-½in closed) standard design oil filter wrench, 5 quarts oil (see *What About Oil*, earlier in this chapter), 22mm socket or box-end wrench (or 8in adjustable wrench), can opener ("church key" type), and funnel (an old plastic 1 gal. bleach bottle will do)—or some type of oil can spout. *You may also need* some brake fluid (DOT 3 or 4). NOTE: **Z-series:** You'll need a short-handled (3in) standard design (3-½in closed) or cap style filter wrench because of the tight working space.

Remarks: It's good to change oil often, especially if you use your car for short trips (where the engine never really gets hot enough to evaporate the moisture oil attracts) or if you drive long distances, working the oil hard. Dusty conditions make the oil gritty enough to merit frequent oil and filter changes.

In any case, use good quality oil and try to avoid mixing weights or brands of oil unless you completely drain the crankcase and change the filter. NOTE: It is reported that used motor oil causes skin cancer. On a daily basis, this may be true. At any rate, wash your hands well after contact.

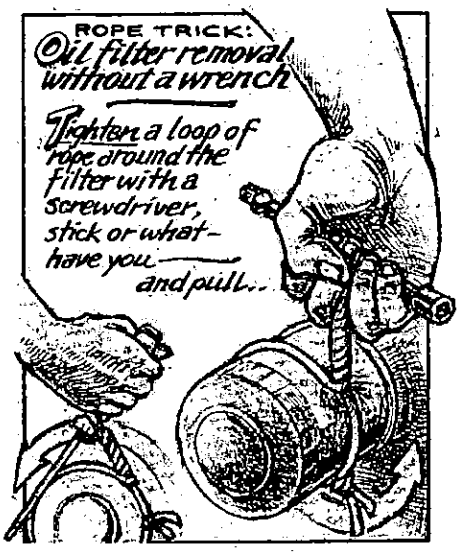
Step 1: Pull the Plug.

Warm the engine to operating temperature and park on a level surface. Switch off the engine, put it in gear, and set the handbrake.

Look under the engine and locate the oil pan. On one side of the pan you'll find a bolt head (usually 21 or 22mm) that is threaded into the pan. When the **plug** (bolt) is removed, the old oil will flow out fast. Loosen the plug counterclockwise and put the drain pan where it will catch all the oil. *Beware of hot oil!*

Try not to plop the plug into the drain pan. Hold onto the plug while unscrewing, keeping some pressure against it so that you can control the flow once the plug threads out.

Let the oil drain for at least five minutes after the stream has dwindled to a drip. Clean off the plug and stash it where you'll find it.



Step 2: Remove the Oil Filter.

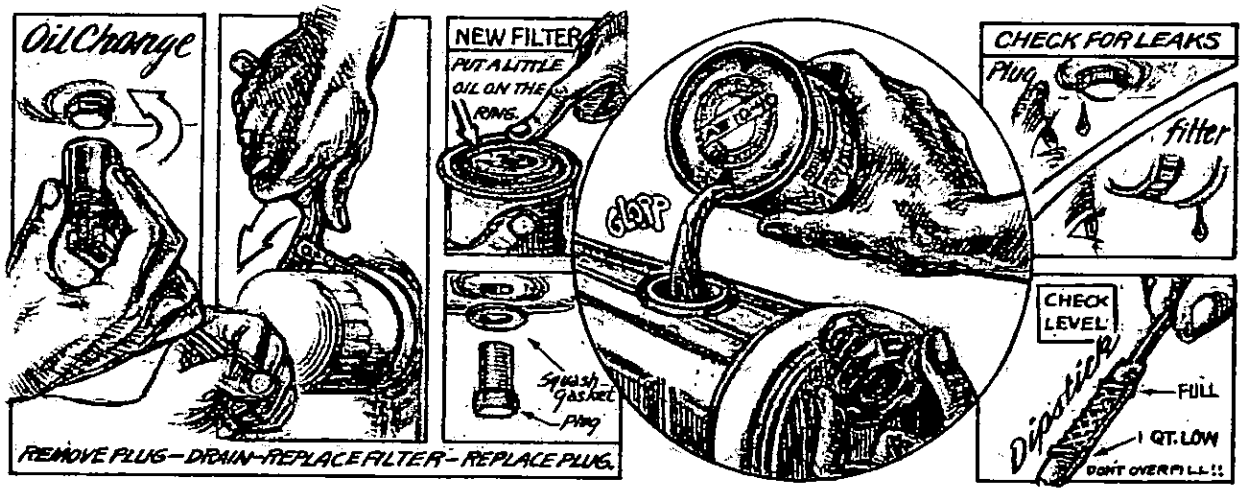
The filter is on the right side of the engine block, behind the alternator. Position your drain pan directly under the filter and a rag under the oil pan to catch remaining drips.

Check out the new filter (sure it's the right one?) and read its brief installation instructions. NOTE: It may be shorter, but should be otherwise identical to the one removed.

Unscrew the old filter counterclockwise. Usually you'll need an **oil filter wrench**, which is designed to tighten around the filter as you push against the handle. Put the round, strap part of the wrench over the old filter with the handle on the front side of the filter. When you pull counterclockwise, it should tighten against the sides of the filter. If it doesn't, flip the wrench around and try again. Exert some *umph*, and the filter should loosen. Once started, it'll thread out easily by hand. Oil inside the filter will drain out as you pull it free. If the filter is too hot to touch, handle it with a rag. There should be a rubber gasket or O-ring stuck to the face of the filter. If it's not there, it's stuck to the block, and you must lift or scrape it free.

Step 3: Install New Oil Filter.

With a clean rag wipe all excess oil and grit from the area where the filter meets the block. Pick up the new filter, coat its rubber gasket with grease or clean oil, and make sure that the gasket is inside the rim of the filter. Thread the new filter squarely onto its pipe fitting on the block, and turn it until it seats against the block. Then tighten it ½ to ¾ more turns to ensure a snug fit. *Do not use the wrench to tighten the filter—just use your hands.* OK, the new filter's in.



Step 4: Put the Plug Back In.

Pick up the drain plug and examine the little copper *gasket-washer* that should be around the shoulder of the plug. It's an essential part. If yours is disintegrating, replace it with one from Datsun/Nissan or your local parts store.

Wipe the plug clean and take it back to its hole. After you've placed the threads of the plug straight in the hole, turn it clockwise into the pan with your fingers. It should complete a few turns easily. Fit the correct size wrench over the plug and tighten it with the force you would use to close a tight-fitting door.

Step 5: Put the New Oil In.

Open only four quarts of oil if refilling the crankcase. Remove the **filler cap** on top of the **cam cover**.

If you have a push-in (gas station type) oil spout, stick it firmly and completely into the top of the can. Make sure the spout is clean before tapping the can. Otherwise, you can open the cans with a regular puncture-type can opener, and pour the oil in with the help of a large funnel. Make your own by cutting the bottom off a plastic bottle (round half-gallon ones work well). Keep a rag in one hand to mop up any spillage.

When the four quarts are in, put the oil filler cap back on.

Step 6: Test for Leaks and Check Level.

With four in the hole and none on the floor, start the engine. Run it above idle for a few moments. The oil light should go out. Now let it idle and peek under and around the engine for leaks—especially at the filter and drain plug. If you detect a leak, you'll have to shut it off and retighten the drain plug or filter.

After two minutes stop the engine and let it sit for five. Reach for the **dipstick**, wipe it clean, and put it in the hole all the way and out again. The new oil's clearness will make it a little hard to see, so look closely for it on both sides of the stick. The quantity between the two marks is a quart. Add enough oil from the fifth can, usually ½—5/8 of a quart, to bring the level up to the H mark. Take care not to overfill.

Put the dirty oil into any kind of sealable containers that won't spill, like an old antifreeze jug or plastic milk bottle, and haul it to the nearest recycling center or gas station. It's stupid to use it as furniture stain or to pour it out in the garden, street or sewer, because used oil contains poisons and heavy metals. The old filter goes into the trash and back to forgiving Mother Earth—wrap it in a baggie so the oil in its innards won't spill.

Step 7: Check the Hydraulic Fluid Levels.

Locate one, two, or three plastic cylinders or teardrop shaped containers bolted to the firewall or in front of a round black housing at the left rear of the engine compartment. These cylinders hold brake fluid. They are **reservoirs** for your clutch and brake hydraulic systems. The fluid levels should be between the high and low

marks on the sides of the reservoirs. Wipe off the reservoirs to see these marks. With age, the seals in these systems start to leak and fluid is lost. It's important to check the fluid levels periodically and refill if necessary with standard DOT 3 or 4 brake fluid.

Remove the caps from the reservoirs, and make sure dirt doesn't fall into the fluids. The reservoir to the left (driver's side) is for the clutch (manual transmission only). The reservoir(s) to the right is for the brakes. NOTE: Do not add fluid to the brake reservoir unless the level drops below *low*.

Usually the clutch reservoir runs dry first, in which case you'll notice the clutch acting up. If the clutch slave cylinder (bolted to the transmission below) is leaking you can keep refilling the reservoir until you replace the cylinder (see Ch. 11, Pt. 1, Proc. 1 [3] for more information).

If your brake reservoir(s) is low or goes dry, you will notice problems in the way your brakes work. By keeping an eye on the fluid levels, you'll know if there are any leaks in either the brake or the clutch system. Some drop in the level of disc brake equipped cars and trucks is normal. If the fluid level continually drops below low, don't hesitate to check out Ch. 5, Proc. 1. Put the caps back on securely and clean up.

PROCEDURE 3: SPARK PLUGS: REMOVE, INSPECT, CLEAN, GAP, AND REPLACE

Condition: You are here for maintenance, to put in new spark plugs, to check cylinder compression, to check for spark to the plugs, to check for piston position, or to check for water in the cylinders.

Tools and Materials: 13/16in spark plug deep socket ratchet and extension, spark plug gapping tool. *Optional:* Pocket knife, feeler gauges, and small pliers. Four new spark plugs. I recommend NGK, Nippondenso, or Bosch brand (see Remarks and chart below).

Remarks: You should drive your car/truck at mid-range highway speeds, choke off, engine fully warmed up, without excessive idling, prior to checking spark plug condition. If you plan to check compression, warm up the engine while reading Proc. 9.

More on Spark Plugs:

Spark plugs are like laundry detergents. There are many manufacturers of similar quality, producing goods that do basically the same job. Every mechanic has a favorite brand of spark plug, depending on his or her experience and product availability. Most quality plugs will last the same number of miles; the three brands I mention in this procedure have good reputations. I put NGK plugs in Datsun/Nissan engines because they have served me well and they are what the factory recommends. Whichever you install have to have a 14mm thread with a 19 mm or ¾in reach.

Below is a chart made up from available sources. NGK part numbers are listed. Each letter and number means something about the construction and application of the spark plug.

The B of B6ES is the thread—14 mm.

The P in BP6ES means that the plug has a projected tip. The vehicles that call for B6ES can use the P plugs if necessary and vice versa. The plug for your engine is listed according to the engine's original pistons and cylinder head. A change in either or both will affect the combustion chamber design. Combustion is a mysterious science!

The BP6ES plug is a medium heat range spark plug. BP7ES is a **colder** plug (range) which means it transfers

heat away quickly: good for steady, high speed, high compression, hot running (electrodes burn fast) engines. BP5ES is a **hotter** plug. It transfers heat less fast, good for slow speed (city driving), cold running or oil burning engines. For most purposes, the plug(s) listed in the chart will satisfy your needs. NOTE: On twin plug NAPS-Z engines, the exhaust side plug is a BPR5ES, and the intake side plug is a BPR6ES.

The E is BP6ES is the reach—19 mm (¾in).

The R in BPR6ES stands for resistor. These plugs suppress radio frequency interference. Use these along with good quality spark plug wires to control radio static. You'll know it's ignition-caused interference if its frequency changes with engine speed.

The S means **super** (what else?) for super wide range construction.

The 11 in BP6ES-11 is for certain electronic ignition systems that require a wider gap for a higher voltage spark. The 11 means 1.1mm or 0.043in (see chart).

The spark plug electrical gap you choose depends on the plug and the engine it's in. A wider gap gives a maximum voltage spark and perhaps more efficient running. The increased gap will, however, require more work for the wire insulation and other ignition parts. The effect may be negligible, however, it is something to remember if your ignition system starts to misfire.

If you check your plug gap often (every 3,000 miles), set the gap on the wide side of the scale. If you neglect your plugs, set the gap that's listed or one toward the tight end of the scale. The average gap is listed first; the range is listed to the right. Check your engine number L-16, 18, 20B or Z-20, 22, 24 for exact application. If you have transistor-electronic ignition, you won't have points in your distributor. NOTE: You may have a California vehicle even if your vehicle was purchased elsewhere.

CARS/YEAR	ENGINE	NGK	ELECTRODE GAP (in.) mm.
510			
1967-72	L-16	BP5ES or	0.033in (0.032-0.036) 0.8-0.9
		B6ES	0.030in (0.028-0.032) 0.7-0.8
1973	L-16	B6ES	0.030in (0.028-0.032) 0.7-0.8
1978-79	L-20B	B6ES-11	0.042in (0.040-0.044) 1.0-1.1
1977(Can.)	(same)	BPR6ES	0.033in (0.032-0.036) 0.8-0.9
1980	(same)	(same)	(same)
1980-81	Z-20S	BP6ES	(same)
(Calif.)	(same)	BP6ES intake	(same)
		BP6ES	
		exhaust	(same)
610			
1972-74	L-18	B6ES	0.030 in (0.028-0.032) 0.7-0.8
1974-76	L-20B	BP6ES	0.033 in (0.032-0.036) 0.8-0.9
1975-76	(same)	BP6ES-11	0.042 in (0.040-0.044) 1.0-1.1
710			
1973-74	L-18	B6ES	0.030 in (0.028-0.032) 0.7-0.8
1975-76	L-20B	BP6ES	0.033 in (0.032-0.036) 0.8-0.9
(Calif.)	(same)	BP6ES-11	0.042 in (0.040-0.044) 1.0-1.1
1977	(same)	(same)	(same)
(Can.)	(same)	BPR6ES	0.033 in (0.032-0.036) 0.8-0.9
TRUCKS			
521			
1968-69	L-16	BP5ES or	0.033 in (0.032-0.036) 0.8-0.9
		B6ES	0.030 in (0.028-0.032) 0.7-0.8

620			
1970-73	L-16	BP5ES or	0.033 in (0.032-0.036) 0.8-0.9
		B6ES	0.030 in (0.028-0.032) 0.7-0.8
1974	L-18	B6ES	(same)
1975-77	L-20B	BP6ES	0.033 in (0.032-0.036) 0.8-0.9
1976-77			
(Calif.)	(same)	BP6ES-11	0.042 in (0.040-0.044) 1.0-1.1
1978-79	(same)	(same)	(same)
1977-79			
(Can.)	(same)	BPR6ES	0.033 in (0.032-0.036) 0.8-0.9
720			
1980	L-20B	BP6ES-11	0.042 in (0.040-0.044) 1.0-1.1
(Can.)	(same)	BPR6ES	0.033 in (0.032-0.036) 0.8-0.9
1981-85	Z-20,22		
	& 24	BPR6ES	
		intake	0.033 in (0.032-0.036) 0.8-0.9
		BPR5ES	
		exhaust	(same)

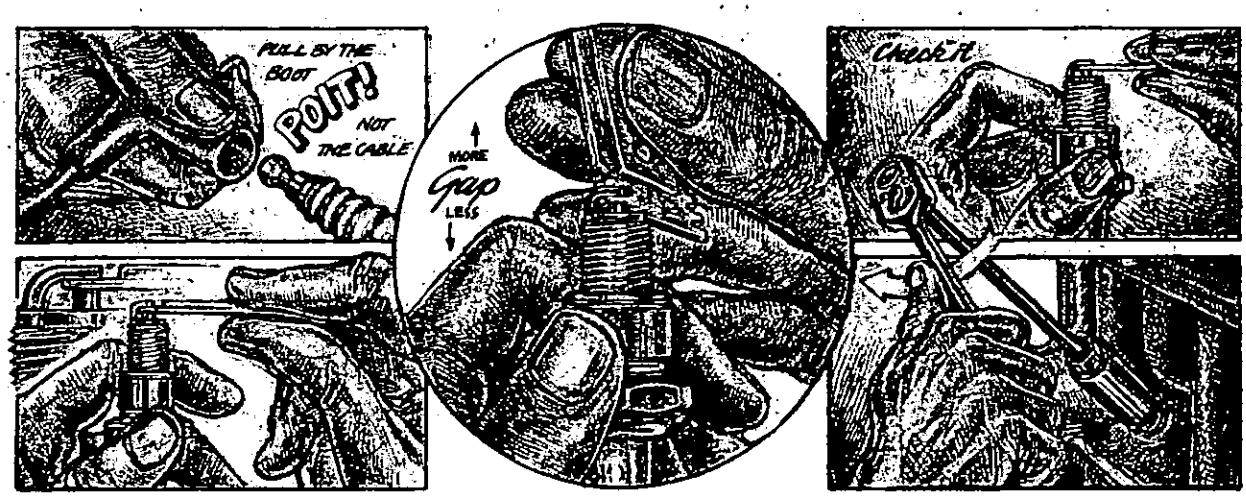
NOTE: All of the spark plugs listed above are available in resistor type. See the preceding text for more details on NGK spark plugs.

Step 1: Where Are They?

The spark plugs are located on the right side of the **cylinder head**, atop the engine. Four big black *spark plug wires* connect the plugs to the distributor cap, crossing over the **cam cover** and head. The spark plug closest to the front of the engine is for your #1 cylinder.

Step 2: Pull the Wires.

Gently but firmly grasp the **boot** that covers the spark plug and twist, then pull it straight off with a pop. Start with the #1 plug. But wait! If there's no **organizer clip** holding the wires in order on top of the cam cover, mark the wires according to their order (#1, 2, 3, 4—front to rear) with pieces of masking tape before you remove them. Detach all four wires from the plugs and let them hang. If there is a clip make sure that the wires are in order.



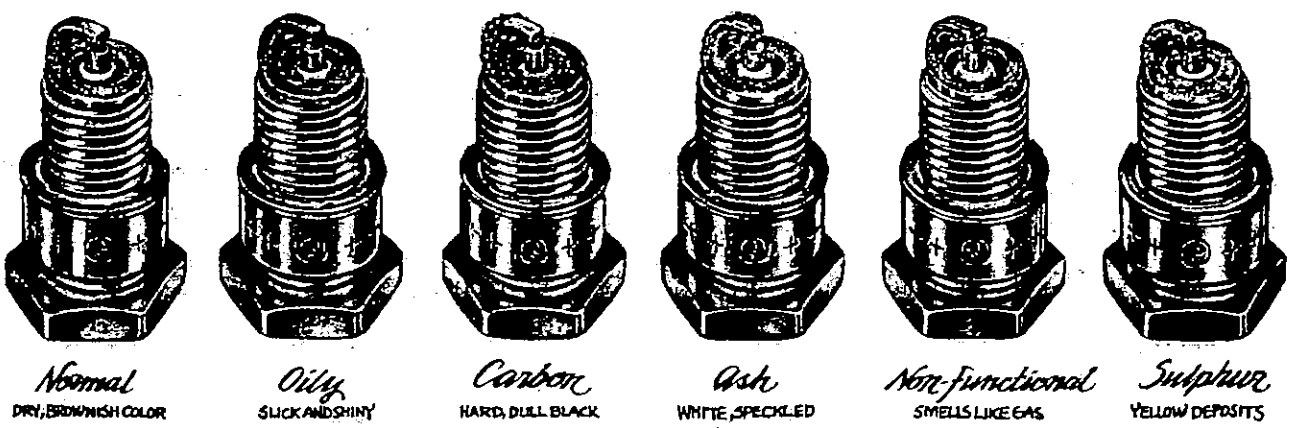
Step 3: Out With the Plugs.

Notice that the base of each plug is metal with hexagonal sides. Fit the spark plug socket fully over the #1 plug until it has the hexagonal base in its grip. Snap the extension and ratchet onto the socket and, with smooth pressure, turn the socket counterclockwise to loosen the plug. If necessary, rap the ratchet handle with the heel of your hand until it starts turning. When the plug is loose, detach the ratchet and use the socket wrench to unscrew it. NOTE: Watch out for hot plugs. Use a rag to handle them as they come out.

Notice the **washer** between the hexagonal and threaded metal part of the plug. If it's loose, don't lose it; it's important for seating and sealing.

Remove the remaining plugs, keep them all in order (#1-4) and lay them out on the work bench. (Unless, of course, you only need to remove one plug.)

If you're planning to check compression, or want to crank the engine with less strain on the battery, leave the plugs out, go on to the business at hand, then return to Step 7 for replacement.



Step 4: The Condition of the Spark Plugs.

A spark plug is an *electrode* that ignites the fuel-air mixture within the cylinder, which runs the engine. It's a crucial component. Much can be learned by looking at the *gap* and business end of the plug.

A healthy engine that does not use excessive oil and burns the proper fuel-air mixture will give you a *tan to gray* color on the spark end of the plug. A *blackened oily or thick sooty* buildup indicates extreme oil burning, and tells you that major work is needed. A *dry carbon* look indicates that the choke may have been stuck on or that your fuel-to-air mixture is *rich* (too much fuel or incomplete burn—check ignition points and timing, and choke operation). An *ash white* color may be normal, but if little specks are visible close up or the electrodes are melted away, the mixture may be too lean and the burn too hot. These last two will lead you to suspect carburetor or timing adjustment problems. A non-functioning plug will appear *wet* and smell like gasoline. A *yellow* tint on the plug end indicates high sulfur or leaded fuel use.

If you have further questions about plug condition, take the plug(s) to a mechanic or consult the literature at the parts house. All four of the plugs should look pretty much alike. If one or more of the plugs are different, note which cylinder the plug came from. Further information may be gleaned from a compression check.

Spark plugs should last 10,000 to 20,000 miles under normal conditions and be replaced in a set (unless one fails prematurely). A new plug electrode has sharp edges and flat surfaces on both pieces. Compare a well-used one with a new one. Unless your plugs are in great condition, it's practical maintenance to replace them.

Step 5: Clean Old Spark Plugs.

If you intend to use the old plugs there is a slight amount of cleaning you should do. Use a pocket knife to scrape off all the scale and crust that has formed around the electrodes and plug base. A light gauge wire grinder wheel works well, but can be dangerous and may damage the plug, if you're not careful.

Step 6: Gap the Plugs (new or old).

You must first know what the gap specification is for your engine. Look at the chart at the beginning of this procedure to determine yours, then proceed. The tools used for this job include a *graduated thickness slide*, or a wire type spark plug gauge or a feeler gauge. The former two accurately allow you to measure the distance between the center and side (movable) electrode. Many gapping tools also include little cutouts used to bend the movable electrode up or down as you require.

You can also adjust the gap with a *feeler gauge* blade slipped flat and parallel between the electrodes. To move the bendable electrode, use the blade itself to increase the gap and light tapping on top of the electrode to decrease the gap. Before you install the plugs, make sure the movable electrode is directly above the center electrode. Use needlenose pliers to straighten the electrode and then recheck the gap. Take care not to break the ceramic outside or inside (center electrode) of the plug.

Step 7: Put 'Em In (but make sure they are properly threaded).

If the plug came out with difficulty, the threads may be worn. If not badly damaged, you can coat the plug's threads with a touch of penetrating oil to ease installation.

Make sure the washer is in place and seated between the threads and shoulder of the plug. Hold the plug with the electrode end toward the hole in the head. The threaded end of the plug must be positioned straight into the hole to be started correctly. Once in place, begin turning the plug clockwise into the hole with your fingers. Feel some resistance? Stop and make sure the plug is properly aimed before continuing. **Never force a plug into its hole.** Turn as far as you can by hand, then ready your plug socket and ratchet.

Fit the socket all the way over the plug. Now continue tightening by socket and hand until the ratchet is needed. A standard sized 3/8in drive ratchet is best because accurate feel is needed. Remember, the plugs are steel and the head is made of softer aluminum.

If the plugs are old the washer at the base will already be crushed flat. New ones will crush down slightly as you tighten against them. The idea is to know when the washer meets the top of the hole, i.e., when turning resistance increases. On new plugs, the "new washer crush" feels as though the plug sinks slightly after contact, as you turn. Used plugs bottom out right away. When you feel more than a little resistance, go easy.

Use a torque wrench if you can. Place one hand on the head of the ratchet above the socket and the other hand on the handle end. Feel the wrench turn harder as the plug tightens. Only mild force (12 ft.lbs.) should be placed upon the wrench handle, something like tightening a jar lid securely.

Borrow a torque wrench if necessary. Too loose is as bad as too tight.

Repeat the removing, cleaning, adjusting, and replacing process with all of the plugs. NOTE: If you happen to strip a spark plug hole thread (but not too severely) or it's hard to install a plug, you can usually save the threads by carefully running a 14mm **thread chaser** into the hole. How to do this? Ask at a machine shop.

Step 8: Check the Plug Wire Resistance and Reconnect the Wires.

If you have an ohm meter, it's common in a tune up procedure to check the electrical resistance of the high voltage spark plug wires. Bad wires (high resistance, shorting, or open wires) will make your engine miss or be hard to start. To check these, refer to Ch. 7, Proc. 12.

The wires are held in place by the organizer clip atop the cam cover or are numbered on masking tape. If you have any question about the correct firing order and the way the wires connect, check Ch. 7, Proc. 12. If the order appears all right, push any of the caps on the ends of the wires over the tops of the plugs. If any of the caps fits loosely (pulls off very easily), tighten it following directions in Proc. 4 (11).

Now start the engine. If it runs poorly or not at all, recheck the firing order (positions) of the wires.

PROCEDURE 4: ADJUSTING VALVES (COLD AND HOT)

You can do it either way. These instructions include settings for both *cold* and *hot* valve adjustment. The best method is to set valves with the engine hot; however, if you're inexperienced (or assembling the engine), I recommend that you run through the procedure with a cold engine to get the knack of it, then go back and re-adjust the valves hot. *Read through this procedure completely before actually starting the work.* As always, the driver's side is on the left, passenger side on the right. NAPS-Z-20, 22, 24 valves are slightly easier and faster to adjust.

Condition: You are here for routine maintenance, or because clatter from the valve cover tells you the valves are not adjusted, or to check for valve seat pounding (Step 5), or to check for timing chain stretch (Ch. 9, Pt. 2, Proc. 1) or you are assembling the engine. It's a good idea to inspect the camshaft for wear while the cam cover is off (Ch. 9, Pt. 1, Proc. 1).

Tools and Materials: 13/16in spark plug or deep socket, ratchet and extension, screwdrivers (straight and Phillips), 14mm and 17mm (L-series) and 12mm (Z-series) open-end wrenches, masking tape, parts container, cam (valve) cover gasket—change at 12,000-mi intervals (preferably the *white* kind up to 1/83 and a rubber one for 1/83 and later Z-series engines), remote starting device (Ch. 13, Pt. 2), feeler gauges (0.008, 0.010, and 0.012in—L-series and 0.008, 0.009, and 0.012in—Z-series). **Z-series People:** An alligator clip jumper wire. *Optional:* Pliers, speed wrench, soft hammer.

Step 1: Know Where You Are.

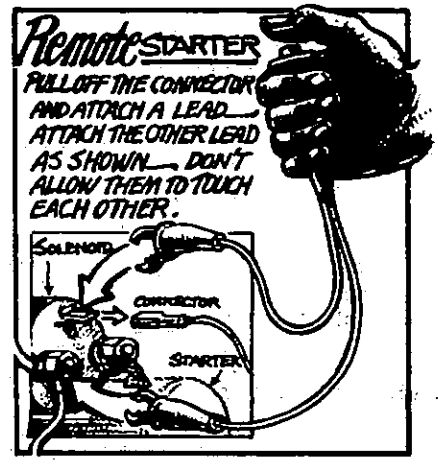
Read Ch. 2 "How Your Datsun Works" to understand the basic operation of the engine. In this procedure you will be setting the critical relationship between the **cam** and the **valves**, a setting which gradually yet constantly changes throughout the life of the engine.

Raise the hood (and take a deep breath). I shall begin by identifying the players by their names and locations. The **air cleaner housing** sits on top of the engine on the left hand side (L-series), right side (Z-series). It's blue. Directly on top of the engine sits the **cam cover**. There are six (L-series) or eight (Z-series) small 10mm headed bolts that hold the cam cover to the **cylinder head**. You have a **gasket** under the cam cover (the gasket should be changed when leaking, ripped or every 12,000 miles).

Four **spark plug wires** cross the cam cover; they connect the **distributor cap** on the left side of the engine to the four spark plugs on the right side of the cylinder head. (These are the intake plugs on Z-series engines with eight spark plugs.) A block crankcase **breather hose** on the top of the cam cover connects to the air cleaner housing.

Step 2: Safety First.

Place the transmission in Park (automatic) or Neutral (manual) with the ignition turned off and the emergency brake on and wheel chocks in place.



Step 3: Connect the Remote Starter or Prepare a Socket to Rotate the Engine.

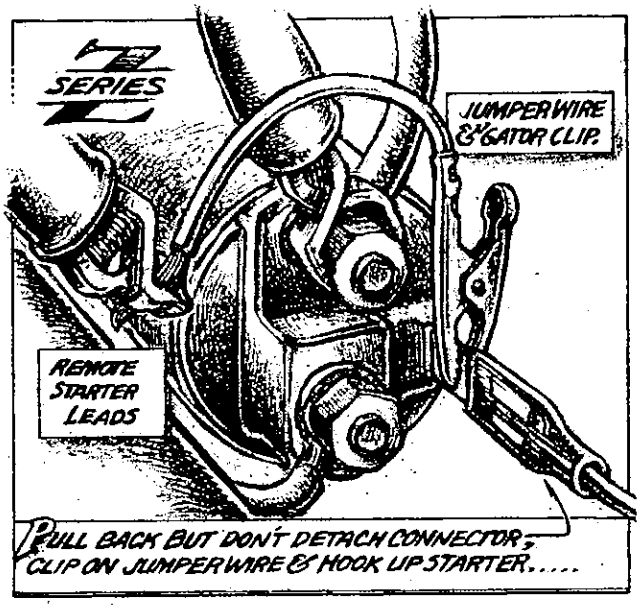
The remote starter tool and wrench or socket are explained in Ch. 13, Pt. 2. **Remote Starter:** Locate the **starter** (cranking) **motor** and the **solenoid** on the lower right rear of the engine.

•**L-series People:** Find the *small wire* connected to the solenoid and unplug it. Now connect one of the remote starter clips to the now visible brass "spade" sticking out of the solenoid—where you unplugged the small wire. Connect the other clip to the large terminal

below and to the outside of the spade. The positive (+) battery cable attaches to that terminal.

•**Z-series People:** The starter and solenoid are below and behind the carburetor and intake manifold. The solenoid, tucked in close to the engine, is difficult to reach.

To connect the remote starter, find the plastic tipped connector on a small wire (black/white or black/red), which plugs into the front of the solenoid. Use a light to find it, then pull the connector forward enough to expose a bit of the metal spade it fits over.



Clip one end of the jumper wire onto the metal spade and the other end to one of the remote starter clips (wires).

Now find the heavy wire that connects the positive (+) battery terminal to the solenoid and wrestle the other remote starter clip (wire) onto that. Voila, YOU'RE HOOKED UP. NOTE: Don't let the clips touch (ground) surrounding engine or body parts.

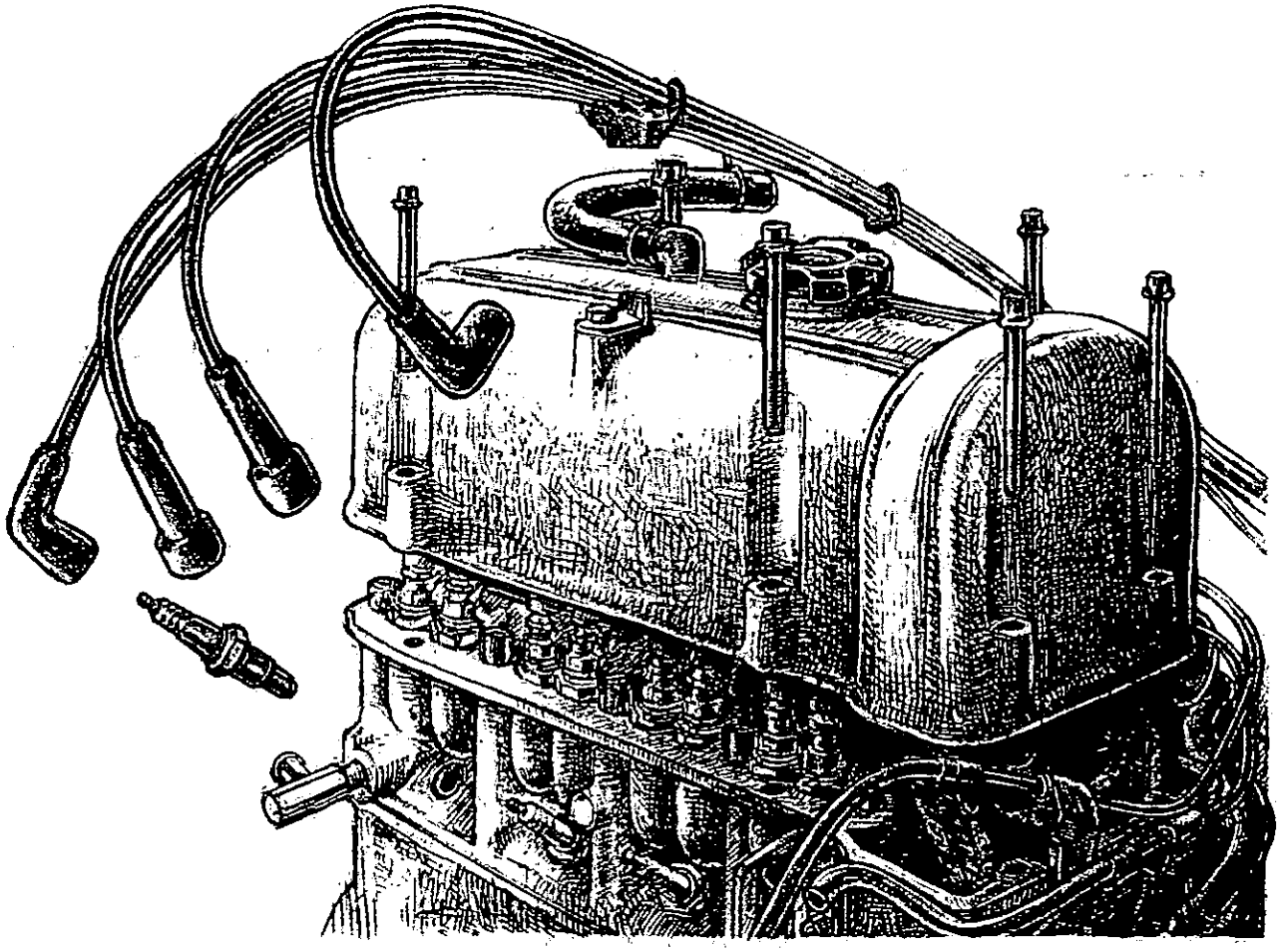
By touching the remote starter button you connect these two terminals and the engine should turn over but not start. (The ignition key is OFF, remember?) While operating the remote starter be sure to keep all wires, human body parts, and tools clear of the front and top of the engine. If the button doesn't crank the engine, recheck your jumper wire connections.

Socket or Wrench Method: Although this way may be slower, you can use a 1-1/16in or 27mm socket or wrench to rotate the engine. These tools are discussed in Ch. 13, Pt. 2; the method is detailed in Ch. 13, Pt. 1, Proc. 3.

Step 4: Remove the Cam Cover (also called the valve cover).

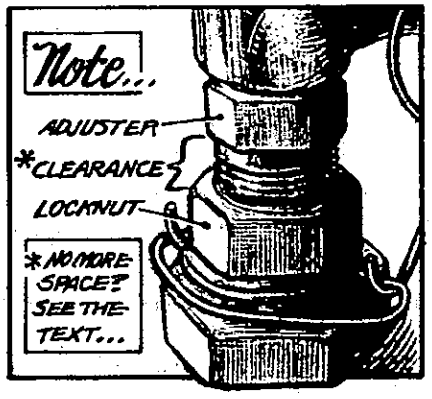
NOTE: If you're an experienced valve adjuster and are ready to set them hot, you should now warm up the engine. While it's warming, read through the next five steps and get your tools ready. Start with Step 6 to check the gap. If you're doing them cold, skip ahead to the next paragraph. **Z-series:** You have to remove the air cleaner housing to remove the cam cover. These instructions are in Fuel (Ch. 6, Pt. 1, Proc. 1). Be sure to plug the necessary pipes and hoses so the engine will run with the housing removed. Press the accelerator pedal twice (to set the choke) and turn the ignition ON (dashlights on). If the remote starter is connected, crank the engine with the remote button rather than the key. Start the engine and keep it running until the temperature gauge reaches its normal position. While it is warming, gather the tools you'll need. (**L-series**, 14 and 17mm open ends; **Z-series**, a 12mm box-end and screwdriver). When the temperature reaches the mid-range, turn the key to OFF and remove the cam cover.

Follow the spark plug wires over the cam cover to the right side of the head where they connect to the spark plugs. You'll see "boots" on the ends of the wires, covering the plugs. Pull the wires off of the plugs by gently twisting the boots a fraction of a turn, then pulling them straight up and off. Don't yank on the wire, just the boot. Remove all four wires and let them hang. If the wires are not held in order by a plastic holder/organizer on top or side and front of the cam cover, label each one with masking tape and number them 1 through 4, front to rear. **Caution:** The plastic clips break easily—handle them gently. The plastic holder(s) slip-fits over a bracket bolted to the cam cover (**L-series**) or to brackets at each bolt along the side and front of the cover (**Z-series**). Pull the clips up along with the wires and flop them all over to the left side of the engine, but wait. **L-series**: There's another wire holder that slips onto a bracket above the thermostat housing which can also be pulled out. **Z-series**: There's a hose clipped to the wires at the front of the engine. Carefully separate them.



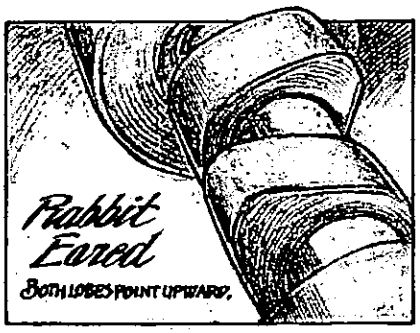
A **black hose** on the cam cover connects to the underside of the air cleaner housing. Push this hose off of the fitting on the cover. Spread and slip back the wire clamp with pliers if necessary. This hose may be tight and hard with age; be firm without destroying it or yourself.

Fit the 10mm socket to an extension and ratchet or speed wrench. Start loosening the six or eight bolts that hold the cam cover in place. **L-series**: Remove and put them in a parts container. If there is a bracket under the left rear bolt (later models) follow it up to the **antistall dashpot** at the rear of the carburetor. A Phillips head screw holds this bracket to the dashpot. Remove this screw and stash it along with the bracket in the parts container. **Z-series**: The clip holders will come off with the bolts. Keep them lined up on the bench in their correct order. They are *not* all the same. There may be a ground wire eyelet bolted to one of the cover bolts or another bolt atop the cover. Remove and let it hang.



•**Everyone:** The cam cover can now be lifted off. Stand on the passenger side of the vehicle and, with both hands, pull the cover toward you. Be careful not to burn yourself on a hot engine. If the cover sticks use the heel of your hand or a soft (not steel) hammer to tap on its ends to loosen it. Lift the cover up and forward, past the master-vac hose (**Z-series**) and off the head. The **gasket** may stick to either or both the cover and/or the head; so separate it carefully. **Z-series 1983½ on:** You have a rubber gasket that should stay with the valve cover.

Set the cover aside, keeping dirt and curious animals out of it. Be careful not to drop things down the front of the engine, into the **timing cover** under the **cam gear**.



Step 5: Check the Works and Check Valve Seat Pounding and Cam Wear.

The **camshaft** and **valve train** are now exposed. Look over the parts and the accompanying illustrations to acquaint yourself with the valve parts. NOTE: **L-series**: The camshaft is above the rockers. **Z-series**: The camshaft is below the rockers. The camshaft is driven by the **camshaft gear**, which is at the front of the shaft. The **timing chain** links this gear to the crankshaft, down below and out of sight. As the camshaft turns, the cam lobes, one at a time, act upon the **rocker arms** (rockers, not mods). These, in turn, push down against the tops of the valves. The **springs** around the **valve stems** return the valves to the closed position once the egg-shaped ends rotate clockwise away from the rockers. You can watch all this in action by operating the remote starter button. Be sure to keep clothing and body parts away from the top of the engine while it moves. I will refer to the cam lobe as the **toe** and the round, evenly shaped part of the cam as the **heel**.

•**L-series**: The measurement you're concerned with is between the *heel* of the cam and the shiny top of the rocker arm—180° away from its rocker top. Check and adjust it when the toe of each arm is pointing straight up.

•**Z-series:** The measurement is between the top of the valve and the outside end of the rocker below the tappet adjuster. Check and adjust it when the toe of each cam is pointing down—180° away from the bottom of the rocker.

•**Everyone**: So you see, the camshaft will have to be rotated before adjusting each of the eight valves. This is where the remote starter comes in.

But before we commence, take a close look at the parts you'll be adjusting.

•**L-series**: Under each cam sits a rocker arm, right? One end of the rocker rides against a *pad* on top of the valve stem. The other end of the rocker sits on top of the adjuster. The top of this is covered by the round end of the rocker. Below are three hexagonal nuts/bolts. The two upper ones closest to the rocker are the ones you'll be concerned with just now. The upper nut is the *adjuster* and the next one down is the *lock nut*. The lock nut has to be loosened in order to turn the adjuster, but wait..

If you are setting the valves *cold*, get out the 0.008in and 0.010in feeler gauges. If adjusting them *hot*, get out the 0.010in and 0.012in feeler blades.

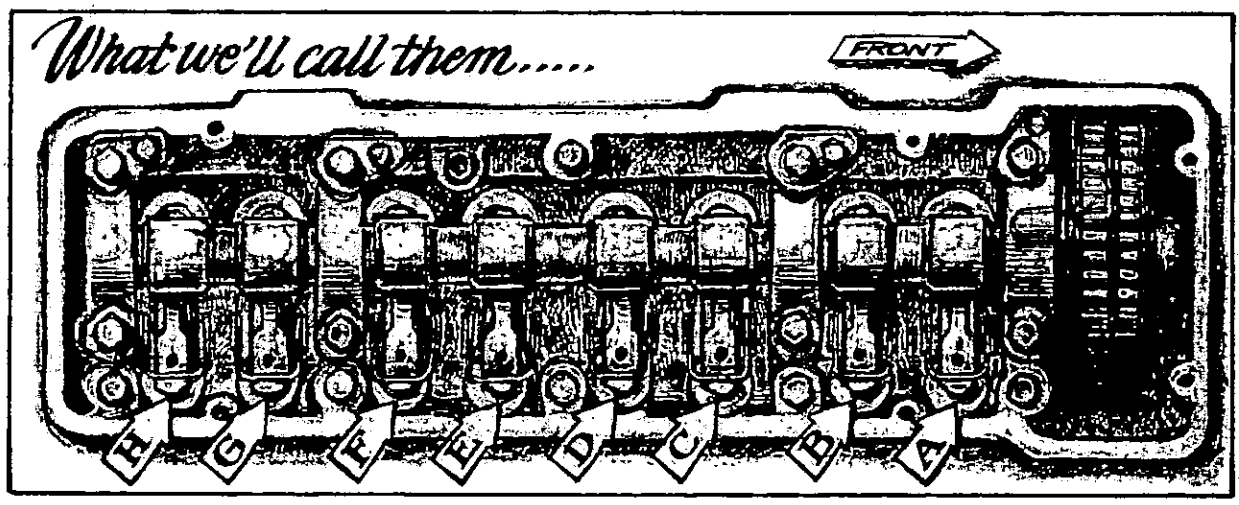
NOTE: Datsun/Nissan recommends all valves be set at 0.010in if an engine is hard starting when *cold*, if it's in good tune and condition otherwise. Some mechanics set them all at 0.010in for two other reasons: (1) the exhaust valves tend to loosen over time while intakes tend to tighten; and (2) if the exhaust valves are set at 0.012in, they are frequently noisy when the engine runs.

If you only set your valves at 12,000-mi intervals or have cold starting problems, adjust both intakes and exhausts at 0.010in (0.008in cold). Otherwise, follow the method described in Step 6, setting the exhausts first at 0.012in (hot) and the intakes last at 0.010in (hot).

Also, watch out for the **hold down springs** that clip over the rockers and onto the **wire wings** under the lock nut. Take care not to unhook these; if you do, be sure to replace them before going on.

You can tell a lot about the *condition* of the valves and valve seats by looking at the distance between the bottom of the adjuster and the top of the lock nut. As the valves and their seats wear, the valve stem end of the rocker gets pushed up toward the cam. After a while, there may not be adequate clearance between the adjuster and the lock nut to make the valve adjustment. If there is little or no room left to make an adjustment or the gap looks close, read Ch. 9, Pt. 1, Introduction. A "new parts all around" valve job can give you as much as ½in of visible thread on the adjusters.

•**Z-series:** The rockers on the right (passenger) side of the engine operate the intake valves, on the left (driver's) side the exhaust valves. Make the measurement at the valve or outside end of the rocker by placing the feeler gauge between the top of the valve stem and the bottom of the tappet adjuster. You can turn the adjuster with a screwdriver once the 12mm lock nut on top of the rocker is loosened.



If you are setting the valves cold, the measurements are 0.008in intake and 0.009in exhaust. The hot measurement for both valves is 0.012in. NOTE: Many mechanics set Z-series valves at a loose 0.010in or 0.011in (hot) to cut down on valve clatter (noise). I prefer setting them all at a snug 0.012in. If you can't tell the difference between snug and loose, set them at 0.011in or 0.012in if you can live with a little valve noise. (First time adjusters tend to make the gaps wide and loose.)

•**Everyone:** To check the condition of the camshaft, see Ch. 9, Pt. 2, Proc. 1.

Step 6: Check the Gap.

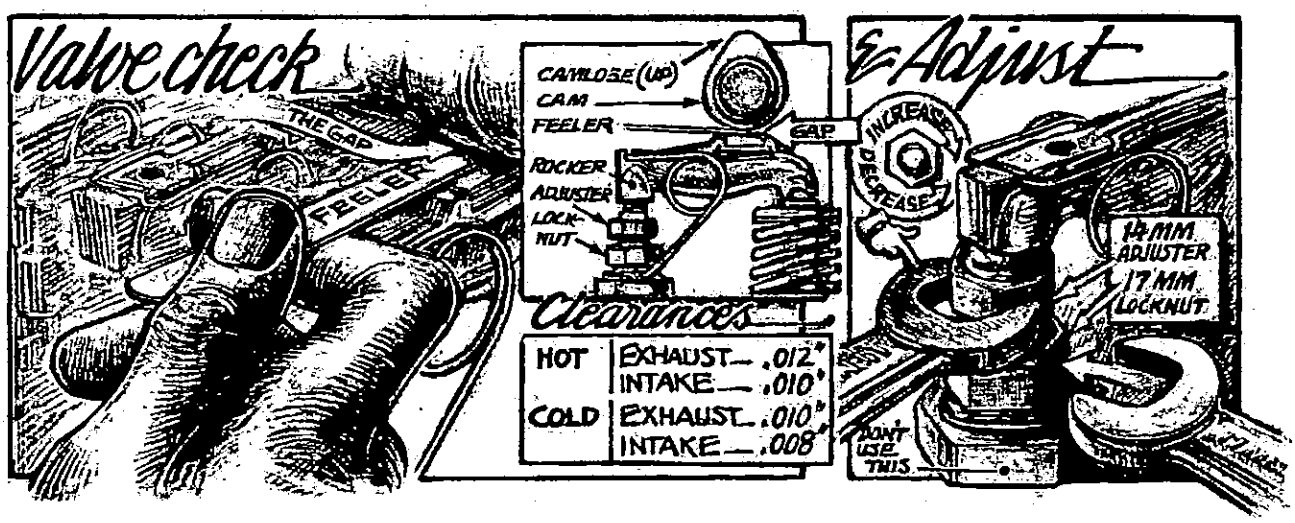
•**L-series:** Find the 0.008in (cold) or the 0.010in (hot) feeler blade and wipe it clean. Now look at the cam lobes. There are eight. I'll refer to them as **A** through **H:** front to rear.

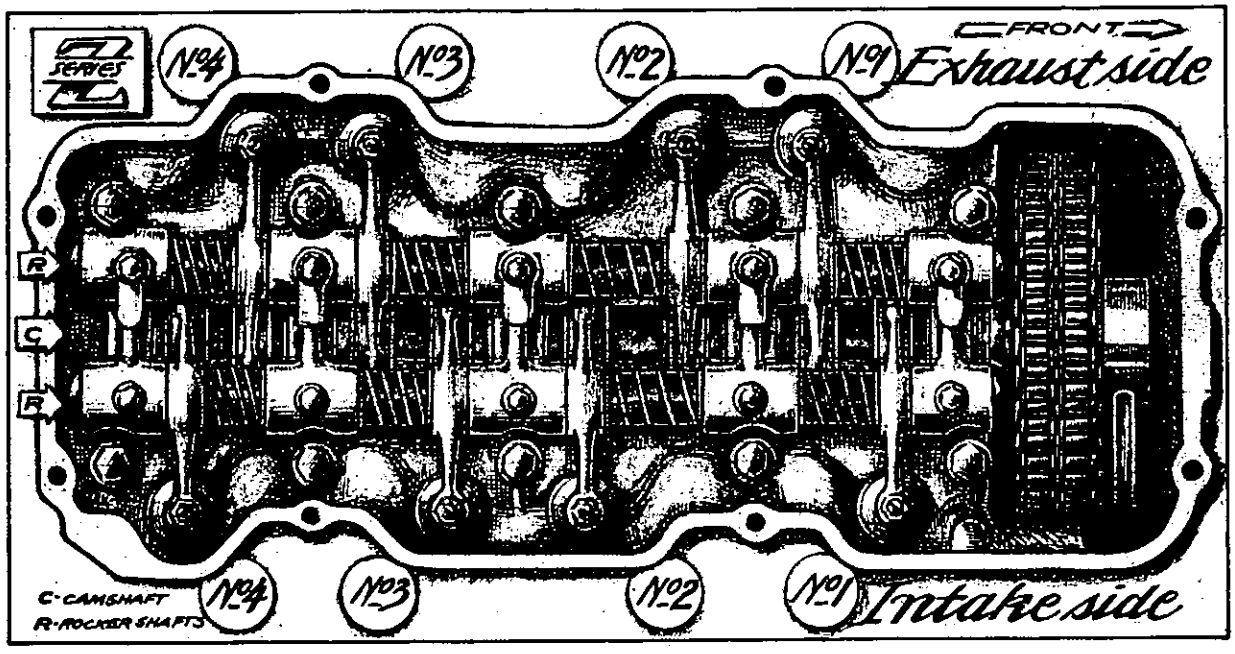
Start with the rearmost cam **(H)** and observe where the lobe (toe) is. Use the remote starter or wrench to rotate the cam and position the lobe so the toe is pointing upward, directly opposite the shiny top of the rocker.

Now try to fit the feeler blade between the cam heel and the top of the rocker. **Z-series:** Find the 0.008in (cold) or the 0.012in (hot) feeler blade and wipe it clean. Now look under and between the rockers and their shafts. The camshaft is nestled there, partially covered by oil.

You want to position the cam lobe (toe) directly opposite the bottom of the rocker you're adjusting. You'll have to use some imagination because the cam lobe (toe) will be submerged in oil when 180° opposite the rocker end.

Start with the next to last or **G** lobe and rotate the cam until it points away from the rocker. Now try to fit the feeler blade between the tappet and the valve stem. This is the rearmost rocker on the left (driver's) side of the engine.





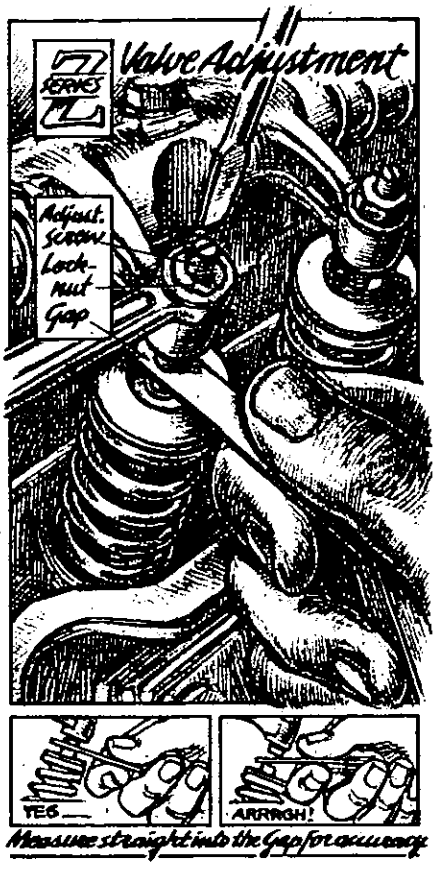
•**Everyone:** The blade should slide in flat. If the gap is too tight the blade won't fit. If the gap's too great there will be no or little resistance as you drag the blade back and forth under the heel. The correct amount of slide feels like pulling the first, tight stick of chewing gum out of its package—some resistance but not too much. If the next larger feeler blade fits, or the correct one swims, the gap is too loose. No go? Too tight.

Step 7: Adjust the Gap.

•**L-series:** To alter the setting, place the 17mm open-end wrench around the middle nut (at the best angle you can) and pull the wrench forward loosening the lock nut just enough to allow the 14mm top nut to turn with a wrench. Increase the gap by turning the 14mm nut clockwise. Decrease the gap by turning it counterclockwise. This process can be as hard on the back and knuckles as it is on the nerves. Check the gap with the correct feeler blade and with the wrenches out from under the rocker. Be sure that you get it right before going on. When you think you've got it, hold the 14mm nut in position with the wrench while you tighten the lock nut. After it's tight, check the gap again.

•**Z-series:** To change the gap, fit your 12mm box-end wrench over the lock nut and tappet adjuster. Turn the nut counterclockwise just enough so you can turn the tappet with the screwdriver. Increase the gap by turning the tappet counterclockwise. Decrease the gap by turning the tappet clockwise.

Check the gap with the feeler blade after removing the wrench and screwdriver so no weight is on the rocker. You can keep the feeler blade in place (if it will stay) while you reposition the tools to fine-set the gap. Don't fully tighten the lock nut until your setting is right. After you get it, tighten the nut then recheck the gap and readjust it if necessary.



•**Everyone:** If this is your first time, you can practice on one of the valves, which will be easier to reach after you reposition the camshaft. However, if you're adjusting valves with a warmed-up engine, work fast. The gap(s) change (tighten) as the engine cools.

As you do your valves, here are things to keep in mind: (1) Don't loosen the lock nut so much that the adjuster turns freely. It's better to let the adjuster nut or tappet drag slightly, so that after you make the adjustment it stays put when you tighten the lock nut; (2) Keep tools and hands clean so that you have a positive grip on things. Valve adjustment can seem tedious at first, but "perseverance furthers"; and (3) Holding the adjuster nut or tappet with the wrench or screwdriver while tightening the locknut will prevent the gap from changing as you tighten the lock nut. **L-series**: The 17mm wrench may be a little tricky to fit on the lock nut because the head bolt and cam towers are in the way. Be careful. Don't lose your cool and smash your knuckles.

•**Z-series:** As you loosen and tighten the lock nuts, try to keep the rockers from sliding too far out of position. And do not tighten the lock nuts too tight. The torque rating is 16-22 ft.lbs.

Step 8: Adjust the Other Exhaust Valves.

•**L-series:** Once you have completed adjusting the **H** gap, look at the **E** cam and operate the remote starter to position it so the toe is straight up, then check the gap and if necessary adjust it. Repeat the process with **D** and then cam **A**.

•**Z-series:** When the **G** valve is set, rotate the cam until the lobe (toe) is pointing down opposite the rocker for **F** valve. Repeat the gap checking and adjusting method described in Step 7, then rotate the camshaft and adjust the valves **C** and **B** respectively.

Step 9: Adjust the Four Intake Valves.

•**L-series:** Now set the intake valves. Crank the engine until **G** is toe up and check and adjust it to 0.08in (cold) or 0.010in (hot). After **G**, do **F** cam, then **C**, and finally **B**. The technique is the same as with the exhaust valves. After you've done 'em all, make sure that all the hold-down springs are clipped into the wire wings.

•**Z-series:** The intake valve rockers are on the right (passenger) side of the head. Crank the engine until the rearmost cam lobe (toe) **H** is pointing down 180° opposite the rocker and check and adjust the gap to 0.008in (cold) or 0.012in (hot). After **H** is set, adjust **E**, **D** then finally **A**. The technique is the same as you used to set the exhaust valves.

After you have set them all, check that the rockers are in position on their shafts with tappets directly over the valves.

•**Everyone:** If you set the valves cold replace the cam cover and spark plug wires (Step 10), run the engine until it's warm, turn it off, remove the cam cover again, and reset the valves. They seldom end up exactly right when hot after being set cold. That's why it's best to reset them hot. Adjusting valves takes some getting used to; a cold trial run is good practice. It's important to get the hot adjustment done quickly, before the engine cools down. Now that you're in practice, set them hot and when done replace the cam cover until next time.

Step 10: Put on the Cam Cover.

Look inside the cam cover. The surface inside this aluminum cover can tell you some things about the rest of the engine's insides. Is there black sludge coating the inside of the cover? Probably the oil hasn't been changed as often as it should have been. Do you see white deposits? If so, moisture has collected in the oil, a little may be due to too many short trips, a lot means coolant may be entering the crankcase. The latter is a sign of real trouble. A light brown coating is called *varnish* and is normal. Use solvent to clean out any sludge or deposits inside the cover. Do the same for the outside (a clean cam cover atop the engine has a great psychological effect) and use a pocket knife, emery cloth, and rags to make the gasket surface smooth and dry. NOTE: 1983½ engines have a rubber gasket fitted into a groove in the cover. If replacing this gasket, remove it and clean out the groove where the gasket fits.

Wipe off the surface where the gasket fits on top of the head, taking care not to get dirt into the works. The mating surfaces must be smooth to prevent leaks.

Place a new or good gasket on the head or in the cover (1983½ on), noting that it fits only one way. See how

the holes or curves (1983½ on) line up. Place the clean cam cover onto the head. Pick up the six or eight cam cover bolts and clipholders (**Z-series**) and insert them. Jiggle the cover to line up the holes and start the bolts. If you took an L-shaped metal bracket or ground wire eyelet off of the left rear bolt, replace it now.

Spin the bolts down with the socket and extension until they stop. Attach the ratchet or speed wrench and, starting with the right rear bolt, lightly tighten all six working across the cover from left to right, from back to front, tightening each one a little at a time. There's a feel to this; it is important not to twist the bolts too tight and strip the threads in the aluminum head—yet you want them tight enough to prevent oil leaks around the gasket. Turn the bolts until they're snug. Some soft material gaskets (like the 1983½ on rubber type) will squash a little and fool you. Just get the bolts snug. If the gasket leaks, you can try tightening the bolts a bit more, but don't overtighten and strip the threads.

Step 11: Fit Everything Else Back On.

If the air clean housing is on, plug the black crankcase breather hose back into the elbow fitting on top of the cam cover, with clamp in place. **L-series:** If your vehicle has that L-shaped dashpot bracket, install the Phillips head screw to connect the dashpot and bracket. **Z-series:** If you removed a ground wire eyelet from the top of the cover, replace it now.

Now flop the spark plug wires back over the cover. **L-series:** Refit the plastic holder/organizer that's closest to the distributor back onto its stand; then fit the other plastic wire holder in place on top of the cam cover. **Z-series:** Route the wires around the front of the head and slip the four clips over their brackets. **Everyone:** The four wires should then hang, in order, next to their correct spark plugs. Slip the boots over their respective spark plugs.

If the boots do not hold onto the plugs securely, look into the boot for the metal "sleeve" that contacts the top nib on the plug. This contact can be squeezed together a little with pliers to tighten the fit. Careful, don't squeeze it too much.

•**Z-series:** Replace the two plastic clips holding a hose or the hose into the clips that mount to the front-most organizer brackets. These clips hold a vacuum hose that you either removed by itself or with the clips.

Step 12: Run the Engine and Listen to the Valves.

After the final adjustment, start your engine and warm it up. Listen to the sounds of the valves. Normally you should hear a light even ticking as the cam lobes strike the rockers. If the sound is not even, chances are that one or more of the valves are adjusted too loosely. If all are too loose the clatter will be disturbing. If too tight, you may not hear even the lightest ticking. Readjust the valves if you're in doubt.

If the engine won't start, backfires or runs rough, check for a mixup in the plug wires (Ch. 7, Proc. 12). If you're satisfied and feel like doing more, proceed to the compression check (Proc. 9) or the next engine maintenance procedure that's due.

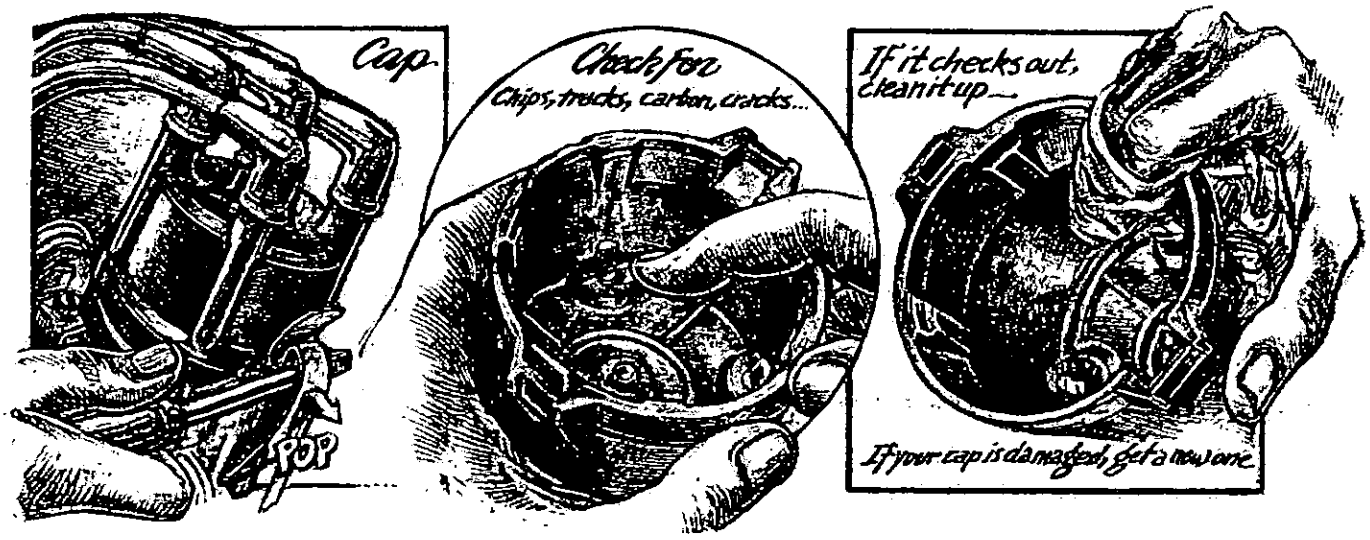
If you removed the air cleaner housing and don't plan to do any more engine maintenance, for example, ignition timing and cam adjustments replace the housing. Otherwise, replace it (Ch. 6, Pt. 1, Proc. 1).

Step 13: Disconnect the Remote Starter.

Unclip the remote starter from the solenoid and reconnect the little wire to the spade. Pinch the connector at the end of the wire if the fit is loose.

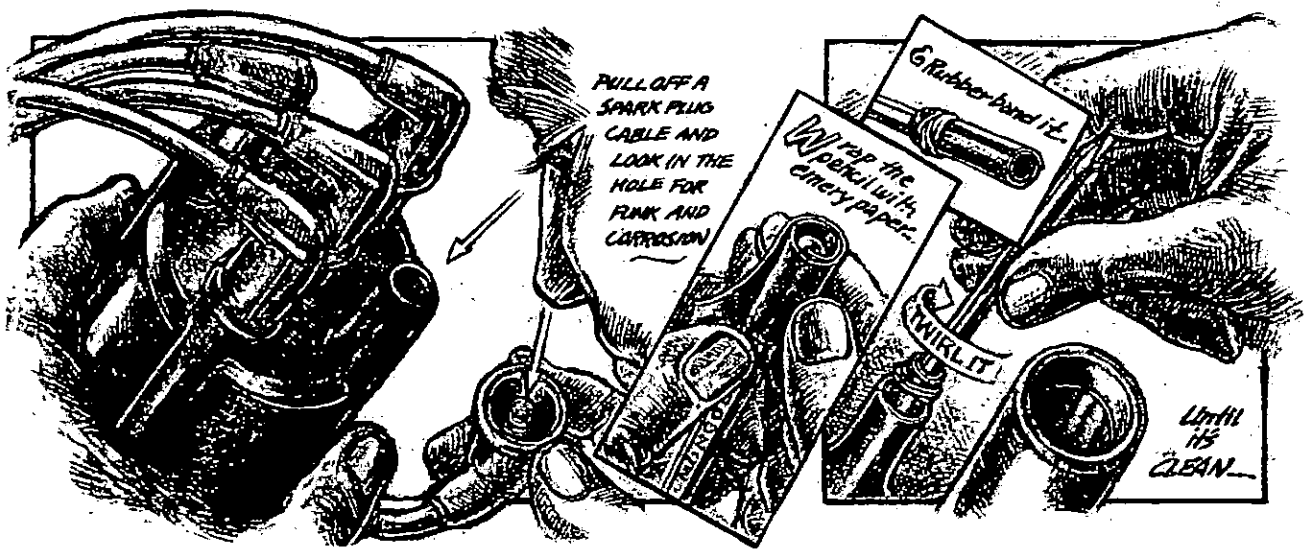
PROCEDURE 5: REPLACE, CHECK, AND ADJUST DISTRIBUTOR/IGNITION PARTS AND REMOVE AND REPLACE THE DISTRIBUTOR

Tools and Materials: New distributor cap and rotor, determine if you need these first (see Step 1), ignition points and condenser(s) (non-electronic ignition engine), regular and Phillips screwdrivers, feeler gauge set, 10mm open-end and socket wrench, pocket knife, sandpaper, a dab of grease (non-electronic ignition engines), and a little paint or fingernail polish. **Z-series**—8mm open-end or socket wrench to replace rotor.



Condition: You are here for maintenance, or the engine will crank but not start, or it starts but runs poorly. To remove the distributor, see Step 7. NOTE: High quality distributor caps and rotors last a long time if the rest of the ignition system is in good shape. Z-series (8 spark plug) caps and rotors are expensive. I have seen caps and rotors go 30,000 miles with a few cleanings. You can be the judge—read on.

Remarks: Because there is a variety of designs for Datsun/Nissan distributors, determine which style you have. Here is a list of the years and their distributor types. It may not be accurate in every case so run through Steps 1 and 3, to figure out what you have. "Federal" vehicles refers to everything except California designated cars and trucks. **1968-69 510s:** Some early 510s may have a single point distributor with an external condenser. Read all of the procedure, because I do not specifically describe your style which is a little like both types I do cover. You'll see. **1970-1974 510s, all 521s, 1973-74 620s and 610s:** Your vehicles came from the factory with dual point distributors. When buying parts for both points, ask for *two* primary point condensers (0.22 microfarad rated, if marked). However, since your distributor may have been modified, read through Step 1 before buying parts. **1975-76 Non-California (Federal) Vehicles:** You have conventional points that are used in all later model Datsuns. **1975-76 California and all Vehicles 1977 on:** You have electronic ignition and need only replace the distributor cap and rotor, if found necessary after inspection. You should also check wires and connections when the distributor cap is off.



Step 1: Pop Off and Inspect Distributor Cap and Rotor.

•**L-series and 1980 510 Z-series (Federal) Four Spark Plugs:** Find the two **clips** on either side of the distributor cap. Use a regular screwdriver to pry between the top of the clip and the distributor cap to snap the clips off the little ledges. Lift up the cap and turn it upside down

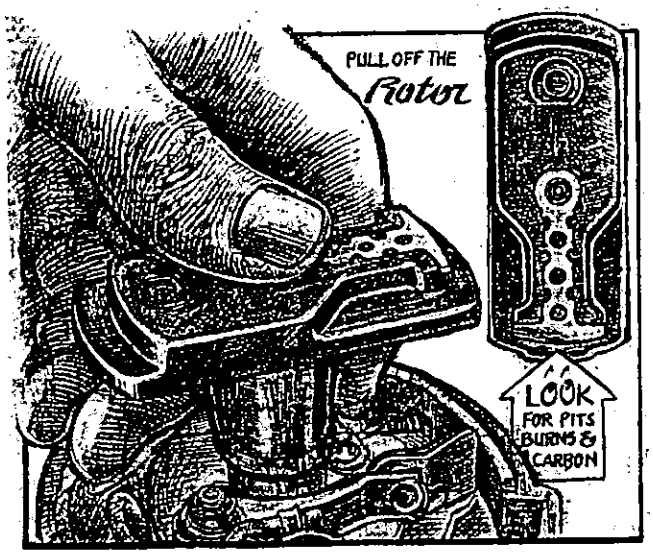
•**Z-series:** Find the two screws or clips on either side of the distributor cap base. Use a screwdriver to turn the screws counterclockwise or pry the clips off the sides of the cap.

When the screws or clips are loose, you can lift the cap up off the distributor and with considerable effort manipulate it up over the rotor then flip it sideways enough to look inside. But wait, if you have screws, thread and pull them up out of the cap and stash them somewhere safe.

•**Everyone:** Look at the four or eight metal contacts around the upper inside of the cap. If the cap is old, they will appear burned, green or ash colored, or deteriorated. Now look at the little black carbon nib(s) in the center of the cap. Press on this (these) to test the spring behind it (them). You should feel it give and spring back. Next, look closely around the inside and outside walls of the cap for hairline cracks or tracks (little carbon lines caused by sparks and arcs). If cracks, chips, tracks, or excessive wear at the contacts are visible the cap should be replaced. Use your pocket knife to chip away "scale" that may have grown over the contacts to expose the base metal. Wipe out the inside with a clean, dry rag.

Turn the cap right side up and pull out one spark plug wire. Examine the end and the corresponding hole in the top of the cap. If you see corrosion, sand the wire ends and, if the cap is to be reused, use a pencil end with a piece of sandpaper wrapped around it to clean out the exposed hole in the cap. Replace the cleaned wire and inspect the remaining three wires, one at a time. **Caution:** Remove these wires one at a time so not to mix up their order.

Now look at the **rotor**, which rides at the top center of the distributor.



•**L-series and 1980 510 Z-series (Federal):** Put a finger under each side of the rotor and pull it off the shaft. If the rotor comes off too easily or fits sloppily on the shaft, definitely replace it. Scrape off the metal contact ends with your pocket knife and set the rotor aside. If either the cap or rotor is deeply pitted or burned, replace both.

•**Z-series:** Your rotor is bolted to the distributor shaft. Looking straight down on the rotor you'll notice three round walls (circles) sticking up. The cap's carbon nibs contact the metal sections you see in the center of the rotor and the next circle out. These surfaces should be smooth and shiny with some carbon traces.

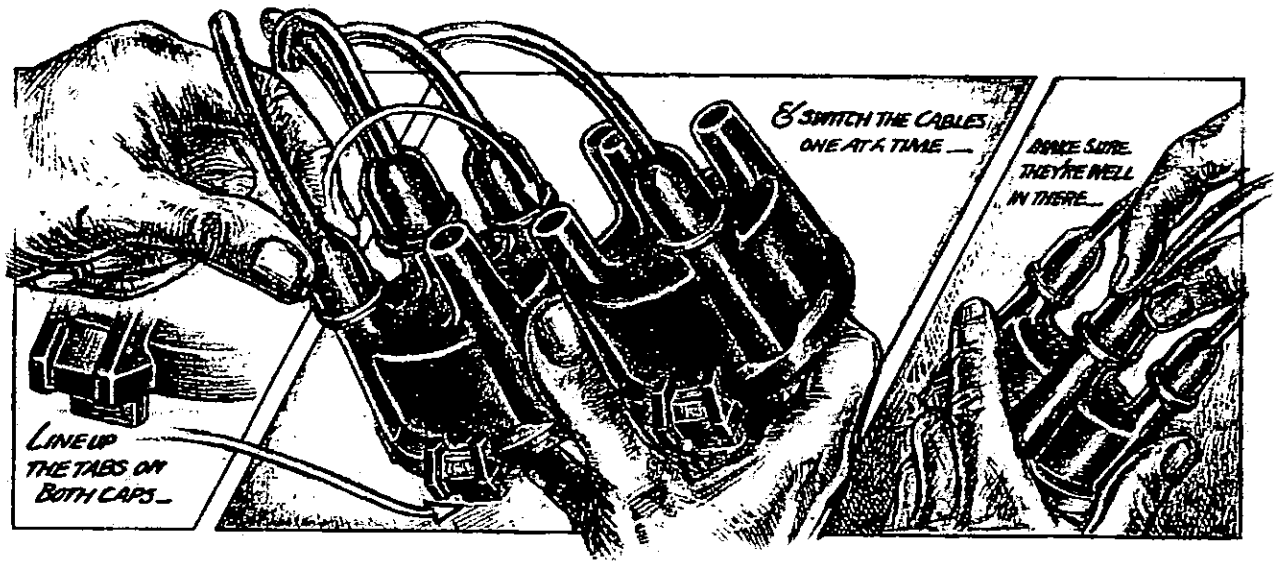
Look between the second and outermost wall to find one of the spark plug wire metal contacts, and the bottom outer edge of the rotor to find the other one. The center nib contact fires the plugs on the intake side of the engine, and the outer fires the exhaust plugs.

Scrape the plug wire contacts with your pocket knife and inspect them for deep pitting or burning. The outer contacts are very close to the plastic rotor body.

If the contacts have been cleaned a few times before, replace the cap and rotor with new ones. Otherwise, scrape off all contacts and reuse.

To remove the rotor, look and feel under the top part of the rotor to find a bolt. Its head is 8mm in diameter and slotted. Use a socket or box-end wrench or screwdriver to loosen and remove the screw turning it counterclockwise.

When out, pull the rotor up off the shaft. Stash the bolt and washer in a safe place.



•**Everyone:** For more on the workings of your ignition system, see Ch. 2 or Ch. 7. Further checks of the distributor cap and plug wires can be made with an ohmmeter. If you have this meter, refer to Ch. 7, Proc. 12.

Step 2: Replace the Old Distributor Cap with a New One (if necessary).

You are now going to change the wires from the old cap to the new one. It's crucial that they all go into the right holes. First, make sure the caps are identical. **L-series and 1980 510 Z-series (Federal):** Turn the old cap upside down in one hand and hold the new cap next to it. Look at the bottom edge of each cap. Notice the two square ears opposite one another. Note that they are different. Position the ears on the new cap facing the same way as on the old cap. Hold this position as you turn the caps so the tops are up. Move one spark plug wire at a time from the old cap to the new one, always plugging each wire into the same hole as it was in the old cap. Exchange the **coil wire** (the center one) last. Push all of the flexible caps securely over the towers on the new cap. The wire ends should be fully plugged into the towers.

•**Z-series:** Most caps are stamped on top next to the towers with the letters "I" for intake and "E" for exhaust with numbers next to each letter, indicating which side of the engine and to which cylinder the wire goes, e.g., I1 means the right (passenger) side of the engine plug wire for #1 cylinder. E1 is directly opposite that on the left side of #1 cylinder. Likewise the plug wires should be marked with similar notation. The two center coil wires and towers are also marked.

Because there are so many wires to swap, be sure to move the wires one at a time. Then recheck their positions to see that they match the correct cylinder. This is very important. If in doubt, check the illustrations in Ch. 7, Proc. 12 (I).

Hold the caps next to each other and begin removing the wires by twisting their ends and pulling up—umph! Try to keep the wires in their original positions as they are bundled together between the cap and the engine. They are easily tangled if you're not careful. You'll be glad you don't have to do this every day. Exchange the coil wires last then recheck that the wires are all in order and plugged firmly into the towers.

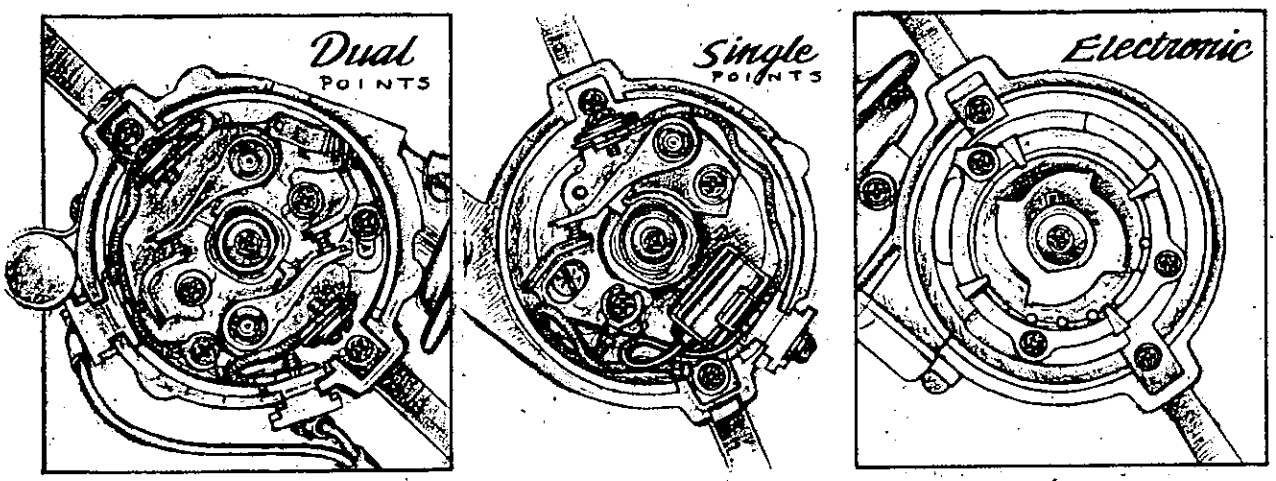
Step 3: Determine Which Distributor You Have.

Look at the illustration to determine which one you have. Dual point types and early single pointers have the **condenser** on the outside of the distributor. Later single point styles have the condenser inside the distributor opposite the **point set**.

•**Electronic Ignition People** don't have points at all and after completing the cap work can go on to Step 14.

Step 4: Check Condition of the Ignition Points.

•**Dual Point People:** You may have only one set of points in your distributor, which means someone removed the secondary set. Follow through this step anyway and I'll explain later. •**Everyone:** Look down into



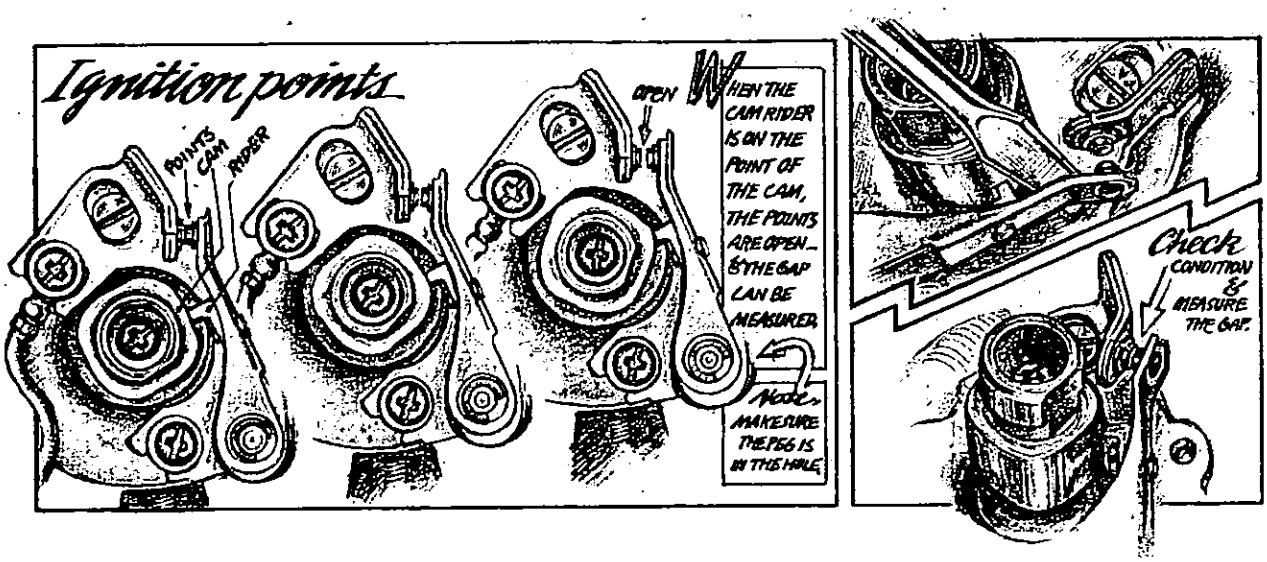
the distributor and examine the **shaft** that the rotor sits on. Near where the shaft disappears into the distributor housing there is a smooth section with four flat and four high spots on it. The **points** have one stationary and one movable part. The movable side has a **fiber block** attached to it that rubs against the smooth square section of the shaft. If you have dual points, there will be a set of points on either side of the shaft. When the shaft rotates, the high spots should hit the **fiber block**, and the points should open. When the flat of the shaft comes around, the points should return to the closed position.

Ignition points wear in two places: (1) where the fiber block rubs against the distributor shaft, and (2) at the contact point surfaces. Examine these two places carefully, especially the contacts.

Use a screwdriver to pry open the old points. Look at the contact surfaces. If they are in in good condition, the contacts will be smooth and their surfaces flat. (Some styles have a hole in the center or a cross-shaped groove cut into each of the contacts.) Discoloration and pitting are signs of deterioration, but visual inspection is not totally conclusive. If the contacts have more than just a little pitting, replace them and the condenser. The top limit is 12,000 miles. If you conclude that replacement isn't necessary and you want to check if they are opening properly, go on to the next step. If you plan to replace the points, go to Step 6 (dual) or Step 10 (single).

Step 5: Are the Points Opening?

To check this, the engine must be rotated until the rubbing (fiber) block is touching a high spot on the distributor shaft. At this point the contacts should be separated a *specific amount*. If the block is on a flat side of the shaft, the contacts should be closed. An easy way to rotate the shaft without starting the engine is to put the transmission in fourth or fifth gear with the emergency brake off (be sure you're on level ground). Automatics



have to be cranked with the starter. Have a friend help push the vehicle just enough to rotate the shaft so that the fiber block sits directly on one of the high spots. **Dual Point People:** Look at the primary point set. **Everyone:** The correct gap is 0.018-0.020in. (If you are without a feeler gauge, the gap is roughly the thickness of a match book cover plus a check or dollar bill placed flat together. Or this book's cover and three pages.) At this point, people with the newer single points system should skip ahead to Step 10.

Step 6: A Word to Dual Point and Older Model Single Point People.

It is much easier for you to remove the whole distributor from the engine to get at your condenser(s); however, this isn't necessary if you're just replacing the points. I recommend replacing points and condenser at the same time, but if you're in a jam, leave the distributor in and follow the instructions to replace just the points (Step 9).

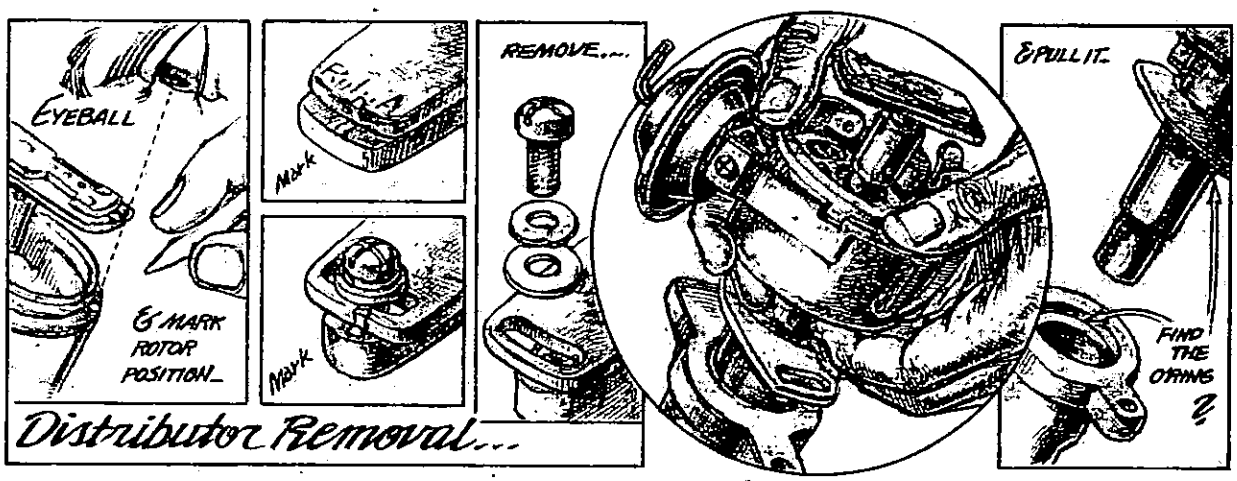
Step 7: Remove Distributor.

Remove the distributor cap now if it isn't already off (Step 1).

Rotate the engine so it's at TDC (Top Dead Center #1 cylinder) (Ch. 13, Pt. 1, Proc. 3).

Make sure the ignition is turned off.

One, two or three wires connect to the side of your distributor. On non-electronic, points ignition engines



(L-series only), the wire(s) either plug in directly at the distributor or have a pull-apart connector a few inches away from the distributor. Unplug the wire(s) at the most convenient place. On electronic ignition engines (L and Z-series), the wires disappear into the distributor wrapped in a black plastic harness. You may also have a single ground wire plugged into the side of the distributor. If so, unplug it now and let it hang.

Underneath the distributor housing is a fixed plate through which one or two 10mm Phillips head bolts screw into the distributor support. This bolt holds the distributor in place and the bolt through the fixed plate is loosened to set the ignition timing. **Z-series** (eight spark plug) engines have two bolts, one in front and one at the rear. On **L-16 and 18 engines**, the bolt's behind the distributor. There are also marks inscribed on the front part of the movable plate with the letters "A" and "R," and a line on the stationary base. On later L-series L-20Bs and 1980 510 Z-20s, the bolt's in front of the distributor. There's also a line on the stationary base on the movable part. **Z-series** (eight spark plugs) don't have any marks. Read on.

•**Everyone:** If you're not doing major engine work, skip the next paragraph. If you are doing an engine rebuild or timing chain job, remove the distributor support from the timing cover by unscrewing the two 10mm bolts that hold the support to the timing cover. One bolt may remain trapped with the support. Leave it there. Bag and label the bolt(s)—"dist supp." Now mark the rotor position as described below. Then tap or pull up on the support to separate it and the distributor from the timing cover. You'll probably need a new gasket between the support and cover. Get one from Datsun/Nissan or your engine rebuild gasket set.

Clean the grime off this plate, to see the bolts and marks.

Draw a line with a sharp tool or paint a visible dab of nail polish to mark the exact location of the fixed plate on the distributor support. Also mark the position to which the rotor points by scribing or painting a corresponding mark paint on the edge of the distributor housing. **Z-series**: Look closely to find the metal rotor tip set into the plastic body. Mark the outer one. If your support is loose, remove the distributor now. Otherwise, remove the one or two 10mm Phillips head bolt(s) that lock the distributor and fixed plate into place. Put the bolt(s) and washers in a baggie labeled—"dist hold down." Find the vacuum advance mechanism on the side of the distributor. If a steel line is attached to it, use a 10mm open-end wrench to loosen the nut and **carefully** pull the line free. If yours has the more common rubber hose connected to the vacuum unit, twist and pull the hose off. Don't tug on the hose. On later model electronic distributors, there may be other wires clamped (or connected) to the distributor's side. Release them now.

Grasp the distributor and pull up away from the engine. The fixed plate will come out with it. The distributor support will stay put. Look for a rubber O-ring that will either be under the distributor housing (below the plate) or still in the distributor support. Find it and put or leave it in the support.

If you don't need to remove the distributor to replace or work on it, lay it aside somewhere on the left fender wall so it can't slip off. If you plan to disconnect the distributor to work on or replace it, keep reading.

•**Non-Electronic Ignition People:** Follow the wire(s) back to the in-line connector and pull it apart. Or, if possible, pull the wires off at the distributor.

•**Electronic Ignition People:** Your wires, wrapped in their plastic covered harness, are still connected to the vehicle. Follow the harness away from the distributor. On later models, there's a big plastic connector "in-line" you can pull apart. It's usually gray (or black) and located near the front left corner of the engine compartment. Don't pull on the wires, just grasp the connector halves. On earlier models, the harness connects to a *connector block* mounted on the radiator top on the left fender wall. A cap may cover the connector. If one does, use a small screwdriver inserted in the slot that's provided and carefully pry the cap up. Inside, you will find nuts holding down eyelets and colored wires, for example, one or two red wires and one green wire (the Yule variety). Or there may be a red wire, a black and white one, and a blue one (the patriotic variety) or some other colors. **Caution:** Make sure the ignition (key) is turned off. Use a 10mm wrench to remove the nuts and washers, which hold down the wires. One at a time, slip off the eyelet for the wires going to the distributor but not the other two or three. Put the nuts and washers back on the studs. Follow the wires back to the distributor, undoing it from whatever it's attached to as you go. The distributor is now free. When you want to install the distributor, go to Step 13.

To Learn More About Your Distributor: See Ch. 7, Proc. 13.

Step 8: Remove and Replace the Condenser (dual points distributor).

Clear off a spot on your bench. On the side of the distributor housing find one or two cylindrical **condensers**. They have wire "pigtails" connected to a screw mounted in an insulator that slips into the edge of the housing. Follow the pigtail connection through the insulator to the **jumper wire** that connects to the points set. This jumper wire should be in good condition with no exposed spots in the insulation and no part of the wire touching the distributor body.

If you have *both* sets of points still intact there will be two condensers, two jumper wires, and two sets of points. Even though both sets may be in place, the secondary set may not be hooked up, or only the condenser points of this set may be in place but inactive (see illustration in Step 3). In this case the wire leading to the distributor or the jumper wire may have been removed or disconnected and taped up. These are common modifications to this system. NOTE: Don't confuse the jumper wire(s) with the black ground wire screwed to the distributor base near the secondary point set location.

The arrangement of the dual points can vary. Look at the illustration for the original layout. The points are the same but the condensers are rated differently. When replacing the condensers, purchase two *primary* condensers if both sets are to be left intact. Most Japanese-made condensers will have *microfarad ratings* stamped on them: 0.22 on the primary condenser (blue wire) and 0.05 on the secondary condenser (yellow wire). Don't hesitate to tote the distributor to the parts house to get the correct replacement parts. Locate the primary point

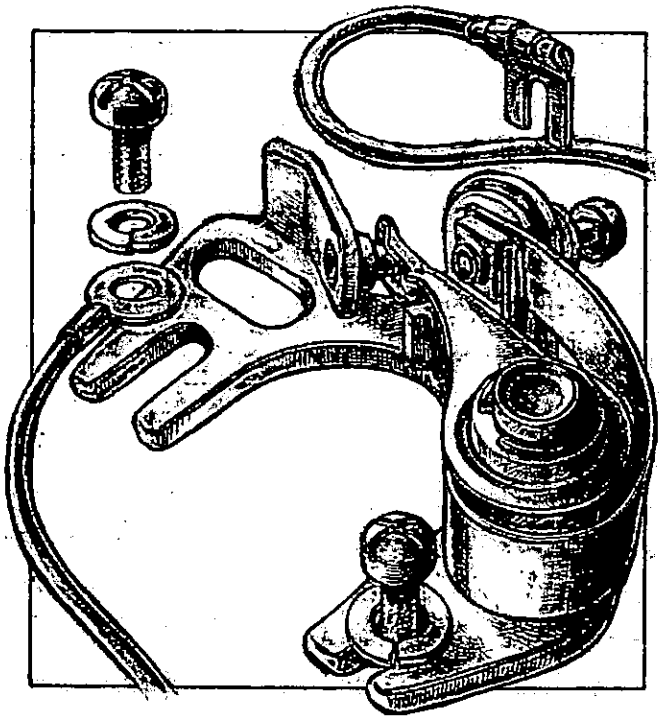
condenser, originally attached opposite to the vacuum advance mechanism. Loosen the screw holding the condenser body to the distributor. Work close to the bench so you don't lose the screw. Now loosen the screw at the insulator, enough to slip the connector out from beneath it. The condenser is now out. Put in the new one, connecting the "pigtail" wire first, then the body. The condenser connector should fit between the lockwasher (screw head) and the spade, or outside the pigtail wire connector.

Step 9: Remove and Install Points (dual points distributor).

Follow the jumper wire to the point set. Find the locking screw that holds the adjustable side of the point set to the base plate. Loosen this screw two turns, and slip the set out from under the flat washer.

Now loosen the screw that holds the jumper wire to the point set and pull out the forked connector. Pick up the new point set and loosen its connector screws. Slip the forks of the connector down between the nut and the flat spring on the inside of the set, then retighten the screw. Go to Step 12, do it thoroughly, then return here.

Wipe off any oil from the distributor base plate. Place the new point set down on the base without twisting the jumper wire. Slip the slot in the base of the set under the flat washer and screw head. The pivot end of the points has a little round **pivot peg** that fits into a hole in the base plate. When it goes in, the adjustable bottom side of the point set should be flush against the base plate. Tighten the hold-down screw just enough to secure the point set. Now grab the set at the pivot end and try to move it back and forth. If the pivot peg is in the hole, the set should be solidly in place. The screw end of the set may move beneath the washer and screw. That's OK for now, as long as the set sits flat. **Install Secondary Point Set and Condenser:** Find the secondary condenser, if still in place. It may look and mount different from the primary condenser but it comes out the same way. The points are replaced the same way as the primary set, but the secondary base plate is higher and has more screws surrounding it. Follow the instructions for the primary set and condenser replacement, taking care to loosen the *correct* screw when removing the point set. This screw (and washer) sits directly on top of the adjustable side of the points. It is *not* the screw that connects to the black ground wire. Remember, when installed, none of the forked connectors should touch any part of the distributor housing—only the insulator and connection screws. **All Dual Point and Old Single Point People:** Recheck your work with the illustration. The jumper wires should be out of the way of point operation, neatly tucked along the inside wall of the distributor and below the edge where the distributor cap sits. Connections should be tight enough so that the forked connectors don't wiggle. Now you can go on to the point adjustment, Step 11. But wait, if there's a piece of paper between the contact surfaces, remove it now.



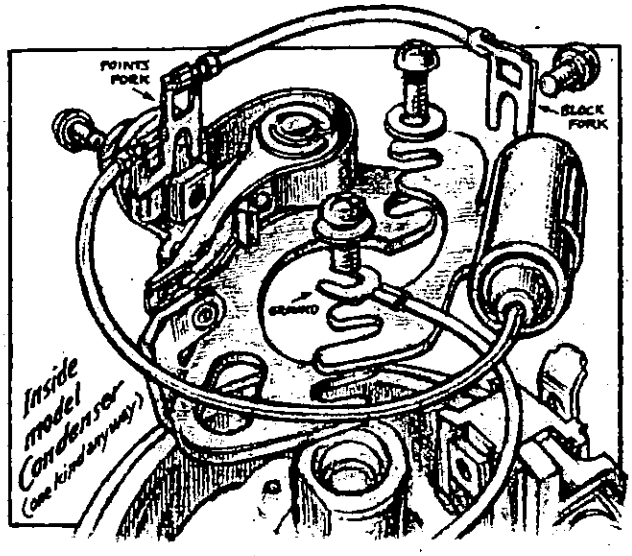
Step 10: Replace Distributor Point Set (1974 California 610 and 1975 and later single point distributors).

The point set and condenser are both inside the distributor. Follow the **external lead wire** to the outside of the distributor housing, where you'll find that it fits onto a spade connector. This connector is attached to an insulator block that slips into the side of the distributor. On the inside of the insulator there is a square nut that holds a forked connector and wire that connects either directly to the point set or through the condenser to the point set. Both the point set and the condenser are held against the distributor base plate by two screws. There is also a recessed screw (it doesn't come out) in a slot in the base of the points. Loosen the two hold-down screws one or two turns and the condenser should slide out and off of the points set, and then the points should come free from the distributor. Let these parts hang out for the moment.

Turn your attention back to the insulator on the side of the housing. Slip a screwdriver tip under the bottom inside of the insulator and gently pry it out of the slot in the housing. Be firm but gentle. Now loosen the screw enough to slip the forked connector from under the square nut. *Do not lose the nut by loosening the screw too much.* Take the point set and condenser over to your bench and compare the old parts with the new ones. You may have one of two setups, since there are two styles of condenser/wire combinations: **Single wire condensers:** Have two wires at the forked connector. This fork connects to the points. The single wire fork connects to the insulator. **Dual wire condensers:** Have two wires—one long, one short—connected to the condenser. The long wire goes to the points, the short one to the insulator.

The point set length may differ, but the slotted base of both the condenser and the point set should be identical. Set the old parts aside and pick up the new. Find the screw on the new point set that connects the forked condenser wire. Loosen this screw just enough to fit the forked connector from the condenser wire (see above) between the square nut and the flat spring on the point set. Slip the fork straight down into place and tighten the screw enough to keep the connector from moving when wiggled. Now turn to Step 12, follow it through, then return here.

Wipe off the base plate of the distributor. Pick up the point set and condenser and carefully slip the base of the point set down onto the distributor base, with the slots under the two matching screws, washers, and the ground wire. The point set fits in the side close to the vacuum advance mechanism. Next slip the slots in the condenser base under the screws, heads, washers, and the wire. The condenser will be opposite the point set. The washers and ground wire must be on top of the condenser base and the point set must be flat against the distributor base. The stationary adjustment screw is now in the hole in the bottom of the point set, right? Tighten the hold-down screws to hold points and condenser secure. They will be loosened again for the point gap adjustment.



There is now one forked connector still out of place. Pick up the insulator in one hand and the forked connector in the other. Slip the fork prongs down between the square nut and the inside of the insulator. Tighten the screw on the outside of the insulator enough so the connector doesn't wiggle. Slip the insulator back into the slot in the side of the distributor housing, until it is even with the top of the housing.

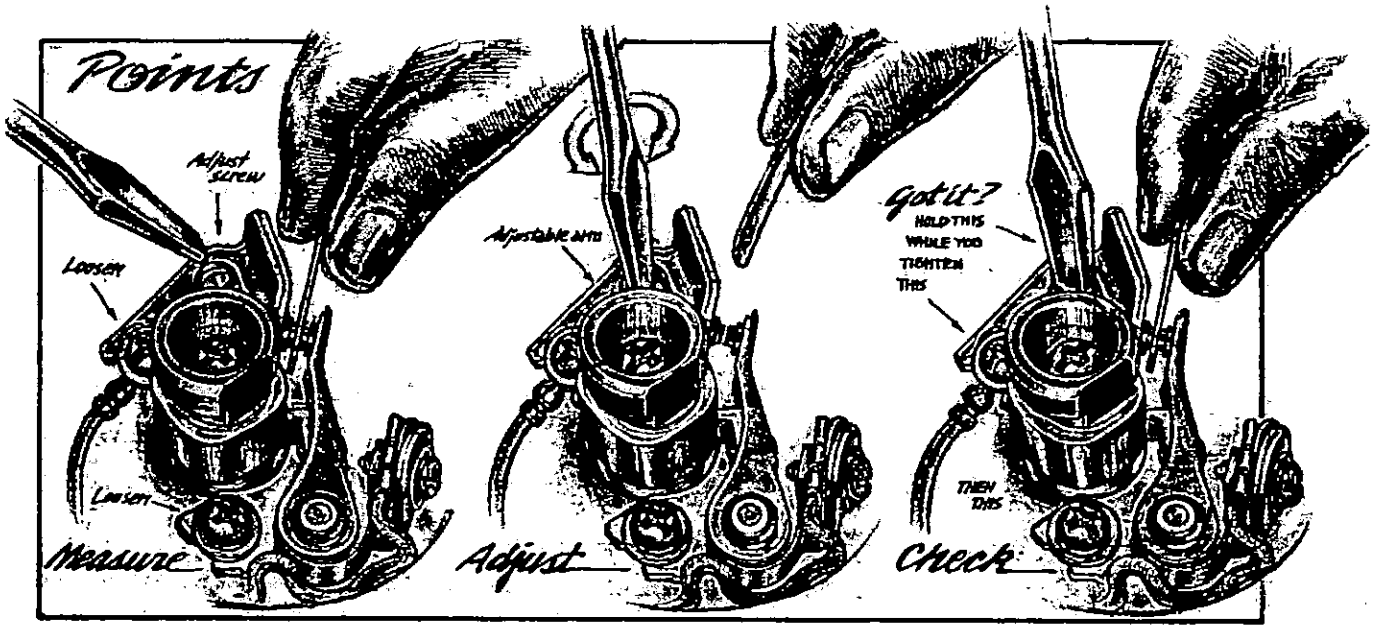
Recheck your work, making sure that the ground wire is in place under one of the hold-down screws and that none of the forked connectors touches the sides of the distributor housing. The point set and condenser must be flat against one another and the distributor base. Got it? Now go ahead to the point gap adjustment, Step 11 (but first make sure that the little wires are carefully tucked so they won't interfere with points action, or get pinched when you put the distributor cap on). If there's a piece of paper between the contact points, remove it now.

Step 11: Adjust the Point Gap.

The points have to open and close to create the spark at the spark plug that ignites the fuel and air that runs the engine. The exact amount of time they stay open determines how efficiently your engine operates. The distance between the points when fully open is called the **point gap**. As the distributor shaft turns, the points should open when the fiber block runs up each of the four high spots on the shaft.

To check and adjust the gap, the fiber block has to be on top of one of the four high spots. Read through Step 5, then return here.

The gap should be 0.018-0.020in when measured with a feeler gauge. (A more accurate way to set points is electrically with a dwell meter when the engine is running. For now, let's set them mechanically with the feeler



blade.) Pick the 0.018-0.020in blade out of your feeler set and wipe it off. Try to fit the blade in the gap between the points; you'll be lucky if the gap is close to 0.018-0.020in. If the points aren't open at all or are less than 0.018-0.020in, you have to increase the gap. If the gap is wider than 0.018-0.020in decrease the gap.

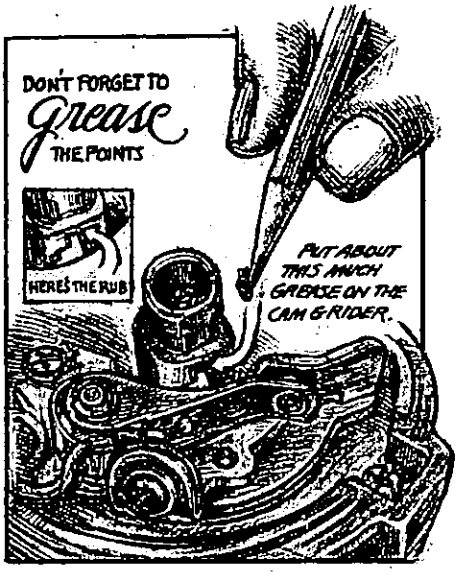
•Dual Point Distributor People: Locate the primary points' locking screws. Loosen each screw just enough so the adjustable bottom side of the point set can slide on the base plate. See the notch in the bottom of the set and tit sticking out of the base plate, behind the movable contact? Slip a medium screwdriver blade in there and adjust the bottom side one way or the other to increase or decrease point gap. Experiment. Try fitting the 0.018 or 0.020in feeler blade between the contacts (with blade perfectly parallel to the contact surfaces and the fiber block sitting on the high point). If it won't go in easily, the contacts are too close; if it goes in without touching one of the contacts, they're not close enough. Try opening them by turning the screwdriver clockwise, then closing them gently on the feeler blade. The gap is critical, so get it right. When the gap is correct, retighten the locking screw and recheck the gap. The next largest blade should not fit in the gap and the movable contact shouldn't spring closer to the stationary contact when the 0.018 or 0.020in blade is withdrawn.

If you have the secondary point set still in place, adjust it. The only difference is you don't have an adjustment notch on this side. Don't confuse another notch located closer to the pivot of the secondary points with a gap adjustment notch. To adjust the gap use your fingers or the screwdriver tip between the side of the point set and the wall of the housing. NOTE: Turn the distributor shaft (Step 5) to get the fiber block directly on a high point to set the secondary points. Install the distributor in the engine (Step 13). **•Single Point People (1974 on):** You have an adjustment screw next to and below the stationary contact point. The screw fits into a slot in the bottom of the point set. The hold-down screws have to be loose enough to allow the adjustment screw head to turn in its slot. With the fiber block on a high point of the distributor shaft, insert the 0.018 or 0.020in feeler blade parallel to the contact surfaces. (If the fiber block isn't on one of the high points, refer to Step 5.) If the blade won't fit, open the gap by turning the adjustment screw counterclockwise. If the 0.018 or 0.020in blade goes in with room to spare, close the gap by turning the screw clockwise. Once you've about got it, try the next bigger blade. If the gap is right, the blade shouldn't fit in there. And when the 0.018 or 0.020in blade is withdrawn from the gap, the spring side of the points set should not move toward the stationary contact. When you think you've got it, tighten the holding screws and recheck the gap. (Did it move a little? Loosen the hold-down screws and adjust again until the gap is correct, when the hold-down screws are snug.)

Go on to Step 15: Replace the Distributor Rotor, Cap, and Primary Ignition Wire(s).

Step 12: Lubricate the Fiber Block.

A small packet of grease may come with your new point set. If not, a good quality non-fiber grease will work. Squeeze or dab a little grease on the vertical side of the fiber block away from the contact points. The distributor shaft turns counterclockwise and the high spots strike this side of the block first, gradually lubricating the surface where they meet. *Make sure that no grease gets on the contact point surfaces.* Neatness counts here.



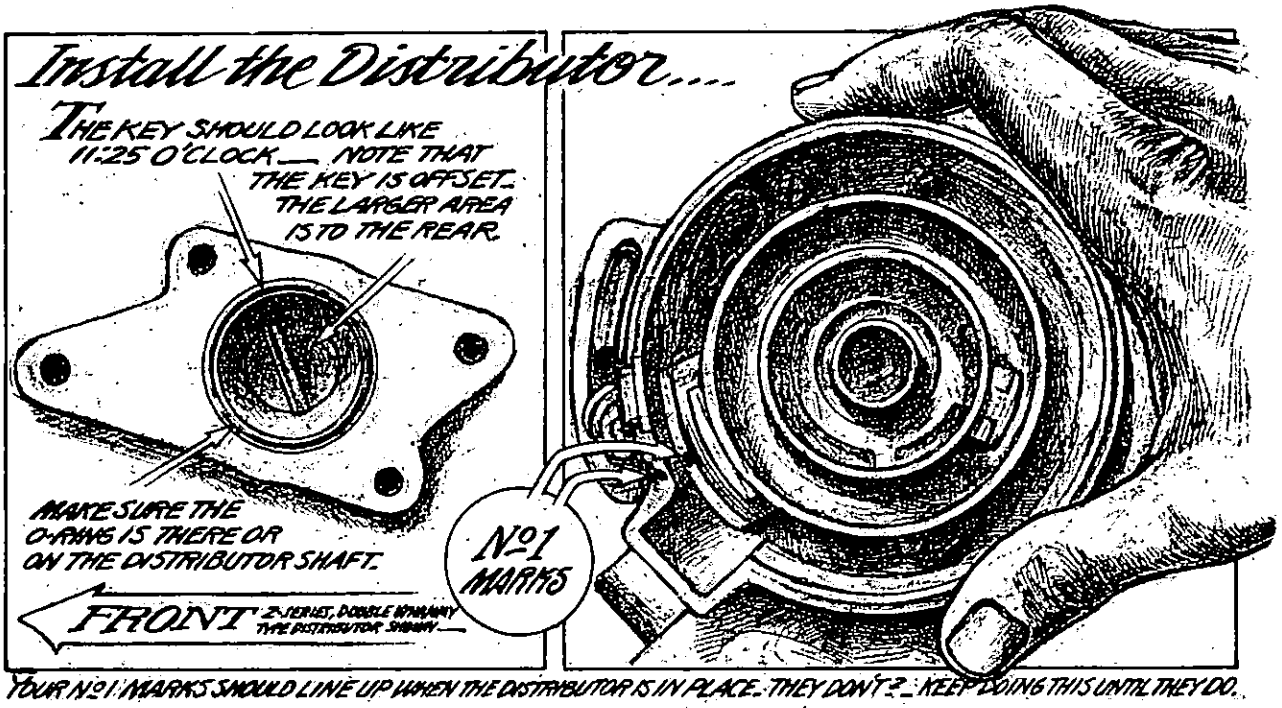
Step 13: Reinstall the Distributor In the Engine.

NOTE: The distributor drive gear must be in place, and the engine at the TDC #1 cylinder. The distributor cap should be off the rotor on (Step 1). If you're putting in a new, unmarked distributor, read through this step and do just the **Everyone** part. Turn the shaft all the way around until it clunks into place. If you're reinstalling your old distributor, turn the distributor shaft until the **rotor tip** is facing the mark you made on the top edge of the distributor housing.

If you removed the distributor with the support attached: Scrape the old gasket off the support and timing cover. When both are spotless, find the new gasket. Make sure it's the right one, and lightly coat it with gasket sealer. Stick it on the timing cover.

L-16 and 18 People, if you are installing the support without the distributor attached: Your support fits on so the little timing bolt and/or hole sits towards the back side. **L-20B** and **Z-series (1980 510)**: Your Support fits so the timing bolt and/or hole faces forward. **Z-series (eight spark plug) People**: Your support fits on one way.

•**Everyone:** Position the support with the gasket in place and stuck to the timing cover. If the distributor's attached, read ahead to align the rotor and/or just move the distributor into place by turning the rotor and shaft around.



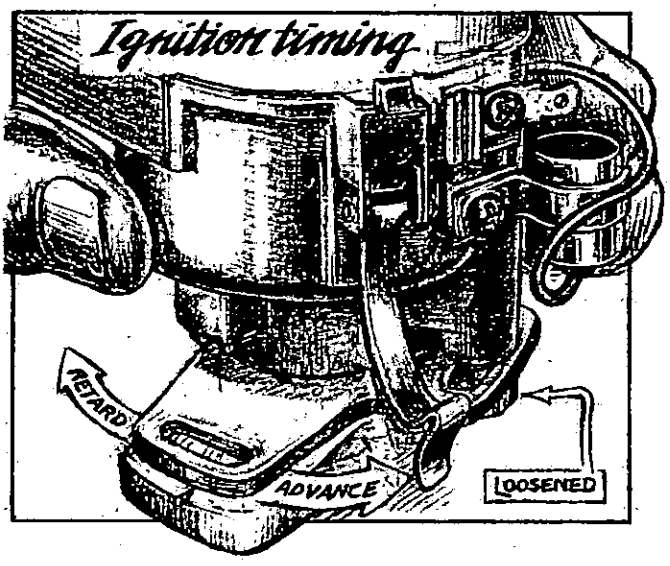
YOUR Nº1 MARKS SHOULD LINE UP WHEN THE DISTRIBUTOR IS IN PLACE. THEY DON'T? KEEP DOING THIS UNTIL THEY DO.

When the support is on, replace the one or two 10mm bolt(s) and tighten them until snug.

If you removed the distributor without the support attached: Account for the rubber *O-ring*, which is either in the distributor support or around the tubular bottom or shaft end of the distributor housing.

•**L-16 and L-18 People:** Align the A-R markings forward over the mark on the distributor support on the engine. The setscrew hole will be to the rear and the marks you made should be roughly in line. The vacuum advance mechanism should be to the left, away from the engine. **L-20B and Z-20 (510 1980) People:** Align the setscrew hole to the hole in the support toward the front of the engine. The marks you made should be roughly in line, and the vacuum advance mechanism to the right, close to the engine. **Z-series (Eight Spark Plug) People:** Your marks should be lined up, and the vacuum advance mechanism to the left and away from the engine. **Everyone:** Slide the distributor into the hole while holding the cap clips against the side of the housing. Once in all the way, turn the rotor until the bottom end of the shaft keys into the drive gear. When it does, you'll feel the distributor housing "clunk" down onto the mounting, if it's not there already. When keyed in, the rotor and shaft will only turn a little before stopping.

Now turn the distributor housing one way or the other to line up your markings. The slotted hole in the fixed plate and the screw hole(s) in the distributor support should now be aligned. Find the one or two 10mm Phillips head screw(s) and thread it (or them) into the hole(s), until the washer(s) just touch the plate.



If you haven't already, now is a good time to check the **vacuum advance mechanism** and **centrifugal advance** in the distributor (Ch. 7, Proc. 13). Then return here. If you've finished work on inside of the distributor, replace the cap (Step 15).

•**Non-Electronic Ignition People Only:** Reconnect the wire(s) to the connector or side of the distributor. If you are going to set the dwell (point gap) with a meter, leave the cap and rotor off until the dwell angle is set. Do, however, connect primary ignition wires (Step 15), then go on to Proc. 6.

•**Electronic Ignition People:** If you have a connector block, gather your wire harness and route it back toward the connector block. Remove the two or three nuts and washers then replace the eyelets over the studs. Match the eyelets with their two or three matching (sized) studs and install the fasteners: flat washer first, then the lock washer and finally the nut. Tighten them only until snug and the wires are in place.

Refit the plastic connector cover if there is (was) one. If you unplugged a gray (or black) plastic connector, find it and route the distributor wire up through the maze to reconnect the two halves. There is a clip built into the side that holds the two halves together.

Find the single ground wire and plug it into the male spade that's screwed onto the distributor housing. Pinch the connector with pliers if it fits loosely.

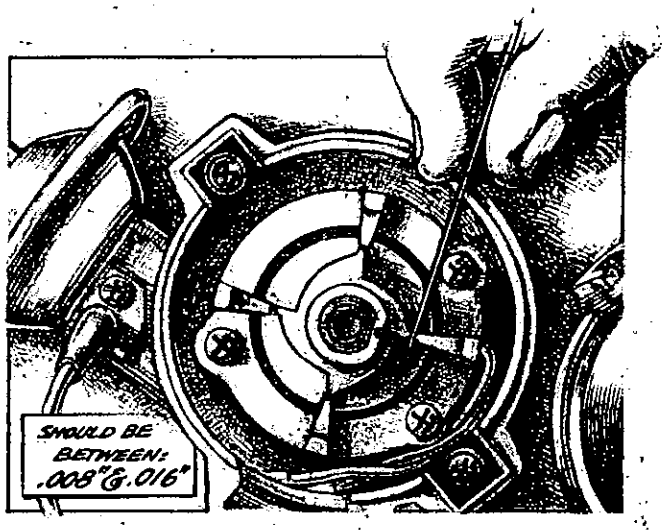
•**Everyone:** You'll have to time the distributor to the engine now (Proc. 6). But first check through the following steps.

Step 14: Check and Adjust the Electronic Ignition Reluctor to Pickup Coil Air Gap. NOTE: This step applies only to California vehicles 1975 and later and all other vehicles 1977 on.

If your rotor is in place, pull it off. Connected to the lower end of the distributor shaft, just above the distributor plate, is a black piece with four points around its edge. This part is called the **reluctor**. Next to the reluctor, attached to the base plate of the distributor, and opposite to where the primary ignition wires enter the

housing, is the **stator or pickup coil**.

As the shaft turns, the points on the reluctor pass a similar point on the stator or pickup coil. Each time this happens, a signal is passed electronically to the Trig or IC ignition unit then to the coil that fires the spark plugs. That's basically how electronic ignition works. The gap(s) between the points on the reluctor and the point(s) on the pickup coil can be adjusted. Although it seldom needs adjustment, it's wise to check this gap now and then.



You really should use a brass or non-magnetic feeler gauge to check this gap, but regular steel blades can be used if you're careful. Put the vehicle in high gear (4th or 5th), while it is sitting on a flat surface. Those with automatics, will have to crank the engine with the starter. Release the emergency brake. Now look at the position of the reluctor tips and the tip on the stator or pickup coil. Push or pull the vehicle until one of the reluctor tips lines up with the stator or pickup coil tip. The distance between these two tips is called the **air gap**. This gap has to be between 0.008in and 0.016in (Trig Ignition) and between 0.012in and 0.020in (IC ignition units).

Find these two feeler blades. If you have one brass feeler in your set between these sizes, get it out too. Since steel blades are magnetic, they will tend to stick to the sides, so take care to get a correct reading. Make sure that the blades are clean. Slip the 0.008 or 0.012in between the tips. If it doesn't fit you have to increase the gap. If the 0.016 or 0.020in blade fits, try the next larger blade. If nothing bigger than the 0.016 or 0.020in fits then you're OK. If you find the gap is anywhere between 0.008 and 0.016in or 0.012 and 0.020in, go on to the next step. If the gap's too narrow or too wide, read the rest of this step.

To adjust the air gap, loosen the two setscrews that hold the pickup coil to the base plate. They are near the ends and on the inside of the stator or pickup coil, close to the reluctor. On the big end of the stator or pickup coil base, next to the setscrew, you might find a tab and a slot to pry against. Pry only against the base of the stator, not the top part. Change the gap and check it until it is within the specified range. Then retighten the setscrews and check the air gap again.

NOTE: If your stator has two tips, check the gap at both points and sides of the reluctor; they should be equal.

Step 15: Put on the Distributor Rotor, Cap, and Primary Ignition Wires.

•**L-series and Z-series-510 People:** If your rotor isn't already on the shaft, put it there now. It fits only one way. The flat side of the hole on the underside of the rotor lines up with the flat spot on the top of the distributor shaft. Push the rotor firmly into place.

Pick up the distributor cap and look at the underside edge. There's a notch in one end of the square ears that matches the raised rectangle on the edge of the distributor body. Position the cap over the top of the distributor with the notch and rectangle aligned. The cap has to be even all around with the housing, or the rotor will play havoc as it turns within. If it's correctly in place, the cap won't turn when rotated. Now find the two clips on either side of the distributor housing and press them up over the sides of the cap and into place in the ledges in the side of the cap.

•**Z-series (eight spark plugs):** Install the rotor: Take the rotor bolt and washer out of your safe place. Look at the distributor shaft to find the threaded hole on its side then slip the new rotor over the shaft, matching the hole in it with the hole in the shaft.

Start the bolt (and washer) through the rotor and thread it straight into the shaft. Tighten the bolt clockwise

with an 8mm socket or wrench until it's snug. The rotor should be secure.

Your cap and distributor have matching tabs and notches so the cap will fit exactly onto the distributor. Place the cap straight down over the rotor, aligning the two clips and ledges or screw holes on the sides of the cap with the clips or holes on the distributor.

When the cap is flush with the distributor (it won't rock or turn): **Clip People**, flip the clips up against the cap then snap them onto their ledges; **Screw People,** find your screws and thread them clockwise through the cap and into the distributor. Tighten them evenly until snug.

Your plug wires should be neatly organized (not twisted and pulling against each other). Need to straighten a few of them? Refer to the numbers stamped on top of the cap and Ch. 7, Proc. 12.

If you need to check the correct location (firing order) of the spark plug wires in the cap, you'll find it in Ch. 7, Proc. 12. **Reconnect primary ignition wire(s).** If the ignition primary wire(s) was disconnected, reconnect it now. Locate the spade(s), pigtail wire or plug on the outside of the distributor housing, and a wire(s) with a plastic or rubber covered connector somewhere near the distributor. **On old dual point vehicles** there are two spades and two corresponding different sized connectors to put together. **Later dual pointers** use the plastic connector and pigtail. **Later single point types** have one spade and corresponding connector. **Electronic ignition distributors** have a pull-apart connector or a black rubber plug and maybe a single ground wire to reconnect or two or three wires, red and green or red, black and white, and blue, that connect to a terminal clock on the radiator or fender wall. Reconnect them with their matching wires and studs, and retighten the nuts. (Modified old dual pointers may have the dead wire taped up or cut.) Put the wire(s) on to the spade or connector. Crimp the connector with pliers if the fit isn't tight. This is a good time to look over the primary igni- to look over the primary ignition wiring for problems (Ch. 7, Proc. 12).

You're done. Almost. If you're tuning your vehicle, finish off by adjusting the dwell and timing, the next procedure.

PROCEDURE 6: CHECK AND ADJUST DISTRIBUTOR DWELL ANGLE AND IGNITION TIMING

•**Non-Electronic Ignition People:** There are two ways of adjusting point gap or dwell angle in a points ignition distributor—with a feeler gauge blade or a **dwell meter**. If you are stuck without a meter you can set the point gap with a feeler blade (Proc. 5 [11]). I recommend using the dwell meter which is more accurate and likely to get you better mileage and performance. Buy, borrow, or beg one of these and a **timing light**, another essential tool for precision engine tuning.

An alternative is to install all of your ignition parts and set points with a feeler gauge (Proc. 5), then drive to the nearest, trustiest mechanic who, for a few greenbacks or beers, will set your dwell and ignition timing.

Condition: You are here to adjust the distributor point dwell angle and/or set the ignition timing. You replaced the ignition parts or are readjusting the old (still good) ones. **Electronic Ignition People:** You need only time the engine (Step 3), if you have done all of your steps in Proc. 5.

Tools and Materials: Set of screwdrivers (medium and small straight tipped and Phillips head), 10mm open end (or long #2 Phillips screwdriver), white paint or light fingernail polish, flashlight, remote starter or a friend. **Dual Point People:** If you have secondary points that are in place and working, you'll need a jumper wire (Ch. 13, Pt. 2).

Remarks: The ignition point gap/dwell, timing, and idle specifications are listed in the Specifications section at the end of this book.

Step 1: How to Set Up the Dwell/Tacho Meter.

With the dwell meter you can recheck the point gap setting electrically. If you have no dwell meter but want one, read Ch. 13, Pt. 2.

The **dwell or cam angle** is the number of degrees in the rotation of the distributor shaft through which the points remain closed (fiber block on the flat spots on the distributor shaft). The feeler gauge adjustment puts us in the ballpark, and the dwell angle puts us right on. If you don't know how to use the dwell meter, a brief description follows.

Most of the less expensive meters have at least two functions: read rpms (revolutions per minute) and determine dwell angle. (The other functions of the combination meters are irrelevant just now.) Is there a four cylinder selector on your meter? (If not, you'll have to set it on the eight cylinder position and all your readings will be *double* what the meter says.) Look at the four (or eight) cylinder degree line on the meter face. This is where you'll make the reading.

Locate the selector position that says "DWELL" and turn the dial to that position. If you have two wires with clips on them coming out of the meter, usually one is red and one is black. Connect the red wire to the negative or (-) connector on top of the ignition coil. You may have to pull off the rubber boot that covers the coil top then replace the coil wire. Look closely for a (-) stamped into the top of the coil. Clip the black lead of the dwell meter to any bare metal surface on the car, such as a bolt or bracket. If your meter has three wires, usually the large red clip goes to the positive battery post, the large black clip to the negative post, and the third (usually smaller) clip to the coil (-) connection. In any case, read the instructions that accompany your meter.

When your meter is hooked up, place it so that when you start the engine, it won't vibrate off and fall into the works. Make certain the wires are clear of the fan. Move all your tools off of the engine compartment surroundings.

Now start the engine (handbrake on, transmission in Neutral or Park). If the engine turns over but doesn't run, or runs roughly, you'll have to recheck some of the steps you've done. The points could be radically out of adjustment, you might have a loose wire, or a bare part of the wire might be touching part of the distributor housing. If the engine coughs but doesn't run or runs roughly, chances are the spark plug wires are mixed up. Recheck them (Ch. 7, Proc. 12). If you had the distributor and its drive gear out, you could have the gear off a tooth. (Ch. 13, Pt. 1, Proc. 3, about finding TDC.) (If the engine runs too rough to make it on its own and all of the spark plug connections are right, loosen the distributor hold-down bolt and move the distributor position slightly clockwise—advance—to improve its running. See Timing, just ahead.) If none of your checks solves the problem, turn to "Engine won't start" or "Engine Won't Idle" (Ch. 4) and perform the checks.

OK, the engine started and is idling. Look at the dwell meter and find the four (eight) cylinder degree line. The needle should be between marks 48 and 55 on the 4-cylinder line or half that amount on 8-cylinder line. If it is not, recheck the meter connections or clip the red wire to the connection at the other side of the coil, or try revving the engine a little. The best place to set dwell is at 49 unless it varies when the engine's revved; in that case, compromise.

If the meter reading is within specifications (48°-55°) at higher rpms, as well as at idle, you are set. If the reading is still off, you'll have to readjust the point gap. If the reading varies more than 2° from idle to high rpms you can suspect a worn distributor shaft; a 5° variance means that it's really worn. If this is the case, set the dwell so that the reading remains within 48°-55° from idle to high speed. And consider replacing the distributor (see Ch. 7, Proc. 13). If your meter reads rpms, keep it hooked up and out of the way until later.

Step 2: Adjust Distributor Dwell Angle.

If your reading is too high or too low, an adjustment is needed. When the angle is too great (a greater degree reading), the point gap is too tight. If the angle is too low (a lower degree reading), the point gap is too wide. Confusing but true. Turn off the engine, remove the distributor cap and rotor and make your readjustment. Read through the rest of this step before beginning.

The fastest way to do this is with a **remote starter** or a friend cranking the engine with the ignition key. The vehicle must be in Neutral (or Park), emergency brake on, wheels blocked from the front, and your safety wits about you. The distributor cap is off and the rotor has been removed.

Disconnect and ground the coil wire(s). Unplug the wire (or wires) that goes to the center tower(s) of the distributor cap by twisting and pulling it (them) up and out of the tower. Lay the metal tip of the wire against a non-painted metal surface as far from the carburetor as possible. If necessary, use packing or duct tape to hold

the wire(s) and tip(s) in place. Don't let it just hang (Ch. 7, Proc. 12 [2]). **FIRE DANGER:** You have to keep the wire clear of gasoline or flammable vapors. **Dwell setters:** Look into the distributor and locate the **point adjustment notch** (early vehicles) or the **adjustment screw** (later vehicles), as described in Proc. 5(ll). Use a medium straight screwdriver. Don't touch the screwdriver to the point contacts when the screwdriver tip is in the notch or your reading will be affected.

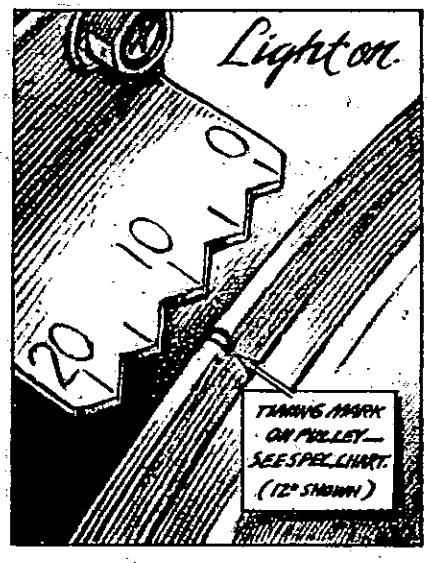
Loosen the set screw(s) just enough to move the bottom side of the points. Keep meter wires, hands, and hair out of the fan at the front of the engine while making the adjustment.

Turn the ignition key to ON. The remote starter should be hooked up (see Proc. 4[3]) or your assistant should be in the driver's seat, ready to crank and stop cranking at your command. OK, crank the engine and watch the dwell meter reading. It should be between 49° and 55°. (Remember to double the reading if you're using the 8-cylinder scale.) **Dual Point People:** Your primary point reading should be *exactly* 50°. For the secondary reading see Step 5 in this procedure. **Everyone:** If there is no reading, check the connections and make sure the points are installed correctly and are opening and closing. If all is well, there should be a spark at the coil wire when it is held ¼in from bare metal as the engine is cranked or when the points are opened manually. (If nothing happens refer to Ch. 7, Proc. 12.)

Remember, to decrease the point gap, you raise the reading; to increase the gap, you lower the reading. A small adjustment will radically change the reading, so experiment by cranking and reading while moving the bottom side of the point set at the notch or the adjustment screw. Remember, the set screw(s) should be just loose enough to move the bottom side. When the proper dwell reading is reached, retighten the set screw(s) and crank and check once more. (NOTE: If the battery is weak, you can remove the spark plugs to make the cranking job easier on the battery.) When the dwell is correct, replace the distributor cap and rotor.

Replace the coil rubber boot: Push the coil wire into the center tower of the distributor or cap.

Dwell setters: Start the engine with the dwell meter connected. The reading should remain within specification. If it isn't, remember whether it's high or low, stop the engine, and increase or decrease the gap (wider gap—lower reading, smaller gap—higher reading). If the reading varies between idle and high speed, compensate for the variation as described in Step 1 of this procedure. Do your final angle check with the engine running. This method of checking and rechecking takes time but it makes for a well-timed vehicle. If your meter has a tachometer, you'll want to keep it hooked up to set the idle speed (Step 3), or use the one on your dash if you have it.



Step 3: Check Ignition Timing and Adjust Idle Speed.

First, locate your timing marks: **On Older Model Engines, pre-1974 or 1975:** The marks are grooves in the **crankshaft pulley**. As the engine turns, the grooves pass a pointer above the pulley that's located on the right side of the engine. There are six grooves, each indicating 5° of crankshaft rotation—clockwise as you face it. You may have to crank the engine around and shine a light down there to bring the grooves into sight. The four grooves on the left (driver's side) of the biggest notch indicate degrees *before* #1 (or #4) piston is at *top dead center* of its compression stroke. These marks pass the pointer before top dead center is reached. The big groove is top dead center (TDC), and the one to the right is 5° after TDC. Clean off the pointer and the pulley marks. If the grooves are hard to see, use bright paint or fingernail polish to mark the TDC and your timing mark (see Tune-up Specifications at the end of this procedure). **On newer**

models: The degree marks are on a stationary indicator, on the front of the engine and left of center. A single mark on the pulley passes these stationary degree marks. You may have to feel or look around the pulley to find the groove, or crank it around into sight. Once you clean off the marks indicator with emery cloth, the numbers can be clearly seen. The pulley turns clockwise past the degree marks; the first number the pulley groove passes is 20°. We'll want the pulley groove to line up with 12° on the indicator, which is just to the left of the number 10 arrow. Make sure you can see this before proceeding. **Air Conditioned Models:** You may have marks and grooves on the opposite side than indicated. In this case your marks may be hard to see from above. **High Altitude People:** Your setting should be advanced 1° for each 1,000 ft of altitude above sea level. **Everybody:** Now let me introduce you to your timing light. The light is *stroboscopic*. It's designed to flash each time high voltage current is zapped through it—the kind of current it takes to ignite the fuel and air mixture (30,000 plus volts). We will hook it up so that each time the number one plug fires the light will flash. Our goal is to make it flash when the correct timing mark and the pointer line up exactly, while the engine runs at idle speed.

The timing light beam may remind you of a light show at the disco. The flash makes the moving pulley and the fan blades appear to be standing still—they aren't. White paint is a good marker because it shows up so well, just like your white shirt on the dance floor. If you are using a weak *neon-type* timing light, the marks will be hard to see, especially in daylight. You might try setting the timing at night, or in a cave.

Three wires come out of the light, usually at the handle. (Cheap lights have only two wires, one to the spark plug and one to the engine block.) Two of the three wires have clips on their ends and are colored red and black. These go to the positive (red) and negative (black) posts of the battery, but wait. The third wire is heavier and has a clip and adapter that you slip over the top of #1 spark plug and clip to the #1 spark plug wire. ("Induction type" attachments are also available, which clamp directly over the #1 spark plug wire.) On Z-series dual plug models, clamp on the In. (right side) wire. If there's a 12-volt/6-volt switch on your light, turn it to 12 volts. If you're still in doubt about how to hook up the timing light, read the instructions that came with it.

Hook up the spark plug lead first. Make sure the connections are secure. Attach the red lead to the positive (+) post of the battery, then connect the black wire to the negative (-) post of the battery, i.e., the one with the cable that bolts to the engine block or starter mount bolt not the solenoid stud. Carefully move the light and all the wires to the right (battery) side of the engine, keeping the wires well away from the fan.

Turn your attention to the dwell meter's *tachometer*. (If you don't have one, you might gain some understanding from reading this bit anyway.) Check that all of the connections are still in place. Set the meter switch to rpms. Remember that your meter's 8-cylinder readings may have to be doubled if you have a 4-cylinder vehicle. Again, make sure the meter or its wires won't fall into the fan.

Engine timing should be adjusted at a specified rpm, usually idling speed.

To Adjust Idle Speed: The idle speed specifications are in the tune-up chart at the end of this procedure. *Idle speed* is controlled by an **adjustment screw** on the right rear of the **carburetor**. Stand to the right of the vehicle and peer over the engine at the carburetor (L-series) or above the intake manifold at the base of the carburetor (Z-series). The idle speed adjustment screw is on the right rear bottom side of the carburetor.

On air conditioned models, the adjustment screw is located between the **throttle delay valve**, which you may have removed to take off the cam cover to adjust the valves.

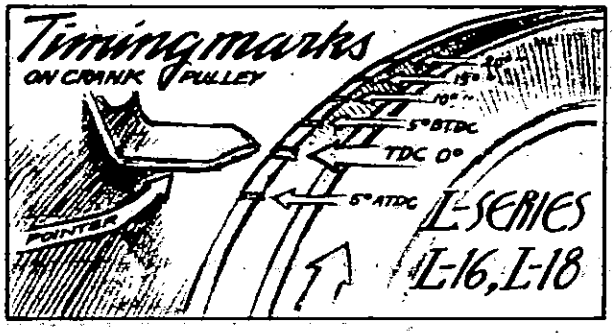
NOTE: If your engine won't idle or idles too high and can't be adjusted read Ch. 6, Pt. 1, Proc. 2; if you're an electronic carb person, see Ch. 6, Proc. 17.

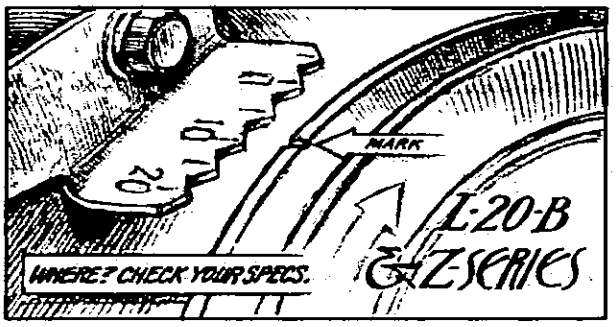
Don't confuse the idle screw with a screw to the right front of it, that is, the **idle mixture screw**. On L-series carbs the idle screw protrudes from the carb base and may be covered by a plastic cap with a Phillips head. On Z-series carbs the idle screw is recessed in the base. It, however, is probably hidden, covered by a plug. There is more about this is Proc. 7. Whatever, *don't* turn the idle screw until after you have checked for correct rpms. If you don't have a tachometer, set the idle speed so the engine idles comfortably, not too high or close to stalling.

Check Ignition Timing: Make one last check to make sure the timing marks are visible. The marks on older style and some air conditioned models are really hard to see, especially if they are not painted. Practice aiming the light at the pointer on the engine while peering between and around all of the obstructions. It'll take a few tries to position yourself exactly. WARNING: The engine will be running. It is easy to push the timing light and wires into the fan while trying to see the timing marks, so prepare well before starting the engine—

keep your soberest wits about you.

Start the engine and let it warm up. Engine temperature must be at the operating level (choke off) to set ignition timing. While it's warming, see that the tachometer is working. Familiarize yourself with the scale. Now look at the Specification Chart at the end of this procedure or refer to the little decal of specifications either on the inside of the hood or in your owner's manual. All manual transmission vehicles are timed in Neutral. If you have an automatic, the timing is set with the emergency brake on, *wheels blocked*, and transmission in Drive. (Don't stand in front of the vehicle when it's running in Drive.)





Pick up the timing light and press the trigger. It should flash. If it doesn't, recheck your connections. Aim the light at the timing marks. The mark(s) on the pulley should appear to stand still. Now look at the tachometer. Are the rpms at the number specified for your model? If the reading is too high or too low, you will have to adjust them using the **idle screw**. To increase rpms use your screwdriver to turn the screw clockwise. To decrease rpms, turn counterclockwise. If the idle won't go down (Auto Trans People put transmission in Neutral or Park), press and release the accelerator pedal or push in the choke knob (Manual Choke People). If this doesn't work, see Ch. 4, Proc. 1, or go directly to Ch. 6, Proc. 2 and 4.

When the idle is right on, reaim the timing light at the marks. **Disconnect Vacuum Advance Hose, 1977 and Later Vehicles:** Find the **vacuum advance mechanism** on the side of the distributor. You should see a black rubber hose plugged into the tube on this device. Unplug the hose at the pipe and plug the hose with a screw or a golf tee.

On older (pre-1974 or 1975) models, one of the degree notchs on the pulley must line up with the crankcase pointer when the light flashes. On new (1975 on) models the single notch on the pulley must align with one of the degree marks on the indicator at the front of the engine. The mark you choose depends on your vehicle and altitude. If the marks don't line up when the engine is at the proper rpms, you will need to change the position of the distributor. Your vehicle's timing specifications are at the end of this procedure under tune-up specifications.

•**Z-series:** Before you go on, do this simple procedure. (1) Run the engine at 2000 rpm fully warmed up with your foot on the accelerator pedal for two minutes. Then let the engine return to idle. Rev it a few times up and down. Let it return to idle for one minute. (2) Now check and adjust the ignition timing as described in the next step.

Step 4: Adjust Ignition Timing.

High altitude people should read all of this step and see the note in the specification chart about advancing ignition timing before acting.

Turn off the engine. Loosen the Phillips head 10mm screw at the base of the distributor just enough so you can turn the distributor. **L-series**: On older models the screw is to the rear of the distributor; on later models the screw is to the front. On all **Z-series** except '81 (Fed.) single plug 510s, there are two screws (bolts) one in front and one behind. Use a 10mm box-end or a long, large Phillips screwdriver to loosen the set screw.

When turning the distributor, grasp the housing or vacuum advance mechanism on the side of the distributor, not the cap. Take your time, and be aware of the fan blades and the light and meter wires. With your wits about you, restart the engine.

You will see that when you turn your distributor housing clockwise, the mark on the pulley will move to the right (passenger side) and the rpms will increase. Turn it counterclockwise and the pulley mark will move to the left (driver's side). Move the distributor until the mark on the pulley aligns with the pointer or specified degree mark on the indicator. Got it? OK, lock the distributor in position by tightening the set screw. Recheck the rpms. If they are higher than specified, readjust the idle speed and check the location of the timing marks again. If you've turned the distributor as far as you can one way and it still can't be brought into time and the set screw is loose enough, the fine timing has to be set (Ch. 7, Proc. 13). There is no fine adjustment on Z-series distributors.

NOTE: The whole procedure may seem a little complicated, what with having to juggle all those components and specifications, but that's what accurate tuning is all about. If you are confused or uncertain, reread this step, breathe deeply, and try again.

Still having problems? If, after setting the dwell and timing, your engine runs as poorly as before you timed it, you may have problems in the carburetor or fuel supply (Ch. 6), and the distributor or plugs (Ch. 7), or perhaps camshaft timing. By "tuning" the engine, you are eliminating possible causes. Carry on! If the engine knocks or pings on acceleration, low octane gasoline or too advanced timing is usually the culprit. You can live with this if it isn't constant, or if you can correct it by using different fuel. Another factor is altitude. For every 1,000 feet you can advance the timing 1°. Beyond 5,000 feet this rule doesn't always hold true. You can experiment by gradually changing the setting.

Do you have dual points? Go on to the next two steps. Otherwise, move on to Step 7.

Step 5: Dual Point Distributor Secondary Point Timing (up to 1974 only—510, 610 and 521 People).

NOTE: This is for dual point people with secondary (retard) points still in place. You are here to make a jumper connection to activate the dual point distributor's secondary point set. Wire colors: Primary points (510—black and red; 521, 610, 620—blue and yellow); secondary points (510—black and yellow; 521, 610, 620—black).

You have two wires running to the side of the distributor housing. The connection closer to the engine is the **primary point wire**. The next one—moving counterclockwise around the distributor—is the **secondary** connection. These wires are hooked to the distributor by plastic covered connectors at the distributor or one plastic multiple connector a few inches away from the distributor. Refer to Proc. 5(8) to ensure that your distributor is wired as described.

Disconnect the wires to both sets of points at the connector(s). Bend a stiff wire or a paper clip to fit inside the female primary point plug-in. When the fit is snug, connect one end of the jumper wire to the bent wire and the free end of the jumper wire to the spade connector of the *secondary* points on the side of the distributor. If you are the plastic multiple type, clip the free jumper wire end into the primary wire spade within the plastic housing, making sure you don't touch the secondary spade inside the housing. You're ready now to set the dwell angle. Connect the red (or third) dwell meter wire to the secondary or jumper wire (metal) connection.

Now check the secondary dwell angle the same way you did the primary points dwell angle (Step 1). The dwell angle for the secondary point set is: 1970-71: 55° 1972-73: 53-½° 1973-74: 52°

The adjustment notch for the secondary set is in a different place than the primary one. Be sure to loosen *only* the set screw holding the bottom side of the point set. Adjust as before. Retighten and recheck the dwell angle until it is exact. Once the secondary dwell is set, disconnect the jumper and extra wire setup and reconnect the original wires to the distributor. Now time the primary point set (Steps 3 and 4), then proceed to Step 6.

Step 6: Set Secondary Point Timing.

Up to 1974 only: Hook up the jumper wire to the secondary points as described in the previous step. Start the engine under the conditions described in the timing steps, 3 and 4. If the secondary set is correctly adjusted, the timing will be closer to the Top Dead Center groove or mark than the primary was. If your secondary points have been modified, as many these days have, they will be adjusted to fire at the same timing mark as the primary set. This modification defeats the emissions control design. You can leave the points alone or carry on with this step with no harm done to the engine.

To time to the retarded (correct) specification, remove the cap and rotor. Locate the bottom of the secondary point set and the distributor base plate. Loosen the two screws on the secondary points base plate. On the front end of the plate you will see a V-groove, with marks below the groove. Moving the adjustable base plate clockwise retards the timing, counterclockwise advances the timing. Place a screwdriver in the adjustment notch to move the plate. Each mark is approximately 4° on the crankshaft pulley. Set the groove against the *center mark*, and retighten the set screws. Put on the rotor and cap, then run the engine. Check the timing with the timing light as you did in Step 3. The correct specification for secondary points timing is 5-8° closer to the TDC mark than the primary point timing. Repeat the adjustment until it's right on.

Finally, shut off the engine, disconnect the jumper setup and reconnect the original wires. Drive the vehicle to see how it runs. The secondary points operate in third gear only (1970-72) and in all gears but fourth (1973). If the system causes you trouble or you suspect it is the culprit, disconnect the wire to the secondary point set to see if that helps.

Step 7: Disconnect Dwell Meter, Timing Light, and Pick up Stray Tools.

Unclip the wires from the dwell meter to the battery and distributor (or coil). Remove the meter from the engine compartment. Now get the timing light which may also be connected to the battery. It is also connected to #1, spark plug wire, spark plug, or distributor tower. Reconnect the spark plug wire securely to the plug or distributor if removed. Make sure all of the connections you may have disturbed are tight and look around for stray neckties and tools. NOTE: If you removed the rubber boot from the coil, replace it now, positioned so the "up" stamping is up. Refit and secure the coil wire into the coil over the boot.

The next task of the tune-up is to set the carburetor, but you may be on your way to a hot date, in which case have fun.

TUNE UP SPECIFICATIONS CHART

MODEL, YEAR & ENGINE	POINT/GAP	IGNITION TIMING:	VALVE CLEARANCE	IDLE SPEED
Look for and go by decal in engine compartment if one.	DWELL ANGLE or AIR GAP.	BDTC-Before Top Dead Center High Altitude People see below (*)	HOT COLD	Automatic Transmission* in Drive (D)

NOTE: For Spark Plug Type and Gap Information (Ch. 3, Proc. 3).

510, 521 & 620

1968-71 (L-16)	0.018in-0.022in/ 48°-55°	Primary: 10° BTDC Secondary: TDC	.010 Int. .012 Exh. .008 Int. .010 Exh.	700 rpm 600 * in (D)
1972 (L-16)	(same)	Primary: 7° BTDC Secondary: 8° BTDC	(same)	(same)

1973-74 (L-16)	(same)	Primary: 7-12° BTDC Secondary: 8° BTDC	(same) (same)	800 rpm 650 * in (D)
1978-79 (L-20B)	0.008in- 0.016in	8° BTDC	(same)	600 rpm all * in (D)
510				
1980 (Z-20)	0.012in- 0.020in/ 48°-55°	8° BTDC 6° BTDC (Calif.)	0.012 Int. 0.010 Exh. 0.008 Int. 0.009 Exh.	(same)
1981 (Z-20)	(same)	6° BTDC	(same)	(same
610 & 620				
1973 (L-18)	0.018in- 0.022in/ 48°-55°	Primary: 7° BTDC Secondary: 8° BTDC	0.010 Int. 0.012 Exh. 0.008 Int. 0.010 Exh.	800 rpm 650 * in (D)
610, 710 & 620				
1974-75 (L-18 & L-20B)	0.018in- 0.022in/ 48°-55°	12°BTDC 10° BTDC	0.010 Int. 0.012 Exh. 0.008 Int. 0.010 Exh.	750 rpm 650 * in (D)
1976-77 (L-20B)	(same)	12° BTDC	(same)	(same)
1976-79 (Can.) (L-20B)	(same)	(same)	(same)	(same)
1976-79 (Cal.) (L-20B)	0.008in- 0.016in	(same)	(same)	600 rpm (all) * in (D)
1978-79 (Fed.) (L-20B)	(same)	(same)	(same)	(same)

720

1980 (L-20B)	0.008in-0.016in	12° BTDC	0.010 Int. 0.012 Exh. 0.008 Int. 0.010 Exh.	600 rpm (all) * in (D)
1981 (Z-22)	0.012in-0.020in	5° BTDC	0.012 Int. 0.012 Exh. 0.008 Int. 0.009 Exh.	650 rpm 2WD * in (D) 800 rpm 4WD
1982-83 (Z-22)	(same)	3° BTDC	(same)	(same)
1983½ -1986 (Z-24)	(same)	(same)	(same)	700 rpm 2WD 800 rpm 4WD 650 rpm (Can.)
1983½ -1986 (Z-20)	(same)	5° BTDC	(same)	600 rpm-650 * in (D)
		—further BTDC—		

(*) You want to advance your ignition timing 1° (one degree) per 1,000 ft above sea level. If you hear pinging (or a light rattle sound) upon acceleration when driving, the timing may be too far advanced. Try retarding it some until the noise goes away. Also, see Proc. 3 to check spark plug condition if it's too advanced.

PROCEDURE 7: CHECK AND ADJUST THE CHOKE AND CARBURETOR IDLE MIXTURE AND SPEED; REMOVE, INSPECT, AND REPLACE AIR FILTER

Here you'll be doing the two basic tune-up adjustments to the carburetor. On today's emission-controlled engines, the carburetor has graduated from a simple fuel-air mixture pot to a delicate valving and sensing device. This is particularly true with 1983½ California and all 1984 on USA trucks with electronic fuel metering. But its function is basically the same—to blend air and fuel for delivery to the engine's combustion chambers as efficiently as possible. The emissions control system, especially on newer vehicles and on the electronic carbs, the electrical system, intimately affects the function of the carburetor, and thus how the engine runs. Maintenance of the emissions parts is crucial for problem-free operation. These systems around and related to the carburetor have environmental merit, but they do seem mind-boggling at first glance. A lot of carburetor-related problems (such as rough idling, stalling, surging, hesitation, hard starting, poor mileage) may be traceable to the associated emissions or electrical systems. You should check to see that all the little rubber hoses and wire connections in the area (vacuum hoses, plastic connectors, and wires) are free of breaks and are properly connected (Ch. 6, Pt. 1, Proc. 1 and 2, and Ch. 6, Pt. 2, Proc. 1).

In this procedure, your aim is to finish your tune-up by smoothing the idle, thus conserving fuel and reducing emissions. Most carburetors, including yours, can only be adjusted externally in two aspects: the *choke control* and the *idle*. This is not true for Z-series engines unless modified—but read on anyway.

Condition: You are here for maintenance (tune-up), or because of high fuel consumption, stalling at idle, or inefficient or erratic operation during warm-up. Make sure first that the valves are in adjustment, the ignition timing has been set (Proc. 6), the air cleaner housing has been removed, and there are no obvious vacuum leaks

i.e., exposed vacuum hoses (Ch. 6, Pt. 1, Proc. 1 and 2). NOTE: You can check but not adjust the choke by simply removing the top of the air cleaner housing. Carb adjustments can be done with the housing in place, but are easier with it removed.

Tools and Materials: Jumper wire (described in Ch. 13, Pt. 2) good light, short Phillips screwdriver and medium regular screwdriver, a long skinny screwdriver, a tachometer on a combo tune-up or meter, or the tachometer on your dash. *Optional:* Friend, test light (12 volt).

Remarks: With a manual choke you control the opening and closing of the **choke flap valve**, that round flap you see across the top of the carburetor's mouth. Manual chokes are marvelous and efficient because you have maximum control over them. With automatic chokes (1970 and later vehicles) as with anything automatic, you're dependent on the system working right all by itself. Little goes wrong with an automatic choke, but it's an easy and important thing to check.

When closed, the choke flap limits the amount of air drawn into the carburetor and helps atomize fuel. This is important for easy starting and proper running during the warm-up period. When activated, the **choke fast idle** linkage increases the engine "fast-idle" speed.

•**Z-series People:** If your engine **knocks** when first started **cold**, consider lowering your fast idle. Keep reading.

•**Automatic Choke People:** Check your choke's operation often, especially if your engine idles fast—hot or cold—or your gas mileage drops.

•**Everyone:** To warm up your engine with least wear, pump the accelerator once or twice then start. Let it idle for 30 seconds then drive slowly without "loading" the engine until the temperature gauge reads normal. Excess choking eats gas, wears cylinder walls, and tempts the driver to overwork the engine while it's still cold.

For automatic choke vehicles, manual choke conversion kits are readily available. If you buy one, get a quality one. I have none to recommend, however. They include the knob and cable and brackets and are fairly easy to install, but may be illegal in your state. Models less than 5 years old (or fewer than 50,000 miles) have warranteed emission control. Tampering with the fuel or emissions control systems is illegal and often destructive.

One more point: Don't let your engine run at idle with the choke on for more than a couple of minutes, except when doing this adjustment or when timing. If you have to run it longer to warm it up, rev it every 30 seconds to reset the choke and not load the catalytic converter. **Never run the engine in a closed, unventilated space.**

Step 1: Check and Adjust Manual Choke.

Those of you with no choke knob on the dash have automatic chokes and should go to Steps 2 and 3.

Manual choke people should check the operation of the choke because often the flap valve does not open fully when the control knob is pushed in. When this happens, the result is greater fuel consumption, poor running, overheating, unnecessary pollution, etc. NOTE: This description is not accurate for non-factory choke modifications.

When the knob is pushed all the way in, the **butterfly valve** at the mouth of the carburetor should be open—straight up-and-down. The engine is turned off. Have a friend operate the choke knob while you look at the butterfly valve, as well as the choke cable and linkage in between. A **setscrew** holds the cable solidly to the choke linkage, and here is where you can make an adjustment, if it's necessary.

To adjust, push the control knob in all the way and loosen the setscrew with your Phillips screwdriver enough so the cable (wire) slips freely through the **setscrew fitting**. Now open the butterfly valve all the way (vertical) with your fingers while you pull on the cable wire taut with a pair of pliers. OK, now tighten the setscrew, and have your assistant pull the knob out then back in. The valve should close almost all the way when the knob's out, and return to the full open position when the knob's in. Does it bind or stick? Get a new cable, a good one. (Installation isn't covered in this book.) That's all there is to it. Go on to Step 4.

Step 2: Check Automatic Choke.

Here's how to see if your automatic choke is working properly. With the car or truck at rest, engine off, depress and then release the gas pedal. This "sets" or closes the choke flap valve. Now find the flap at the top or mouth of the carburetor. If your engine was fully warmed up, this flap should be vertical. If the engine has been off a while the flap should be almost fully covering the carb mouth. If you are experiencing hard starting when the engine's cold, there's a chance that it isn't closing or not closing far enough when the engine's cold. Let it cool for 15-20 minutes or longer if it's hot outside, then press down the accelerator pedal to close the choke.

A gap no more than 1/8in and no less than 3/32in should be visible between the upper edge of the flap and the bore of the carb. Now turn the engine on and let it warm up. As it warms up press down on the gas pedal once or twice, the flap should gradually open. About two minutes after starting, the flap should be fully open (vertical).

Here is how your automatic choke works: When you start the engine, electricity passes from the **alternator** to the **choke relay**, then to a **heater coil** inside the **automatic choke assembly**, that round thing with a wire running to it on the top rear of the carburetor. When you push on the gas pedal once or twice before starting, springs force the choke butterfly valve closed. The electricity to the choke assembly turns on a little **heater** which warms up a metal **coil**. The coil expands slightly, uncurls a little, and as it does, opens the flap valve.

Some things to check when examining the automatic choke's operation are the following:

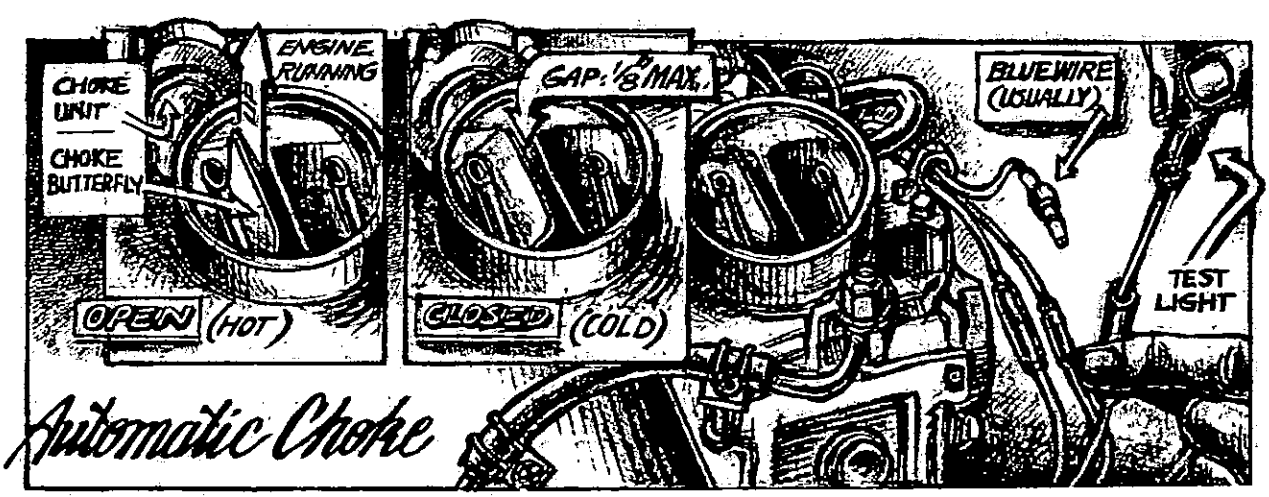
Does the choke valve close completely when the engine is cold? And do you feel spring pressure when trying to push it open with your finger?

Is the choke valve opening itself at all? And can you close it easily if the throttle (accelerator) is open (depressed)?

Does it open completely when the engine is warmed up?

If the choke doesn't close when cold and after the accelerator has been depressed, check its adjustment (next step). If the choke doesn't open at all, chances are electrical current isn't reaching the heater to warm up the coil that's inside the choke housing. The wire to the choke is blue. Make sure the **bullet-style** and/or **multiple connector** to the wire and the connection at the choke housing are intact. If they are, and the choke still won't open by itself when the engine warms up, you can check the circuit with a test light.

To check electrical current to the choke: Separate the wire at the in-line connector or find where the wire connects to the choke and start the car. Connect the test light clip lead to ground, and put the pointy probe lead into the female (vehicle side) connector (not the one connected to the choke). Touch only the plug that goes to the blue wire. If the light comes on, there is current to the choke; if the other connections to the choke are good, the choke assembly or choke valve adjustment is the culprit. If the latter is the case, reconnect the choke wire and adjust the choke (next step). If the choke unit won't adjust, check for a sticky choke flap or a stuck linkage, the mechanism that connects the choke to the accelerator, on the back of the carb, see Step 3 and Ch. 6, Pt. 1, Proc. 3.



If the light doesn't work, the cause could be a faulty alternator, regulator, or connection between the alternator, choke relay or choke unit (read Ch. 7, Proc. 8). If the alternator is charging, check the wiring to the choke relay (Ch. 7, Proc. 14 and 15).

Step 3: Adjust the Automatic Choke.

NOTE: Most Z-series carburetors have choke elements riveted in place. Datsun/Nissan lists numbers for some of these parts, meaning you can cut off the rivets, replace the element and install screws or new rivets in their place. I have never done it. If the element's bad, go to the dealer and ask them what they do. 1980 and 1981 510, Z-20, and all Z-24 engines have replaceable elements (although riveted). Z-22 (1983½ on) engines (by part number) aren't designed to be replaceable, but I think they could be. Good luck. Adjust the new element as described below for L-series.

Hot Choke Adjustment.

•**L-series:** On the backside of the choke element housing you will see arrows and the words OPEN (lean) and CLOSED (rich). Now find the three Phillips head screws that hold the **housing cap** to the carburetor. Bend down any wire retainers and loosen these three screws slightly, which will allow you to turn the housing cap. Turn the housing cap clockwise to the OPEN position. Hold the throttle open with its linkage, or have your friend depress the gas pedal all the way, whilst you turn the housing. If the flap is stuck, use carb cleaner and penetrating oil to free it, working the flap while the accelerator's depressed. This will work if the linkage and fast idle cam aren't stuck. Turn the assembly clockwise until the butterfly valve is fully open (LEAN or vertical). Don't turn it past that point; if it is set beyond that point, the choke may not close far enough when the engine's cold. Turn off the engine and tighten the screws, but don't overtighten them. Recheck your adjustment when the engine's cold.

Cold Choke Adjustment.

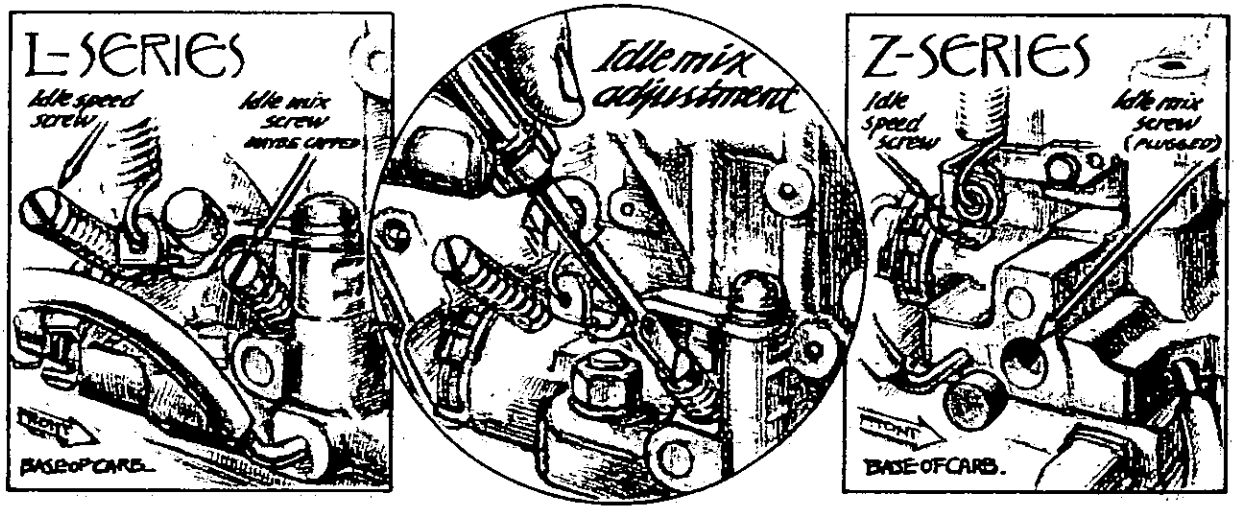
Let the engine cool for 15 to 20 minutes, then depress the gas pedal once and release it. The choke valve should be nearly closed—as described in the previous step. If it's close, let it be.

To adjust the choke, loosen the three Phillips head screws on the plastic or metal choke housing enough so that you can just turn it. Rotate the cover until you've got that little 3/32in to 1/8in gap, and retighten the three screws. Finally, start the engine again and watch the choke valve open up gradually. Depress and release the accelerator pedal once every 30 seconds. After three minutes the choke valve should be fully open. In the rare event it is not, your problem is in the choke element. To replace it, see Ch. 6, Pt. 1, Proc. 12 and 14.

Step 4: Adjust Idle Mixture and Idle Speed.

L-series: The **idle mixture screw** can be seen while standing at the right side of the car and peering over the cam cover at the base of the carburetor. **Z-series:** The idle mixture screw is probably covered by an aluminum plug in the center of the carburetor base, keep reading. **Everyone:** The screw is forward of the **accelerator pump lever return spring**. Don't confuse this screw with the idle speed screw. The other end of the mixture screw is actually a tapered valve that permits fuel to pass through the carburetor in a measured amount when the engine is at idle. When your engine is idling, it should be running on the least amount of fuel possible. For the idle "circuit" (fuel passage) to function, the accelerator linkage and cable must be correctly adjusted so the engine will idle at the correct speed, the choke valve open all the way, and the engine running at idle speed. Your vehicle's idle speed specifications are at the end of Proc. 6. The idle speed adjustment is also in Proc. 6. NOTE: Some L-20B models may have a **plastic cap** on the mixture screw that is designed not to be removed, but can be easily broken or pried off. **L and Z-series:** In many states and cities emissions tests for carbon monoxide (CO) and hydrocarbon (HC) are done while the car idles or on a dynometer, when it's running under load. The idle mixture screw (along with other emissions control devices) is adjusted until the emissions aren't excessive. In some places these tests are mandatory. Many garages routinely set the mixture to acceptable levels while the engine's idling. The adjustments I outline will not necessarily put you within the specified allowable CO or HC, but will get it close. Catalytic convertor—unleaded gas vehicles often have a rotten egg smell if the mixture is too rich or the "cat" is bad. Poor quality or leaded fuel will play havoc on a "cat" too. Consult the dealer for advice.

•**L-series:** Warm the engine until the gauge reads normal. Put the transmission in Neutral (automatics in Drive, with wheels blocked and handbrake set). Turn the idle speed screw with a screwdriver so the engine idles



as slowly as possible, until it almost stalls. **The choke has to be fully open to make this adjustment.** (If the idle will not go low enough, check for a binding or out of adjustment throttle cable, stuck antistall dashpot, or BCDD valve out of adjustment [Ch. 6, Pt. 1, Proc. 2].)

•**Z-series People** fall into two categories: (1) 1983½ California (1/83) and 1984 USA (7/83). You and all later models, except Canada, have electronically controlled carburetors. You are known as **E.C.C. People.** (2) Trucks with production dates before the above dates and all Canada models have non-electronic carburetors, therefore **Non-E.C.C. People.**

You already know about the covered idle mixture screw. If the plug isn't there, you can easily get to the screw and adjust the mixture. Even if the plug is covering the mixture screw, you can still remove the plug as directed in Ch. 6, Pt. 1, Proc. 12(18) and get at the screw. But wait. There is the law to consider. I want your engine to run well but also stay within the correct (legal) emissions. So if you don't need to adjust the idle mixture, leave it.

If you do adjust the mixture, have the exhaust analyzed by a garage with an infrared or compatible CO meter after you make the adjustment.

Below I have listed some conditions for you to fulfill before messing with your mixture. This is particularly important for E.C.C. People. In your case, a mixture adjustment probably won't solve rough idle problems, but you must eliminate that possibility. I encourage E.C.Cers to read Ch. 6, Pt. 1, Proc. 2 and 17 before doing anything to better understand how your fuel system works. In this case, the more you know the better.

Conditions for Z-series Idle Mixture Adjustment: You are considering adjusting the idle mixture and/or removing the plug that covers it, and smoothing out the idle; you just rebuilt the carburetor and installed it correctly (Ch. 6, Pt. 1, Proc. 6).

There is adequate fuel going to the carburetor, and there are no fuel or vacuum leaks. Or if the engine won't idle at all, see Ch. 6, Pt. 1, Proc. 2 and Ch. 6, Pt. 2, Proc. 1.

The spark plugs and distributor cap are in good condition, and the air gap is properly adjusted (Ch. 3, Proc. 3 and 5). The spark plug wires and other ignition components are sound (Ch. 7, Proc. 12).

The valves are in adjustment (Ch. 3, Proc. 4). And the compression is up to snuff (Ch. 3, Proc. 9).

The ignition timing is set to specification (Ch. 3, Proc. 6 [3]).

Make sure your deceleration devices are working (Ch. 6, Pt. 1, Proc. 2 and Ch. 6, Pt. 2, Proc. 13).

The oil and coolant levels should be at correct levels (Ch. 3, Proc. 1).

All electrical loads, for example, air conditioner, heater fan, head lights, etc., should be off. (Models with Power Steering: Aim the front wheels straight ahead.)

The emergency brake is on and the wheels are blocked.

Connect a timing light and tachometer (if necessary) (Ch. 3, Proc. 6).

•**Automatic Transmission People:** When making adjustment, put the transmission in Drive (D). When revving the engine, shift into Neutral (N) or Park (P).

To Adjust Z-series Idle Mixture: (1) Warm-up engine to normal operating temperature. (2) Rev the engine

to 2000 rpm and hold it there for two minutes, then let it idle for one minute. (3) Readjust the idle speed if necessary (Step 4). (4) **E.C.C. People**: Disconnect the hose from the rear *Vacuum Switch*. It's the rear one of those two black plastic cylinders on the right (passenger) side fender wall. If you can't find it, check Ch. 6, Pt. 2, Proc. 1 and 15. Plug the hose with a golf tee or screw. (5) **E.C.C. and Non-E.C.C. People**: Rev the engine two or three times and let it idle again for one minute. If it idles roughly and you're sure there aren't any vacuum hoses disconnected and not plugged, nor are there any gasket leaks at the carburetor or intake manifold, go ahead and set the mixture. To remove the plug, see Ch. 6, Pt. 1, Proc. 12 (19) To set the mixture, see below.

•**Everyone:** Turn the mixture screw in (clockwise) until the engine runs roughly or almost stalls. *Do not turn the screw in too hard or the needle valve tip of the screw will be damaged.* (**L-series**: Your engine should nearly stall when the screw is turned in fully. If it runs well when fully in and the idle speed is correct, you have a plugged idle circuit. Read on.) Back the screw off (counterclockwise) until the engine speed increases and the engine runs smoothly. (**Z-series**: If there is no difference in smoothness, turn the screw out ¾ - 1½ turns and stop. Rev it a few times then let it idle for a minute and reset if necessary. Z-series engines generally run a little rough no matter where the screw is; listen closely for the best idle between ¾ and 2½ turns out.) (**Auto Trans People**: Rev it in Neutral or Park.) Remember that the farther out the screw is turned, the more fuel the engine consumes when idling, so don't turn the screw out farther than necessary—just until the idle is smooth. If you turn the screw in far enough to make the engine **stumble**, back it out, until the idle smoothes. You should not have to turn it out more than 2½ turns for optimal idle.

If the engine will not idle, make sure that the **fuel shut-off solenoid wire** (the red one to the carburetor) is connected. If you cannot get the idle to change as the mixture screw is turned in, you may have some internal carburetor circuit problems. That's a common problem with these carburetors—especially L-series. Read the last part of this step (**Everyone**), and if all that fails see Ch. 6, Pt. 1, Proc. 2.

•**L-series**: Once the idle's smooth, I suggest you adjust the mixture screw to "lean drop." This method lowers the carbon monoxide level near to or as low as the amount specified by law. The idea is to make the idle mixture more lean by turning the mixture screw clockwise from the smooth setting just enough to lower the engine speed by 50 rpms. If you have a tachometer, hook it up and use it, or simply listen for a slight drop in engine speed. The engine will idle a bit rougher but you can live with that.

•**Z-series:** If you can't get your engine to idle well after all this, turn to Ch. 6, Pt. 1, Proc. 2 to delve deeper into the system.

The rules say: Install a new plug to cover the mixture screw once the mixture's set. But wait. You should have your CO level checked by a garage with such a meter. Their reading should be below 5% on non-E.C.C. engines and below 4% on E.C.C. engines. Ideally the percent should be 1% or less at idle.

After this is done, go to Datsun/Nissan and get a new plug #16031-06W00.

•**E.C.C. People**: If you disconnected the hose to the rear vacuum switch, unplug and reconnect it now.

•**E.C.C. and Non-E.C.C. People**: Run the engine at 2000 rpm for two minutes, then rev it up and down a few times. Let it idle for a minute then recheck and adjust the idle speed as directed below. (**Automatic Transmission People**: Put the transmission in Drive or Park when revving.)

To adjust the idle speed, L and Z-series: Find the right idle specification for your engine on the chart at the end of Proc. 6 or on the sticker in the engine compartment, and connect the tachometer if you have one. If you don't, just set the idle speed screw to what feels right. It shouldn't be so low that you stall in traffic, or so high that your engine roars at a stoplight.

•**Automatic Transmission People:** Your final idle speed must be set with the transmission in Drive, the emergency brake on and the wheels blocked. When shifting at a stop from Neutral to Drive or Reverse, the car should neither leap nor stall.

•**Everyone:** If after all this the engine runs poorly, go back and recheck your work. If what you did made no improvement, chances are something else is wrong in the engine or carburetor. Check all of the vacuum hoses for leaks and go over the ignition, fuel and emissions control systems (Ch. 6, Pt. 1 and 2, and Ch. 7, Proc. 12).

•**Air Conditioner People:** If you use it frequently, set the idle speed with the air conditioner turned on.

If you used the dwell/tach meter to read rpms at idle, unhook it. You have finished setting the idle mixture and speed on your carburetor.

Step 5: Check Air Filter and Install Air Filter Housing.
NOTE: If your housing is off the engine, check the filter with the housing removed.

If you are here just to deal with the air filter, first locate the big, round blue **air filter housing**, resting on top of everything, right over the carburetor and engine. Look around its edges. Are there metal clips? If so, lift up their sides to take tension off the hooks that hold on the top section—flip these hooks down to hang on the side. All models have an **hexagonal or wing nut** in the center of the lid. Remove this nut and the lid will come off.

Inside the housing is the ring-shaped, corrugated fiber air filter, which is replaceable. Does it look grimy? If so, shine some light through the filter's corrugations. If you can see light clearly from the other side most of the way around, the filter has life in it and can be reused. Before putting it back in, tap the dust out of the filter and wipe out the housing with a rag. If, however, light won't show through your filter, replace it with a new one. Parts and department stores, as well as the dealer, have them. Is there oil on the filter or in the housing? If so, the engine has blow-by. Check the PCV system, see Ch. 6, Pt. 2, Proc. 2 and also read Ch. 10, Proc. 1 and 2.

You'll want to check the PCV filter if you have one. It fits into the inside wall of the air cleaner housing and is washable in solvent or replaceable (Ch. 6, Pt. 2, Proc. 2).

Other components in the engine need maintenance about the same time as the air filter. Refer to the maintenance schedule at the beginning of this chapter and Ch. 6, Pt. 2 and Proc. 10 in this chapter.

If you've been doing the carburetor choke and idle adjustments, the air cleaner housing has to go back on. Install the air cleaner housing onto the carburetor, taking care to get the vacuum hosing plugged in right. Chap. 6, Pt. 1, Proc. 1 will help you get it right.

Finally, put the new or usable filter in the housing, and secure the lid with the hexagonal or wing nut. Make it snug, but not so tight that you'll have a struggle getting it off next time. If your housing has side clips, flip the hooked ends over the lid, into the groove then snap the lever end down against the side of the housing. Bon!

PROCEDURE 8: CHECK CONDITION AND TENSION OF FAN DRIVEBELTS

Condition: You are here for a regular maintenance check. The engine's off and the hood's open. Electrical problems like dimming head lights and a weak or dead battery are often caused by a loose belt.

Tools and Materials: A trouble light or flashlight. *Optional:* Small ruler.

Remarks: Correct belt adjustment is a crucial part of maintenance. This procedure describes how to examine all your engine's drivebelts. It may have one, two, or three.

Step 1: Find the Alternator/Fan Belt.

Look in front of the engine, behind the radiator and fan. Look to the lower right (passenger side) and you'll see the **alternator**. A black rubber belt connects the **pulley** on the alternator to the pulley behind the fan and to the crankshaft pulley directly below that. If you have an **air pump** or **power steering pump** and/or an **air conditioner** there will be other belts running on the same and other pulleys. For now, look just at the fan belt described, keeping in mind that the principles for this belt apply to the others as well.

Step 2: Examine the Belt.

Use your light to look closely at the stretch of belt between the fan pulley and the alternator. Turn it with your fingers to check the underside. It should be rubbery and supple, not dried out or cracked. There should be no missing portions or cuts. Now look at all the belt's length, top and bottom, checking its condition again. You may have to crank the engine around to get different views of the belt. Remove all lights and fingers before cranking.

Next check the *tension* by pressing your thumb against the stretch between the alternator and fan pulley—the

longest stretch between two pulleys. A properly adjusted belt has just under ½in deflection with **moderate** pressure against it.

Check any other belts in the same fashion, but use the deflection specifications in Ch. 6, Pt. 2, Proc. 4 for the air pump belt. The power steering pump belt info is in Ch. 12, Proc. 13. Replacement of these belts is covered in the same procedures.

If your fan/alternator belt is cracked, frayed, brittle, or has chunks missing, replace it. Turn to Ch. 7, Proc. 9 to remove the belt, and take it with you to buy a new one. That way you'll know it will fit.

Dealer belts are easy to match. After-market (parts store) belts should be compared as well as checked with those in the store catalog, which is often incorrect. It's wise to carry a spare fan belt in the vehicle (the old one will do).

PROCEDURE 9: CHECK CYLINDER COMPRESSION

Do you want to check the internal condition of the engine, i.e., the parts you cannot see? A lot can be learned about your piston rings, valves, and head gasket by measuring the compression in each of the four cylinders and by careful examination of the spark plugs, which you must remove to check the compression.

Compression is what prepares the fuel-air mixture for ignition inside your engine. If compression is low, combustion will not be efficient and there will be a loss of power. Compression readings and the color of the tips of the spark plugs are helpful clues for analyzing the condition of your piston rings and valves. Write down the compression readings and keep the spark plugs in order, cylinder by cylinder. There's a complete explanation of compression readings in Step 3.

NOTE: It's a good idea to drive your vehicle at medium-high speeds before checking compression and spark plug condition.

Condition: If lack of power, excessive fuel or oil consumption, or uneven idling have been your lot, it may be time to do this procedure to help evaluate your engine's condition. If you have never done a compression check and are just curious about what shape your engine's in, in terms of slow but inevitable wear, this procedure will help. Even if your engine runs well, the compression test will give you readings for your maintenance records and possibly alert you to trouble. If you haven't done a compression test before, be sure to read the procedure through before beginning. Also, remove the lid of the air cleaner housing.

NOTE: Your battery has to have a good charge and be strong enough to crank the engine many times without starting it.

Tools and Materials: Compression tester (screw-in or press-in types are available at parts and department stores), pencil and paper, screwdriver, and remote and starter or a friend.

Remarks: If your engine doesn't run, and thus can't be warmed up, you can still find out if one or more of the cylinders has low or no compression by doing the test. In fact, you can actually determine if you have very low compression in a cylinder *without* a compression tester! Simply crank the engine with the spark plugs out while pressing your thumb over the vacant spark plug hole. Feel (and listen) for the pressure of the piston rising in the now-sealed cylinder.

If you suspect that there is no or very low compression in a given cylinder and the ones next to it are up to snuff, you can remove the valve cover and crank the engine. Watch the camshaft and valves work over the cylinder in question. If the camshaft lobes are operating the rockers on all of the valves, on all cylinders, there's probably a valve that's not seating properly (burned, bent, or cracked valve), or perhaps you have a broken piston or really bad rings. To make sure, perform the rest of this procedure on all cylinders. If the valve in question does not spring back or stays open (stem doesn't move), you may have a stuck valve. To deal with bent, burned or stuck valves, see Ch. 9, Pt. 1.

Step 1: Warm Up Engine, Remove Spark Plugs.

To get an accurate reading, make sure your valves are in adjustment (Proc. 4). Park the vehicle on level ground and remove the top of the air cleaner housing. Start the engine and get it up to operating temperature, then turn it off and remove the spark plugs (Proc. 3). Be sure to keep them in order. Each tells you much about the condition of the cylinder it came from (Proc. 3): **Z-series People (with eight spark plugs):** Remove only four plugs—the exhaust ones. It is easier to work from the left side.

If you have a remote starter, hook it up (Proc. 4[3]) and leave the ignition key at OFF. If you don't have a remote starter, disconnect and ground the **coil wire(s)** at the distributor (Proc. 6[2]). Remove coil wire(s). Find a patient friend to operate the key and crank the engine at your command. The wheels should be blocked, emergency brake ON, and the transmission in Neutral or Park.

Step 2: Prepare Engine and Insert Compression Tester.

Your choke and throttle should be *open* while checking compression. If your vehicle has an automatic choke (no choke knob on the dash), you'll have to hold open the **choke valve** (Proc. 7 [1 and 2]). It's the round plate you see when you look down the mouth of your carburetor. Press on the valve to see how it opens and closes (flip/flap). Stick a screwdriver down the top of the carburetor to keep the valve open enough to let air pass through. Don't drop anything smaller than the size of your fist down the mouth of the carburetor.

OK, now look at your compression tester gauge. The increments on the dial (0-250 or thereabouts) represent pounds of air pressure per square inch. If your gauge has a rubber snout, this end is pressed *firmly* into the vacant spark plug holes. If it has a threaded tip, this screws into the holes. **Caution:** Do not crossthread the adapter. You'll see a tiny pin somewhere on the tester (on the side of the gauge or inside the snout) which, when pushed, returns the needle to zero. Before taking each reading, be sure the needle has been returned to zero. NOTE: Some threaded models have an adapter to fit different bore spark plug holes. You want the 14mm diameter x 17mm length adapter.

Step 3: Do the Test.

Put your tester into the #1 spark plug hole. If it's the press-in type, press the rubber snout directly and firmly into the hole. A little saliva on the end of the snout will help seal it snugly in the hole. The press-in kind has to be held firmly in place during the cranking part of the test.

If you're using an assistant, she or he should be in the driver's seat, gears in Neutral, accelerator depressed. Hand and hair out of the works? OK. Bark the command to crank. Your friend turns the key to START and lets the engine crank over for five or ten seconds or until the gauge needle stops moving. You may feel the pressure against your grip. You may be a bit startled by loud hissing or leakage of air out of the hole. If so, try it again, but first reset the needle to zero by pressing the little pin. When the tester is properly in the hole, you'll hear very little or no hissing.

If you're working alone with a clip-on remote starter, hold open the throttle at the rear of the carburetor by hand, and push the button on the remote starter.

Watch the gauge as the engine cranks. You'll notice how the needle rises in graduations, and at one point will go no higher. Where it stops is your final reading. Write down the number on a piece of paper (e.g., #1 - 162). Better yet, write it on the cam cover or inside fender of the vehicle in pencil. Then when you're done, write the numbers, with the date and mileage at which you did the test, right here in the book. Handy, huh? Now do the other three cylinders the same way. Remember to reset the gauge needle between each one.

NOTE: Altitude affects compression. Your readings will be lower overall at higher elevations.

The reading on a new or rebuilt engine might be around 170 pounds (psi) for each cylinder. An older engine that has some wear might measure under 120 psi per cylinder. However, the amount of compression is *not* as important as the *closeness* of the four numbers to one another. Ideally the compression of all your cylinders should be within a 20% range. For example, if your highest reading is 155 psi, your lowest should not be below 124 psi. Be concerned if there is a difference of more than 35 psi between the highest and lowest cylinder.

The figures will vary with conditions. Your readings may even vary from one day to the next. If you question your readings, drive awhile and recheck them, then draw an average.

Take a close look at the spark plug(s) from the cylinder(s) with markedly low reading(s). For instance, if the readings from cylinders #1-4 are 148, 155, 120, and 140, take a look at the plug from #3 cylinder. Is it shiny, wet and oily, black, gray-tan, or dusty black in color? Compare it with the other spark plugs. For further interpretation, see Proc. 3 (4). (If your vehicle was only idling and not driven on the road last time it ran, the plugs may be carbon black from the normal fuel-rich idling mixture, in which case it will be difficult or impossible to "read" them.)

Compression loss is due to one of the following: worn or faulty rings, worn or burned valves or valve seats, or a leaking head gasket. If the piston rings are not sealing well, are broken, or are just worn out, low compression and excessive oil consumption will occur. Usually the spark plug will have a black-sooty-wet look to it.

The heads of the valves, where they enter the cylinder, must be smooth and match the round seat against which they seal. If, because of wear, chipping, or "burning" one does not, you'll have an air leak through the valve and seat and resulting loss of compression in that cylinder. The spark plug will look different from the others.

A bad (broken) head gasket is indicated if the compression of two adjoining cylinders is lower than the others. Or if water (coolant) shoots out of one or more spark plug holes when the engine is cranked. In this case you may also notice excessive loss of coolant and milky colored oil, steamy exhaust and the engine may run very poorly or not at all. The spark plug may look rusty.

If any of these symptoms possesses your engine, see Ch. 9, Pt. 1, Proc. 1.

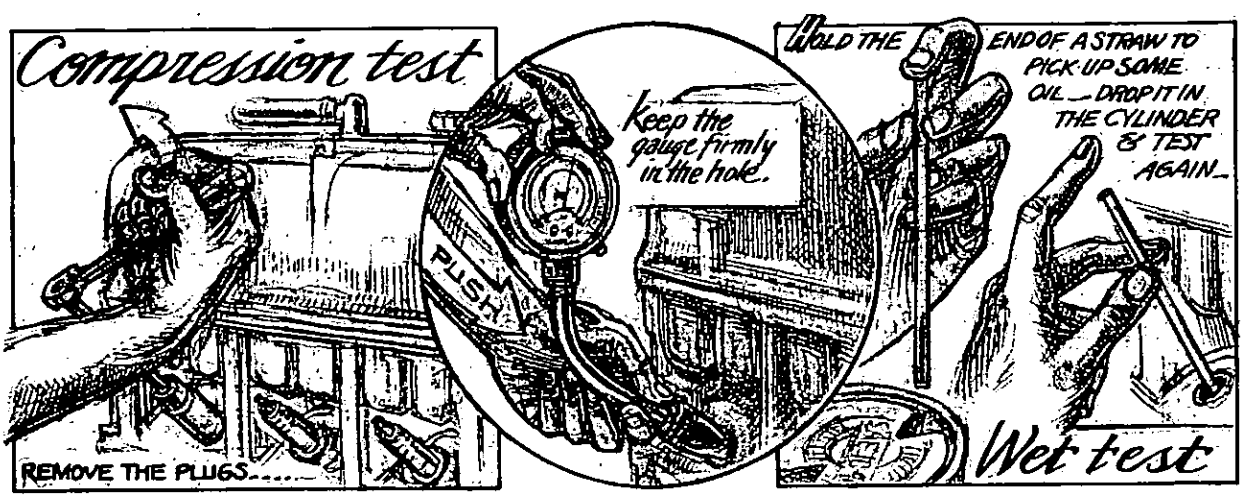
Step 4: Do the "Wet Test."

The "wet test" is a simple way to find out whether the piston rings or valves is the more likely source of your problem. Squirt a few shots of oil (one teaspoon or less) through the spark plug holes into the cylinders or use the straw method as illustrated. What this does is coat the cylinder walls with enough oil to compensate for piston ring wear. Crank the engine for a few seconds to help spread the oil.

Now do Step 3 again. Compare the new readings with the old ones. If the numbers for the low cylinders increase say 10 or more pounds, either worn or broken rings or worn pistons or cylinder bores are indicated. In any case, the fix is an engine overhaul. Other signs of bad rings are high oil consumption, black carbon-coated, wet-looking electrodes on one or more spark plugs, and blue-white smoke out the tailpipe. For more on engine internals, see Ch. 9, Pt. 1, Proc. 1 and Ch. 10, Proc. 2.

What if the compression in the lowest cylinder(s) did not increase when you did the wet test? Provided your valves are in adjustment, you can suspect bad (leaking) valves or a bad head gasket. In both cases you'll have to remove the cylinder head to have the fix done (Ch. 9, Pt. 1).

If your readings are within 20 psi of one another, and no serious problems are evident after a tune-up, you can feel secure and continue on your merry way until it's time to do another compression test. Remember, keep-



ing track of the figures from this test will help you read the progress of your engine the next time you do it.

One final note: Datsun/Nissan engines usually maintain great compression yet still consume a lot of oil through the valve guides and/or oil rings. In most cases, in fact, the engine will use excessive amounts of oil before the compression gets so low that the engine is hard to start or you notice a real loss in power. In this case you may find it economical to just keep driving it, although polluting the air, aware that eventually you'll need an overhaul. See Ch. 9, Pt. 1 and Ch. 10 for reasons why your engine burns (or leaks) oil.

Step 5: The Last One.

Hook up the coil wire(s), if you disconnected it (them) in the first step (Proc. 6[2]). If you have a screwdriver or pencil sticking out of the carburetor mouth, pull it out. Unclip the remote starter if you used one (Proc. 4 [13]). Install the four spark plugs and put their wires back on (Proc. 3). Put the air cleaner lid back on. Consider it done, and if a friend sat there patiently cranking the engine for you, take her or him out for a drink. If you're in the middle of a tune-up, go back to Proc. 3 (4 or 5).

PROCEDURE 10: REMOVE AND REPLACE FUEL FILTER(S)

Condition: You are here for maintenance or to check for leaks and/or poor running condition. Read through this procedure to determine which filter you have: L-shaped or U-shaped or metal style (**E.C.C. People**) (this pertains mostly to 1978 and later truck people). NOTE: **E.C.C. People** are those of you with electronically metered carburetors, (1983½ on California and 1984 on USA). **Non-E.C.C. People** are those who come before 1983½ and all Canadian vehicles.

Tools and Materials: Phillips head and/or straight blade screwdriver, new fuel filter (1980 on truck people—pay close attention to your filter pipe size and shape), new hose clamps if necessary, drip pan (chassis mounted filter people), and safety glasses. NOTE: 1981 (Z-22) trucks use a filter with larger tubes. E.C.C. engines use a metal one. Check your new filter for its shape and pipe size. Internal filters for the electric fuel pump are only available from Datsun/Nissan, to my knowledge.

Remarks: It helps to have the fuel tank almost empty to avoid spillage. **FIRE DANGER**—*Do not smoke or light matches near this work!* You'll have gasoline dripping, oozing or occasionally squirting around, so be especially careful. **Chassis-mounted Filter People:** Roll up your sleeves and wear your safety glasses.

Step 1: Locate the Filter.

On all models except air conditioned and late model trucks, the filter is clipped into a bracket in the right side-fender wall of the engine compartment. You can follow the fuel lines back from the carburetor to find the plastic filter. Pull the filter out of its clip.

On 1978 and later trucks the filter is clipped to the chassis rail on the right side, midway between the fuel tank and the back of the cab. **E.C.C. People**: Your filter and fuel pump are atop the chassis rail above the fuel pump, which is covered by a metal shield.

On some air conditioned and all E.C.C. trucks and many cab and chassis trucks that have electric fuel pumps, there is another filter inside the fuel pump. This filter is located near the right rear frame rail and may be covered by a metal shield (Step 4).

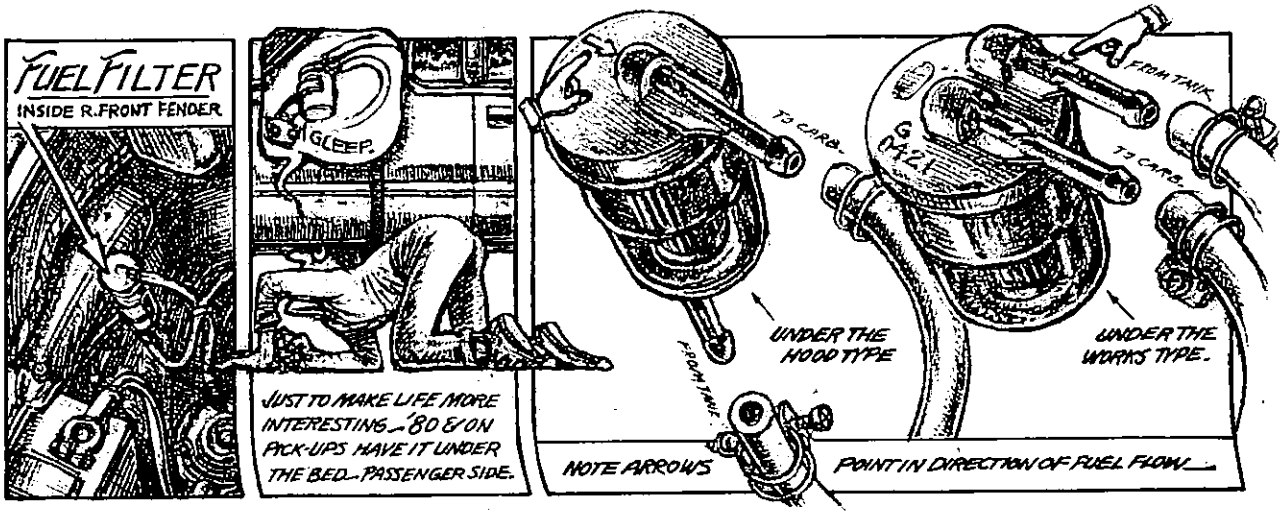
There is also another filter on all models that generally does not need to be replaced. It is within the fuel inlet inside the carburetor and can be replaced using the needle and seat procedure (Ch. 6, Pt. 1, Proc. 7).

Step 2: Out with the Old, In with the New (plastic and metal types).

Remove the gas tank filler cap, i.e., the one you unscrew to fill the tank.

•**E.C.C. People:** You may find it's easier to get at the filter with the metal shield removed. Four 10mm bolts hold the shield to the frame. Remove them with a socket wrench and set aside with the shield.

•**Everyone:** Pull the filter out of its clip. Look at the new filter and notice which pipe is marked—usually



by an arrow—inlet and outlet. Also note where each hose is mounted on the filter you're removing. This is important! If you're under the truck, get comfortable.

NOTE: If your filter is frame-mounted, you can save yourself loads of grief by clamping the inlet hose before disconnecting the clamp. Do this with a Vise Grips with a rag placed between the jaws and the hose to protect it. Find the hose coming from the fuel tank and gently clamp it a few inches away from the filter inlet.

•**Everyone:** Loosen the two clamps that connect the filter to the fuel lines. On the chassis-mounted styles this can be painfully difficult, so be patient and careful. Have the new filter close at hand. Pull off the tank hose first, then quickly stick it into the bottom end (pipe) of the new filter. (**U-shaped and metal filter people:** Stick it on the inlet pipe first, fast.) Do the same at the other end. Did any fuel run down your arm? Curse Nissan, not me.

If the clamps or hose are getting cracked or dry, replace either or both with standard clamps and/or new sections of hose—small ¼in (6mm) pre-1980, large 5/16in (8mm) 1980 on.

Step 3: Tighten Clamps, Clip in Filter.

Tighten the clamps and place the new filter into the bracket. Now install the gas filller cap and run the engine and check your connections for leaks. If you have trouble getting fuel to the carburetor you may have an air leak at the hose connection, or occasionally you'll find a cheap filter that will leak at the seams. I use Datsun/Nissan or brand name filters. Also take a quick look at all of the rubber fuel hoses to check for cracks, splits, and fraying. Replace or shorten questionable hoses.

•**E.C.C. People:** If you removed the metal shield, install it now unless you want to replace your fuel pump filter.

Step 4: Replace Electric Fuel Pump Filter.

•**E.C.C. People:** You need to remove the metal shield covering the pump (see E.C.C. instructions in Step 3).

•**Everyone:** One end of the fuel pump has a hexagonal head on it. Place a drip pan under the pump and use a 17mm open-end wrench to turn the **end cap** slowly counterclockwise, just enough to free the cap from the tabs that hold it in place, then carefully pull it away from the pump. **Caution:** Fuel will come out. Locate the little magnet and washer that may be stuck to the cap. The filter is under the washer. There is another washer under the base of the filter to account for too. Remove the old and install the new filter. Put in the washer and magnet, centered to the cap and pump housing. Install the cap, align the tabs, turn the cap into place clockwise, and finally retighten the cap with the wrench until snug. Finally, check around the cap for leaks with the engine running.

•**E.C.C. People:** Reinstall the metal shield. Match it with the bolt holes in the chassis and install the four 10mm bolts with washers.

PROCEDURE 11: GREASE STEERING, SUSPENSION, CHASSIS PARTS, AND DRIVESHAFT GREASE FITTINGS IF NECESSARY

Condition: You are here from the "Maintenance Checks." Or you have rebuilt or replaced a greaseable component, such as the king pins, idler arm, universal joints with grease fittings, or ball joints.

Tools and Materials: Grease gun, NLGI-2 multi-purpose lithium-based grease (most common grease guns use a replaceable cylindrical cartridge available at auto parts and department stores), 8mm box-end wrench, 6mm or ¼in grease fittings (straight or angled, see Remarks), trouble light, safety glasses. *Optional:* A friend.

Remarks: Are you a macho 4-wheeler or rough rider? If your vehicle is subject to dusty or rough conditions, I recommend greasing the front suspension more frequently than suggested in the "Maintenance Checks." This is true especially with king pin trucks and those driven through deep water.

Most vehicles arrive from the factory with plugs in the grease points instead of greaseable zerk nipples. Dealers generally only insert *some* of the zerks on the first maintenance. You should insert *all* of the fittings and begin proper maintenance now. This is especially true with trucks.

NOTE: Your vehicle is tapped for 6mm grease fittings, although ¼in zerks are frequently and successfully installed when the metric ones aren't available.

Step 1: Chock, Jack, and Support the Vehicle.

Although it isn't essential to raise your vehicle to grease it, you'll find it makes the grease points more accessible. In most cases it is only necessary to raise the front end. (Refer to Ch. 13, Pt. 1, Proc. 1 for safe jacking and blocking techniques.) On ball joint trucks the upper fittings are easier to reach when the truck is on its wheels, not jacked up.

Step 2: Locate the Grease Fittings.

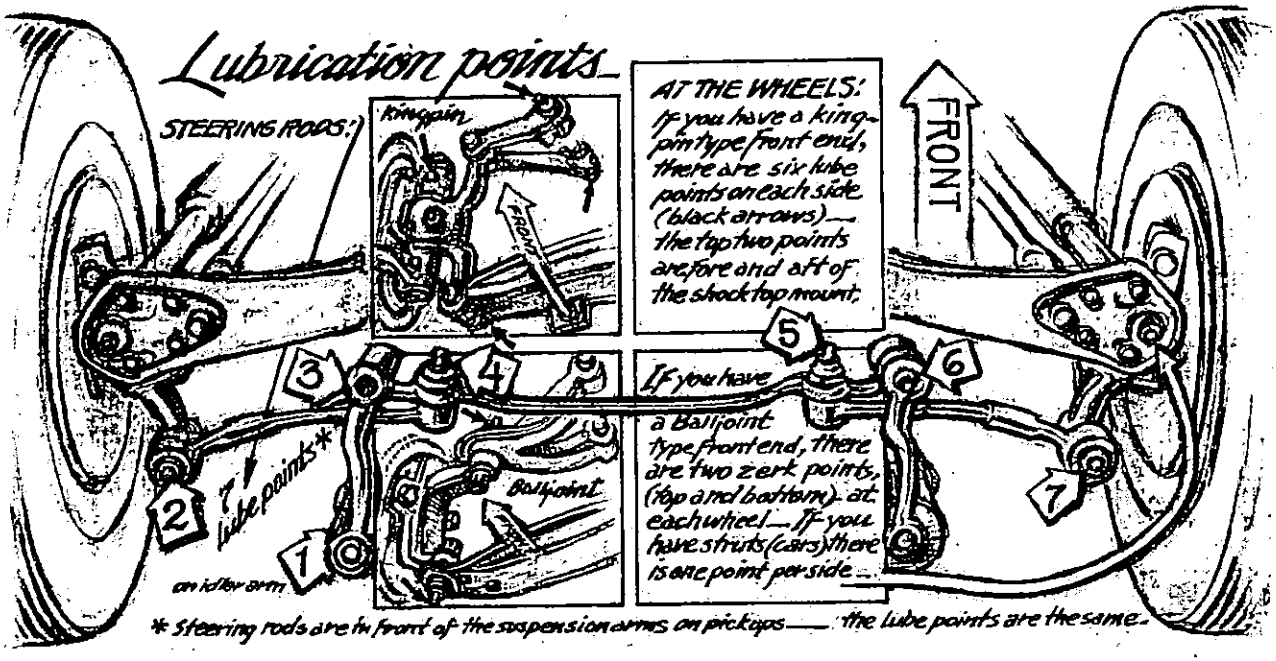
NOTE: Many newer trucks don't have grease fittings or plugs tapped into the joints.

Use a good light and see Chapter 12 to identify the parts of these systems. With your safety glasses in place, lie under and in front of the vehicle. Locate the **center steering** or **cross rod** and follow it out to its ends. By wiping around the **small ball joints** or **tie rod ends** at the ends of the rod, you will uncover the **rubber boot** and **small ball joint housing**. Somewhere on the housing you should find a hexagonal **plug** or **grease zerk**. If it's a plug, remove it with an 8mm box-end wrench. Replace the plug with a 6mm or ¼in zerk fitting. But before jogging downtown to the parts store, read the rest of this step.

Turn the wheels either direction to facilitate finding the grease points. You will encounter a grease fitting at each end of the center cross rod. Next to these points you'll see plugs or zerks on each of the **side rod ends** (joints). Follow each of the **side rods** outward toward the wheels where there will be other joints with grease points. At the ends of the center cross rod locate two cast metal (not rod-like) pieces (arms). The one on the driver's side runs to the **steering box**, and the one on the passenger side to the **idler assembly**. Follow this idler arm up to the part bolted to the frame in which it turns. Look or feel on top or on the side of this for another fitting. OK, now you've found seven grease points at most.

•**Car People:** Locate the **lower large ball joints** next to the inside of both front wheels. On the bottom of these ball joints is a grease point. These are often broken off or plugged (no zerk). This makes two more points for you to grease, nine possible in all.

•**Truck People (1969-1977):** Follow the **steering arms**, connected to the outer ends of the side rods, to below the **king pin support** and **steering knuckle**. Go up the knuckle and find two grease points (probably zerked) on the front of the knuckle. These are for the **king pin**. Very important! Trace back to the base of the king pin support to the inside of the knuckle. Here are two grease points (front and rear) placed in the center of the hexagonal bolt that joins the support and the lower control arm. They probably have plugs. Now go up the support to the **upper control arm**. Follow the control arm inward to where it joins the truck's frame. There, at both ends of the hexagonal heads where the control arm pivots, you will find the two most neglected grease



points. They are likely to still have plugs. To put in zerks and grease them, these points are best reached from the engine compartment by lifting the rubber covers attached to the inside fender walls. Screw in angled zerks here. This makes nine grease points in all.

•**Trucks 1978-on:** At the end of each of the side rods locate the **lower large ball joint.** Look on the bottom sides of these joints to find a grease point. Directly above the lower joint is the **upper large ball joint**. On top of this is another grease point. This makes 11 grease points in all.

•**Everyone:** Determine the number and types (regular or angled) of zerks you need. Go get the zerks, unscrew the plugs with the 8mm box-end wrench, screw in the zerks, and snug them down with the 7 or 8mm or a 5/16in or 3/8in wrench depending on your zerk type.

Step 3: Grease the Fittings.

Operate the grease gun's lever to push a little grease out the tip and wipe this excess off of the tip. Now wipe the first zerk tip clean and fit the tip of the grease gun *firmly* over the tip. (If you have a helper, he or she can hold the tip against the zerk as you pump grease gently into the fitting.) Most tips can be tightened to fit snugly against the fitting. When greasing ball joints with rubber boots, take care not to over-grease. When full, you will see or hear grease come out from a hole in the boot or from around its edges. At the other joints, watch the gaps where the pieces fit together, where you'll see grease come out when they are full. Too much grease doesn't help; it just wastes grease and tears boots. If you see grease ooze out between the gun tip and the fitting when you squeeze the trigger, the the tip is not firmly on the zerk. If there's fresh grease coming out between the zerk and the hole it's screwed into, it wasn't screwed in properly. You may have to remove the stuck or leaking zerk and open the little valve in it with a paper clip or replace it with another zerk. Test the zerk before putting it back in.

Step 4: Finishing Up.

When you've got all the points greased, clean off the tip of the gun and lower the vehicle to the ground. Keep a record of the mileage, so you'll know exactly when to hit the zerks again.

PROCEDURE 12: INSPECT THE EXHAUST SYSTEM FOR CONDITION AND LEAKS

Condition: You are here for a safety check of the exhaust pipe, muffler, and tailpipe. It's necessary for proper maintenance. Or, if you hear a constant, loud, and obnoxious exhaust noise coming from your vehicle. Or, there's

a soft, constant *phfist-phfist* sound coming from the engine compartment or under the vehicle. In extreme cases that must be dealt with right away, you smell exhaust fumes within the passenger compartment. Don't delay. Carbon monoxide is an odorless, invisible killer.

Tools and Materials: Good ears, eyes, caution, safety glasses, and a 2½ ft piece of garden hose for a listening device.

Remarks: I do not cover exhaust system replacement in this book. So, if there is a weak point in your system, you're on your own, but have it repaired as soon as possible. California vehicles since 1975 and most others since 1977 are equipped with **catalytic converters** fitted into the exhaust system. Yours may have been removed. Be cautious, the exhaust system will be hot just after the engine has been running. It cools within a half hour; however, the catalytic converter and its shield may remain hot up to three hours after the engine is turned off. NOTE: Other exhaust leaks can occur in the engine compartment within the emission controls AIS or EAI system. (See Ch. 6, Pt. 2, Proc. 1, 6, and 7, if that's your problem.)

Step 1: Block, Jack, and Support the Vehicle.

Instructions for safe and proper jacking are found in Ch. 13, Pt. 1, Proc. 1.

Step 2: The Tour.

Your exhaust system begins at the engine. The **manifold** is on the left side of the engine. There is a gasket (and potential leak point) between the cylinder head and the manifold. Follow the manifold down to where it is bolted to the **exhaust pipe** at a *flange*. The gasket or connection between the manifold and exhaust pipe flange can also leak. Now go under the vehicle and look up at the pipe. Follow it back under the length of the floor.

•**All Pre-Catalytic Converter Cars:** You have a **premuffler**, *another stretch of pipe, the main* **muffler**, and the **tailpipe**. The hanger locations and pipe routing are different in all models, but the sequence is the same.

•**All Catalytic Converter Cars and Trucks:** The first non-pipe piece you'll encounter is the **catalytic converter**. It is shielded by sheet metal. Flanges at both ends connect it to the system. Farther along are the muffler and the tail pipe.

•**All Trucks Without Catalytic Converters:** The only thing that interrupts the exhaust pipe is the muffler.

•**Everyone:** There may have been some modifications of your exhaust system, installed on your car or truck sometime in its history. I've described just the factory installations.

Step 3: Check the System for Breaks and Leaks.

Rust and scale form on the pipes and mufflers as soon as normal exhaust heat begins the slow process of oxydizing the steel. Road salt, water, vibration, and age do the rest. Holes and cracks will turn up in the pipe and muffler, allowing noisy and smelly exhaust leaks. The system is hung from the floor by **hangers** that eventually vibrate and break. The **rubber insulator** parts of the hangers also deteriorate in time.

If the pipe is cool, grab it at various places and wiggle it. It should not be very loose or rattle against the body. Look at the pipes all along checking closely for holes and cracks. Look especially at the joints near the mufflers. Look at the muffler, knock on it with your fist. It should be solid, without a loose rattling sound inside.

Now start the engine. Do this outside, *not* inside a closed garage. Listen for leaks at all of the joints. Work your way back through the system checking for hissing or *phfist-phfist* sounds. A 2½ft piece of garden hose with one end held up to your ear and the other end placed at joins or holes in the pipe(s) can isolate leaks. Old rusty pipe is difficult to weld if broken, so don't be surprised if the muffler shop tells you that you need new pipes. Have holes, breaks, or major flaws in the pipe and muffler taken care of quickly. You should not attempt to deal with the catalytic converter yourself. These "cats" are high-tech, expensive, and seldom go bad. If your exhaust smells like rotten eggs or worse, or you otherwise suspect a bad "cat," have the dealer or qualified emissions control mechanic check it out.

Step 4: Wrap it Up.

Lower the vehicle after your checks are finished.

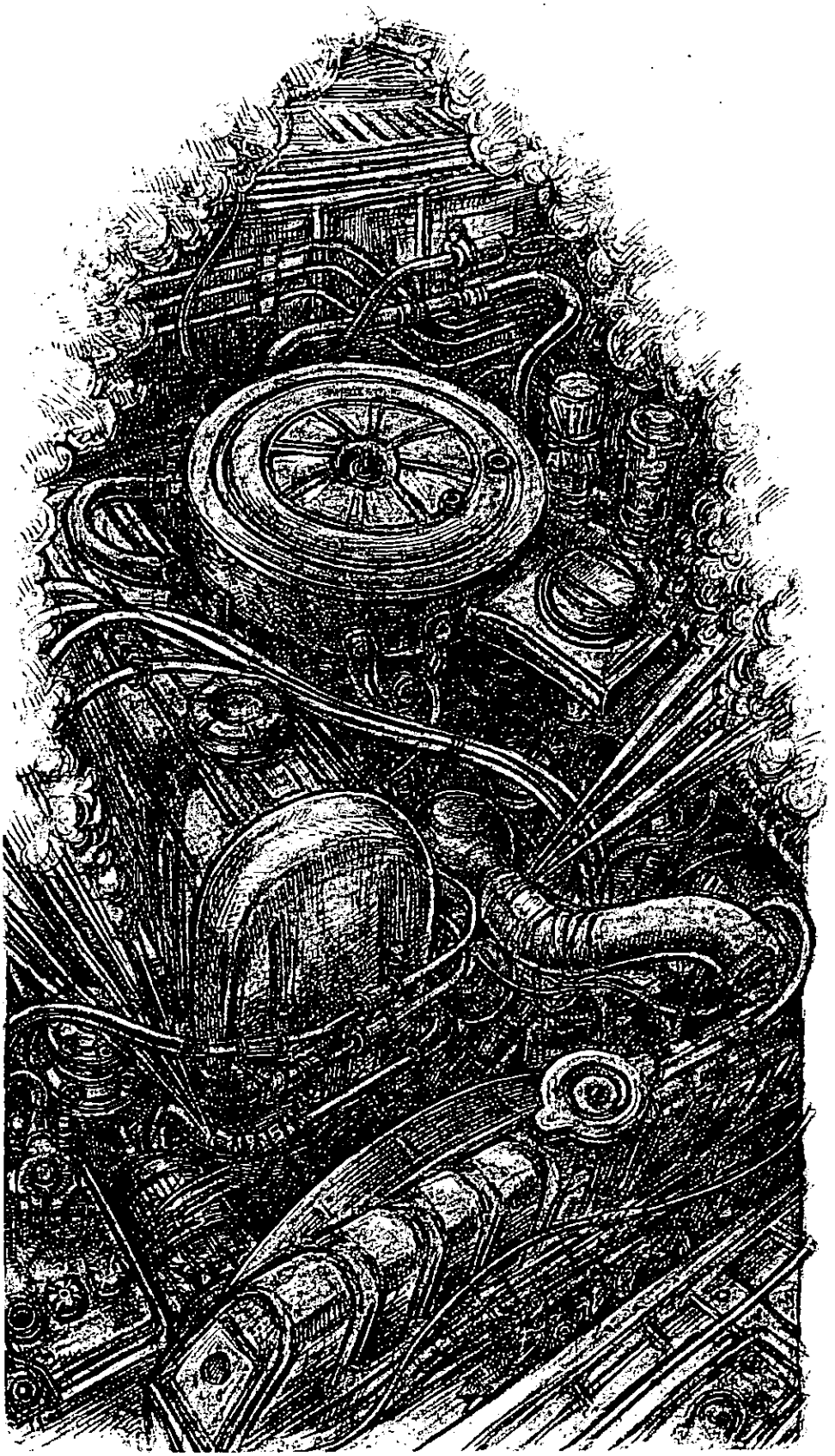
PROCEDURE 13: CHECK FOR FLUID LEAKS

Step 1: Where?

For fluid leaks, see Ch. 3, Proc. 12; Ch. 5, Proc. 1; Ch. 6, Pt. 1, Proc. 1; Ch. 8, Proc. 1; Ch. 10, Proc. 1; Ch. 11, Pt. 1, Proc. 1; and Ch. 11, Pt. 2, Proc. 1. Truck people with power steering, see Ch. 12, Proc. 1.

NOTE: Water dripping off the chassis or body after driving through puddles or a car wash is normal, as is some condensation from an air conditioner after it has run awhile. Get in the habit of checking your fluid levels often and glancing at the ground under your parked car or truck for telltale signs of leakage.

Troubleshooting



1: TROUBLESHOOTING ENGINE PROBLEMS 4-2

2: TROUBLESHOOTING REST OF VEHICLE 4-6

CHAPTER 4
TROUBLESHOOTING

You're probably reading this because you've got a problem. Something's wrong with your Datsun/Nissan and it's time to troubleshoot. Welcome to the gray area of auto mechanics, a place where the diagnoses frequently take more time than the repair, where wild guesswork seldom pays off and experience and common sense do. Here works Mr. Hit-or-Miss who replaces auto parts helter-skelter, hoping each time that his last move will fix the problem. His opposite is Mr. Model Technician who approaches the problem with keen, sober precision (and starched overalls), using his logical mind to analyze carefully all the symptoms and systems before spending a dime. The model technician keeps a cool composure while using deductive reasoning to determine how, when and where the problem occurs. After isolating the faulty system, he makes sure he thoroughly understands that system before coming to an educated conclusion. By this method our model mechanic minimizes his chance of failure. A sensible fellow indeed.

This chapter has two procedures. Procedure 1 covers maladies of the engine, describing them as events (or non-events, as the case may be). Procedure 2 is sensual; it deals with the rest of the vehicle, using your senses as diagnostic tools to explore the symptoms by smell, sound, and sight, etc. Whenever Mr. Hit-or-Miss comes around and tempts you to replace something you're not convinced will cure the problem, stop. Read through this chapter, Chapter 2, and parts of the chapter that pertain to the system at fault (assuming you know which system it is). Take note when, where, and how the symptoms occur.

Try and understand what's going on mechanically (or what should be going on). And if you really get stumped, don't let your pride stop you from consulting a professional mechanic. Take the vehicle (if possible) and an accurate description of what you hear, see, or feel happening, to someone who's experienced in diagnosis. The knack of troubleshooting is perhaps the professional mechanic's greatest skill. Have him or her tell you what the easiest remedy is, or how you can return to the pertinent section of this book and make the repair yourself.

PROCEDURE 1: TROUBLESHOOTING ENGINE PROBLEMS

Let's start with the car at rest, and take it from there. Hop in and turn the ignition key to START. Either the engine will start or it won't, or it may not behave as it should if it does start. Here are some possibilities.

Engine Does Not Crank when Key Is Turned to Start

•**Automatic Transmission People:** Try pushing and holding the shift lever in Park or Neutral. If it starts now, there may be a problem in the transmission linkage. An adjustment may be needed (not covered in this book). Consult a transmission expert. If it still doesn't start, see "Everyone" below. If all those suggestions check out, go to Ch. 7, Proc. 6 and 7, and test the starter "cranking" motor. You have a switch connected to the transmission that allows the engine to start only in Park or Neutral, called the *inhibitor switch* (Ch. 7, Proc. 12).

•**Everyone:** Turn the ignition to the ON position (not START position). Are the dashboard warning lights now on, and does the horn honk when you try it? If not, check the battery (Ch. 7, Proc. 4 and 5).

If the dashboard lights do go on and the horn works, turn the key to START. If you hear a click or clicks with the key at START, the battery is lacking electrical punch, the connections at the battery are funky (remove the cables, clean 'em, and put them back on securely), or the cables may be corroded or worn through. These conditions may also be due to faulty charging or starting components. The solutions to all these problems are in Chapter 7. Start by servicing the battery using Proc. 4 and 5, and/or jump start the engine using Proc. 2. Test the starting system with Proc. 6 and 7. Check out the electrical charging system using Proc. 8, 9, and 10.

•**Cars made in the mid-1970s:** You may have a *starter interlock switch*—a red button on the firewall in the engine compartment, just below the windshield. This setup was installed to prevent starting the engine

without the seatbelts locked in place. By now, a lot of these systems have been disconnected, which means tampering has been done to bypass this button anyway. To operate the override for this system, turn the key to ON, push the red button on the interlock switch, then turn the key to START.

Engine Cranks Normally but Does Not Start

First, make sure there's gasoline in the tank. If yes, check for spark to the distributor and the spark plugs (Ch. 7, Proc. 12). (If the engine's not cranking fast enough to start, check the battery connections and its condition [Ch. 7, Proc. 1 and 4].)

If you've got spark but the vehicle still doesn't start, your problem may be with the fuel supply (Ch. 6, Pt. 1, Proc. 2).

If you've got spark and fuel is getting to the engine, check engine compression (Ch. 3, Proc. 9). If you have spark, fuel, and compression, go through the basic engine tune-up procedures (Ch. 3). Also make sure there aren't any disconnected or broken vacuum hoses (see the illustrations in Ch. 6, Pt. 2, Proc. 1).

Engine Starts, But with Difficulty

•**When the engine's cold:** Is your engine in tune? (See Ch. 3, Proc. 3-7 and 9.) Also check the spark plug wires for proper resistance (Ch. 7, Proc. 12). Most of all, make sure you're not pumping the gas pedal too much or too little—flooding or starving the engine. On all engines except ECC (electronic controlled carburetor) Z-24s, one or two pumps of the accelerator pedal should do. If you smell gas, hold the pedal to the floor while cranking—don't pump it. For more on fuel and carburetion, see Ch. 6, Pt. 1, Proc. 2.

•**When the engine's hot:** Make sure the engine's in good tune (Ch. 3, Proc. 3-7 and 9). A likely cause of hard starting with a warm engine is "flooding" in the carburetor or fuel starvation (Ch. 6, Pt. 1, Proc. 2). Also check the ignition system (Ch. 7, Proc. 12).

Engine Starts, But . . .

•**But It won't idle:** Check idle setting on carburetor (Ch. 3, Proc. 7, and Ch. 6, Pt. 1, Proc. 2, 3, and 18). Check also for vacuum leaks (Ch. 6, Pt. 2, Proc. 1). Make sure the engine's in tune (Ch.3, Proc. 3-7 and 9, and Ch. 7, Proc. 12).

•**But It won't accelerate right:** If the engine stumbles and then picks up after you press on the gas pedal, see Ch. 6, Proc. 2. Also make sure the engine's in tune (Ch. 3, Proc. 3-7 and 9, and Ch. 7, Proc. 12).

•**But It idles erratically or lopes:** Is the engine up to snuff and in tune? (See Ch. 3, Proc. 3-7 and 9.) Check also for vacuum leaks (Ch. 6, Pt. 2, Proc. 1). The fuel system should be working correctly (Ch. 6, Pt. 1, Proc. 2). The engine's condition should be sound (Ch. 9, Pt. 1, Proc. 2 and Pt. 2, Proc. 1). If these check out OK, try Ch. 7, Proc. 12.

•**But It won't run under load (transmission in gear):** The engine should be in tune with no vacuum leaks (Ch. 3, Proc. 3-7 and 9, as well as Ch. 6, Pt. 1, Proc. 2 and Pt. 2, Proc. 1). If these check out OK, try Ch. 7, Proc. 12.

•**But It idles too high:** Make sure the choke is open and in proper adjustment and the idle speed is set right (Ch. 3, Proc. 7). The throttle cable may be out of adjustment or bound (Ch. 6, Pt. 1, Proc. 3). Also check Ch. 6, Pt. 1, Proc. 8 and Pt. 2, Proc. 13.

Engine Runs, But Misses, Cuts Out, or Backfires

The causes of these conditions are often the most elusive to figure out. Look into the ignition and fuel systems, but first cover the basics (Ch. 3, Proc. 3-7 and 9, and Ch. 6, Pt. 1, Proc. 2.) Your problem could be a clogged fuel filter (Ch. 3, Proc. 10). Make sure the vacuum hoses are working properly (Ch. 6, Pt. 2, Proc. 1) Look also at Ch. 7, Proc. 12.

Try to isolate the source of the problem by determining under what circumstances it occurs. Is it steady, or does it occur only at idle, at middle engine speed, or at high speed? If it's an intermittent problem, isolate when it happens: going uphill, when it rains, when the vehicle's loaded down. Most intermittent problems involve the fuel or electrical systems.

You're Getting Poor Gas Mileage and/or Weak Performance (loss of power)

First check that your tire air pressure isn't too low (see the *Weekly Checks* in Ch. 3). Another cause could be dragging brakes (Ch. 5, Proc. 1). Miles-per-gallon figures can vary with differing road conditions and driving habits. On L and Z-series Datsun/Nissan engines your mileage should range from the low 20s to the high 30s—and it's not uncommon for identical vehicles to get very different mileage, even when maintained similarly. The difference is probably in driving habits and quirks of carburetion.

If tire pressure and the brakes check out OK, do the major tune-up (Ch. 3, Proc. 3-7 and 9).

Other things to look for are a slipping clutch or torque converter (automatics) (Ch. 11, Pt. 1, Proc. 1), worn wheel bearings (Ch. 12, Proc. 3), and improper wheel alignment (Ch. 12, Proc. 1).

Don't waste your money on miracle mileage boosters (psychic healing will produce better results). Changes in altitude will also account for poor mileage and performance, as will too-heavy engine, transmission, or rear axle oils. Heavy, non-aerodynamic loads like camper shells will decrease mileage, as will non-radial tires.

Charge Light ON When Engine Is Running, and/or Battery Goes Dead

This could mean a broken fan belt, bad alternator, bad voltage regulator, a weak battery or burned fuse. If the light goes on when you're in the boonies, try to drive to the nearest place where you can work on the vehicle. If the battery goes dead, you might be able to charge it and get yourself home (Ch. 7, Proc. 1-4 and 8). Don't drive with a broken fan belt. If it needs to be adjusted, turn to Ch. 7, Proc. 9.

If you know your charging system's weak, avoid using electrical devices like the headlights, radio, etc., until you get to the place where you can turn the engine off. You'll need all the electrical power you've got just to keep the spark plugs firing.

Engine Oil Light ON or Oil Pressure Gauge Needle Drops When the Engine Is Running

If your oil light suddenly comes on or the gauge needle drops below 10-15 psi when driving, turn off the engine **immediately**. It means that you no longer have sufficient oil pressure to lubricate the internal parts of the engine, and you run the risk of serious and expensive damage. You may have an oil leak, a faulty or broken oil pump, or a clogged filter, the engine may be low on oil, or overheated, or the gauge isn't working properly.

Look for obvious signs of oil leakage under the engine and in the engine compartment. A detailed leak check is found in Ch. 10, Proc. 1. Check your oil level on the dipstick, using Ch. 3, Proc. 1, if you've never done it before. There's more on oil in Ch. 3, Proc. 2.

If you've been adding large quantities of oil, you've either got a leak somewhere or your engine's burning oil, a sign of advanced wear. For more on this, see Ch. 9, Pt. 1, Proc. 1 and Ch. 10, Proc. 2.

If the oil level is low, add oil, but keep an eye on the oil light or gauge as you drive, and check the dipstick often.

The problem could possibly be a faulty *oil warning light* or *gauge sending unit* (Ch. 10, Proc. 16).

EGR Light Comes ON When the Engine Is Running

This light tells you to check a component of the emissions control system. Not a serious immediate worry here, so drive on. When you get home (or to a quiet weekend retreat), read Ch. 6, Pt. 2, Proc. 1, 9, and 10.

Temperature Gauge Moves to HOT (or Stays Too Cold)

An overheating engine is a serious situation. You could have a coolant leak, a broken thermostat, a bad water pump, or a broken alternator/fan belt. Don't drive a vehicle with an overheating engine; major damage to the innermost works can result. Pull the car over and read Ch. 8, Proc. 7. Don't open the radiator cap when the engine's hot.

It's not so serious if the temperature gauge needle hovers near the COLD side, but it should be checked out at a convenient place and time (Ch. 8, Proc. 1). You probably need a new or hotter thermostat sender or the wiring is faulty.

Loss of Coolant or Hissing When Engine Is Turned Off

These are clues that the cooling system parts should be checked out, before the engine overheats. You may see drips under the radiator. Could be a leaking hose or radiator cap, radiator leak, or a leak inside the engine. Or perhaps the radiator was just overfilled. Read Ch. 8, Proc. 1 to check out the possibilities.

Smoke or Steam from the Tailpipe When Engine's Running

First, which is it?

If it's smoke, you'll probably notice a loss of engine oil and fouled, oily spark plugs when you pull them out. You can tell if you have an oil burning problem by placing a clean, white rag over the end of the tailpipe as the engine runs. Black soot on the rag means, yes, your engine's burning oil. Time to read Ch. 9, Pt. 1, Intro and Ch. 10, Proc. 2 and discover the reasons. Actually, an oil burning car can run quite awhile without major work, if you're willing to put up with diminished power and adding oil at frequent intervals, not to mention the air pollution. But there comes a time in the life of any engine when it has to be taken apart and fixed, or junked.

Steam coming out of the exhaust pipe means there is a water (coolant) leak into the combustion chamber(s) inside the engine. This is usually due to a blown head gasket, but sometimes caused by a cracked head or engine block. You'll notice you have to add more coolant. You may also notice oil in the water, and vice-versa. If you suspect such an internal water leak, do not drive the vehicle; serious damage will result (Ch. 3, Proc. 1). In cold weather condensation will cause vapor exhaust out the tail pipe; that's normal. Oil and steam vapor, which is more obvious during warm weather, is not normal.

If you notice a little water dribbling from the tailpipe, it's probably OK, since water is a normal product of combustion.

Sundry Unusual Engine Noises

These merit special discussion. It's difficult to label odd noises that may emit from the engine simply because it's tough to get people to agree on like descriptions of the same noise. Some of these sounds are also covered in the next procedure, which has to do with using the senses to isolate problems. There are, however, some very specific inner engine sounds I should try to describe.

The first and easiest step to further pinpoint the source of any of these sounds is to use the stethoscope as described in Proc. 2, just ahead. After that, you might search for and isolate the broken, worn or loose parts.

•**Rattle when engine is first started (when cold):** This is usually caused by a worn timing chain. Check this closely by starting the engine cold and listening for the rattle near the front of the engine. CAUTION: Don't get your hair, clothes, or body caught in the engine's moving fan. If the chain's bad, you might hear that rattle at idle speed too (Ch. 9, Pt. 1, Proc. 1 and Pt. 2, Proc. 1). Many Z-series engines knock when first started cold. Some say this is combustion noise, others say its rod bearing knock. Make it go away by doing Ch. 6, Pt. 1, Proc. 3.

•**Clicking sounds (most noticeable at idle):** If these seem to be coming from the top of the engine, your problem is likely loose valve adjustment (Ch. 3, Proc. 4).

• **At high speeds:** This could be serious. Determine if it's coming from the engine, drivetrain, body, or chassis (Proc. 2).

•**Hissing sounds:** Probably a vacuum leak. A vacuum hose—one of those really skinny ones that connect to the intake manifold—may be disconnected or broken. Examine all hoses connected to the intake manifold or carburetor, following the hose maps in Ch. 6, Pt. 2, Proc. 1.

•**Spitting or popping sounds:** These are typically due to an exhaust or smog pump leak, at or near the exhaust manifold or emission control air hose (Ch. 3, Proc. 12 or Ch. 6, Pt. 2, Proc. 1, 6, 7, or 11).

•**Knocking sounds:** First, make sure the knock isn't from another part of the vehicle; read Proc. 2 of this chapter. If you're sure it's in the engine, determine *when* you hear it.

If the knocking occurs at idle and it sounds deep (not a click or tap), don't drive the vehicle until you solve the problem. If the sound isn't deep in the engine, look for something external that's loose or vibrating. If it happens upon acceleration or when revving the engine, check the oil level (Ch. 3, Proc. 1), the ignition timing (see Ch. 3, Proc. 6), the tightness of the alt/fan, air pump, air compressor or power steering pump drive belts

(Ch. 3, Proc. 8), and the motor mounts (Ch. 10, Proc. 7 and 11).

If the knock is heard after releasing the gas pedal and it's a heavy sound, it may be in the "bottom end" (main or rod bearings) of the engine. Bad news. (See Ch. 10, Proc. 2) But before you rip the engine apart, read Ch. 11, Intro to eliminate other possibilities.

It's also wise to check for loose components that are bolted to the engine, like the air cleaner housing. Tightening a bolt is a lot easier than pulling off an oil pan, only to discover it wasn't necessary.

PROCEDURE 2: TROUBLESHOOTING THE REST OF THE VEHICLE (A SENSORY/SYSTEMS APPROACH)

I once worked for a farmer whose arthritis acted up just before his tractor broke down. Whenever he complained of stiff joints, I paid close attention to how the tractor was running—and often nipped the trouble in the bud.

There's a lot going on in an operating car or truck. Getting to the source of trouble is easier if you narrow the problem down to the system (or systems) involved. Figuring out *where* on the vehicle something's afoul is important, but not always easy. It's often more important to first determine *when* the problem occurs: at a standstill with engine running? at take off from a dead stop? on acceleration? while cruising at a certain speed? when shifting, braking, turning, operating an electrical component (lights, heater, starter, etc.)? It is essential to have a general idea of your vehicle's workings by first reading Ch. 2. With a little knowledge of the systems beneath you and around you, and by knowing exactly *when* you notice something amiss, you have a good chance of identifying the difficulty and finding the appropriate procedure to deal with it.

Let your senses be your guide. Your sight, smell, hearing, etc., plus logic and a little knowledge gleaned from Chapter 2, are your most important diagnostic tools. Don't ignore instinct; it's a great tool when allied with knowledge of how the automobile works. I will tell you how to use certain senses to determine the system and sometimes the part that's causing the trouble. From there you should go to the chapter dealing with that system. We'll go through the phenomena, sense by sense.

HEARING

Due to the telegraphic nature of metal, a sound can "travel" and fool your sense of where it is originating from, especially when the car is in motion. Be aware of this as you go after the source. If the offending sound is coming from the engine, you can use the stethescope trick described at the end of the SOUNDS section to put you a little closer to the culprit.

1. Grinding:

•When starting the engine it's likely a starter motor problem (Ch. 7, Proc. 1 and 7).

•When shifting gears or upon taking off from a stop, it could be a clutch throwout bearing or transmission problem (Ch. 11, Pt. 1, Proc. 1).

•When stopping with brake pedal applied, it's possibly worn brake pads or shoes (Ch. 5, Proc. 1).

2. Growling:

•All the time while the engine is running, it may be a worn out water pump. Attend to this immediately (Ch. 8, Proc. 1). If the starter motor's acting up, see Ch. 7, Proc. 7, or if it's coming from the transmission, see Ch. 11, Proc. 1. Also read the stethoscope/listening technique described below.

•When headlights or any other high drain electrical device is turned on, check the alternator. You could have bad diodes and/or alternator bearings (Ch. 7, Proc. 8).

•When the air conditioner is on, see an A.C. specialist.

•When the clutch is pushed in or when shifting, it may be the clutch throwout bearing, a disc problem, or transmission trouble (Ch. 11, Proc. 1).

•When cornering or running straight, coming from the rear end (differential), it could be a rear axle or driveline problem (Ch. 11, Pt. 2, Proc. 1).

•When cornering or running straight, coming from the front end, it could be a bad tire or wheel bearing or other steering, suspension, or brake problem (Ch. 12, Proc. 1 and Ch. 5, Proc. 1).

3. Squeals, Whines, and Howls:

•From the engine compartment it could be a bad alternator bearing. Take a close look also at the condition and tension of the fan belt (Ch. 3, Proc. 8). Also read Ch. 7, Proc. 9 for drivebelt adjustment. Look for a cat caught in the works.

The alternator/fan belt loops around the water pump pulley and the alternator. If the belt is in good condition and adjustment, yet the noise persists, you have to find out which of these two components is at fault. The cause may be the pulleys and bearings in either the water pump and, if there, the air conditioner compressor, the smog pump or power steering pump. The alternator can also sing when dry or worn. You can remove the drivebelt for each component and run the engine for a very short time to confirm which one is the culprit. And/or you can use the stethoscope/listening technique described below, but be extremely careful when working anywhere near an operating fan blade. It's vicious!

•When the vehicle is moving (and the sound is *not* from the engine compartment), it could be a bad wheel bearing, or brake, differential, U-joint, or transmission problem. The cause can be hard to pinpoint, but some moving part is probably due for replacement. Or it could be the sound of the wind through your deluxe hubcaps. Consult Proc. 1 in each of the following chapters: Ch. 11, Pt. 1 and 2, and Ch. 13, Pt. 1. (The spots to look for are the place where a shaft or hub turns and where there's a bearing/wear point. These include the front wheel bearings, driveline carrier bearings on pickup trucks and 610 station wagons, and the U-joints that are also part of the driveline, all of which are covered in Ch. 11, Pt. 1, Proc. 1.)

•When applying the brakes, this may mean worn brake pads or linings, or other brake problems (Ch. 5, Proc. 1).

4. Squeaks, Rattles, and Clunks:

Pay particular notice to when these sounds occur. Squeaks and rattles generally happen on rough roads, which usually indicates something's loose. Common causes are little rocks in the hubcaps (pull off cap, remove rocks) and loose or broken exhaust system parts. To deal with the exhaust system, see Ch. 3, Proc. 12.

•Do the sounds seem to come from the wheels, springs, or the steering wheel? You could have loose steering or suspension parts, such as shocks and bushings (Ch. 12, Proc. 1).

•Clunks that occur when shifting or accelerating could mean something is loose in the drivetrain (Ch. 11, Pt. 1 and 2). Before tearing your hair out, check for loose beer bottles or the baby buggy in the trunk.

•Clunks, etc., when stopping, see Ch. 5, Proc. 1.

•Slapping, dragging or rattling sounds could be caused by the slap of a bad tire; dragging or rattling could be due to a loose spare tire mounting or something caught under the vehicle.

5. Stethoscope/Listening Technique:

Special mechanic's stethoscopes, designed with a long hollow needle end, are used to pinpoint sounds within a running engine. They are nifty. You can use a cut-down broom handle or a long screwdriver as a makeshift stethoscope, but do be careful. There's a knack to placing the business end of the tool in strategic places without endangering yourself. First stick the pointed end of the screwdriver, or one end of the broom handle, firmly against the part you're testing: valve cover (for loose valve adjustment), water pump or air pump housing (for bad bearings), crankcase (for worn connecting rod or main bearings), etc. Make sure it won't slip. Then put your ear to the blunt end of the tool to pick up the amplified sound. If the noise is a lot louder when you do this, you've located the source of the trouble. Be aware of moving parts—especially the fan, belts, and nearby pulleys! If you get too close to these, painful and serious injury could result. And they'll be moving, because the stethoscope system is useful only when the engine is running. Although almost magical, this technique isn't for you people who are careless, easily distracted, or drunk.

TOUCH, FEEL, AND "FEEL"

You can feel a problem through your hands or through the seat of your pants. The sense of touch also infers an inner sense, one of intuition. Both kinds are important in troubleshooting. You're on your own with intuitive feel, but after becoming familiar with your vehicle's systems (Ch. 2) you'll find yourself employing this sense in an informed and useful way.

Remember that what's wrong often turns out to be less serious than you might have thought in the initial moment of panic. Intuition without knowledge leads to paranoia. But give yourself time, and experience the pleasure of how "feel" becomes one of your best troubleshooting friends.

Now I'll deal with touch in the more tangible sense:

•Vibrations through the steering wheel: This is common when tires are unbalanced or worn out. You'll also feel it when steering and suspension parts are worn and when wheel bearings are loose. Notice if it happens all the time, at certain speeds, or while you're turning. When it's a constant shake, it's called *shimmy*, or if the vehicle wants to go to one side, it's called *pull*. First, check the tire pressures (consult your tire's manufacturer's suggested ratings: a range of 28-34 psi is typical). If you feel pulling or dragging through the steering wheel, check Ch. 5. Proc. 1. You may also sense a general looseness and impreciseness to the steering, which indicates worn steering components, misalignment of wheels, or that an adjustment is needed at the other end of the steering column.

•Other vibrations, from the engine or throughout the car: Again, check the condition and pressure of all the tires. If the vibration comes from the engine, one cylinder might not be firing properly. Check the wires to the distributor and spark plugs as well as other engine maintenance procedures in Ch. 3, Proc. 3-7 and 9.

Loose insulating mounts between the engine, transmission, driveshaft, differential and the body will send vibrations throughout the whole vehicle.

•Brake pedal feels "soft" or squishy: Check brake fluid level. You may have air in the hydraulic system, if the pedal feels "soft" (like stepping on a plum) or if you have to pump it to get firm braking action (Ch. 5, Proc. 1). If the pedal goes down too far before you can feel the brakes grab hold, you could have poor brake adjustment, worn brake linings or pads, or a hydraulic system problem (Ch. 5, Proc. 1).

•Clutch pedal doesn't feel right: If it doesn't engage firmly or engages too near the top or bottom of pedal travel, your clutch linkage may be out of adjustment, need to be bled, or you may need a new clutch disc (Ch. 11, Proc. 1).

•Feels hot: A hand on any one of the four wheels can confirm and isolate a brake or wheel bearing related problem. If one wheel is hotter than all the others, you're getting warm.

A note of caution when dealing with an overheating cooling system: You may be tempted to test the radiator by touching it—Don't! Before touching or opening the radiator, read Ch. 8, Proc. 1.

•Feels wet: Leaking fluids can be felt as well as seen. Coolant feels different from motor or gear oil, even though these oils feel a lot like brake fluid, the third major fluid in your car.

SIGHT

Here's a sense that's quick and easy to use. Know what your vehicle looks like when normal and make a habit of looking at hoses, wires, and belts for their condition. Check under the engine, transmission, rear axle (differential) and gas tank for leaks. Overall vehicle sight checks are covered in Ch. 3, Proc. 13. Leaking heater hoses can dampen or swamp the passenger compartment. Don't ignore fluid leaks.

As I said under FEEL, with a little experience you'll be able to put some of the leaking fluid between your fingers and tell whether it's water, oil, transmission fluid, or brake fluid. Brake fluid may look a little like motor oil, but it smells quite different.

Steam coming from under the hood means there's a problem in the cooling system (Ch. 8, Proc. 1 and 7).

Coming from the tailpipe, smoke and steam are hard to differentiate visually without a little test (Proc. 1 in this chapter).

As you work on and around your vehicle, make a habit of looking around for trouble.

SMELL

"It smells hot." That's frequently the first sign of a problem. Most fluids, paints, and non-metallic materials (such as brake linings and clutch disc linings) in your vehicle will give off distinctive odors when they're too hot. Oil or brake fluid dripping onto a hot manifold stinks. Boiling coolant also has its distinctive and discouraging smell. (After working on an engine, left over WD-40, gasket seal, or hair tonic will perk up your olfactory senses as they burn off. A recently rebuilt running engine will be a circus of smells for a while.)

Odors from out of the blue should be investigated immediately, especially the smell of burning rubber or vinyl.

If you smell something suspicious while driving—and you're sure it isn't your passenger or a nearby zirconium plant—pull over and turn off the engine.

If you can see flames, stay away from the vehicle and get help, preferably from the fire department. Some auto fires have been successfully put out by smothering them with blankets or sand, though a fire extinguisher is better. Keep one in your car or truck. However, if electricity and gasoline are involved in your particular fire, things can get very dangerous fast. If you value your hide, it's best to follow the precautions in Ch. 1 and avoid heroics.

If you smell something burning, no flames are present, and it isn't the brakes or clutch, stop the vehicle, turn the engine off, and open the hood. Burning electrical wires? (Even electricity has its distinctive smell.) Stop the flow of electricity by disconnecting the battery cable that goes to the negative (-) terminal on the battery. Above all, *do not use water* on an electrical fire. Water's a conductor of electricity, and you can easily make matters much worse.

A fire involving gasoline will have flames. The carburetor and fuel lines can be sources of gasoline fires. If it's a small blaze, smother it. If it's a medium or large fire, or is spreading fast, stay away! Better a cooked car than a cremated you! Fortunately, such fires are fairly uncommon.

The most frequently detected odors are brake and clutch smells. Brakes "burn" (the linings or pads overheat and cook a little) after a lot of downhill slowing, or if they're dragging. The clutch will slip and burn if worn or overloaded, such as when you go up a steep grade (Ch. 5, Proc. 1, and Ch. 11, Pt. 1, Proc. 1).

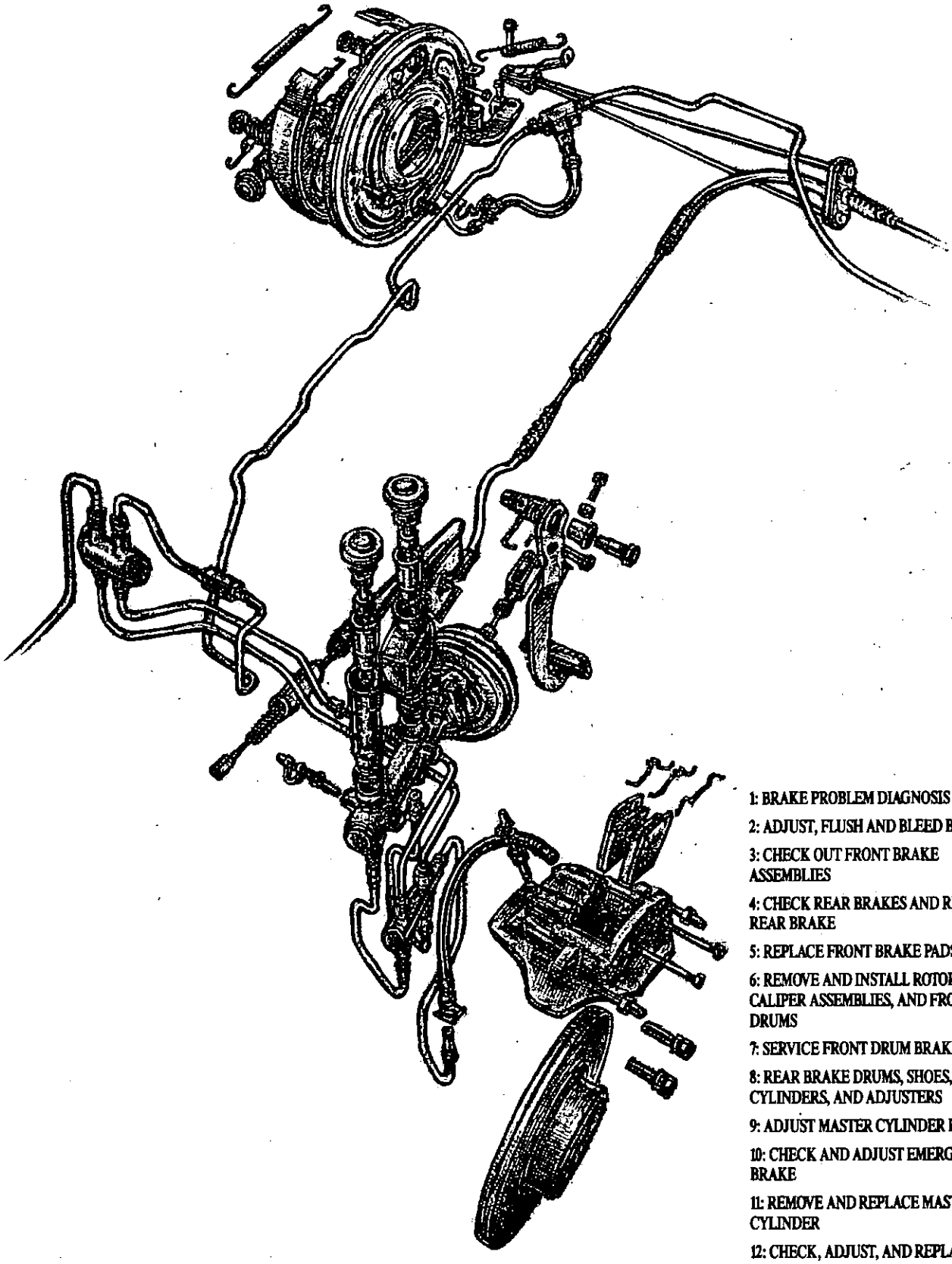
Burning oil (oil that's getting through to the combustion chambers because of bad rings or valve guides) has its peculiar smell, too. You can detect it more easily coming from other people's cars and trucks than your own. We've all seen and smelled clouds of blue smoke billowing from some ancient heap in traffic. It's a crime to foul the air we all breathe, so consider it a favor if someone yells at you at the stoplight.

TASTE

Please do not taste any of the fluids that go in or out of your vehicle's works. The fluids and compounds are all noxious or poisonous to one extent or another. It's bad enough that so many automotive wastes are carelessly strewn around in and on Mother Earth. Use good environmental sense.

Occasionally an experienced (if foolhardy) mechanic may use taste to detect or differentiate a particular automotive fluid. Antifreeze does taste different from brake fluid. It's still best to leave this sense out of it entirely.

Brakes



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CHAPTER 5
BRAKES

If the brakes break, you've got your hands full. Of all the systems in your car, the braking system deserves foremost attention when it comes to safety. Actually, of all vehicles covered in this book, only the 521 pickups have systems that could give out on you all at once without any warning. In any case, your job is to nip trouble in the bud before you drive through a busy intersection or farmer's fence madly pumping the pedal.

The brake system has two phases: *hydraulic* and *mechanical*. When you press on the brake pedal, a rod pushes against a piston in a sealed container called the **master cylinder**. Above the sealed side of the piston there is a reservoir of fluid. The piston has a seal around it that keeps the fluid from leaking back toward the rod. On the fluid side of the piston there's an inlet for filling the cylinder and an outlet for the fluid to escape from the cylinder into the rest of the system.

When you step on the pedal, rod, and piston, fluid is forced out of the cylinder and into steel *lines* that run to each of the four wheels. Because it isn't compressible, the fluid responds immediately. The steel lines link the fluid to **wheel cylinders** inside the braking works of each wheel. The fluid pressure hits the front wheels a little before the rear wheels. Inside the wheel cylinders are one or two pistons that move *outward* as the fluid fills the cylinder. All cylinders and lines make a closed hydraulic system, full of fluid. Unless fluid gets out and air or moisture gets in, the system should operate reliably.

Datsuns have **drum** and/or **disc brakes**. Both types use stationary friction pieces pushing against a moving part of the wheel to slow it down. I'll describe the drum brakes first.

The wheel cylinders are linked inside the wheels to the **brake shoes**. At this point the system becomes mechanical again. The brake shoes stop the wheels from turning. Brake shoes are arced and mounted inside of a smooth drum that revolves with the wheel. The drum resembles a cake pan. So, brake fluid travels through the lines to the wheel cylinders, moving the pistons which move the brake shoes which slow and stop the drums from turning.

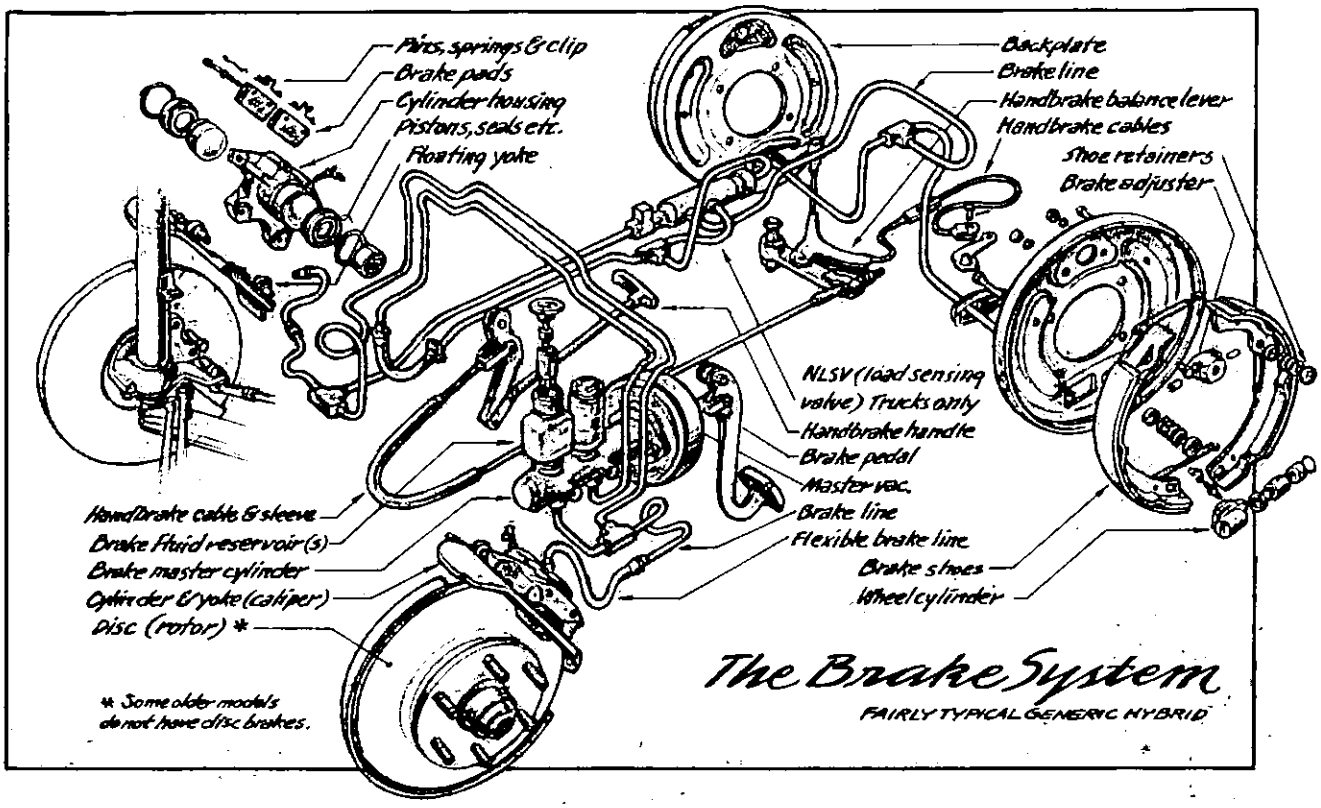
Disc brakes work in a similar way, but instead of shoes inside of drums, there are **pads** on either side of a **disc** (or *rotor*, as it's called in shop talk). This system works much like a ten-speed bicycle's brake. When the brakes are applied, the fluid forces a piston(s) against the two friction pads, which squeeze against the spinning disc's sides, causing it (and the wheel it's attached to) to slow down.

On both brake systems, the pads and shoes are made of friction material (linings) and the rotors and drums are made of steel. The surfaces wear due to dirt, heat and strain, and thus occasional replacement is necessary.

510, 610, 710, late 620 and 720 models use disc brakes on the front wheels and drum brakes on the rear. 521 and pre-1978 620 pickups use drum brakes all around. All models, except the 521 pickups, employ a twin master cylinder—separate hydraulic systems for the front and rear brakes. This guards against all the brakes failing if a fluid leak occurs. All 1973 and later Datsun/Nissan vehicles have *vacuum assist* brakes (called 'Master Vac' by Nissan). This doesn't improve the stopping; it just decreases the amount of effort you need to move the brake pedal. There are other features included in some of the systems which we'll look at later on in this chapter.

Let's go back to the master cylinder for a moment. On top of the master cylinder is a reservoir (or two) which contains extra fluid. This excess fluid keeps air out of the system and supplies enough to compensate for minor leaks and brake pad or shoe wear. However, it's wise to check the brake fluid levels on a weekly maintenance basis.

Another part of the brake system is the **emergency brake**. The *handbrake* control operates cables that connect mechanically to the rear brake shoes. Setting the handbrake locks the shoes against the drum, preventing



the vehicle from moving. I never thought much about emergency brakes until the hydraulics gave out in an old truck I was driving. The reflex to grab for the handbrake is a good one—as long as it works—and in that case it did. When brake shoes wear and the cables stretch, adjustment and/or replacement is called for.

There are ways you can read the brake system by checking the fluid level and by being aware of the brake pedal and emergency brake responses. The following procedure outlines the signs and symptoms of healthy and ailing brake systems.

PROCEDURE 1: BRAKE PROBLEM DIAGNOSIS

Condition: Something's fishy in the binder department: your brakes are acting abnormally or not at all. Or you're simply curious about their condition. Read the introduction to this chapter to determine whether your Datsun has disc or drum brakes, or both.

Tools and Materials: Two 8mm x 1.25 bolts, jacking equipment, brake fluid (DOT3 or DOT4), safety glasses, dust mask, soft hammer, large screwdriver, flashlight.

Remarks: Master Vac problems are very rare, and therefore not covered in this book.

The braking system demands a certain amount of maintenance, and unless you intend to leave servicing up to someone else, you should be in touch with each part. The Datsun's braking system is well within your ability to maintain and repair.

OK, you know you have two basic subsystems in the braking operation hydraulic and mechanical. Reservoir checks and being aware of how the pedal feels and how the brakes respond keep you in touch with the state of

the system. If the **brake dash light** goes on, check the fluid level. Also check the handbrake, which has to be fully disengaged.

For some info on how to cure brake squeal, see Step 7.

Step 1: Check Brake Fluid Level.

Raise the hood and look to the left rear of the engine compartment. Find the two or three white plastic cylinders (reservoirs); they're mounted to two horizontal aluminum cylinders. The plastic reservoir(s) closest to the engine is for the brakes. If you have a clutch, the cylinder to the left is for that system.

•**All 521 and very early 510 models:** You have one round plastic reservoir which works for the whole system.

•**All other models, except 720 trucks:** You have two reservoirs, both are round or one is round and the other is squat and square. Some of you may have two squat reservoirs.

•**720 People:** You have one teardrop shaped reservoir with two chambers inside it.

•**Everyone:** The reservoir(s) has (have) marks depicting low and high fluid levels. The marks can be seen from outside the cylinder—if it's clean. But this check isn't enough: look inside of the reservoir(s) to see the real state of the fluid. On earlier models, the caps pull straight off and on the later models the caps turn, then pull off. Some may have wires with wires and floats attached.

Remove the caps (and pull out the floats). Inside (you hope) is **brake fluid**, which may be black, green, or a clear yellow color or anywhere in between. Compare the *fluid level* to the marks on the side of the reservoir. NOTE: There may be a removable **screen** fitted into the container.

If there's fluid in the reservoirs and the level isn't down, jump ahead to Step 4.

If the fluid is very dark colored, you ought to change it. The system should be *flushed* and new fluid put in (Proc. 2 [1]).

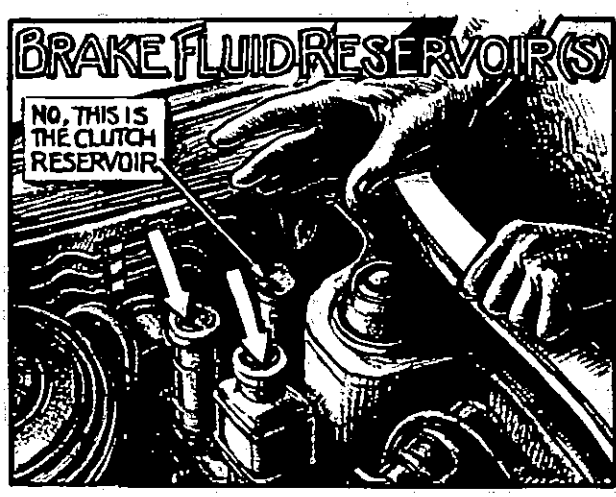
•**Drum Brakes:** If the fluid level is down below "low" on the drum brake reservoir, you should adjust brakes, fill the reservoir, and check for leaks somewhere between the reservoir and the brake shoes.

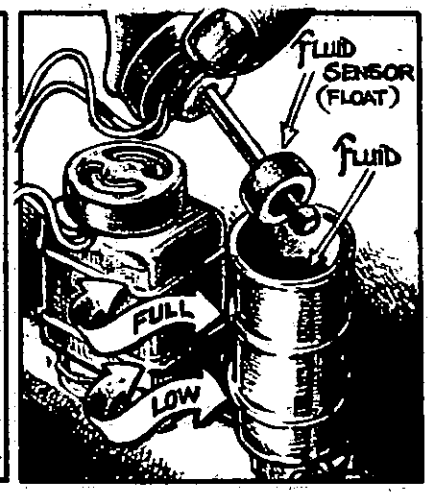
•**Disc brakes:** It is normal for the squat reservoir to go down as the pads wear. Do not add fluid unless the level is below "low," and then only add a little. Watch for leaks and check the pad wear.

•**Everyone:** If there is no fluid in the reservoir, but your brakes are working and you have to drive, add fluid, pump the brake pedal, and read *all* of this procedure to find the cause for the fluid loss. Make the repair as soon as possible.

If you are losing fluid, a leak somewhere in the system is causing it to escape. Dark fluid means that it is contaminated, if not by dirt than by moisture, which is absorbed by the brake fluid. Flushing the system every one to two years protects the seals, metals, and valves within.

If you don't have a leak and want to skip leak checks, jump ahead to Step 6.





Step 2: Check for Wheel Cylinder Leaks.

Leaks usually start in the wheel cylinders or the master cylinder. Occasionally a brake line or hose or fitting will leak.

If you have the twin reservoir type of master cylinder, you can pinpoint whether the leak is in the front or rear brake system. The front **disc** brake reservoir is always the front one. The rear **drum** brake reservoir is cylindrical or squat. On pickups, with drum brakes all around, both are cylindrical and the front brake reservoir is the back one. To be sure, look for the letters "R" and "F" stamped on the bottom left side of the master cylinder. When you know which reservoir is which, you can isolate a fluid loss to the front or rear part of the system.

Fluid leaking from a wheel cylinder will eventually contaminate the brake shoes (or pads). It's easy to make a quick check for this condition. With the engine shut off, put the emergency brake ON and set the transmission in gear. You'll have to get on your knees and back for this one, so put on your work clothes and safety glasses. NOTE: Drum brake wheel cylinders leak more often than front disk ones do.

Start at the rear of the vehicle. Between the two rear wheels is the **rear axle housing**. The **backplate** on the inside part of each wheel bolts to the outside end of the axle housing. See the illustration at the top of this step.

If a lot of fluid is leaking from a wheel cylinder(s), you'll see dark, moist traces staining the backplate, the center backside of the wheel or around the brake line and bleeder area. The brake line runs along the top of the **axle housing**. The lines lead directly to the wheel cylinders, either on the top or the bottom of the backplate. Unless the leak is severe you may not notice fluid stains from the outside; you'll have to remove the wheel and drum to take a closer look. There's also a chance that rear axle oil leaking from the end seals could cause similar stains.

It's hard to see any staining if the underbelly is all wet. *Smell* and *feel* the suspect fluid. Brake fluid has a definite odor and feel to it. (If there is a stain but no loss of brake fluid from the rear wheels' reservoir, and its smell resembles sulphur, turn to Ch. 11, Pt. 2 and check the differential oil level.) After looking at one wheel, check the other one, following the steel lines as you cross from one side to the other.

After you've checked the rear wheels and lines, go to the front of the vehicle and examine the backs of the wheels for leaks. The front wheels can be turned side to side making them easier to examine.

•**510, 610, 710, 720 models:** Turn the wheels to the left and look behind the *right wheel*. Find the curved rubber hose that runs to an assembly inside the wheel. This is the wheel cylinder. If you have a leak there, fluid stains will appear either on the hose, at its connection to the cylinder, or on the other side of the cylinder where the piston meets the brake pad. Isolate the brake parts and points below where fluid would drip. Repeat the leak check on the left wheel.

•**521 and 620 drum brake models:** Turn the front wheels to the right and look in behind the right wheel from the *front* of the vehicle. Find the curved rubber brakeline that connects at the top inside of the wheel. Behind that is the wheel cylinder. If fluid is leaking, you'll see stains around the hose connections, brakeline or on the backplate. If the connections and lines are sound, you can assume that the leak is in the wheel cylinder.

•**Everyone:** Carefully check the rubber hoses leading to the front wheel cylinders. These hoses get funky with age and should be replaced. Remember where you found suspect spots or areas.

Step 3: Check Master Cylinder for Leaks.

Look at the illustration panel above. Note the frame about the master cylinder. Typically the master cylinder leaks at the very back of the cylinder inside the passenger compartment in front of the brake pedal linkage, or between the master cylinder and Master Vac.

•**Non-Master Vac People:** Follow the brake pedal arm upward until it disappears. Use a good light. Find where the pedal arm connects to a rod. Straight in front of the pedal and rod linkage you'll see where the rod goes through the firewall. Here is the business end of the master cylinder. A rubber boot keeps dust out of this end of the cylinder, it does not seal any fluid in the cylinder—seals around the piston do that. If fluid is leaking out of the cylinder, you'll see dampness all around and below the boot. Push on the sides of the boot to force out any fluid that could be building up inside. A very *light* amount of fluid is normal. Dust, etc., tends to collect on the damp fluid. When the leak gets too severe, you'll have to replace the master cylinder.

•**Master Vac People:** Look inside the engine compartment. Find where the rear of the master cylinder and Master Vac join. Run a finder under the seam to check for fluid. If there's a leak, fluid may be present here. (To be absolutely sure, loosen the two mounting nuts temporarily and pull the master cylinder away from the Master Vac. Don't forget to retighten the nuts.)

•**Everyone:** Internal master cylinder leaks can be felt by reading the pedal. We'll get to that later.

Step 4: Check the Hydraulic Brake Lines for Leaks.

If you intend to do brake pad or shoe work or checking, skip this step until the vehicle is jacked up.

There are many yards of steel and rubber brake lines in the system that could develop a hole or leak fluid or such in air. Usually if there's an air leak, there will also be a fluid leak. Even if you've already found the leak elsewhere, it's a good idea to check out the condition of the brake lines. On **510** and **610** sedans, there are flexible rubber lines at all four wheels. On all other models, only the front brakes are fitted with flexible lines.

A leak is easily spotted by a stain. The idea is to follow the brake lines all of the way to the wheel cylinders from the master cylinder. You'll probably have to jack the vehicle up to see all of the lines. Follow instructions on jacking, see Ch. 13, Pt. 1, Proc. 1. When you look, be sure you are following brake lines and not a fuel or fuel evaporation line.

•**1976 and later pickups:** You have a **load sensing device** located in the middle of the underbody about half way between the master cylinder and the rear wheels. Take a look around the fittings on this device as you work your way forward.

If a leak is found, that section of line has to be replaced. Standard lengths of American-made 3/16in diameter brake line with metric flair fittings work on the Datsun systems. However, if a leak or serious deterioration is found in a flexible line, use a Nissan/Datsun original replacement. Tote the old one down to the parts store to get the correct size and length piece. Although available lengths are not always exact, you can come close enough. **Caution:** Removing, installing, and fitting brake lines aren't covered in this book, so be sure to get advice locally. Remember, once a line in the system has been removed, the section involved has to be *bled* (Proc. 2 in this chapter).

Step 5: Determine What Repairs Are Necessary Based On Leak Check Information; What Fluid to Use.

If you found the source of a fluid leak, you can figure out what repair is necessary. If you didn't find a leak and you are definitely losing fluid, look closer. You may have to take off a wheel and drum.

If you have a leaking wheel cylinder, it's a good idea to get on with the repair soon; it won't stop until the cylinder is rebuilt or replaced.

I think the best brake fluid to use in Datsun systems is Castrol L.M.A. fluid, DOT4, made distinctive by its green coloration. Most other brands are DOT3 and are a clear brown.

By flushing and bleeding the system before the cylinders leak, you can lengthen their lives. Fresh fluid keeps corrosive elements out and titilates the innards. *Never* add used fluid to the system unless nothing else on earth is available including Moxie.

If there's no fluid in the reservoir and the brakes are not working, you need to get home, and the emergency brake works, read Proc. 2 in this chapter. Perform diagnostic checks and plan to do whatever repairs you find necessary "pronto."

Step 6: "Read" Brake Pedal and Brake Line Information.

It may sound absurd, but mechanic talk includes expressions like this to color up the trade. Even if you haven't been losing fluid, but know that the vehicle isn't stopping as it should, you have to try "reading" the pedal to get to the problem.

As brake shoes in drum style brakes wear down, the wheel cylinders have to push the shoes farther to reach. (With disc brakes, pad wear does not affect pedal travel. They are self-adjusting.) If the shoes and drums are in good condition, the shoes can be adjusted and drawn out closer to the drums to return the position of the brakes—and the pedal—to like new. The only way to be certain of the mechanical condition of your brakes is to look at them. But before doing that, make some tests with the wheels still on the ground.

Problems with the drums and shoes are usually felt in poor pedal response (not pumping), lots of pedal travel before braking action begins, noise, or a hard, sudden feeling when the brakes engage instead of smooth, positive reaction and stopping. If the pads or shoes are contaminated with leaking brake fluid, the action will be poor even if the pedal feels high.

If pedal travel varies from time to time (with the emergency brake off) or the braking position of the pedal gets higher when you pump it or feels mushy, then there probably is some air in the hydraulic system. If the pedal tends to sink when there is full force put on it, an internal leak in the master cylinder is indicated. Or, if there's a leak outside of the master cylinder and the pedal fades when you press on it when the car is sitting still, get

ready to do master cylinder or other hydraulic work. If the pedal needs pumping to reach its maximum level, then the system should simply be adjusted and bled, then checked for leaks. Both of these procedures are in this chapter.

A little air in the system is something you can live with awhile, but realize that the air is getting into the system from somewhere. The situation should be investigated and the leak fixed.

If the pedal goes completely to the floor and nothing happens, check the reservoir and add fluid if necessary. Try pumping the brakes a few times. If they come to life, you've got brakes but just barely. Find the leak when you've reached a place where you can safely diagnose and work on the problem.

If the brake light goes on when it shouldn't and the handbrake and its switch are off, you may be low on fluid, have lots of air in the system, or the front disc pads are worn so much that the fluid level dropped causing the warning light to go on when the brakes are applied. This applies to models with **fluid sensors** in the reservoirs. **Everyone:** The light will come on when there is no or low fluid pressure in the system, usually caused by a bad master cylinder. Often the little switch in front of or under the handbrake screws up and makes the light flash on. Find and disconnect the wires to the switch to determine if that is the problem or if it's something serious in the hydraulic system.

Heat and wear cause the brake shoe and pad lining to break down, get hard, and lose efficiency. Worn shoes and pads should be replaced before the lining wears down to the steel backing. If you hear grinding noises when the brakes are applied, *don't hesitate*: read Proc. 3 and 4 to check for wear, before driving another mile.

Occasionally either one or all of the brakes will "drag." The cause can be hydraulic or mechanical. To test this, let the vehicle coast and see if a slight drag is slowing you down. Drive the car or truck in a straight line on a smooth surface. If there is a pull to one side or another, a dragging brake or a dry wheel bearing may be the problem. Problems like damaged mechanisms, stuck wheel cylinders or adjusters, or broken return springs can also cause a wheel or wheels to drag.

Step 7: Road Check for Brake Problems.

Remove the hubcaps with a screwdriver and make sure the lug nuts are tight and the tires are properly inflated. Then go for a test drive.

After driving for awhile without using the brakes a lot, stop the vehicle, get out and check each wheel, feeling the curved inside part of the wheel, not the tire, just around and outside of the lug nuts. If brakes are dragging, the wheels will feel very hot to the touch. It's OK if they're a little warm when the vehicle has been driven and stopped normally or hot if you've just come down a long hill. If one wheel is hotter than the rest check it out. If all of the wheels are hot, there could be a problem in the hydraulics, such as a stuck or out of adjustment master cylinder.

If drum style brakes are adjusted too tight, they will drag. You may also smell if the brake linings are burning! Corrosion around the caliper or inside of the wheel cylinder or adjuster slide can keep the brake shoes or pads from returning to their original position. Further diagnosis can be done with the vehicle off the ground.

The *rear* brakes can drag when the **emergency brake control cable** or levers don't release the shoes inside of the drum. This condition is common in older or super rusty trucks. It's easy to diagnose when the vehicle is jacked up.

Drive the vehicle in a straight line on a smooth road. Make sure nothing's behind you and apply the brakes hard. A Datsun/Nissan with good brakes will stop straight and the pedal will remain high and consistantly even. Now see if all four wheels brake at the right time. If the vehicle pulls to one side or the other, or if the rear end tends to fishtail, one wheel is grabbing before the others. The cause can be: Improper adjustment, a stuck wheel cylinder or shim slide, lining failure, or a bad master cylinder. If all of the brakes seem to "grab" (respond too fast), or the bad symptoms change, the master cylinder may not be functioning properly. If the pedal gets too high and the brakes drag when warm, bleed and adjust the brakes (Proc. 2), then readjust the master cylinder pushrod (Proc. 9). If it continues, replace the master cylinder.

Sometimes when brakes get hot they tend to *fade*: the normal pedal travel ends, and then sinks a little further. This is caused by the hot brake drum expanding away from the shoes. Unless this persists, it's not a big deal. If it occurs during normal driving, you should be concerned. All drum brakes except 1982½ on (1/82) utilize shims that allow the brake shoes to slide. These are often not serviced and stick causing the brakes to feel only partially effective.

There should be a feeling of reserve in the pedal under all sorts of slowing and stopping. The distance you have to push the pedal should be no more than three inches and the response should be even and consistant

without your having to pump. Adjustment can decrease pedal travel, but if the linings are seriously worn, adjustment isn't a satisfactory cure. If the vehicle stops well and there is excessive pedal travel, then an adjustment is what you need. If the pedal feels high, but the response when it is applied is hard or delayed, you had better take a closer look right away. There could be trouble lurking at the next intersection.

If you have problems with squeaking brakes it's usually on disk brake vehicles. Try this. Drive a medium speed and when no one's behind you, tap hard on the pedal a time or two. By doing this, you take the **glaze** off the pads. Glaze builds up from repeated, slow in-town braking. For more on brake squeal, see Proc. 5 (9). If you hear it in a truck's rear brakes, go to a Nissan dealer and ask for "Nissan Tech News" (Vol. 3, No. 3) and get frustrated.

Step 8: Check Out Brake Noises.

Brake noises shouldn't be ignored. Disc brakes normally tend to squeak. NOTE: On later pickups squeals and rattles from the disc brakes are common. The best way to determine where the noise is coming from and why is to jack up the vehicle and check out each wheel.

There's a gadget called a **proportional valve** in the brake system. If this valve malfunctions (uncommon), it may cause the rear of the vehicle to fishtail or skid. To test for this problem, run the car or truck at 30 or 40 mph and apply the brakes *hard*. If the rear brakes come on noticeably earlier than the front brakes, make a note about this valve, but first do a brake adjustment, and further diagnose the system. For 1976 and later truck people, this test applies to the **load sensing valve**—something I have never found to fail.

Remember, brakes are of utmost importance. Don't cut corners or put these problems off.

Emergency brake problems are covered in Proc. 10.

Step 9: Check Out the Brakes, Wheels On, Vehicle Jacked Up.

You have to raise the car or truck off the ground so that the wheels can be turned and/or removed. Inspect the internal brake parts, a good idea if you have time. To do this, loosen the wheel lug nuts slightly first, but don't remove them yet. Read the jacking and safety instructions can be found in Ch. 13, Pt. 1, Proc. 1.

Make sure you know whether you have disc or drum brakes up front. The gear selector should be in Neutral and the handbrake *off*. Consider the wheels as pairs, front and rear. Spin the wheels one side at a time; they should turn freely. Listen for dragging sounds. A slight scraping is normal, but the sound should be about the same quality and loudness on both sides.

If the wheels won't turn, or one or both of them is hard to turn, chances are that the brake shoes (or pads) or wheel cylinder(s) aren't returning, the handbrake cables are stuck, or the brakes are adjusted too tight. Now get a friend to sit in the driver's seat and pull fully on the handbrake. Try to spin the rear wheels. If the hand brake is working right, the wheels shouldn't turn. Now have your friend release the hand brake. The wheels should spin easily. If they're tight, the cable(s) is sticking (Proc. 10).

Spin one of the wheels and have your friend apply the foot brake and hold it down. The wheels should stop. If this stops only one of the wheels, chances are that the wheel cylinder in the free wheel is stuck and won't operate. If the brakes on both wheels are inoperative, bleed the rear system to see if fluid is getting to the wheel cylinders. If one or both wheels drag or make wierd noises when the brakes are applied, they are either out of adjustment or something is sticking. If the sound is a grinding one, inspect the insides immediately. Adjust and/or remove the drums for inspection. Pickups with drum brakes should have dust boots covering the adjusters on the bottom of the backplate to keep out dirt and water. Front drum brake checks are just like the rear checks.

Disc brakes always rub a little when they're turned. However, the wheel should turn smoothly and stop when the brakes are applied. They cannot be adjusted. If you feel tight spots while turning the wheel (rotor), it may be warped—out of true—causing noise or shimmy or pedal vibration.

While your attention is on the front wheels, you might as well check for other wear points such as the king pins, steering linkage, and wheel bearings (Ch. 12, Proc. 1).

If you haven't completed the brake fluid leak check, see Step 4.

All remaining braking system checks should be done with the wheels (and drums) removed (Proc. 3 and 4). Other noises heard when braking could be related to suspension or rear axle problems.

PROCEDURE 2: ADJUST, FLUSH AND BLEED BRAKES

Condition: The vehicle isn't stopping as it should. You think the system needs to be flushed or bled. There is air in the lines. Read Proc. 1 if you wonder about the condition of the system. You need to do this before adjusting the emergency brake.

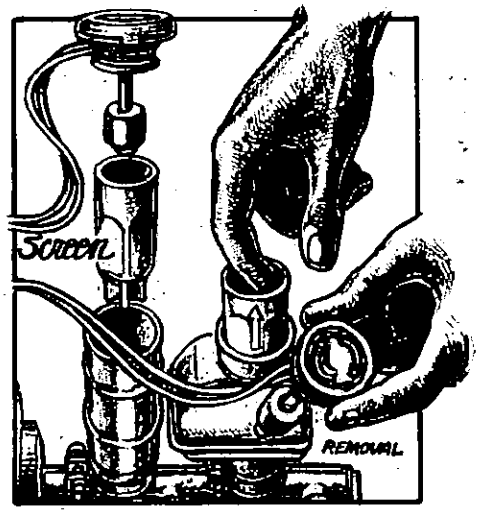
If you had the hydraulic system apart, make sure that the **bleeder nipples** are closed and that all line fittings are secure.

Tools and Materials: Two small cans of DOT3 or 4 brake fluid, plastic ½ pt. juice type bottle with cap and clear hose, 3/16in clear vinyl from hardware store (Ch. 13, Pt. 2), flashlight, safety glasses, stubby screwdriver or a small/medium screwdriver with its tip end bent at 45° (essential for 1981½ 720s (pickup models), pliers/Vise Grips (all other people), 6mm (older car people) and 10mm open end wrenches, an assistant for bleeding, a Phillips screwdriver, penetrating oil, some water.

Remarks: Brake fluid is poison and toxic to the skin for many people. Avoid getting the stuff on you, the tires or paint. Use only new brake fluid. Keep water handy to wash off spilled fluid.

Make sure the fluid you use is approved for disc brakes. Silicon fluid is an expensive alternative, but it lasts a lifetime. **Self-adjusting Brake People** are 1978 and later 510s and 1982½ (1/82) on 720s. You should read Step 8 before beginning.

Step 1. Check Brake Fluid and Clean Reservoirs.



Find the fluid reservoirs and their low-high marks. If there's sludge in the reservoirs, you should clean it out before bleeding. Remove the caps and screens. If there's fluid in there and you can see the bottom of the reservoirs, go on to Step 2. But if you feel a lot of goo at the bottom of the screen or the reservoir, you ought to clean it. **Do not remove** single late model teardrop reservoirs; skip ahead to Step 2.

Drum brake reservoirs can usually be cleaned without removing them. Disc brake reservoirs have to be removed.

The reservoirs are clamped to the top of the **master cylinder**. Any fluid in the plastic containers has to be drained before cleaning. **521 models** have only one reservoir and no "bleeder" at the cylinder. On all *dual* reservoirs, you'll find bleeder nipples on the engine side of the master cylinder. Follow the instructions in Step 3 on bleeding the master cylinder. Without adding fluid you can drain the reservoir by pumping the brake pedal, with the bleeder open.

When the reservoir is empty, loosen the clamp at its base with a Phillips screwdriver. Twist the reservoir from side to side while pulling it upward and off of the master cylinder. Carefully clean the container and the screen (if yours has one) with a rag. *Do not* use petroleum solvents to clean brake hydraulic parts; use Isopropyl rubbing alcohol or brake fluid only. Next attack the goo down in the master cylinder.

NOTE: Be careful not to push sludge into the little holes below.

When everything's spotless, twist the reservoir onto the master cylinder until it bottoms out.

Position the level marks so you can see them. Tighten the clamps, reinstall the screen, and add fluid to the high mark and replace the cap. Service the other reservoir, if it needs it.

Step 2: Block and Raise the Vehicle.

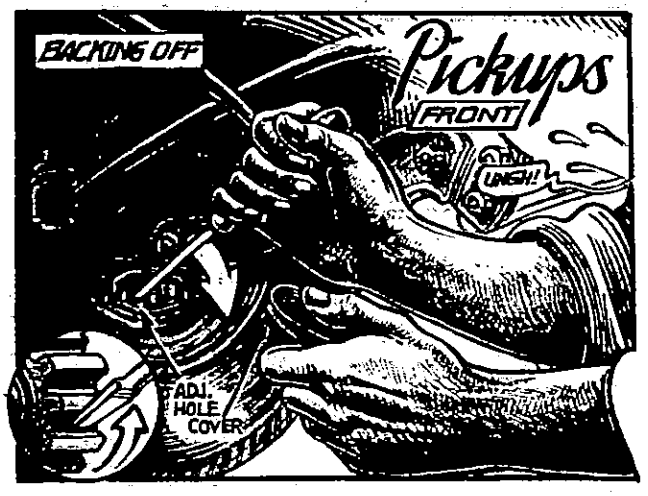
See Ch. 13, Pt. 1, Proc. 1.

You'll either be lifting all four wheels or just the ones you're bleeding and adjusting. Front disk brakes can't be adjusted so you don't need to raise them unless you want to spin them.

Step 3: Bleed the Master Cylinder.

1983½ on trucks, skip this step.

Make sure the reservoirs are full of clean brake fluid; leave the caps off. Don't let the fluid level get below the LOW mark. If you have only one reservoir, go on to the next step. If you have two, there is a bleeder nipple for each of the reservoirs (the bleeders may be covered with little pop-off rubber caps). Start with the front reservoir. See the illustration in Proc. 1 (2) for bleeder location, then turn to Proc. 1 (4). Three to seven good strokes ought to flush the cylinder. Close the bleeder nipple while your helper keeps the pedal to the floor. Repeat the process with the other reservoir.



Step 4: Adjust the Brakes.

Because adjusting and bleeding are easier done at the same time, read through the next two steps before beginning. Make sure the transmission's in Neutral (N), emergency brake off. Start at the left rear wheel.

•**Pickups except 1982½ (1/82 720s:** Lie on your back, eyeballing the inside of the wheel. At the bottom of the backplate you'll find a little rubber dust cover or the open adjuster hole. Pry the boot off. Look inside the front end of the hole with the flashlight and find the star adjuster. Use the short or bent screwdriver to pry the star **downward.** The illustration below shows front drum brakes; rear brakes are similar. If your stubby screwdriver isn't really short, it won't fit under the axle so you'll have to bend a small medium driver shaft. See Ch. 13, Pt. 2 or use a small bladed brake adjusting tool.

If the star doesn't move and the wheel spins, the adjuster may be stuck, which means the drum has to come off to free it up. If it's OK, then move the star a few clicks and spin the wheel. A couple more clicks and another spin. You should begin to hear the shoes dragging against the drum.

Keep going until the wheel and the adjuster star will no longer turn.

Now back the shoes off by prying the star upward. Count the number of clicks until there's just a little rubbing sound and the wheel turns freely, usually between 7 and 12 will do it. Replace the rubber dust cover.

Now do the right wheel the same way. Tighten the adjuster all the way, then count back the same number of clicks as the left, or until the right wheel spins with the same sound and resistance as the left. If any dust boots are missing or there is corrosion around those funny looking adjuster shims, you may have to lube and service the shims. This can be done without pulling off the drums. If the shims don't slide, the brakes won't work right (Proc. 8 [7]).

•**All car models except 1978 and newer 510:** Lie on the ground and look at the inside of the left rear wheel. On the top of the backplate you'll see a square-headed, threaded stud sticking out between two nuts. Ideally, a 6mm open-end wrench will fit the square head, but corrosion causes the threads to get tight so frustrated mechanics use Vice Grips or pliers to turn the adjuster. Try the wrench first, after dripping a little penetrating oil onto the threads. Now try to turn the adjuster one way then the other.

OK—now spin the wheel and begin to turn the adjuster clockwise. You'll hear scraping as the shoes make contact with the drum. The tip of the adjuster is designed to wedge those shoes outward closer to the drums (see the illustration in Proc. 8 [7]). Do not force the adjuster; it should be set so the shoes scrape slightly against the drums as the wheel spins. Back the setting off so you can turn the adjuster either way without great resistance.

Repeat this step on the right rear wheel.

• **1978 on 510s and 1981½ on 720s:** You have self-adjusting brakes. You should not have to do anything if you use the hand-operated emergency brake often (Step 8). For trucks the procedure's a bit different (Step 8 has details). However, if you suspect that the rear brakes need adjustment (more likely on trucks than cars),

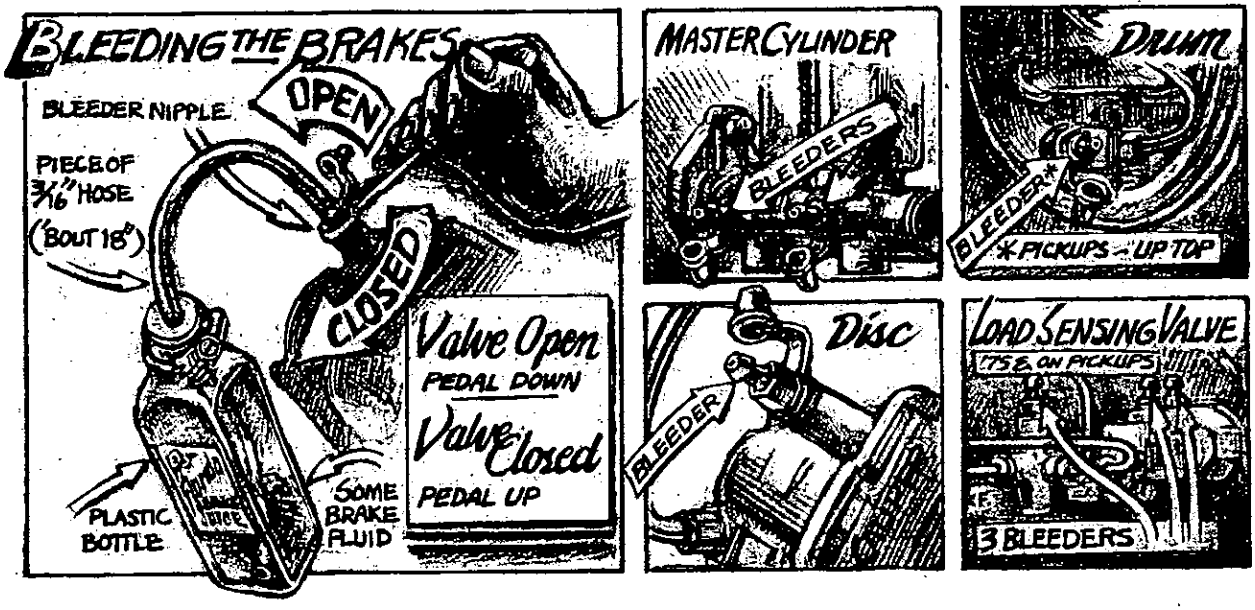
pull out the little rubber inspection plug. On 510s it's above and behind the wheel cylinder connections, on the inside of the backplate. On (720s) trucks it's at the bottom inside of the back plate. Inside the hole you'll see a star adjuster (illustration, Proc. 4 [4]). You can adjust the brakes manually by prying this star downwards, one click at a time while spinning the wheel. Follow the pickup brake adjustment instructions in this step; however, **do not tighten the shoes fully against the drum,** just until they drag slightly, the same amount on each side. Replace the plug. If the star doesn't turn or you want to check out the adjuster, remove the wheel and drum (Proc. 4) and service the rear brakes (Proc. 8).

•**Everyone:** Once the rear brakes are adjusted, you can bleed them. If you choose to do so, move ahead to Step 6. **Pre-1978 pickups** have front drum brakes, so do Step 5 before bleeding the front brakes.

Step 5: Adjust Front Drum Brakes (pre-1978 pickups only).

The front adjusters are the same as on the rear but easier to work on; you can turn the wheels and use a longer screwdriver as illustrated in Step 4.

Turn the steering wheel to the left, and get down in front of the left wheel. Take off the dust boot at the bottom of the backplate. The movement and setting of the adjuster star are just like the ones at the rear wheels, except that the front brakes need to be more precise. If one front brake engages before the other, the truck will "pull" to that side. To avoid this anguish, the number of clicks from the fully tightened position should be exactly the same for both wheels.



Step 6: Bleed the Brakes and Flush the System.

This should be done every year or two or to cure and diagnose problems, e.g., spongy brakes.

Start with the rear wheels unless you are only working on the front.

•**Pickup People, 620 and 720, 1975 and later:** Read through Step 7, then return here.

•**521 People:** You have to bleed all four wheels.

Bleeding was practiced by healers in the middle ages. Today it is performed by auto mechanics. You'll need a friend who'll work from the driver's seat. Instruct him or her to press on the brake pedal and hold it down, lift the pedal, leave it up, or pump it when you say so. Your assistant can also refill the reservoir as the level drops. Keep the can of fluid and a rag nearby. NOTE: Water neutralizes brake fluid. Keep dirt and dandruff out of the reservoirs and recap the can of fluid when it's not in use. Don't overfill the reservoirs. Read through this step before you start.

Gather your tools: the bleeding bottle and hose (3/16in clear vinyl), 10mm open-end wrench, penetrating

oil, and small Vise Grips. Put some fluid and the tip of the hose in the bottom of the bottle. Fill the reservoir(s) to the full line. Have your assistant refill the reservoir each time it reaches the "low" line. The master cylinder has been bled (Step 3).

Now get down and look at the backplate of the left rear wheel: **Pickups:** The bleeder valve (nipple) is near the top of the backplate, above the axle housing. (See the illustration in Proc. 8, if you can't identify the bleeder valve.) **All sedans and wagons:** The bleeder valve is on the bottom of the backplate.

Remove the rubber cap covering the end of the bleeder. The bleeder valve is often devilish to loosen. If it won't budge with the wrench, see Ch. 13, Pt. 1 before you destroy the damn thing.

Now, the first thing to know about bleeding is that when the valve is open and the pedal is being pushed, fluid will be forced out of the system. When the pedal is lifted, air or fluid in the bleeder hose will be sucked in—unless the valve is closed and then fluid will get drawn into the system from the reservoir. To remove all the air and old fluid, one end of the hose should fit tightly over the bleeder valve while the other end is submerged in fluid in the jar. Get set up then tell your assistant to step on the pedal, while you open the bleeder ½ turn. The pedal should sink to the floor as fluid (and air bubbles) are forced out. Keep the hose submerged and the bottle upright. If nothing comes out, open the valve more. Still nothing? You'll have to remove the bleeder valve and unplug it with a drill bit or needle.

Have your friend *pump* the pedal slowly up and down two or three times, while you watch what comes out of the hose. Now check the reservoir level. If bubbles or dark fluid are still coming out of the nipple, bleed it some more.

After adding fluid, wait until any bubbles rise to the top of the reservoir before starting to pump.

When a stream of pure, clean fluid comes out of the hose, tell the assistant, hold the pedal to the floor. Close the bleeder and give the order to pump five more times. The pedal should feel hard. Recheck the reservoir level. Replace the rubber cap on the nipple. OK, you're done with the first wheel or master cylinder.

Now bleed the right wheel the same way you did the left, reminding your assistant to check the level at the reservoir after every few pumps.

Bleed the left front wheel next.

•**All cars and wagons (510, 610, 710 and 720):** The bleeder valve is at the rear of the wheel cylinder.

•**1976 and later pickups:** See Step 7 then return. If you have trouble finding the bleeder valve refer to the illustration in Proc. 7.

•**Everyone:** If the wheel is off of the vehicle, it is easy to work from the outside looking over the top of the disc or drum.

The bleeding technique is the same for the front wheels.

Finally, bleed the right front cylinder. When you're done, **make certain all of the valves are closed**, top off the reservoir and replace the caps.

Pump and press on the pedal. If it feels mushy or you have to pump to get the pedal height up to snuff, or the pedal sinks when you put pressure on it, you need further brake work. Make *sure* that you have some pedal response before test driving the car anywhere.

If the pedal feels solid, but there is still too much play between the pedal at rest and the place where the pedal stops recheck the drum brake adjustment. If there's still play, the master cylinder pushrod probably needs to be adjusted. Don't drive if you doubt the condition of your brakes (Proc. 9).

Step 7: 1976 and Later Pickups Only: Bleed and Check the NLS Valve.

This is the "Nissan Load Sensing" valve. It is located in the brake line at mid-truck, bolted to the inside of the chassis rail. (I've never had any problems with these valves, but the Datsun manuals say that the rear brakes bind before the front when the valve screws up.) The factory manuals also recommend a definite bleeding sequence. The method of bleeding them is the same as the wheel cylinders. Usually you can ignore the valve and bleed through it. However, if you have problems, follow the factory sequence. The NLS valve has three bleeder valves.

Factory recommended sequence: **Up to 1980**—Bleed (1) master cylinder for front brakes, (2) master cylinder for rear brakes, (3) NLS valve front bleeder, (4) front wheels, (5) rear wheels, left first, (6) NLS valve

rear bleeder, and (7) NLS valve center bleeder. **1980 and later models**—(1) Master cylinder (if you have a bleeder there), (2) NSL valve (if three bleeders there—[A] rear, [B] front, [C] center), (3) rear wheels—left first, and (4) front wheels—left first.

Step 8: Try to "Self-Adjust" Rear Brakes (1978 and later 510s and 1981½ (1/82) 720s).

These brakes are designed to adjust when you operate the hand brake (cars) or when the truck is stopped in reverse by operating the hand brake. It's easy to try this 5-10 times to see what happens. Then or if you have the vehicle jacked up, check and adjust the rear brakes if necessary (Step 4, this procedure). But first see if you need to bleed the brakes (Proc. 1 [1-3]).

PROCEDURE 3: CHECK OUT FRONT BRAKE ASSEMBLIES

Condition: You've decided to take a closer look at the front brakes.

Tools and Materials: Basic Tool Kit, assistant.

Remarks: Do not step on the brake pedal when the brakes are disassembled.

Step 1: Jack Up the Front of the Vehicle and Remove the Front Wheels.

See Ch. 13, Pt. 1, Proc. 1, for these instructions. While you're here, check out the wheel bearing condition (adjustment) (Ch. 12, Proc. 1 and 3). Remove the right wheel first.

Step 2: Examine Brake Pads.

•**510, 610, 710, 620s with disc brakes (1978 and later) and 720s:** Start on the right (passenger) side of the car.

The hub and disc brake assembly is now visible. There are bearings inside the hub that allow the **rotor** (disc) to turn on a **spindle**. Over the upper rear side of the rotor is the **brake caliper** which houses one or two wheel cylinders and two brake pads on each side of the rotor. Look at the illustrations in Proc. 5 to identify your style and the parts.

•**Early 510, 610 and 710 models:** The brake pads are covered by a bent piece of sheet metal with printing on it. Carefully unclip and remove this piece. See the single piston (Akebono disc brakes) illustration, Proc. 5 (3). If the clip is corroded or has no writing, mark it to indicate the top, and the side (left or right) of the vehicle.

•**Everyone with front disc brakes:** You can see the pads (backing and linings) through the back of the caliper. Disc brake pads wear out faster than drum brakes. As the pads wear, the friction (lining) material gets thinner. The pads should be replaced before the lining wears down to the steel backing. Rub your fingers over the shiny rotor's surface. If there is any noticeable roughness, deep grooving, or discoloration on the shiny part of the rotor, make a note of it. If it's not shiny but rough looking, chances are the pads are worn down to metal. The inside surface is not easily visible, but it can be felt by sticking a finger in (near the pads) where the inside rotor surface is exposed.

If the thinnest part of either brake pad is 1/8in (2mm) thick or less, it should be replaced. If just one pad is completely worn down, it's an indication that the unworn side of the caliper isn't working as it should. In this case, caliper servicing should be done, along with pad and rotor service or replacement.

Look carefully at the wheel cylinders to see if there is leaking. There are two basic designs of wheel cylinder. Models 510, 610 (until 1975) and 710 (until 1976) and all 720 trucks from 1982½ on operated with a single piston design. On these cars, the pad material is angled so one end of the pad will always be thicker than the other; on these trucks, the lining material is flat. The piston is on the inside of the caliper between the housing and the inside pad. The piston forces the pad against the rotor. The whole caliper housing then moves inward until the outer pad contacts the rotor with equal force. On 1978 and later models up to 1982½ trucks, the assemblies work much the same way, but instead of one piston, there are two. One of the pistons pushes against the inside

pad and the other pushes against a yoke which connects and pushes against the outer pad.

Now determine what *needs* to be done. If the wheel was "frozen," i.e., didn't turn at all, or didn't stop when the brakes were applied, or there's evidence of cylinder leakage, you probably need to overhaul the wheel cylinders at least, or free up the caliper's sliding operation. If the brakes stopped the wheel but the pads are worn, the rotors are acceptable and the cylinder is not leaking, you can get away with as little as pad replacement—a quick job. If the rotor sticks only sometimes as you rotate it, it may be out-of-true (warped). In this case the hub and rotor should be removed and checked by a machinist unless you have a **dial indicator.**

Most mechanics replace the pads and if necessary resurface the rotors if they are badly grooved and reusable. If there's any doubt whether your rotors are reusable, take them off and haul them to the machine shop for an expert opinion. Many later model, 1974-on rotors cannot be resurfaced; they have to be replaced. And on 4WD trucks, removing the hub and rotor isn't so easy (Proc. 6).

Datsun front disc wheel cylinders seldom leak but are prone to seize. If a wheel cylinder is seized, you have to remove the caliper assembly to get to the cylinder and piston. These cylinder assemblies should be rebuilt, by a pro. If the cylinder was leaking, or the pads are unevenly worn, you should replace the pads as well.

Hand-in-hand with a front brake job is wheel-bearing work. You have to deal with the wheel bearings when you remove the rotor. The bearings can be checked then. If the rotors are machined on the hub, you have to repack the wheel bearings.

•**521 and early 620, drum brake trucks:** You can remove the front wheel and drum together, by simply removing the **spindle nut, washer,** and **outer wheel bearing**.

Turn to Proc. 6 (4): Remove Spindle Nut, Wheel Bearing and Drum, then return here.

When the drum is removed, turn to Proc. 7 (3), and identify the components but don't take anything apart, then return here. The front brakes work slightly differently than do the rear brakes. You have a single piston cylinder that acts against the front shoe, no shoe retainer springs, and no emergency brake mechanism. Now read Proc. 4 (4, 5 and 7), then return here.

Step 3: Replace the Wheels.

Once you've figured out what needs to be done, if anything, decide whether you have to do the work now.

•**521 and 620 People with drum brakes:** If you're ready to replace the drum now but want to inspect and/or repack the bearings first, turn to Ch. 12, Proc. 3, then return here.

•**Early 510, 610 and 710 People:** Before putting the wheel back on, replace the cover clip (Proc. 5 [7]). Piston People Clip Replacement.

•**Everyone:** You can now replace the wheels, lower the vehicle and tighten the lug nuts. (Ch. 13, Pt. 1, Proc. 1).

PROCEDURE 4: CHECK REAR BRAKES AND REMOVE REAR BRAKE DRUMS

Condition: You're here to inspect or repair the rear brakes. Don't step on the brake pedal when the drums are off unless the instructions say to.

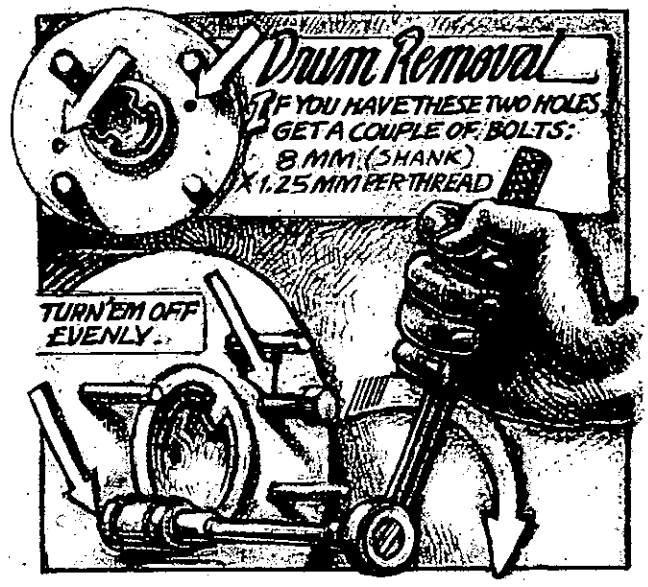
Tools and Materials: Basic Tool Kit, pliers, large screwdriver, two 8mm x 1.25 x 30mm bolts *or* brass hammer (if necessary), penetrating oil, dust mask, ruler, assistant.

Step 1: Jack Up the Rear of the Vehicle and Remove the Wheel.

Complete jacking and wheel removal instructions are in Ch. 13, Pt. 1, Proc. 1. Go there and return here for more fun. Remove both wheels and keep them separate. Take the transmission out of gear and the handbrake off. The drum and hub are now visible.

Step 2: Remove the Brake Drum.

Spin the drum around. If it turns without rubbing, keep on with this step. If you hear the brake shoes dragging against it, turn to Proc. 2 (4) and adjust—loosen—the shoes away so the drum can slip off. Turn the adjuster up. Self-adjusting brake people can't do this. If that doesn't allow the drum to turn, disconnect the emergency brake cable.



•**1978 and newer 510s:** Look on the back inside of the backplate. Find the **emergency brake lever** that is connected to the **clevis**. A spring connects the clevis to the backplate. Unhook and remove it. Between the clevis and where the lever goes through the backplate there is a little rubber stopper with a pin through both it and the lever. Engage the hand brake and pry out—up—the little pin and remove the stopper. Disengage the hand brake. Keep these pieces in a safe place.

•**Everyone:** Look to the outside of the hub center for two threaded holes opposite one another in the drum.

•**No drilled holes models:** Because your drums are not drilled, you have to pry and pound them off. Pick the largest straight-bladed screwdriver you have. Stick the screwdriver behind the lip on the backside of the drum where it slightly covers the backplate. (The drum is harder than the backplate, so don't get carried away and bend the plate way out of shape.) On early 510s and 610s the backplate is really soft. Squirt some penetrating oil on the center of the drum so it'll soak between the drum and the hub. Do this on both drums; then take a break while it soaks in. Pick out your brass hammer (or get a friend, a steel hammer, and a piece of wood). Insert the screwdriver between the plate and the drum and begin to pry—gently at first, then harder if necessary. At the same time, tap on the sides of the drum, then once or twice on the center of the hub. If you don't have a brass hammer, place the wood behind the edge of the drum and tap it with your steel hammer. Stop, turn the drum so that it is in a different position; insert the screwdriver, then pry and tap again. The process can drive you insane, but the drum will eventually come off. If you have an early **510 or 610 sedan**, work from the rear with a punch and hammer, tapping on the edge of the drum and turning it occasionally.

•**Holes drilled in the drum models:** Make sure you have the correct 8mm x 1.25 bolts to thread into the drum. Use some penetrating oil to get the bolts started, then turn them in with a 12 or 13mm socket so there is *even pull* on both sides of the drum, forcing it straight off. If the drum binds, back the bolts off, then try again. Remove the bolts when it's off.

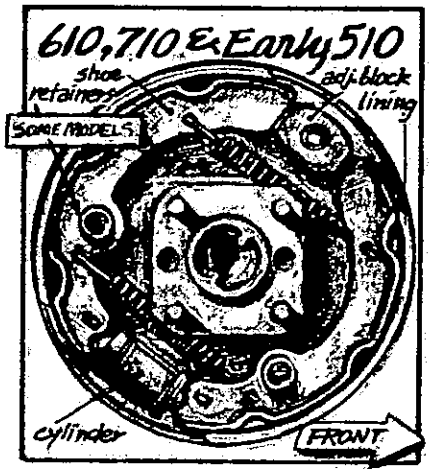
•**Everyone:** If really bound, you may need to adjust the shoes down more. Put on your dust mask. **Caution!** There is asbestos in brake shoe material, a known carcinogenic lung irritant. Use care when handling brake parts. There's usually a lot of dust in and around the drum which is full of the dreaded fibers. Don't blow or use compressed air to clean the stuff off.

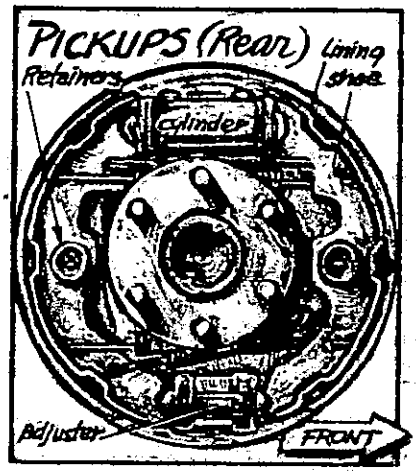
Step 3: Identify the Parts. CAUTION! Do not depress the brake pedal with the drums removed *without* first reading this entire step!

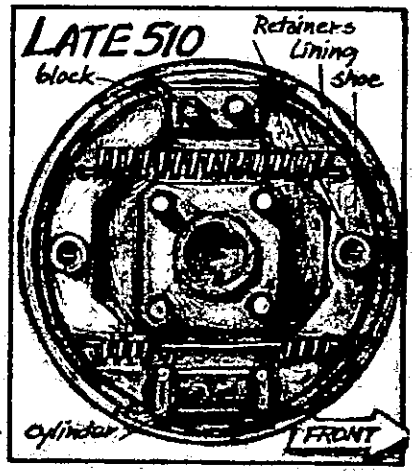
•**Everyone:** Compare your brakes with the ones in the pictures below.

•**510, 610 and 710 models:** Pre-1978 cars use a single piston wheel cylinder. 1978 and later cars use a two piston cylinder. You can tell which you have by how many rubber boots the cylinder has, one or two.

•**521, 620 and 720 models:** The wheel cylinder is dual acting, which means that it directly operates both of the brake shoes. The adjuster is at the bottom end of the shoes. The emergency brake lever is behind the rear shoe. The lever pivots on a pin at the top of the rear shoe. On 1983½ and later trucks a cable connected to the rear shoe activates a self-adjuster.



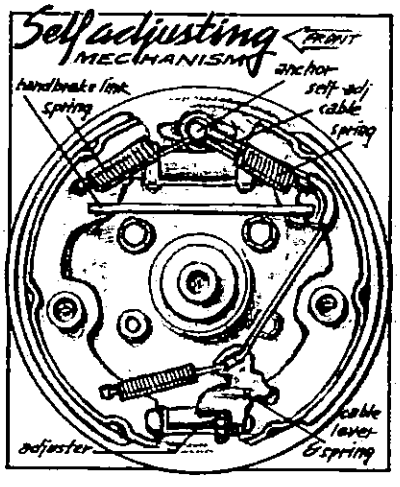




Step 4: Check Out the Wheel Cylinders and Shoes (all drum brake people).

First check for signs of fluid leaking from the wheel cylinders. If the works are coated with black, moist looking dust (rather than dry, light gray or tan colored dust) there might be a leak in the wheel cylinder. To check it out further eyeball the rubber boot(s). If fluid's leaking, this is where it will come from. Press on the boot(s) and pull the edge back slightly to see if there is visible liquid. A little fluid on the boot is normal, but if it is beginning to leak down and spread around on the cylinder body, you'd better replace the cylinder soon.

If the leakage is bad enough to have contaminated the brake shoes, you ought to replace them. Do not confuse a leaking axle seal (rear brakes) or grease seal (front brakes) for a wheel cylinder leak. Axle oil or grease and brake fluid smell different. Brake fluid washes off with water while axle oil and grease will not. If your drum brake fluid reservoir level was low, it's probable that the wheel cylinders leak.



Next check the condition of the brake linings. Measure 'em. If the linings are less than 1/8in thick, anywhere on the brake lining, consider replacement. The very bottom line is 1/16in (1.5mm). The lining should be pretty uniform in thickness, top and bottom, with no deterioration or separation between the bonding and the steel backing. If one shoe's worn down a lot more than the other, suspect a sticking wheel cylinder piston, stuck emergency brake cable or corroded adjuster slides.

Retainers, little springs with washers on either side of them, are on the steel part of the shoes. Front drums and early car (all except 1978 on 510) rear brakes don't have them. Look at both shoes to see that these springs and the washers, two for each spring, are complete and in position (see illustration in Proc. 8 [3]). There are two larger **return springs** between the shoes that should be straight—not bent or distorted—and in place. On pickup brakes of **pre-1982½ models** there should be a third, smaller spring just above the adjuster, hooked from the backing plate to the rear shoe. Look closely.

•**1983½ and later 720 pickups:** There are two upper return springs, one for each shoe and a third lower spring stretched between the front shoe and the adjuster lever. Carefully examine the parts for the self-adjusting mechanism.

Step 5: Examine the Brake Drum.

Pick up the drum and carefully empty out the asbestos dust into a trash can without releasing any of it into the atmosphere. Rub your finger over the shiny inside surface to check for grooving and wear. The surface should be even all the way from the edge into the face. Wear is evident if there is a "lip" between the shiny part and

the rusty edge, or if there are deep ridges (grooves) on the shiny braking surface. In either case, the drum may need to be resurfaced (machine shop job). Even if the drum is smooth and shiny, the surface may be glazed which will cause poor braking.

If a drum is worn past a point where if machined it would be dangerously thin, it'll have to be replaced. This is something the machinist will help you decide. There are numbers cast into the drum that specify the minimum thickness allowed.

•**Front Brake People:** Move ahead to Step 7.

Step 6: More Yet (Rear Brake People).

Check for a rear axle oil leak.

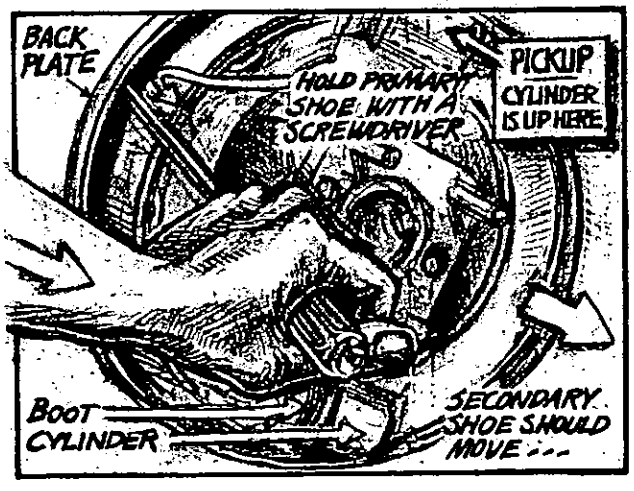
Locate the end of the axle—that flanged piece the wheel bolts to and the lug bolts stick out of. This is part of the axle which connects to the differential gear inside the rear end. Look around behind the flange where the axle goes into the back plate or axle housing. You'll see four bolts holding a **cover** around the shaft. An oil leak will be evident at the bottom of this cover or around it, as oil may have been slung by the rotating axle.

If there is liquid, wipe a little onto your finger to smell. Gear oil has a distinct odor, different than brake fluid or your dentist's cologne. It smells like sulphur. Contrast this to the smell of brake fluid. Brake fluid washes with water; axle oil does not.

If you haven't been losing brake fluid, and you suspect an axle oil leak, turn to Ch. 11, Pt. 2, Proc. 1 for more depressing advice. Of course, the possibility exists that you have both a wheel cylinder *and* a rear end leak, but let's hope not.

Step 7: Watch 'em Work.

It's a good idea to check out the actual operation of the brakes with the drum off. You need an assistant to do this part. You're going to watch the brake shoes move as your friend gently pushes down the brake pedal. Make sure that, upon your order, the brake pedal is pressed down ever so slowly until you say halt. While he or she does this, keep your eye on the wheel cylinder to see how it responds. **Caution:** If the pedal is depressed too far, the wheel cylinder piston(s) will pop out of the cylinders, making an awful mess. **Another Caution:** All brake drums except the one you're looking at should be slipped temporarily over their shoes.



Brakes

•**Everyone:** Look at the illustration (the left side is shown), and get your screwdriver ready.

•**510s through 1973, 610s, 710s, 521, and 620 Front Drum People:** When your friend pushes the pedal, watch the shoe next to the wheel cylinder dust boot start to move. Now set the screwdriver against the front (trucks) or the rear shoe (cars) to see if the adjuster or the wheel cylinder slides in the opposite direction. Halt! If the shims behind the wheel cylinder or adjuster stick from corrosion the secondary shoe won't slide easily.

Tell your assistant to let up on the pedal. The primary shoe should return to rest as the piston retracts into the cylinder.

•**521, 620 (1978), 510 (1978 on) and 720 People—rear brakes:** Watch both ends of the wheel cylinder as your assistant presses slowly on the pedal. (Don't let the pistons come too far out from the cylinder.) One side will probably move before the other. Insert the screwdriver against the shoe that moves first and pry. This should make the other piston and shoe move. If you can't get the second shoe to move, don't risk popping the cylinder; tell your assistant to stop pressing.

The shoes should return to their rest position when the brake pedal is released. If after a few tries the brake shoes do not react to the pedal action, you'll need replace the cylinders; they're probably corroded internally (Proc. 8). Push forward and back on the bottom of the shoes. The adjuster should slide on the backplate. If it doesn't, you should read Proc. 8 and deal with the adjusters. If you plan to do the brake work now, leave the drums off and get the parts you need for the job. Otherwise, put the drum and wheel back on, then adjust the brakes.

PROCEDURE 5: REPLACE FRONT BRAKE PADS (EXCEPT DRUM BRAKE 1969-77 PICKUPS)

Condition: Pulling, noisy, or poor braking brought you here. You should perform Proc. 3 and leave the wheels off.

Tools and Materials: Stool, pliers, Vise Grips, parts can, medium-large screwdriver (large channel lock pliers if you have them), safety glasses (wear them!), four new pads, rubbing alcohol or brake cleaner (if reusing old pads), 10mm socket or box-end, wheel bearing grease.

Remarks: 4WD People: If your rotors are shot, you need special tools to replace them. Have the garage doing this work replace the pads while the caliper's off and save yourself the grief.

Step 1: Block and Jack.

Raise and support the front end of the vehicle, using technique in Ch. 13, Pt. 1, Proc. 1.

Step 2. Remove Wheels and Identify the Surrounding Parts.

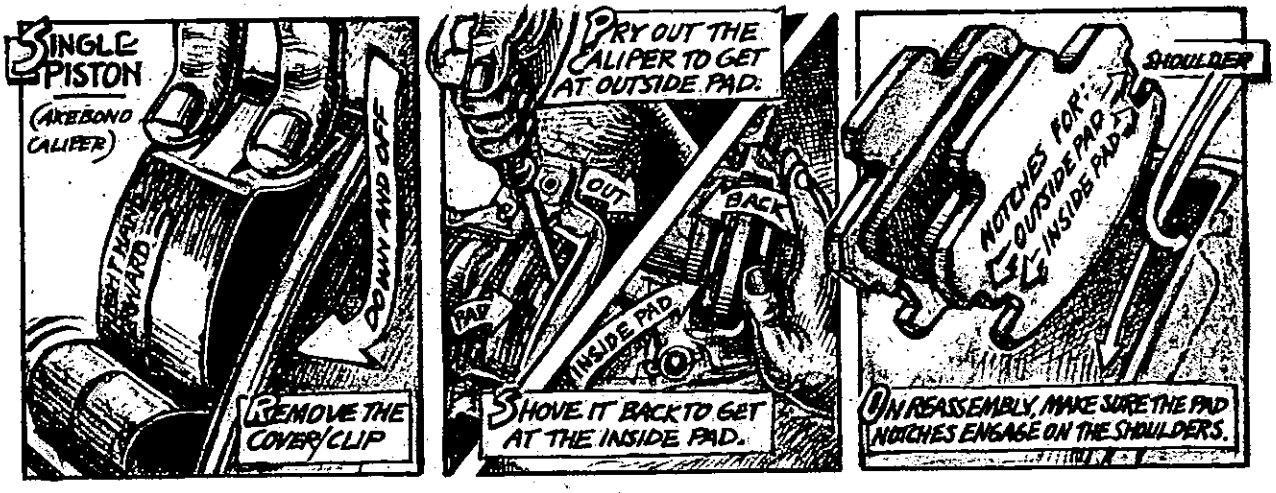
Begin on the right side. Remove and stash the lug nuts. Set the wheel aside. The center part, inside the lug nut studs, is the **hub**. The **rotor** is the shiny disc that turns with the hub. The **caliper assembly** houses the **pads**, which are set on either side of the rotor.

Step 3: Before You Can Remove the Pads.

NOTE: Angle the wheel so the caliper is closer to you.

•**510 (1968-73), 610 (1973-75), and 710 (1973-76) models** (you will be called **Single Piston People**): You have to remove the **sheet metal clip** covering the back side of the caliper assembly. Printing on it identifies rotation and the side it fits. It's bent at the ends to hold it into the housing and in the center to hold down the brake pads. Press down on the side sections with your thumbs while pulling the clip off. Don't force it. Pull it out of the pads and unclip the bottom. Keep the clip with the parts from the side you are working on.

To remove the pads, insert the tip of your medium-large screwdriver between the outer pad backing and the caliper housing (not the sheet metal part). The housing should move and, as you pry against it, the piston (behind the inner pad) will ease into its cylinder. Keep prying until the caliper housing stops moving. NOTE: If the reservoir is full, it may overflow when fluid is displaced from the cylinder. If the reservoir is full to the top, consider connecting the bleeder hose and bottle to the wheel cylinder that you're working on (Proc. 2 [6]).



Close the bleeder valve when the cylinder is collapsed. If the cylinder doesn't collapse even after the valve has been fully opened you'll have to remove the whole caliper to have the seized piston replaced.

Remove the screwdriver and wiggle the outer pad, toward the rotor, up and out. Set it aside and push the caliper assembly inward. If necessary, use a hammer to tap the outside, top and bottom of the caliper inward. When it has moved far enough, pull the inner pad out and up.

Now repeat this step on the opposite wheel.

•510 (1978 on), 610 (1975 on) 710 (1976-77), 620 (1978 on), and 720 (1980 on), 83 (11/82) 2WD and 1983½ 4WD (You are hereby referred to as **Dual Piston People**): There are **retainer pins** that hold the pads in place. A **safety clip** (or clips) goes through and fits between both (or each) of the pins. You'll find it (or them) between the outer pad and edge of the caliper housing. There are slight differences between clip designs, but whichever you have, carefully use pliers or a screwdriver to grab and wiggle or pry the clip out of the upper pin. You may have to turn the end of the retainer pins with the screwdriver or pliers to position and remove the clip(s).

Repeat this with the lower pin. Be careful not to damage the clip(s) or pin. Stash the clip(s) in the parts container right away.

Use the pliers to get a grip on the head (outside end). NOTE: You have either wire **springs** or flat steel springs that fit under the retainer pins to keep the pads from moving around. Hold both of the springs down with your fingers as the pins are pulled out. If the pins are frozen, use a little penetrating oil at the points where they fit into the caliper. But don't contaminate the pads or rotor with oil. Remove the bottom pin next.

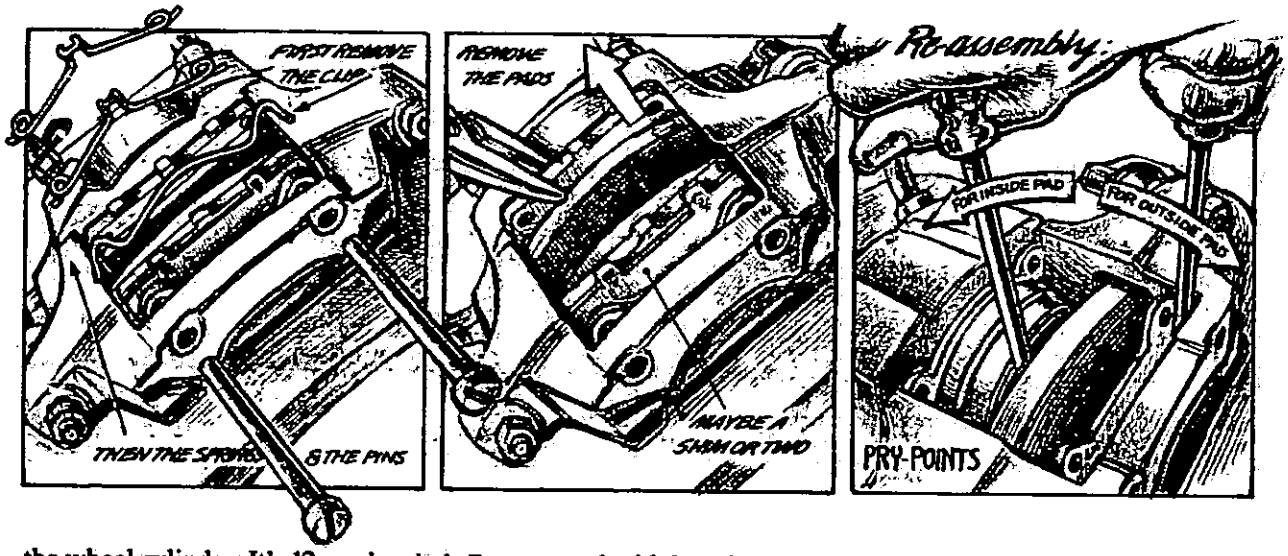
•610s produced 9/74 to 8/75 only: You have a **coil spring** on the lower pin that goes between the brake pads. Put your hand over the spring and pin as you withdraw the pin, otherwise the spring will fly. Slide it back over the pin and stash both in the parts can. If you lose this spring, go to Datsun/Nissan for another.

•Everyone: Grab the pad springs and put them into the parts can along with the pins. Theoretically the pads should now pull straight out. However, pads that are coated on the back or unevenly worn may be stuck. This means that the pistons have to be pushed into the wheel cylinders so the pads can clear the rotor (disc) and caliper. Start with the inside pad. Pry carefully between the pad's backing and the inside of the rotor. Lay the screwdriver tip flat on top of the lining between the steel pad backing and the rotor, then pry sideways. When there's space between the rotor and pad, slip the screwdriver straight down into that gap and pry the two apart, just enough so that the pad can be pulled up and out, not anymore than you have to. See note below.

Lay the pad with the lining face up. Do not contaminate it with brake fluid, grease, or hair tonic.

The outer pad is easier to remove because you can pry between the outside of the pad and the caliper. Move the caliper away from the rotor (disc) just enough to remove the pad.

NOTE: There may be thin metal shims behind each of the pads. Carefully remove the pads and shims; keep the shims with the pins and clips you already removed. There are usually two round inner shims and one rectangular outer shim. The shims may be stuck to the pads. **1983 on 2WD (11/82) and 1983½ on 4WD:** You have a flip-up style cylinder body. Find the lower (sub) pin bolt. Its head is visible on the inner side of the body below



the wheel cylinder. It's 12mm headed. Remove and withdraw it with a socket and pliers. Stash the bolt in the parts container.

Now lift the cylinder body up so it pivots on the upper (sub) pin bolt. NOTE: There are shims on the backsides of both pads. They may fall off or remain stuck to the pads. Keep track of these. If the cylinder housing doesn't stay flipped up by itself, tie it to the steering.

Look at the exposed back of the pads. There are two thin metal retainers one on top and one on the bottom end of the pad. They fit between the pad and caliper. Using pliers and maybe a screwdriver, carefully slide the outer pad out sideways and lay it with the lining side up. Account for the shim that already may have fallen off or is still stuck to the back of the pad. Now slide out the inner pad. It has two shims. The retainers are free once the pads are out. Put them in the container with the other parts.

•**Everyone:** NOTE: When the pads are out, do not push on the brake pedal because the pistons will pop out of the cylinders. Lock the doors to keep out pesty youngsters who might want to take an imaginary spin and fool with the pedal. Keep your old pads for identification and for help during reassembly. If you plan to reuse them, keep them clean and dry.

If you plan to remove the rotor to service the wheel bearings or replace the rotor, go on to Proc. 6.

Step 4: Examine Pads.

Brake pad bonding material, like everything else, loses efficiency with age, heat, and wear. If the pads are smooth, pretty even in color, and have lots of lining (¼in or more) left on them, they can be cleaned with brake cleaner or alcohol and reused.

If the pad lining measures 3/16in (2mm) or less in thickness, it must be replaced.

If the pads are saturated with brake fluid, they should be replaced.

If one pad is a lot more worn than the other, one side of the caliper isn't functioning as it should. This means that one of the pistons isn't working or the caliper housing is stuck. In this case the caliper should be removed and the piston rebuilt or the caliper's sliding surfaces cleaned and lubricated (Proc. 6).

Start a parts list if the pads and/or anything else looks worn. Always replace all the pads at the same time; they are sold in sets of four. Rotors can be replaced one at a time.

Step 5: Examine the Rotors.

Rub your thumb across the shiny part of the rotor to feel for wear (scratches are acceptable, grooves or furrows are not). It's a waste to replace pads if the rotor isn't in good shape. If past the pale, get the rotors turned at the machine shop or replaced, depending on your model. At the same time, you can service (repack) both of the **wheel bearings** and replace the **grease seals**.

If the pads are worn all the way down to their steel backing, the rotors will be marred and you'll have probably heard sounds of the battle each time the brakes were applied. Spin the rotor; if it wobbles, check for wheel

bearing play (Ch. 12, Proc. 1 and 3): If you have any questions, remove the rotor and take it to the machinist to be checked for wear and run out.

Most early car and all truck rotors can be turned (machined smooth) up to a point where they become too thin to handle the heat to which they are subjected. The machinist will determine that with a micrometer.

If the rotor is smooth on both sides (feel the back side with your finger) you don't have to turn it—as long as the rotor on the opposite wheel is usable. If you have to turn one rotor certainly do the other, unless you're really hurting.

If you want to remove and resurface the rotors, turn to Proc. 6. If only the pads get replaced, read on. If the old pads are going back in, clean them, then jump ahead to Step 7.

Step 6: Buy New Pads.

Make sure the new pads are exactly the same as the old ones. Early (Akebono style) pad linings are angled; the later ones are all flat. Take the old pads, as well as the month and year of your vehicle (stamped on the driver's side door jamb), to the parts store for positive identification.

If you have problems with squealing brakes, see Step 9. You may need to buy some anti-squeal compound.

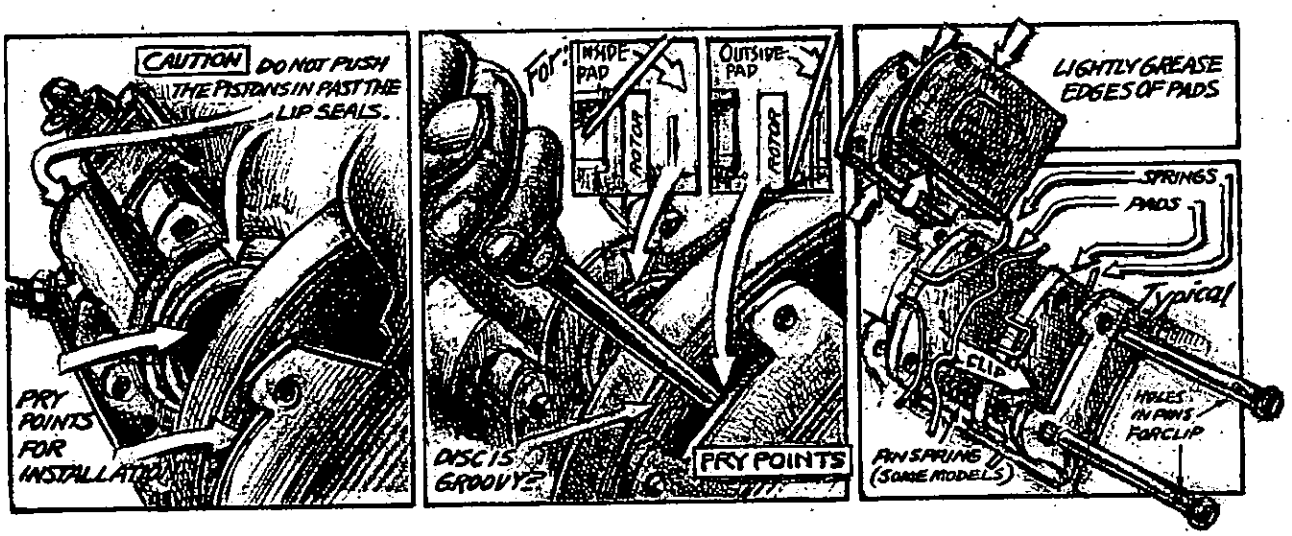
Step 7: Install Brake Pads.

Clean the inside of the calipers where the pads sit. Scrape off any scale. Do not contaminate the new pads with grease or brake fluid.

•510 (1969-73), 610 (1973-74), 710 (1974-75) single piston models: Lay out the new pads on clean newspaper. The pads for the left side of the car will have the steel backing on the left and the thick part of the lining on the inside top as you look at the width of the pad from the jagged (top back) side. The right side pads will be just the opposite—with the thick part of the lining on the top when the backing is on the right, looking at them from the jagged edge. Separate the pads left and right sides.

Start on the right side. The piston has to be pushed into the cylinder to make room for the new pads between the caliper and the rotor. If the piston is already a quarter of an inch or so from the edge of the cylinder, you won't have to do this. Carefully pry against the rotor and the hollow center of the piston. (If either the piston or caliper does not move, one or the other may be seized; the caliper then has to come off and/or the cylinder rebuilt or the sides of the piston scraped clean.) As you collapse the piston, look out for the reservoir overflowing. You can drain it off by opening a bleeder valve, see Proc. 2.

Look at the illustration in Step 3 and separate the inside and outside pad—the thick end goes down on the inside pad, up on the outside pad. Install the inside pad first. Put a little dab of grease in the deepest notch on both ends of the pad. Slip the pad into the caliper, with the lining against the rotor, until the top edge of the lining is even with the outside edge of the rotor. Push the pad inward until the deepest notch fits into the shoulder in the caliper housing.



Now slide the caliper toward you. Put a dab of grease on the shallow notch on the outside pad and slip it into the caliper. Make sure that this notch fits into the caliper with the lining even with the rotor edge.

Once the pads are in place, you can refit the clip. An arrow and writing on the clip indicate forward and right or left side of the car.

Put a spot of grease on the curved ends and on the humps across the pad (underneath) side of the clip. Install the bottom end under the cover piece in the caliper. Press the humps down into the pads. Then, one at a time, fit the two bent ends on the top under the edge of the caliper cover. The clip should fit evenly into the tops of the pads with the ends securely located in the caliper.

Spin the rotor and listen for any noise other than the slight rubbing of the pads against the rotor. If improperly installed, the clip will rub on the rotor (or the wheel, once it is on).

Install the pads and clip on the left side of the car. Then go to Step 6. **610 (9/74 on), 710 (9/75 on), 620 (9/77 1983 (11/82) on 2WD and 1983½ on 4WD), 720 and 510 (7/78 on) dual piston models:** Start on the right wheel. The pistons have to be pushed back into the wheel cylinder. The outside piston is the one that is closest to the rotor. Note the lip seal around the edge of the piston. **The piston should be pushed only to the edge of the lip, no further.** Use your thumbs to collapse the piston. Keep an eye on the reservoir. It may overflow from the fluid you push out of the cylinder. Open the bleeder valve to drain the excess (Proc. 2).

If the piston sticks, carefully place the tip of a medium-large screwdriver on the inside of the piston and the shaft against the rotor's edge. (Large channel lock pliers work better for this if you have them.) Pry outward slowly, keeping an eagle eye on the piston and lip seal.

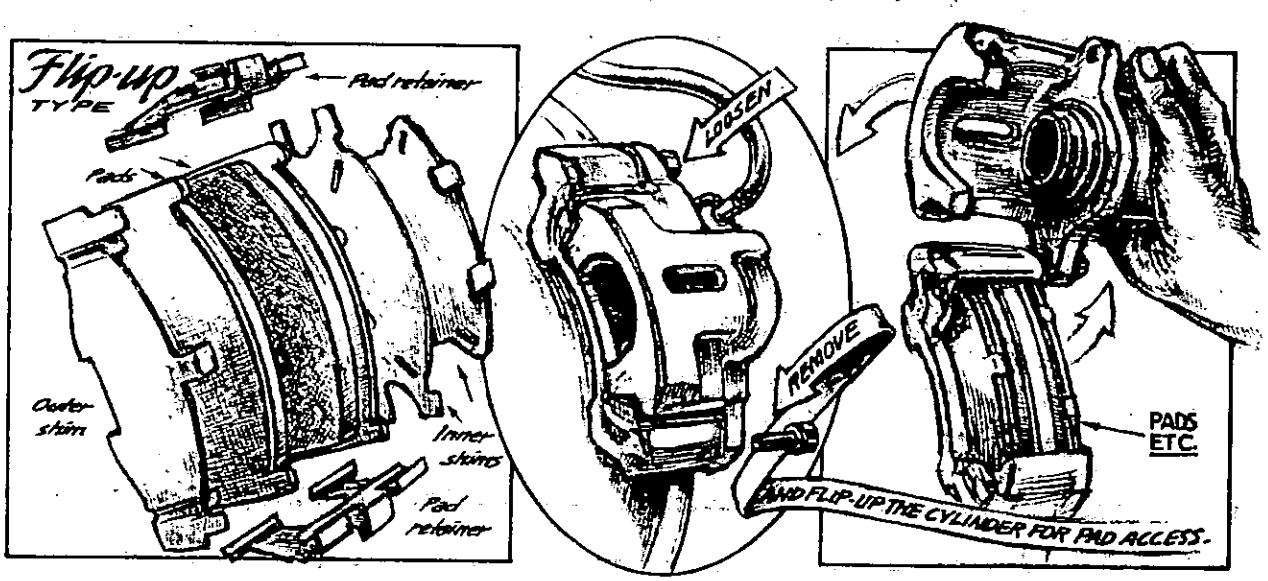
Now for the inner piston, see the middle frame of the illustration. Insert the screwdriver as shown. But first check the inner piston and lip seal as well as the reservoir level. If the caliper or pistons won't move, scrape the scale off the sides of the piston. If that fails, remove the assembly to be cleaned and/or rebuilt (Proc. 6).

Set some wheel-bearing grease close at hand and a clean rag. Scrape off the area inside the caliper where the pads go.

If you have problems with excessive brake squeal, see Step 9.

Put a light smear of grease on the top and bottom steel edges of the pads. (See the third illustration frame.) If you have pad shims, and they are not rubber-coated, clean them well and coat both sides with some grease or anti-seize compound. Clean, but do not lube, rubber-coated pads. If you have only one shim, it fits behind the outer pad. The ears of the shims fit over the top edge of the pads and/or holes matched with the pin holes. If you're reinstalling old pads, scrape off the backing. If rubber-backed, scrape then recoat them with anti-squeal compound (Step 9).

Slip the outer pad (then shim) into the caliper, with the lining side facing the rotor and pin holes facing up (back). Push the caliper toward the rotor and install the inner pad (then shim).



If the pins are rusty, sand them clean. Coat the pins with a little grease or anti-seize and set aside. Now clean up the springs and clip(s). You may want to look back at the drawings in Step 3 if your springs look different from the ones here. Start with the outer pad. **Flat or Straight Wire Spring People:** Fit the bent part of the spring against the top of the lining and the squared tab over the steel backing. Hold the pad and spring in place while you line up the pin holes. Push the bottom pin through the caliper (shim) pad and over the curve in the outer spring, then stop. Push down on the top end of the spring and insert the upper pin part way.

Curled Wire Spring People: If your spring is wire and rather curly or bent, the center squared part fits against the back of the pad lining. If one end has a loop in it, align it with the bottom pin.

•**610s produced 8/74 on:** Remember the coil spring that covered the lower pin? Replace it between the pads as you push the bottom pin through the holes.

•**Everyone:** Position the inner spring and push the bottom pin over it then through the pad (and shim). Push down the top end of the spring and push in the upper pin. Both pins must be in all the way.

•**610s produced 9/74 to 8/75 only:** Pick up your two clips. Turn the pins so you can see the holes and install the clips.

•**All Other Dual Piston People:** Your clip fits through both pin holes with the curved side facing up. To get the clip through both holes, the holes have to be lined up just so; turn the pins until the holes are visible. Put one end of the clip through the bottom hole. Hold the center of the clip in one hand while you bend the free end toward the upper pin hole. Be careful not to bend the clip too much. Once it is through both pins push down on the clip while turning the pins back and forth to seat the clip.

Repeat the step on the other wheel.

•**1983 on 2WD (11/82) and 1983½ on 4WD:** Notice where the pads fit into the housing. They contact on the top and bottom. Smear some grease or anti-seize compound at each of these four points. Don't get any on the rotor.

Now match the inner shims with the inner pad. If using the old pads, scrape them and the old shims smooth. (If you have squealing brake problems, see Step 9.) Put a dab of grease or anti-seize on the top and bottom edges and the pad's metal backing. Then coat both sides of the shims with grease or anti-seize compound and put them together as shown in the illustration. If you have round shims, place both flat side toward the pad. To fit the housing over the inner pad, you have to do so with the shims sitting in the piston. If you have two rectangular shims, the larger one without tabs fits against the pad backing while the other one fits with the tabbed side on top of it. These tabs are wear indicators that make noise when the lining's worn down.

Set the pad and shims aside on a clean surface. Find the two spring retainers and wipe them clean. Put dabs of grease or anti-seize on the ends of both retainers. One of them fits into the housing on top of where the pad fits, and the other goes below. Install one of the retainers wide end first, flat side down. Now put the other retainer in on top with the wide side first and the flat part up against the housing. If it doesn't stay there by itself, you'll have to hold it up while installing the inner pad.

Pick up the inner pad without the shims. Install the pad so the lining faces the rotor and the tabs on the backing face rearward. Slide the pad sideways into the housing between the retainers. You'll have to push down on the bottom retainer spring and pry up on the upper one to install the pad.

If you have round shims, put them together. The one with the four tabs fits (tabs first) into the hollow piston, which has been flipped up; the tabs should center it. The tabs on the other shim fit into the first shim you installed, and the lube should keep the two together, in place. If you have rectangular shims, stick them against the pad backing; use lubricant to hold them together and to the pad.

When the inner pad and shims are secure, push the cylinder housing inward, sliding on the upper sub-bolt. Now lower the housing down over the pad and rotor. When it's positioned so the lower sub-bolt hole is aligned, insert a medium/large screwdriver through the opening in the back of the housing, placing its tip against the outer edge of the rotor. Use the screwdriver as a lever to slide the housing outward as far as possible.

Lift the cylinder housing back up. Install the outer pad as you did the inner one. But first scrape and coat its shim and stick it to the pad backing with the single tab over the back edge of the steel backing. If there are two other tabs, they fit under the forward edge, facing the lining. The shim should stay put while you lower the housing over the pads and rotor. If it won't fit over the pads, you'll have to repeat the lever routine.

When the housing's in place and the sub-bolt holes are aligned, install and tighten the bolt with a 12mm socket. The torque rating is 16-23 ft.lbs, or pretty snug.

Step 8: Put on the Wheels and "Settle" the Pads.

Make sure you have installed all the brake parts and that both bleeder valves are closed.

Pump the brake pedal a few times. This will seat the pads against the rotors. If you did not bleed the brakes and you want to or if the reservoir went dry, do Proc. 2 now. In any case, check and top up the brake fluid.

Finally, replace the wheels, tighten the lug nuts once the vehicle is on the ground, clean yourself up and if you're tired, take a nap. When you're ready, go for a test drive. But first, apply the brakes a few times to check them out. Recheck your brake fluid level after the drive. If it's all OK, buy yourself some Mr. T auto air freshener or foam dice. If something is amiss, run through Proc. 1 before cursing your head off.

Step 9: Excessive Front Disc Brake Squeal.

Squealing noises when braking are most aggravating. They frequently turn up in wet weather, although not always. As I mentioned, Nissan/Datsun sells special (expensive) rubber-coated shims that fit between the pad backing and the caliper. Lead-based **PBC grease**, also sold by Nissan, works too when used properly. An alternative to this is a lead-based **anti-seize compound** instead of the grease. Other disc quieting compounds are also available. I discuss them below. In any case, you'll have to disassemble the pad assemblies.

A trick used around wet western Oregon to cure the wet squeal problem is to file the edges of the pad lining slightly to round them off. Some mechanics also cut a groove 1/8in wide in the length of the pad lining with a hacksaw. Although I know this does work, I recommend that it be done under the supervision of a professional who has done it before.

If your problem is a constant one, I suggest using a combination of remedies. Coat the shims with the lead-based lubricant as mentioned in this and Step 7. Also use an anti-squeal compound (available from most parts stores) on the pad backings and edges.

Most of these products provide application instructions. Follow them carefully. **Caution:** Some products tell you to put the liquid on the lining rather than the backing. Make sure you know which type you have before using it. I use the stuff that goes on the backing and feels like liquid rubber then air-dries to harden. I put it not only on the main part of the backing but also on the top and bottom edges of the pad backings, where they fit into the housing. This is where most noise occurs, I believe. Don't put too much on, certainly none on the rotor or pad linings.

Recently I have used a compound (cadmium?) grease made by Girling that's sold in little packets. I get it from my friend Dave Lang, a Volvo mechanic, and apply it like the other stuff but more sparingly.

Also, read Proc. 8, end of Step 12, about rear brake squeal.

PROCEDURE 6: REMOVE AND INSTALL FRONT ROTORS AND CALIPER ASSEMBLIES, AND FRONT DRUMS (Everyone except 720—4WD)

Condition: You're here because the rotors are scored or grooved, and have to be removed to be machined or replaced. There is a leak in one of the front disc brake wheel cylinders (they should be rebuilt in pairs by an experienced garage; the procedure is not covered in this book). The wheel bearings are to be checked and repacked. **4WD People:** You must have the hubs removed and rotors replaced by a properly equipped garage. It takes special tools and knowledge to get the hubs off. There's more on front wheel drive in Ch. 11, Pt. 1, Proc. 15. Have the drive axles checked while the hub(s) is off. You can use this procedure to remove and install your "caliper" assembly.

Tools and Materials: Penetrating oil, Vise Grips, 10mm and 14mm box end, two 1in x 1/16in and two 1in x ½2in cotter pins (single piston people), basic tool kit, 10mm brake line wrench (optional), small hammer, bleeder hose and bottle, mechanic's wire, baggie, nail polish or paint, wheel-bearing grease, anti-seize compound, solvent and brush, wheel grease seals, emery cloth, and drip pan.

Remarks: If you have to replace the flexible brake line, read Step 3 this procedure and Ch. 12, Proc. 4 (2).

Step 1: Jack It Up and Remove Front Wheels.

Loosen the lug nuts slightly, then safely raise and support the vehicle. Refer to Ch. 13, Pt. 1, Proc. 1. Remove the right wheel. Drum brake people go to Step 4.

Step 2: Remove the Brake Pads.

•**All Disc Brake People:** Go to Proc. 5 (2-6) then return here.

Step 3: Remove the Caliper.

NOTE: I refer to the caliper assembly as the cylinder housing and yoke (or torque member) combination.

• **510 (1969 to -74), 610 (1973 to -75), 710 (1974 to -76) single piston models:** If the cylinder and yoke are OK and there is no need to replace the flexible brake line, leave the line connected, and go to the next paragraph. If you plan to remove the caliper assembly, the flexible brake line has to be loosened. Find a hexagonal fitting where the flexible line enters the wheel cylinder. Fit the 17mm open-end over the fitting, then tap on the other end of the wrench to move the fitting counterclockwise. Stop when it's loose.

On the upper side of the caliper assembly there's a 10mm "castellated" nut that holds a **pin, spring** and **hold-down bracket**. The **cotter pin** which fits through the **nut** and pin is often rusted and hard to remove. Carefully bend the legs of the cotter pin straight; then grab the rounded end with the pliers to lever the pin through and out. See Ch. 13, Pt. 1, Proc. 2. It is a drag to get this cotter pin out if it breaks.

Grab the hold down pin with pliers while you remove the nut. The hold down pin, spring, washer and bracket will slide out of the caliper. Put all of these parts on the pin held by the nut, then drop everything into the parts container.

At the bottom opposite end of the yoke is a 14mm castellated nut, pin, and spring arrangement. Remove this cotter pin the same way as the other one, then remove the nut. (There's a washer behind the nut and then the spring with another washer between it and the caliper.) Put all these parts with the others.

Look again at the flexible brake line. If there is a **spring** attached to the line, disconnect it at the fitting clamped to the line and let it hang.

Pull the caliper assembly up and away from the housing. Don't let the caliper hang from the brake line. Wrap a piece of wire around the caliper and coil spring to avoid straining the brake line. Now the rotor can be removed (Step 4).

If you're going to separate the caliper from the brake line, get a drip pan to catch the brake fluid. Hold the caliper assembly in one hand and the loosened line fitting in the other. Turn the assembly off the line, clockwise. Find a copper washer between the line and the wheel cylinder and put it in your parts container. Hold the inlet hole upright until you can dump the fluid inside into the drip pan. If the cylinder is going to be rebuilt, make sure you can get the parts and someone to do the work. The calipers should be rebuilt in pairs.

•**510 (78 on), 610 (75), 710 (75 on), 620 (77 on), and 720 (up to 1983-½), dual piston models.** You have to disconnect your brake line so as not to damage it. Find the brake line connection at the wheel cylinder. The **fitting** is 10mm. Squirt a little penetrating oil on the threads. Place the 10mm open end over the sides of the fitting and turn it counterclockwise. If it starts to round off the squared edges of the fitting, stop. (There's a special wrench for this, but with care and the Vise Grips info in Ch. 13, Pt. 1, Proc. 2, you can do without it.)

•**Pickup People (except 1983 (11/82) on 2WD and 1983½ on 4WD):** The brake line is held by a bracket on the back of the caliper assembly. Read through this step and remove the bolt that holds the line, then proceed to **Everyone** below.

•**Everyone (except 1983 (11/82) on 2WD and 1983½ on 4WD):** Unscrew the nut fully. Now follow the line to where it connects to the flexible line. Loosen that 10mm nut and carefully turn the line inward away from the cylinder and out of the way. Place a drip pan underneath the line to catch brake fluid. Take care not to damage the line or fitting.

•**1983 on 2WD (11/82) and 1983½ 4WD:** You need only disconnect the brake line if you're taking the caliper assembly off for repairs. Otherwise leave it connected, but don't let it hang on the brake line; tie it to something nearby like a steering component. When that's done go below to remove the caliper.

To Disconnect the Brake Line from the Caliper (Flip-Up Caliper People): Your brake hose connects to the cylinder housing with a bolt through the fitting that mounts on top of the housing. (Scribe a scratch or paint mark on the fitting and a matching one on the housing.) Put a drip pan underneath and unscrew the 12mm bolt clockwise. Before removing it, account for the washer that fits between the fitting and housing. Withdraw the bolt and find another washer between it and the fitting. Stash the bolt with washers in a clean container. Let the hose hang.

To Remove the Caliper Assembly (Everyone): Look behind the backplate, in front of the cylinder. Two 17 or 19mm bolts with washers hold the caliper or torque member to the steering assembly. Don't confuse these with the smaller gripper or sub-pin bolts. Use a socket, short extension (and breaker bar) to loosen and remove the bolts. They'll be tight, and your breaker bar may be too long to work with easily so get a good socket fit on the bolts before trying to loosen them. Once the bolts are removed the caliper assembly will pull up and away from the hub. (On pre-1983 (11/82) 2WD and 1983½ 4WD pickups, the upper bolt secures the brake line bracket. Move the lines aside. On all pickups, slide the caliper out from between the backing plate and steering arm.) Hold the caliper upright until you can pour the fluid inside of it into the drip pan. Stash the bolts and washers in a container.

If you are having work done on the wheel cylinder or caliper or yoke/torque member, take it to a reputable garage or the Datsun/Nissan dealer for rebuilding. Otherwise, keep the assembly with the other parts from that side of the vehicle, marked left or right.

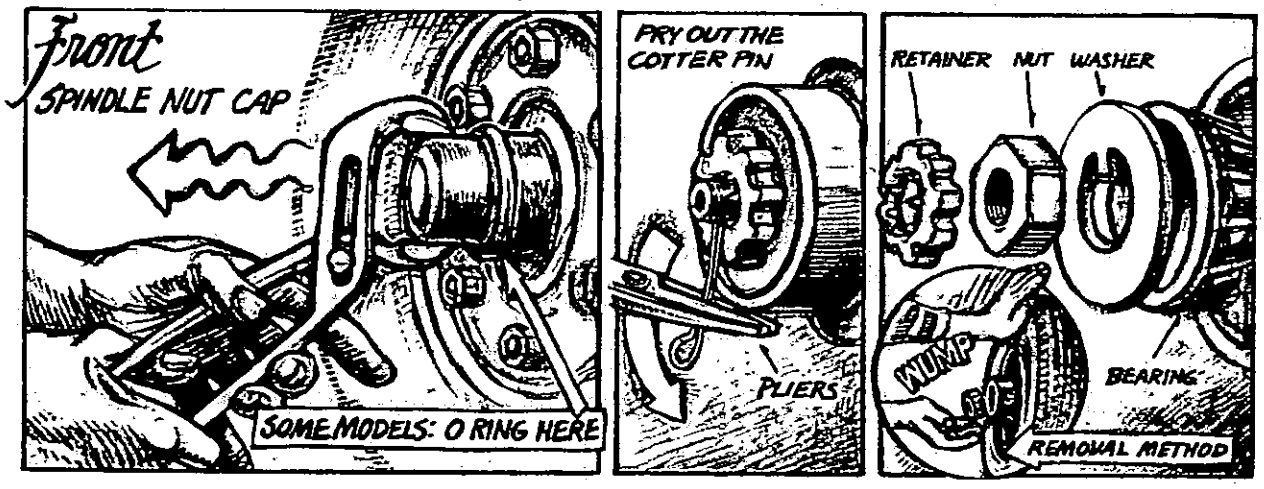
If all you want to do is remove the caliper assembly and not the rotor, then carry on with your caliper business and come back to Step 7.

Step 4: Remove the Rotor or Drum and Hub (all except 720, 4WD).

This step applies to all vehicles (disc and drum brakes) covered in this book. At the center of the hub you'll see a rounded **cap**. Use wide-jawed pliers ("'Channel Locks") to remove it, see the caution strip below. Set the cap, cup side up, nearby on a clean, level surface. If you plan to only work on the wheel bearings, proceed now to Ch. 12, Proc. 3.

With the cap off you can see the tip of the **front axle** or **spindle** and the **nut**, **retainer**, and **cotter pin** that holds the wheel bearings and hub in place. Straighten the legs of the cotter pin and pull the pin through the axle from the head side (see illustration below). Keep the pin to match up a fresh replacement. Next take off the **retainer**, which just slips off the top of the nut. (521s and early 510s have a slotted nut with no retainer.) The nut should come off, counterclockwise, with your fingers, or loosen the nut with a wrench or pliers. Put everything you remove into the cap for clean safekeeping.

Under the nut is a **washer** with a little tab that fits into a groove in the top or bottom of the spindle (axle). Bump the top outer edge of the drum or rotor and the washer and **outer wheel bearing** should pop out of the hub. IMPORTANT: Catch the bearing so it doesn't hit the floor. Store it in the cap with the rest.



•**Disc Brake People:** You might have to pry behind the rotor, at a point where the backplate doesn't bend, to coax the rotor out.

•**Everyone:** Now the hub assembly (rotor or drum) can be pulled off the spindle.

•**Drum brake models:** If the drum is stuck, and it won't spin, push the drum back onto the spindle and turn to Proc. 2 to adjust the shoes away from the drum.

•**Everyone:** Be extra careful not to drop the rotor or hub. Mark rotors and hubs left and right with chalk or nail polish to keep them separate. If you plan to have the rotors or drums turned (resurfaced), you'll have to remove the inner bearing (Ch. 12, Proc. 3 [7]).

Step 5: Separate and Assemble the Hub and Rotor or Front Drum (Optional step for disc brakes people who have to replace a rotor).

NOTE: The front drum can be easily tapped off and put on the hub.

Around the inside of the hub and center of the rotor are two or four bolt heads. These have to be removed for the hub and rotor to separate. These bolts are usually rusted and tough to remove. Squirt penetrating oil onto the bolts from the outside. Position the assembly, hub side down, in the jaws of a vise; take care not to damage the hub. No vise around? Have a friend hold the rotor to keep it from turning while you loosen the bolts. The bolts are 17mm and *tight*. You'll probably need a breaker bar or cheater on the ratchet. Once the bolts are out of the hub, the two pieces should come apart with a few taps of the old hammer. **Do not** pound on the edge or hub (the lip around the seal cavity). NOTE: There may be a **baffle plate** screwed into the hub which can be removed with a 10mm socket and penetrating oil.

When reassembling the rotor and the hub, make sure the mating surfaces are scraped clean. Clean up and oil the bolt threads; then screw them in with their lockwashers and tighten them evenly until they are as tight as they were before. Make sure the two parts are completely flush with each other and carry on with the next step.

Step 6: Install the Hub and Drum or Rotor.

NOTE: If you need to service the wheel bearings, see Ch. 12, Proc. 3.

Set the rotor or hub on the side of the vehicle it goes on. The outboard bearing, washer, nut, and new cotter pin should be spread out on a clean surface all ready to install.

Wipe off the spindle with a rag and brush the threads clean. Any sharp metal burrs on the axle or on the shoulder at the inside base of the spindle should be smoothed out with emery cloth.

Carefully, fit the drum or hub onto the spindle. Position the tip of the spindle inside of the inner wheel bearing and slide the hub straight in until it stops and the spindle's threads are sticking out. The inner race of the inner bearing may hang up. On drum brakes the brake shoes may have to be adjusted down or centered (moved up, down or sideways) before the drum will fit. Once on, there should be an inch or so of the threaded spindle sticking out of the hub.

Pick up the outer wheel bearing and washer. Notice that one edge of the washer is more rounded than the other. This rounded side should face out with the squared edge toward the bearing. Slide the bearing over the end of the spindle until it is flush with the hub (race). Now slide the washer over the spindle with the tab lined up with the groove in the threads. Push them into the hub as far as they'll go. The bearing rollers should now be seated in and against the angle of the race and the hub should turn. Now start the nut onto the spindle, turning clockwise until it contacts the washer and bearing. (The more square or non-castellated side of the nut goes against the washer.) Wiggle and spin the drum or rotor to see if the bearings are in all the way. Do not overtighten the nut—you just want it to contact the washer.

•**Drum Pickup People:** Go to Ch. 12, Proc. 3 (4). When the bearings are adjusted on both wheels, adjust the brakes and lower the truck (Proc. 2).

•**Disk Brake People:** Go on to Step 7.

Step 7: Install the Caliper Assembly (all disc brake people).

Separate the caliper assemblies left from right, if off the vehicle.

•**510 (1969-74), 610 (1973-75), 710 (1974-76) single piston models:** If the caliper is separated from the brake line stay here. Otherwise, go on to the next paragraph. The flexible line threads into the wheel cylinder.

The hole for the line is near the bleeder nipple. The threads on the line as well as the hole have to be absolutely clean. Find the copper washer for the fitting and set it over the threads. Turn the wheel cylinder and caliper counterclockwise onto the fitting. Make sure the threads match when they meet, pick up the 17mm open-end wrench. Hold the caliper firmly while you tighten the fitting just enough to keep it from vibrating loose or leaking.

Look at the **caliper assembly**. The hole in the bottom of the assembly fits over the pivot pin set in the bottom of the mount which is attached behind the rotor. Look closely at the underside of the caliper and the top of the mount. Locate the shiny contact points where the two parts stick against each other. These points should be sanded off and dabbed with grease. Get the big nut, spring, and thick and thin washers ready.

Position the caliper over the mount so the flexible hose is gently curved, not twisted. The gap in the yoke goes over the rotor, with the piston on the inside. Put some grease around the pin and on top of the caliper. Pick up the thin washer and slide it, the spring, and then the thicker washer over the pin. Thread on the castellated nut, square side first. Tighten the 14mm nut until the cotter pin hole is fully visible. Insert the larger cotter pin through the slots and hole in the pivot pin, spread and bend the legs around the sides of the nut.

Find the **holddown pin, spring, and washer** in your parts container. Remove the nut. There should be a bent steel bracket, then washer and spring on the pin in that order. Keep them all together. Put a dab of grease on the bottom, flat side below the tab where it contacts the caliper. Slip the pin through the upper hole in the caliper from the front under side so the threads are sticking up and back, with the tit on the bracket fit into the cut-out in the top of the caliper. Hold it all in place, and put on the 10mm nut with the slots facing out. Turn the nut until the cotter pin hole shows through the slots. Slip a new cotter pin through the slots and the hole in the pin. Bend the legs around the nut.

Now put your hands on either side of the caliper assembly and try to slide it in and out. It should move over the mounting smoothly. Follow the flexible brake line up to the little spring, hook the spring into the clamp on the brake line and up into the hole in the bottom of the **coil spring perch**. Now go on to Step 9.

•**510 (1978 on), 610 (1975 to -76), 710 (1976 on), 620 (1978 on) and all 720 Dual Piston People up to 1983 (11/82) 2WD and 1983½ 4WD** (you are all **Flip-Up Caliper People**, see below): There are two parts to the caliper assembly, the yoke and the wheel cylinder. The yoke surrounds the wheel cylinder and pistons.

The brake cylinders are designed to slide within the yoke. You'll see the slot in the top and bottom of the cylinder where the yoke fits. Squirt a little penetrating oil at the sliding point where the two pieces join. Be very careful not to push either of the pistons any farther into the cylinders. If the caliper was sticking it should be disassembled and repaired before going any further.

•**All Dual Piston and Flip-up (1983 (11/82) 2WD and 1983½ 4WD) Caliper People:** Find the two 17mm or 19mm bolts with washers in the parts container. Put some penetrating oil on their threads and set them aside.

If the brake line is connected, and the caliper assembly is tied up near by, free it. When you reposition it, make sure the brake line isn't twisted but curves smoothly. Way cool, no?

The caliper fits over the rotor with the wheel cylinder on the inside and the bleeder valve on top. The bolt holes have to align. (**Pre-1983 (11/82) 2WD and 1983-½ 4WD Truck People:** The upper caliper hole fits between the back plate and the steering arm.) (On all **4WD and 1983 (11/82) on 2WD**, the caliper fits between the spindle and steering knuckle.) Set it all straight; then start the bolts and washers. **Pre-1983 (11/82) 2WD and 1983-½ 4WD Truck People:** Line up the brake line and bracket with the upper hole.

•**Everyone:** If one bolt is longer, insert it through the upper hole. Use a socket and breaker bar to tighten the bolts. Make sure the tool is on the bolt head properly and watch your knuckles! You want to get the bolt tight. Don't get carried away, just flatten the lockwasher and then some.

Step 8: Connect Brake Lines to Wheel Cylinder.

•**All dual piston pre-1983 (11/82) 2WD and 1983½ 4WD People:** Find the metal brake line end. Clean out the exposed end of the steel line and the nut. Line up the threaded nut with the hole in the wheel cylinder (or fitting). *Don't try to thread in the nut until you are sure the end is straight and square to the cylinder (or fitting).* The flanged end of the line has to fit squarely into the wheel cylinder (or fitting). Start the threaded nut into the hole, turning it by hand—never force it. Tighten the nut with the 10mm open-end wrench. If the sides

are such that you can't grab them with the open end, it's possible to snug the fitting with more brutal tools, an art described in Ch. 13, Pt. 1, Proc. 2. Follow the line to the upper fitting and tighten it. Repeat this step on the opposite side of the car.

•1983 on 2WD (11/82) and 1983½ on 4WD: Do this only if you disconnected the brake line. Find the hollow bolt and two copper washers in the parts stash. Wipe them clean then find the brake hose and fitting nearby. Wipe the fitting and the area around the hole where it mounts to the wheel cylinder.

Pick up one of the washers and slip it around the bolt. Stick the bolt through the hose fitting and the other washer over the exposed bolt end. Position the hose fitting against the housing so the flat side of the fitting butts against the lumps in the housing. The hose should have a smooth curve to it; the marks you made should match.

Thread the bolt tight against the washers and tighten it with a 14mm box-end wrench until it's snug. You'll feel it "sink" into the soft copper washers. Do not overtighten this bolt!

Step 9: Replace the Brake Pads.

While you're here, squirt a bit of penetrating oil onto the bleeder valve. Now turn to Proc. 5 to replace the pads.

Step 10: Bleed the Brakes (only necessary if you separated the caliper assembly and brake line.)

See Proc. 2 (6 and 7). You only need to bleed the front brakes.

Step 11: Put the Wheels on, Adjust the Front Wheel Bearings and Lower the Vehicle.

Turn to Ch. 12, Proc. 3 (4).

Then go out to the movies.

PROCEDURE 7: SERVICE FRONT DRUM BRAKES (521 AND EARLY 620 MODELS)

Condition: You've done the check-out procedures and know that front brake work is necessary.

Tools and Materials New brake shoes (see Remarks below), grease seals (maybe), safety goggles, dust mask, good string or light gauge wire, containers for parts and a drip pan, new adjuster or shims if necessary, wheel bearing or chassis grease, emery cloth, penetrating oil, tooth brush, solvent. *Optional:* light gloves. If necessary: Top Return Spring (red) #41021-32200, Bottom Return Spring (large, yellow) #41021-36700.

Remarks: If the brake drums need to be "turned" take them to the machine shop at the same time you go shopping for shoes. These trucks tend to pull to one side during braking. Replacement brake shoes sold by Datsun have different lining material on each pair of the four shoe brake set. There are two *fore* and two *after* shoes, which are installed with the fore shoe in the frontmost (lead) position and the after shoe in the rearmost (trailing) position. Aftermarket shoes don't usually make this distinction, but compare the lining material and consult the store you bought them from if you're doubtful.

Step 1: Block and Jack and Remove Front Wheels.

Before jacking up the truck loosen the lug nuts. For complete instructions see Ch.13, Pt. 1, Proc. 1 and 2.

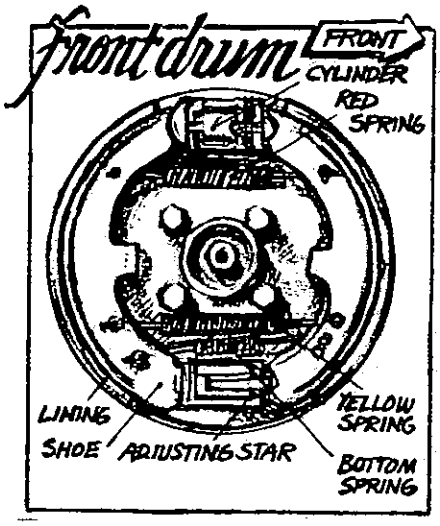
Step 2: Remove the Brake Drums.

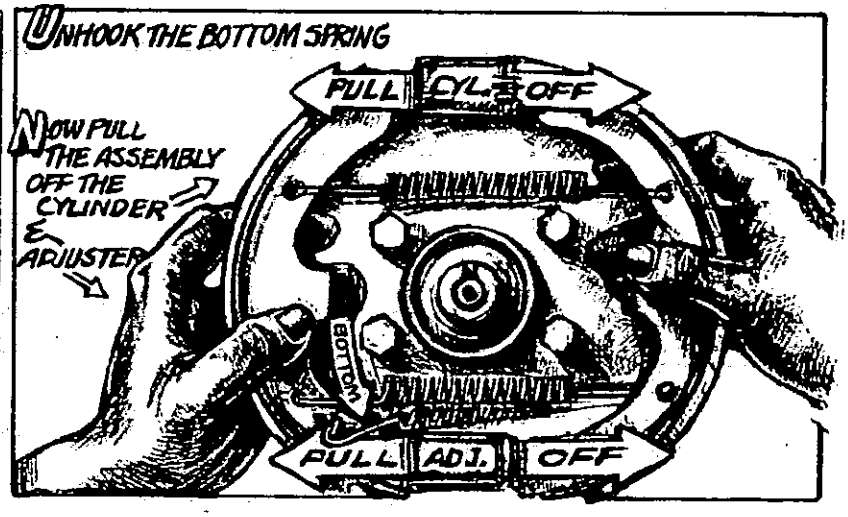
Read Proc. 6 (4), then return here.

Step 3: Remove Brake Shoes and Springs.

Caution: You'll be dealing with springs and asbestos dust, so I recommend wearing light gloves, safety glasses, and a dust mask.

Refer to the illustration. Find the smaller **bottom spring** between the big, yellow bottom spring and the adjuster assembly. Use pliers to grab and disconnect the long end of the bottom spring from the hole in the rear shoe. Slip the other end off of the back plate. Put the spring into a parts container.





Now for the shoes. Start on the top rear. Get a good hold on both shoes and pull the top of the front shoe out of the wheel cylinder slot. Hold onto the rear shoe so the spring doesn't drop out. Next, pull the top of the rear shoe out of the wheel cylinder, then tilt both shoes toward you and out of the adjuster slots. Hold the shoes apart to keep the springs intact. The rear part of the adjuster will probably fall out. Stash it in the parts container along with its spacer washer (if there is one).

Lay the shoes flat on the ground. Keep the springs on the shoes until you're ready to install the new shoes. When you buy new shoes, the parts people may want your old set. Without them they will charge you a few dollars extra that you'll get back when you bring in the old shoes and show your receipt. This is called a "COR" (Cash On Return) charge.

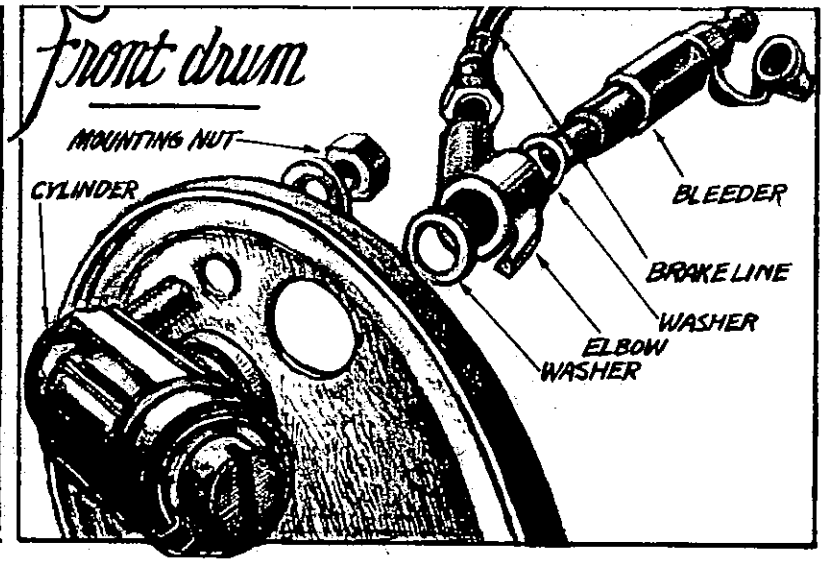
NOTE: Don't let anyone push on the brake pedal while the drums or shoes are off.

Repeat the brake disassembly on the opposite wheel. Then take the model number and production date of your truck down to the agency or parts house to buy new shoes.

But first, recheck the wheel cylinders for leaks (Proc. 4 [4]) and the adjusters for corrosion and binding (this procedure, Step 9). If you haven't checked the condition of the brake drum, see Proc. 4 (5). If you plan to have the drums resurfaced you'll need to remove the wheel bearings (Ch. 12, Proc. 3).

Step 4: Check and Remove Front Wheel Cylinder(s).

If the wheel cylinder is leaking or old, it should be replaced. You can learn all about wheel cylinders in Proc.



4 (4), then return here. Perform the step below, if you have to remove the wheel cylinder. Remember, you have a **single** acting piston type cylinder.

Step 5: Remove the Front Wheel Cylinder (if you have to).

Place a drip pan under your work.

Look at the next illustration to identify the wheel cylinder and its parts. Find the head of a 14mm bleeder bolt that holds the **elbow fitting** in place. Place the box end of your 14mm wrench over the nipple end and bleeder bolt, then loosen it counterclockwise. *Do not fully remove it*. Pull the bolt, fitting, and washers away from the cylinder together. If the outside washer falls off the bolt, put it in the parts container.

Now pull the bolt out of the elbow. Watch for another washer on the inside of the elbow. Keep the washers with the bolt in the parts container. Tie or hang the line and elbow above the drip pan. Replace the rubber brake line if it's cracked or deteriorated.

Next to where you removed the elbow there is a 17mm mounting nut and lockwasher. Loosen the nut by tapping on the end of the wrench to get it started.

If the wheel cylinder is stuck, you'll have to tap it out of the backplate. Thread the nut out to where it is even with the end of the threaded stud, then tap on it to remove the cylinder.

Pour the brake fluid out of the cylinder into the drip pan. Take the cylinder with you to the parts place to ensure that you purchase the correct replacement. Keep the right and left wheel cylinders separate from each other. They should be marked (R or L) on the inside where the elbow was attached.

Step 6: Replace Front Wheel Cylinders.

NOTE: Wheel cylinders should be replaced in pairs but often are replaced solo. If you have a new cylinder, remove the bleeder bolt, elbow, and washers. Keep these parts separate from the old ones.

Clean the backplate with solvent and wipe it dry. Make sure you have the right cylinder for the side you are working on (R or L). Remove the 14mm bleeder bolt, washers, elbow and then the 17mm holding nut. Keep all connector parts together. Position the wheel cylinder in the back plate so the dust boot is forward; fit the lockwasher and 17mm nut. Tighten the 17mm nut until the lockwasher flattens. Make sure that the cylinder is flat against the back plate.

Step 7: Replace the Bleeder/Elbow Assembly and Brake Line.

If it's a new wheel cylinder, it probably came with a new elbow, bleeder bolt, and washers. To replace this unit you'll have to remove the old elbow from the brake line. Otherwise leave the old one where it is. To do this, find the old bleeder bolt and put one washer onto it. Make sure its threads are clean. Hold the old elbow against the hole in the back of the cylinder. Install and tighten the bleeder bolt until it is flush, then snug it until secure with the 14mm box end wrench. Now the fitting is locked in place and you can loosen the line.

See the hexagonal fitting on the end of the flexible line? Use a 17mm open end to loosen it counterclockwise, then stop. It's soft so don't round the edges. Now the bleeder bolt and elbow can be removed again and screwed off the flexible line. Don't lose the copper washer between the line fitting and the elbow.

When you replace the elbow on the line fitting, the flexible line often ends up twisted, so you have to change the position of the flexible line. Follow the rubber line up to the bracket where it joins with the smaller steel line. You have a 19mm hexagonal fitting on the end of the flexible line and a 10mm **flare fitting** on the end of the steel line. Squirt a little penetrating oil on the flare fitting. Loosen (don't remove) the brake line flare fitting.

Check below the flare fitting and on top of the bracket. See the flat **retainer piece** with a bend at one end and a forked end at the other? Position the shaft of a medium screwdriver between the bent end of the retainer and the brake line fittings. Use the screwdriver to pry the clip away from the fitting and off of the bracket. Let the line hang.

Now bolt the new elbow to the cylinder. Put the copper washer onto the threaded end of the flexible line. Then thread the elbow onto that. It should turn on easily. Be careful not to start the threads in crooked.

Pick up the new bleeder bolt and two copper or steel washers. Sandwich the lot together with a washer on either side of the elbow (see the illustration). A tit in the top of the elbow lines up with a hole in the wheel

cylinder. Look for a letter stamped next to the hole: left (L) or right (R). The tit plugs into the hole, pointing downward, on whichever side the cylinder is on. Thread in the bolt. No need to play Samson on this one, it only has to be tight enough not to leak.

Turn the flexible line at the upper fitting so it has a smooth, untwisted curve to it when the front wheels are straight. The line should remain flexible when the front wheels are steered fully in both directions. When you've got the line positioned, retighten the 19mm and 10mm hose and line fittings carefully until snug, then push the 19mm hexagonal fitting back up into the cutout in the bracket. Pick up the slotted retainer. It fits on top with the bent end oriented rearward and up. Push up on the line and slip the retainer's legs into the groove on either side of the line fitting. Tap it all the way on from the bent end. Omm!

Step 8: Remove the Brake Adjuster.

The adjuster is located at the bottom of the backplate. Look at the illustration below. The adjuster has to stick and turn for the brakes to work properly. If it hasn't recently been serviced, do it now. Look on the bottom inside of the backplate to find the oblong rubber cover; if it's missing you'll see the exposed shims. Remove the boot and scrape off the dirt around the two or three shims between the backplate and the tab on the adjuster. (If there are three shims, remove the top and middle shims the same way.) These shims are soft and difficult to correct if bent, so remove them with care.

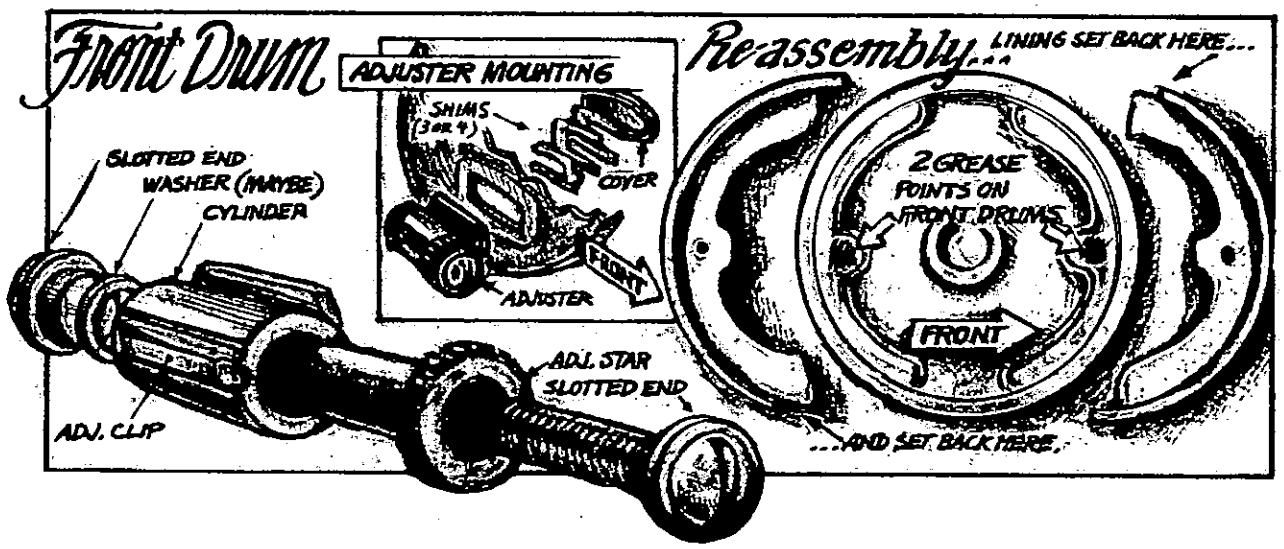
The top shim is held in place by the bottom shim, which is curved to provide some spring tension. The ends of the bottom shim hold the top one from sliding forward. Take two small/medium screwdrivers and, without distorting the shims, pry the screwdriver tip under the back end of the top shim and one of the bent ends (legs) of the lower shim. Use another screwdriver to carefully tap against the legs on the front of the upper shim to drive it out of the slot in the adjuster. Now the bottom spring shim is free to be wiggled out. If the shim(s) are bent up or hopelessly distorted, replace them with a new set from Datsun/Nissan. Make a note to replace the dust boot(s) if missing or torn.

Slide the adjuster forward and out of the hole in the backplate. It may need a tap from the inside to separate it from the backplate.

Step 9: Clean and Replace the Brake Adjuster.

NOTE: The right and left adjusters are different so keep their parts separate. Use a bristle brush and a pan of solvent underneath your work. Absorb excess solvent *completely* with a rag before going any further.

If you are replacing the adjuster assembly, there's no need to disassemble the old one, of course. Look at the adjuster closely. Examine the metal piece that fits into the notches of the star wheel. If it has sprung out and away from the star, it can be bent inward once the star is removed from the housing. Disassemble the adjuster by first removing the rear slotted piece which may have already fallen out, then clamp the square sides of the adjuster in a vise or Vise Grips and tap the star and threaded slot piece out with a punch. Some twisting and penetrating oil might help. When they're both out, the threaded piece should turn out of the starred piece—



clockwise to the left side of the truck, counterclockwise to the right. Soak the adjuster in penetrating oil if it is stuck. Be careful not to damage the pieces with too much force.

Take a piece of emery cloth, penetrating oil (some solvent), and a few dabs of grease or anti-seize compound. Wrap some emery cloth around your finger and sand inside the bore of the adjuster housing. Do both ends, occasionally dipping the housing in solvent. When the inside ends are smooth, rinse and dry off the housing. Now clean the little slotted end piece. Sand off the smooth surface that fits into the housing. The star piece is next. Sand smooth the cylindrical part that turns in the housing. Next do the threaded piece.

Clean the threads with solvent and a toothbrush. Do the same for the inside of the star piece and dry them both. Coat the threads of the slotted piece with grease, then screw it all the way into the starred adjuster. Put a coat of grease on the cylindrical part of the star piece and a little in the adjuster housing. Fit the starred and slotted piece into the end of the housing with the spring tab slid into one of the notches.

Pick up the other slotted end and the washer (if your vehicle had one). Clean the pieces and grease the cylindrical part. Fit the washer and slotted end onto the housing. If the end tends to fall out of the housing, dab on some more grease to hold it. Now turn the housing around and find the *arrow* on the back. This indicates the forward direction, so the right and left adjusters won't get mixed up.

Use clean emery cloth to clean off the the backplate (front and back) where the adjuster and shim fit.

Sand off both sides of the shims. The spring shim with the bent ends goes on first. Pick up the adjuster assembly and put some grease on the flat part that fits against the backplate and on the inside slide area of the backplate. Push the adjuster through the hole in the backplate so the arrow and the star end point forward.

Pick up the spring shim and slide the legs over the backside of the adjuster from the front so the legs bend out. Put a dab of grease on the one (or two) top shim(s) and slide it from the rear—over the spring shim until the cutouts in the end fit down into the bends in the ends of the spring shim. The third shim (if one) slides over this one(s) from the same direction. Once it's all together the adjuster should slide forward and backward smoothly, yet remain secure and flush against the backplate. Wipe any excess grease from the adjuster, backplate and your hands. Position the slotted ends so they are straight up and down.

Step 10: Replace the Front Brake Shoes.

The old shoes and return springs are together on the ground nearby, right? Take the new shoes out of the box and lay them next to the old ones; look at the holes in the steel parts and the position of the bonding material. (If your new shoes are labeled fore and after, install fore shoes in the lead (front) positions and after in the trailing positions.) The lining does not cover the entire steel backing on one end of each shoe (see the illustration). The front (fore) shoe is mounted with the exposed part to the top; the rear (after) shoe goes on with the exposed part on the bottom. Make certain you have the correct shoes before going ahead.

Notice the springs on the old shoes. Usually the top spring is painted red and the bottom larger spring is yellow; however, yours might have no color remaining or were mixed up by the last brake job. The real difference is that the bottom spring is slightly bigger than the top one. Compare the way the springs are attached to the old shoes with the illustration earlier in this procedure.

Clean and dry the spring. Remember, don't touch any part of the new brake lining. Pick up the new front shoe and study the way the spring ends fit into the shoes. Insert the upper spring into the top hole of the front shoe, then into the top of the rear shoe.

Remove the lower spring from the old shoes. Clean and fit it onto the bottoms of the new shoes. The finished product should look like the illustration.

Note the position of the linings on the shoes, front and rear. Check out the drawing at the end of the last step. Face the backplate, with a supply of grease, a clean rag, the medium screwdriver, the new brake shoes, and a pair of light gloves on. Put little dabs of grease on the end slots of the adjuster and wheel cylinder and on the two spots on the backplate where the shoes contact it. Wipe your hands clean. Make sure that the rear, adjuster end piece is in the adjuster.

Pick up the shoes-and-springs set in both hands with the shoes pulled apart to keep the springs from falling off. The shoes should be in position. Hold the front shoe securely and slip the ends of the rear shoe into the rear slot in the adjuster and the rear slot in the cylinder.

Now, while you keep the rear shoe in the slots, move the front shoe into place. Put the top end of the front shoe into the front slot of the wheel cylinder. Hold that and the rear shoe in place while you pull the bottom of the front shoe forward far enough to clear the adjuster and fit the end of the shoe into the adjuster slot.

Now replace the little bottom return spring. Put a tiny dab of grease on the hooked ends of the spring. The long end connects to the bottom hole of the rear shoe and the short end hooks into a stamped metal piece fixed to the backplate. (Refer to the illustration in Step 3.) Hook it on the backplate first, then use pliers to force the long end into the rear shoe. Recheck all the springs to see that they are in place and that the shoes are centered and flush with the backplate so the drum will fit over them.

Step 11: Put on the Brake Drum.

Once the shoes are in place, the drums can go on.

If the wheel bearings and seal are in place and have been serviced you can install the drums, adjust the bearings, and then adjust the front brakes. Wheel bearing servicing can be found in Ch. 12, Proc. 3. If you are simply replacing the drum turn to Proc. 6 (6) in this chapter.

Step 12: Replace the Wheel, Adjust and Bleed the Brakes, and Lower the Vehicle.

Put the wheel on the lugs and tighten the nuts. With the wheel on you can adjust the brakes and bleed the lines if necessary (Proc. 2). When that is done go to Ch. 13, Pt. 1, Proc. 1, to lower the vehicle and tighten the lug nuts.

PROCEDURE 8: REAR BRAKE DRUMS, SHOES, WHEEL CYLINDERS, AND ADJUSTERS

Condition: Something's wrong with the brakes. You have performed Proc. 1 and 4. (This procedure is most often done with the front brake procedures as part of a complete brake job.)

Tools and Materials: Two 8mm x 1.25 x 30mm bolts, a hefty large screwdriver, a medium screwdriver, brake spring tool (if you're lucky), basic tool kit, safety glasses, dust mask. NOTE: An assistant makes fixing truck brakes easier. If necessary, have on hand brake return springs, **(pre-1982½) P'ckups:** top spring #44070-32200, bottom spring #44071-32200; **Cars: 1969-76,** top spring #44091-22000 and -21010; **510 1978 on:** top spring #44091-08700, bottom spring #44090-08700.

Remarks: Brake check-out details are in Proc. 4. When working on brakes, it's wise to keep the parts in containers, not mixed up but separated by wheel. If you buy Datsun/Nissan replacement shoes, two of the shoes in the set of four will be labeled *fore* and two will be labeled *after*. The fore shoes fit in the frontmost (lead) positions and the afters in the rear (trailing) position. On 521 and 620 trucks the lining material is different. Aftermarket shoes aren't marked. Consult the store that sold them to you if you're doubtful.

Step 1: Jack and Block the Vehicle.

See Ch. 13, Pt. 1, Proc. 1 and 2. Raise the rear of the vehicle only.

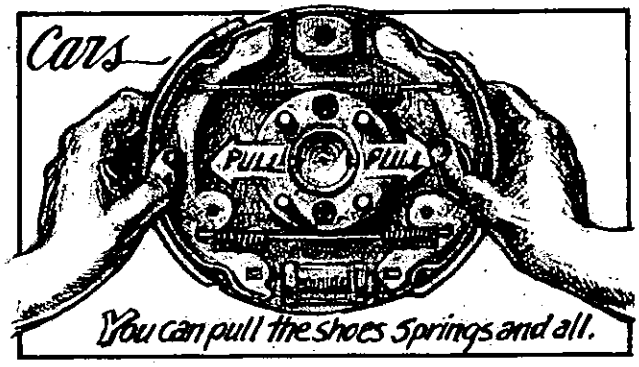
Step 2: Remove the Brake Drum and Check Its Innards.

Read rear drum check-out (Proc. 4 [1 and 2]) which will tell you how to check out the drums, shoes and wheel cylinders. Leave the drums off and return here. Work on the right side first.

Before disassembling the brakes, compare your set-up with the illustration in Proc. 4 (3) to assure correct assembly.

•**521, 620 and 720 Truck People:** Go to Step 4 to remove the return springs, then come back to Step 3.

Step 3: Remove the Shoe Retainers.



Many **early 510 models** did not have shoe retainers; if none are there, go on to Step 4. But if you have them look at the third frame in the illustration in the next step for guidance in disassembling the retainers. Catch the pieces as they come off of the pin. There is another washer behind the spring. The front brake shoe will fall off, the rear will hang, Truck People. **Car People:** The return springs will pull the shoes together. Push the pin through the shoe and backplate. Repeat this on the other retainer and stash all of the parts in a container for that wheel. If any of these goodies are missing or damaged, make a note to replace them. **Truck People:** Gather the adjuster (the slotted end may fall out) and the extension link. On newer models there's a spring on one end of the link. Stash all the various parts in the container for that wheel.

•**Truck People:** Go on to Step 4 and remove the emergency brake extension link.

•**Car People:** Go on and do Step 4.

Step 4: Remove Shoes and Return Springs.

The springs are strong, so wear your safety glasses, dust mask, and watch your fingers.

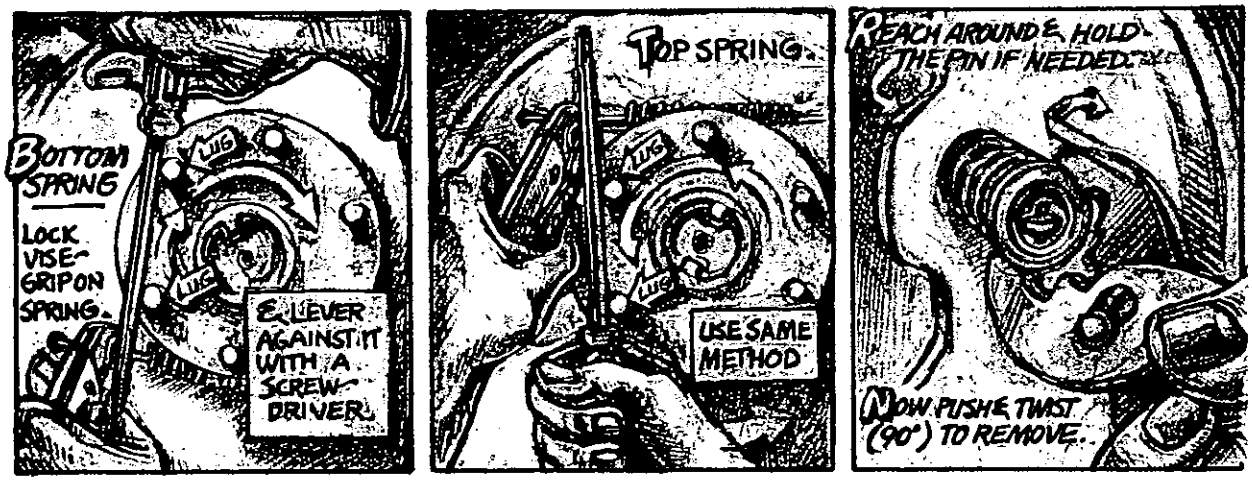
•**510, 610, and 710 models:** The top spring is either a single or a double coil. Notice how the ends go through the brake shoe. Make a note to replace any bent or distorted springs. If the springs are different colors, make a note which goes where. Draw a sketch of how the spring ends fit into the shoes and whether or not the springs mount in front of or behind the brake shoes—this is all very important for correct reassembly.

Move the top of the rear shoe out of its slot, then the front; push both shoes down out of the bottom wheel cylinder slots. Now the springs can be maneuvered out and past the axle flange and the whole assembly removed. Try to keep the springs on the shoes, laying everything down gingerly in one unit.

•**510, 1978 on People:** The automatic adjuster should flop down and remain stuck in the backplate. Leave it there until you service the adjuster.

•**521, 620 and 720 up to 1982½ (1/82) models:** Find the smallest spring that's between the adjuster and the lower return spring. Clamp your pliers on the rear (longer) straight part of the spring and unhook it from the rear shoe. Unhook the other end from its place on the backplate.

The return spring above is next. If you don't have a brake tool use the following method. Clamp the Vise Grips on the end of the spring as shown in the next illustration, which shows the right side. Use a screwdriver to lever between the Vise Grips and the lug studs. Make sure that the pliers are well clamped on the spring and



Brakes

that the screwdriver doesn't slip. Watch your hands and face. While you take tension off the spring maneuver the hooked end of the spring out of the brake shoe, UMPH!

The **upper spring** has a bar under it called the **extension link** which makes it harder to grab with the pliers. Remove this spring as you did the bottom one. Use the screwdriver for top leverage and unhook the spring from the shoe. Release the Vise Grips.

•720 1982½ (1/82) on: Find the three return springs between the shoes. On top there are two: a white one and a black one. The white spring should be on top.

Remove the end that's hooked on the anchor pin—not the shoe end. Use strong pliers or Vise Grips and watch your hands as you stretch the spring forward. Let the spring hang. Remove the black one next. Stretch it rearward and pull it off the anchor pin.

Now look at the bottom spring. This smaller fellow helps operate the self-adjustment lever (that flat metal piece the spring's attached to). Disconnect it by prying the lever and spring rearward. Unhook the lever from the rear shoe, and the spring from the lever and front shoe.

When the tension is off, the adjustment parts will come loose. Carefully remove each piece, putting them all in a parts container. You have so far removed the two large return springs, the smaller return spring, the adjuster, the cable, and cable guide. Finally remove and stash the diamond-shaped shoe guide plate from the anchor pin.

Now for the shoes. A retainer spring and pin holds each shoe to the backplate. Flip back to Step 3 to remove the retainers then come back here. **All Truck People** should now return to Step 3 to remove the shoe retainers, then return here.

Double check that you have all the pieces. Look at the drawing below to identify things then put them in a parts container. The rear shoe will remain attached to the emergency brake lever and cable.

If you're putting new shoes on, you'll have to separate the lever from the shoe. Otherwise let the shoe hang. There's a **clip** on the back of the shoe that holds a pin in place that keeps it all together. Put one of the pliers' jaws on the pin and the other jaw on the split end of the clip. The idea is to squeeze the clip off of the pin. You may have to spread the clip with a screwdriver first. There is also a washer behind the clip. *Don't lose these pieces.* You can pull the shoe away from the pin by prying a screwdriver tip between the lever and the shoe backing. The lever will hang. Keep the clip and pin in a parts container.

•Everyone: Lay all of the brake parts out on the ground in the positions they were in when on the backplate. Use the old set up and the illustration in Proc. 4 as models when assembling the new parts.

If you plan to replace the shoes, buy new ones after you've checked the wheel cylinders, adjusters, drums, and springs. Leaking wheel cylinders will ruin good shoes. Remember to take the model and production date information with you. When you buy new shoes, the parts store will usually charge you a C.O.R. deposit for the old sets. If you don't have them with you, keep the receipt and take it and the old shoes back to the store later for a refund.

If you intend to reuse the old shoes, store them in a clean, dry place.

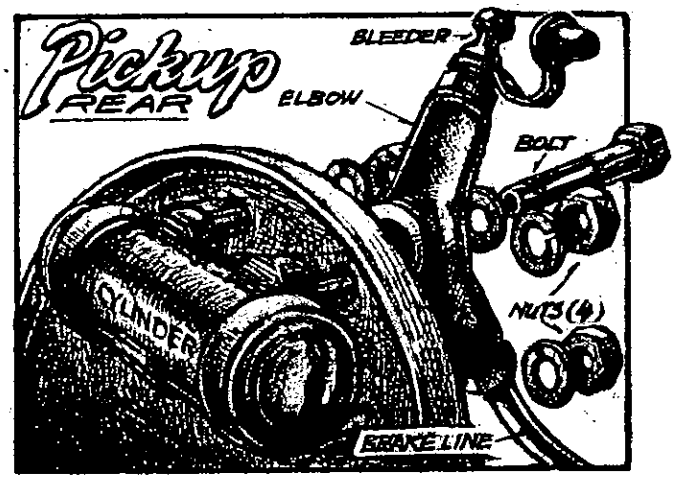
Step 5: Examine the Brake Drums and Wheel Cylinders.

Drum information is in Proc. 4 (5)—read it carefully. In addition, check around the round hub cutout hole for cracks or distortion. Ask a machinist if in doubt. Although wheel cylinders are frequently rebuilt, I do not recommend that you do it on your Datsun/Nissan. They are aluminum and do not always hold a rebuild. Step 6 tells you how to replace them.

Roger Ulrich, an inspiring friend of mine, says, "Do it all or not at all, especially when it comes to brakes." He's right. It pays to do a complete job. Take the new shoes to the machine shop doing the drum work and ask if they will check the arc of the shoe against the newly surfaced drum. Occasionally rebuilt brake shoes will need to be cut away at one or more places to suit the drum. This is called *arcing* and is often done for free at the parts store or machine shop. Got everything you need? OK, head for home. If you aren't replacing the wheel cylinder go on to Step 11.

Step 6: Remove Wheel Cylinder (if necessary).

•510 (1969 to 74), 610 and 710 models: The cylinder is at the bottom of the backplate, held in place by spring shims. The wheel cylinder supports the emergency brake lever.



Lie on your side and look at the rear inside of the backplate. This is a **flare fitting** that holds the brake line into the wheel cylinder. The line will come loose if turned counterclockwise with a 10mm open end wrench. If the fitting is really tight, don't force it. It may be corroded. Use penetrating oil on it and if necessary the Vise Grip method in Ch. 13, Pt. 1, Proc. 2. Unscrew the fitting and carefully pull the line out of the cylinder. Catch the dripping brake fluid in a rag or container.

Find the **emergency brake lever** that goes through the backplate. It moves the rear shoe against the drum when the handbrake is operated. The back end of the lever is connected to the rod or cable by a clevis pin and cotter pin. Straighten the cotter pin legs and remove it. Slide the clevis pin and rod or cable away from the lever. Put the pins into a parts container.

Next disconnect the spring to the backplate and clevis. (The spring may be missing.)

Find the **rubber boot** that covers the back of the cylinder. Pull it up over the bleeder nipple and past the steel brake line and out of the way. **Spacer shims** underneath hold the cylinder to the backplate and allow it to slide.

Some wheel cylinders have four shims and others three. Use a screwdriver and hammer to tap the top shim forward a bit. The top shim has a tit sticking out of it toward the front. Place a screwdriver tip behind the tit to tap or pry it off of the cylinder. On four shim styles, the second one down comes out the same way. The third shim also slides out forward, but the fourth shim has bent ends that hold the middle shim in place. Use a small straight screwdriver to pry between the legs of the upper and the bottom shim. With another screwdriver, push the middle shim forward and over the bent ends of the bottom one. The bottom one should now wiggle rearward and out. The wheel cylinder can now be tapped out of the backplate.

The emergency brake lever pivots under and is separate from the wheel cylinder. You can pull it through the backplate after the cylinder is removed. Take the old cylinder(s) with you to match with a new one. Shims and a new boot usually come with a new cylinder.

•521 and 620 model trucks: The wheel cylinder is at the top of the backplate. The opposite or inner side the steel brake line is fitted to an **elbow** or goes straight into the back of the wheel cylinder. The bleeder valve is on the top end of the elbow or screws right into the back of the cylinder. On elbow types, a **hollow bolt** holds the elbow to the cylinder. If you plan to replace the wheel cylinder loosen the 10mm brake line fitting (Ch. 13, Pt. 1, Proc. 2). Next remove the elbow with a 14mm socket or box-end. There are two copper washers, one on either side of the elbow. Once the hollow bolt is unthreaded and withdrawn, the washers will be free. See 'em?

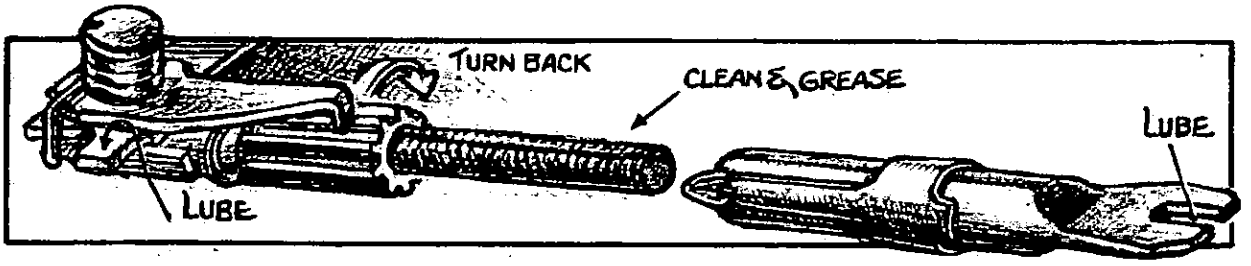
Carefully move the elbow and steel line away from the cylinder. The four 13 or 14mm nuts with lockwashers hold the wheel cylinder in place. Remove the nuts and washers and tap and wiggle the cylinder off the backplate. Put the hollow bolt, copper washers and nuts and washers in your parts container.

•510 late model people (A-10): Your wheel cylinder is at the bottom of the backplate.

•720 model trucks: The wheel cylinder is on the top of the backplate. The brake line goes straight into the back of it. The bleeder valve is above the brake line.

•510 (A-10) and 720 all: First loosen and remove the 10mm flare nut that holds the brake line to the cylinder. Do not damage the line or round the nut. Use penetrating oil on the nut's threads and if necessary the Vise Grip method in Ch. 13, Pt. 1, Proc. 2. Turn the fitting counterclockwise until free.

Pull out the brake line carefully to clear the cylinder and place a pan under the line to catch drips.



•510 (1978 on) and 720 (with two bolts): Find and remove and stash the two 10mm bolts and washers that hold the cylinder to the backplate. Now the cylinder should push or pull away from the plate. NOTE: Some 510 people may find their cylinder held on by four 12mm nuts. Don't despair, read the 521 and 620 instructions above.

Step 7: Check Out and Service the Adjusters.

•510 (1969 to 1974), 610 and 710 models: The adjuster assembly is on top of the backplate. There is a stud threaded into the housing from the back side. When the adjuster stud is turned *clockwise*, it pushes against the dowels forcing the brake shoes toward the drum. Corrosion can freeze these studs up tight, so you should clean and lube them now.

Pick up the 6mm open end, or the like. Find the squared end of the stud on the back side of the backplate. Try to turn the adjuster both ways. If it doesn't turn, squirt a little penetrating oil on the threads from both sides and let it sit. If after a few tries the screw does not loosen, you'll have to remove the whole assembly and soak it in penetrating oil. When the screw turns, thread it out as far as it will go.

Next pry out the dowels with a medium screwdriver as shown. If they're really stuck, get one of them out using the prying method, then use a punch or screwdriver through the open dowel hole to tap the second one out. You can also use a screwdriver in the slots to turn the dowels back and forth to loosen them inside the housing.

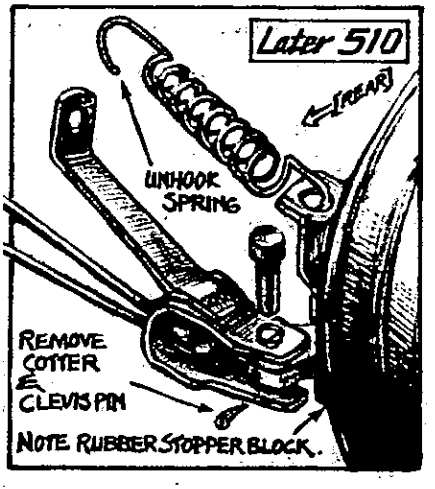
Once the dowels are out, sand their surfaces with emery cloth until all rust and corrosion is removed. Clean up the inside of the adjuster. Wipe it all off with a rag and coat the dowels and their holes with grease.

Replace the dowels with help from the illustration. Turn the adjuster back into the assembly until it just touches the dowels.

•Late Model 510 People: You have to disconnect the emergency brake cable to remove the adjuster. Follow the illustration and remove the spring, cotter pin, and clevis pin; the adjuster will then pull through the dust boot and backplate. The adjusters are activated by the emergency brake. Right and left assemblies are threaded differently and have to be kept separate. Now's the time to disassemble and lubricate the adjuster.

Slide the forked adjuster bar off the main assembly. The starred **roller nut** should screw off the threaded stud (*clockwise* on the left side and *counterclockwise* on the right side). If either the roller nut or the *toggle lever* is stuck, soak the whole works in penetrating oil until free, then remove the roller nut. See illustration, Step 10.

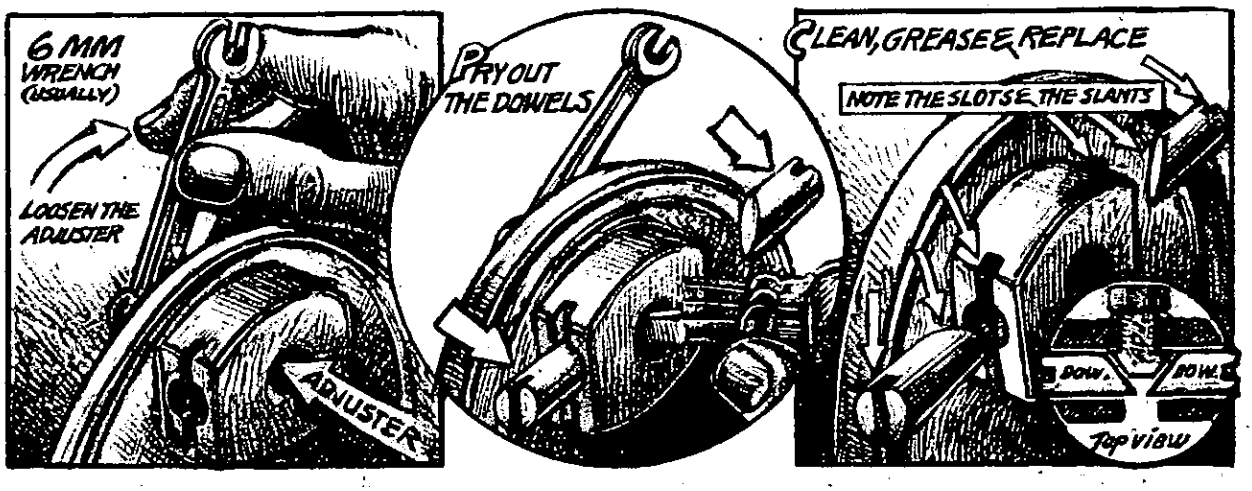
Clean up the adjuster assembly and put grease on the threads. Now turn the roller nut all the way back into the main assembly. Put dabs of grease between all moving parts and points of friction: the toggle lever and below the spring, the roller nut, and insides of the forks at the end of the adjuster bar. Set the assembly aside on a clean surface.



•521, 620, and 720 up to 1982½ (1/82) people: Turn to Proc. 7 (9 and 10) which deals with adjusters and shims, then return here.

•720 People 1982½ (1/82) on: Caution: Don't mix up the right and left side adjusters. Keep them separate.

One end of the adjuster has a threaded bolt and star piece. The other end has a slotted end that may have fallen out. If so find it (or else).



Separate all these parts and clean them with solvent and a bristle brush. The idea is to remove all the old grease and brake grime as well as the corrosion if any. It's especially important in order for the self-adjusting mechanism to work.

The left adjuster has reverse—left hand—threading; the right side adjuster screws out normally. Turn the threaded end out of the star. If stuck, soak the lot in penetrating oil, clamp the star, and unscrew the adjuster.

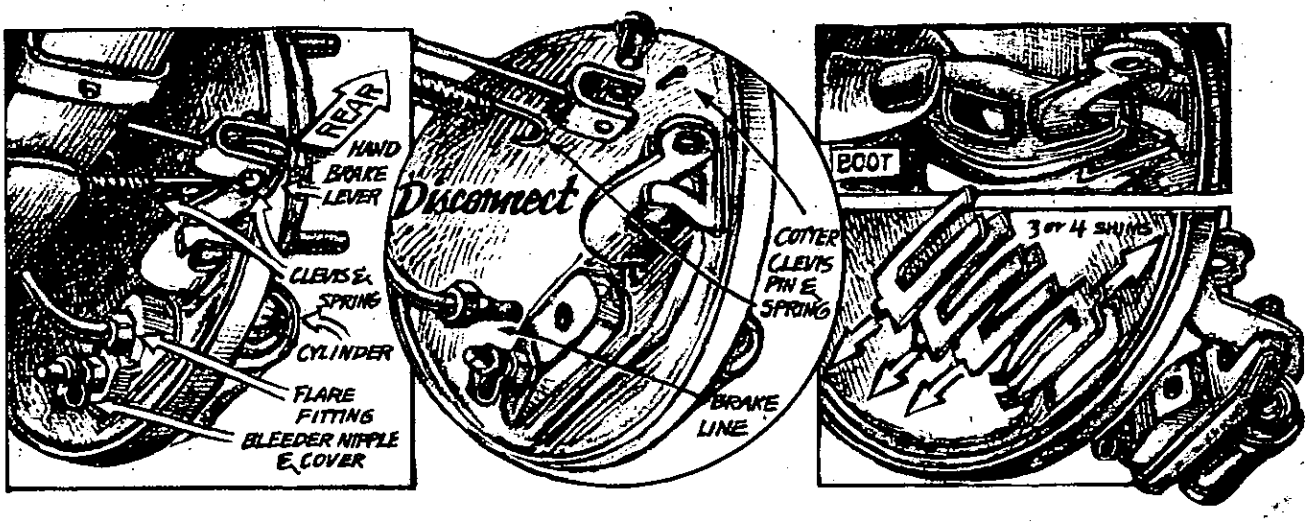
Clean and dry the threaded end then the star. Use emery cloth on the smooth cylindrical end which fits into the main body. Finally clean the slotted end as you did the star piece. When all the pieces are dry, smear a light coat of grease or anti-seize goo on the threads as well as the cylindrical sides of the slotted end and star piece (the parts that fit into the adjuster body).

Assemble the pieces, star first, then screw in its slotted mate clockwise or counterclockwise, so it's threaded all the way into the adjuster body. Keep the slotted end nearby and lay the assembly next to it.

Step 8: Clean the Backplate, Locate Replacement Parts.

Usually plenty of dust, wet or dry, has accumulated on the backplate. Never blow this dust off; it contains asbestos. Use a brush and solvent, with a pan underneath to catch drips. Scrub all the scummy build-up until the paint shines through. Use an absorbent rag to mop off everything thoroughly.

If your brakes had shoe retainers, account for two washers, a spring and a pin for each shoe. Clean these parts and the return springs and keep them all in order close at hand.



If you didn't remove the wheel cylinders, jump ahead to Step 11. Otherwise read on.

Step 9: Replace Wheel Cylinders.

•510 (1969-1974) 610 and 710 models: Take apart the new wheel cylinder, removing the three or four shims. Clean and lay out the emergency brake lever, clevis pin, and cotter pin.

The wheel cylinder fits through the backplate with the piston end facing rearward. The emergency brake lever fits into a cutout in the back of the cylinder against the backplate.

Pick up the emergency brake lever and put a dab of grease on each one of the cylindrical nubs on the big end of the lever. Put the nubs into the cut-out in the back of the wheel cylinder so the very end of the lever fits into the slotted end of the wheel cylinder. Put the cylinder and lever down on something clean. Refer to the illustration in Step 6.

Find the shims. They should be sanded clean or new. Lay out the shims in their order of assembly. Be careful not to bend the legs as you work. Put a light coat of grease on each of the shims.

Rub a little grease on either side of the backplate around the hole where the wheel cylinder fits. Pick up the wheel cylinder and hold the lever in place. The small end of the lever goes through the backplate first, pointing rearward. Before you place the cylinder against the backplate, fit the rubber dust boot over the lever. Now slip the lever through the hole and guide slot and hold the cylinder flush against the backplate.

Keep the dust boot out of the way while you fit the first curved shim over the part of the cylinder that's sticking through the backplate. The shim slides on from the rear, the legs facing forward, and the curved ends facing away from the backplate.

Pick up the shim with the tab on one end and install it from the front between the first shim and the back of the wheel cylinder. Push this one on until the bent ends of the first shim spring over either side of the tab.

The last one or two shims also slide on from the front, over the second one.

Grab hold of the wheel cylinder and pull in and out; it should be solid. Now try to slide it front to rear. It should move freely with a slight bit of resistance.

Fit the oblong rubber boot over the back side of the wheel cylinder and lip on the backplate. The brake line hole should be exposed. Clean out the threaded hole and the end of the steel brake line. Gently insert the line in the cylinder and start to screw it in. It must turn without binding, do not cross thread it. Hold the line in the cylinder while pushing the fitting into place. Tighten it with the 10mm open end until the fitting is snug.

Reconnect the emergency brake rod or cable to the end of the lever. Put a dab of grease on the clevis pin and slip it in from the top. Push the cotter pin through the hole in the clevis pin and spread its legs. Reconnect the return spring to the emergency brake lever guide and clevis.

•521, 620 and 720 up to 1982-½ (1/82) models: New wheel cylinders usually come with an **elbow and bleeder valve**. The old elbow is still attached to the brake line. Disconnect it from the steel brake line with a 10mm open end. Now remove the new elbow from the new wheel cylinder. (Refer to the illustration in Step 6.) Make sure that the line fitting turns on the line. Lubricate the fitting with penetrating oil and work it until it turns. Put the steel line into the new elbow as far as it goes. Line up the fitting and turn it clockwise into the elbow. But don't tighten it quite yet.

Attach the wheel cylinder to the backplate. Make sure that it is flush against the backplate (right side, the printing on the cylinder is upside down; left side, the printing's normal). Find the four (13 or 14mm) nuts and washers that hold the cylinder in place and start them, washers first, onto the four studs sticking through the backplate. Tighten the nuts until the washers are flat then snug.

Elbow People: Now reconnect the elbow and line. Hold the connector in place against the hole in the back of the wheel cylinder and slide one of the copper washers between the cylinder and elbow. Slip the other washer over the hollow bolt and slide it through the elbow and inner washer, then tighten clockwise, while making sure that the brake line isn't bent out of shape.

Tighten the hollow bolt with a 14mm box-end or socket, without moving the elbow and line. Then tighten the 10mm brake line flare fitting until snug. If the line isn't already connected, align the fitting with its hole and tighten.

•**510 (A-10) and 720 (1982½ on) People:** Fit the wheel cylinder through the backplate. Position the cylinder so the bleeder valve is on top. The brake line hole is below. Put the washers and bolts into the holes in the back of the cylinder and tighten clockwise until snug. Clean out the end of the flared brake line and the fitting. Push the flared end fully into the cylinder hole below the bleeder and when properly aligned, start the flare nut carefully into the cylinder—don't force it. Tighten the fitting until snug with a 10mm open end. NOTE: 720 people with four nuts (wow!), jump back to the 521, 620 instructions.

•**510 (A-10) People:** Now replace the adjuster. The starred end goes toward the rear. The lever has to fit through a slit in the dust boot that should still be in the backplate. When the lever is sticking through you can slip the emergency brake cable clevis over the big hole in the lever and insert the pin from the top. Coat the inside of the clevis and pin with grease. When the pin is in, stick the cotter pin through the bottom of the pin and bend its legs. Now hook up the spring between the backplate and the clevis. The adjuster should just hang there.

Step 10: Replace Rear Brake Shoes and Return Springs.

NOTE: If your shoes are marked fore and after, install them in those positions as described in **Remarks**, this procedure.

Put your safety goggles on for this one. Handle the new brake shoes with *clean* hands. **510, 610 and 710 models:** Look at the four new brake shoes. Notice that the linings are positioned differently on the front and rear shoes. Line up the four shoes with the square holes on the bottom of the steel part. The linings on two of the shoes have more lining material on the end with the square holes. These two are front shoes. Lay them on the ground next to the right and left wheels. On the other two shoes the linings are bonded to the end that doesn't have square holes in it. These two shoes are rear shoes, one for right side and one for left. NOTE: On Datsun replacement shoes the fore and after shoes have linings mounted opposite to the above description. I have seen shoes mounted both ways and they work well. However, I prefer the positioning I describe in the above text.

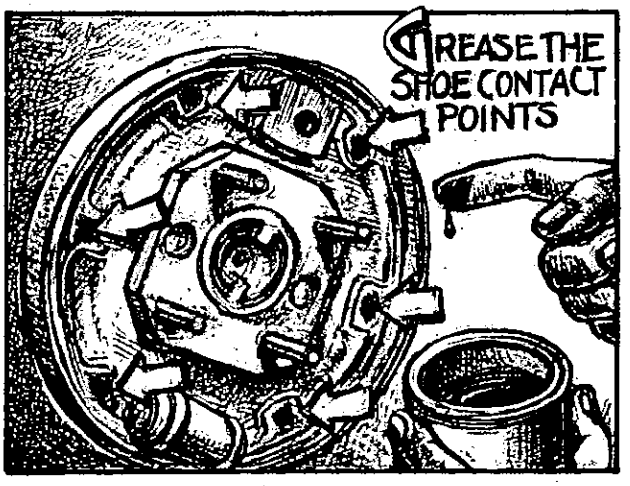
Check the panel illustration of rear brakes in Proc. 4 (the right side is shown). If your brakes had shoe retainers, insert the two pins through the backplate on either side. Push the pins through the plate toward you.

Maybe you made a sketch of how the springs were placed and hooked into the shoes. In every case except 510s (1978 on), a double coil or darker spring goes on the bottom with the single coil or lighter colored spring on top. (**Late 510s:** single spring top, double spring bottom.) Work with the shoes close to the floor.

Start on the right side of the vehicle. Pick up the bottom spring and front shoe. Hook the spring into the correct hole, then do the same with the rear shoe.

The upper spring may have similar or different hooks: Twist the spring and shoes to get the upper spring in position. Some juggling skill is required to keep the springs attached while doing all of this. Lay down the springs and shoes and look at your sketch to make sure everything is as it should be.

Have these at hand: pliers, a bit of grease, and a rag. Small dabs of grease go on the shoes at both ends (four points) where they fit into the adjuster and wheel cylinder. Also put a dab on the end of the emergency brake lever, the six "high spots" on the backplate, and the *base* washers of the shoe retainers. Wipe your hands clean and do not get any grease on the brake linings. (**Late 510s:** Put a dab on the ends of the adjuster assembly where it fits into the shoes.)



•**All Car People Except 510, 1978 on People:** Pick up the shoes and keep 'em spread. With one shoe in each hand, slip the springs behind the axle flange. Slip the two bottom shoe ends into the slot in the wheel cylinder and the square hole over the emergency brake lever on the rear side of the wheel cylinder.

Put the top end of the front shoe into the front adjuster slot. Hold the front shoe in place while you pull the rear shoe back and into the rear slot. With the shoes securely in place, double check the position of the shoes and springs. They should be flat against the backplate and in all of the slots.

•**Late 510 (A-10) People:** Find an assistant or use your knee to hold the rear shoe against the axle while performing this feat. Pick up the shoes and springs keeping the springs taut and in their holes. Place the front shoe into the top locator, fork of the adjuster, and slot in the wheel cylinder. Use your knee to force the rear shoe-springs taut against the axle while keeping the front shoe against the backplate. Find the front shoe retainer spring pin and push it through the hole in the front shoe, then assemble the washer, spring, and retainer for the front shoe. (Whew!) So far, so good. Now work the rear shoe and springs over the axle and against the backplate. See that the emergency brake lever end fits into the square hole in the rear shoe. When the shoe ends are positioned in the top locator and bottom cylinder slot, install the shoe retainers and go on to the end of this step.

•**Cars with shoe retainers:** Refer to the 521, 620, and 720 information below and find the section on replacing spring retainers. When that's done, go on to the next step.

•**521, 620 and 720 (all) models:** Separate the four new rear brake shoes into two sets. (All the shoes are identical.) Start on the right side. Take one set to that wheel and lay them down so the ends of the shoes with the most lining are at the top. On the upper inside steel part of the shoes you'll see slots. These are for the emergency brake bar-extension link.

Clean and dry all of the parts you removed from the brake assembly. You should have three return springs, two shoe retainer springs each with two washers, the retainer pins, and the extension link. There's also a lever (hanging) with a pin, washer, and clip for the emergency brake. **720 (1982½ on)**, you have additional parts, four for the adjuster mechanism and one shoe guide plate.

Place screwdriver, Vise Grips and dab of grease nearby. Pick up the emergency brake lever and remove the pin, clip, and washer. The lever fits flat against the inside of the **rear** brake shoe, held by the pin, washer, and clip. Put a small dab of grease on the part of the lever side that slides against the brake shoe. Put a dab of grease on the pin's shaft. Hold the lever against the shoe with the hole lined up.

•**720 models:** Put the washer over the pin and slip the pin through both pieces from the rear.

•**521 and 620 models:** Push the pin through both pieces from the front side. The washer fits over the end of the pin and against the lever. If the pin doesn't fit, try tapping on it without destroying the shoe. If that doesn't work, you may have to ream the hole slightly with a drill bit.

•**All truckers:** Pick up the clip and make sure that it is straight and flat. Find the groove cut around the pin where the clip fits. Hold the shoe steady while you manage the clip into place with pliers or fingers. Make sure that the lever is securely connected to the brake shoe.

Take a look at the bottom end of the lever where the cable is connected. When the brake shoe and lever are up against the backplate, the lever should not crimp the cable. Let them hang or rest on the axle.

NOTE: If you had trouble with the emergency brake cable binding, squirt penetrating oil down between the cable and housing (after you tap the housing out of the back plate). Put the housing back in after you've given it a squirt. If this fails to help you'll have to replace the cable if that is where it's stuck (Proc. 10).

Make sure all three of the *return* springs are present and clean.

•**521, 620, and 720 up to 1982½:** Notice the differences in the ends of the springs. The spring with the hooked ends turned opposite goes on the top. The other large return spring fits on the bottom. It has identical hooked ends. The third, small spring fits between the backplate and the rear shoe and has one straight end longer than the other.

•**720 1982½ on:** You have two upper springs, one white and one black and a smaller lower spring. There's also the extension link spring.

•**All Truck People:** Put a dab of grease on each of the spring hooks, as well as on each of the four ends of the shoes where they fit into the wheel cylinder and adjuster slots.

•**720 1982½ on:** Don't grease the extension link spring. Do put a dab on the rounded cut-out on the top of each shoe where it touches the anchor pin.

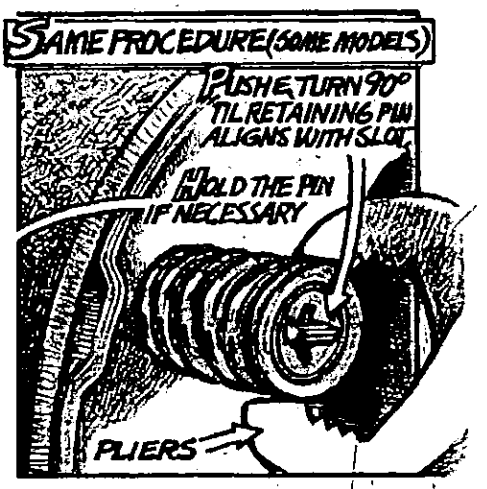
Pick up the *extension link*. On one end there may be two notches cut out and only one on the other end. Put small dabs of grease in these notches. Wipe your hands.

•521, 620 and 720 (up to 1982½) People: The single notch fits into the slit cut out on the upper end of the front shoe. The other end of the extension bar fits against the rear shoe and lever. The deeper of the two notches fits in around the lever and the smaller notch into the slit in the shoe. On 720 trucks (1982½ on), there is also a short fat spring that fits over the front end of the extension link. Your link is curved. The "curved out" (convex) side faces out. Hold the link, curved edge facing you, and slip the spring on the left or front end.

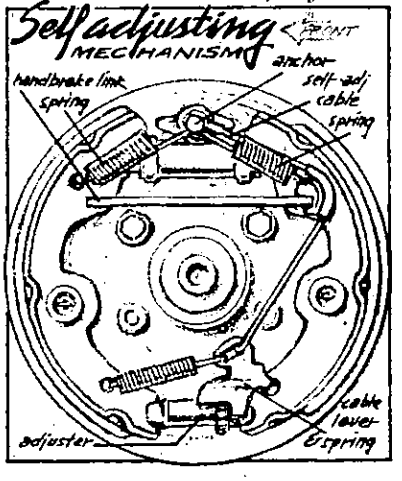
•All Truck People: Look at the last two illustrations to find the grease points on the backplate and lube 'em. A little dab'll do ya.

To install the spring retainers: Hold the front shoe against the backplate with the ends in the wheel cylinder and adjuster.

•Up to 1982½ on anchor block and wheel cylinder 1982-½ on: Push the shoe retainer pin through the hole in the back plate and the matching hole in the shoe. Slip the (larger one) shoe retainer seat, cupped side out, over the pin and against the brake shoe. Next place the spring and (smaller) retainer over the pin and compress the spring and the retainer far enough to clear the flattened end of the pin, check out the illustration. Rotate the retainer 90° and release the spring. Make sure the spring is square to the retainer and seat, top and bottom, and the pin is securely seated in the retainer. **Truck People:** You only want to install the retainer on the front shoe unless the rear shoe is already on.



•521, 620 and 720 up to 1982½: Slip one end of the upper spring in behind the front shoe so the end of the hook sticks out through the shoe. Let it hang. Next fit the extension link under the spring so it is in the slot in the front shoe. Let them both hang for the moment. Pick up the rear shoe and lever and move them into position against the backplate. Keep the return spring to the front side of the shoe and fit the link into the slot and against the lever. Install the shoe retainer washer, spring and top washer as illustrated and described before. Make sure the shoe is correctly in place.



Now you have to lever the upper spring into the rear shoe with the hook on the outside. Look at the illustration panel in Step 4. This same method is used to replace the springs. The Vise Grips have to be clamped on the springs tightly and the front hook of the upper spring has to stay put.

When the upper spring is in place, pick up the other large return spring. These hooked ends are alike and attach from the outer side of the shoes. Hook one end in the lower front shoe cut-out and clamp the Vise Grips as you did before, using a large screwdriver to pry the spring into place. Check that the hooks of both springs are properly in place.

Finally, find and clean the smallest of the three springs. Look behind the front shoe and under the axle flange on the backplate. You'll see a little tab with a notch in it. The short end of the spring hooks into this tab and the long end into the bottom most hole in the rear brake shoe. This spring is easier to stretch into place.

Check again that all spring ends are fully in the shoes. Now center the shoes so their arc is even with the edge of the backing plate. The ends of the shoes must be in the slots on either end of the wheel cylinder and adjuster. See that the bottoms of both shoes and adjuster assembly slide on the backplate by prying gently between the shoe and the lip of the back plate. (If they don't, the adjuster must be serviced.) All parts in place? OK, put on the lid.

•720 People 1982½ (1/82) on: Read through the previous section, To install spring retainers, then come back here. Pick up the extension link (and spring). Hold it so the spring faces forward and find the cut-out in

the front shoe below the wheel cylinder. The link slot fits into the shoe, compressing the spring.

Now you need a third hand. Position the rear shoe (and lever) against the backplate with the rear extension link slotted over the emergency brake lever. The retainer pieces should be within reach. Align the retainer pin holes in the brake shoe and backplate and insert the pin. Then fit the cupped seat, spring, and retainer to hold the lot together. Bon!

Now find the diamond shaped shoe guide plate and slip it over the anchor pin so it touches the shoes. Pick up the adjustment cable and slip the eyelet end over the anchor pin, turned so the crimped side faces out. Let the cable hang over the rear side of the axle.

Find the big black return spring. Hook its short end into the brake shoe, there's a hole just above the link. The curved end fits flush against the back side of the shoe. Stretch this spring up and over the anchor pin, shoe guide, and the eyelet. Your third hand can help by holding the rear shoe in place and pushing it forward.

Check that the link's in position and find the curved cable guide. It has a hole in it with a little sleeve sticking out the back side. This sleeve fits nicely into the hole in the center of the rear shoe. Put a dab of lube around the sleeve and fit the guide against the hole so the curved edge is toward the lining. Hold the guide in place and pick up the white return spring. Its short end fits into the same hole as the guide sleeve, holding the guide against the shoe. Install it flush as you did the other one. Stretch the spring up and under the anchor pin. It and the guide should be flush with the shoe.

Lift the cable up around the curved edge of the guide, but first lube the part where they contact.

The adjuster mechanism should be screwed together so it's as short as possible. The starred, threaded end fits against the bottom end of the rear shoe and the slotted small end against the bottom of the front shoe. Have your third hand hold all this together while you dig up the adjusting lever and remaining return spring. Put a touch of lube on the hooked end of the cable and hook it into the hole in the adjusting lever. Place the lever so the stamped side (L or R) faces out. Hook the short end of the return spring into the nearby hole in the front shoe and the long end in the lever hole (with the cable hook).

Now stretch the spring and lever down and back to hook the lever's bent tab into the bottom-most hole in the rear shoe. Watch your fingers.

The straight bottom edge of the lever should be parallel to the starred adjustment mechanism. If you push the starred part down, you should hear a click as it operates the adjuster. If it's not together correctly, redo it. For your own safety, don't cut corners.

When you're satisfied, put a touch of lube where the lever and star touch. Look everything over to make sure the pieces fit together as illustrated. Before you quit, center the brake shoes by sliding them up, down or sideways until they are centered on the backplate. OK? You're done. Go on to the next step.

Step 11: Replace the Brake Drums.

Wipe the drum clean with a clean, grease-free rag. (*Don't* blow the dust out.) Use another piece of emery cloth to sand the inside of the hole in the center of the drum, and sand off any rust on the end of the axle. Clean surfaces with a rag, then put a light coat of grease around the center edge of the hub where the hole in the drum fits. It'll come off easier the next time.

Pick up the drum and place it over the shoes. For the drum to fit, the shoes have to be "backed off"—adjusted close to each other and centered to the back plate and hub. The shoes can be pushed from the ends and sides to get them centered. Line up the wheel studs with the holes in the drum. If the drums won't fit, check again to see if the adjuster is backed off and the emergency brake is fully disengaged and adjusted down.

Push the drum over the shoes as far as possible. When the lug nuts and wheel are on, the drum will be drawn tight against the hub. Now try turning the drum and axle. If the transmission is in Neutral and the emergency brake is off, the drum should turn with the axle. If it won't, pull the drum off and check again that everything's installed properly.

NOTE: If the drum just will not fit over the shoes, it may be due to too thick cut-rate linings, which means that the drums may have to be machined down a little. The problem could also be an expanded wheel cylinder; open its bleeder, press the shoes together, and close the bleeder. Or the emergency brake may be adjusted too tight, check for slack in the cable (Proc. 10).

Now do the brakes on the other rear wheel.

•**510 1978 on People:** Refit the **rubber stopper** slotted side over the clevis and flat side toward the backplate. Insert the **pin** down through the stopper and emergency brake lever. Then fit the **clevis** over the **emergency brake lever** and install the **clevis pin** through the holes in the clevis and lever from the top. Install the **cotter pin** through the **clevis pin** and hook the **return spring** between the clevis and back plate.

Step 12: Replace Wheels, Bleed and Adjust.

Replace the wheels (Ch. 13, Pt. 1, Proc. 1). Then adjust the brakes, using Proc. 2 (1, 2, 4 and 6). You must adjust the brakes before you drive.

But first, tighten the lug nuts as much as you can to draw the drum in tight.

•**510 1978 on and 720 1982½ on People:** Operating your hand brake keeps the rear brakes adjusted (Proc. 2). NOTE: Nissan claims the 720 trucks have a rear brake squeal problem. I haven't heard it. If you do and want to fix it, go to a dealer and ask for Nissan "Tech Notes" (Vol. 3, No. 3).

Step 13: Test and Adjust Emergency Brake.

After the rear brakes have been adjusted, try the emergency brake. It should pull up (or out) five to seven clicks, then prevent the vehicle from rolling down a hill. To adjust it, see Proc. 10.

Before you take the car out and test the brakes, press the pedal to make sure that there are brakes. Do they sound and work like brakes should when you drive? Any odd noises or unevenness in their action? Any parts left in the parts containers? Remember, brakes deserve your closest attention when it comes to safety. If something isn't right check it out, see Proc. 1.

PROCEDURE 9: ADJUST THE MASTER CYLINDER PUSHROD (all but 521 people)

Condition: The brakes *must* be adjusted and bled before you do this procedure. The emergency brake should be off (disengaged).

Tools and Materials: 12 or 14mm open-end wrench, pliers.

Remarks This procedure involves the rod between the top of the brake pedal and the piston inside of the master cylinder (or Master-Vac). If after bleeding and adjustment you still have a lot of play in the down stroke of the pedal before any braking resistance is felt, check the rod adjustment. I recommend that with new brakes you drive the vehicle for 100 miles or so after the brake assembly and adjustment are completed before doing this procedure, and always do it when the brakes are hot after lots of stop-and-go driving. Although there is no master cylinder adjustment on 521 models with a single brake fluid reservoir, pedal height can be measured (Step 1). If your brake problems persist, see a brake specialist. Quote from 1975 620 Service Manual: "Note: Take care not to allow the push rod getting into master cylinder in free condition." No liberated push rods please.

Step 1: Figure Out Where You Are.

Open the driver's door and kneel down so your face is near the pedals. Follow the brake pedal upward to where it pivots. Just below that point, there is a **clevis** attached to the pedal, into which the **push rod** is threaded. Put one hand on the rod while you push the pedal down with the other. There should be between 1/16in and 3/16in (1-5mm) of free play before you feel resistance as the rod contacts inside the cylinder or Master-Vac. Unless it's excessive, too much is better than no play at all. On 510 cars without Master-Vac and 521 trucks, the free play should be between 0.2 and 0.6in (5-15mm).

To measure pedal height: This is the distance between the top of the pedal (when it's not depressed and the rubber pad's attached) and the bare floor (with the mat and carpet out of the way).

This distance should be: **Cars**—510 up to 1974: 7.36in (187mm) M/T or 7.95in (202mm) A/T; 610 and 710: 7.28in (128mm); 510 1978 on: 6.06—6.30in (154-160mm). (A/T models are slightly higher). **Trucks**—521 and

620 up to 1976: 5.51in (140mm); 620 1976-77: 5.83in (148mm); 620 and 720 up to 1983½: 6.61-6.85in (168-174mm); 720 1983½ on: 6.93-7.32in (176-186mm).

If you have adequate pedal height, go on to Step 2.

If you don't have enough pedal height try this: Loosen the push rod lock nut as described in Step 2 and increase the push rod length until the correct height is reached. If the rod won't extend that far (the pedal binds), go to Proc. 12 to adjust the brake light switch. Finally set the pedal height by the push rod. But before tightening the lock nut, recheck pedal free play.

Sometimes a piston will stick in the master cylinder, keeping the brakes partly or fully engaged. When this happens, you can adjust the rod full length and still never reach the piston. The master cylinder or MasterVac should be replaced. If you have a MasterVac, you may hear a vacuum hiss when the pedal is depressed.

To determine exactly where the brakes are engaging, drive the vehicle until the brakes are good and warm. Now drive about 10 mph, and coast while slowly putting pressure on the brake pedal. You should feel when the front brakes begin to slow the wheels. Between the top of the pedal when the brakes engage and the top of the pedal when at rest (it's up) is the actual *pedal travel*. There should be about 1¼ in (30mm) and 3¼ in (95mm) of travel. If there is too little play definitely shorten the rod length, if a little too much don't worry about it. I think the maximum allowable distance of travel given is dangerously excessive. If yours travels that far, and the brakes are in good condition and adjusted, reread Proc. 1, and then maybe adjust your pushrod length. Something is wrong.

Step 2: Adjust the Pushrod.

Pick out the 12 or 14mm open-end and the pliers (or 17mm open-end 720s) and look up at the rod. Find the **lock nut** on the rod in front of the clevis. Fit the open-end wrench around the nut from the right side and pull down to loosen the nut. You can now twist the rod clockwise into the clevis to decrease the play or counterclockwise to increase it. Use the pliers (or 17mm wrench) to turn the rod a little at a time. Start the engine and check the point of engagement of the brake pedal. When you have it right, tighten the nut while holding the rod with the pliers. Remember that the rod has to have *some* free play in it.

Once the adjustment is correct, check the **return spring**. It's located below the fulcrum point on top of the brake pedal. One end should be connected to the pedal, the other end to a stationary point above it.

Step 3: Check Pedal Resistance and Height Again.

Pump the brakes a few times to see how they act. If the pedal resistance feels different each time you press it down, something's wrong. If it takes a few strokes to reach its maximum height, feels spongy or "fades" when you put a lot of pressure to it, you have hydraulic problems, such as a leak or air in the system. (If you have a MasterVac and check valve it could cause problems. This is very rare and not covered in this book, but if you have a vacuum leak in the hose between the intake manifold and Master-Vac, problems will be felt in engine performance and braking.) There is more on diagnosis in Proc. 1. Too tight a brake pedal rod adjustment or a bad master cylinder will cause your brakes to bind and drag. This is especially true with disc brakes. If the pedal height changes and gets hard and high during actual driving, back off the adjustment a little. If it continues to give you trouble, check the brake light switch adjustment, Proc. 12.

PROCEDURE 10: CHECK OUT AND ADJUST THE EMERGENCY BRAKE

When you pull on the handbrake it pulls a cable that connects to the rear brake shoes at each rear wheel. Slack in the brake cables can be taken up with adjustment, but the rear brakes should be checked and adjusted first. Often, especially on trucks and early 510 and 610 sedans, the cables get stuck in their housings and don't release, causing the rear shoes to drag. On late model **510s and 720s 1982½ on** there's a self-adjusting brake mechanism incorporated in the emergency brake function.

When the system is working properly the handle should come out or up five to ten clicks and stay in place, holding the vehicle securely from rolling down a slope. An electrical switch wired to the handle turns on a light

on the dash to tell you the handbrake is on. This light also indicates other hydraulic brake problems. To further check out your emergency brake you'll need to raise the rear end of the vehicle.

Condition: The vehicle doesn't hold on hills (with handbrake on). Or the rear brakes drag, the brake handle doesn't release positively, or it pulls up without resistance.

Tools and Materials: Vise Grips, 10mm open-end wrench, penetrating oil, friend.

Remarks: The rear brake adjustment affects the distance the emergency brake has to be pulled out and to some extent the shoes' holding ability. Make *sure* that the rear brakes are adjusted and in good shape before adjusting the emergency brake.

Step 1: Jack and Block the Vehicle.

It's only necessary to jack up and safely support the rear. Follow instructions in Ch. 13, Pt. 1, Proc. 1.

Step 2: Watch the Brake Cables Work.

Have an assistant sit in the driver's seat, hand near the emergency brake lever, while you, the mechanic, crawl under the vehicle and look at the inside of either of the rear wheels.

•**Cars:** On the wheel backplate the brake cable or rod connects via a clevis pin to the lever that disappears into the back plate. Most of the cable is exposed and visible between there and the **balance lever**, located on or in front of the differential. Locate the balance lever.

•**Trucks:** The cable connects to the bottom front side of the wheel backplate. The entire cable is enclosed in a sheath (**housing**) except for a section around the balance lever, located on the rear center or right side of the central chassis crossmember. Find the lever.

Have your assistant pull on the handbrake while you watch the balance lever and/or the individual wheel lever (car people). With handbrake applied the cables to each wheel should become taut and the rear wheels are prevented from turning. Try spinning each wheel (transmission in Neutral). If the cable on one side is disconnected or broken, the other side will not work either. Now have your helper release the handbrake. The cables should slacken and the wheels should turn freely. If they don't and there's slack in the exposed cable, the rear cables are probably stuck in the housing.

Step 3: Free Things Up, If They're Stuck.

•**Cars:** You should have a return spring connected between the cable clevis and the backplate. Without this the brake on that side may drag. On early 510 and 610 sedans the cable has a tendency to stick where it passes through the chassis. By disconnecting the cable at the clevis and squirting some penetrating oil into the hole in the chassis the cable can be worked free.

•**Trucks:** Springs around the cables inside the backplates help return the cable and release the brake shoes and cable to the rest position. The cable tends to stick in its housing. To free it up try grabbing the housing and rotating it in a circle (do not actually twist the housing, just move it in an arc). If the sticking persists, you'll have to remove the wheel and brake drum, disassemble the rear brakes, and remove and replace the cable. (Whew!) New cables are expensive. Trying to free stuck ones is nearly impossible. See Proc. 8 in this chapter, which illustrates the lever-to-cable connection. Ch. 11, Pt. 2, Proc. 2 (4) tells how to separate them and (10) tells how to reconnect them. Once that is done the cable housing can be tapped out of the backplate and the other end disconnected at the front at the balance lever. See Ch. 11, Proc. 5 (3) for information on removing the balance lever and disconnect the cable. You have to get these cables from Datsun/Nissan, left and right are different.

•**Everyone:** Follow the cables all through their route of travel, watching as they engage and release. Squirt penetrating oil on all of the levers and housing to cable points. Corrosion often causes the levers to freeze up. Their pins, or the entire levers, should be removed and lubricated.

Step 4: Check Out the Hand Brake Mechanism.

The old style handbrake handle used in all trucks and early cars is mounted on the dash. The cable comes up through the firewall and connects to the end of the handle. Looking up under the dash you can watch the mechanism function. If the brake doesn't stay on, the problem is probably in this mechanism. When the brake is released you should see the cable slide back toward the brakes.

On later cars, the lever is between the front seats. To reach the cable and inner workings of the lever, a boot and the carpet have to be lifted and four bolts holding the mechanism to the floor removed. The rest is up to you to figure out.

Step 5: Emergency Brake Adjustment.

There are a number of design variations. In all cases the adjustment is made with the handbrake in the down or off position. The adjustment point is at or near the balance lever, underneath the car. Find a threaded stud connected to the cable with a nut or two on its end. Squirt the threads near the nut(s) with a good dose of penetrating oil and let it soak in. **Caution:** The cable end has a tendency to break under even a little twisting force.

Clamp the non-threaded segment on the cable end with Vise Grips and loosen the outermost nut using a 10mm box-end wrench. Now turn the cable or clevis (if there is a second nut, turn it) to shorten the cable length and take up slack. Check your adjustment by pulling the handbrake and counting the clicks. It should take seven clicks to fully engage the console type brake and eleven to thirteen for the under-the-dash type. Once you've got it, retighten the locking nut. Turn the wheels around with the handbrake released to make sure they do not drag.

Step 6: Lower the Vehicle.

All clear under there? Put your car or truck back on all fours, then drive it and test the handbrake for hill-holding and emergency stops.

PROCEDURE 11: REMOVE AND REPLACE THE MASTER CYLINDER

If, after brake work, bleeding and/or adjustment, the brakes still aren't right, a new master cylinder might be in order. Poor braking means that the pedal is spongy, the brakes fade, pull or drag, or the vehicle doesn't stop as it should. Bleed and adjust the brakes.

Condition: Perform a complete check (Proc. 1) and service individual brakes before pointing the finger at the master cylinder. If the master cylinder leaks, it should be replaced.

Tools and Materials: A new master cylinder, 10, 11, 12, 13mm open-end wrenches, brake fluid. *Optional*: Helper, pipe cleaners.

Remarks: You can remove and replace the master cylinder yourself, but I do not recommend you rebuild it.

Step 1: Remove the Master Cylinder.

Look at the illustrations here or in Proc. 1 to locate the master cylinder under the hood. If necessary, disconnect the two wires to the caps on the reservoirs at the pull-off bullet style connections.

Now find the two steel lines connected to one side or the bottom side of the cylinder (521s models have just one line). They are held in place by 10 or 11mm hexagonal nut "flare" fittings that you have to disconnect. Be careful not to strip the fitting or twist the steel line when doing this. Loosen the fittings (counterclockwise) with an open-end wrench until they are out of the cylinder body. (Read Ch. 13, Pt. 1, Proc. 2 on Vise Grip method if the fittings are stubborn.) Carefully pull the lines and fittings out of the holes and a little away from the cylinder, but do not mix up their positions. Fluid will leak out of the lines—catch it with a thick rag.

Find where the cylinder is bolted to the firewall or MasterVac. It is held on with two 12 or 13mm nuts or bolts.

•**Early 510 and 521 People:** In order to remove the master cylinder, you have to disconnect the *push rod*

and *clevis* from the brake pedal. (On 521s, the brake return spring hooks to the pin. Remove the spring and disconnect the two wires at the brake light switch before removing the clevis pin.) Peer under the dashboard. Connected to the brake pedal shaft up top is a clevis piece with a pin through both it and the brake pedal. A clip holds the pin in place. Remove the clip with a screwdriver and push the pin out. Put the clip and pin together in a container.

•**Everyone:** Remove the nuts or bolts and washers at the firewall or MasterVac. The master cylinder is now free.

If the master cylinder sticks, wiggle it up and down and side-to-side gently, being careful not to spill fluid. There may be some shims between the cylinder and its mounting; be sure to catch them when the cylinder is pulled away. Non-MasterVac people, remove and stash the push rod.

Carry the cylinder to a place where the old brake fluid can be safely dumped; it's toxic.

Compare the old cylinder with the new one—it has to be identical.

Step 2: Check and Adjust MasterVac Output Rod Length:

NOTE: There is no specification given for 720 1983½ on or 510 and 521 models without MasterVacs.

Find the rod with a rounded end sticking out of the MasterVac. Measure between the tip of this rod and the flat surface that the master cylinder bolts against. The distance should be: disc brake vehicles (all except 620 trucks up to 1978)—0.39in (9.75-10mm). On 620 drum brake trucks—0.39 to 0.41in (10-10.5mm). If it isn't right, adjust it with an 8mm open-end wrench and pliers.

Step 3: Replace Master Cylinder.

Line up the cylinder with the holes or studs in the firewall or MasterVac. If there were shims behind the cylinder, put a dab of grease on each to hold them in place and slip them in.

•**Early 510s and 521s:** You have to reinsert the push rod and position the clevis so it'll fit over the brake pedal lever. A helper in the passenger compartment is helpful here.

•**Everyone with MasterVacs:** The pushrod that controls the master cylinder is connected to the MasterVac. Put a dab of grease on the end of the rod.

•**Everyone:** Fit the flanged end of the cylinder over the hole in the firewall or Master-Vac. Line up the bolt holes. Make sure the cylinder goes flush with the firewall or vacuum unit and install the washers, nuts, or bolts. Tighten the nuts or bolts until the washers are flat.

Make certain the steel brake line(s) that connect to the cylinder are clean. Pipe cleaners are useful to clean the lines. Now match and slip the lines up into their holes on the bottom or side of the cylinder. It is absolutely essential that the hexagonal nut fitting threads be started into the cylinder straight. *Take your time* to screw the fittings in smoothly, while holding the line firmly into the cylinder. Tighten the fittings with your wrench so the line is secure within the cylinder.

•**Early 510s and 521s:** Duck inside the passenger compartment with your clevis pin and clip. Crane your eyes up on top of the brake pedal lever to where the clevis pin attaches. The clevis fits over the lever and the pin holds the two together. Put a spot of grease on the pin and install it through the clevis and hole in the lever. (On the 510 the pin goes through from the left, and on the 521 the pin goes through from the right.) Slide the clip over or through the pin to secure it.

•**521 models:** The return spring has to fit over the non-clip end of the pin. Make sure the spring is fully installed. Then reconnect the bullet connectors for the brake light switch wires.

•**610s, 710s and late 510s:** If you had wires to the caps on the reservoirs, reconnect them now.

•**Everyone:** Once the cylinder is in, the entire brake system should be bled. (Refer to Proc. 2 for this and brake adjustment.) When its all bled, you should adjust the master cylinder push rod (Proc. 9). Then recheck it after driving.

It is possible to bleed just the master cylinder itself. Fill the reservoirs and loosen the **bleeder nipple(s)** on the side of the cylinder. Connect one end of a clean hose(s) to the bleeder(s) and place the other end into the fluid in the reservoir. Pump the brake pedal until the hose is cleared of all air. Tighten the bleeder(s), remove the hose, make sure the fluid level is correct, and put the cap(s) back on. Take a short slow drive to make sure your brakes are working. Check for leaks at the lines and back of the cylinder.

PROCEDURE 12: CHECK, ADJUST, AND REPLACE BRAKE LIGHT SWITCH

Condition: The brake lights don't go on and you've checked fuses and brake light bulbs (Ch. 7). You can't get enough pedal height as described in Proc. 9 (1).

Tools and Materials: Insulated 12-18 gauge wire 3-4in long, assistant, 12 or 14mm lock nut.

Step 1: Locate the Switch.

Follow the lever connected to your brake pedal up under the dash. On your (left) side of the lever there's a little metal can with two wires connected to it. This is the brake light switch. As the pedal is pushed down, the lever moves away from the switch, and a button in the switch springs out which completes a circuit and turns on the brake lights.

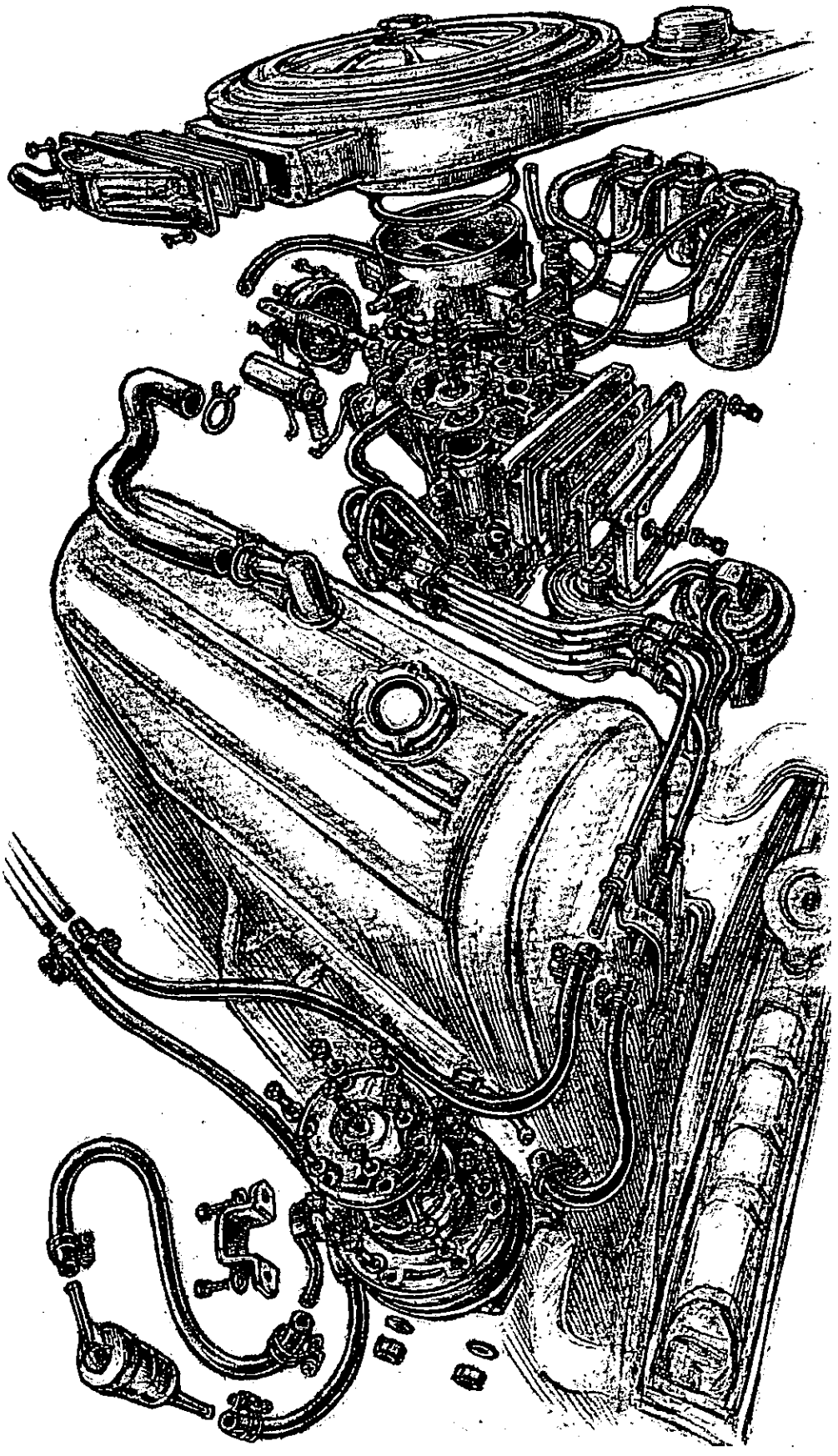
When the pedal returns the button should push back into the switch. There should be no more than 0.003in (virtually no) distance between the rubber stop on the pedal and the button. If you don't have adequate pedal height, go on to the next step and adjust the switch back until you can lengthen the pushrod enough to get the right pedal height.

Step 2: Test the Switch.

Use the 3-4in long insulated wire. Bare the ends of the wire back a half inch (and twirl the strands together with your fingers). Trace the switch wires up a few inches to two plastic coated connectors. Pull the wires apart at these connections. Take the female ends of the wires that are now free of the switch and stick an end of the test wire into each of the connector ends. You have now jumped the switch, making a complete circuit for the lights. Look to see if the brake lights are on. If they are, chances are the switch is bad.

Look at where the pedal lever meets the switch. There's an adjustment on the switch button to shorten and lengthen its stroke. When the pedal is pushed all the way down the switch should not touch the pedal. And when the pedal is up the switch shaft should be all the way in. To adjust, remove and replace the switch, loosen the 12mm or 14mm lock nut that holds it in place and after disconnecting the wires, thread the switch out of the body. Thread it back in to replace it. To adjust its position, reconnect the wires and get an assistant to watch the tail lights while you position the switch so that it operates when the pedal is slightly pressed and turns off when the pedal comes to rest. Retighten the lock nut.

Fuel and Emissions



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CHAPTER 6
FUEL AND EMISSIONS

Part 1: FUEL SYSTEM

Fuel is the vital element that runs your car or truck. Without this precious luxury our whole transportation system would fall apart. Actually, just a small percentage of the gasoline you put into the tank moves you and your wheels down the road. Most of it is wasted as heat, noise, and incomplete combustion—pollution out the tailpipe. No one can claim the internal combustion engine is really efficient.

Let me take you now on a journey through your fuel system, from gas tank to engine. Once the engine is cranked, fuel is pumped through steel and rubber lines from the tank up to your carburetor. The fuel arrives first at the **fuel filter** then moves along to the **fuel pump**. Most Datsun/Nissans use a *mechanical* fuel pump, mounted on the right front side of the cylinder head. The camshaft moves a lever that activates the pump. Many 1978 and later trucks (especially air conditioned and power steered) use electric fuel pumps that are mounted under the truck and near the fuel tank. There's an additional filter in the electric fuel pump (Ch. 3, Proc. 10). The fuel pump sucks fuel from the tank and pushes it to the carburetor. The *inlet* line goes into the pump and the *outlet* comes out of it. The outlet line runs over to the carburetor *inlet pipe*. Just below this fitting (and out of sight) is another small filter and the **needle and seat**.

You're now in the carburetor. The needle and seat assembly is a valve that regulates how much fuel is stored in the carburetor's **float bowl**, the last storage place before the fuel is consumed by the engine. As this bowl fills, a float floats up with the rising level of gasoline, much like the float in a toilet tank. When the level reaches the correct point, the needle, riding against the **float tab**, contacts the seat and cuts off the supply to the bowl from the pump. At this point the fuel pump idles until the float level drops, when you step on the gas. From the bowl, the gasoline is drawn through small circuits and drillings in the carburetor as the engine runs and draws air in through the carburetor. The engine's pistons create this negative pressure on their *intake strokes*; this is called *intake vacuum*.

The carburetor is a precise metering device that has complex functions while the engine's running. You'll find more about the carburetor and other fuel system parts further along in this chapter. 1984½ (1/84) Calif. and 1985 (7/84) Fed. and later 720 (trucks) have electronically controlled carburetors (E.C.C.). Your characteristics are mentioned in specific places throughout this chapter. Proc. 17 is dedicated to you.

Most L-series engines have a fuel return system that fits between the pump and the carburetor. Z-series ones have a return valve in the fuel pump. These systems are really nothing more than plumbing that allows fuel to circulate back to the fuel tank, preventing fuel overheating (or vapor lock). Early 510s have a fuel return valve bolted to the carburetor. Two hoses connect to it.

One part of the fuel system, the *fuel tank ventilation system*, is covered in Part 2 of this chapter.

A WORD ABOUT THE DANGERS

Above all, when dealing with the fuel system, take safety precautions. Gasoline is flammable. Never use flames, make sparks, or smoke when working around gasoline fumes or an engine for that matter. Places where sparks can occur are the following: inside the distributor, between the distributor and coil or distributor and

spark plugs, and at the battery posts. High voltage sparks will jump to the closest ground (metal—the body, engine, or frame) from a disconnected coil or spark plug wire if the ignition is turned on and the engine cranked (or points opened). Crossing between the battery posts with a metal tool will make spectacular sparks that can burn you. In any of these cases, if fuel is present, fire and explosion can result. Be cautious and think. Always track down leaks and fuel odors.

Avoid getting gasoline on your skin, or in your eyes or mouth—it's a poison. Never store gasoline in glass or plastic. Keep it out of children's reach and in a well-ventilated room (not the inside of a car trunk or passenger compartment). Read through the general safety precautions found in Ch. 1 before commencing work.

Most people know that gasoline is most combustible in its vapor state. But sometimes it takes more than advice to teach an idiot how dangerous it can be. In high school I was a motorcycle fanatic. Old English bikes were my passion. The first chopped-out classic I took on was a 1949 BSA Rocket Star 500 twin. I spent every free minute restoring this relic. My friends and I rebuilt the engine with limited knowledge and tools, locating parts where we could and manufacturing what we couldn't. The last step was painting the frame and tank. My winter evenings passed in the basement, sanding and spraying. When spring arrived, my ego trip was ready to roll: Naturally there was an audience: two nervous parents and some overanxious friends. Opening the fuel tank valve I noticed and ignored a constant drip, drip, drip of gasoline from the carburetor. Being impetuous and not concerned that the distributor was directly below the carburetor, I opened the throttle and kicked down the starter bar. The engine started, and so did the fire. In a flash flames licked up my pant legs. My mother, conditioned by incendiary bombs during the London blitz, ran for an extinguisher. "My paint job!" I howled, jumping off the bike, ignoring the unpredictability of a full gas tank. It seemed like forever before anyone approached the blaze. Driven by my adolescent instincts to save the bike, I approached and with a quick squirt, quenched the fire. The result was a tarnished tank that unveiled many layers of unsanded paint and a solid lesson in the combustibility of gasoline. Moral: *Watch for spark potential when fuel is present and keep a fire extinguisher handy.* Thanks, Mum.

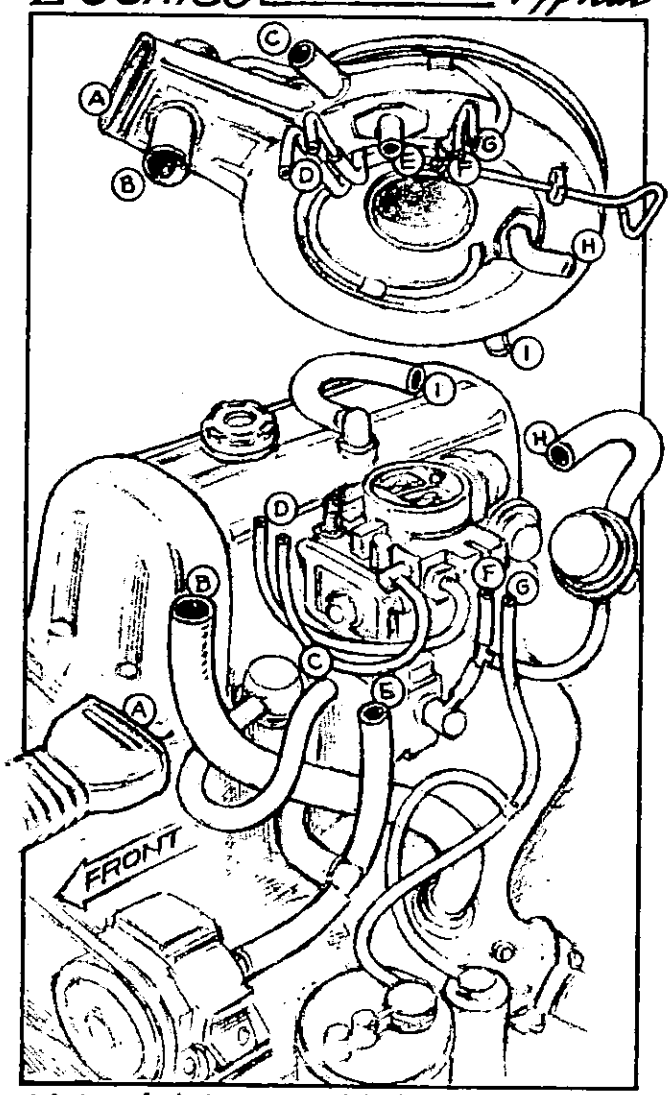
GASOLINE FACTS AND LORE

There are basically four types of gasoline available at present: regular and premium grades in leaded and unleaded. Most late models require unleaded fuel; many of them don't run well on regular but smooth out on premium unleaded. Your Datsun/Nissan engine won't run well on regular (or low octane) fuel if the cylinder head has been resurfaced and the compression increased. There's more on this in Ch. 9, Pt. 1, Proc. 1 and Ch. 10, Proc. 2. I use unleaded gas although it's a bit more expensive and my vehicles were designed to run on leaded. Lead is a serious pollutant, and unleaded fuel is low in phosphorus and sulphur. Tetraethyl lead was put in fuel to improve "drivability" and valve wear. Unleaded fuel has other additives to take the place of lead. Most performance complaints pertaining to fuel quality are pinging/knocking, which is a "pre-ignition" phenomenon called detonation, and on earlier models, "running on" after the key is shut off. If you have these symptoms and the engine is adjusted to specification, try a higher (premium) grade of fuel. The higher the octane number the less likely the engine is to knock. These octane ratings are posted on the gas pump.

Another somewhat uncontrollable situation was common during the oil embargo in 1973. I was travelling in the South with my buddy Plastic Eddie in his '53 Dodge pickup. Somewhere in northern Mississippi we filled up at a Billups station, hoping to make New Orleans that night. Having hair somewhat longer than "fashionable" for "decent" men at the time, we motored along with trepidation. A few miles out of town the truck began to power jerk like a mechanical bull. Having just filled the tank, we suspected a fuel problem. "Don't let the sun set on you in Mississippi" Eddie mumbled, pulling the truck off the road. Anxiously I considered what those famous Mississippi haircuts would feel like. Using the only tool we had, a screwdriver, I opened up the carburetor and peered into the float bowl. Alas, droplets of water lay along the bottom of the bowl majestically separated from the fuel. Water contamination! One could picture the little devils hanging up in the main jets, causing Old Blue to cough and jerk. I mopped out the bowl and reassembled the top of the carburetor. On we went till the next rash of water hit the jets, again and again we stopped to swab out the carb. Tired and frustrated, we lurched into a beautiful, quiet Mississippi town and magically came to a halt beside a rustic garage, operated

by three gentlemen. Night had fallen and the shop was closing. Sensing our fear and desperation, the mechanics laughingly welcomed us into the simple garage where we drained the tank, blew out the fuel lines with compressed air, drank cheap bourbon, then disassembled and cleaned the carburetor. Finally we replaced the water-laden fuel with some fresh and the truck ran like the healthy old timer it was. We offered our noble hosts the few bucks we had left, which they refused. I wish I could remember the name of that town . . .

L-SERIES AIR CLEANER HOSES Typical



A-A Fresh air duct & snout F-F to intake manifold
B-B warm air duct from stove (plug if running engine)
C-C Air control valve (some) G-G to carbon canister
D-D High altitude models H-H AB (anti-backfire) valve
E-E Air relief valve I-I PCV hose to cam cover

PROCEDURE 1: REMOVE AND REPLACE THE AIR CLEANER (AC) HOUSING

Condition: You want to expose, adjust or work on the carburetor. You want to work on engine components that the air cleaner covers.

Tools and Materials: Screwdrivers (Phillips and straight), 10 or 12mm open-end or socket, pliers, a few colors of nail polish or masking tape, pen (small felt tip is best), parts container, pocket knife, 6 in. piece of ¼in (6mm) and 5/32in (4mm) rubber hose, 2-3 golf tees or screws to plug rubber hoses. **Air Pump or Air Injection People:** 1 or 2 wine corks.

Remarks: There are many designs of air cleaner housings found on Datsun/Nissans, depending on the year and model you have. California, Federal and Canada models vary as do L and Z-series. Figure out what model you have by looking at the engine and reading the I.D. plate riveted to the driver's door frame. These details are covered in Ch. 1. More subtle differences come with high altitude engines, read on. Many of you may have some of the original hoses disconnected. Do your best to follow along.

NOTE: AC is my abbreviation for air cleaner (housing). There are basically two types of rubber hose connected to the AC housing: the larger **air hose** is 1in outer diameter, and the smaller **vacuum hose** is 5/16-7/16in outer diameter.

Step 1: Remove Mounting Bolts.

Set your parts container somewhere it won't get knocked over. Open the hood and look at the main round part of the **air cleaner housing**.

•**L-series:** On its side and front locate two 10mm headed bolts with washers under them. They hold the housing to a **securing bracket** (blue) that takes the strain off the top section of the carburetor. (If the bolts or bracket are missing I recommend you replace them.) Remove the bolts and keep them in the parts container.

•**Z-series:** Follow the *inlet snout* that passes over the top of the engine and attaches in two places (on either side of the snout) to the cam cover. Remove the bolts with a 12mm socket and put them in the container.

Step 2: Remove Crankcase Ventilation (PCV) Hose.

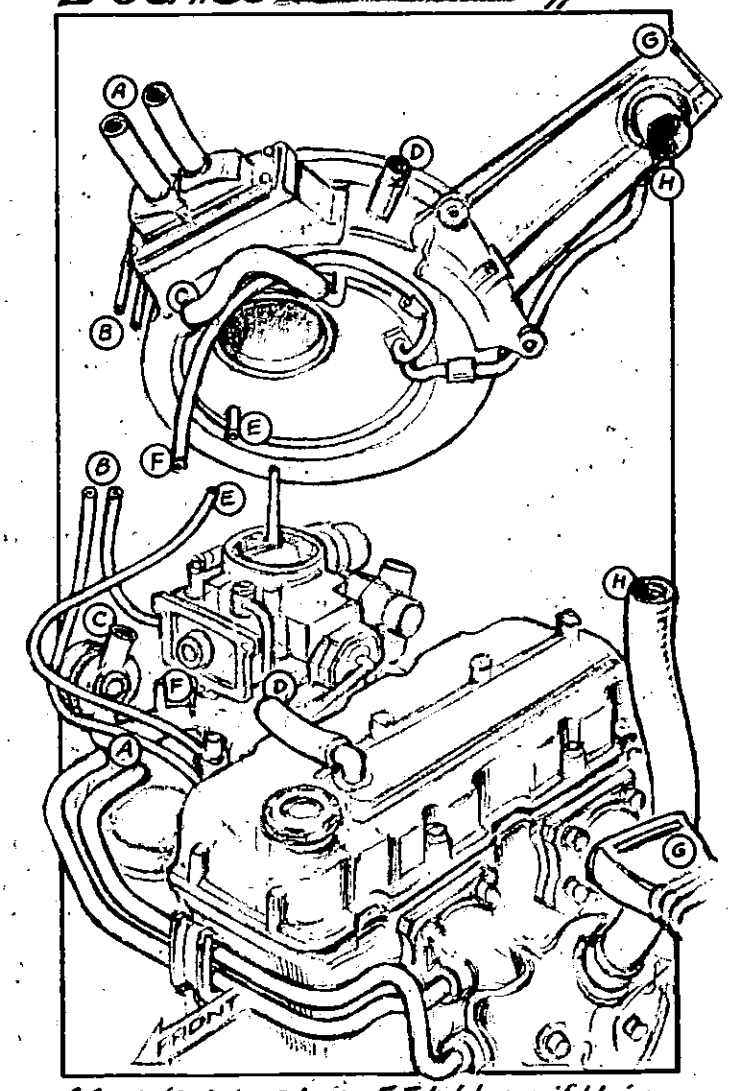
The aluminum housing atop the engine is called the **cam cover**. Look along its top to find a thick black hose secured to an elbow pipe fitting. Push this hose off of the pipe. You'll probably have to pinch the **wire clip** around the hose and slide it back along the hose, then pull, push or wiggle the hose off the pipe. Keep the other end of this hose on (with) the AC housing.

Step 3: Remove Air Cleaner Housing Top and Disconnect Air Intake Preheat Hose.

To remove the top of the housing turn to Ch. 3, Proc. 7 (5). Return here when the top is off. **L-series People:** You can leave the top on and remove the housing but removing it makes installation easier. See the **snout** leading into the housing? On the bottom of this snout there should be a fat, white flexible hose held (maybe) by a clamp. This hose is important for proper air temperature mixture and often deteriorates with age. If missing, make a note to replace this hose with one of the exact same size. If clamped, disconnect it with a Phillips screwdriver and gently pull the hose down off the snout.

•**1974 on L and All Z-series Models:** Look for a flexible plastic or rubber hose attached to the very front of the snout. A coil spring, wire clamp, or screw should hold this hose to the snout. Once detached from the snout, stash the clamp or screw and if plastic, turn the hose out of its slotted place in the vehicle body and set aside. If rubber, the hose will remain attached to the body.

Z-SERIES AIR CLEANER HOSES Typical



A-A EAI (AIS) 1 or 2 hoses F-F Intake manifold pipe
B-B Loop - high altitude only (plug if running engine)
C-C AB (anti-backfire) valve G-G Fresh air snout & duct
D-D PCV hose to cam cover H-H warm air duct from
E-E Top connection TVV valve exhaust manifold stove.

Step 4: Loosen Carburetor Air Horn Clamp (L-series only).

Run your hand under the bottom left (driver's side) of the round part of the housing, and work your way rearward until you feel a **steel rod with a handle** bent into the end of it. Turn the handle counterclockwise three full turns. The AC housing should now pull at least a little way up and off the carburetor. If you're an early L-16 or 18 person and alterations have been made, your housing may come away from the engine now. Otherwise, there is more to disconnect.

Step 5: Disconnect Air and Vacuum Hoses.

•**1969—1971 Cars:** If the **smog pump** is still connected in your car there'll be an air hose coming up from the smog pump to the bottom of the AC housing. It's best to disconnect this where it meets the air cleaner but if that's a hassle, take it off anyplace you can. You have one vacuum hose to disconnect, go ahead to **Everyone:** Disconnecting Vacuum Hoses.

•**1972—1973 Models:** No smog pump was installed on your engines. Jump ahead to **Everyone:** Disconnecting Vacuum Hoses.

•**1974 Cars:** You should have a smog pump. Your instructions are the same as 1972-1973 models, except you have an air hose running to the AC Housing from the **smog pump inlet**. Disconnect this at the AC housing. Now go on ahead to **Everyone:** Disconnecting Vacuum Hoses.

•**All Models (L and Z-series), 1975-on:** Anti-Backfire (AB) Valve Hose: This hose attaches to: **L-series**—the rear underside of the AC housing. **Z-series:**—the front underside of the AC housing. **Everyone**—The other end of the hose connects to the **AB valve** a cylinder that may be clipped to a bracket on the intake manifold or bottom of the housing. Loosen the clamp on the valve end just enough to free the hose. You'll have to pull hard on the hose and maybe wedge a screwdriver between it and the valve. Leave the valve connected to the engine.

•**L-series:** Move your hand forward, around the base of the AC housing until you come to another air hose. This one's for the **air relief valve**.

•**Fed and All Calif (L-series) Models:** There may be an air hose connected to the front left side of the AC housing. It goes to the **air control valve**. Loosen the clamp and wiggle the hose off the fitting and bend the hose back out of the way.

•**Everyone:** Disconnecting Vacuum Hoses, L and Z-series: You have one or more vacuum hoses that connect the air cleaner to the intake manifold, the altitude compensator, the BCDD valve the carbon canister, carburetor, and/or TV valve. How many and where you disconnect these depends on your model year, whether it's Fed., Can. or Calif., and L or Z-series. On L-series, many components connect from the left fender wall. On Z-series they connect from the right. Tape and label the hoses, using numbers to match them to the pipes or connectors they come off of so you know where they go. Disconnect only hoses necessary to remove the air cleaner housing. Make a note to replace or cut back any cracked or otherwise deteriorated hoses. A vacuum leak can ruin your whole day. Tape and label on or next to the pipe or fitting corresponding to the hose that connected to it. If you have a few colors of nail polish around, paint the corresponding hoses/pipes with like colors. That'll make this task easier next time. My favorite colors are Cherries in the Snow and Pink Paradise. What are yours?

These hoses can be tenacious little buggers. To unstick or remove them from pipes (fittings) pinch together the little clamps around them (if any), then twist gently with pliers while pulling with patience.

•**Everyone:** Plugging Instructions: If you plan to run the engine (for maintenance, carburetor checkout, etc.), all exposed vacuum sources have to be plugged. (Early vehicles need not do this.) Use a screw or golf tee to plug exposed hoses on (or connected to) the intake manifold. To plug exposed pipes (fittings) on the intake manifold, cut short (2-3in) pieces of rubber hose. Plug one end with the screw or golf tee, then slip the other end over the exposed pipe. Which size hose you use depends on your engine. Try and see—read on.

•**L and Z-series People with Air Injection (AIS) or Exhaust Air Injection (EAI)—1980 on non-ECC People:** You are one of these if there's an air hose connected to a pipe on the side of the air cleaner housing. On L-series it's on the back side and on Z-series you have one or two hoses on the front side.

The pipe this hose connects to is part of a removable cover (4in long) that's held to the side of the housing by four small screws. The hose is probably fixed to the pipe by a crimp style clamp.

If you're doing maintenance, I recommend you check the filter that's inside the side (reed valve) cover. You can unscrew the cover, remove the AC housing, then install the filter when you reinstall the AC housing (Ch. 6, Pt. 2, Proc. 6 for more about this). Stash the little screws back in the cover.

If you just want to disconnect the hose(s) use a screwdriver to either spread the crimped part of the clamp or unscrew the strap type clamp. Don't damage the hose in the process. If you spread the crimp style clamp, you'll have to install a 5/8in strap type heater hose clamp in its place.

If your hoses are disconnected and you have a wine cork or two handy, stick them in the ends of the hose. It's quieter that way.

Step 6: Install Air Cleaner (AC) Housing and Hoses.

There are so many variations, pay close attention. Lay or hold the AC housing nearby or above the carburetor and visually match up the connections. **L-16 and L-18 People:** The smaller vacuum hose connects to the upper pipe of the **flow valve**, mounted on the wall of the engine compartment. If you have a *smog pump* an air hose goes to the pump (which may or may not still be functional), the vacant end connects to a pipe at the bottom left of the AC housing.

•**1972-73:** No smog pump on your engine, proceed to **Everyone** below.

•**1974:** You originally had a smog pump. Read through the 1969-73 instructions to install your AC housing then go to **Everyone** below.

•**Everyone (L and Z-series engines)**: Starting at the rear, connect the PCV hose. On L-series engines it's on a pipe underneath the air cleaner. On Z-series it's on the front side. It fits onto the pipe elbow on top of the cam cover. You probably pinched a wire clamp on the cam cover end to remove the hose. Pinch and slide this hose back into place.

Turn your attention to the vacuum hoses. Here is where you have to consult the labels or colored markings you made to match the (smaller) vacuum hoses. These connect to some of the following: the intake manifold, the carbon canister, the BCDD valve, the altitude compensator, carburetor, and/or TV valve.

You certainly plugged one or more vacuum sources (pipes or hoses) with your self-made hose(s) and/or golf tee(s). Remove these and connect all the housing's vacuum hose(s). Replace damaged hoses with new ones, cutting them to the exact length and fit.

•**Everyone (pre-1975):** If you have no air (smog) pump and all other black vacuum or air hoses are left disconnected, jump ahead to **Everyone**—all years and models.

If you have an air (smog) pump drop down to **Everyone** with AIS or EAI and make sure your air hoses are properly connected.

•**Everyone with AIS or EAI:** The air hoses are the larger rubber kind (lin OD). Usually it's easier to take a dry run by setting AC housing down over the carburetor and eyeballing the hose to pipe positions.

Find the AB valve. It has a vacuum hose and another air hose connected to it. On L-series one hose connects to the underside of the back of the AC housing and the other to the rear branch of the intake manifold. On Z-series the AB valve and its hoses are in front and below the AC housing.

•**Everyone with AB Valve (E.C.C. People included):** You can remove the clamp and simply slip the hose that's on the AC over the AB valve pipe, and if the hose fits leave the clamp off.

As you fit the large hoses keep an eye on the vacuum hoses. Reconnect the vacuum hoses if they jostle loose. This is a juggling act. **L-series with Air (smog) Pump:** Another air hose probably connects to the bottom of the housing. You can treat this and other air hoses like the AB valve—no clamp, simply slip the hose over the pipe.

You may have an additional or solitary hose at the front of the housing. All these air hoses lead to the smog pump. Lots-O-Plumbing. When they're all secure go ahead to **Everyone** below. **L-series and Z-series with EAI:** You have one or two hoses connected to the rear (L-series) or front (Z-series).

If you removed the four little screws and reed valve cover, the hoses are still attached. Inspect the filter and reinstall the cover, filter and valve as described in Ch. 6, Pt. 2, Proc. 6, then return here.

If you pulled the hoses off the pipe(s) on the reed valve cover, slip it (them) back on. You should have a hose clamp(s) to secure the hose(s) after they're in place. Of course, if you corked the hoses, uncork them first.

•**L-series People:** (Remove the air cleaner's top if you haven't already.) To get the AC housing to slip over the carburetor air horn and match up with all the various hoses, you may need to loosen the air cleaner clamping screw a little more than it is already.

•**Everyone—all years and models:** Center and wiggle the housing over the carburetor into place. Take another look at the hose connections, especially the vacuum hoses.

•**L-series:** Align the two holes in the front of the housing with the two corresponding holes in the bracket

mounted to the front of the intake manifold. Once the housing is down in place, put in the two bracket to housing 10mm-headed bolts with washers. Now feel around for the clamping screw at the rear of the housing. Turn the steel handle clockwise. NOTE: If the handle's missing and/or the ring around the air horn's funky, go to Datsun/Nissan and order replacement(s).

•**Z-series:** You have two 12mm bolts in your parts container. Align the bracket on either side of the inlet snout with two holes in the cam cover. Screw the bolts in here and tighten them snug.

•**Everyone:** Find the large hot air duct hose that connects the AC snout to a **heat riser** attached to the exhaust manifold. Replace this hose if it's out of commission. On early models the sizes vary. Connect the duct hose to the round fitting under the snout. On all L-series there should be a clamp on the top end. If there, tighten this and check the lower connection at the exhaust manifold.

•**1974 on L and Z-series:** You should have an accordion-looking plastic or oval rubber hose that connects the inlet of the snout to the front of the engine compartment (body). If plastic, the front end twists into a keyed hole in the body, the rear over the snout. If it's rubber the front's attached, so slip the rear over the snout.

A coil spring, screw, or wire horn clip should hold the fresh air inlet to the snout.

Step 7: Recheck Everything.

Recheck all the hose connections, using the checklist below. Look closely at the hose connections, especially the vacuum hoses. Make sure your air filter element is in good condition before placing it back into the housing. For more on that and info on installing the AC housing top, see Ch. 3, Proc. 7 (5).

Your air cleaner has one or many of these connections. Check them:

•PCV hose—cam cover to AC housing

•Hot air duct—AC snout to exhaust manifold

•Fresh air inlet—front of AC snout to front of engine compartment (1974 on only).

•Vacuum hoses directly from intake manifold or via connectors or components on engine or fender wall, e.g., carbon canister, altitude compensator, carburetor, TV valve. (You want no vacuum leaks).

•Air hoses from AB valve, air (smog) pump or its valves, or on non-smog pump engines the one or two EAI hose(s).

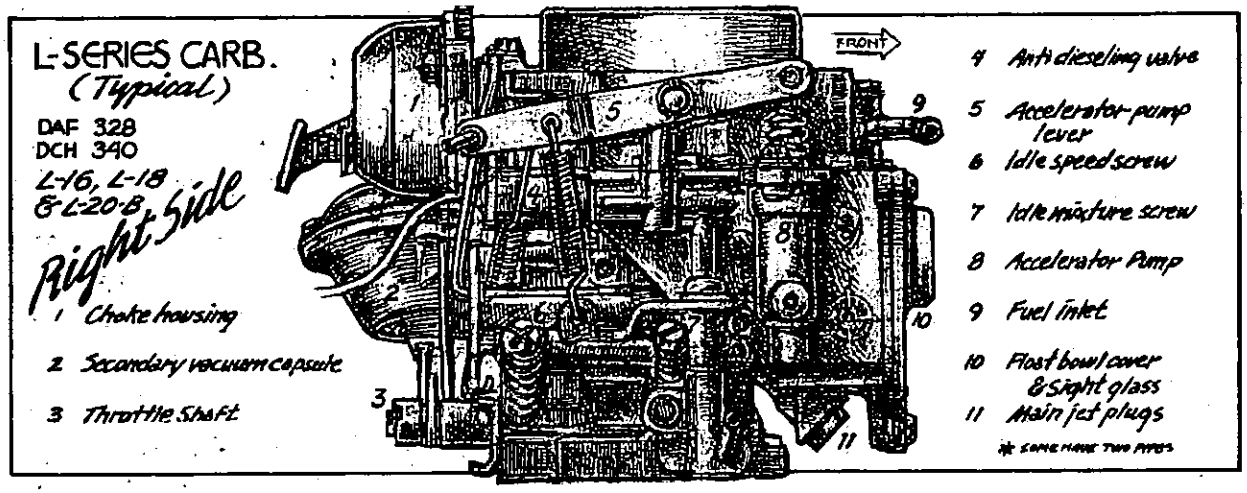
Account for all vacant hoses. Make sure the AC housing is secure and happy. Are you? Run the engine and check for vacuum and air leaks.

PROCEDURE 2: CARBURETOR CHECK OUT (WHILE IT'S ON THE ENGINE)

Condition: Your engine doesn't run. You are having problems with irregular idling (won't idle, low or high idle), hard starting, stalling, erratic engine behavior, poor acceleration, excessive fuel consumption, hesitation or surging at medium and/or high speeds. Before condemning a carburetor, perform a complete tune-up, and check the fuel and air filters (Ch. 3). (Also check vacuum hoses, see hose layout in Ch. 6, Pt. 2, Proc. 1.) Some carburetor checks can be made while performing the tune-up. Drive the vehicle after the tune-up, making careful note of any disagreeable symptoms. If your engine doesn't run and you want to check if there's fuel getting to the carburetor, do Steps 1, 5, and 6 in this procedure.

Tools and Materials: Phillips and straight screwdrivers, trouble light and/or flashlight, small mirror (L-20B and Z-series People). For Step 13 get a can of aerosol carburetor cleaner (with tubular nozzle piece), two clean parts containers, a clean rag, needlenosed pliers, small paper clip, masking tape and pen, safety glasses.

Remarks: If the carb or other part of the engine has been worked on and troubles crop up, determine exactly what work was done before condemning any one part, especially the carburetor. If you push the accelerator pedal to the floor and nothing happens, the cable may be broken or damaged (Proc. 4). The sides of the carburetor are viewed from the driver's seat. **Front** is the side closest to the front of your vehicle. **Right** is the passenger side, **Left** driver's and **Rear**—well, your guess. "Your right or left" is from **your** perspective facing the object.



Step 1: Remove the Air Cleaner Housing.

The engine has cooled down. Park the vehicle on level ground. Set the emergency brake and put the transmission in Park or Neutral. Go to Proc. 1 to remove the housing then return here.

Step 2: Check "Security" of the Carburetor Sections.

One problem with Datsun/Nissan carburetors is the tendency of the sections to come loose—especially early carbs. Vibration is the cause. Your carburetor is made up of three main sections: the air horn/top section, the main body/midsection, and throttle/lower section. The **airhorn/top section** is the top part of the carburetor. Place your hand over the big hole-airhorn, grasping it firmly. Try to turn this part one way then the other. If the top section is loose, you'll feel play. Next hold the midsection (main body) of the carburetor between both hands. Turn it back and forth, to determine if the main section-to-lower-throttle section screws are loose; this is quite common on L-series carburetors. Now find the front two nuts that hold the carburetor onto the manifold (see Proc. 5 for location). You can determine if the carb-to-manifold or main section to throttle section is what's loose by looking at the specific parts while trying to move the carb.

The **float bowl** is on the **front** of the carburetor. Between the float bowl and the air horn and slightly to the **right** (L-series) or **left** (Z-series) find the *fuel inlet*. Old style DAF carbs have a **fuel inlet/return combination** with two pipes pointing down. Newer L-series and all Z-series carbs have one inlet pipe. Follow the inlet pipe to find a 12mm bolt head above the float bowl. All newer carbs have a retainer over this bolt to keep it from coming loose. Grasp the inlet pipe and try to wiggle it. It shouldn't move. If it does, the **needle and seat assembly** is probably loose or the 12mm bolt is loose. Look closely. The bolt threads into the needle and seat so the whole lot will turn if the assembly is loose. (There's more on this in Proc. 7.) On later, L-series DCH carbs the inlet pipe is kept in line by a forked bracket, which is attached by the **front** top section-to-midsection screw. This screw is cause for much grief in the Datsun/Nissan carburetor world. What happens is that the needle and seat and/or the 12mm bolt loosen, allowing vibration to work on the other parts including the screw, which in many cases strips the threads in the midsection. The entire top section of the carburetor may then come undone at the seams. **L-series:** Because the air cleaner housing is clamped around the airhorn, a lot of additional stress is put on the top section. That's why there's a bracket (blue) between the intake manifold and the front of the air cleaner housing.

Step 3: Recheck Loose Carburetor Screws.

If you found the midsection-to-lower section loose, the carburetor has to be removed to tighten them. The gasket between the sections should be replaced if the looseness damaged it (Proc. 5 and Proc. 14 [2]).

If top section screws are loose, you'll probably be able to retighten the screws and be back in business. But, if the screw holes are stripped, you may have more to do. The midsection (carburetor body) is soft metal and cannot tolerate overtightening. If vibration, overtightening or the use of an oddball screw hasn't destroyed the

existing threads, you can usually salvage what is there. Keep reading.

Start with the **front** screw atop the float bowl, i.e., the one that holds the needle and seat retainer. (Z-series carbs have two screws on the front.) Try to loosen each of the four (or five) top section screws gently. If one is loose, I suggest you remove it before trying to retighten it. Don't drop the washers. Look at the screw's threads, taking note if there's any metal from the carburetor stuck between them. If there is, the stripping process has begun and I recommend you chase the threads with a 5mm x 0.75 tap or chasing tool. If they're really stripped, the holes can be retapped oversize and new screws installed. This is painstaking and not covered in this book. Another carburetor may be your only alternative. NOTE: Don't mix up the screws! Remember their exact locations.

Step 4: Tighten Loose Carburetor Screws.

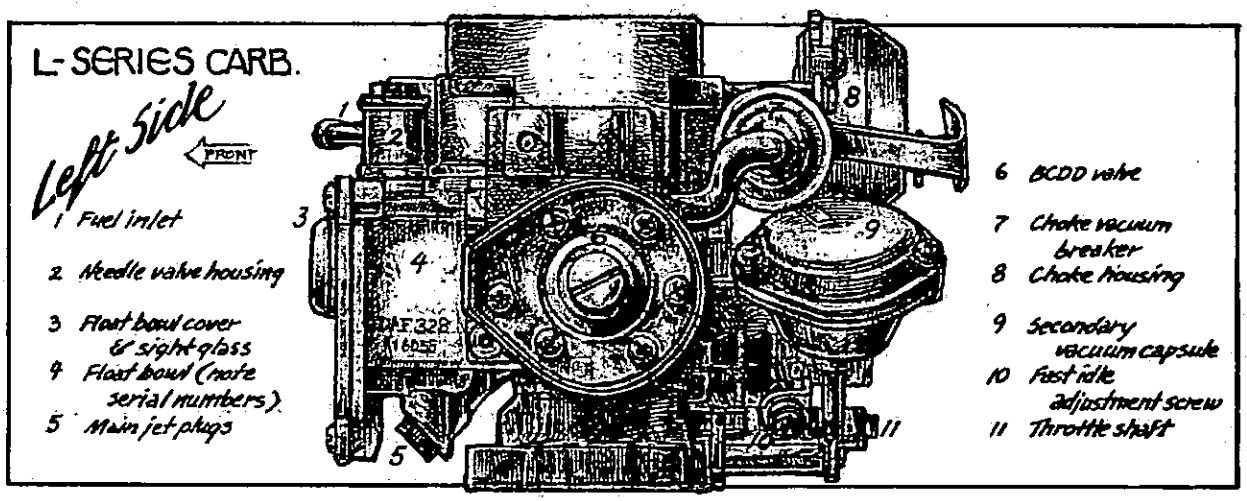
Here are some important pointers. I'll describe putting in a front screw: If you removed flat washers along with the screw, fit them back over the screw. If you're using a new different length screw, the washers can act as shims. Make sure the screw threads are clean. I have used *Loctite* (blue) sparingly on the threads of the front screw, if it frequently loosens. (NOTE: On most single inlet L-series carburetors there's an inlet pipe guide and on most L and Z-series models there's a retainer that fits under the front main screw. Insert and tighten the screw into the carb. Stop before it tightens. If you removed more than the front screw, install the rest the same way. When all are in place, begin tightening them, working round the carburetor evenly. Don't strip 'em. "Feel" is necessary here. If the threads fail, a sickening sensation will come over you as the screw keeps turning.

Step 5: Check Float/Fuel Level and Fuel Condition in the Bowl.

The float bowl is on the **front** of the carburetor. Three screws hold a frame and window over the bowl. Older carbs had a "Fulvu" window while newer models have a tiny round window. Use a flashlight to get a good look at the fuel level on these. On the Fulvu window an etched line indicates the correct level. On the round small view window a dot indicates the level. Wipe off the glass and stoop down so you're at eye level with the line or dot. NOTE: On late model L-series and Z-series engines your view's obstructed. With a strong flashlight and small mirror you can get a decent eyeful.

If the level isn't visible, bounce the vehicle up and down, then look again. You should see fuel sloshing about. If you can't find the level or the level is too low in the bowl, run the engine (if possible) and look again. Still nothing? You'll have to test the *needle and seat* and *float*, then readjust the float level; it may be too high or too low (out of view). If the engine won't run at all, fuel may not be getting to the carburetor. Try the next step before taking things apart. If the level's correct, go on.

•**Glass Cover/Window Fuel People:** Look at the bottom of the float bowl. If you see rusty looking particles or droplets of water on the bottom, there's corrosion or water in your fuel.



•**Everyone:** If you see or think there's sediment or water in your float bowl, remove the float bowl cover (Proc. 12 [9]), wipe out the rust, water or whatever, adjust the float, and reinstall the cover (Proc. 14 [28 and 29]). Your problems may go away. But wait. If you have running problems now and sediment or water in the float bowl, chances are the problem will recur. While you're here consider spraying out the carburetor's circuits (Step 13). If that fails, you'll need to do a complete carb overhaul (Proc. 12-14). Steps 11 and 12 describe more specific running problems related to carburetion. Steps 6-10 address external carburetor functions you should quickly check first. If there's water in your fuel, draining the tank may be necessary (Proc. 11).

Step 6: Check Accelerator Pump.

On the **right** side of the carburetor and to the **front** sits the top of the **accelerator pump plunger**. A lever, triggered by the throttle linkage, operates the pump, squirting fuel into the **primary** throat when you press the accelerator. A malfunctioning pump is the likely problem if there's hesitation upon acceleration.

•**L-series People:** The only adjustment you can make on accelerator pumps is the placement of the lever in the holes at the top of the plunger and/or the position of the linkage pump rod. In the old days the top hole in the plunger was for a long winter stroke, the lower hole for summer. The pump rod adjustment is done by placing the rod in one of three holes on the **rear** linkage end of the lever. On well-worn carbs I place the lever on the upper setting and gain a little more pep, or place the rod in the rearmost rod hole. You have to slip the lever off its pivot, turn the pump plunger or disconnect and reposition the rod, then reinstall the lever (Proc. 12 [6] and Proc. 14 [23]).

•**Z-series:** Only one style carb on your engine has an adjustable lever. If you choose to play with the adjustment, screw it in ½ turn then drive to test the acceleration. If turning the screw doesn't improve acceleration, you may need a carb rebuild or a new accelerator pump.

•**Everyone:** Examine the screws and plate that hold the pump assembly. The plate should be level and the two screws in place. Look at the boot; with age it becomes ripped. If the pump piston is leaking, there may be signs of fuel on the boot. Reach behind the carburetor to the throttle control or have a friend operate the throttle. Even when the engine's not running, the accelerator pump will squirt fuel. Here's how you can see it operate (engine off): Open the **choke flap** by pushing the flap down and holding it open (Automatic Choke People). Use a flashlight or trouble light (not a flame, please!) to peer down into the carburetor throat under the choke flap.

Watch the tip of the **discharge pipe** as you operate the throttle. A spray of fuel should be emitted with each stroke of the plunger as long as there is fuel in the float bowl. When the pump on-stroke stops, no drips should come from the pipe. If the spray is not strong and mist-like, or there's no spray, or you get dribbles and fuel in the float bowl, there's trouble in the accelerator pump circuit or the carburetor's not getting fuel. Is the tank full? Yes? (See Proc. 9 to check out the fuel pump.) NOTE: The accelerator pump can be removed without disassembling the carburetor. Accelerator pumps seldom fail completely; they just get weak or leak. New plungers are sold in carb rebuild kits. There's more on accelerator pump dribble in Step 11.

Step 7: Check Vacuum Break or Choke Pull-Off.

See Proc. 16, then return to Step 8 in this procedure.

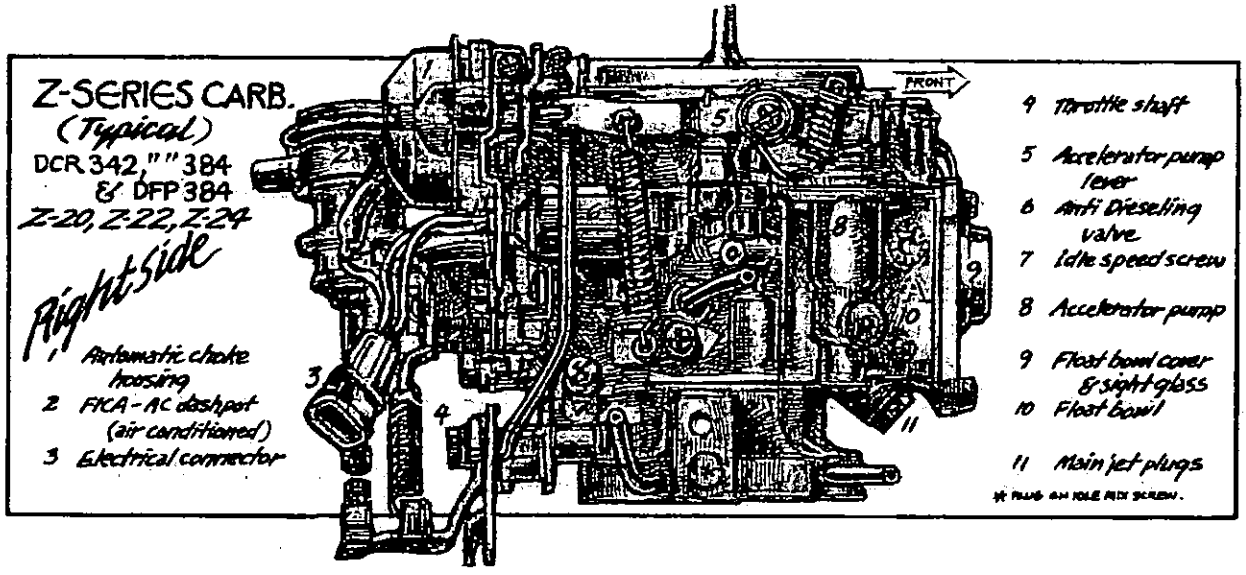
Step 8: Examine Choke Operation.

(Engine must be cold for this check.)

If you have problems starting the engine, if the engine races at high speeds as it warms up, or if excessive fuel consumption is noted, you may have trouble in the choke department. Ch. 3, Proc. 7 describes the choke check and adjustment. If the engine idles too fast when the choke's on, the *fast idle cam adjustment* has to be lowered (Proc. 3). This only applies to automatic choke models (manual choke adjustments are far simpler and less prone to problems).

Step 9: Check Throttle Operation.

Open and close the throttle (behind the carburetor, at the linkage) with one hand while "reading" the smoothness. Or watch the throttle linkage while an assistant pushes and releases the accelerator. If there is bin-



ding, carefully look for where it may be (see Proc. 3 for more on the throttle mechanism).

Step 10: Other Considerations.

There are many problems resulting in poor engine performance that are rooted in the carburetor. On trucks with electronic (E.C.C.) carbs there are even more. You should read Proc. 17 as well as this one. Most carburetor functions are behind the scenes and therefore difficult to speculate on or pinpoint without disassembling, cleaning, and overhauling the carb. This is why all other possibilities should be eliminated before condemning the carburetor. As for subtle problems that are noticed at specific times rather than all the time, there isn't much I can do for you. If you're determined to get at it yourself, I recommend you learn carburetion by reading books about modern carburetors, (most public or tech school libraries have this resource), then determine in which circuit, or between which circuits, the problem occurs. The carburetors covered in this book are basically the same. The only major change came when Nissan put a microprocessor in trucks (1983½ [1/83 Calif.] and 1985 [7/84 Federal]). This is a complex, interesting and efficient system, which I describe superficially in Proc. 17.

Step 11: Tests While Engine Is Running.

When the engine idles it should sound smooth, running at between 650 and 850 rpm, depending on your model. Use a mirror and flashlight and look into the **primary throat** of the carburetor. Do not look directly into the carburetor when the engine's running. At idle there should be no fuel visible in the upper part of the throat. You should hear a slight hiss/slurp sound coming from the bottom of the throat. If you see moisture below the top section (around the seam between the top and midsection), chances are your idle will be rough/erractic. Your carburetor is flooding. Try tapping on the fuel inlet bolt and revving the engine. No luck. . .still flooding? Check and/or adjust the float level (Proc. 12 [9] and 14 [28 and 29]). If you see fuel dribbling out the **accelerator pump discharge tube**, see Step 13, remove the carb top section; then do Proc. 12 (15) (remove accelerator pump discharge parts); and finally, go to Proc. 14 (10) for the solution. This is an old DAF carb problem mostly.

Idle Problems: If, after doing Ch. 3, Proc. 7, you can't set the idle mixture, there may be some small particle within the *idle circuit* (Step 13). If the engine won't idle, see Proc. 18 and test the anti-diesel (fuel shut-off) solenoid.

Check for Vacuum Leaks: Even if you don't have cracked, broken or unplugged vacuum hoses, there could be intake vacuum leaks elsewhere. Most common places are at the intake manifold to head gasket or between the carburetor and intake manifold. To find out whether you have one of these pesky leaks, stand at arm's length from the engine with a can of spray carb cleaner (nozzle attached) poised over the running engine. The idea is to spray this along and around the intake manifold gasket and carb base. If you notice a change in engine speed as you do this, that spray point is where there's a leak. The only way to fix such a leak is to replace the gasket

involved. Don't spray this stuff near electrical (distributor) connections.

Other leak points are in (around) vacuum controlled components (see Ch. 6, Pt. 2, Proc. 1).

Step 12: Using Your Hand Over the Carburetor to Flush the Jets.

(Read through this step before trying it.)

This is a trick used by mechanics that only sometimes works. It's worth trying though. You must be careful when doing this, and never do it on an engine that backfires. Wear a tight-fitting leather glove on the hand you use to cover the carb airhorn. And never look directly into the carburetor.

The air cleaner housing's off? Good. Start the engine and warm it up. Get an assistant to sit in the driver's seat to operate the accelerator pedal. The transmission's in Neutral (or Park) and the emergency brake's off.

Have your helper raise the engine speed to mid-throttle (a medium roar) and hold it there. When it reaches this point, you have to cover the air horn with your gloved hand as completely as possible. The engine will try to stall, starved for air, and you'll feel tremendous suction. Fuel in the carb will back up into the circuits, jets and air bleeds, and you hope flush out any foreign matter. Before the engine stalls, remove your hand. Tell your helper not to pump the pedal no matter how tempted. Removing your gloved hand at the right time is what keeps the engine running.

Repeat this a few times then let the engine drop to idle. If this really fixes your problem, great. If it fixes it only for a while, there's probably something floating around in there, so try the next step.

Step 13: Spray out the Carburetor Circuit while the Carb is on the Engine.

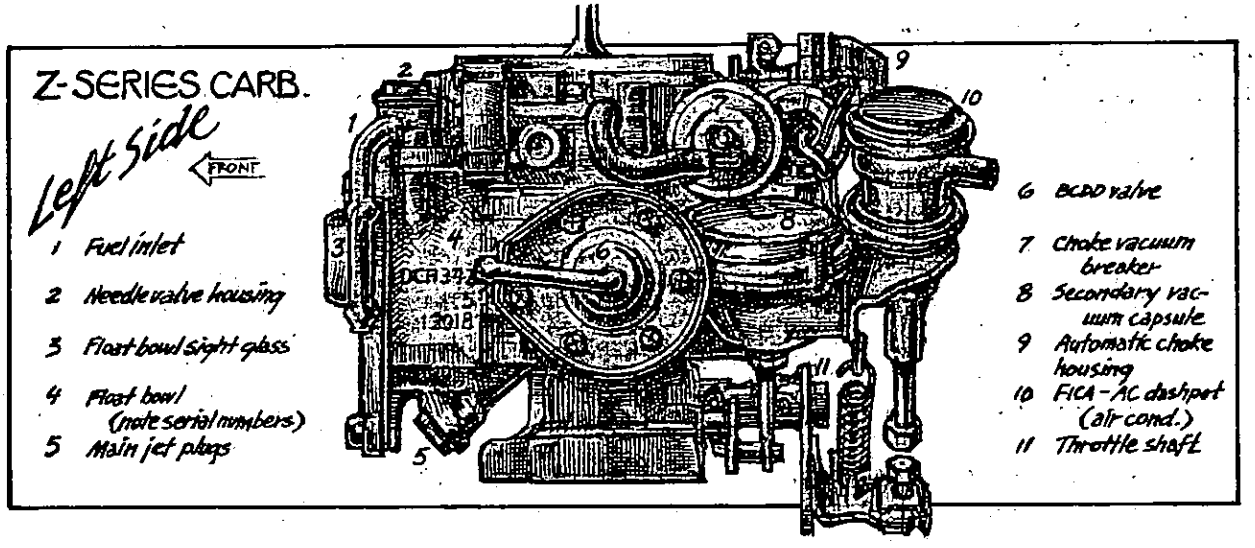
NOTE: This technique solves carburetor running problems half the time. It's worth a try though. To get at the carb's innards you have to carefully lift off the top section and remove air bleeds and jets and spray out the fuel circuits. To do this you have to disturb the gasket between the top and midsection. You risk damaging this fragile (important) gasket. Therefore, it's wise to know where to get a replacement gasket if you ruin this one. Things you'll need: two clean parts containers, a can of carb cleaner with nozzle piece, a clean rag, needlenosed pliers, a little magnet, a small paper clip, masking tape, pen and safety glasses.

Remove the top section: To begin with let's get our directions straight. The sides of the carburetor are from the perspective of the driver's seat. Step 2 describes this in detail, so read it again then, return here.

Take a deep breath. Try not to drop anything—thinking caps on now folks. Remove the top section screw that's above the float bowl first. On most models this screw holds the L-shaped fuel inlet bolt retainer and maybe the inlet hose guide (L-series). If you can't get the guide off and/or you find the needle and seat assembly loose, read Proc. 7 for some hints.

Keep the screw and parts together in one of your containers.

Move around to the **right** (your left) side. Find the accelerator pump lever. Proc. 12 (6) tells you how to



disconnect this. Leave the lever attached to the linkage rod and don't lose the springs.

Now for the hard part—the **rear** side. There's a return (interlock) spring hidden in front of the linkage maze, connecting the linkage (throttle section) to the bracket on the top section. (DAF oldsters, you have two springs. The newer your carb, the harder this is (Proc. 12 [7] for details). Use needlenosed pliers or a screwdriver to unhook the top of the spring. Leave the bottom end attached.

•**L-series:** Now for the **left** (your right) side. Find the little black choke break hose and unplug it from the lower (midsection) end (Ch. 12 [3]). Keep it connected to the choke break.

•**Everyone:** Three of four top section screws remain. Keep these screws in order as you remove them (as described in Proc. 12 [11]). (E.C.C. People: As you lift up the top section, slip the enrichment solenoid wire through the boot in the top section.)

Once all the screws are out, carefully lift the top section straight up as high as possible (¾ in) then stoop down to look between the top and midsections. You probably have a power pump piston sticking down from the top section. You want to watch that this doesn't damage the gasket as you tip the section over to your left, hinged on the choke rod (linkage) on the **rear** side. Don't force the top section and bend the linkage. Look at the gasket. Inspect it carefully to check for rips and damage. The top section should stay flipped halfway over by itself, but you may need an assistant to hold it as you do the rest of the job.

Spray out the jets: You need a can of carb cleaner with a tubular nozzle to do this. The idea is to **blast** out the circuits, air bleeds, and jets, hoping to unplug the problem passage. Proc. 12 (15) tells how to remove the jets and bleeds giving you access to the circuits. The only one you won't be able to get right into is the accelerator pump discharge. Just spray over the weight or ball down in the hole once you've removed the plug and let the solvent seep into the circuit. If you have removable venturis, do not remove them, only the main air bleeds and emulsion tubes. You can pull out the tubes with a toothpick. I repeat, do not remove the venturis. Do check them for looseness, however.

Put on your safety glasses. Remove the jet, plug, air bleed one hole at a time to spray out that hole, then replace these parts—thus no confusion. There's a rap on cleaning the disassembled midsection in Proc. 13. Don't overtighten the bleeds, plugs or jets—only until they're snug.

Follow Proc. 12 (15) attacking each circuit on both the **primary** and **secondary** side. Blast out the removed jets, bleeds, and tubes too. Most often the problem lies in the idle circuit. To do this circuit justice you should remove the idle mixture screw from the throttle section **right** side (Proc. 12 [18]). (**Z-series:** You might have a plug to contend with.) First, be sure to count how many turns (clockwise) it takes for the mixture screw to bottom out. Don't force the screw hard against its seat and don't replace the mixture screw until you have sprayed out all the circuits from above.

While the top's off, spray out the holes in it from the under (mating) side. If there are air bleeds in the top section, check them for tightness. Also spray and wipe off the choke flap. Give the **primary** and **secondary** throats in the midsection a good spray and wiping too.

Before you reinstall the top section you might want to clean the float bowl, check the needle and seat, or spray through the main jets. On E.C.C. carbs the main jets are visible in the float bowl and removable. On all other carbs there are two holes in the back of the bowl that let fuel into the mains—you have to remove the carb to get at your jets from below.

To remove the float bowl cover see Proc. 12 (9). Don't lose the little spacer that's in front of the float.

You can easily remove the needle and seat assembly while the top section's off (Proc. 12 [12]).

To reinstall the needle and seat and adjust the float, see Proc. 14 (16 and 27-29).

If you have any trouble putting any of this back together, refer to Proc. 14.

When you're quite satisfied and high from carb cleaner, wipe the mating surface clean and refit the gasket. (If you're using a new gasket, it has to match the old one exactly.) Align the gasket with the holes and plugs in the midsection. When in place carefully lift and move the top section over into place. Watch the power valve piston doesn't damage the gasket. It fits into the round hole that's between and in front of the **primary** and **secondary** throats. Don't start the top section screws until you're sure it's flush with the midsection.

Install them as described in Proc. 14 (17-20). Be sensitive with that front screw.

L-series (with automatic choke): Reconnect the choke break vacuum hose of the **left** side (see Proc. 14

[27] if necessary).

Everyone: This is a pain. On the **rear** side you should find the return (interlock) spring and have to reconnect it. Use needlenosed pliers as described in Proc. 14 (21). Good luck.

When that's done reconnect the accelerator pump lever and spring(s) as described in Proc. 14 (23).

If you removed the idle mixture screw, install it now (Proc. 14 [3]).

Before you start the engine you may want to replace the fuel filter (Ch. 3, Proc. 10).

Now that it's all back together run the engine to see if any of this helped. The air cleaner housing should be off, therefore, make sure all your unplugged vacuum hoses/pipes are plugged (Proc. 1). It'll take some cranking before you get fuel to the carburetor so crank and pump the accelerator pedal until it starts. Once the engine's warmed up reset the idle mixture as described in Ch. 3, Proc. 7.

I hope you succeeded. If not, you may want to consider a carburetor overhaul.

Step 14: Fuel System Alternatives.

There are many alternatives to gasoline power. Some of these are systems (carburetors) that have been designed that deliver phenomenal economy but cost thousands to manufacture. I suspect that if a more efficient car could be built at a cost within the means of the masses, the Japanese would build it.

If you're wondering what to do about this carburetor of yours and don't feel up to rebuilding it yourself, you can take it to a person who is skilled in such things (not easy to find) and have him/her do the job. You can also purchase a rebuilt or new carburetor from Datsun/Nissan or some other parts supplier. If you purchase a rebuilt carb, they'll ask you for your old carburetor on a cash or return basis—C.O.R.

Carter and Holley also manufacture bolt-on carburetors that replace the original Hitachi. The simple Weber DGV 32-36 with an adapter is also available but usually comes jetted too rich. These can be easily fitted to your manifold with an adapter and some modification to the linkage. They are not authorized by Federal Emissions Standards and can be a nightmare to set up correctly. Redline sells the best Weber adapter kits. They also have an economy carburetor that supposedly meets emission standards. Ask around. Remember that modifications may be in violation of Federal and state laws.

Shop around asking local garages that have good reputations where they get their rebuilt and/or new carbs. There are also shops that specialize in carburetion. Many of these shops do not do foreign carburetor work; if they do, it is worth it to have your carb rebuilt by someone who does it all the time.

My favorite fuel is propane. It's cleaner to burn than gasoline and less expensive. The components needed to convert are initially expensive but without question propane extends engine life, as well as spark plug, exhaust system, and oil longevity. Trucks without canopies are easily converted because the tank can be placed on the bed, and filled and vented outside of the passenger compartment. Ask your local propane dealer.

Step 15: Replace Air Cleaner Housing.

Once you have completed the checkout and are ready to run the engine on the road, put the air cleaner housing back on (Proc. 1 [6-7]).

PROCEDURE 3: ADJUST FAST IDLE CAM SETTING AND CHECK ACCELERATOR CABLE SLACK

Condition: The fast idle is set too high, if the engine races during engine warmup (when the choke is in operation). It's set too low or the choke isn't working, if it idles too low to keep the engine running when cold. Idle should be normal when choke is no longer in operation (choke flap open). The engine should be cold to make this adjustment.

Tools and Materials: 8mm open-end wrench, needlenosed pliers, trouble light, patience.

Remarks: If your carb is **off the engine**, the set-up directions are in Proc. 14 (32). This is a hard adjustment to make while the carburetor is on the engine but easier than removing the carburetor. Before beginning this step, check the *cold start idle speed* with a tachometer, if you have one (engines with manual trans: 1900—2300 rpm; engines with automatic trans: 2200—2800 rpm). I find the factory levels—especially on late model L-series engines—too high. Set the speed at lowest level. I recommend this on Z-series engines with cold engine knock. Lubricate the **fast idle screw**, if sticky, with penetrating oil.

Step 1: Open the Hood, Remove the Air Cleaner and Plug Exposed Vacuum Pipes or Hoses.
See Proc. 1 (1-5).

Step 2: Is the Choke Flap Closed?
Depress the accelerator pedal once fully. With the engine turned off, look down the **airhorn** of the carburetor. The **choke flap** should be closed, covering the **primary** throat of the carburetor. If it isn't, try depressing the accelerator pedal again. Still doesn't close? Go to Ch. 3, Proc. 7. The flap should close within 1/8in of the airhorn wall.

Step 3: Check Throttle Cable Slack.
Throttle Cable People Only: Look on the backside of the carburetor at the throttle cable. There should be slack in the cable between the **mounting** and the **lever**. No slack when the choke's closed? (See Proc. 4.)

Step 4: Make the Adjustment.
The throttle lever is where the cable or rod connects to the **rear** of the carburetor. Just in front of the lever and also connected to the **primary** throttle shaft, find a small screw with a nut on it. You will need a good light to see this. **L-series People** with AIS or EAI, remove the anti-backfire (AB) valve from its bracket and push aside. If the bracket's in the way, loosen (with a 10mm open-end) at base of manifold.

The upper end of the screw should be resting on the second to highest step of the **fast idle cam**, which is directly above the throttle shaft. Turn the throttle lever counterclockwise while watching the relationship of the parts.

I prefer setting the speed by ear or on the lowest specification possible; however, the specifications listed above are the legal ones. To adjust the speed, loosen the 8mm nut, then turn the screw in to raise the idle speed and out to lower it. It is easier to loosen the lock nut than to turn the adjustment screw. Shut off the engine while doing the adjustment. Hold the throttle open with one hand, then push open the choke flap with the other. This should allow the fast idle cam to spring back to normal (lowest) position. If it does not, the spring and/or cam are damaged.

Pick up the needlenosed pliers and, with grace and concentration, fit the tips around the end of the screw and turn it in the direction you wish. Do not turn the screw too much before rechecking the fast idle with the engine running. Tighten the lock nut and check idle speed again. Remember, the choke has to be on (closed) for the fast idle cam to be in the fast idle position. If the engine's too warm for the choke to close by itself, open the throttle, push the choke flap closed so the screw will come to rest on the second to highest step, then let the throttle spring close.

•**L-series People:** Replace the (AB) bracket and tighten the base bolt if removed. Put the (AB) valve back in the bracket.

Step 5: Reinstall the Air Cleaner Housing.
See Proc. 1 (6-7).

PROCEDURE 4: REMOVE, REPLACE AND ADJUST THE ACCELERATOR CABLE

This applies only to models with throttle cable (not rod) 1974 on cars and 1969 on trucks.

Condition: The cable is broken or stretched, or burned from a bad electrical ground. Or you cannot get the engine to idle at a low enough speed. Or there's no acceleration at all. Or you just reconnected the cable to the carburetor.

Tools and Materials: 12mm open-end, 10mm open-end or socket, pliers, grease, an assistant.

Remarks: If you find that the cable housing is burned or melted, check the main ground or fusible links that connect to the **negative** (-) battery clamp to the engine and body. Also check the ground connection at the alternator (Ch. 7, Proc. 1, 9, and 11).

Step 1: Check Out the Situation.
Open the hood. Look at the **rear** side of the carburetor to locate the **throttle crank** and **cable mounting**.

Have your assistant pump the accelerator pedal a few times as you watch the throttle crank. It should move its full length of travel. To determine what the full distance is, operate the crank by hand from the closed to the full open position. It should rotate without resistance. Grab the cable housing (the part covering the cable) and wiggle it from side to side. It should be set firmly in the bracket. If the nuts (or screw) are loose or you want to check the adjustment, go to Step 5.

If it is evident the cable is broken, continue with the next step.

Step 2: Remove the Accelerator Cable.
Open the driver's side door and with a good light in hand, fit your body in around the pedal area. Trace the pedal up to the top of its lever and find a black clip fitted over its end. If there's no clip, you'll see the round metal "slugged" end of the cable fit between the lever's forked end. If there is a clip, pull it back off the rod. Now slip the slugged end of the cable up and out of the slit in the rod. If there's a nylon collar under the end piece, pull the cable back then up and out of the lever.

Go back up to the engine compartment and find the place where the cable comes through the firewall.

•**521 Models:** A nut holds the cable housing to the firewall.

•**620, 610, 710, 510, and 720 Models:** There is a metal bracket where the cable housing comes through the firewall. Remove it by turning out the two 10mm nuts or bolts on either side of or above and below the tube.

•**Everyone:** Follow the cable (housing) toward the carburetor. If nuts hold your housing in place, loosen the 12 or 14mm nut on the carburetor side of the bracket. Turn the nut completely off the threaded end. If you have a screw-type bracket, loosen the screw and pry apart the bracket.

Look at the throttle crank that the cable fits over. This end of the cable fits into a slotted hole on the other end of the crank. On L-series the cable runs over the crank, on Z-series it runs under the crank.

Turn the crank counterclockwise toward the bracket and move the slugged end of the cable out through the slot and the hole in the crank. Pull the cable and housing through the firewall and out of the bracket. The housing may be clamped or screwed to the firewall. If so, remove it with a screwdriver or gentle tug.

•**Z-series:** Pull off the connector bracket that clips over the throttle cable bracket. There may also be a black plastic hose holder that clips over the throttle cable. This fellow clips onto itself. Look closely at it and carefully pry its attached end up then hinge it open enough to separate it from the housing.

Step 3: Purchase a New Cable.

Take the old one with you to the Datsun/Nissan dealer to get the correct replacement.

Step 4: Install the New Accelerator Cable.

Unwind the new cable. Find the end of the housing that fits into the bracket and remove the locking nut (if so fitted). Slip the round accelerator pedal end through the firewall, then back toward the pedal. Go under the dash and put a dab of grease on the round slug then slip it into the slit in the top end of the accelerator pedal rod. Push the clip forward over the rod or if there's a nylon collar on the cable, grease and fit it into the hole in the lever.

Back in the engine compartment, fit the threaded or cylindrical end of the housing into or under the bracket. How you attach it depends on your model. Place the locking nut (if there) over the cable and onto the threaded housing, hexagonal end of the nut toward the bracket. Or, if you have a screw style clamp, align the bracket over the smooth cylindrical end of the housing.

•**521 Models:** Push the nut against the fitting on the firewall and turn it clockwise to start it into place. Tighten slightly more than finger-tight with pliers.

•**620, 610, 710, 510 and 720 Models:** Push the fitting against the firewall so the tube at the end points toward the carburetor. Line up the fitting and gasket (if there) with the holes in the firewall and install and tighten the two 10mm nuts or bolts and washers.

•**Everyone:** Smear some grease on the end of the cable and the slug. Remove the top of the air cleaner housing. Open the throttle crank fully and fit the slugged end of the cable into the hole and cable through the slot on the crank. Let the throttle return. The cable should lie in the the curved trough along the top or bottom of the crank. If your cable was screwed or clamped to the firewall, reclip or fasten it now.

•**Z-series:** You pulled the carb wire connector bracket off the cable mount. Slip the forked bracket around the cable and over the mount. If you unclipped the hose holder, fit it back over the housing and snap it closed.

Step 5: Adjust Throttle Cable.

Hold the throttle crank open all the way. Push open the choke flap. Release the throttle crank and the choke plate should remain open. The idea is to adjust the cable so there is a little slack in it when the choke is **open** and the throttle is **closed.** Be sure the cable housing is securely fitted into the bracket and the cable's in good condition. **Locking Nut People:** Turn the adjusting and locking nuts all of the way opposite one another (counterclockwise). **Screw Type Bracket People:** Reposition the cylindrical end piece in the bracket to adjust the cable tension.

•**Everyone:** Pull the housing away from the carburetor until the cable slack is taken up. **Locking Nut People:** Turn the locking nut up until it touches the bracket, then turn the adjuster (housing side) nut down to the bracket. **Everyone:** Change the positions of these nuts (or housing to bracket) until a slight amount of slack exists in the cable, then tighten the nuts or Phillips head screw. The choke flap must be open to make the final adjustment. There should be a slight amount of slack in the cable when you pinch and wiggle it between two fingers.

If you cannot get enough cable slack (the cable will not return to its lowest—at rest—position) or if there's too much pedal play, the pedal lever stop screw has to be adjusted. Go under the dash and follow the accelerator pedal up to where the cable attaches. To the right of that find a 10mm lock nut and screw head. Loosen the nut and turn the screw counterclockwise to get slack and clockwise to increase it. When the adjustment is final, up by the carburetor, and there's a correct amount of slack, tighten the lock nut at the pedal lever.

Step 6: Replace the Air Cleaner Top and Adjust Idle.

Replace the top of the air cleaner housing. Start and warm the engine, then adjust the idle (Ch. 3, Proc. 7). If the idle's too high and turning the adjusting screw out won't lower it, recheck the cable slack.

Step 7: Check the Action of the Accelerator Linkage.

Sit in the driver's seat and press the accelerator pedal to the floor, then let it return. The action should be smooth and the return complete. Check for binding or incorrect adjustment, if it's not.

PROCEDURE 5: REMOVE CARBURETOR

Condition: You have run through the fuel system's diagnosis procedure, including a thorough tune-up and emissions check. There is a noticeable loss of performance and/or economy indicating carburetor troubles. Or it's necessary to make adjustments with the carburetor removed. This applies only to original equipment Hitachi carburetors.

Tools and Materials: 12mm open-end, a good light (no candles or exposed bulbs please), a small rod type magnet, two parts containers, short ruler (dashpot models), medium screwdriver, hammer, masking tape (and pen) or a few colors of nail polish, a 5-6 in. long pen or pencil.

Remarks: If the fuel tank is more than half full, get a 6 or 8mm bolt to plug the fuel line.

Left is driver's side, **Right** is passenger side, **Front** and **Rear** are where you might imagine. Removing 1975 on carburetors is a lot easier with a special Z-shaped wrench, with it you won't need to do Steps 9 and 10. These two steps are written for those of you with standard design 12mm open-end wrenches.

Step 1: Remove the Air Cleaner Housing.

Complete Proc. 1 (1-5), then return here once the carburetor is exposed.

Step 2: Disconnect Negative Cable from Battery Post and Cover the Carburetor.

To determine which cable is **negative** (-) and how to disconnect it, refer to Ch. 7, Proc. 1. Cover the top of the battery with a thick rag so you can't short across the posts. Tuck the cable end well away from the battery post. You want no sparks.

Stuff a clean rag into the top of the carburetor air horn, to keep screws, spectacles, and curious children from falling in.

Step 3: Disconnect Throttle Linkage from Carburetor.

•1968-73 510 and 610 models:

The crooked end of the rod fits into the throttle lever held by a cotter pin on the lower side. Straighten and remove the pin with pliers. There should be a washer and a spring on the inside of the lever that can be removed once the rod is withdrawn. Slip the pin, washer(s), and spring back onto the rod end once it's out of the lever.

The rod should stay where it is, held by the return spring.

•521,1973-on 620 models, 710 and 1978 on 510 and all 720 models: A cable operates the throttle plates in the carburetor. At the **rear** of the carburetor find the curved throttle crank and cable. The end of the cable has a slug on it that fits into and connects it to the crank. Operate the crank by pushing it away from the engine. Hold the throttle fully open and the cable will slacken. Slip the slugged end out of the crank and the cable is disconnected. Return the crank to rest (Proc. 4).

Step 4: Disconnect Manual Choke Cable

1968-73, 510 and 521 only: Find the **choke cable**, its housing, and the bracket to which it's screwed. Loosen the screw clamping the cable housing in place. The cable is attached to a lever by another type of screw and clamp. Loosen the screws enough to withdraw the housing and cable. Push the cable out of the way.

Step 5: Disconnect Electrical Leads to Carburetor.

NOTE: Mark any non-matching or color-coded wires.

•Automatic Choke L-series People: On the rear side of the carburetor there is a wire connected to the choke housing. A few inches from the choke housing is a connector. Hold either side of the connector securely and pull the wires apart. Directly below and to the right of the choke housing look for a 2in long hexagonal device. If there, follow this wire to a connector and pull it apart. **Careful:** Earlier models' (pre-1975) wires can

easily break off the solenoid.

There may also be a third wire that operates another hexagonal device on the **rear** left side of carb. This wire disconnects in the same way as the others. On **1975 on L-20B models**, all (three) of the wires are bundled together on the left side of the carburetor.

•**Z-series:** There's a large plastic connector next to and behind the throttle cable bracket. Pull the connector out of its bracket and separate the connector halves.

•**Manual Choke People:** You old-timers may have a solenoid on the left side of the carburetor. Disconnect the wire that runs to it.

Step 6: Remove Fuel Lines to Carburetor.

•**1968-1972:** One or two hoses connect to the left front side of the carburetor. Follow instructions below.

•**1973 on:** Find the hose that connects to the fuel inlet pipe on the top **front** side of the carburetor. The hose is held by a screw type hose clamp. Loosen the clamp until it's loose on the hose. Place the tip of the screwdriver against the body of the carburetor and the shaft against the end of the hose. Using the tip as the fulcrum, lever the hose off the inlet pipe.

•**Everyone:** Note if inlet pipe is loose..

Step 7: Remove the Vacuum Hoses.

•**1968—1972:** On the **right** side of the carburetor's base find a 10mm nut holding a small steel tube. Use a 10mm open-end to remove the nut, turning counterclockwise. Be careful not to twist the steel line while turning the nut. Carefully move the line and nut slightly away from the base.

•**1973 and 1974:** On the bottom right side of the carburetor a vacuum hose connects to a steel tube. Use your fingers or screwdriver to work the hose off the tube.

•**1973-on, L and Z series, Everyone:** On the **left** side of the carburetor, there may be another hose plugged into a horseshoe-shaped device. Pull it off. Tape and label this hose BCDD.

•**1975 High Altitude Models:** Refer to Ch. 6, Pt. 2, Proc. 1 for hose maps (illustration) for altitude compensator hoses to carburetor top section connections. Remove and label (these two or three) hoses #1 (front or upper) and #2 (rear or lower), or #3 (rearmost hose). On L-series engines (and Z-series with high altitude kit) on the **right/front** corner of carb, and on Z-series on the **left/front** corner.

On the bottom **right** side of the carburetor there are one, two or three hoses connected to pipes. These hoses may be covered with a braided cloth (L-series). Use a screwdriver tip to help pry the hoses from the pipes. Label these hoses "A front" and "B rear" and if a third, "C upper."

•**1975 on L and Z-series:** There may be an additional vacuum hose connecting the carburetor to the carbon canister that's located in the **left** front corner of the engine compartment. On L-series this hose connects to the **left** side base of the carburetor. On Z-series the hose connects to the **front/left** top section of the carburetor. Remove and label this hose "C Canister."

Step 8: About Removing Those Carburetor Mounting Nuts.

Find the four nuts and washers securing the carburetor base to the manifold. On pre-1975 models the nuts are quite accessible, while on later models with the L-20B and all Z-series engines the nuts are hard to reach. **Pre-1975 People:** Jump ahead to Step 11.

Step 9: Cut Through the Outside Skin.

•**L-series (L-20B):** Find the dashpot on the lower **rear/right** corner of the carburetor; it's a muffin-shaped cylinder with a threaded stud on one end. The FICD is a round black plastic device with a hose connected to it. A 19mm nut holds it to the bracket. Remove this nut and pick the FICD out of the bracket. Keep the nut with the FICD and lay it on the engine, hose attached.

The dashpot is removed by loosening and removing the 12mm nut that holds it to the bracket on which it is mounted. Before turning the dashpot out, measure the distance between the end of the stud and the bracket and write it down. Find the throttle crank and rotate it fully clockwise. Hold the crank in this position and thread

the dashpot out counterclockwise. Allow the crank to return to idle position and put the lock nut back on the dashpot. Now remove the two 10 or 12mm bolts that hold the dashpot bracket to the manifold. Use a socket, extension, and ratchet. Use needlenose pliers to remove the return spring connecting the bracket and crank. Store bracket, dashpot, springs, and bolts in a parts container.

•**Z-series:** Look at the throttle cable bracket. The bottom of the bracket bolts to the intake manifold just below the carburetor. Remove the two 10mm nuts, pull off a fuel line bracket that's on top of the throttle bracket, and then the throttle bracket itself.

Let both brackets hang and put the two nuts back on the studs for safe keeping.

Step 10: Remove the Accelerator Pump Lever

L-series only: See Proc. 12 (6) and keep the parts labeled "accelerator pump" in a baggie.

Step 11: Remove the Four Carb Base Mounting Nuts and Carburetor.

Doing this step you'll find yourself dancing around the engine compartment, trying different angles to reach the mounting nuts. Be patient, rest your back and dance on.

Find and remove the right rear nut. Use a 12mm open-end. Loosen the nut counterclockwise until you can turn it easily with your fingers, then stop.

•**L-20B People:** If you removed your accelerator pump lever, work the lever and rod back up into position, fitting it over the shaft (without the springs) and into the accelerator pumping rod.

The right front nut is easier to reach by removing the air cleaner bracket (the blue Y-shaped piece bolted to the intake manifold). Try fitting the wrench onto the nut before removing the bracket. If necessary, here's how to remove the bracket. Two 10mm cross headed bolts hold it to the manifold. Remove one of the bolts with a socket, and loosen the other. Move the bracket to one side, store the bolt in the hole.

•**Everyone:** On pre-1975 vehicles there should be no problem removing the four nuts. On all engines the following general suggestions that might help: If the wrench angle does not fit the nut, try turning it over to change the angle of approach. As soon as the nut feels loose enough, try turning it with your fingers. A little penetrating oil might help ease the turning. On carbs where the nuts won't turn all the way off the stud, loosen them until they are nearly off the studs or as far as possible. Keep your magnet handy to pick up the loose fasteners. Your right rear nut should already be loose and partially up its stud. Now get the **Right** front nut.

•**L-18 and 20B People:** Try fitting the wrench over the nut working at an angle from the front over the top and side of the EGR valve. If the wrench won't fit, try a medium screwdriver and hammer. Look down at the nut from the top of the carburetor. If the nut is still tight, use the tip of the screwdriver to start the nut turning by placing it behind a corner of the nut at a 45° angle. The idea is to tap on the screwdriver handle end (turning the nut counterclockwise) until the blows loosen the nut. If the nut is loose but the wrench won't fit, use the screwdriver placed straight down against the side of the carburetor body behind the accelerator pump, in front of the cross-headed screw and next to the nut. By turning the screwdriver blade against the side of the nut, you can effectively turn the nut until it is loose enough to work off with your fingers.

•**Everyone:** The **left** front nut should give you no trouble. Loosen it until it is near the top of the stud.

•**Late Model L20B People** (except for remote BCDD engines): Remove the BCDD solenoid. If you have one, it is on the **rear** left side of the carb. The nut below may be easier to reach with the BCDD removed. Disconnect the BCDD wire from the clips on the **left** and **rear** side of the carb. Remove the solenoid with a 19mm open-end, turning counterclockwise (Proc. 12 [2]). Do not lose the plunger and washer once removed from the solenoid. Store the pieces in the parts container.

•**Everyone:** The **left** rear nut is the invisible one. Watch the placement of your wrench from above (L-series) or other side of engine (Z-series) inserting it from the corner. Turn the wrench to fit the angle of the nut. Once the nut is loose use the tips of the open-end to flick the nut up the threads.

When all of the nuts are loose and turned up the studs as far as possible, find a pencil or similar device about 5in long. Lift the carburetor off its mounting. If the carb is stuck to the base, tap on the base using a brass drift or dowel as a punch with a hammer as the driver. Don't pry the carb from underneath.

When the carburetor is ½in or so above the manifold, slip the pencil under it so that when let down the carb

sits slightly above the base. Now the four nuts and washers can be removed without falling into the engine. Use your magnet to grab them once they're off the studs. A nimble master can loosen the nuts completely, leave them resting on the carburetor base, and gingerly lift the unit straight up and off the engine in one move without dropping the nuts. **Early Cable People:** Move the bracket away from the left side and let it hang.

•**Everyone:** When all the surrounding wires, hoses and cables are aside and the nuts and washers accounted for, the carburetor should easily lift off. Carry it to a nearby bench. Keep the carburetor upright or gasoline will spill out the float bowl vent tubes. If you plan to take it anywhere, find a wide mouth metal container and turn the carb upside down to drain out the fuel.

Step 12: Account for and Remove the Base Gasket (Insulator).

There's a 3/8in plastic or thin metal insulator sandwiched between the carb base and manifold. It is either stuck to the carb or still on the manifold. Some Z-series insulators are also electric heaters and are very expensive.

You want to preserve the insulator, maybe reuse it. If you're putting the carb back on right away and the gasket(s) isn't ripped or broken, leave the piece in place, probably on the manifold. If you plan to replace the insulator (and gaskets), which is advisable, carefully pry it off the carb or manifold. Take it with you to the parts store. More on this in Proc. 6 and Proc. 13 (3). Z-22 and 24 engines may have a metal gasket piece that fits on top of the insulator. It is sold separately and may be still stuck to the insulator.

PROCEDURE 6: INSTALL CARBURETOR ON ENGINE

Condition: The carburetor is new, in good condition and/or rebuilt. You have a new **base gasket insulator**, and **shield gasket** (L-20B People). If you can't get a new base gasket insulator and are using non-factory gaskets, you'll have to scrape the old insulator clean and apply new matching gaskets to it (read Proc. 13 [3] for details). Get a factory replacement insulator if possible.

Tools and Materials: 12mm open-end, screwdriver, small pliers, 5-6in pencil or the equivalent, razor blade, new base gasket (insulator), and shield gasket (L-20B).

Remarks: As always, when working around gasoline and solvent, do not smoke, use open flames or unprotected lightbulbs. It is crucial that you clean the gasket surfaces in this procedure thoroughly. Don't use gasket sealer on the carb or manifold sides of the gasket. Use it only as directed in Proc. 13.

Step 1: Prepare the Mating Surfaces and Fit the Base Gasket.

Look at the surface on the manifold where the carburetor mounts. If the **insulator gasket** is still there, it has to be removed and the surface below thoroughly cleaned to make a good seal. Don't attempt to pinch pennies and save the old gasket unless you have the heater kind (Proc. 13 [3]). Be careful not to gouge the soft aluminum alloy manifold or shield trying to pry or scrape the old spacer off. Stuff a bit of rag into the holes to keep stray pieces from falling into the manifold. Use a razor blade with care to scrape the old hard-to-get-off gasket from the manifold. Account for any little bits that fall into the holes.

•**L-20B Models:** Under the insulator gasket there's a flat aluminum shield that fits over the carb mount studs and bolts to the front web of the intake manifold just below and behind the **air pump/check valve**. Remove the bolt with a 10mm socket and lift the shield up and off. Under the carb studs is another thin gasket. Peel it off and scrape, then sand the surface with emery cloth. Install the new gasket.

Now clean the shield thoroughly. Install the shield with the bolt hole forward so the four stud holes line up to and over the studs. Install the 10mm bolt. Tighten gently until secure.

•**1968-74 Models:** Look at your insulator gasket. Find the side that says TOP or has printing on it. Compare the gasket with the old, if possible, to make sure it's the right one. Place the new spacer, top side up, over the studs and onto the manifold once the surface is clean and smooth.

•**L-20B and All Z-series Models:** Your insulator gasket may have a collar or latticed element built into it or on a separate metal piece. This collar or element fits **down** into the manifold on the **primary** throat hole; that's the one with the linkage connected to it. The **primary** hole is smaller than the **secondary**. If you removed a metal piece (Z-22 and 24), it fits on **top** of the insulator, non-gasket side down.

•**Everyone:** Do not use any sealer on this gasket or the mating surfaces. Rub a bit of penetrating oil on the threads of each of the four mounting studs.

Step 2: Mount the Carburetor.

•**L-20B Models, 1975-on:** If you disconnected the accelerator pump lever to reach the **right** rear mount bolt and remove the carburetor, refer to Proc. 12 (6), and undo the clips and pins to slide the lever off its shaft. Move it aside for the moment.

•**L-20B and All Z-series:** Pick up the 5-6 in pencil or pen and lay it lengthwise (fore to aft) across the gasket and manifold holes. Leave enough sticking out on one side to grab. Now place the carburetor straight down over the four studs correctly positioned with the throttle linkage to the rear.

Find the four washers and mounting nuts. The plan is to install a washer then the nut onto the stud one at a time without dropping either. Use a good light and your fingers to manipulate the fasteners into place. Install the **left** rear and the **right** front nuts first, then the other two. Don't tighten the nuts any more than the first few threads. Withdraw the pencil and turn the nuts down as far as you can by hand.

•**Pre-1975 Models:** Set the carburetor onto the manifold over the four studs. With the throttle lever to the rear. Find the four nuts and washers. Start the **right** rear one first then the **left** front. You'll have to lift the carburetor slightly to fit the nuts over the studs. Start the nuts on the remaining two studs once the washers are in place.

•**521 and Early 620 People:** The throttle cable bracket is set aside; pick it up and position it over the studs on the left side.

•**Everyone:** When all of the nuts are started and the washers are in place, turn the nuts clockwise as far down the studs as you can by hand. Pick up the 12mm open-end and begin tightening, each one a little at a time to ensure that the base is drawn evenly against the insulator surface. Work diagonally, tightening the nuts gradually until the lockwashers flatten. Make sure the nuts are all tight.

•**L-20B People:** You probably removed or left the accelerator pump lever partially connected. If still in place, remove and reassemble it with spring(s) now. Find the "special" pump lever spring in the parts container (refer to Proc. 14 [23] for details).

Dig into the parts container and find the dashpot bracket, dashpot, or FICD and two 10 or 12mm bolts. Place the bracket with the tall side to the **rear** and bolt holes to the **front** matched with the holes in the manifold. Don't pinch the throttle cable under the bracket. Put a dab of oil on the bolt threads and insert them, turning clockwise through the bracket and into the holes. Tighten the bolts with a socket, extension and ratchet.

•**Dashpot People:** Pick up the dashpot. Coat the threads on the dashpot with a little oil and make sure the 12mm locking nut is turned all the way down the stud. Hold the throttle crank fully open (clockwise) and fit the dashpot between the bracket and the flat stop on the crank. The threaded stud turns clockwise into the hole on the engine side of the bracket. Turn the dashpot into the bracket as far as it was when you measured it before removal and release the crank. Turn the 12mm locking nut toward the bracket until it touches, then tighten it with an open-end.

•**FICD People:** The FICD fits into the bracket aligned with a slot. Remove the 19mm nut you stored with the FICD. Once the FICD is installed thread the nut back on and tighten.

•**Everyone:** Find the spring that connects the throttle crank and the stationary dashpot bracket. There's a hole in the dashpot bracket and one in the flange at the rear of the throttle crank to accomodate the hooked spring end. Install the spring from the inside on the throttle end and the outside on the bracket end.

If you removed the BCDD solenoid, find it, a copper washer and a plunger. Reinstall the solenoid into the **left** rear side of the carburetor with the flat washer over the threaded end of the solenoid and the plunger installed with the pointed end sticking out. Tighten this a little more than finger-tight with the 19mm open-end (17-13 in.lbs.!). Refit the wire over the back of the secondary diaphram chamber and close the clip over the wire.

Step 3: Remount Air Cleaner Support Bracket or Throttle Cable Bracket.

•**L-series:** If you didn't remove the bracket, go on to the next step. This bracket is blue and Y-shaped. Find the one or two 10mm bolts with washers you removed. The bottom end fits against the front of the intake manifold placed so the top of the bracket leans slightly forward of the base. Find the **EGR vacuum hose** with the rubber grommet on it and fit it in the crotch of the Y. Tighten the two 10mm bolts. Not too tight; they thread into aluminum.

•**Z-series:** Find the throttle bracket hanging nearby. Remove the two 10mm nuts and metal piece from the side of the manifold under the carb. Slip the bracket over the studs, then the metal piece, and finally install and tighten the two 10mm nuts. Good.

Step 4: Replace Rubber Vacuum Hoses or Steel Vacuum Advance Line.

NOTE: Ch. 6, Pt. 2, Proc. 1 has illustrations of hose maps that might help here.

•**1968-72 Models:** On the carburetor's **right** side near the base, next to the valve cover, is a steel tube with a captive nut on the end. This nut and line fit into the threaded hole on the side (base) of the carburetor. Carefully bend the line into place with the fitting inserted straight into the thread hole. Use a 10mm open-end turned clockwise with a slight bit of pressure against the nut to get it snug.

•**1973-75 Models:** Slip the rubber vacuum hose over the tube at the carburetor base on the **right** side. Follow this hose back to a steel pipe. Replace the hose with a new one (5/32in or 4mm) if it's deteriorated.

•**1975 on:** There are two (or three) hoses located on the right side of the carburetor. You labeled these A, B (and C). Slip them over the pipes fitted into the carburetor base: "A" hose on the front pipe, "B" hose on the rear. If you have a "C" hose, it fits on the upper pipe, the one that sticks out of the carb's midsection.

•**High Altitude Models:** Replace the altitude compensator hoses. When you removed these two or three hoses from the **left/front** corner (**L-series** all and **Z-series** with high altitude kit) of the carburetor, you marked them as #1, #2, and maybe #3. On non-kit Z-series carbs the pipes are on the **right/front** corner of the carb. Find the hoses and the pipes. The #2 hose fits on the rear pipe, the #1 hose on the front pipe. If you have a #3 hose, it fits on the rearmost pipe.

•**1973-on:** Look on the **left** side of the carburetor for a tube sticking out the front of the horseshoe-shaped BCDD valve. If there was a hose removed from this tube, you taped and marked it "BCDD." Slip the hose over the tube.

•**1975 on L and Z-series:** You may have another vacuum hose connecting the base of the carburetor to the carbon canister. On **L-series** carbs it connects to the **left** side. On Z series it's on the **left/front** of the carb's top section. You labeled this hose "C Canister." Reinstall it now.

Step 5: Reinstall the Fuel Line(s).

•**1969-70 Models:** You have two different sized hoses to connect to the **front/left** side of the carburetor. The inlet hose from the fuel pump fits over the smaller pipe (the lower one). The return hose is larger (upper pipe). Install the hoses as far as they can go and tighten the clamps. Replace any worn or cracked hoses with new ones—¼ and/or 5/16in. Use strap style hose clamps in place of the originals.

•**1973 on L and Z-series:** A single fuel inlet hose connects to a steel tube on the **front** top of the carburetor. Make sure this hose is in good condition before installing it. (It's ¼ or 5/16in.) Once in place tighten the clamp until secure. Do not overtighten this clamp.

Step 6: Replace and Adjust the Manual Choke Control Linkage

•**1968-71 only:** If you have an automatic modified to a manual choke, this also applies to you, with slight variations. Find the choke control cable somewhere to the rear of the carburetor. Push in the choke control knob. Now find the choke cable retaining bracket on the **left/rear** corner of the carburetor (or elsewhere, if modified). There's a lever on the bracket or choke control that operates the choke flap within the carburetor air horn. Push the lever forward and the choke flap should be wide open. To the rear of the bracket find a clamp. If this screw is loose, the cable and housing should slip under the clamp; keep pushing the cable until the housing is fully

under the clamp. Turn the slug in the control lever so the screw head is facing away from the carburetor, and slip the wire (cable) end through the hole. Pull the cable through the hole until there's ¾ - 1in of cable between the end of the housing and the slug. Tighten the housing clamp and the slug setscrew with a screwdriver.

Operate the choke control; it should feel smooth. The flap should be wide open (straight up and down) with the button in, and almost touching the side of the carburetor air horn when the knob's pulled out. If it is rough or not fully opening, a crimp in the housing (cable), too tight a clamp, or too long a cable might be the trouble. Keep adjusting until the operation is exact.

Step 7: Reconnect the Electrical Wires.

•**Early 510, 521 People:** If there's a cylindrical solenoid on the left side of your carburetor, connect the wire you marked and disconnected.

•**1972 and Later L and Z-series Models:** The later the model the more organized the wires. The ends of the three wires are of different shapes or there's one plastic connector, so mixing them up is not a problem.

•**L-series:** Follow each of the wires from the carburetor (one or two solenoids and one for the choke) to the bundle of wires on the left side of the carburetor. On earlier models the **choke wire** connects from the rear. Be sure the "push-on" connectors are fully inserted into one another.

•**Z-series:** You have a white plastic connector to put back together. It only goes one way. Make sure the wires and ends are well inside the connector and push the halves together. The connector will now snap neatly into a clasp attached to the throttle cable bracket.

Step 8: Reconnect Throttle Linkage to Carburetor.

•**1968-73 510, 610, and Early 521 Models:** There's a crooked steel rod attached to the firewall behind the carburetor that operates the throttle. Remove the cotter pin, washer, and spring from the end of the rod and locate the forked lever on the bottom rear of the carburetor. Turn either the lever or the rod enough to slip the end into the top of the lever. Slip the spring and washer between the forks and under the rod end. Push the rod all of the way through to the other side of the lever. Lift the washer against the spring to uncover a small hole in the rod. Insert the cotter pin and bend back its legs. Operate the rod and lever to see it work. Look in the parts container or on the rod (or body) to find the **return spring** that connects to the rod and to the body. Hook one end into the bracket on the firewall and the other end onto the hole in the rod.

•**Late 521, 1974 on 610 and 710, 1978 on 510, and All 620 and 720 Models:** Find the throttle crank on the bottom rear of the carburetor. Also, find the slugged end of the throttle cable. There's a slot on the rear side of the crank. Twist the crank fully clockwise. Slip the slugged end into the matching hole and the cable through the slot. This will only work when the crank is fully open. Once the slug is in place the wire will fit gracefully against the curve atop the crank and stay put when the crank is released. You can check the cable adjustment and operation later.

Step 9: Reconnect the Negative Cable to the Battery.

If you need help with this, refer to Ch. 7, Proc. 1. While the cable is off, you may want to clean the post and cable ends on this—the positive—side. Clean the positive side first while the negative is still disconnected.

Step 10: Start the Engine and Make Adjustments (with air cleaner housing off).

Plug any exposed intake manifold hoses and tubes if not already done (Proc. 1). Check throttle cable adjustment (Proc. 3). Before starting the engine you should replace the fuel filter (Ch. 3, Proc. 10). Then you will have to crank the engine for 30-45 seconds to fill the float bowl while pumping the accelerator pedal before it will start. Once started, the carburetor idle and mixture and choke setting have to be adjusted (Ch. 3, Proc. 7), float level should be rechecked, and all connections examined for leaks (Proc. 2).

Step 11: Replace the Air Cleaner Housing.

See this chapter, Proc. 1 (6-7).

PROCEDURE 7: REMOVE, SERVICE, AND REPLACE NEEDLE SEAT AND FILTER (WITH CARBURETOR ON ENGINE) AND CHECK FLOAT ADJUSTMENT

Condition: The float bowl is overflowing with fuel—you see it or smell it. The engine won't idle or run at all. This problem can be erratic and damaging to the engine as well as a dangerous fire hazard. Take no chances; replace the needle and seat if in doubt and/or run through Proc. 2 (5 and 6). If the float is out of adjustment, it won't cuts off the fuel supply to the carburetor when necessary or cut it off too soon and starves the engine when under load or at severe angles, e.g., on hills or around corners. If something gets lodged between the needle and seat or the tip of the needle becomes worn, the fuel supply will not be cut off; therefore, the float level will be too high—fuel will flood the carburetor. Since there is a frequent, constant flow passing through the valve, this is an infrequent problem, but shouldn't be overlooked. (See Step 9 for flooding cures.)

Tools and Materials: Medium Phillips or straight screwdriver, 12mm open-end wrench, 17, 18, or 19mm open-end wrench, pliers.

Remarks: To make sure the needle and seat are at fault, run through the checks in Proc. 2. To dislodge a stuck needle and seat and start a flooded engine, see Step 9.

Step 1: Disconnect the Fuel Line(s).

See Proc. 5 (6).

Step 2: Remove the Fuel Inlet Pipe Assembly.

NOTE: **Early 510 People** with dual pipe inlet (return), see Proc. 12 (10), then return here.

•**Everyone:** The **fuel inlet** fits over the needle and seat assembly. A special 12mm bolt threads into the needle and seat, holding the inlet in place. Later Model People must remove the carburetor **front top section screw** to remove a **locking retainer** and maybe the forked guide that fits over the 12mm bolt and maybe the forked guide that fits under the inlet pipe. This is a touchy screw and should be removed with caution (Proc. 2 [2 and 3]). Set it aside with the locking retainer. Once the screw and locking piece are off, the 12mm bolt is reachable. It is often tight in the needle and seat assembly, so the whole thing turns. Try to keep the assembly from turning by holding the inlet pipe base carefully so the pipe won't bend and break. If you can't remove the bolt, try wedging a screwdriver tip between the needle and seat and carb body. No luck? You'll have to remove the carb top section and get a wrench around that assembly to keep it put (Proc. 12 [11]).

Remove the 12mm bolt, keeping the washer with the bolt. The inlet pipe will now pull up off the assembly. Watch for the filter screen which will remain inside the inlet or on the needle assembly. Examine the screen for debris and clogging. There's another washer under the filter. Keep all this with the inlet. On DCH 340 and later DAF 328 models there is a forked pipe guide that will come off with the inlet. Place all of the washers for the inlet parts somewhere safe.

•**Carburetor Disassembly People:** Return to Proc. 12 (11) and put these parts in the TOP box.

Step 3: Remove Needle and Seat Assembly.

Next fit a 15-19mm open-end (whatever fits) onto the hexagonal base of the needle and seat assembly. If your wrench is too thick, you may have to remove the top section if nothing else fits. Turn the 12mm bolt counterclockwise to loosen it; lift it off the inlet pipe and the guide will follow.

Now if you are in the boonies and your needle and seat aren't working, you can disassemble the unit and clean it. These assemblies aren't meant to be taken apart, but if they are not stamped together, you can service them. You'll have to figure this out yourself. If you are near a parts store and want to buy a new one, chances are you will have to buy a whole carburetor rebuild kit to get one. However, the dealer might sell you the needle and seat assembly alone.

Step 4: Replace the Needle and Seat and Fuel Inlet.

This step is detailed in Proc. 14 (16) and after that in Proc. 14 (19). To install the **Front** top section screw, read precautions in Proc. 14 (20) as well.

Step 5: Remove Float Bowl Cover, Spacer and Float.

See Proc. 12 (9). **L-20B People**: You'll have to work around the air pump check valve. All Z-series with anti-backfire valve, you'll have to unclamp and move the valve aside to reach the cover easily.

Step 6: Check Float Adjustment (with carburetor on the engine).

You will need a 6in piece of ¼ or 5/16in (6-8mm) hose (depending on your carburetor), or disconnect the existing piece of fuel line that attaches to the carburetor. This information is in Proc. 14 (28). Read through this using what pertains to you. When the level is correct, go on to the next step.

Step 7: Replace Float Spacer and Float Bowl Cover.

See Proc. 14 (29).

Step 8: Reconnect the Fuel Line(s) and Check for Leaks.

See Proc. 6 (5). You'll have to crank the engine for a bit before it'll start. When it does, check the float bowl cover closely for leaks. If the cover isn't placed or tightened just right, it'll leak as will the hoses.

Step 9: How to Stop a Flooding Float Bowl and Start a Flooded Engine.

•**To stop a flooding float bowl:** Remove the air cleaner housing (Proc. 1) and tap the top of the fuel inlet fitting. Start the engine and run it at high idle to use up fuel and bring down the fuel level (you hope). **To start a flooded engine:** Don't pump the pedal; simply hold it to the floor and open the choke flap if it isn't already. The idea is to let as much air in as possible, not more gas.

PROCEDURE 8: ADJUST THE DASHPOT OR FICD

Condition: This procedure pertains to early 510 automatics and all cars and trucks after 1975. You are here because of high idle and have checked the throttle cable for slack (Proc. 3) and that the choke is working (Ch. 3, Proc. 7). Vehicles 1975 and later with air conditioning have an FICD that operates when the air conditioner is on.

Tools and Materials: A tachometer (or your good judgment of engine rpms), a 10 or 12mm open-end wrench.

Remarks: The deceleration dashpot was originally designed into automatics to avoid stalling, but has since evolved into a an emissions control device. When the throttle is released quickly and the throttle plates close, large amounts of hydrocarbon emissions result. The dashpot lets the throttle down gradually. Familiarize yourself with its operation by watching the throttle linkage in action (engine off). The FICD increases idle speed when the air conditioner is on.

Step 1: Where Is This Character? How Does It Work?

Find out where the throttle linkage connects to the back of the carburetor. On the engine side of the throttle crank there will be a flat tongue which contacts a **plunger** and **diaphram** mounted on a bracket. It's much easier to reach the dashpot or FICD with the air cleaner removed. If it isn't already, see Ch. 6, Pt. 1, Proc. 1 (1-5).

•**Dashpot People:** When the throttle's released, the dashpot rod absorbs the throttle return. By loosening the locking nut on the lower side of the bracket, you can turn the dashpot toward or away from the throttle.

•**Air Conditioned Models:** The FICD is vacuum operated. Vacuum is ported through an electrical switch

mounted on the firewall. The adjustment is made by turning a screw built into the throttle crank. Check the vacuum hose condition and hose connections starting at the intake manifold, then to the switch, and finally to the FICD. This is a potential (minor) vacuum leak point. The hose is 1/8in (3mm).

Step 2: When Is It Doing What It Should?

•**Dashpot People:** When the engine's running, warmed up and in good tune, with the carburetor adjusted, the rpms should drop to about 2000, then to 1000 in about 3 seconds, and on down to idle speed. If the dashpot is adjusted properly it will neither override the idle setscrew nor will it interfere with the idle speed.

If you have a tachometer, hook it up (as described in Ch. 3, Proc. 6) and run the engine until warm. Manually raise the engine speed above 2000 rpms, then release the throttle. Loosen the lock nut and/or turn the whole dashpot by the muffin part or with a screwdriver in the slotted end. Recheck the rpm drop until it's within specification. If the drop will not adjust properly and the dashpot appears to be working, read Procedure 2. Retighten the lock nut, if loosened.

•**FICD People:** Start your engine and let it idle with the air conditioner off. It should idle at normal speed. When you turn on the A/C the speed should rise to about 1,300 rpm. You can adjust the speed by turning the set screw. If the FICD doesn't operate check its switch connections. If they look all right, test current to the switch and/or unplug the hose to the FICD and suck on it to see if the rod moves.

PROCEDURE 9: TEST THE FUEL PUMP

I have heard some good stories about fuel pumps that have died miles from civilization. One couple disconnected the hose from the outlet side of the fuel pump and hooked it up to a stretch of air compressor hose that they ran into the passenger compartment through the firewall. While one person drove, the other held a funnel stuck on the end of the compressor hose at a higher level than the carburetor and poured in gasoline upon demand. Although extremely dangerous, it worked and got them out of the mountains. Another dead fuel pump case I know of was solved when the owner plumbed the windshield washer pump inline between the fuel pump and the carburetor. When fuel was needed, he turned on the squirter switch. This method may ruin the washer pump or be tough to rig up, but it worked in this case. The best insurance is to carry a spare fuel pump, especially if you travel to Alaska or Mexico.

If your electrical pump is on the fritz, check its fuse in the fuse box.

Condition: The engine doesn't start or runs like it's starving for fuel. No fuel is getting to the carburetor or there's none you can see. You smell gas and it smells and/or looks like it's coming from the fuel pump. You have fuel in the tank and you have changed the fuel filter(s). The vehicle occasionally or always acts like it's running out of gas. You have done Proc. 2 for a general Fuel System Checkout, especially the hoses for cracks and distortion.

If the fuel pump squeals, it is an indication that there is a constriction between the pump and the tank.

NOTE: Electric fuel pump tests are written with the pump off the vehicle and covered in Step 7. Read through this procedure first, then if necessary see Proc. 10.

Tools and Materials: Graduated measuring container, vacuum/fuel pump gauge, half-filled fuel tank, screwdrivers, friend. a multi-sized plastic T-fitting, 1 ft of ¼ or 5/16in (6 or 8mm) fuel line, depending on your vehicle, safety glasses, and a fire extinguisher.

Remarks: *Before condemning the fuel pump make sure there's gas in the tank.* The gas tank should be no more than half full for this test. Wear your safety glasses. If you have any of the above symptoms and the fuel pump's leaking around the seams, don't bother testing it. Remove and replace it with another (Proc. 10).

Step 1: Is the Fuel Pump Really the Problem?

Datsun/Nissan fuel pumps are reliable and often condemned erroneously. This test is worth the time. Like all plumbing or electrical troubleshooting, you must start at the furthest point in the system (the carburetor) and work back to the beginning (the tank). If no fuel is getting to the carburetor, there is gas in the tank and no obvious leaks, there's either blockage in a fuel or vapor vent line or the pump isn't working.

On vehicles with lever type (mechanical) fuel pumps the pump's on the front right side of the cylinder head, on the engine. On trucks with electric fuel pumps the pump's on the right side of the frame, back near the gas tank. (If you have an electric pump, there'll be a vacant spot on the right front corner of the head, perhaps where your power steering pump is mounted.)

•**Electric Pump People:** Once you've found your pump, look in the engine compartment and find two pipes running up the right fender wall and toward the engine. One of these pipes connects via a hose to the carburetor. If the carb is accessible, remove this hose at the fuel inlet. Otherwise disconnect a hose at the pipe closer to the body.

•**Mechanical Pump People:** Disconnect the rubber hose on the outlet pipe of the fuel pump. To determine which this is, follow the line(s) toward the carburetor; the one that goes to the carburetor fuel inlet is the outlet.

•**Everyone:** Once the hose clamp has been loosened three full turns, twist, pull and pry the hose off the pipe without breaking either one.

If you want to make a quick check, attach a 6—12in piece of fuel line to the outlet pipe. Aim the open end of the hose into a container or toward the ground, far from danger.

•**Electric Fuel Pump People:** Start the engine and listen to the pump. You should hear it clicking. If you can't hear it, check the fuses and wiring to the fuel pump. If you have a volt meter or even a test light, there should be 12 volts going to one of the electrical terminals on the pump when the engine's running. The filter in the pump may be plugged if the pump works and there is no fuel emitted. If the engine won't run, remove the pump and test it (Proc. 10 and Step 4 in this procedure).

•**Everyone:** Have a friend crank the engine from the driver's seat with the key. Keep your hands clear of the fan. As the engine turns over, the fuel pump should pump a good stream of fuel. If it does and there's no fuel in the carburetor *float bowl* (Proc. 2), check the needle and seat assembly (Proc. 2 and 7). If there is no fuel coming from the pump, go to Step 3. If there is flow from the pump, go to Step 2.

Step 2: Check Fuel Pump Operating Pressure.

You need a vacuum/fuel pump gauge, a graduated measuring container, and a piece of ¼ or 5/16 in x 6 in piece of fuel line. Connect a T-fitting to one end of the hose.

Slip the other end of this hose over the outlet pipe. Put another end of the T-fitting into the fuel line that goes to the carburetor. The hose to the vacuum gauge now goes onto the third, free end of the "T." (If you have a set of instructions for the gauge, read them before continuing.)

When all connections are made, crank the engine. (Electric Pumps: just turn ignition ON.) **Caution:** Be sure there's nothing around to catch in the fan blades.

If you get less than 1.5 psi (9-12 kg/cm) while cranking, that's too little. Go to Step 3. If the engine starts and runs, there should be 2.56 to 3.41 psi on L-16 engines and 3 to 3.9 psi on L-18 and L-20B engines. For Z-22 engines the pressure should be 2.8 to 3.8 psi and on Z-20 and 24 engines 2.7—3.4 psi. If there is less than 2 or more than 4 psi, fuel starvation or carburetor flooding may be the result.

•**Electric Pump People:** If the pump pressure is low, go back to the pump and repeat the previous steps with the hose and gauge connected to the pump's outlet pipe. This is the pipe that **does not** connect to the fuel filter. While you're at it check the condition of the fuel pump inlet hose. If there's a crack in the inlet hose, the pump will suck air and fuel pump output pressure will be affected (Step 5).

•**Everyone:** If the pressure's too low, proceed to the next step now. If too high and you're flooding out, you should replace the fuel pump.

Rev the engine a few times and watch the pressure. It should be steady within specifications even as the revs change. If it fluctuates wildly, either there's a constriction before the pump (intake) or the pump is sick. Go to the next step.

Turn off the engine and watch the dial. The pressure should remain high for at least one minute. If it drops immediately, replace the pump.

Step 3: Check Pump Intake Pressure.

Mechanical Pump People: There has to be at least some fuel in the carburetor float bowl to do this check. Also, if you don't have a vacuum gauge (field test), you can place your finger over the inlet, crank the engine, and feel for suction.

Disconnect the hose from the intake pipe of the fuel pump. This is the one that leads to the fuel tank and filter. Connect the vacuum gauge hose to the pipe (without the T fitting attached). Now run the engine. If the pump is strong, it should build up to 10in vacuum on the gauge. If it is below 7 in, replace the pump. If the pressure is "up to snuff" check the plumbing as described in Step 5.

Step 4: Check Fuel Pump Output Capacity.

Do this one only if the engine runs.

Connect the piece of ¼ or 5/16in fuel line hose to the pump outlet pipe. Put the other end of the hose into a clean graduated measuring container. Start the engine and run it at 1000 rpms, or slightly above idle, for one minute. In that time it should deliver 1000 ml or a little over 2 pints (Mechanical Pump), or 1400 ml/3 pints L-20B, Z-20 and 24, or 1500 ml Z-22 (Electric Pump). If much more than these amounts, the pump is overacting; if much less, it is too weak.

If the fuel pump is delivering fuel properly and there is fuel in the float bowl, but you still suspect fuel problems (e.g., high speed missing and the ignition system is OK), check the *inline fuel filter(s)* and the filter in the carburetor needle and seat.

Step 5: Check the Plumbing to the Pump and Carburetor.

•**Electric Fuel Pump People:** Because the pump is back near the tank the piping between it and the carburetor is all outlet plumbing. Your pump inlet line is short because it's so close to the tank. Inspect the system with this in mind.

•**Everyone:** If there's a constriction between the pump and the tank, it can damage the pump severely. A slight restriction or pressure blockage can cause starvation at high speeds or under load.

Usually it's caused by the fuel filter, but it's possible that the fuel tank isn't venting properly. Keep reading.

If you haven't changed the inline filter and cleaned the filter in the needle and seat at the carburetor, you'd be wise to do these before you blame the pump. (Electric pumps have a filter in the pump itself.) For filter info, see Ch. 3, Proc. 10. Make sure your filter's the correct size. A filter with pipes that are too small will leak air and/or fuel.

If the pump checked out and there is fuel in the tank, reconnect the feed hose to the fuel pump, and disconnect the outlet hose. Remove the gas cap. Some suction within the tank is normal. You'll see if there's too much in a moment. Have an assistant crank the engine from the driver's seat for at least three 10-sec intervals. If you notice an increase of flow with the gas cap removed, there is a constriction in the tank's vent system (see Ch. 6, Pt. 2, Proc. 3 for a little on this). For more you'll need to consult a Factory Service Manual and further test the evaporative system. Problems here usually happen if an accident causes plumbing damage.

If there is still low or no delivery of fuel, disconnect the inlet hose to the fuel pump (Mechanical People Only). Wipe off the end of the hose and blow through it; you should hear the gurgling of bubbles back in the tank.

I once found a plugged Datsun fuel line on a truck that had a spare tank. It drove me nuts when the valve got stuck after I had moved it to switch the tanks. This happened on an abandoned stretch of road late at night.

Frequently you'll find hoses distorted because the hose clamps have been overtightened. If this is the case, either cut back and refit the hose or replace it altogether. Also replace the hose clamp with a strap type hose clamp that fits.

If the line is plugged, work your way back along it to the tank, looking for either a crimped pipe or leaking hose. Even if the plumbing looks fine you might have a break in it, allowing air to be drawn in. Have a friend blow through the line as you follow it back to the tank. Look and listen for cracks and leaks. Another possibility:

The *stand pipe* in the tank itself could be plugged. The tank will have to be removed if that's the case.

With age, rubber fuel lines crack. On old 510 models with rubber fuel return lines this is especially true. Look carefully for damp spots; fuel may leak only when the engine is running.

In extreme cases (such as with vehicles that have spent idle winters in the western Oregon rain, tanks empty) corrosion may have formed in the tank. Water and rust produce similar symptoms: the engine may run well for a while, then all at once begin to lose power and miss (Proc. 11). While you're inspecting the plumbing between the tank and carburetor also look at the fuel return system that parallels the delivery plumbing. It too consists of pipes, hoses, and clamps.

Step 6: Reconnect Plumbing.

If you're done for now, reconnect the hoses to the filter, pump, or pipes. For details on pump removal and off-vehicle testing (Electric Pump People), see Proc. 10.

Step 7: Test the Electric Fuel Pump.

NOTE: Do this test in a well-ventilated place.

The pump should be removed to do this test, see Proc. 10.

Before making any electrical tests, drain all fuel from the pump. Do this by removing the filter cap, draining the pump, and replacing the cap as described in Ch. 3, Proc. 10 before returning here.

Look at the connector and two wires leading to the pump. One should be black and the other brown. Connect one end of a jumper wire to the brown terminal and the other end to the black. The test wires shouldn't touch.

Connect the brown contact to the battery POSITIVE terminal and, while holding the pump securely, touch the black wire's jumper to the NEGATIVE battery post. The pump should work.

If it doesn't, remake your connections. Still nothing? If the battery is charged, your pump is bad—replace it.

If the pump works and you had no fuel output, the problem's in the wiring to the pump or the connector.

The fuel pump is wired through the automatic choke relay, which is operated by alternator output. Your problems could stem from one of those components. Read on (Ch. 7, Proc. 8 and 14). Good Luck.

Reinstall the pump if it checks out. Otherwise, replace it. Your pump is rebuildable, but I don't discuss it. If you have to replace the pump, use one that fits, not one on which you have to modify the wiring and mount to make work.

PROCEDURE 10: REMOVE AND REPLACE THE FUEL PUMP (mechanical and electrical types).

Condition: You have run through Proc. 9 and determined the fuel pump is the culprit. The gas tank should be no more than half full. You want to replace the fuel pump to cylinder head gasket (Mechanical Pump People) or the fuel pump hole cover gasket (Electric Pump People).

Tools and Materials: Mechanical Pumps: New (or used) fuel pump (avoid rebuilt fuel pumps), Phillips screwdriver, two pump-to-head gaskets or better yet a spacer block with gaskets included from Datsun/Nissan, silicon gasket sealer or other sealer, pocket knife, emery cloth, replacement fuel hoses ¼ or 5/16in for any that are deteriorated, maybe a cam cover gasket. **Electric Pumps:** A new pump and filter, hoses (if deteriorated), Phillips screwdriver, 5/16in bolt to plug fuel line, metal (quart) container, and two jumper wires to test the fuel pump.

Take the old pump with you to assure that the pipe placement is the same on the new one.

Remarks: Mechanical Pumps: Although it isn't necessary to remove the cam cover to replace the fuel pump, I include it in the procedure for those who are not familiar with how the pump's operating lever mounts. When purchasing a pump, buy one that looks the same as the original. I have found pumps in many parts houses to be of lesser quality and more costly than the original style. They also look cheap. Because the surface between

the pump and the head is a common place for oil leaks, I use a Datsun/Nissan pre-made gasket (insulator) sandwich—#16420-A0600. Buy one, if possible.

Electric Pumps: You should remove your pump to further test it.

Step 1: Disconnect Battery Negative Cable.

Disconnect the cable at the battery. See Ch. 7, Proc. 1, then cover the top of the battery with a dry, thick rag.

Step 2: Remove the Cam Cover.

Mechanical Pumps Only: See Ch. 3, Proc. 4. Remove the cover to expose the shaft and timing chain.

Step 3: Disconnect the Inlet, Outlet and maybe Return Hoses to the Fuel Pump.

•**L-series People:** You have only two hoses to disconnect—an inlet and an outlet.

•**Z-series People:** You have three hoses to disconnect. The third—return hose—is the one that connects to the pipe that tees off the outlet fitting. Disconnect this not at the pump but farther back away from the pump where there's a short piece of pipe or where it joins the pipe under the manifold.

•**Mechanical People:** The pump is located on the right top front side of the engine. The hoses are connected to the pipes by hose clamps. Loosen the clamps enough so they turn on the hose, then work the hoses off the pipes by pulling by hand, gently twisting them with pliers, and prying against their ends with the shank of a screwdriver.

•**Electric People:** The pump is located to the right of the fuel tank under the truck in front of the rear wheel. Patiently disconnect the hoses at the pump and plug the inlet hose with that 5/16in bolt when removed. Catch any excess fuel in a container. If you have a shield over your pump remove it by unbolting the four 10mm bolts. Put the bolts back in their holes and set the shield aside.

Step 4: Remove the Fuel Pump.

•**Mechanical Pumps:** Do not drop anything into the engine with the valve cover removed. Stuff a rag down around the timing chain just in case. The pump is held to the side of the head by two 12mm nuts with washers. Try fitting a socket on the nuts. An open-end should fit the nuts if nothing else will. Remove the nuts, lockwashers, and flat washers. If there is pressure against the **pump lever**, the pump will push away from the head. Or it may be stuck and need to be tapped to come free. When loose, tip the pump slightly to slip the lever through the hole in the head.

•**Electric Pumps:** If you have a metal shield covering your pump, remove the 10mm bolts as described in Step 3, as well as the 10mm bolts that hold the pump to its mounting. Separate (unplug) the electrical connector and remove the pump. To test your pump go to Proc. 9 (7). Put the mount bolts back in their holes for safekeeping.

Step 5: Remove the Gaskets and Spacer Block.

Mechanical People Only: There is an **insulator block** between the pump and the head with gaskets on either side of it. The block will be stuck to either the head or the pump. Remove it by carefully wedging a small screwdriver tip between it and the surface to which it's stuck. Do not mar the soft aluminum head while doing this. Once the insulator has been removed, scrape the surface of the head with a knife blade without scarring it, then use emery cloth to sand the surface smooth. This is important for good sealing. Be thorough and do it right.

If you are using the old insulator, the old gaskets must be scraped off and new ones installed. All the old gasket must be removed without scarring the spacer. Then sand the spacer to prepare the surface for the new gasket. Just before installing the pump put a light coat of silicon sealer on the insulator and gasket surfaces, then immediately install the gasket.

Step 6: Install the Pump:

•**Mechanical People (Z-series):** Remove the return hose from your old pump and install it on the new pump.

•**Everyone:** Lightly coat both gasket (insulator block) surfaces with sealer and fit the block over the studs and against the head. Put a dab of penetrating oil on the stud threads. Pick up the pump, and if the mating surface is clean, tip the operating lever into the hole, lining up the holes in the pump with the studs. Watch that the face of the lever fits against the out-of-round (eccentric) on the front of the cam gear (cam cover removed). Hold the pump against the head and install the washers (flat first, then lockwasher) and nuts onto the studs. Tighten the nuts evenly, keeping the pump against the head. Tighten until the lockwashers flatten and the nuts are snug.

•**Electric Fuel Pump People:** Remove the mount bolts and align the pump with the bolt holes. Install and tighten the bolts. Find the electrical connector and reconnect it solidly.

Step 7: Reconnect the Fuel Lines to the Pump.

Push the hoses onto the pipes. This outlet pipe on mechanical pumps often has an arrow in the housing or rubber boot above it. Replace any deteriorated hoses. Tighten the clamps until they no longer turn on the hoses. Do not overtighten. If any of the clamps is faulty, replace it with strap style clamps, Electric Pump People especially.

Step 8: Replace the Cam Cover.

See Ch. 3, Proc. 4.

Step 9: Run the Engine and Check All of the Connections for Leakage.

Look carefully at all the points where you opened up the system.

•**Electric Pump People:** If you removed a metal shield, unscrew its bolts from the frame, reposition the shield, then reinstall and tighten the bolts.

PROCEDURE 11: DRAIN THE FUEL TANK

Condition: You're here because you found water in the carburetor float bowl, or you suspect fuel contamination. This procedure is meant for those who want to just drain the bottom of the tank—sediment and/or water out. To completely drain the tank, use a syphon hose designed for this following the instructions provided with it. *Do not syphon by mouth*—gasoline rots gums and can kill.

Tools and Materials: Safety glasses, a drain pan to catch the fuel, 12 or 14mm socket, extension and ratchet, storage can, maybe a funnel, fresh fuel. Do not pour gasoline into storm drains or on the ground. Recycle it as you would used motor oil.

Remarks: I once knew a band of pranksters who went around putting egg whites in the gas tanks of police cars before the law got wise and started locking them. You may consider a locking style gas cap if you hold public office or are grouchy with the neighborhood punks. Don't even think about lighting a match or smoking while doing this procedure. If you want to get water out of the tank, let the vehicle sit still for a while to let the water settle to the bottom of the tank.

Step 1: Jack Up the Vehicle So It Is Level (not necessary on pickups).

See Ch. 13, Pt. 1, Proc. 1.

Step 2: Find the Fuel Tank and Its Drain Plug.

Locate the gas tank beneath the rear of the vehicle. The plug has a regular bolt head. It's threaded into the bottom of the tank. If you want to get water or heavy sediment out of the tank, you need only drain a quart or two from the tank.

Step 3: Remove the Filler Cap and the Drain Plug.

Caution: Watch your eyes and look out for sparks!

Remove the gas cap from the filler spout. Go under the tank with your drain pan, socket and ratchet. Put the pan under the plug. Turn the plug counterclockwise to remove—use your fingers when loose. When the plug nears the end of its threads, be careful. Put some pressure against it to control the flow of fuel awaiting liberation. Drain whatever's necessary. Do not store fuel in a glass or plastic container. Use only metal!

Step 4: Put the Drain Plug Back In, and Flush, Drain and Fill.

Reinstall the plug, turning clockwise. If empty, pour a little fuel into the tank and redrain (flush) by unscrewing the plug and draining it again. Replace the plug tightly. Refill the tank with fresh fuel.

If the rest of the system is still contaminated with bad gas, you may still have problems but you can rest assured that the tank is purged. A rusty tank will make rust-colored gas sediment. You should also drain the carburetor float bowl and flush the lines to the carburetor if this is the case.

Step 5: Lower Vehicle If Raised.

See Ch. 13, Pt. 1, Proc. 1.

PROCEDURE 12: DISASSEMBLE CARBURETOR FOR REBUILDING

Condition: You have diagnosed the symptoms as being connected with the carburetor. Having run through the checkout Proc. 1, you removed the carburetor (Proc. 5) and have the time and patience to overhaul it. The job can be done in an afternoon but is better approached with a weekend's time. Above all, avoid working under duress or dirty conditions. As Poor Richard says, "Carburetor rebuilding is really more like fine watch repair than car repair, and you will need an uncluttered, clean place to work."

There used to be a flock of chickens living around my shop that, given the chance, would fly onto the work bench and make their marks, which wasn't so bad. What most annoyed me was their skill at repositioning carefully arranged parts. Dumb clucks!

Keep carburetor components in order and under a watchful eye, because lost parts are hard to reclaim. If you're replacing the carburetor with one of a different style, be sure to read the introduction to this chapter to get the low down. It is a good idea to reassemble the carburetor as soon as you can to keep the procedure fresh in your mind.

Tools and Materials: Toothbrush, hacksaw, assorted screwdrivers (one that's medium sized and cheap), carburetor cleaner (enough to bathe the carburetor in), pipe cleaners, a can of aerosol carb cleaner and/or access to an air compressor, pen and masking tape, basic tool kit, a muffin pan or similar containers, and carb rebuild kit (I recommend the Datsun/Nissan factory kit even though it's more expensive than after-market kits). Other parts I highly recommend that you get at the Datsun/Nissan dealer are a base gasket (take model and production date), float (not necessary but preferable), a base shield gasket (if this applies to your engine), PCV valve and hose (if necessary), fuel filter (you could get this anywhere).

NOTE: On newer carbs the screws and jets are tight. A straight-tipped offset screwdriver works to loosen tight screws and jets without wrecking them. I also describe a tool in Step 13 that you can easily make. Read that description for making a power valve tool.

Remarks: There are four distinct series of carburetors covered in this book. Within these series there are endless variations. To keep things straight I refer to the carb types by the first six letters and digits of their classification. The specific differences are defined as we come across them. Because there are so many differences, I plead with you to have mercy and use your imagination if my instructions are not to a T. Believe me, this chapter has brought me many a carburetored nightmare.

I want to emphasize that no two models or engines operate with identical characteristics so no suggestion or modification is absolute. There are carburetors that are born losers and incorrigible. You are your own mechanic, don't forget—not I.

Fire Danger!! Do not smoke around the carburetor as combustible fumes linger.

I suggest you do this work somewhere other than in the house, e.g., in a well-ventilated garage. Noxious gasoline and carb cleaner fumes linger and are unhealthy.

•**DFP (E.C.C.) People:** Your carburetor is rebuildable but not always done successfully. You may want to consider replacing the carb instead of overhauling it. No matter how thoroughly you clean and rebuild the carb it may not work well. This model has a bad track record.

Step 1: Make Friends with Your Carburetor and Drain It.

Give yourself time and a comfortable clean working space. Spread out some butcher paper under good light.

Unless you have already spilled it there should be gasoline left in the float bowl. Look at the round throat on top of the carb. Find the two vent pipes cut at an angle. If you turn the carburetor upside down, gasoline will pour out these pipes. Catch the fuel in a container, cover and store it away from sparks and smokers.

Throughout this procedure I identify the four sides of the carburetor as **front**, **left**, **right** and **rear**. The perspective is from the driver's seat. Position the carb so you're looking at the linkage. **left** is on your left. And **right** is where the accelerator pump lever is. And yes, the **rear** side is where the linkage lives. You're looking at it.

Look at the left **front** corner of the carb. On the flat area on the side of the body look for a group of numbers starting with a D. Use some spit or carb cleaner to wash off grim. Don't rub too hard, the print may be wiped out. They will read DAF 328 or DCH 340 (L-series); DCR 342, 384 or DFP 384 (Z-series). Next to or below this there are other numbers and letters. For now we are interested in the first six digits only. If you are replacing the carburetor, however, the other numbers may help, so read on. All carburetors covered in this book are made by our friends, the Hitachi Corporation.

The carburetor breakdown by years, models, and engines goes like this:

1968-71 (5/71) 510 and 521 models: DAH or DAF 328 (man choke) L-16 engines

1971-72 (6/72) 510 model: DAF 328 (auto choke) L-16 engine

1972 (3/72)—1980 510, 610, 710, 620 and 720 models: DCH 340 (auto choke) L-16, 18 and L-20B engines

1980-83 (11/82) 510 and 720 models: DCR 342 (auto choke) Z-20 and Z-22 engines

1983-½ (11/82 2WD, 1/82 4WD)—1985 (Fed. & Can.) 720 models: DCR 384 (auto choke) Z-20 and Z-24 engines

1983-½ (11/82 Calif.), 1985 (7/84 Fed.)—1986 720 (E.C.C.) models: DFP 384 (auto choke) Z-24 engines

Note: For you oldsters with DAH carbs take heed. Throughout the following procedures you fall under the DAF classification. Remember this.

If you can't find any numbers on the side of the carburetor, use the above list as a guide. And if you plan to replace your carburetor, take the old one with you for an exact match.

There are endless variations to the carburetors listed but don't fear. Go one step at a time, and you'll be amazed how it all fits together. Be aware of the following differences: **L-series Oldsters:** whether or not your DAF carb is manual or automatic choke, and if it has one fuel line (late) or two (early). Or if your DCH carb is pre-1975 or later (referred to as early DCH or late DCH) Or Z-series—If you have E.C.C. or not (see Proc. 17).

If none of these identification instructions fits your carburetor, it may not be the original. I'll say no more.

Step 2: Remove Coasting Enricher Solenoid or Boost Controlled Deceleration Device.

•**1970-72 DAF 328 People:** If you have this device, there'll be a cylinder with a triangular three-screw base on the left side of the carburetor. Remove the three screws from around the solenoid and carefully tap it off the carb body. Remove the parts inside of the solenoid carefully: a black O-ring from the carburetor and a copper washer, spring, and plunger. Put these parts together labeled "decel solenoid." Insert the screws back into their holes.

•**DCH 340, DCR and DFP People:** Screwed on the **left** side there's a horseshoe-shaped object with six screws on and around it. Only three of these have to be removed. Start with the one on the small or float end

of the horseshoe. (If there are seven screws, start with the lower of the two on the small end.) Count round the screws clockwise and remove the third (or fourth) screw, then the fifth (or sixth) screw, leaving the others alone. The BCDD will come off the carburetor with light tapping or prying. There's a gasket under the valve.

NOTE: A few of you 1974 people may have a horseshoe-shaped plate. Remove and box it like the piece described above.

Everyone: Tape the screws together labeled "BCDD." Put the lot in a box labeled "LEFT."

Step 3: Disconnect the Vacuum Break Vacuum Hose.

Automatic Choke Only: Still on the **left** side, find a small black vacuum hose connected to a round diaphragm above and to the right of where the BCDD was attached. Slip or pry the hose off the diaphragm pipe. Slip the other end off the pipe on the carb body. Store the hose in the **left** parts container.

Step 4: Remove the Choke Thermostat Cover and Dashpot.

•**Automatic Choke People and Everyone with Dashpots:** Turn the carburetor so the **rear** (linkage) side faces you. **L-series:** (If the carb is on the engine, follow the blue choke wire to a clear plastic connector and disconnect it.) Three screws and a bracket (late DCH) or three screws and quarter-moon clips hold the choke in place. If the carb is on the engine, use a stubby Phillips screwdriver. Remove the screws and clips or retainer binding the lower wire clasp down, if there, then carefully pull the thermostat away from the carburetor body. Place the unit in a container with the inside (spring side) facing up. Be careful not to drop it.

Put the retainer or retainers and screws back in their holes for safekeeping. If the carburetor is on the engine, leave the screws out of their holes, and store them together labeled "choke."

•**DAF People with Dashpots:** If you have a dashpot, it is located to the right of the throttle linkage. Measure the distance between the end of its threaded part and the bracket. Record this distance, then remove the 12mm nut. Thread out the dashpot, replace the nut and stash them.

•**DCR and DFP People (with auto trans and/or air conditioner):** You should have a FICD dashpot mounted on the vacuum actuator to the left of the choke housing. Loosen and unscrew the 19mm nut that's under the bracket. Store it and the nut in a box labeled "REAR."

Now unhook the spring from between the FICD bracket and the throttle linkage with needlenosed pliers. Store it with the FICD.

Step 5: Remove the Secondary Vacuum Capsule.

You're still looking at the **rear** side. Find the secondary vacuum capsule (actuator) which is under and to the left of the choke housing. The capsule sits at an angle and a rod coming from the bottom of it connects to the secondary throttle linkage.

Look closely to notice that the rod is held in place by a tiny round "E" clip slipped into a groove in the shaft. Remove the clip carefully so as not to lose it by finding the open end of the clip and pushing it off the shaft with your small screwdriver. Set the clip in the **rear** parts box.

Follow the capsule body to where it attaches to the side of the carburetor. Three cross-headed screws hold it in place. (On later L-series carbs the top screw holds a cam stop, an angled piece.) Remove the screws and the brace for the dashpot. **DAF People with Dashpots:** put the dashpot screw back into the brace. Lightly tap the capsule to separate it from the carb. Keep the three screws with the capsule and set the lot in the **rear** parts box.

Step 6: Disconnect Accelerator Pump Lever and Spring for Adjustment, Carb Removal and/or Disassembly.

If the carburetor is off the engine, turn it so the **right** side is facing you. NOTE: Not all late DCH carburetors have adjustable levers.

•**Everyone:** On the upper right side of the carburetor find the accelerator pump lever. On the back end the lever connects to the throttle assembly by a vertical rod, pivots on a little shaft and operates the accelerator pump rod on the RIGHT front corner of the carburetor. Look at the center of the lever where the pivot shaft is.

•**DAF, DCH, DCR 384, and DFP People:** Remove the cotter pin from the shaft after straightening its legs. There's an "E" clip between the pin and the lever. Remove this by turning the clip until you can slip a screwdriver

tip between it and the shaft to pry it off. Don't lose the clip; keep a sticky finger nearby to catch it and store it in a parts container labeled "RIGHT." Now lift off the peculiar spring that's hooked on the inside of the lever. Pull the lever out and the shaft out of the hole in the accelerator pump. Remove the inner spring once the lever is free and store it with the other pieces. Let the return spring connected to a bracket below drop, held by its lower hook. Push the lever out of the way rearward and let it flop.

If you want to change the lever to pump or the linkage to lever position and **not** further disassemble the carburetor, see Proc. 14 (22). If you're disassembling the carburetor, make a sketch, noting at which position (hole) the rod connects to the lever and lever to pump, if adjustable.

•**Z-series DCR 342 People:** Loosen the cross-headed screw that holds your lever in place. Put your hand under the lever as you remove the screw and the bushing it slides through. On the inside there's a flat washer and spring that will fall free along with a lever when the screw's removed. Let the lever drop out of the way and collect the screw, bushing, washer, and spring and tape them together, stashed in a box labeled "RIGHT."

•**DAF People:** If your lever and rod are connected by a cotter pin, leave them together.

•**Everyone:** Manipulate the lever off the rod and unhook the spring (if there) from the hole in the lever. Unhook the other end of the spring from the bracket below, and tape the two together. If the coil spring looks like it won't fall off the bracket, leave it there. Tape the pieces together and stash them in the **right** box.

•**L-20B People:** If you're removing the carburetor with plans to rebuild it, put the springs in a box labeled "RIGHT" as described above. Otherwise put the springs in any local parts container and go back to Proc. 5 (11).

Step 7: Remove SECONDARY Interlock Spring and Fast Idle Rod and Throttle Return Spring.

•**DAF People with Manual Chokes:** You are in a minority, so I don't cover you very well. To ease reassembly make a good sketch of your linkage spring and rod layout (connections).

•**Everyone:** On the **rear** side of the carb hidden behind things, find one or two coil springs. If two, one is larger than the other. It (or both) connects to a stationary bracket on the top side of the carb. The bottom end of the spring(s) hooks to the throttle linkage(s). Use small-nosed pliers or a screwdriver tip on the inside of the upper hook(s) to pry the end(s) out of the hole in the bracket(s). Remove the lower ends the same way.

•**DAF People:** If you have two springs, label with masking tape by position "INNER" or "OUTER."

•**Everyone:** If necessary, turn the throttle control, then the fast idle cam enough to bend the spring end out of its hole. Place spring(s) in the **right** box.

There is also a fast idle rod connecting the linkage and choke control. Disconnect the bottom end of the rod by pulling out the cotter pin or "E" clip and then the washer behind it. Open the throttle and lift the fast idle cam enough to push the rod out of its lever.

•**L-series:** There is another washer on the rod. Reinstall the outer washer and cotter pin on the rod for safekeeping.

•**Z-series:** Put the "E" clip in the **left** box. You may have another two part elbow action rod that connects to a lever on the outside of the fast idle cam. Remove the "E" clip, pull it off the rod, and stash the clip in the **left** box.

Step 8: Remove Accelerator Pump Assembly.

Find the black rubber boot on the **right** side toward the front and on top. Remove the two screws at the base of the boot. If either of the screws was loose, look at the threads in the carb body. Note if any are stripped. Keep the carburetor flat on the bench and pull the rod up while wiggling it. The plate and boot should lift up with the pump assembly. Set aside. Now, look down into the pump well. There are a spring and chrome ball down there. Pick out the spring then turn over the carb, palm covering the well to remove and catch the ball. Got it? Put all these parts except the screws in a box labeled "primary." Reinstall the two screws in their holes.

•**DCR and DFP People:** Find the tan plastic collar that's pressed into the top part of the accelerator pump well (hole). Try to remove it with your finger. If you can't get it out, leave it. Otherwise remove and put it in "primary" box.

Step 9: Remove Float Bowl Cover, Gasket, and Float Assembly.

Turn the carburetor so the **front** faces you. Three screws hold the frame piece and window in place, two on top and one below. Remove the screws and the frame and maybe a gasket (newer DCH and all DCR and DFP carbs don't

have this gasket) and the window piece will pry away from the carb.

There's a black rubber gasket set into a groove in the carb body. Use a safety pin or the like to remove the gasket. Set the parts aside. The float is now exposed. Notice the shaft on which the float pivots and a little brass spacer on its end. Remove this spacer and immediately store it in a box labeled "front." Pull the float off the shaft and shake it. If it has a leak in it, there will be gas sloshing around inside. If so, you'll definitely need another float. Put all of the parts you removed in the FRONT box. Put the cover screws back into their holes.

Step 10: Remove the Fuel Inlet.

•**DAF (early style):** You have two tubes, inlet and return, and two possible types of brackets holding the return in place. One bracket is clamped to the side by two screws and further secured on top by one of the main screws. The other style simply fits over the top of the return, held by a main screw. Loosen and remove the screw then set it aside. Follow the return back to above the float bowl and loosen the 12mm bolt securing the inlet assembly turning counterclockwise. Stash your parts in the TOP box.

•**DAF (later single inlet style), DCH, DCR, and DFP People:** Your instructions are in Proc. 7 (2). Come back here when done.

Step 11: Remove the Carburetor Top Section (Choke Chamber).

Turn the carb so the **front** (float bowl side) is facing you. There are four or five main screws holding the top section (choke) to the midsection (carburetor). You may have already loosened one of these screws while removing the fuel inlet. On the FRONT (float bowl) side the screw is next to the throat above the center of the float chamber. Keep the screws in order as you remove them. The first one is? Yes, #1. Work clockwise to find the #2 screw just behind and below the accelerator pump pivot, on the **right** (your left) side. The #3 (longest) screw is on the **rear** opposite the float bowl side, inside the throat. The #4 screw is on the flat top edge next to the throat. There may be a clasp holding some wires. Keep it with the screw.

•**DCR and DFP People:** You have a fifth screw (#5) on the **front** of the carb just to the right of the needle and seat, in the corner there; that's right. Tape each screw and label it #1—#4 (or #5). Do this before the chickens come and mix them up. Put the screws in a box labeled "TOP."

The top section can now be separated from the midsection. Light and careful prying and tapping may be necessary to loosen the two parts.

•**DAF People:** Once the top is off the midsection, disconnect the choke link rod. A key in the rod fits a slot in the control. Turn the top part to line up the key and slot and disconnect the top from the midsection. Now swing the lower end of this rod to position the key with the slot to free the rod. If the lower end of the rod's held by a cotter pin, washer, and spring leave it attached. Tape and label the rod "choke link," if removed, and store it in the **rear** box. Set the top section aside.

•**DFP People:** You have to work the **enrichment solenoid** wire through the top section. Find the main connector you unplugged to remove the carburetor. Find the wire that goes to the top section. Look at the pin in the connector. Pry back the two little legs holding it in the connector, and push it out. To remove the top section, you'll have to work this wire through the boot. Keep the boot with the top section.

•**DCH, DCR, and DPF People:** Lift the top section straight off the midsection.

•**DCH People:** Remove any wires by bending their clasps back. If hung up, check that the choke rod on the linkage side is free and that the power valve actuator (power piston) isn't stuck. Lay the choke chamber top side down on the bench to avoid damaging the actuator.

•**DCR and DFP People:** You'll still be connected to the fuel shutoff solenoid wire. Lay the top section aside and read Step 13. Set the freed top section safely aside (upside down) with the solenoid still attached.

Step 12: Remove the Needle and Seat Assembly.

The needle and seat are removed as a unit. The assembly threads into the float chamber. Remove it with a box-end wrench or socket fitted over the hexagonal base of the assembly to turn it out counterclockwise. I have found the size to range from 15-19mm. Hold the carburetor steady and fit your wrench squarely over the fitting. Store the needle and seat in the TOP box. Account for the screen which is either stuck inside the inlet or has slid over the needle valve.

There should be a washer under the screen but not one under the needle and seat where you might find one.

Start a list with two columns: one titled "Primary" and the other "Secondary." This will be your road map.

Step 13: Remove the Power Valve.

•**DFP People:** You have a fuel enrichment solenoid instead of a power valve. Leave it alone and go on to Step 14.

•**Early DAF People:** Read through this step to determine whether or not you have a power valve. Under the "Primary" column on your list write "No Power Valve."

•**All DCH People:** You have a power valve if there's an actuator piston connected to the underside of the top section. The power valve is located and visible inside the float bowl. Look down from the top of the midsection and note the slot in the valve and the little plunger in its center. Out of a 5/16in wide-tip inexpensive screwdriver I made a power valve tool by cutting a groove in its tip with a hacksaw. The groove lets the tip fit into the slot without pushing down and damaging the plunger. You'll have to clamp the driver's shaft and cut a 1/16—1/8in deep groove. Fit this special tool in from the top to turn counterclockwise and remove the power valve. There should be a washer under the valve. Account for it.

NOTE: It's common the these power valves to work loose from normal vibration.

Under the "Primary" column write "Power Valve" and next to that the number stamped into the valve's top, for example, #35, #43, or #58. Place the valve in the "Primary" box. Keep the washer with the valve.

Step 14: Remove the Fuel Shut Off Solenoid.

•**DCH 1973 on and All DCR and DFP Carburetors:** On the REAR or linkage side of the carburetor find the fuel shutoff solenoid. It has a red wire pigtailed to it. If you don't have this, go on to Step 15. On pre-1975 models the wire tends to fray and break off where it joins the solenoid. If the wire has come loose, the solenoid has to be replaced unless you can figure a way to mend it. The design failure was corrected on L-20B engines. Remove the solenoid with a 17 or 19mm open-end wrench holding the carb flat on the bench and turning the solenoid counterclockwise. **DCR and DFP People:** You'll have to turn the top section so as not to twist the wire.

•**Everyone:** Once loose, remove the unit with your fingers turning the wire with it to avoid twisting. There is a copper washer around the solenoid and a plunger within it. DCR and DFP solenoids have a little spring inside the plunger. Tape all of the parts together and stash them in the **rear** box.

Step 15: Remove the Primary and Secondary Throttle Circuit Plugs, Air Bleeds, and Jets.

Start a new box labeled "secondary." Place the carburetor so you are facing the float bowl **(front)** side. NOTE: The most common problem people have in overhauling carburetors is mixing up the parts from the **primary** and **secondary** circuits. So pay attention to every step and quit daydreaming about how smooth you hope the engine will run when you're done. To avoid an error, start a list naming and numbering each piece you remove. The parts from each side (circuit) go into separate boxes, one **primary** and one **secondary**.

DAF and early DCH carbs have quite different designs from the later ones. The differences are in the design of the venturis, which are those round objects in the center of the throats. All DAF carbs and some early DCHs had different shaped primary (Solex style) and secondary venturis and throats. All later DCH, DCR, and DFP carbs have similar venturis (Stromburg style). The differences in these are that in some the venturis are removable and some not. Look down at the top of the middle section. The float bowl is facing you so the **primary** circuit is on the left and the **secondary** on the right. **DAF and early DCH People:** Your **primary** throat is round and there's a small tube pointing into the hole and the **secondary** side is a different shape. You will from here on be referred to as such.

•**Later DCH, DCR and DFP People:** You will be called this. The distinctions within the categories will be made as we get to them.

All right, the secondary side is on the right. Begin working from your far right or the left side of the carburetor. Remember all the air bleeds, plugs and jets turn out counterclockwise. They are brass, soft and easily damaged by a screwdriver. Use a tip that fits and position it well.

Remove deceleration jet (coasting jet). Early DAF carburetors without a decel solenoid or BCDD

horseshoe need not apply here. DCR and DFP carbs don't have a coasting jet either. If you are one of these types, go on to the next part of this step. But first, make a large note on your list "No Decel Jet." Later DAF and all DCH carbs have this piece. Most pre-1975 carbs have a bleed on top of the jet. For simplicity I'll call what you remove a "jet" until we know otherwise. The decel jet is the one closest to the left edge of the carburetor. Don't confuse it with the two pieces that are closer to the throat. Remove the decel jet and write down "Decel Jet" and the number from its top under the "Secondary" column. Put the jet in the "Secondary" box. Look down into the jet hole. If there's another piece down there, rename your first listing "Decel Bleed." Now remove the jet if there and label and number it "Decel Jet." Store them in the "Secondary" box. Make a note on your list, specifying whether your decel is one or two pieces.

Remove slow air jet plug and spring. On the front **left** (your right) corner of the midsection and parallel to the side of the throat find the top of the *slow air jet (plug)*.

On earlier models the plug and the jet are one piece, while the later carbs use a plug with a jet below. Remove this. If one piece, the base of the plug will have a short tube with holes in it. On later models, the plug is just that, a plug. Write on your list "Slow Jet Plug—No Number" or "Slow Jet (one piece) #_____." Later DCH, DCR and DFP People: There's a stubby spring under the plug. Find and remove it.

If the jet's still in the hole, turn it up and out with a thin screwdriver. Write "Slow Jet #_____" on your list. Store all these pieces in the "Secondary" box. Also note "Slow Jet Spring" on your parts sheet if removed.

Remove secondary slow air bleed: Behind the slow jet hold find the *slow air bleed.* Remove then name and number this "Secondary Slow Air Bleed #_____." Store it in the "Secondary" box with the rest. NOTE: On some DCR and DFP carbs the slow jet is really a plug and not numbered. Make note of this.

Remove secondary and primary main air bleed, venturi and emulsion tube: DAF and Early DCH People: Look into the **secondary** throat for a round piece suspended across the throat. The piece is attached on the front side by two screws with an air bleed between. On the other end, there may or may not be a third screw. (You are not of this group if your secondary venturi has two screws and only one arm connected to one side of the air horn. If you do, go below to the DCH, DCR, and DFP section of this step.) Find the *main air bleed* between the screws on the front side of the secondary throat. Remove the bleed and write down "Secondary Main Air Bleed #_____" on your list. Store it in the "Secondary" box. Remove the screws on either side of the bleed hole. If you have a third screw on the opposite side, remove it too. Gently pry the venturi up and out of the carb. There's a gasket under the big end and a washer under the small end. Put the pieces in the "Secondary" box. Find the emulsion tube sticking out the bottom of the venturi. Push it up and out of the venturis. Put them both in the "Secondary" box.

Now look at the **right** (your left) side of the carburetor into the **primary** throat. If it's round, you have a Solex Style DAF carb. If so, there's a brass nozzle (tube) to the right of center and forward. This is the accelerator pump discharge. Don't damage this while working around it. In the center of the throat, there's a brass piece—the *primary main air bleed.* This has to be removed, but carefully, with a well-fitting screwdriver. The piece below it may turn too. If it does, wrap a soft or folded edge of a rag around the bulbous section of the piece just below the air bleed. Look closely at where the pieces separate. Carefully grab the center piece with pliers. **Do not damage the piece.** Hold the pliers tight, without damaging the brass and remove the bleed. Record its name and number and place it in a new box labeled "Primary."

NOTE: If the bulbous piece came out, press it back into place after removing the air bleed. Go ahead to the section to remove accelerator pump discharge and parts.

•DCH, DCR, and DFP People: Both the **primary** and **secondary** throats look alike. There are removable and non-removable venturis mixed in through the years, so it's important to figure which style you have. DCR and DFP carbs are all non-removable. Read through this section ignoring what doesn't pertain to you.

The venturi is mounted in the center of the throat. Removable types are supported by a single arm attached to the front throat wall. Non-removable (fixed) types are connected by two arms. Removable types are secured by two screws on either side of the main air bleed, and fixed types have no screws visible from the top, only the main air bleed. Once you have established what you are, proceed.

Facing the float bowl, start on the **secondary** or **left** (your right) side. Remove the main air bleed. **Non-Removable People:** Your air bleed and emulsion tube are one unit. So when the bleed is loose it'll lift out of

the carb with the emulsion tube attached. **Removable People:** Remove the two screws on either side of the main air bleed hole. Holding on to their washers, set them aside for the moment. With some light prying lift the venturi out of its well. There should be a gasket under the base end. Push the emulsion tube up and out of the venturi. Replace the two screws into their holes as far as they will go. Stash the venturi and gasket in the "Secondary" box. Write "Secondary Main Air Bleed" and its number on your list. Put it and its Emulsion Tube in the "Secondary" box.

•**Everyone (Removable and Non-Removable People):** The primary venturi cluster is the same design as the secondary, but that doesn't mean you can mix up their parts—oh no. Label another box "Primary" and take a deep breath. Ahh, the smell of gasoline. Now repeat the steps you used to remove the secondary venturi and/or parts. Be sure to list and number the "Primary Main Air Bleed" (number stamped on top). Store all parts in "Primary" box.

•**Non-Removable Venturi People:** Check to see if your venturis are loose. Wiggle each one side to side, up and down. They should be tight. The older your carburetor (DCH especially) the more likely the problem. If they're loose, try tightening the set screw on the rear side of the carburetor. This usually won't work. The solution is to wedge a piece of shim material (cut the width of the slot) between the **rear** end of the venturi and the carb wall. The thickness of your shim depends on how loose the venturi is and what you use for shim material. I use brass shim stock but aluminum or steel from a can will work. You must be your own engineer and mechanic. Try to keep the venturi straight.

Remove accelerator pump discharge and parts: DAF and early DCH People: On the primary side there's a brass nozzle and curved tube pointing into the throat. This piece is held in position by a 10mm bolt. The tube is easily bent so be careful. Use a socket or box end to remove the bolt. There are washers on either end of the fitting, top and bottom. Keep these washers, the nozzle and bolt together in the "Primary" box.

•**DCH, DCR, and DFP People:** Between the accelerator pump well and the throat find a slotted plug. There is no hole in this piece, and it is the largest of the plugs on that side of the carburetor. Remove the plug and the washer under it. Put these parts in the "Primary" box.

•**Everyone:** Within the hole from where the plug or nozzle came, find a spring and/or cylindrical weight and chrome ball. Turn the carb upside down with your hand covering the hole to catch the parts as they fall out. This is important. Each design of carburetor is fitted with different combinations and styles of parts. Discharge nozzle carbs won't have weights, unless modified. Early DCH 340 carbs had no springs, just a weight. Later DCH and DCR and DFP carbs had both springs and weights. Keep all these parts in the "Primary" box.

•**Remove primary first slow jet and secondary slow air bleed.**

•**DAF and Early DCH People:** There are two fittings remaining in the primary side. The one closest to the **front** side is the slow air jet. Remove and list the Primary Slow Jet.

•**Later DCH, DCR, and DFR People:** Find the plug that's just behind and to the outside of the pump discharge hole. There's a spring and jet below the plug. Remove the plug. Look into the hole to see if there's a stubby spring. If so, remove it. Now remove the jet with a screwdriver that's skinny enough to fit into the hole without messing up the threads on its side. Record the jet's number and label the "Primary Slow Jet." Also list the Primary Jet Plug and Spring.

•**Everyone Except Some DCH, DCR, and DFP People:** To the rear of the slow jet hole sits the slow air bleed. Remove it now.

•**Some DCH, DCR, and DFP People:** Your Primary Air Bleed is in the top section. Look on the underside of the casting next to the choke flap. Find and remove the slotted air bleed.

•**Everyone (DAF, DCH, DCR, and DFP People):** List the Primary Slow Air Bleed and its number. Stash the slow jet, plug and spring (if fitted), and slow air bleed in the "Primary" box.

Step 16: Remove the Main Jets and Plugs.

•**DAF, DCH, and DCR People:** Turn the carburetor upside down so the float bowl faces you. Between the opening of the bowl and carb's bottom section find two 12mm bolt heads, one for each throat of the carburetor. The **primary** or smaller throat is on your right and on your left, the **secondary**. If there's a retainer around the bolts, pry it off. Unfortunately there's no graceful way of doing this. Use a socket or box-end to remove the bolts.

Keep the washers, if any, with the screws in the "Primary" and "Secondary" boxes. Stash the retainer in one of the boxes.

The main jets are set down in the holes at an angle.

•**DFP People:** The main jets are inside the float bowl. Before you remove them make sure you know which is which, the **primary** side is on your left as you face the float bowl.

•**Everyone:** Remove the **primary** jet using a good light, if necessary, to locate the slot in the jet. Loosen it a few turns, enough to tip the carburetor so the jet can fall out. Write down the jet's number and label it "Primary Main Jet." The number should be between 97.5 and 117. Put the jet in the "Primary" box.

Remove the **secondary** jet from the other side and record its name and number "Secondary Main Jet #_____." Stash it in the "Secondary" box.

Step 17: Remove the Throttle Section.

•**DAF, DCH, and DCR People:** Your carburetor is still upside down.

•**DPF People:** You have to turn your carburetor upside down. But wait, you also must support it so it isn't resting on the enrichment solenoid. Use blocks to keep it off the bench.

•**Everyone:** The bottom, throttle section isn't made of aluminum alloy like the rest of the carb; it's made of cast steel. The brass throttle plates are screwed to shafts set inside the casting. These should not be removed. Notice how their sides are slightly beveled to match the throttle bones.

Find the three or four cross-headed screws recessed into the bottom of the throttle section. Remove the base gasket if it's covering the base. On carbs with a power valve, look at the screw on the float bowl side. It should have a hole in its center. If it doesn't, look at the other screws to see if it may have been misplaced. Sometimes more than one screw has this feature. Remove the three or four screws, which may be very tight or too loose. These screws have the habit of loosening.

•**DAF and DCH People:** Set the screws aside and turn the carburetor top side up with the **right primary** side facing you. On a little ledge on the lower mid-section of this side find another cross-headed screw that is the fourth and last one holding the carburetor together.

Remove the screw and set it, washers accounted for, with the other three. Place these fellows in a baggie labeled "Throttle Section." On some DAF and DCH carbs there's a spring bracket under the last screw. If you have one, store it on the screw in the bag.

•**Everyone:** The throttle section will now separate from the midsection with light tapping and prying, if all of the screws have been removed. There is a gasket between the sections. Scrape and carefully chip off as much of it as you can, and set the midsection aside.

Step 18: Remove the Idle Mixture Screw.

Place the throttle section so the right side is facing you.

•**DAF and DCH People:** Find a screw with a spring under it in the center of this side. If the screw has a plastic cap over it remove the cap by prying up gently with a screwdriver tip. Don't worry if it breaks.

•**DCR and DFP People:** Your screw may be plugged over (see Step 19).

•**Everyone:** Do not confuse this with the idle speed screw on the linkage **rear** side. Remove the mixture screw, turning counterclockwise. Place this with its spring in the bag with the throttle section screws. Leave the idle speed screw where it is. Put these parts in the "throttle section" box.

•**DCR and DFP People:** Your screw may be hard to get out. Use a magnet or something sticky. There's a metal and rubber washer as well as the spring to account for.

Step 19: Remove Mixture Screw Plug.

DCR and DFP Z-series People Only: You probably have to remove a plug to reach your idle mixture screw, which is recessed in the throttle body. The plug is the larger, lower one on the right side of the throttle section. It's aluminum (the other's brass) and easy to drill. Use a nail to center punch the plug to help start the 1/8in bit needed to drill a hole in the plug. The plug is 3/16in thick. After drilling the hole, screw in a 3/16in sheet metal or self-tapping screw. Thread the screw into the soft aluminum as far as possible. Clamp your pliers

round the screw then lever it and the plug out of the body. If the screw strips, use a slightly larger one and try again. Before you remove the mixture screw count how many turns it takes to turn the screw in—clockwise. (One turn is a full 360°.) Don't force the screw once it stops. Record the number of turns, e.g., ¾ or 1¼.

Step 20: Oh no! All these Parts! Help me Mama!

Before the chickens come and roost on the parts find a safe place to store everything. Make sure the boxes and bags are labeled. Keep it all together and reassemble the carburetor as soon as possible.

PROCEDURE 13. PREPARE CARBURETOR FOR REBUILDING.

Condition: The carburetor is disassembled, and you intend to rebuild it.

Tools and Materials: A straightedge (a 6in ruler will work), some emery cloth, a small container of carburetor solvent and can of aerosol carb cleaner, access to an air compressor with a nozzle (try a service station) or plenty of aerosol carb cleaner.

Remarks: The most important part of the carburetor rebuild is in this procedure. All the invisible passages must be clean and dry before beginning reassembly. Strong carburetor solvent and compressed air or carb cleaner are vital.

Step 1: Clean and Check the Carburetor Sections.

WARNING: Carburetor solvent is a strong poison and should be kept in a well-sealed container and off your skin. Breathing it, I believe, is just as harmful as touching it. Wear rubber gloves (thick ones) when handling the parts in contact with the solvent. Find a metal pot big enough to fit the carb midsection and throttle body. You don't need to put the top section in this bath of death.

Before immersing the parts use regular solvent or gasoline to clean off the heavy grime on the exterior of the parts. Also use a knife and emery cloth to smooth the mating surfaces of the three sections as well as the secondary vacuum actuator and its contact on the midsection. Do not scratch these surfaces; only make them free of gaskets and clean.

The top section can be cleaned with regular solvent but not immersed. Spray the section off with carb solvent, but don't get any in the vacuum break, choke or other electrical parts. Wipe the top section clean with a rag.

Lay your ruler across the top of the midsection to check it for warpage. There should be no gap between the ruler and the carb body if the surfaces are clean. The same applies to the bottom of the choke chamber and midsection. The steel throttle body is unlikely to warp, although the aluminum alloy midsection and top section may.

Look into the float bowl. The surface of the bowl should look like the rest of the carburetor. With age, the inside surfaces may begin to flake off or oxidize. In extreme cases the carburetor must be replaced. There should also be no sign of cracking anywhere throughout the carburetor. This is most likely around the screw, jet, and plug holes. Ask a professional for advice if in doubt. The float bowl edge should also be flat.

The power valve plunger in the top section should press in and spring back smoothly. Light penetrating oil can be used to free a sticking plunger.

The throttle shaft(s) should have very little up and down play in them. The **primary** side is most likely to wear, but extreme wear is not common on these carbs. You can have these rebushed by a carburetor specialist. Ask foreign car garages for someone's name.

When ready, immerse the sections into the cleaner so that they're covered completely. Let them soak for no more than 15 minutes. Put on your gloves and remove the sections then rinse them off with a spray of clean water. Clean the jets and plugs with spray cleaner and if possible blow each one out with compressed air. **Do not mix up the jets.** Head for the nearest air compressor or use spray cleaner to blow out all the holes.

Step 2: Blow/Spray out the Passages.

(This is a crucial part.) Start with the throttle body. The wet sections should be dried well by compressed air or carb cleaner and evaporation. The idea is to blow through all of the passages in the carburetor, even the screw holes. Do not miss **any**, and make sure there is no lingering water or solvent anywhere in or on the sections. The middle part with all of the passages is the hardest so take your time.

NOTE: Water settles at the bottom of air compressor tanks. If there is a fine mist coming from the nozzle, find another source of air. Hold the jets tight and blow them out just as carefully. When all is dry and clean the carburetor can be reassembled.

Step 3: Buy Parts for Carburetor Rebuild.

I prefer the more expensive factory rebuild carb kits from Datsun/Nissan because of their quality and the replacement parts included. You'll have to go to the dealer anyway to get the base insulator gasket(s) and maybe a float. Non-factory kits usually include two gaskets, one for each side of the insulator, but you have to scrape off the old gaskets **thoroughly**. This is as important as is the correct replacement of the gaskets—use sealer only on the insulator side of the gaskets—not on the carb or manifold sides. I always buy a new insulator and highly recommend such because the gaskets come already on it. This insulator and gaskets as well as the operation of the carburetor are crucial for your engine to run right. This is why I buy factory kits.

On L-20B engines there's a thin gasket under the heat shield. Ask your parts person for this one too.

I also replace the float during a rebuild. This is because the float gets heavy from the accumulation of additives in the fuel. You can weigh it with a gram scale to be exact, but believe me, most older floats are heavy. If you can spare a few extra bucks, buy a new one. Otherwise, use the old float unless it's leaking or blistered.

There are less expensive after-market carb kits available that will work. Whatever you do, make sure the gaskets are identical and that you replace all torn or damaged seals and gaskets.

•**DCR and DPF (ECC) People:** You may have a special heated insulator that fits under the carb. It has wires connected to it and a lattice in the primary hole. You would have seen it stuck to the manifold, or it's still stuck to the carb base. On all other engines covered in this book, I strongly urge that the carb base insulator be replaced. On your engine, however, it's a matter of price. A new heated insulator costs more than $60. Your options are to use the old one as long as its gaskets aren't damaged. If they are damaged, you can scrape off the old gaskets and put on new ones from a non-factory carb kit (if the kit comes with base gaskets that match yours). Or you could make gaskets from gasket material, but you had better be precise when cutting the holes and sides. Another option is to take your old insulator to the Datsun/Nissan dealer and match it with a non-heated type. The purpose of the heater is to improve drivability when the engine's cold. If you leave the wires disconnected, tape over the connector end.

PROCEDURE 14: ASSEMBLE (REBUILD) THE CARBURETOR

Condition: You are here to adjust the accelerator pump lever (Step 23). You have a rebuildable carburetor that is disassembled (Proc. 12) and ready to reassemble. You have read Proc. 13 on preparing for rebuilding. The gasket surfaces should be perfectly smooth.

Tools and Materials: The list you made during disassembly, assorted screwdrivers (including a straight-tipped offset screwdriver and the power valve one you may have made in Proc. 12), the basic tool kit, an aerosol can of carb cleaner, a plate or similar container (clean), an old tooth brush, penetrating oil, pipe cleaners. **DAF (pre-1974 People):** Piece of 3/32 x 1½2in bronze or stainless steel brazing/welding rod.

Remarks: Don't rush through this procedure. Follow your disassembly list, and read the instructions carefully. Try not to babysit or be disturbed while doing this. It's a job that takes concentration.

Fire Danger! Don't smoke or use open flames around fuel and solvent!

Step 1: Ready the Components.

The chief rule for this procedure is "Keep the surroundings clean." If the smallest piece of dirt becomes lodged in a passage or jet, your work could be for naught. Work slowly, not skipping steps, following the disassembly list closely.

Lay down some open sheets of newspaper or butcher paper. Keep the carb sections, new parts, and parts boxes separate. Do not blow through jets or bleeds with your breath. Purists say breath moisture can condense in the wrong places. Instead, use carb cleaner to blow through the holes. Never use wire or sharp objects to ream out or unplug carburetor parts (unless pipe cleaners are specified).

Open the new package and carefully tip its contents into a clean, empty container. Handle the new gaskets without ripping them.

Step 2: Assemble Throttle Body and Midsection of Carburetor.

Lay the midsection top side down on a clean surface with the **rear** linkage facing you. (**DFP People:** Support your section on blocks.) The primary or smaller throat will be on your left.

Lay the throttle section nearby. NOTE: The gasket surfaces, top and bottom, must be absolutely clean. Find the gasket that fits the bottom of the midsection. Lay the gasket squarely on the midsection. It should match the holes and edges of the section exactly. Your kit may include more than one of each gasket to cover a few designs. It is very important that the holes in the carburetor aren't covered by the gasket. **Early People** have a thin gasket, while **Later People** have a thicker sandwich gasket.

The linkage side of the throttle section is where all the hardware is. Hold it so it faces you, and rotate the linkage so the **secondary** (bigger) plate is flat, closing the throat. Do the same with the **primary**. Move any rod(s) that are connected to the throttle section out of the way, and lower the throttle section straight down on top of the midsection, lining the edges up. Find the four screws you boxed and labeled "Throttle Section." Lay the screws out and look at each one. If you have a power valve, one or more of the screws will have a hole through it. Brush clean the screws with solvent and dry. Run a pipe cleaner through the holed screw(s) to clean it out. Line up the screw holes in the throttle section with the corresponding holes in the midsection. Put a touch of penetrating oil on the threads of each screw.

Insert the hollow screw(s) first. It goes in the hole on the float bowl side (the one opposite the linkage). If you have a second hollow screw, put it in the hole that's on your right as you face the linkage. Install the remaining screws.

•**DCR and DFP People:** The longest screw goes in the left hole as you face the linkage. Once they are all started, tighten the screws evenly until snug.

•**DAF and DCH People:** Do not tighten fully yet. Turn the carburetor up right, facing the **right** or primary throttle side. On the lower edge of the midsection, find the hole for the fourth screw and thread it into the base. There may be an angled bracket in the bag. This bracket fits under this screw with the hole toward the linkage side. Tighten the screw until it begins to feel tight. Turn the carb upside down. Tighten the three bottom screws as much as possible. Use your offset driver to snug the screws gently without stripping the midsection. These fellows tend to come loose. Check and recheck. Turn the carb over and tighten the fourth screw on the number two side.

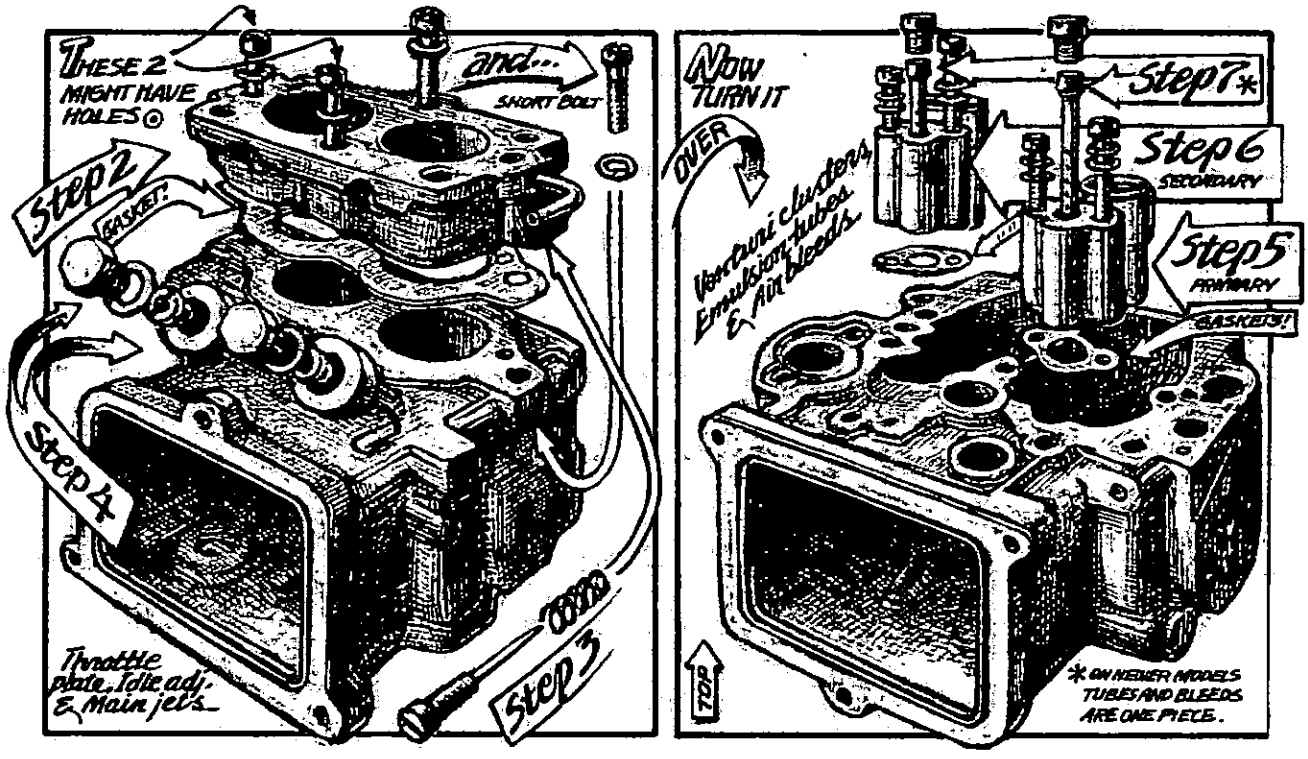
•**DCR and DFP People:** Tighten the screws as much as possible. Use your offset screwdriver to snug them but not enough to strip the midsection.

Step 3: Install the Idle Mixture Screw.

Find this in the "Primary" box. It is pointed on one end with a slotted head and a spring on the other. (DCR and DFP screws have a metal and rubber washer too.) If you purchased a factory kit, it may include a new screw and spring. Compare the new one with the old; they should match. If you use the old screw, it shouldn't be grooved or bent. Brush the old screw and spring until clean then wipe dry. Slip the spring over the screw.

•**DCR and DFP People:** Put on the metal washer, then the rubber one over the screw's end.

•**Everyone:** Thread the mixture screw into the hole in the left side of the throttle section. Carefully turn in the screw until it stops; then turn it counterclockwise (back out).



•**DAF and DCH:** 2½ full turns.
•**DCR and DPF:** 1 full turn.

Step 4: Install the Main Jet(s) and Plugs.

•**DAF, DCH, and DCR People:** Turn the carburetor upside down so you're facing the **front**, float bowl side. Those two eyes (holes) on the base of the midsection are where the main jets live.

•**DFP People:** Turn the carburetor upright so the **front** float bowl side faces you. The holes inside the bowl are where the jets fit.

•**Everyone:** If you have a factory kit, new main jets may be included. Look at your disassembly list to find "Secondary Main Jet." Find the jet in the "Secondary" box that matches the number on your list. The number should be between 150 and 170.

When sure that you have the correct jet, compare it to the new jet (if there is one). They should match. If your old one is a lower number and looks the same, use it. If yours is identical but a higher number, using the lower (leaner) jet may cause you running problems unless you live at a high altitude. Make a note if you replace the jet with another. If the jets don't look alike, use the one from the kit. If the jets are the same use the new one.

If you are using the old jet, blow it with the carb cleaner. Don't poke the jet with wire.

Make sure you know which is the **secondary** main jet hole; it's the larger of the two bores. Look at the bottom of the throttle section to determine the match of the throttle bore and jet position. Drop the secondary main jet into the hole, threaded end down, slotted end facing you. Pick a screwdriver with a tip that's skinny enough to fit in the hole in the carburetor and wide enough to fit securely in the slot in the jet. Gently push the jet into place and turn the screwdriver slightly counterclockwise and then clockwise until you feel the threads start. You do not want to start the jet in crooked. When you're sure it's right, continue turning until the jet begins to tighten. If the screwdriver tip is well fitted in the slot, turn the jet just enough to **tweek** it tight. **DANGER:** Don't twist so much that the steel tip strips the sides of the slot. Look at the jet to see that the slot isn't damaged and there aren't any pieces of brass lying around. If so, get 'em out.

Find the 12mm plug and maybe the washer in the "Secondary" box. Separate the copper washer and the plug and find a similar washer among the new parts. No washer on the old plug? Look for one that fits in the new stuff. Clean the plug. Fit the washer, then install and tighten the plug until it's snug with a 12mm box-end wrench.

Look in the "Primary" box and reread this step, starting with the second paragraph, all the while remembering that you are dealing with the **primary** main jet. When both main jets and plugs are installed, go on to Step 5. If you had a bow-shaped retainer covering your plugs, reinstall it now with the center bend toward the carburetor.

Step 5: Install the Primary Venturi Cluster.

This step applies only to DCH People with **removable venturis.** DAF (solex style) People with the brass discharge tube in the center, go on to Step 7.

Turn the carburetor so the **right** side faces you. The throat closest to you is the **primary**. The primary venturi is installed much like the secondary. They are different in shape only. Reread Step 5 for instructions, thinking **primary** instead of **secondary**. Look in **primary** box and go to work installing the **primary** venturi.

Step 6: Install the Secondary Venturi Cluster.

If you are DAF or a DCH Person with removable venturis, this step applies to you. If you removed a venturi, it'll be in the "Secondary" parts box. There should also be a gasket in the bag that fits under an end of the venturi. If your venturis are non-removable (DCH, DCR, and DFP carbs) they will still be in the carburetor. Non-Removable Venturi People go on to Step 7.

Pick up the venturi and scrub it clean. Dry it well and spray carb cleaner through it, especially the center hole in the base. In the new gaskets, find one that exactly matches the old gasket. There will be at least two similarly shaped. The correct one matches the shape of the venturi base, i.e., the end with three holes in it. **Old Style People:** You have a venturi with two bases. If this is you, find another round washerlike gasket to fit under the smaller base.

•**All Secondary Venturi People:** Place the carburetor upright with the **right** side facing you. The float bowl will be on your left. You're looking at the **secondary** half of the carb. Look into the front of the **secondary** throat and find the cutout where the base of the venturi sits. Remove the two screws that are waiting there. **Old Style People:** On the opposite side there's another cut out and maybe another screw (if there was one in the first place). Remove this screw.

•**Everyone:** Examine the surface where the venturi sits. Clean it competely free of the old gasket. Position the new gasket so it fits exactly.

•**Old Style Secondary People:** Place the new round washer gasket on the opposite side, making sure it's the same thickness as the bigger opposite gasket. If not, find the correct one in the new parts.

•**Everyone:** Look at the venturi. Determine which side is up and which is down. The top of the venturi is the round smooth part and a bit larger than the bottom.

Lower the venturi into the secondary throat. Squirt the screw threads with a little penetrating oil. Start the two screws, washers in place, into their respective holes on either side of the base until finger tight. If you feel resistance, remove the screw and find out why. Don't force carb parts. If there's a third screw, start it into place. Wiggle the cluster to make sure it's well seated, then little by little tighten each screw evenly onto the venturi. Tweek the screws tight but not too tight. Feel the washer flatten then stop.

Step 7: Install the Emulsion Tube and Main Air Bleed.

Look into the **secondary** box. Using your list, find the **emulsion tube** which is the long brass tube with tiny holes in it and the **main air bleed.** On non-removable types the tube and main jet are one piece; on removable venturi types the tube and main jet are two pieces. Scrub this (these) parts spanking clean and spray it (them) out with carb cleaner. No wires please.

Position the carburetor so you're looking at the **front** (float bowl). Focus on the secondary venturi on your right.

•**Non-Removable Venturi People:** The emulsion tube and jet fit into the threaded hole set in the cutout on the float bowl end of the venturi piece. Install and thread it in finger-tight.

•**Removable Venturi People:** The emulsion tube fits between the two venturi mount screws. Push the tube

into the hole. It should fall into place easily. Once there thread in the main air bleed above the emulsion tube finger-tight.

•**Everyone:** Recheck your numbers to assure you have the correct main air bleed. Now for a lecture. Because there are oh! so many air bleeds and jets to come, you must be aware of the danger you face in brutalizing these precious pieces with a simple screwdriver tip. The tip is harder than brass. You must use a well-fitting screwdriver. I add only that when you fully tighten a fitting into the carburetor alloy, it often makes a tweek sound and feels that if you went any further you would damage the brass. Tighten the main air bleed with this in mind and relax.

•**All Non-Solex Style People (DCH, DCR and DFP):** The **primary** emulsion tube and main air bleed are installed exactly like the secondary. Open the **primary** box and draw out the emulsion tube and main air bleed following the numbers on your list. Read through the first part of this step and you've got it.

•**Solex Style Primary Circuit DAF and Early DCH People:** You old odd balls come last. Your **primary** throat is round with the brass discharge tube in the center. Look in the **primary** box and on your list to find the primary main air bleed. It has a slotted top numbered something like 240 and a tube with holes in it. Clean it with the toothbrush, and carb cleaner. The bleed threads into the top of the discharge piece in the center of the throat. Tighten it with a screwdriver, taking care not to overtighten and cause the discharge piece to turn. If this happens tap lightly on the top to make sure the discharge isn't loose. Try wiggling it with your fingers.

Step 8: Replace the Primary Slow Air Bleed.

Again refer to your disassembly list. Look under the **primary** column for the *Slow Air Bleed*. On many later DCH and all DCR, and DFP carburetors the slow air bleed fits into the top section (you made a note to this effect). On DAF and early DCH carbs the bleed fits in the midsection.

•**Everyone:** You listed the bleed by name and number. Find it in the "Primary" box and clean it with a spray of carb cleaner. Position the carburetor so the **right (primary)** side faces you.

•**DAF and Early DCH People:** Look at the top of the midsection closest to you between the edge and primary throat. The small threaded hole closest to the throat is where this slow air bleed fits. Find a screwdriver that fits the bleed and start it into its hole. Continue turning it until tight (not too much, remember). The air bleed will remain slightly above the top of the carburetor.

•**Late DCH, and All DCR and DFP People:** Your primary air bleed fits in the top section next to the **primary** throat (choke flap side). It's the only threaded hole. Insert the bleed and tighten until snug.

Step 9: Install Primary Slow Air Jet and Plug.

Look on your **primary** list to find the number for the slow jet and dig it out of the "Primary" box. Clean the jet and spray out its holes. All the holes must be clean. DAF models have a one-piece plug and jet. Newer DCH, DCR, and DFP models use a two-piece setup. If this is you, find the plug. Don't confuse it with a larger plug that won't fit into the hole anyway. On the late DCH and all DCR and DFP carbs there is also a stubby spring, which you noted on the parts list.

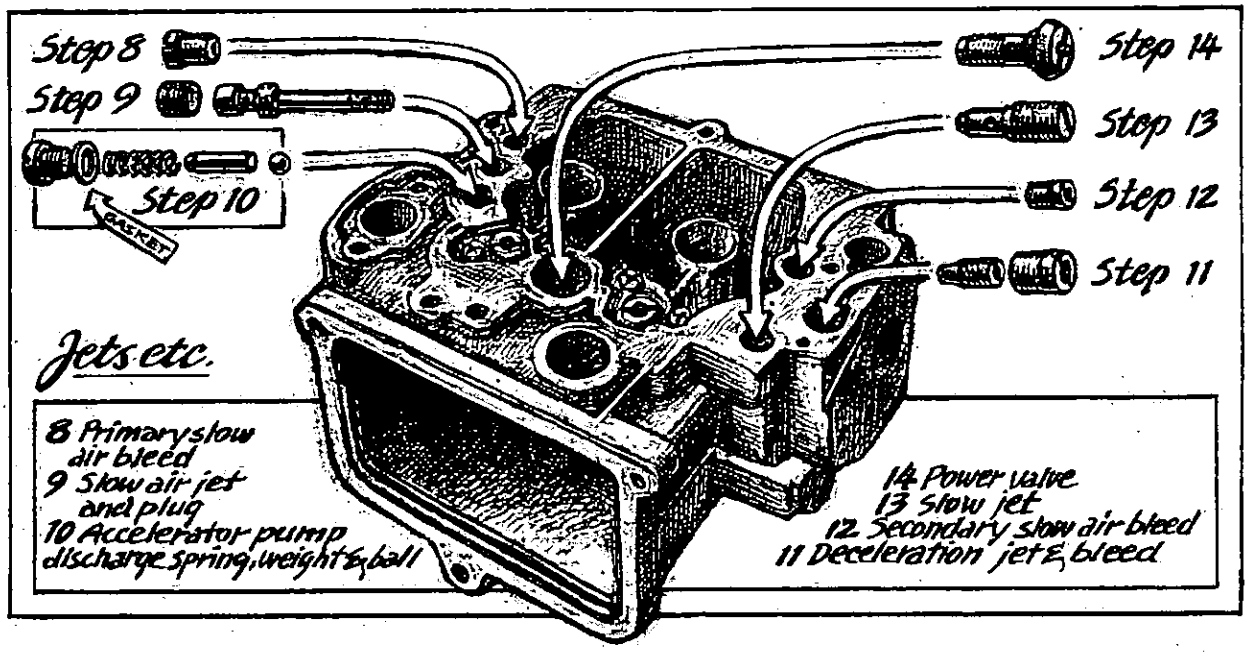
If you're in the one-piece category, the plug/jet combo has two sets of threads on it. Two-piece people have to use a skinny screwdriver that will fit the hole, once the jet submerges.

The primary slow jet fits into the hole next to its air bleed (if yours is in the midsection), or the vacant hole above the accelerator pump well and its discharge plug hole. The slow jet will only fit in one hole. Fit the jet and screw it in by hand.

•**Two-Piece People:** Pick out and use a screwdriver that won't damage the upper threads of the hole! Very important. When the jet feels tighter, give it a little more of a turn until set.

•**One-Piece People:** When the upper threaded section of the jet starts into the carburetor, go easy. The piece will begin to tighten and then stop. The top of the plug should remain slightly above the top of the carburetor. Go to the next step.

•**Two-Piece People:** If you had the stubby spring, make sure that there are no cat hairs on it and drop it into the hole atop the jet. No spring? Okay. Pick up the plug and start it into the hole. Tighten it with a proper screwdriver until tight. Good work.



Step 10: Install Accelerator Pump Discharge Ball, Spring, Weight, and Plug or Discharge Tube.

•**DAF and Early DCH People:** Your accelerator pump parts are in the "Primary" box. If you are truly of this group, you'll find a discharge nozzle. Your **primary** throat is of the Solex style. Pick out the nozzle, a matching 10mm bolt, two copper or aluminum washers, a spring, and a chrome ball.

If this isn't you, go to the next section.

•**Solex Style People:** If your discharge has been modified, there may be a small piece of brass or stainless steel rod. Gather these parts and clean them with carb cleaner. Don't bend or forget to blow out the nozzle. Look in the new parts for a new chrome ball. If there is none, use the old one. Locate the discharge hole in the carb top. It's between the **primary** throat and the **front** edge.

Wipe the ball clean and drop it into the hole. Pick up the little spring and drop it into the hole on top of the ball. Make sure it's the spring you removed. Now, if yours is modified and has the piece of rod that acts as a weight, read on patiently. To modify the discharge, get a piece of 3/32in brass or stainless steel rod. Cut it exactly 1½2in and file off rough edges. Wipe the rod clean and drop it into the center of the spring on top of the ball.

Pick up the discharge tube, place the washer with the larger hole into the cut out around the hole. Put the other washer on the 10mm bolt, then put the bolt through the top of the discharge nozzle. Aim the nozzle into the **primary** throat and fit the discharge piece over the hole. Screw in the bolt until it stops. If it stops before contacting the discharge piece, your weight is too long.

Position the nozzle midway between the center of the throat and the inside wall of the throat. Use a pair of needlenosed pliers to hold the discharge body gently while you tighten the bolt. The nozzle tip must be in the correct position and the whole piece secure.

•**DCH, DCR, and DPF People:** Look in the "Primary" box to find a chrome ball, a cylindrical brass weight, a small spring (some earlier models had no spring), a brass plug with a tit on the bottom of it, and a flat washer. Remove these parts. In the new parts container, look for a similar ball and washer. If you're lucky, there may also be a new spring. Find the discharge hole; it's the vacant threaded one between the **primary** throat and accelerator pump well. Wipe the ball clean and drop it in the hole. Now put the spring, if there is one, over the weight and drop them (big end of weight first, tit up) into the hole. Pick up the plug, clean it then put the washer on it. Thread in the plug then tighten until secure with a screwdriver.

Step 11: Install the Deceleration Jet Air Bleed or Coasting Jet.

•**DAF and DCH People Only:** This step applies only to DAF and DCH carburetors with a deceleration

device. You listed the decel jet under the "Secondary" column. If it was two pieces, you listed a "decel jet" and "bleed." If you had no such device (early DAF, DCR, and DFP people), you made a note of it on your list, so go on to the next step.

Look into the "Secondary" box and find the jet (and bleed). Turn the carburetor so the **left** side faces you and the **front** (float bowl) is on your left. On the top corner closest to you find a threaded hole. Match the number(s) on your list with the part(s) in the "Secondary" box, and pick it (them) out. Spray out the jet (and bleed) and drop the jet into the hole then tighten it until snug.

•**Two-Piece People:** You'll have to use a screwdriver thin enough to fit into the hole and not damage its threads. When the jet's tight, screw in the bleed until snug. Voila!

Step 12: Install Secondary Slow Air Bleed.

Look on your list for the number of the **secondary** slow air bleed. This piece might be the same number as the **secondary** slow jet, but the air bleed is smaller. On Many DCR and DFP carbs the bleed is really a plug and not numbered. Find the bleed and spray it out with carb cleaner. Find the hole closest to the **secondary** throat almost in line with the decel jet (if one was installed). Start the bleed into its hole and snug it tight with a screwdriver.

Step 13: Install the Secondary Slow Jet.

On early models this jet is one piece. Later DCH, DCR, and DFP carbs use a separate jet and plug. Most of these have a stubby spring between the jet and the plug. On your list you described the pieces: Slow Jet Plug—no number, Slow Jet (one piece), Slow Jet, etc. Find these pieces in the "Secondary" box, and spray them out with carb cleaner. Find the vacant hole in the top of the midsection in front of the air bleed you just installed.

•**One-Piece People:** Install and tighten the jet until snug. Go on to the next step.

•**Two-Piece (Plug and Jet) People:** Drop the jet into the hole and turn it down with a screwdriver. Do not damage the threaded sides of the hole. Like the **primary** jet, this one must be turned in fully.

If you have the stubby spring, drop it into the hole atop the jet. Now for the plug. You're getting good at this!

Step 14: Install the Power Valve.

If you're an early DAF person, you don't have a power valve, but check anyway. Look under the **primary** column on your list for "No power valve." Everyone else, you have a power valve. Look on the "Primary" list for power valve. Match the number with the piece in the "Primary" box. Now look in the new parts container to see if the nice people gave you a new power valve. If so, compare your old numbers with those on the new valve. They should match. A higher numbered valve may have been installed to cure a hesitation problem. The old valve is still probably good if its plunger springs up when depressed, then released. I like to replace the power valve regardless. Factory kits usually come with new ones.

The valve goes inside of the float bowl, so turn the carb so the bowl faces you. Find the hole in the bottom of the float bowl. The inside of this hole is threaded. Look in the **primary** box for a brass washer that fits the valve. Look for a similar washer in the new parts. The fit has to be right. If you have no washer, make the valve very tight. Install the valve either through the float bowl or down through the hole. Spray out the valve especially the little holes in it.

Slip it (and washer) over the hole and thread it into place with your fingers. When its down, grab the special screwdriver you made in Proc. 12 (13). From the top carefully fit the driver over the plunger and into the slot. Tighten the valve until secure **without damaging the slot.** This is important. Look through the float bowl to see that the valve is tight against the washer or base. Blow out any brass chips you may have made tightening the valve. It must be tight, but not destroyed.

Step 15: Align the Top Section to Midsection Gasket.

Look in your new parts for a top section to midsection gasket, the biggest one. If there's more than one gasket included, you'll have to match the correct one. Turn the carburetor so that the float bowl faces you. Compare

the old gasket with the new one and the holes and shapes in the midsection. It's crucial that this gasket's the correct one. Look closely. All the plugs, bleeds, and jets in the midsection should be left uncovered with the gasket in place. If you have a few gaskets to choose from, try them all until you find the perfect fit. Plus all the screw holes in the gasket have to match the holes in the carburetor. Do not use gasket sealer on this gasket. Set the gasket aside.

Step 16: Install Needle and Seat.

The needle and seat assembly is one piece. You stashed it in the TOP box with its screen, a washer, and the inlet pipe and parts. The carb kits always include needle and seat assemblies although the original assemblies seldom fail. A steady flow of fuel through the valve keeps the parts clean. While you're here you may as well replace it. Your old needle and seat may look slightly different than the new one. Some kits also include a new screen. If yours doesn't, separate the old screen and inspect it for damage. Handle the fine screen with care. If it's torn, consult the Datsun/Nissan dealer or make a trip to the junk yard.

Turn the carburetor so the float bowl faces you. The needle and seat assembly threads into the top of the float bowl on the **left** (your right) side. **Don't put a washer under the needle and seat**. . . no, no, no. Turn the assembly into place and tighten it with a box end wrench—15—19mm. Make sure the wrench fits well, and tighten the assembly holding the carb steady with one hand. Don't overdo it, but do get it tight.

Step 17: Prepare the Linkage and Install the Top Section, Fast Idle Rod, and Interlock Spring.

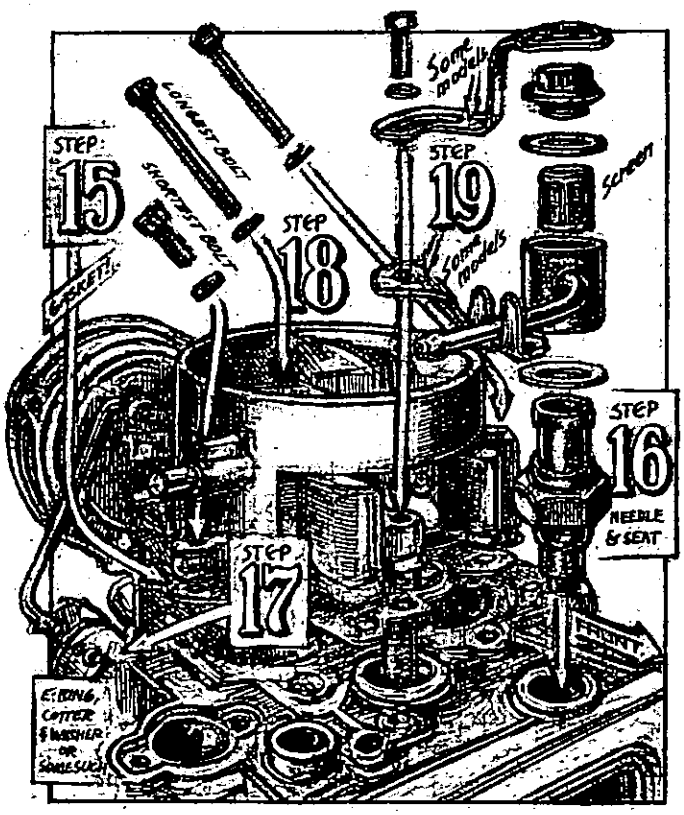
Find the top section. If you haven't already, check and clean it as described in Proc. 13.

Position the gasket on the midsection so it's lined up.

I hope you made a good drawing of your linkage because it's complicated. My description is a "thumbnail sketch" at best.

•**DAF People with Manual Choke:** Turn the carb so the **rear** (linkage side) faces you. There are one or two rods connected to the linkage and base section. Let the rod(s) lie flat on the bench. If you have one rod, look in the **rear** box for the choke link rod. Fit the rod into the lever connected to the throttle shaft with the throttle closed. The choke link is the inside most linkage piece. The rod on the outside is for the accelerator pump lever. You have to fit the keys in the rod ends through slots in the linkage as you assemble the carb. Pick up the top section and turn it so the **rear** side faces you. Both of the throttle plates must be closed.

Find the choke shaft and its linkage (lever). (People with dashpots have a bracket to work around.) On one end side of this (lever) there's a slotted hole for the fast idle rod. Without dumping the carb on the floor, swing up the fast idle rod (the one on the inside) and open the choke flap. Tip the top section sideways. Align the key in the rod and the slot in the lever. Fit the rod into the hole then slightly close the choke flap to move the lever enough to clear the bracket next to it. Tip the top section and push the rod farther into the hole past the bend. Now manipulate the top section to move the bracket under the rod. The rod has to end up between the choke lever and the bracket.



As you level out the top section, reposition the rod so the hole is between the bend and the keyed end of the rod. The top section should now fit over the midsection. If there's binding in the fast idle rod or elsewhere, the sections will not mate well. Check and align the gasket. Fit the top section, lining up the edges and the screw holes. Hold the top steady and operate the choke lever. The action should be smooth. Look in your **rear** box and find the **inner** and **outer** springs. Follow your drawing carefully and install the springs as shown. (After this you may want to enroll in the Peter Aschwanden School of Art.)

•**DAF People with Automatic Choke and All DCH, DCR, and DFP People:** Place the carburetor so you're looking at its **rear** (linkage side). Find the springs(s) in the **rear** box. The longer spring has different length ends to it; that's the one you want. Rotate the **secondary** throttle linkage fully counterclockwise and the **primary** fully clockwise. Directly above the **primary** shaft there's another smaller shaft. An "E" clip holds two or three gadgets on to this smaller shaft.

•**DCH People:** Turn these gadgets, as well as the main shaft, clockwise. Pick up the spring and hold it so the spring end's up. Point the straight, long end down, in front of the gadgets and **primary** shaft.

•**Everyone:** Turn the spring so the hook points away from the carburetor. Look on the inner front side of the **primary** throttle linkage almost next to the base section and find a lever with a small hole (and maybe a nylon bushing) in it. This lever relates the **primary** linkage to the **secondary** shaft. Slip the hook into the hole from the carb side. It should stay there once you let it go. Breath deeply. All right, exhale.

Open the primary throttle carefully so the spring doesn't come dislodged. Move the fast idle cam (the outermost or plastic gadget on the shaft directly above the **primary** throttle shaft) counterclockwise; then return the throttle shaft clockwise to the closed position so the fast idle screw prevents the cam from springing back. Notice that the lever (gadget) behind the fast idle cam has a hole in it. A light spring keeps this related to the cam.

•**DCR and DFP People:** Replace your fuel shutoff solenoid. It's hanging from the top section connector by a red wire. Go to Step 30 then return here.

•**Everyone:** Pick up the top section. Find the choke rod in front of the choke housing. Let the rod hang down. (DCR People with a second rod see below).

•**DCH People:** If you replaced the washer(s) and cotter pin on the end of the choke rod, remove all but one of the washers. If there is only one washer, remove it.

•**DCR and DFP People:** You don't have washers.

•**DCR People with Second Rod (choke solenoid):** You have to swing the bottom half of the rod (its arm) up under the choke housing while you lower the top section down onto the midsection. As you do this, connect the choke rod. But wait—read on.

•**Everyone:** Take a trial run lowering the top section onto the mid section. The power valve piston has to fit into its hole between and in front of the throats. As you do this watch the choke rod as it heads for the lever (hole) behind the fast idle cam. (**DCR People:** Remember your choke solenoid arm.) When you think you can do it smoothly install the top section to the midsection gasket so it fits exactly over every hole and edge. This is crucial!

•**DFP People:** You have to run the fuel enrichment solenoid wire through the top section where the boot is. A third hand might help in this matter.

•**Everyone:** Gently lower the top section over the gasket watching that the power valve piston goes into its well and the choke rod ends up fitted into the hole in the lever. (**DCR People:** Let the choke solenoid arm drop next to the plastic cam.) Once the choke rod's in place—**DCH People**: Fit the washer and then the cotter pin onto the end of the rod; **DCR and DFP People:** Snap the "E" clip over the inside of the rod end behind the lever.

•**Everyone:** In order for the chamber to lie flat, it has to fit straight down over the various parts of the midsection. Do not force anything. The top will fit perfectly when everything's aligned. Use the outer bolt holes as guides.

Look into the float bowl at the power piston, which should be squarely on top of the valve. Lift and reposition, if crooked.

Operate the choke flap with the tab in the choke thermostat housing or the flap itself. If stuck, examine the linkage for binding or sticking. Release the **primary** throttle turning the fast idle cam clockwise. The throttle should move freely and the stop should close against one of the steps of the cam.

•**DCR People with Choke Solenoid Rod:** Find a little lever on the outside (closest to you) of the plastic cam. The solenoid arm fits over the little shaft on that lever. The lever should be to the left of the main shafts. Fit the arm and its "E" clip.

Step 18: Install the Top Section (choke chamber) Screws.

Look in the TOP parts box to find the four (or five) screws labeled with masking tape. DAF and DCH carbs have four screws. DCR and DFP carbs have five. Turn the carb so the **front** (float bowl side) faces you.

Find the #2 screw, unlabel and clean its threads. Lube them lightly with penetrating oil. This screw fits in the hole on the **right** (your left) side of the throat (over there on the ledge). It should have a lockwasher on it. Do not fully tighten it, just until it touches bottom.

Find the longest (#3) screw and washer. Clean and lube it. This one goes between the primary and secondary throats on the **rear** (opposite the float bowl side). Install the screw just until it touches.

The #4 screw goes on the **left** (your right) side about in the center line of the carburetor next to the outside of the throat. Clean and lube it first. (This one may have a plastic coated clasp along with it.)

The #1 screw fits on the **front** right above the float bowl. Leave this screw out for the moment. Put it back in the box for safekeeping.

•**DCR and DFP People:** You have a fifth screw (#5) that fits on the **left** (your right) front corner of the carb. Clean, lube, and install it loosely.

Step 19: Install the Fuel Inlet Parts.

These are stashed in the TOP box. They are the inlet pipe, a 12mm headed (special) bolt, its wide flat washer, and maybe a Z-shaped slotted retainer. On most DCH carbs there's a forked L-shaped guide piece as well. Look in your new parts box for two washers and compare them to the old ones in the TOP box. If you have a choice, use the metal washers. Some washers are fiber; I prefer the metal ones. The washers have different inner diameters (ID). The larger ID washer fits over the needle and seat. Now pick up the screen and slip it over on top of the washer. Set the other smaller washer aside with the cap screw.

Look down into the needle and seat assembly from above. Is it clean in there? Good. Pick up the inlet assembly.

•**DAF (early style):** You're very old. I treat you with casual respect. If this is you, your inlet has two pipes on it, an inlet and a return. Hold the tubes pointing down with the round inlet to your left. Notice if there's a bracket attached to the inlet. If so, remove the top section screw on the **left** (your right) side. Fit the round part of the inlet down over the top of the needle and seat while lining up the bracket. Slip the screw into the bracket and carburetor until it touches (not tight). Go on to Step 20.

•**Late (1975 on) DCH People:** You should have a forked inlet pipe guide. Hold the guide with the fork upward and to the left. The curved flat end goes against the carburetor body. Slip the guide into place, lining up the guide hole with the screw hole. If the guide is attached to the pipe, slip it into place at the same time as you install the inlet pipe.

•**All DCH People:** Pick up the inlet piece and notice that the round ends (top and bottom) have different diameters. Look closely. The larger diameter goes over the needle and seat. (On carbs with a forked guide, the pipe fits in between the tabs on the guide.) The top of the inlet should fit perfectly over the needle assembly and the screen.

•**DCR and DFP People:** Your pipe mounts so the tab under the round part fits down into the carb and the pipe hangs over on the **left** (your right) side of the float bowl.

•**Everyone:** Find the 12mm special bolt and washer you set aside. The washer must fit under the screw perfectly inside and out. Turn the bolt and washer into the needle and seat assembly, securing the inlet. Stop when the bolt touches. Pick up a 12mm open-end and fit it over the bolt. Hold the inlet pipe from turning and tighten the bolt clockwise. The hole in the guide or bracket must not shift. Tighten the bolt until you feel it "sink" in and stop. Do not overtighten.

Find the L-shaped (slotted) locking retainer. Most of you have it. On one end there's a starred cutout that fits over the 12mm bolt. The other end fits into place to be fastened by the #1 top section screw. If you don't have

a retainer, go to the next step after starting the #1 screw.

Fit the retainer over the bolt's head. There are a few ways it'll fit, but the end, which lines up to the screw hole, is what counts. Later styles are slotted.

Put the #1 screw into the front hole. It should have a flat lockwasher on it. Take a break and read. This screw is a devil in disguise. Too often it comes loose causing everything underneath it to let go—chaos. The threads strip inside the carb. Oh! So this is what you do. Try installing and tightening the screw. Make sure the retainer guide, etc., etc., is flat against the carb body. If it feels okay, then leave it alone, but do not tighten it fully yet. If it feels as though it won't tighten, you need to get one or two 5 x 0.75mm screws. Some hardware stores carry them. Also get an assortment of well-fitting flat washers to use as shims. Take your old screw to the parts store to match it with a new one. In some factory carb kits, a fine-threaded metric screw is included to retap and renew the damaged threads; it seldom helps. If you can't get the #1 screw to work, it may need professional attention. When tightening the #1 screw, make sure it doesn't bottom out before contacting the retainer, guide, or carb body. Do not fully tighten yet.

Step 20: Tighten the Top Section to Midsection Screws.

Check that all four (or five) screws are in place. There's more on these screws in Proc. 2 (3 and 4). Start with the #3 **rear** screw; tighten each screw a little at a time gradually drawing the two sections together. Work your way clockwise around the four (or five) screws until all are snug. Remember, that #1 is the stripper, so tread lightly.

NOTE: These screws tend to vibrate out causing the top section to work loose, so from now on keep an eye on them.

•**DFR People:** You have that enrichment solenoid wire still on the loose. Its metal end fits into the blank hole in the plastic connector. Snap it in now. Bend the tabs to hold it in the connector.

Step 21: Fit Interlock (throttle return) Spring.

•**DCH, DCR, DFP and DAF (with automatic choke) People:** You installed the bottom end of this spring earlier. Face the **rear** (linkage side) of the carburetor. Find the interlock spring, hooked to the lever; it's way in there between the throttle shafts. If the bottom of the spring is still in place, turn the carb so you face the **left** (your right) side and grab the upper end of the spring. Stretch it up enough to slip the hook into the hole in the angled bracket to the inside of the choke mount.

•**DAF People with Manual Choke (early DAF auto chokes may be similar):** Install the inner and outer return springs. You installed them according to your diagram. Hold the carburetor down and stretch it holding the upper end with a pair of needlenosed pliers. Slip the end into the inside hole in the angled bracket next to the upper choke connecting rod end.

Now connect the second, longer throttle return spring. Hold the carburetor steady and stretch the long end of the spring up under the fast idle rod and into the hole on the end of the (overhanging) bracket. Hold the carburetor up off the bench and operate the throttle. It should move smoothly.

Step 22: Install Accelerator Pump.

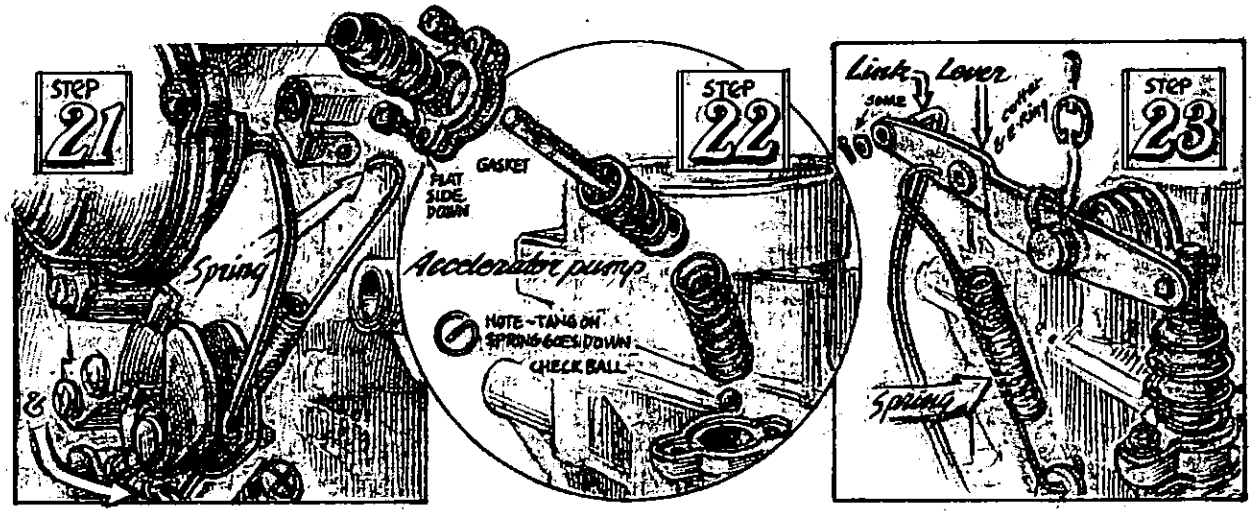
Turn the carb so you face the **left** side. Find the accelerator pump well and its screws, which are in the carburetor. Remove these and set them safely aside. Find the accelerator pump parts in the "Primary" box. Account for a little chrome ball, a big spring, a plunger, gasket (DAF and DCH carbs only), a steel plate and an accordion type dust boot.

•**DAF and DCH People:** Hold the plunger and slide the rubber boot off the rod end, followed by the steel plate then the gasket.

•**DCR and DFP People:** Lift the plate off the plunger, then remove the dust boot.

Your new parts kit has at least a new pump (plunger) in it. Try to match the other parts too. Probably a new plunger, a spring, a gasket, and ball. Factory kits go overboard here.

Use whatever new parts you get. If there are instructions on the sheet included with the carb kit, read the fine print. If the piston (cupped) end of the plunger is leather, soak in light oil for a few minutes, then wipe it



dry before assembly. Look on the underside of it to see if it is the texture of suede or rubber.

•**DCR and DFP People:** You may have removed a tan plastic collar from the pump well. Find this sleeve in the "Primary" box and fit it into the top of the pump well. You also probably have a plastic cover sleeve over the piston end of the new plunger assembly. Remove this sleeve and set the plunger aside, somewhere very clean. Wipe off the chrome ball. Double check that the accelerator pump well is clean before dropping the ball into it. Make sure it falls all the way to the bottom.

Find the spring. On one end the wire cuts across the inner diameter. This end goes down into the well, fitting the wire (that cuts across) into the slot in the bottom of the well and over the ball.

Look into the pump well (hole). Note that the well has a different inner diameter at the top, center, and bottom. The piston end of the pump assembly has to fit down into the bottom (smallest diameter) of the well. As you install the piston, make sure it fits into the bottom section without hanging up on the shoulder and damaging the piston. Don't force it.

•**DAF and DCH People:** Pick up the new gasket, generally cork, and drop it over the plunger rod. Next, look at the plate (cover). One edge is rounded, the other sharper. Then pick out the new dust boot. One end of the boot is grooved and fits into the center of the cover from the top or rounded side. Squeeze the boot into the plate.

•**Everyone:** Slip the boot big end first over the pump rod without ripping it. There's a groove in the plunger shaft about 10mm from the top end. Fit the top of the boot into this, exposing the end of the rod.

•**DCR and DFP People:** Slip the cover plate cover the plunger. Note that on one side of the cover the edge has sharper edges. This side goes down.

•**DAF and DCH People:** Pull the gasket up against the plate. Push the plunger straight down into the well making sure the edges of the piston fit in properly. Push it down, aligning the cover and gasket (if there) to the inset in the midsection.

Everyone: Once the cover and boot are flush, install the screws evenly until tight. (If either of the screws does not thread in, you'll need a longer one, e.g., 4 x 0.75 x 10mm [or 12mm] with lockwasher.) Gently now. Push the plunger down and release it to spring up by itself. It should operate smoothly. Recheck that the dust boot is correctly installed.

Step 23: Install Accelerator Pump Lever and Springs.

In the **right** side box you should find a lever with holes in it. Depending on your carb model, there may be other parts to look for. NOTE: DCR People: You are now DCR 342 and DCR 384 or DCR (all). **Early DAF People** will find nothing more than the lever and possibly a rod. **Later DAF, DCH, DCR, and DFP People** will find a long coil spring with hooked ends. If it's not in the box, it's probably still hooked in the bracket that's attached to the side of the carb.

•**DAF and DCH People:** If your lever has more than one hole in the flat end of it, look at the sketch you

made or the holes to determine which hole the rod was attached to when you removed it.

•**Everyone:** Find the accelerator pump rod, connected to the throttle linkage. The rod's end is bent, keyed, or has a cotter pin and washers and possibly a spring with it. Remove these parts if there. Fit the top end of the rod through the (proper) hole in the lever. The shaft or rod on the other end goes toward the carburetor. Install the rod retainers. **DAF and DCH People:** A washer, spring, washer and cotter pin—all or some of these. Otherwise either a key or bends in the rod keep them together. Let the lever and rod hang.

•**DCH, DCR (all), and DFP People:** There should be a coil spring in the box that hooks on the bottom end to a bracket (nylon grommet) to the left and above the idle mixture screw. Hook one end into the bracket hole. Use the short end if one is longer. (If you have no spring, that's normal, you're an old timer.)

•**DAF, DCH, and DCR 384 People:** Look for the shaft sticking out the middle of the top section (**left** [you're facing it] side). Find a cotter pin and/or a round "E" clip fitted into it or in the box. Remove these items and set aside. Take a dab of grease and smear it round the shaft (lever pivot).

•**DCR 342 and DFP People:** You have a screw, lockwasher, a steel bushing, and flat washer to remove from the **right** box. Set these aside.

•**DCH (L-20B People):** You may have had to remove the lever to get at the rear (right) carb base nut. If so, simply slip the lever into the shaft temporarily. Put the front end into the (lower) hole of the accelerator pump plunger and stick the cotter pin through the hole in the rod for the time being. Go on to the next step.

Install the Accelerator Pump Lever: Most of you have a special spring still in the **right** (or general) parts box. Pick it up. Early DAF carbs didn't have this spring. If this is you, read on—ignoring the special spring instructions—and just install the lever.

•**DCR and DFP People:** Put the bushing over the screw, shouldered end toward the head. Smear a dab of grease around the bushing. Lay the flat washer close at hand. If you have a pivot shaft, install the washer over the shaft now.

•**Everyone:** Fit the straight end of the spring forward in between the accelerator pump and top section. Center the coiled part up and over the pivot shaft or screw hole. Pick up the lever and slip it over the pivot shaft or center it with the hole. At the same time, lift the hooked end of the spring up and onto the top of the lever. Push the lever all the way against the top section.

•**DAF, DCH, DCR 384, and DFP People:** As you do this, carefully insert the accelerator pump end of the lever through the hole in the accelerator pump plunger. Turn the plunger to align if necessary. (If you have two holes to choose from, put it in the lower one.) When the lever is on, insert the pivot bushing (DCR 384 and DFP) and "E" clip if there is one. There may be a new clip and cotter pin (if you need one) in the new parts container. Fit the "E" clip (if necessary) onto the groove in the shaft with a screwdriver. Find the cotter pin and fit it through the hole from the top; then bend up its legs.

•**DCR 342 People:** Slip the flat washer behind the lever (between it and the top section). The tab on the front side of the lever fits over the plunger top. When in place insert the pivot screw and bushing through the hole. Tighten the screw until snug.

•**Everyone:** Operate the throttle to assure it works smoothly. If you have a return spring connect it now to the hole in the lever close to the rod end. Whew!

Step 24: Install Secondary Vacuum Capsule.

NOTE: You should have tested and if necessary serviced the capsule (Proc. 15).

Turn the carburetor so you face its **rear** (linkage side). Directly above the **secondary** throttle shaft, find four vacant holes. Three of them are threaded. Find the vacuum capsule in the **rear** parts box. Also get out the three screws. If necessary, sand off the capsule's gasket surface with emery cloth. Locate the capsule's gasket in the new parts container. It has four holes in it. Also look for a new "E" clip. It's tiny. None there? Use the old one from the parts box.

Look at the **secondary** throttle shaft. See the stepped shaft sticking out at you? This is where the capsule rod has to fit. Put a dab of grease around this and relax. You're getting close.

Set the carb (linkage side up) in your lap. Match the capsule gasket with the holes in the carburetor. Keep

the gasket aligned and pick up the capsule. Lower it into place (aligned) slipping the hole in the rod over the small stepped shaft.

•**Late DCH People:** There should be a small angular bracket under the top screw. Position the bent end down toward the **primary** linkage. The flat end fits against the capsule.

•**DAF People with Dashpot:** Find the brace. Match one end up with the top capsule hole. The other brace end fits under the dashpot bracket. The screw threads into the brace through the bracket.

•**Everyone:** Install and start the screws, gradually tightening them until secure. When you're sure the capsule's flush with the gasket (carburetor) slip the little "E" clip over the groove in the end of the stepped shaft. United!

Step 25: Install Automatic Choke Thermostat.

•**Manual Choke People** and those of you who didn't remove the choke, go to Step 27.

Face **rear** side of the carburetor. The choke thermostat assembly is in the **rear** parts box. Its mounting screws and washers are threaded into the top section. They have to come out. Many earlier carbs use half-moon keepers under the screws. Other later models have a retainer ring or just plain washers under the screws. Remove these and set aside.

Pick up the black plastic or metallic thermostat, taking care not to drop or upset it (sensitive personality).

Before you go any further turn to Ch. 3, Proc. 7 and read about choke adjustment. You will need to do this soon.

Pick up the black plastic or metallic thermostat taking care not to drop or upset it. Look at the **rear** outside of the choke assembly. Find the words OPEN (lean) and CLOSE (rich) plus arrows. You may also find a little line or mark on the edge above the words. Now look at the top edge of the housing. There may be a series of marks there too.

Look inside the choke part of the top section to find the tang that operates the choke flap. Got it? Okay. Turn the primary throttle shaft counterclockwise (open) and hold it there.

Rotate the choke tang counterclockwise to **close** the choke flap. Let the throttle close too. Pick up the choke assembly again and look at its **front** (insides).

Find the bent end of the thermostat coil. When the assembly is mounted that bent part should touch the tang. Mount the assembly so the words (marks) are on top, and the bent end of the coil is on the right side of the tang. The assembly will seat tightly into the cavity in the top section.

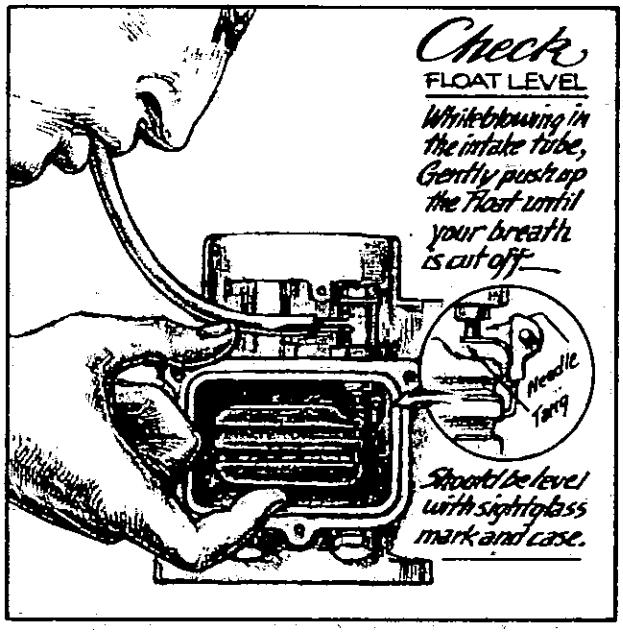
Look at the alignment marks on the outer edge of the assembly and/or top section. Turn the choke assembly clockwise. If you're sure it's flush with the carburetor, turn it counterclockwise until the marks align. Hold it there and push down on the right side of the choke flap. You should feel spring tension against the flap. It should return to the closed position by itself. If not, turn it farther counterclockwise until you feel spring tension. If nothing, make sure the coil is engaged with the tang.

If all is well, hold the thermostat where it is, marks aligned. (If the assembly's plastic with a steel ring around it, line up the holes in the ring with the holes in the choke housing.)

When you're sure the assembly is flush with the carb housing, install the three screws.

•**Metallic Body People:** Have your half-moon keepers handy. Install these with the curved side toward the body.

•**Everyone:** If you have a wireholder with one of the screws, it fits under the bottom screw, bent side out. Tighten the three fasteners evenly until the thermostat is secure. Do not overtighten. When the thermostat won't turn, they are tight:



Step 26: Install the Booster Control Deceleration (BCD) Valve or Enrichment Solenoid.

This step applies to everyone except Early DAF People. If you removed a solenoid (early) or valve (later people), there will be an exposed area with a hole in the center on the **left** side. Look in your **left** parts box for a cylindrical solenoid or horseshoe shaped device or plate. Nothing? Go on to next step.

•**Early People with Solenoid:** Face the **left** side. Account for the solenoid and its parts: a plunger, a spring, a copper washer, and a black "O" ring. Remove the three screws. Install the plunger, small end first, into the carb. Then fit the "O" ring into the cutout around the outside of the hole. Turn the solenoid open side up and install the copper washer and then the spring. Hold the solenoid sideways with the wires to your right and slip it into the hole. Align the screw holes. When the solenoid's flush install the three screws, tightening them evenly until snug.

NOTE: If you removed a horseshoe-shaped plate, scrape it clean and install it, using the new BCDD gasket.

•**Everyone:** Your BCDD may or may not have a hexagonal solenoid screwed into it.

•**DCH, DCR, and DFP People:** In the LEFT box find the BCDD. It's that horseshoe-shaped device with holes in it. If the gasket is stuck to it, remove it. Smooth the mating surface with emery cloth, working around the plunger that's in the center of the device. Do not disassemble this creature.

Unwrap the three long and skinny screws from the parts box. Find the new gasket and match it to the BCDD, aligning all the holes. Look into the hole in the carburetor to assure it's clear.

Fit and align the BCDD to the carb. Install the three screws into the three empty holes. Tighten them evenly until snug, then a bit more.

Step 27: Install Vacuum Break Hose.

Auto Choke People Only: This is an "S" shaped vacuum hose lying seductively in the **left** parts box. Face the **left** side of the carb, and look above the secondary vacuum capsule and/or BCDD valve. Here lies the choke vacuum break. You probably checked it in Proc. 16. Good. Plug one end of the hose into the pipe of the carb midsection and the other end onto the capsule. If the capsule's no good, leave this end off and plug the hose.

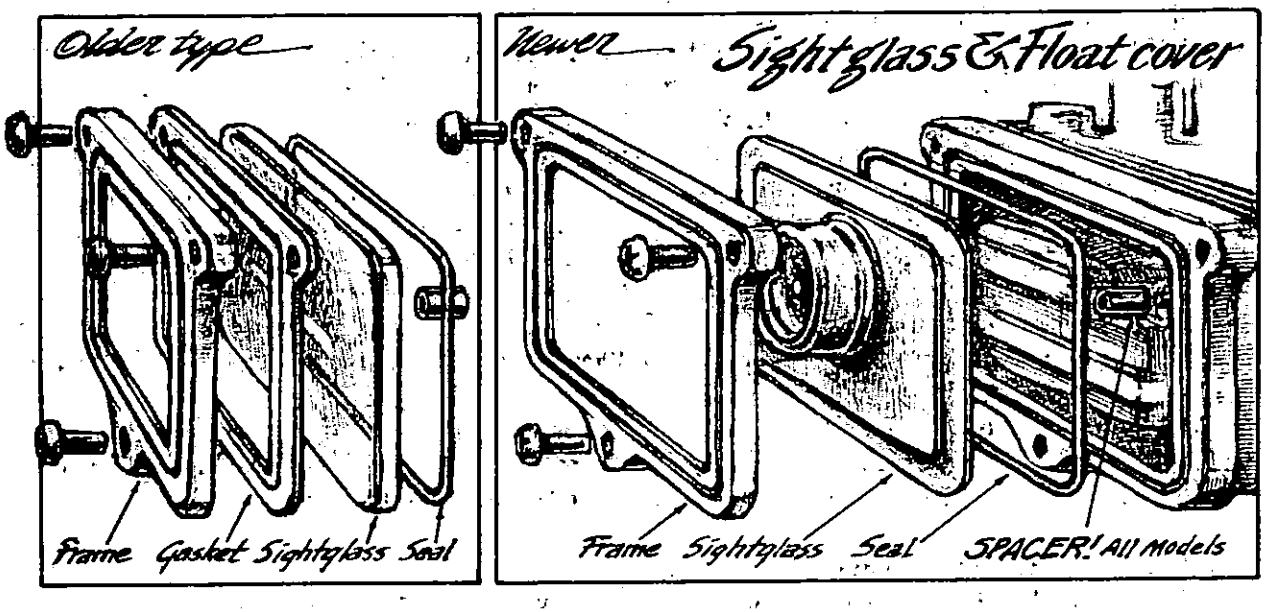
Step 28: Install and Adjust the Float (on and off the engine).

Face the float bowl and turn the carburetor upside down (if possible). Find the float in the **front** box. Also find the precious brass (cylinder) spacer packed with it. If you bought a new float unpack that too. Hold the float so its brass parts are on your left and the hinge (holes) is down.

•**To adjust the float:** The float's hinge and tabs bend easily, so be careful. There is a brass shaft mounted inside the float bowl for the float to hinge upon. Slip the float into the bowl with the rod through the hinge holes. When the choke's in all the way the lower tab will rest on the needle valve stem. If you're working with the carb on the engine, you'll have to lift up the needle valve as you install the float. Use a small screwdriver or the like.

There are many ways to adjust a float. The official way is not the way I'll tell you how to do it. My method is unorthodox but saves lots of frustration. Turn the carburetor upright and supported so it's sitting flat on the bench. Locate the fuel inlet pipe (**DAF Return People:** it's the lower pipe.)

Notice that the float is hanging. Connect a piece of 6mm (5/16in) fuel line to the inlet pipe. Blow through the hose imagining your breath to be fuel. As you do this, lift the float gradually until you can no longer blow through



the tube. This means that the needle has seated. At this moment stop lifting the float and hold it still. Pull your head back and look at the float. Do you see the two grooves in its side? The top groove should be parallel to the top (inside) of the bowl when the needle is completely seated. (**DAF People with Fuel Return:** A moment after the needle seats the return may open and your breath will pass.)

•**Everyone:** You have to repeat this check a few times to get the hang of it. To adjust the setting, remove the float and bend the tab that's touching the needle valve carefully with pliers a little at a time. Bend the tab **up** to shut off the flow **sooner** and **down** to shut it off **later.** Recheck by blowing (as above) after each adjustment. Make sure you get this adjustment right. It is crucial.

Look at the brass tab that's below the hinge. It should touch the float bowl wall before the float touches the floor. It usually isn't necessary to adjust this too. Recheck float level if you do.

Step 29: Install Float Bowl Cover.

Place the carburetor in your lap again with the float bowl facing up. Remove the three screws around the edge of the bowl (if there) and set aside. Find the metal frame piece that holds on the window. It's in the **front** parts box where you left it. Find the new black rubber gasket. Clean out the groove it fits in and fit the gasket into place. It must fit squarely into the groove. If it seems to be too large, work it all around until it fits correctly.

Now find the little brass spacer you have so wisely been protecting. Slip this onto the end of the rod on top of the float hinge. Pick up the window piece and clean the glass. **Full Glass Window People:** Notice the white line in the glass. It's etched on one side of the glass. This side goes to the **outside** and **up** when installing the plate. **Round Sight Glass People:** The bulged (convex) side of the plate goes to the **outside** and **up** when installed.

•**Everyone:** If the window's clean, and the little brass spacer's in place, fit the window into the recess around the edge of the float bowl on top of the rubber gasket. When the window's in place evenly all around, find the frame with three (four) holes in it. Look at it from the side. Is it flat or slightly warped in at the screw holes? If so, lay it on something hard and flat and gently tap on the front (flat) side until it looks level. Look in the cover or the old parts for a paper gasket that fits the cover. If you didn't remove one, OK (late DCH didn't have one). If so, find the new gasket and fit it into the frame matching the holes. Set the frame on top of the plate with the holes aligned and, after a little thread lubing, start in the screws. When they all touch the frame, stop. Carefully turn each screw until you feel a slight bit of resistance, then stop. Do this on your lap, float bowl facing you, checking that the window stays flush. Although the temptation to tighten these screws is great, resist it.

Step 30: Install Anti-dieseling Solenoid (fuel shut off).

•**DCR and DFP:** Your solenoid may already be installed—go on to the next step.

You stored this solenoid in the **rear** box or with the top section. There are three or four parts in all: a plunger (maybe a spring), a copper washer, and a solenoid body. On early solenoids the wire had the tendency to fray and break at the solenoid. Handle with care. If you have a spring, slip it into the plunger. Install the plunger, big end first, into the solenoid body. Fit the copper washer over the plunger and threaded end of the solenoid. Turn the carburetor facing the **rear** side. The solenoid threads into a hole in the upper right side of the midsection. Turn the pigtail wire along with the solenoid to avoid twisting and breaking it off.

•**DCR and DFP People:** If your solenoid is attached to the top section and connector, you'll have to turn the top section as you thread in the solenoid. Don't twist the wire.

•**Everyone:** Finally tighten the solenoid with a 17 or 19mm open-end. Holding the carburetor flat against the bench, tighten the solenoid well (12-25 ft/lbs.).

•**DCR and DFP People:** Lay your top section aside and return to Step 17.

•**DCH People:** Move the wire to your left and hook it into the clasp on the outside edge of the secondary vacuum capsule. On later models the wire fits under a clip on the **right** top section screw.

Step 31: Install Throttle Return Spring.

This applies only to DCR and DFP carburetors. You disconnected a coil spring that should be in the **rear** parts box. This little spring connects between the throttle cable crank (**primary** shaft) and a bracket screwed to the **secondary** vacuum capsule. The holes for the spring hooks should have nylon grommets in them. Insert the hooks toward the carburetor.

Step 32: Adjust the Fast Idle.

•**Automatic Choke People:** If your carb is on the engine, read through this step ignoring "off engine" details. When you're familiar with the fast idle cam and setscrew, read the info at the end of the step.

If your carb is off-the-engine, make the adjustments then recheck with the engine running, carb in place.

If you have high idle problems especially when the choke's on, this adjustment's for you. It's a lot easier to reach the adjustment screw on the bench. Depending on the engine, the fast idle speed will vary; to make it simple, I give one setting for all. On Z-series engines a lower fast idle is better. On late model L-series the fast idle was often too high when the vehicle left the factory.

The fast idle is controlled by the choke and a light spring. The fast idle cam is on the **rear** side of the carburetor, part of the linkage maze. Face the **rear** side. Look at the **primary** throttle shaft. Just behind the throttle rod or cable crank find a threaded stud (screw) and nut. The inside end of the stud should be touching the fast idle cam. If your linkage doesn't look or work right, reread Step 17.

Turn the **primary** throttle shaft counterclockwise and the choke should spring closed, if it isn't already there. Return the throttle shaft to the closed position. Look straight on at the fast idle cam. Note the three small steps cut into it on the left side. Move the cam one way or the other, lifting the throttle if necessary until the setscrew rests on the second highest or middle step of the cam.

Find a paper clip, standard size (#1 not Jumbo) 1-¼in long. Bend the outside leg of the clip straight. Turn the carb upside down and look into the **primary** throttle bore between the inside wall and the throttle plate. Try to fit the paper clip wire between the wall and the throttle plate. Your adjustment is to get the clip to fit exactly between them. If it's a little tight, leave it. If sloppy, adjust it.

To adjust the fast idle speed: Loosen the 8mm lock nut and turn the setscrew one way or the other until the setting is correct. Use penetrating oil to lube the threads.

•**Carb Off-the-Engine People:** Once the gap between the bore and throttle plate is set (a tighter fit is better than a loose one), tighten the 8mm lock nut and replace your carburetor. Well done.

Step 33: Install Dashpot or FICD.

DAF People: You measured and recorded the distance between the end of the dashpot and bracket. Install the dashpot up into the bracket to the measured position, install the lock nut and tighten.

•**DCR and DFP People with Automatic Transmission and/or Air Conditioning:** This will be in the **rear** box. It fits through a bracket on the **rear** of the carb. There's a flat side on the threaded end of the FICD with a corresponding cutout in the bracket. Install the FICD, aligning it and the bracket, and tighten the 19mm nut.

PROCEDURE 15: DISASSEMBLE AND SERVICE SECONDARY VACUUM CAPSULE (ACTUATOR)

Condition: You have removed and checked out the vacuum capsule (Proc: 12 [5]). It's a lot easier to remove this if the carburetor is off the engine.

Tools and Materials: Screwdriver, #2 Phillips or medium straight, clean pipe cleaners; a carburetor kit from Datsun/Nissan that includes a new diaphragm.

Step 1: Check Capsule's Operation.

Turn the capsule so the flat carburetor mating surface faces you. You want to suck on the hole that isn't a screw hole. OK, pucker up and do what you're told. The rod should move into the housing when you suck and it should stay there as long as you liplock the capsule.

Step 2: Remove the Top of the Capsule.

The top is held on by three screws. Hold the capsule steady and remove them. Store these in their own container. A clasp may be under one of the screws. Mark its position. Keep the parts together.

The top will now come off with a light sideways tap around the edge. Hold the capsule upright to remove the top and coil spring underneath it. The diaphragm is now visible. Push the rod up to separate the diaphragm from the body. The rod is part of the diaphragm. Don't turn the capsule upside down.

Find the screw hole in the edge of the body with a second hole beside it. There's a small spring and ball in this hole. Place your palm over the hole and turn the capsule over to dump the spring and ball out of the hole. If they're stuck, use a piece of wire to draw the spring out; the ball should fall out once the housing is inverted. Store the spring and ball safely in the parts box.

Step 3: Clean Out the Vacuum Ports and Housing and Replace the Spring and Ball.

Wipe the capsule housing clean with a rag. Use a pipe cleaner to ream out the hole where the spring and ball fit. Also clean a similar hole in the top part of the housing. Blow through the passages to ensure they are clean. Scrape the mating surfaces around the edges of the housing and top without nicking or scoring the metal, then sand the surfaces lightly with emery cloth.

(In the old days, to improve secondary carb circuit performance, we would cut the coil springs shorter and leave the little balls out. For later DCH on carbs this isn't such a problem.)

Hold the capsule housing upright and pick up the chrome ball. Drop it into its hole. Place the spring into the hole over the ball. Do not turn the housing upside down until the top is in place.

Step 4: Install the Diaphragm and the Coil Spring.

Pick up the diaphragm and slip the rod through the housing. Line up the holes around the edge of the diaphragm with those in the housing. The diaphragm only fits one way. Pick up the coil spring and place it in the center, metal section of the diaphragm. Now the top section. Lay it directly over the center of the spring, lining up the transfer hole with the position of the matching hole in the diaphragm and lower section. (The coil spring fits around the raised center on the inside of the top section.) Compress the top section against the housing, watching the edges of the diaphragm. When the sections are together, and the diaphragm is properly aligned, start one of the screws. The diaphragm holes must match the holes in the capsule. With one screw in, take a little of the pressure off the top, allowing the diaphragm to straighten enough to insert the other two screws. The screw with the clasp on it fits into the hole you marked.

Tighten the screws a little at a time, drawing the top section down evenly. Continue until the screws are snug.

Step 5: Test the Assembled Capsule.

Retest the capsule to see that it operates correctly. If it does not, review this procedure.

Step 6: Reinstall the Secondary Vacuum Capsule.

If you're ready to, turn to Proc. 14 (24) and replace the capsule.

PROCEDURE 16: TEST, REMOVE, AND REPLACE VACUUM BREAK (CHOKE PULL-OFF)

Condition: The carburetor is either on or off the engine. You have problems accelerating when the choke is on, i.e., engine cold. **Z-series People:** You have to remove your carburetor (at least the top section) to replace the vacuum break, because your choke housing is riveted in place.

To test and replace the vacuum break, remove the air cleaner housing (Proc. 1 [1-5]).

Tools and Materials: A 6in piece of 5/32in or 4mm vacuum hose (for testing), screwdriver, new vacuum break, cotter pin, 1 x 14 or 15mm.

Remarks: The break assembly is most easily removed with the carburetor removed and disassembled; however, it can be replaced with the carb in place. If the carburetor is due for an overhaul soon, or you don't mind a little cold acceleration stumble, simply plug the vacuum hose where it connects to the break until the carb is off and the break is more accessible.

Step 1: Test the Vacuum Break.

Find the black vacuum hose on the **left** (driver's) side of the carburetor top section. Pull the hose off the pipe on the vacuum break. Connect your test hose and suck on it. The rod on the other end of the break should move and stay pulled in. If it doesn't the diaphragm leaks and you have a minor vacuum leak.

Step 2: Remove the Automatic Choke Assembly.

(Go on to Step 4 if carb is disassembled or the choke assembly has been removed.)

You'll find details on removing the choke assembly in Proc. 12 (4).

Step 3: Disconnect the Secondary Interlock Spring.

(Go on to Step 4 if the carburetor is disassembled.)

This move was described in Proc. 12 (7). Do not disconnect the lower end(s) of the spring(s) or the fast idle rod. Use needlenose pliers or a screwdriver tip. When the top end of the spring(s) has been removed, return here.

Step 4: Disconnect the Choke Break Rod from the Diaphragm Assembly.

Follow the rod on the inside of the vacuum break to where it connects to the choke linkage. Here the rod is connected by a cotter pin. Carefully straighten the legs of the pin and remove it using needlenose pliers. There's probably a flat washer under the cotter pin. If so, remove it. There may be another similar washer in the other side of the pull off as well, but wait.

Step 5: Remove the Choke Mount Screws.

The choke mount is in front of where the choke thermostat was mounted. Find a screw to the left and center of the mount. To the left of this find another smaller screw. Both of these must be removed. If your carburetor is still on the engine, use a short screwdriver to fit between the carburetor and the firewall. Loosen and remove the screws and set them aside. (If the lower of the three choke thermostat screws is in place, remove and stash it now.)

Step 6: Remove the Vacuum Break Assembly from the Carburetor.

Pull the choke housing toward you until it butts against the tang on the end of the choke shaft. Tip the bottom of the housing toward you and turn it clockwise until the hole in the vacuum break and the linkage rod are visible. Use a screwdriver tip between the break and the rod, to pry the rod out of the hole. Be firm but don't bend the rod.

Turn the choke housing slightly while pulling the break assembly out and off the locater on the carb to section. If it sticks, move the tang off the choke shaft and try again. Lower the break a little to separate it from the carburetor. If the carburetor is assembled, tip the assembly slightly upward and twist it enough to clear the secondary vacuum capsule below. Once removed, let the choke housing hang. Remove the additional washer, if there is one, from the rod.

Step 7: Replace the Vacuum Break Assembly.

Compare your new assembly with the old one. The new one may have one extra hole in its mount plate, but should be the same general shape. Locate the linkage rod that fitted into the vacuum break. Hold the loose end of the rod against the bottom part of the choke housing. Turn the housing clockwise enough to give room for the break replacement. Hold the new assembly in your left hand with its pull-off rod aimed at the choke housing. Twist the break sideways enough to slip its bracket between the choke housing and the secondary vacuum capsule. Straighten the assembly once it is in place. Let the pull-off linkage rod drop down between the pull-off and the bracket against the side of the carb.

If there was a washer on the inside of the rod, replace it. Maneuver the end of the linkage rod between the bracket and pull-off then into the hole in the pull-off rod. Be patient, the fit is tight. A touch of grease on the linkage rod tip may help.

Replace the outer flat washer (if removed) using a screwdriver blade behind the linkage rod to hold it out. Insert the cotter pin through the hole in the rod and spread its legs round the rod. Lift the break assembly up onto the locating dowel that's cast into the upper right corner of the carburetor.

Step 8: Install the Choke Housing and Vacuum Break Screws.

Lay the two screws close at hand. Hold the vacuum break against the carburetor, lined up to the edge of the casting. Align the choke housing, holding it and the vacuum break flush against the carb. Install the larger screw into the hole closest the choke shaft and tang, turning it in until it touches the housing. Insert the smaller screw. Tighten the screws evenly until secure. Do not over tighten. Find the interlock spring and see that it's properly hooked on the bottom end. Lift the spring with pliers hooking the top end into the hole in the upper bracket. If the carb is disassembled, ignore the spring hook up for now. If the carburetor is assembled either on or off the engine, reconnect the vacuum hose between the break and the carburetor body.

Step 9: Install the Automatic Choke Thermostat and Connect Interlock Spring.

(Skip this step if the carb is disassembled after replacing the lower thermostat retaining screw and clamp.)

Replace the choke thermostat (Proc. 14 [25]). The final adjustment of the choke should be rechecked once on the engine.

Reconnect the dreadful secondary interlock spring (Proc. 14 [21]).

PROCEDURE 17: TO UNDERSTAND AND TROUBLESHOOT THE ELECTRONICALLY CONTROLLED CARBURETOR (E.C.C.) SYSTEM.

Condition: You have a Nissan 720 (truck)—1983-½ (1/83) on California or 1985 (7/84) on Federal. You are here to get familiar with the system. You should read Step 1 of this procedure to determine if you really are an E.C.C. person and read Ch. 6, Pt. 2, Proc. 1 to understand the relationship between the emissions system and E.C.C.

Your truck won't run, it cranks, the battery's strong; there's fuel in the float bowl and spark to the plugs. Or the engine runs but it won't idle, it stalls or dies, it hesitates under load. You have performed engine maintenance (Ch. 3) and carburetor checkout (Proc. 2).

E.C.C. Precautions: Do not use jumper cables to start your engine; always charge the battery with the battery cables disconnected. **Do not** disconnect the battery cables when the engine's running. **Do not** crank the engine and operate the fuel pump if the gas tank is empty. **Do not** disconnect the E.C.C. connector at the brain unless you know what you're doing and only then if the battery is disconnected.

Other instructions having to do with starting and connecting electrical accessories are in your owner's manual.

Remarks: Your carburetor is electronically integrated with the engine's emissions, cooling, and ignition systems by microprocessor. Before tearing into your carburetor or disconnecting any hoses or wires, take time to read the following steps.

Step 1: How Does This High Tech System Work?

The E.C.C. is a complex system that I only discuss superficially; without copious instructions and test meters you can only do basic troubleshooting. Fortunately, that's often all you'll need to fix the problem.

There are basically two subsystems to the E.C.C. system: **input** and **output.** Signals from the input side are sent to the **E.C.C. brain** that's under the driver's seat. The input components (sensors) are a *coolant temperature sensor* that's located under the thermostat housing; a *throttle valve switch* of the **rear** (linkage) side of the carburetor; an *inhibitor/neutral switch* that's mounted to the right side of the transmission; a *clutch switch* (manual trans.) placed above the clutch pedal; a *vacuum switch* mounted on the right fender wall; maybe an *engine speed detector* that picks up rpm from the ignition coils, on high altitude models there's a *sensor* under the dashboard; and a *switch* on the right fender wall. On MPG models there's a *detonation sensor* screwed into the engine.

Finally and the most important player of all is the *Oxygen (O_2) Sensor* that's screwed into the exhaust manifold between the header and the flange.

All these parts detect engine conditions and send signals to the brain (computer). The O_2 sensor detects presence of oxygen in the exhaust. This is where the high tech comes in. The brain then sends, limits, or stops **output** signals to the following: the *anti-dieseling* (fuel shutoff) *solenoid* that's fitted into the carburetor; the *electronic ignition unit* that controls ignition timing; the *mixture heater* that's between the carburetor and manifold; and on air conditioned models the *FICD dashpot* that's part of the throttle linkage. And the most active member of the troup, the *fuel/air ratio solenoid*, is mounted inside the carburetor. This is also known as the enrichment solenoid.

The correct operation of these electrical components as well as the brain depends on a healthy battery and good contact between the positive and negative (ground) connections for the components.

If any one of these components malfunctions or fails, the output controls will enrich or lean the fuel mixture or change the ignition timing thereby effecting the exhaust emissions. This condition is read by the O_2 sensor, which sends an incorrect signal to the brain. It's a vicious cycle.

When all these players perform properly your engine performance should be acceptable (at best underpowered under load, at least reliable) and your economy (emissions) should meet your expectations (and the environment's).

Step 2: Typical E.C.C. Malfunction Symptoms.

The most common problems belong in the "drivability" department. Hesitation upon acceleration, stalling (won't idle) or dying (engine quits) are typical complaints. Intermittent problems are the hardest to cure (pinpoint). Cruise or above idle speed (underload) problems seem to be built into the system (Step 3 includes some tips that might help).

All you can really do without a factory service manual and a volt/ohmmeter is cover the basics. I tell you about typical problems and possible places to try and fix them. Much of this information is courtesy or two of my friends at Albuquerque Nissan: Lane Hice and Daryl Webster.

Step 3: What Can You Do?

Well, to save yourself time cover the basic areas first: The engine should be in good maintenance (a major tune-up), the filters (air, fuel, and emissions) should be clean (Ch. 3 and Ch. 6, Pt. 2), and the battery should be serviced and the fuses all intact (Ch. 7).

To inspect the E.C.C. components: Check all wire and hose connections pertaining to the E.C.C. and anything else you notice while on the prowl. I gave you the sensor and control component locations in Step 1.

A common break point is at the ground eyelet that bolts to the intake manifold below the carburetor. Two black wires connect here. They should be in complete condition and the bolt holding them tight. If necessary, you can splice on a new eyelet. While you're here check the mixture heater connection just above the eyelets (Ch. 6, Pt. 2). Also check engine-to-body ground wires. There should be one between the back and the left side (exhaust manifold) or on top of the cylinder head and the firewall.

The temperature sender connector must be tight. I don't tell you how to test the sensor, but you can remove it like the main engine temp sensor (Ch. 8) and have it tested at your local dealership.

The vacuum switch(s) is (are) connected to the brain by wires and to the engine by vacuum hoses. These connections should be solid.

The altitude switch (high altitude models) and sensor or detonation sensor (MPG models) also have electrical and vacuum connections, which you can inspect the same way.

The O_2 sensor has a green pigtail wire and connector to look at. Follow that wire as far as you can. Remake the connection at the connector.

You should remove the air cleaner housing (Proc. 1 [1-5]) for the following carb checks. Inspect the plastic connector that's next to the throttle cable bracket. It should be secure and its wires all equally well plugged in. Follow these up to the carb and check the connections there, especially the anti-dieseling solenoid, which screws into the **rear** right corner of the carb. There's more on this in Proc. 18.

While you're here look at the throttle valve switch (buried down in the linkage maze) and its two wires. Two other wires run into the top of the carb and connect to the mysterious air/fuel ration solenoid.

There's a single (yellow/green stripe) wire on the right side firewall (strapped to a wiring harness) that's probably wrapped in blue tape. This is a test wire. Make sure it's properly connected.

Look over all these connections: vacuum and electrical. Ch. 6, Pt. 2, Proc. 1 might help with the hose layouts. Some hoses will be vacant if the AC housing's off.

E.C.C. tests you can make: The following and previous information will help you communicate with the mechanic if you end up taking your truck to be repaired. If you haven't already run through Proc. 2 (general carb checks), do so now.

You can test the anti-dieseling solenoid (see Proc. 18, Condition). The O_2 sensor can't really be tested, but there's an electronic check you can make that's discussed in Ch. 3, Proc. 7. Other O_2 information is in Ch. 6, Pt. 2, Proc. 15.

Other tests entail tricking the brain to isolate components, but for these to mean anything you'll need exhaust meters.

If you take it to be fixed be sure you have covered all the basics previously mentioned to eliminate unnecessary work by the mechanic. Take it to someone who knows the system, e.g., a Nissan dealer. The tests might damage the brain or O_2 sensor. These are really expensive and difficult to test specifically. Mechanics usually replace them as a last resort, gambling that it's the problem. Before reaching that point all other tests should be performed.

You might get to a point when you break down and buy the Factory Service Manual, and a volt/ohmmeter then do the work yourself. It may be cheaper in the end, plus you'll learn more than you care to about E.C.C. Just wait until they put lasers under the hood.

If you're done testing, replace the AC housing (Proc. 1 [6-7]).

Step 4: What More Can You Do About Surging and Hesitation.

If you can live with minor "drivability" problems, do. This system isn't worth messing with unless something serious is wrong. One way you can improve performance without increasing emissions and decreasing

mileage (slightly) is to install a larger **primary** main jet.

On most engines you could increase emissions by doing this, but with an O_2 sensor you can't. The sensor senses and the brain compensates for the rich mixture.

Doing this also might violate federal law and your emissions control system warranty, so I don't recommend it. The main jets are accessible through the float bowl once the AC housing is removed, the AB valve is disconnected and moved aside, and the float bowl cover and float removed. The **primary** jet is the one on your left. If stuck, whack the end of your screwdriver and turn out the jet. Your truck comes with a #94 jet. You might try a #101 - 104. Have your CO and HC emissions tested afterward.

Another culprit that will cause bucking and hesitation is the throttle valve switch. You need an ohmmeter and instructions to adjust that. Sorry. It has an adjustment screw that you shouldn't confuse with the idle speed screw.

PROCEDURE 18: TEST ANTI-DIESELING (FUEL SHUTOFF) SOLENOID

Condition: Your engine won't idle or it dies.

Tools and Materials: If your solenoid is still on the carburetor and mounted on the engine, you'll need test wires long enough to reach from the battery to the wiring connector near the carb. If it's off the carburetor and/or engine, two short test wires will work. An 19mm open-end is needed to remove the solenoid from the carb.

Remarks: This procedure covers two types of AD solenoids: the single wire kind used on all 1975 on carburetors, and the dual wire type used on E.C.C. carburetors (1983½ on Calif. and 1985 on Fed.).

This solenoid shuts off the fuel supply to the idle circuit when the ignition's turned off. On E.C.C. carbs it operates during deceleration too.

Step 1: Find and Test the Solenoid.

If your carburetor's apart, the solenoid is in the **rear** parts box.

If your carburetor is together, find the solenoid on the **rear** (linkage side) of the carb. It's hexagonal in shape. If you have two such devices on your carb the AD solenoid is the one toward the right (passenger) side.

Step 2: Test the AD Solenoid.

To test the solenoid while still in the carburetor, do the following. Have someone turn the ignition switch on (not start) while you listen to the solenoid. It should click if it's working. If it doesn't, test it further. Unplug the connector close to the carburetor. Find the wire(s) that lead to the solenoid.

•**One-Wire People:** Connect one jumper wire to the solenoid wire and the other to the POSITIVE battery post. Hold the other wire against the side of the solenoid and touch the other end to the NEGATIVE post. **Two-Wire People:** Connect one test wire to the red wire running the solenoid and its other end to the POSITIVE battery post. Clip the other wire to the black solenoid wire and the NEGATIVE post. **Everyone:** Your solenoid should click. If it doesn't, remove it and test it off the carb (Proc. 12 [14]). I have heard of solenoids on E.C.C. carbs that work when tested but not in action. What can I say?

To test the solenoid off the carb you'll have to put the plunger back into it then retest the thing as described above. This time watch the plunger move in and click. If the wire is broken off the solenoid, you'll have to replace it.

If it tests OK, reconnect the wiring to the solenoid and unhook your test wires.

Step 3: The Rest of the Story.

If your solenoid tests OK and your engine still won't idle, make sure the solenoid plunger's the right one and is assembled correctly. Also recheck your idle speed and mixture adjustments. On E.C.C. engines the ground circuit may be bad; it goes through the brain.

If you have to get another solenoid, make sure the replacement is exactly the same. The plunger length and extension are important. On E.C.C. connections you have to push those two pins out of the connector. Look closely to notice the little legs holding in the pins. Use a needle or a similar object to push in those legs, then you can pull the wires out. Make sure you get the wires back into the connector in the correct position.

To reinstall the AD solenoid see Proc. 14 (30).

Part 2: EMISSIONS

INTRODUCTION: WHAT YOUR DATSUN DOES TO PLANET EARTH

The U.S. auto industry knew how to limit certain engine emissions in the first quarter of this century. In spite of this, if mandatory requirements hadn't been placed on the manufacturers in the 1960s, the air today would be much worse than it is.

There are three major forms of notably harmful internal combustion engine emissions: **hydrocarbons, carbon monoxide,** and **nitrous oxides.** Hydrocarbons (HC) are a product of unburned and evaporated fuels. Carbon monoxide (CO) is formed by incomplete combustion of the carbon in fuel due to insufficient available oxygen. Nitrous oxides (NOx) are formed by high combustion temperatures. These plus other compounds resulting from incomplete combustion contribute to air pollution. For example, tetraethyl lead is a villain that was put in fuel to control knocking and improve "drivability." Millions of tons of it are distributed throughout the world annually. There is a definite link between lead and brain damage, especially in children.

And if that isn't enough to give you nightmares, here's more to dream about: Brake and clutch linings contain asbestos and particles that are freed into the atmosphere each time you use the clutch or brakes. Antifreeze, oils, and brake fluid frequently end up in our ground water. Recent EPA studies found that half of all underground gasoline storage tanks in the U.S. leak. Excessive amounts of carbon dioxide, created from burning fossil fuels, affect global temperatures and moisture distribution. Fluorocarbons, contained in air conditioner refrigerant, destroy our atmosphere's ozone layer, contributing to the greenhouse effect and planetary warming. Nitrous oxides are blamed for damaging forests in Europe and North America, acidifying lakes and streams as well as ozone destruction. The problems don't end here. Noise pollution is sinister and difficult to ignore, as is the visual pollution of countless vehicles, miles of highways, parking lots, smog, and billboards.

Less obvious are the effects from automobile and fuel production. These processes require energy consumption as well as mining and exploitation of human and natural resources. Auto manufacturing plants are heavy sulphur dioxide producers, the major cause of acid rain. The automobile is indeed a paradox that enslaves us. Addicted motorists will drive at any cost. The automobile is at the core of our economy and lifestyle, and to keep it running we have developed a thirst for oil and other raw materials that dictates our relationship with the entire globe. We consume more energy per person than any population on earth. Our penchant for automotive convenience is complex, woven deep into our lifestyle and psyche. Our lust for mobility—an offshoot of abundance and freedom—may satisfy us now but is leaving a questionable legacy for generations to come.

This chapter deals with systems designed to meet Federal laws and reduce automotive pollution and help keep your engine "efficient." So, before you tamper with the emissions control or fuel system on your vehicle, take time to understand how it works and consider the consequences of your acts. In fact, the newer your vehicle is the more integrated to engine functions the emissions control is. Remember, the best emissions control is to limit your driving. **Facts:** •At least ⅓ of the energy consumed by the engine is converted into heat and sound. •Two hundred cubic feet of air are consumed with every pound of gasoline. •In 1971 there were more cars in Los Angeles County than in all of Africa. •40,000 pounds of minerals are consumed by each person in the U.S.A. each year. •"An increase in the gross national product results in a decline in health and welfare. Automobile use is a result of a higher standard of living but contributes to heart attack, cancer and lung disease" (Barry Weisburg). NOTE: Your emissions control system is covered by a 50,000-mile warranty by Federal law. This means that if anything in the system fails within that mileage, the dealer has to replace it for free. The law might be stretched to cover the carburetor and other engine components that, if faulty, could cause engine pollution. But that's a legal issue and if you think mechanics are expensive, try lawyers.

•NOTE: On trucks with electronically controlled carburetors (E.C.C.) the emissions and fuel systems are interdependent; tampering with either can be a very expensive mistake.

Engine performance problems, related to the emissions control system, are usually caused by poor maintenance, e.g., vacuum (hose) leaks. The maps that follow, I hope, will give you a clue to how it all fits together. They won't do much good if your engine has a non-factory carburetor and air cleaner or if many components have been ripped out, however.

Z-series engines (Z-20, 22, and 24) 1980-81 510s and 1981 on 720s: This engine is also called NAPS-Z (Nissan Anti-Pollution System). It has a cross-flow combustion chamber, that is, intake on one side and exhaust on the other. The shape of the combustion chamber is hemispherical (dome). This design minimizes heat loss, cooling of combustion gases, and HC emissions, while providing good performance.

1980 510s were the first vehicles sold in the USA with the Z-series engine. It had four spark plugs. In 1981 both 510s and 720s (trucks) got the NAPS-Z engine but with eight spark plugs, two per cylinder. The plugs are positioned opposite each other, one on the exhaust and one on the intake side of the head. Both plugs fire at the same time too except under heavy load when only the intake plug fires. So you people have four extra spark plugs and wires to maintain.

In 1983½ (1/83) Calif. and 1984 (7/84) Federal, 720s entered the computer generation with E.C.C. This system shares many of the same components as earlier models, but with E.C.C. the emissions and fuel systems are interdependent; components in both systems as well as the cooling system send and receive signals to and from a microprocessor that's under the driver's seat. There's an oxygen (O_2) sensor made from ceramic zirconia screwed into the exhaust manifold that tells the computer how much oxygen is in the exhaust. The "brain" then tells various switches and valves what to do to keep emissions down and performance and economy up. For more about this ingenuity, read this chapter and Chapter 6, Pt. 1, Proc. 17.

It's common practice and harmful to the environment (and your engine) to tamper with and disconnect the emissions control system. Some cities and states require a DEQ test before you can register a vehicle. So, I advise you to leave things the way they are.

I have also worked on vehicles after someone had gone into the engine and pulled any wire and hose that resembled an emissions control device. Usually what they disconnected either didn't affect performance or the engines didn't run or ran poorly afterward. These acts of ignorance are expensive to fix. There are ways to improve fuel economy and performance by modifying older engines. (For environmental and legal reasons I don't reveal them in this book.)

PROCEDURE 1: A TOUR OF THE EMISSIONS CONTROL SYSTEM

Remarks: This system has evolved through the years. There are differences between California, Federal (the rest of the country), and Canadian designs. 1983½ California and 1984 Federal 720s have electronically controlled carburetors. I try to keep all this straight, but may fall short of being exact. Use the text and illustrations to determine which components you have and go from there.

The chapter is laid out so you can go to the procedure that covers the component in question and be able to deal with the most common problems. Certain, less troublesome areas of the emissions control system aren't covered in this book. The common culprits are. The Factory Service Manual for your vehicle has in-depth troubleshooting procedures.

On many vehicles there is an emissions hose routing diagram in the owner's manual or on a decal stuck on the underside of the engine's hood. Once you have identified what the components are, the map is easy to follow.

The **Positive Crankcase Ventilation System** is a simple closed system. An air hose on top of the valve cover connects to the air cleaner housing. Air is drawn from the air filter into the engine, through the crankcase, and passes out of a pipe on the lower left side of the block. A hose connected here and to the PCV valve (which is threaded into the intake manifold) allows oil and blow-by vapors to be drawn into the combustion chambers.

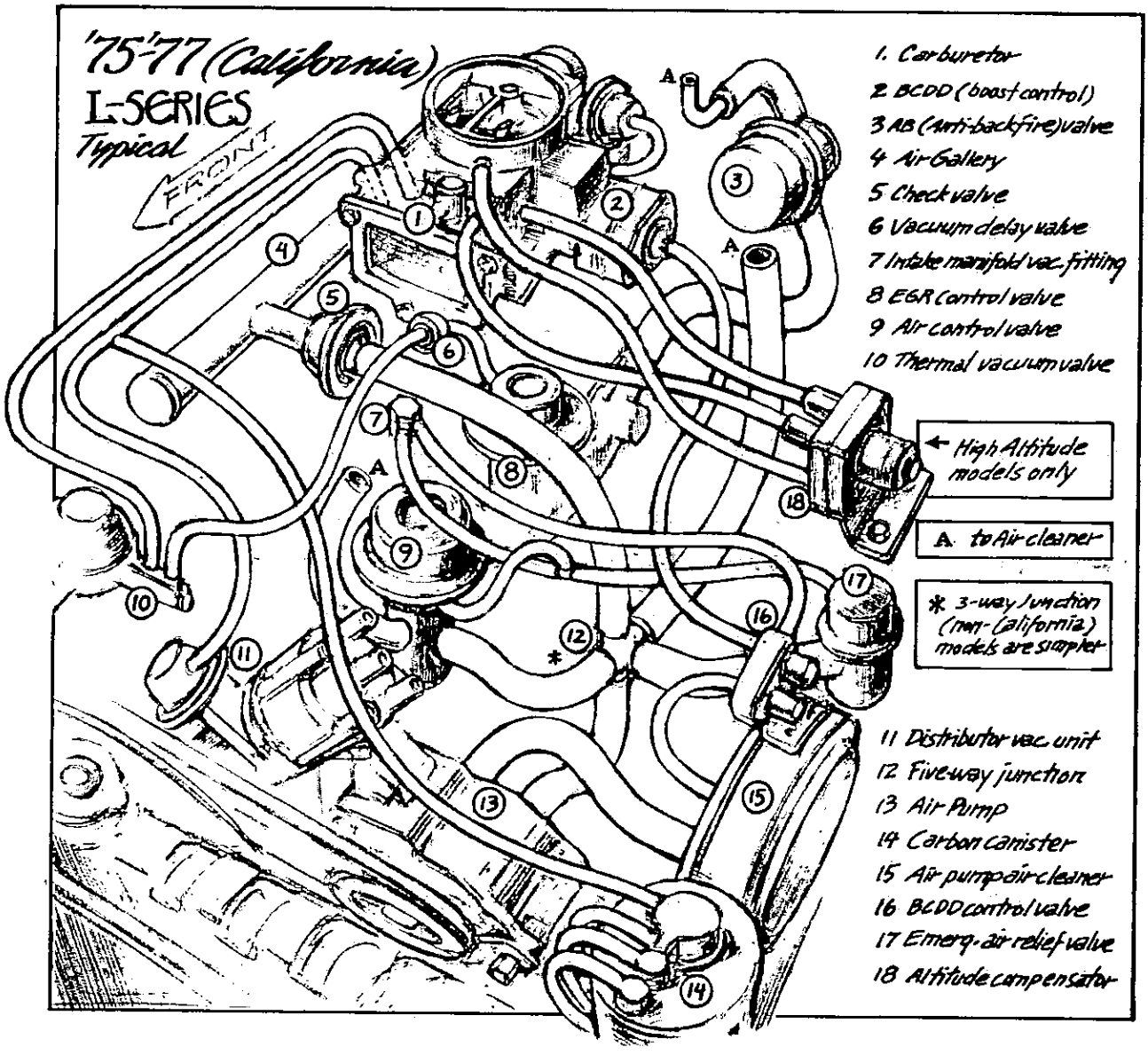
On engines with excessive blow-by some vapors will go the other way into the air cleaner and you'll see oil residue there.

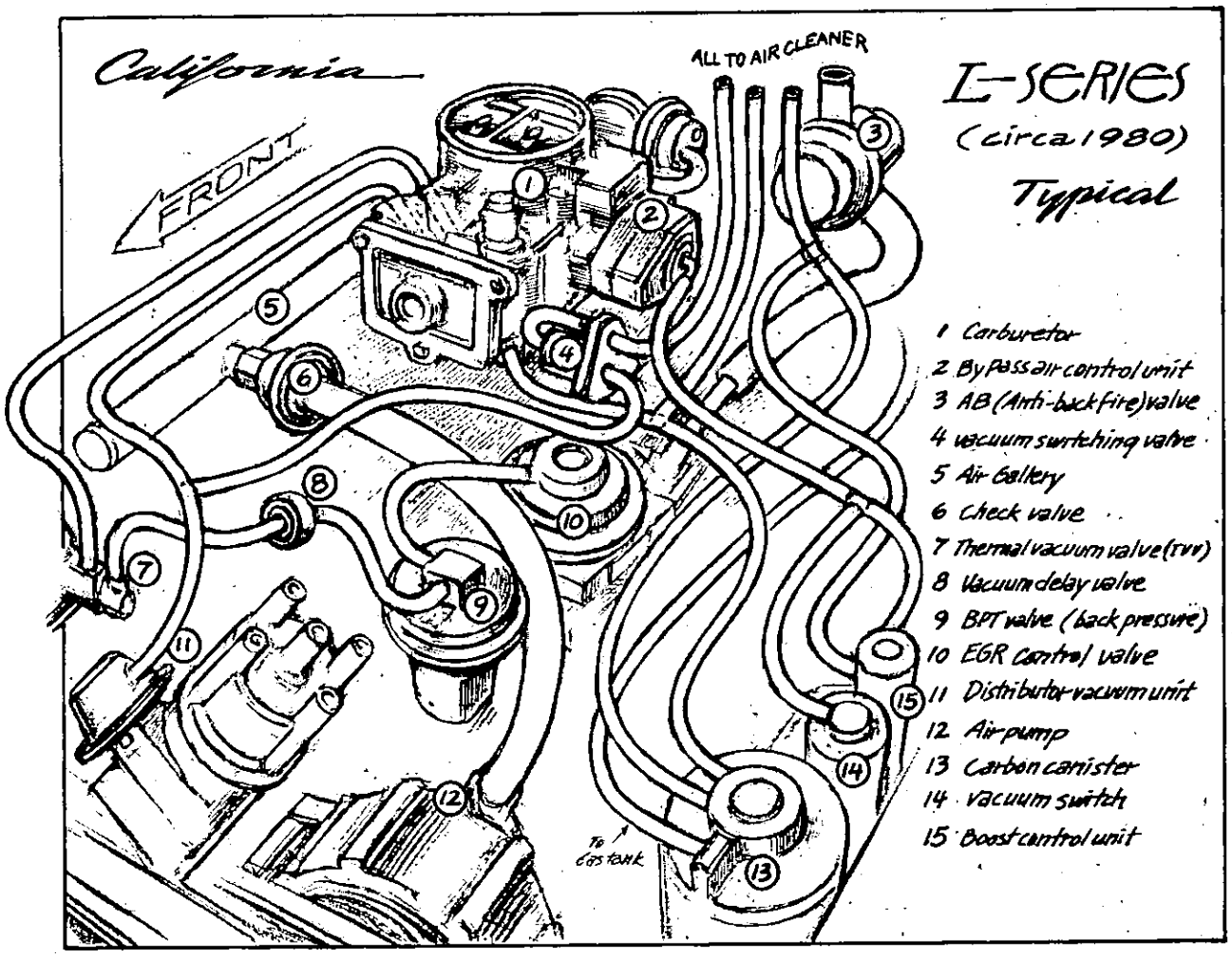
The **Fuel Evaporation System** contains evaporated fuel from the gas tank and carburetor and recirculates it to be burned.

• 1970 through 1974 Datsuns use a flow valve placed on the left engine compartment wall. Hoses connected to the air cleaner and crankcase pipe join at the flow valve with plumbing to the fuel tank. Check these hoses and the filter in the air cleaner housing.

• 1975 and later models use a carbon canister to collect fuel vapors from the tank. These hoses connect to the distributor vacuum source and the air cleaner. The engine vacuum draws the vapors into the combustion chambers. It's important to check these hoses and clean the canister filter.

• 1974-1979 vehicles: The **smog (air) pump (AIS)** was put on cars in the early seventies, removed for a few years, then reinstalled. Eventually all cars and trucks got them until 1979. The pump is on the lower left front of the engine and is belt-driven by the crankshaft pulley. This belt should be inspected and adjusted. On early models air is drawn in from the main air cleaner. 1975 and later vehicles have a separate air cleaner on the





left side of the engine compartment. Air is pumped into the exhaust manifold through a check valve mounted on an injection manifold, along the left side of the valve cover. California, catalytic convertor models have more complex hosing.

The pump adds a molecule of oxygen to the exhaust gas turning the carbon monoxide (CO) into carbon dioxide and also helps complete hydrocarbon (HC) combustion. A number of other valves, depending on your model, are added to this system to control the amount of air injected at various engine conditions. These valves include the Anti-backfire Valve, the Air Control Valve, the Emergency Air Relief Valve, and the Combined Air Control Valve. These help control backfiring, HC emissions, and exhaust temperature. Along with these latter combinations are the vacuum switching valve and the air control switch found on heavy duty California trucks and some vehicles with EAI (mentioned below) and are wired through an electronic control unit. On vehicles with an air pump there is a relief valve located in the bottom of the air cleaner housing. This protects the system from excessive pump pressure at high engine speeds. This system can develop exhaust leaks and should be inspected.

•All 510 and 720s (except 2WD L-20B) 1980-83 ½ Calif. and 1985 Federal: The **Exhaust Air Injection System (EAI) (also called AIS by Nissan),** simpler than the air pump design, minimizes CO and HC in the exhaust without using a pump. Instead, negative exhaust pressure is used to draw air into the exhaust manifold from the air cleaner through a one-way reed valve(s). It is important to maintain the filter(s) in this system. It (they) is mounted in the air cleaner housing behind the reed valves.

All L-series engines with EAI have anti-backfire (AB) valves while some Z-series engines don't. This valve

decreases HC emissions by letting more air into the intake manifold during deceleration.

See map and Proc. 7 (5), to determine if you're an AB person.

The **Exhaust Gas Recirculation System (EGR)** was installed on 1974 and later vehicles to control nitrous oxide (NOx) emissions by injecting exhaust gases into the intake fuel/air mixture to lower combustion temperatures. The EGR valve and passage is located on the left side of the intake manifold (L-series) and on the rear right side (Z-series). Engine vacuum tells the valve when to operate depending upon coolant temperature. 1974 models use a temperature sensor, which operates an electrical switch that in turn opens and closes a solenoid valve directing vacuum to the control valve. 1975 on models use a thermal vacuum valve that passes or prohibits vacuum at given temperatures.

Later L-20B and all Z-series models incorporate a **Back Pressure Transducer (BPT) or Venturi Vacuum Transducer (VVT) valve** that senses exhaust pressure to further regulate the control valve operation. There may be an EGR warning light on your dash that comes on to indicate the system should be serviced (every 25,000 miles). The EGR system can also develop vacuum and/or exhaust leaks and become plugged by carbon. It should be inspected, tested, and maintained.

Many models utilize **ignition timing control systems** that affect the spark plug timing either electrically or by vacuum. Early L-series engines have **dual point distributors** with an advanced and retarded set of points. Individual operation of these sets depends upon switches controlled by gear selection, temperature, and throttle position. Most of these systems have been tampered with. Many 1973 and later engines use a **vacuum control system** that controls the spark advance to the distributor, lowering HC and NOx emissions by venting engine vacuum through a switching solenoid feed into the distributor advance hose. On early L-series engines, the solenoid is signaled by switches in the transmission that are moved by gear selection. On Z-series the vacuum control valve and/or vacuum switch(es) are controlled by vacuum and on E.C.C. engines the switch(es) are operated by signals from the microprocessor.

To control excessive hydrocarbon emissions created by high vacuum during deceleration the **Booster Control Deceleration System** (BCDD) was designed into the carburetor. The early BCDD was all part of the carburetor. The later version is broken into two components, a **Boost Control Unit** located on the left wall of the engine compartment and the **Air Bypass Valve** on the left side of the carburetor. This later system has more vacuum hoses and is called the intake manifold vacuum control system. It is a highly controlled circuit that also regulates oil consumption by reducing negative pressure on the intake guides and seals during deceleration.

On 1979 and later vehicles there is a **Fuel Shutoff system** designed to further control HC emissions. Engine vacuum, gear, and clutch position switches operate the components. The components are the **Fuel Shutoff Valve** or the vacuum switch and the **Fuel Shutoff Solenoid,** which is part of the carburetor as discussed in Ch. 6, Pt. 1. On E.C.C. engines the engine temperature and vacuum, throttle, and gear (clutch) positions signal the "brain" to activate the shutoff solenoid. It is important to keep these wires and hoses connected or mind-boggling problems could arise.

A **catalytic convertor** was installed on 1975 and later California cars and 1976 trucks, then on all others in 1977 on. Unleaded fuel, which is low in phosphorus and sulphur, is required in these vehicles. The convertor is part of the exhaust system. It is a circuiting device that looks like a muffler and converts oxygen, carbon monoxide, and hydrocarbons into carbon dioxide and water. It is constructed of a bed of aluminum oxide pellets coated with Palladium and Platinum. E.C.C. engines use a three-way "cat" to oxidize and reduce nitrous oxides as well as CO and HC. Adequate oxygen and heat allow the unit to function. Other emissions control and fuel system components provide these ingredients. The oxygen is provided in a correct ratio by the Air Injection System or O_2 sensor (E.C.C. engines). If these are not working properly or the carburetor is too rich, convertor problems can result. Datsun/Nissan vehicles have a good track record with their "cats" holding up, as long as leaded gas isn't used and the systems aren't tampered with.

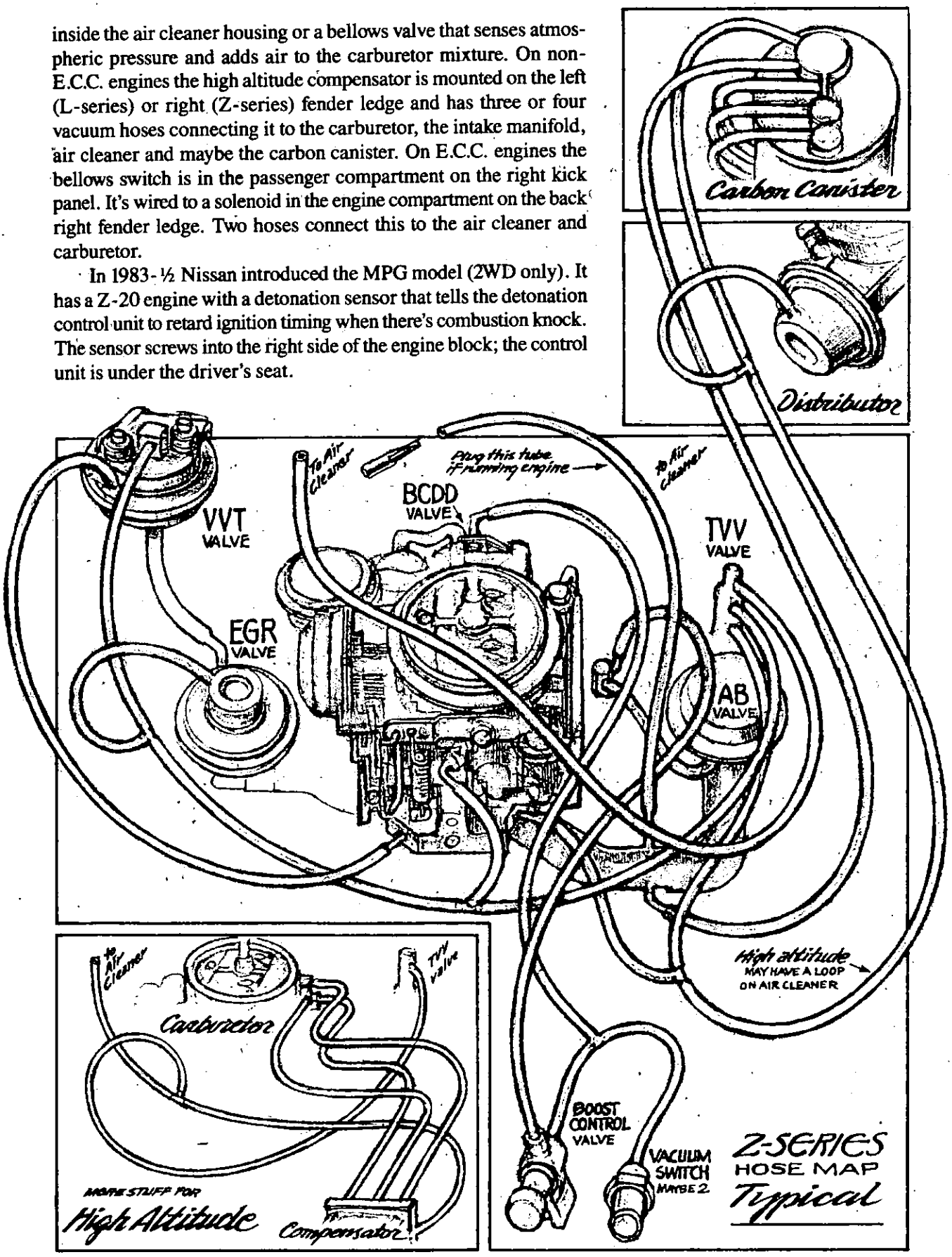
The Catalytic Converter is located in front of the muffler under the driver's seat, below the floor. Many cars have a temperature sensor, relay, and warning lamp that indicate when the "cat" temperature is too high.

On some vehicles there are **Spark Delay Valves** placed between the carburetor and distributor vacuum line or the carburetor and EGR vacuum line. These disk-shaped valves smooth out sudden changes of intake vacuum.

All new vehicles sold since 1975 in high altitude areas (over 4,000 ft) have either a high/low altitude switch

inside the air cleaner housing or a bellows valve that senses atmospheric pressure and adds air to the carburetor mixture. On non-E.C.C. engines the high altitude compensator is mounted on the left (L-series) or right (Z-series) fender ledge and has three or four vacuum hoses connecting it to the carburetor, the intake manifold, air cleaner and maybe the carbon canister. On E.C.C. engines the bellows switch is in the passenger compartment on the right kick panel. It's wired to a solenoid in the engine compartment on the back right fender ledge. Two hoses connect this to the air cleaner and carburetor.

In 1983-½ Nissan introduced the MPG model (2WD only). It has a Z-20 engine with a detonation sensor that tells the detonation control unit to retard ignition timing when there's combustion knock. The sensor screws into the right side of the engine block; the control unit is under the driver's seat.



Another masterpiece introduced in 1983½ is Spark Timing Control on all except MPG and camper models. There is a half-dollar sized Vacuum Control Valve clipped to the front right side of the cylinder head in front of the TVV, which screws into the top of the thermostat housing. The control valve either allows vacuum to advance the distributor timing or retard it slightly when under heavy load or at high speed. The TVV completely bleeds off vacuum to the distributor at certain temperatures. These two vacuum hoses are connected. I don't tell you how to test the control valve but suggest you keep it clean around the edges and examine its hosing for leaks. To test the TVV see Proc. 9 (5). This system is quite trouble-free.

Two other systems worth mentioning are the Mixture Heating Control and FICD Control. Some pre-E.C.C. engines have a pre-heater under the carburetor that warms the fuel mixture, when the engine's cold, to improve drivability. A coolant sensor (located near the thermostat) controls the current to the heater. On E.C.C. engines the current also goes through the "brain." If you have such a mixture heater, there should be a two-wire plastic connector plugged in below the right side of the carb. Don't confuse these wires with two brown wires and an eyelet connector.

Trucks with air conditioning have an electrically operated FICD switch, which keeps the engine happy while you're staying cool in the cab.

Nissan designed and voluntarily will install a "Drivability" kit on your USA-built Nissan truck starting with production date 4/85. It is a nice gesture that does little to improve drivability. Ask your dealer about "Tech. Bulletin" #TS85-078.

And now for the most important player of the lot, the Oxygen (O_2) sensor. This hard to test and expensive to replace device is mounted in the exhaust manifold. A single green wire connects it to the wiring harness and the E.C.C. control unit (brain). I include some brief tests in Proc. 15 and more about the E.C.C. system in Ch. 6, Pt. 1, Proc. 17.

In troubleshooting emissions system problems, the key related areas to cover are the filters (Proc. 2, 3 and 5), vacuum hoses, and wiring to switches, diaphram, and electrical valves, and also any tampering that has been done to alter the system. And because the emissions system is built around and with the fuel system, get to know the latter too (Ch. 6, Pt. 1, Introduction).

Aside from hoses, the first part of the emissions system to fail is usually the air (smog) pump (if you have one), its check valve, and the anti-backfire valve. The pump either gets noisy or the belt breaks and the pump freezes up. New and rebuilt pumps are expensive so people don't replace them unless a legal inspection requires it. The check valve can get a hole in it and leak exhaust gases. This could be dangerous. A bad anti-backfire valve causes excessive backfiring.

The EGR system is the other emissions component to fail. The EGR manifold, valve, and pipe are likely to plug up with carbon when the engine gets old. And the pre-1977 manifolds have plugs that burn out and cause exhaust leaks. The control valve can stick open and the engine will run roughly. These problems are covered in the following procedures.

I believe in emission controls but also understand that the systems can be expensive to repair. However, our environment is priceless and something for which each of us is responsible—ridepool when you must drive and use your car as little as possible, and not at all if it isn't running well.

PROCEDURE 2: TO CHECK AND SERVICE THE POSITIVE CRANKCASE EMISSIONS CONTROL SYSTEM—PCV VALVE, HOSING, AND BREATHER FILTER

Condition: You are here from Ch. 3. Or you suspect that the PCV valve is plugged or not working, as indicated by oil in the air cleaner or oil leaks due to excessive pressure in the crankcase.

Tools and Materials: Pliers, 17 or 19mm wrench, new PCV valve and/or new valve to crankcase hose (if necessary).

Remarks: The PCV system is crucial to engine operation.

Step 1: Check the PCV Valve to Crankcase Hose.

Find the PCV valve and its hose by reading Proc. 1. Replacement hoses are available from Datsun/Nissan.

•**Z-series:** You have to remove the air cleaner (Ch. 6, Pt. 1, Proc. 1).

Step 2: Test the PCV Valve in Place.

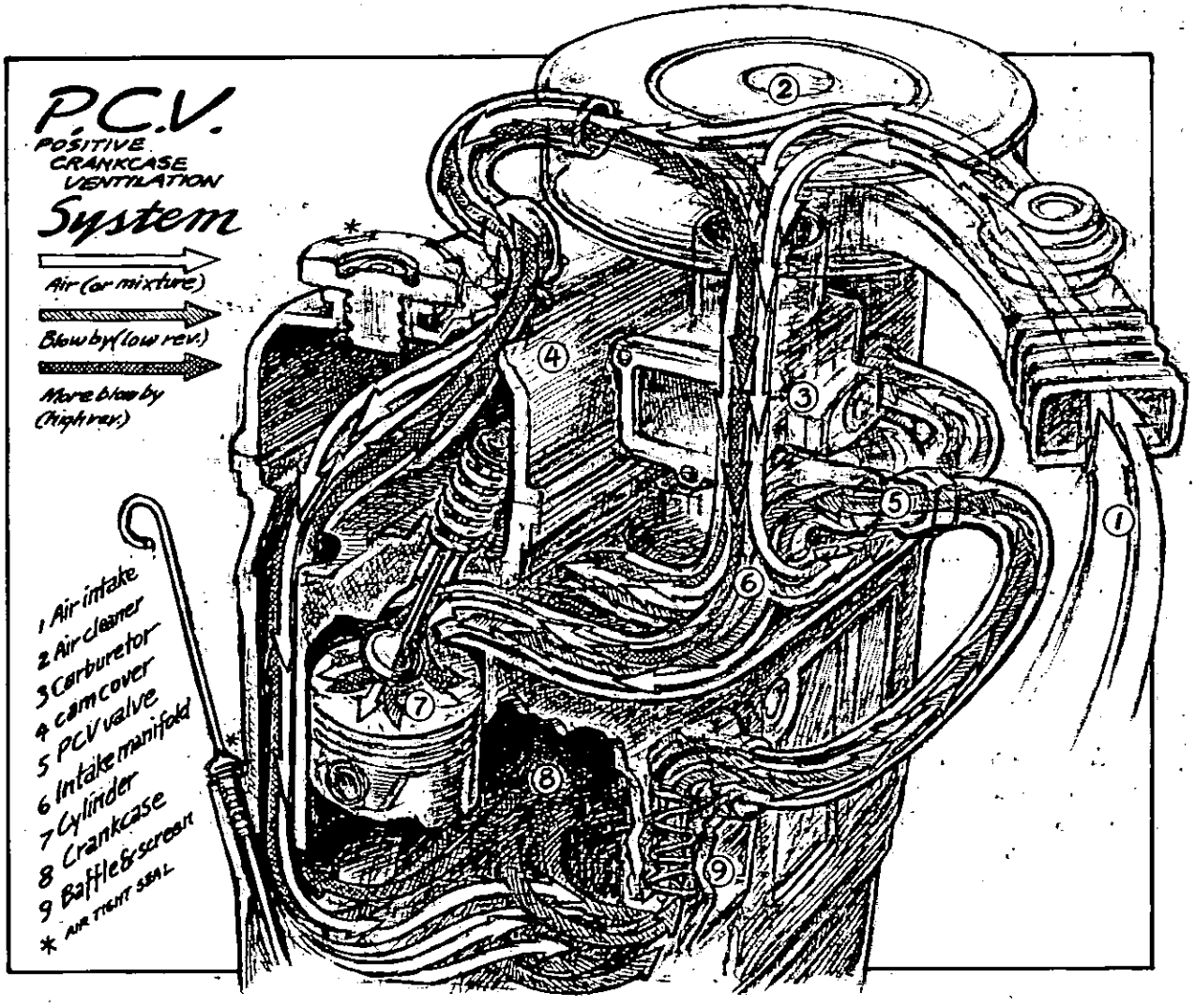
Pull the hose off the valve by spreading the devil's horn clamp and sliding it and the hose off the valve. A brittle hose will usually break and should be replaced. **Z-series:** You have to use a big screwdriver to pry the hose toward the engine.

Start the engine and run until warm. At idle, place a finger over the back end of the valve. You should feel a strong suction and hear a click. Remove your finger and listen for another click, then a steady hissing. Repeat this a few times. If the valve doesn't work, feels like it doesn't click much (suction feels weak), replace it right away. And for further testing, go on to next step. Soot and carbon buildup, symptoms of a worn engine, will plug or restrict the valve. If everything is clean and operable, slip the hose and clamp back in place. Stop engine and go on to Step 5. If you have to, replace the PCV hose. Use only dealer hoses. There are differences in these hoses, so give your correct engine size and year.

Step 3: Remove the PCV Valve to Test or Replace.

With the hose off, the valve can be removed. The hexagonal sides of the valve fit a wrench. Push down or forward to turn the valve counterclockwise. It may be tight so fit the wrench on it well.

Once it is removed, shake the valve body back and forth lengthwise. The valve inside should rattle, indicating it is moving freely. If it moves and rattles when shaken, it has a chance. Get your lips dirty by blow-



ing into the piece from the threaded end. No air should pass. Suck and blow through the hose end. Some air should pass on the suck and a lot should pass on the blow.

If you are in question, replace the valve. In a pinch, you can try soaking the valve in solvent or carb cleaner. But as soon as possible get a new one.

Step 4: Replace the PCV Valve and Hose.

Lightly coat the threads with anti-seize compound or penetrating oil. Thread the valve clockwise into its hole directly either into the intake manifold or extension fitting. Tighten it with a wrench until it's snug. Careful, the threads are tapered.

If you're replacing the hose, pull the big end off of the crankcase pipe below and remove the clamps. Place them on the new hose and slip it into place.

Step 5: Check the PCV Breather Hose and Filter.

This is the black hose that connects the top of the cam cover to the air cleaner. There's a filter in the air cleaner that needs servicing. You get at it by removing the top of the air cleaner, which is held on by a 10mm or wing nut and maybe three or four side clamps.

The filter probably has some dust and a little oil residue on it. It fits into the rectangular compartment next to where the hose connects on the inside wall of the air cleaner housing. If the filter isn't oil soaked—just dusty—go on to the next step.

If there's a lot of oil on the filter and in the bottom of the air cleaner, you have **blow-by** (Ch. 10, Introduction, and Proc. 1 and 2). The mess should be wiped up and the air cleaner checked for oil saturation before driving farther.

Step 6: Clean and Replace the Breather Filter.

If it's dry and still white or nearly, pry it out of its hole and try to knock the dust out.

If it's oily and dirty, you can soak it in carb cleaner or solvent and then shake and squeeze it out. When the filter gets really funky, replace it with one from the dealer.

Install the filter in its compartment after wiping the cavity clean. Replace the air cleaner top cover. Make sure it fits well and replace the wing nut and clamps (if there).

PROCEDURE 3: CHECK, MAINTAIN THE CARBON CANISTER EVAPORATIVE EMISSIONS SYSTEM

Condition: You are here from the Ch. 3 to clean the canister filter. This system was installed on some 1974 and all vehicles 1975 on. Keep it in good condition. NOTE: Pre-canister systems are not covered in this book.

Tools and Materials: Carbon canister filter, if necessary.

Remarks: I don't tell you how to troubleshoot this system other than by visual inspection. It is a sealed system. One of the hoses connects to the intake manifold vacuum. If this hose or the seal or diaphram on top of the canister leaks, you'll hear a hissing and the engine may run poorly. When replacing any hoses, be sure they are fuel and vapor resistant.

Step 1: The Layout of the System.

The carbon canister is located on the front left corner of the engine compartment. Three hoses are connected to the plastic cylinder. There should be color-coded markings to ensure correct replacement of the hoses. Color code: yellow—distributor vacuum; green—purge to air cleaner; blue—fuel tank; and white—plugged or connected to the carburetor.

Step 2: Remove and Clean or Replace the Carbon Canister Filter and Check Vapor Hoses.

Feel under the canister for a thin fiberglass filter.

Clean or replace the filter. If you can't reach the filter, you'll have to remove the cylinder by releasing and separating the clamp or spring around its center. Lift the canister straight up. You may have to remove the fuel tank hose from the canister. **Everyone:** The filter is in the base of the canister and will rip if handled roughly. The filter is replaceable, but can be removed, cleaned, and used again. Pinch one side and carefully slip it out. Replace the filter with one from your local parts house or the dealer. Don't drive in dust or at all if the filter is missing. To clean, simply shake and beat out. Renew the filter, if it's too ripped or clogged. Carefully slip it into the bottom of the canister.

Check the hoses. Look at the hoses and fittings on top of the canister. Note the condition and placement of the fittings and hoses. One or two of these connects to the intake vacuum. If the hose or cap looks cracked, fix it with a new hose or some silicone on the cap. If there's serious damage to the container, replace it. Follow the hoses to connectors or pipes. The connections and hoses must be leakproof, especially the ones that originate at the intake manifold.

If you see gasoline on or around the canister, consult a professional immediately.

PROCEDURE 4: CHECK, REMOVE, AND REPLACE THE AIR PUMP AND/OR AIR CONDITIONER DRIVE BELTS AND POWER STEERING PUMP BELT

Condition: You are here from Ch. 3, Proc. 8, or Ch. 7, Proc. 9, or this chapter, Proc. 7.

Tools and Materials: 12 and 14mm socket, ratchet and extension, hefty screwdriver or pry bar, a new belt if necessary (take the old belt with you for comparison).

Remarks: The engine will run with either belt disconnected. These belts probably have to be removed from the crank pulley to get at the alternator belt. If you are here from Proc. 7, check belt condition (Step 1). If okay, you need only loosen the belt, (Step 2). **Air Conditioned People:** Your belt is tightened much like the air pump belt, either swivel or idler pulley style. Read through these steps and use what pertains to you. You may have to remove the power steering pump belt (Ch. 12, Proc. 13). Factory air conditioners are always mounted on the left side of the engine, after-market ones may be on the opposite side.

Step 1: Check the Belt Tension and Condition.

The air pump and air conditioner are mounted on the left side of the engine below the air cleaner snout and the distributor. Some models use an idler pulley to adjust tension, while others have a swivel bracket on the pump or compressor. A frozen or worn air pump or compressor can be noisy and often wear out a belt or break it prematurely. If there is no belt, the pump pulley or compressor clutch probably won't turn or is stiff and is no good.

To check the tension of the belt, press on it half-way between the pump or clutch pulley and the pulley furthest away from it. There should be ¼in (7-11in stretch) to ½in (12-16in stretch) deflection when pressing your thumb firmly against the belt. If it is too loose or tight, adjust it. Examine the belt for peeling, fraying, or cracking. NOTE: On models with both an air pump and air conditioner there may be a drivebelt running the compressor and a common belt connecting the compressor to the pump.

Step 2: Adjust the Air Pump or Compressor Belt Tension.

NOTE: Don't make this adjustment if the belt is worn.

Determine which design you have. Air conditioner layouts are similar to or combined with air pumps. Early model air pumps swiveled on a bracket high up on the engine block. On many later models the adjustment is made by moving the idler pulley up or down; on still later vehicles the pump swiveled on a lower bracket. The three types are classified as upper bracket, idler pulley, and lower bracket.

•**Lower and Upper Bracket People:** Loosen the bolt and nut that hold the mounting bracket and pump or compressor together. If the mount is on the inner side, opposite the swivel bracket, the bolt runs through the mount and pump or compressor. Use two 12 or 14mm wrenches to loosen the nut a few turns. Find the nut and bolt that hold the pump to the adjustment bracket. These are usually 14mm. If they are loose, you can move the pump.

If the swivel bracket is an upper style, use an 18in screwdriver or the tip of a pry bar carefully placed against the engine block with the bar against the side of the pump or compressor to move the pulley and tighten belt.

If the swivel is the lower style, put your hand under the pump and pull it upward to move the body and take up belt slack. If you plan to replace the belt, go on to Step 3.

Move it in the opposite direction to remove the belt or tension. When tension is correct, tighten the 14mm nut and bolt on the adjustment bracket. Finally, use the 12 or 14mm open-end to tighten the pump or compressor to mounting bracket fasteners. Recheck the belt tension once more.

Idler Pulley People: If you ever worked on farm equipment, this style will be familiar. To the inside of the pump and below it there is a pulley mounted on a bracket. Find a nut in the front and center of the pulley. Loosen this 14mm nut a few turns counterclockwise. Now find the adjustment bolt on the bottom of the bracket. When turned, this bolt remains stationary while it moves the pulley up or down to alter belt tension. A few drops of penetrating oil on the threads of the bolt may help loosen it. If you want to remove the belt, go on to Step 3. I use a 12mm socket on an extension and work from below to make the adjustment. Keep checking the belt tension between the idler and crankshaft pulleys. Retighten the lock nut on the front of the idler pulley when the tension is correct.

Step 3: Remove the Belt.

In order to do this, the alternator fan belt may have to be removed (Ch. 7, Proc. 9 [4 and 5]). If you have an air conditioner, that belt may also have to come off.

NOTE: You may have to loosen and move the timing indicator aside to get the belt off the pulley (Ch. 7, Proc. 9). Check and replace any belts behind the one you're working on while it's off.

Step 4: Replace the Belt.

Fit the belt onto the correct groove of the crank pulley and onto the air pump or compressor and idler pulley if necessary. Replace the timing indicator and tighten the two bolts if removed. Make sure the belt is parallel to the pulleys.

Now adjust the belt tension (Step 2). Replace the alternator/fan belt, if removed (Ch. 7, Proc. 9).

PROCEDURE 5: REMOVE, EXAMINE AND REPLACE AIR PUMP INTAKE FILTER (Air Pump People Only)

Condition: It is due for maintenance; you have driven in dusty conditions. (This pertains to 1975 and later vehicles with air pumps.)

Tools and Materials: 10mm open-end or socket, rag, maybe a new filter, Phillips screwdriver.

Remarks: Do this only if the air (smog) pump works.

Step 1: Remove the Filter.

The housing and filter are blue and mounted in the left front corner of the engine compartment. An air hose connects the filter to a junction or the air pump. Two 10mm nuts hold the filter housing together and to a bracket. Loosen and remove these nuts with a 10mm socket. Pull off the whole housing. Pry off the two steel-backed rubber washers on the studs. These hold the filter and housing together. Store the washers with the nuts. Pull the filter and housing apart.

Step 2: Examine and Clean it.

If there's a lot of dirt in the housing, it should be separated from the air hose and cleaned out. Use a Phillips screwdriver to loosen the hose clamp, then wrestle the housing away from the hose. **California vehicles:** You may have to remove two vacuum hoses from the same side of the housing and a valve on top.

Look at the filter. If it has a lot of dust or greasy grime in its folds, shine a light through filter to see if any light passes. If it does and the grime shakes off, then the filter is okay. If you are suspicious, get another filter from Datsun/Nissan. Unfortunately, you have to buy the steel backing with the filter. Give the parts person your year and model.

Wipe the housing clean, even the little air inlet snout.

Step 3: Replace the Filter and Install in Housing.

If the housing is separate from the air hose, slip them back together, but do not retighten the hose clamp. Fit the filter element into the housing and turn the housing so that the inlet duct is on the bottom side and the two threaded studs are lined up with the bracket holes. Install the steel-backed rubber washers over the studs, rubber side toward the housing. Slip the unit into place. Thread on the 10mm nuts and tighten them gradually, one after another, until the housing is secure and the nuts are snug.

Tighten the clamp on the air hose if it was removed. **Newer or California People:** With BCDD valve and solenoid on top of housing, reconnect the vacuum hose from the solenoid to the filter backing and the long hose from the carburetor to the control valve.

PROCEDURE 6: CHECK, SERVICE, AND MAINTAIN EXHAUST AIR INDUCTION SYSTEM (EAI)

Condition: This is a maintenance item because there are one or two filter(s) involved. The system should be checked more frequently under dusty conditions.

Tools and Materials: Small Phillips or straight screwdriver, new filters or carburetor cleaner, hose clamp(s) for 5/8in heater hose.

Remarks: This is a simple system that is on all 1977 and later vehicles. There are two types in use: those with two pipes (Type A) for California engines and those with one hose (Type B) all Federal and Canada.

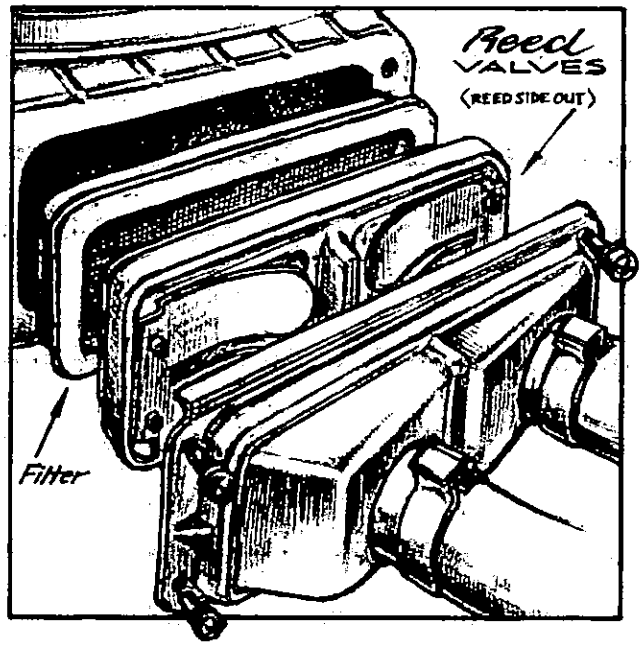
Step 1: Look at the System from the Outside.

Read Proc. 1 to get an idea of the layout and function. There is one or two air hose(s) that connects to the left or front side of the air cleaner housing. The pipe(s) that it (they) connects to is part of an assembly containing a case, reed valve packing, and a filter. The reed valve(s) allows air to pass out of the housing and into the exhaust system, but prevents back pressure from entering the housing.

Step 2: Test the System.

Disconnect the air hose from the induction pipe(s) that connects to the exhaust manifold. It can be a struggle. You need to suck and blow through the hose and against the reed valve in the air cleaner housing. Air should pass from the housing as you suck on the hose and stop when you blow against it. If you can't suck air, check the filter (Step 3). If you can blow through, check and/or replace the reed valves.

Start the engine. You should hear a strong exhaust noise coming from the vacant EAI tube(s), which increases when you rev the engine.



Step 3: Disassemble the EAI System Valve Assembly.

Four small cross-headed screws hold the case to the air cleaner housing. You can remove the case with or without the hoses attached.

Remove the screws, but don't drop them, then work the case away from the housing. The valve is behind the case. It should be clean and the reeds sprung toward the case, away from the air cleaner. The packing and filter are set in the housing.

Spray carburetor cleaner through the filter element to clean it. Or replace the filter if it's very dirty. Datsun/Nissan dealers stock these. Clean out the inside of the air cleaner housing if it's dusty.

Step 4: Reassemble the EAI Valve Assembly.

Install the filter and packing into the housing, then the reed valve, and finally the case with the pipe(s) pointing forward toward the front of the engine. Insert the four screws and tighten the assembly evenly against the housing. When secure, recheck the function of the valve (Step 2). Reconnect the air hose and tighten the clamps. Use 5/8in hose clamps(s) on the hoses where they connect to the induction pipes instead of the crimp or wire type clamps(s).

PROCEDURE 7: TEST AND REPAIR THE AIR INJECTION SYSTEM (AIS) AND THE AIR PUMP

Condition: You can't pass an auto emissions control inspection. You hear bad noises coming from under the hood. The engine backfires when you shift or decelerate. You hear "pssst" sounds. An exhaust leak?

Remarks: Catalytic Convertor People: A bad air injection system can cause more serious engine and convertor problems.

Step 1: General Air Injection System Problems

The belt at the front of the pump should be in good condition and adjusted properly (Proc. 4). Problems occur when the belt isn't on the pump for a long time, and the pump freezes. If the bearings wear out, the pump will get noisy or seize. If the pump inlet filter gets clogged, the pump will also be damaged (Proc. 5).

The check valve can burn out and leak exhaust. The relief valve seldom fails, but may plug up. The anti-backfire valve diaphram can fail and cause, you guessed it, backfiring through the carburetor and muffler. These parts can be replaced and are available from Datsun/Nissan (Steps 3-5).

Other parts like the CAC and Air Control valves (California) aren't common culprits, so I don't cover them in this book. If you have problems like an overheating catalytic convertor or backfiring you can't cure, make sure your hoses are connected properly, and consult a Factory Service Manual for your vehicle or take it to an expert.

The hose condition and connections throughout this system have to be good. Follow the illustration in Proc. 1 to check them.

Step 2: Inspect and Test the Air Pump.

If the drivebelt is connected to the air pump and the pump isn't damaged internally, its pulley should turn and the pump should work.

To test the pump, find the AIS check valve. Look at the diagram in Proc. 1 to locate the valve. Loosen the clamp and pull off the hose connected to the check valve. (Leave the air cleaner housing in place for this test.)

Start the engine. You should feel and hear air pumping out of the disconnected hose. Raise the engine speed. You should hear the hollow popping sound get faster. If the pump doesn't work, and you want to replace it, see Proc. 8. Reconnect the hose to the check valve even if the pump's bad. Leave it disconnected if you want to test the check valve (Step 3).

If you want to see if the air pump is the source of your noise, loosen and remove the drivebelt and run the engine. No noise means a bad pump (Proc. 4).

Step 3: Test, Remove, and Replace AIS Check Valve.

Remove the air hose connected to the check valve by loosening the hose clamp and coaxing off the air hose. Start and idle the engine. Place your hand over the exposed (inlet) pipe on the check valve. You should feel little or no pressure from the pipe. Raise the engine speed to medium engine speed. There should be no pressure (exhaust) felt on the open end of the valve. If there is or if you want to check the valve further, remove it. Turn off the engine.

To remove the check valve: Remove the air cleaner and housing (Ch. 6, Pt. 1, Proc. 1). Soak the threads where the valve and manifold connect with penetrating oil and wait until the engine's cold. Use a 15 or 16mm open-end and crescent wrench to hold the manifold side and another wrench to remove the valve. Turn the valve off counterclockwise. It will be tight and hard to remove.

With the check valve removed, perform the blow test. It's no joke. Blow through the threaded end of the valve. No air should pass. Turn the valve around and blow through the pipe end. Air should pass. If this little test fails or if the valve's corroded, replace the check valve with an exact duplicate from Datsun/Nissan.

To replace the valve, put oil on the threads of the manifold fitting before you install the valve. Tighten the valve clockwise until snug. Replace the air hose onto the valve inlet pipe. Replace the air cleaner housing (Ch. 6, Pt. 1, Proc. 1) unless you plan other tests.

Step 4: Test Remove and Reinstall the Air Injection System Relief Valve.

It's easier to remove the relief valve to test it. First, remove the air cleaner housing (Ch. 6, Pt. 1, Proc. 1). The relief valve is attached to the bottom of the housing by two cross-headed screws. There's a gasket between the valve and the housing. Test the valve by blowing through the pipe end of it. No air should pass. Next, plumb the valve into the hose from which it came and run the engine, no air should pass except at very high rpms. If the relief valve is bad, replace it. You may be able to scrape and bang enough rusty scale out of the relief valve to make it work. If the valve doesn't open at all, there would be no air discharged through it at high rpms. This valve is seldom replaced.

Reinstall the relief valve and its gasket against the bottom side of the air cleaner housing and replace the two screws. Replace the air cleaner housing connecting the air hose to the relief valve pipe unless you're doing more tests.

Step 5: Test the Anti-Backfire Valve. NOTE: Pre-1975 valves are not covered in this section. All L-20B engines have these valves, Z-20s got them in 83½ (1/83), and Z-22 and 24 engines got them in 5/82. (You need a friend to help you perform this step.)

The weak point of this valve is in the diaphram. It isn't rebuildable and is expensive to replace.

To test the valve on the engine: On 1975 and later L-20B engines the valve is located behind and under the air cleaner housing. On Z-series engines the valve is in front of the carburetor float bowl (see layout in Proc. 1). Make sure all the hose connections to the valve are secure (two larger on one small vacuum hose), correctly attached, and in good condition. The inlet connects to the air cleaner and the outlet to the intake manifold. The vacuum hose connects to the intake manifold via a pipe or hose connector. Disconnect the inlet hose from the valve.

Connect a tachometer, if you can't judge engine speed.

Cover the exposed end of the valve pipe with a cork or some duct tape. Start the engine and let it warm up. Expose the pipe and recover it with your thumb. If you feel suction or positive pressure, the valve is faulty and should

be replaced. So far so good—no suction? Have someone operate the accelerator from the driver's seat. Place your thumb lightly over the exposed pipe again. Tell your assistant to raise the engine speed to 2,500 or 3,000 rpm or (medium) engine speed, then quickly release the accelerator. As the engine speed drops off, you should feel a suction against your thumb momentarily, indicating that the valve is functioning.

If the test fails, replace the valve but only after repeating the test a few more times and then again after it is removed. Remove the valve by unclamping and twisting off both air hoses and the smaller vacuum hose.

To test the valve once it is removed from the engine, connect a piece of 5/32in (4mm) vacuum hose to the small pipe on the side of the valve. Have your helper blow into the valve's threaded inlet pipe. No or very little air should pass. Now, suck on the vacuum hose with gusto while your helper blows. Your friend's breath should pass through the valve. If this test fails, replace the valve. If you can suck on the vacuum hose without feeling resistance and your hose connection is good, the valve is shot. Get the exact replacement from Datsun/Nissan.

PROCEDURE 8: REMOVE AND REPLACE THE AIR PUMP

Condition: You know it's faulty and needs to be replaced. Read through Proc. 1 and 7 to determine if the pump is any good. There's excessive noise from the pump before and after tightening belt.

Tools and Materials: #2 Phillips screwdriver, 12 and 14mm wrenches and sockets, new fan belt, new or rebuilt pump.

Remarks: Before starting this procedure, find out where and if you can get a pump. I buy rebuilt pumps from my parts supplier.

Step 1: Locate the Pump and Loosen the Drivebelt.

The air pump is on the driver's side of the engine (left front). Remove or loosen the belt (Proc. 4 [2]).

Step 2: Loosen and Remove the Air Hoses.

There are two hoses on the back of the pump. Each is held in place by a clamp. Use some penetrating oil and a Phillips screwdriver to loosen the clamps. Now comes the hard part. These hoses stick to the pipes like pilot fish to sharks. Use large pliers or channel locks to twist the hoses on the pipes slightly and carefully to unstick the hoses. If you can't get them off the pump, follow the hose up to the closest fitting and try there. You can separate the hose(s) from the pump later.

Step 3: Remove the Pump.

There are three styles of adjustments on these pumps. Refer to Proc. 4 (2 and 3) to determine which pump you have and to remove the drivebelt. Then return here.

•**Upper and Lower Bracket People:** Remove the 14mm nut and bolt (washers) that hold the adjustment bracket and pump together. Look either under or to the side of the pump where it connects and swivels on the mount attached to the engine. Loosen and remove the nut, bolt, and washers (12 mm). If it is difficult to remove the pump, you may need to remove the bolt that secures the adjustment bracket to the timing cover, or at least loosen it to swing the bracket out of the way.

•**Idler Adjustment People:** The pump is held at the top by a bracket and at the bottom by the idler bracket and a mount attached to the engine. The upper nut and bolt are 14mm. Remove these and keep the washers on the bolt with the nut. The lower bolt goes through the idler bracket, the pump flanges, and mount. It is also 14mm and has washers on either end.

•**Everyone:** (NOTE: There may be variations to these mounting arrangements.) Once the fasteners are out, the pump will come off the mountings and away from the engine. Store all of the nuts, bolts, and washers together. Label these and any hoses with a diagram or masking tape.

The new pump, if rebuilt, is sold on a cash on return (COR) basis. Take the old one with you to compare it with the replacement. You may have to reuse your pulley. Replace any hoses (and the drivebelt if deteriorated).

Step 4: Replace the Air Pump.

Look at the pump and the mounting holes in it. When you have the mounting and pump lined up, install the long swivel bolt with washers in place. Don't tighten anything until you're sure the pump will move up (or down) into a position compatible with the adjustment bracket. If you removed or loosened the adjustment bracket, replace it, lined up with the pump. Before tightening the bracket, fit the belt on the crank pulley and idler pulley to see if everything fits together. Keep trying until it all lines up and the belt's in place. Start the adjustment process if all of the nuts and bolts are where they should be (Proc. 4 [4 then 2]). Replace the timing indicator if disturbed when removing the drivebelt.

Reconnect the air hoses and clamps to the back of the pump. Recheck all connections throughout the system.

NOTE: It may take a short time for the pump to break in and stop squeaking. Save your warranty and receipt.

PROCEDURE 9: TEST THE EXHAUST GAS RECIRCULATION SYSTEM, EGR WARNING LIGHT, AND MANIFOLD (Replace Thermal Vacuum Valve)

Condition: The EGR warning light is on, you want to test the warning light and the rest of the system because of rough idle, missing, poor acceleration, or exhaust noise in engine compartment. Rough running when engine is cold.

Tools and Materials: 1ft (or 2ft BPT and VVT people) 5/32in (4mm) vacuum hose.

Remarks: This system controls nitrous oxide (NOx) emissions. NOx isn't tested for in vehicle pollution inspections.

Step 1: What the EGR Light Means and How to Turn it off.

Many vehicles do not use this warning light, but do have the system.

When this light comes on, don't freak out. A physician I know was in the boondocks driving a friend's Datsun when the EGR light came on. Fearing that continuing to drive the car would damage it, not knowing what to do and finding no owner's manual, he parked the car and hitchhiked. I suppose Datsun would argue that the light was installed to keep the emissions control system maintained, but others would differ. There is more than one way to get customers to bring their vehicles back to the dealership for servicing. The light is only a reminder to clean the EGR valve ports—a sound idea. The counter that operates the light reaches 50,000 at 12,500 miles. When an engine is old and consumes oil, the EGR should be checked at least that often.

The counter and reset button are housed in a small metal box inside of the engine compartment.

610: On the right side of the engine compartment toward the rear.

710: On the right rear corner of the engine compartment mounted onto and in front of the windshield wiper motor.

620: On the right center/front side of the engine compartment.

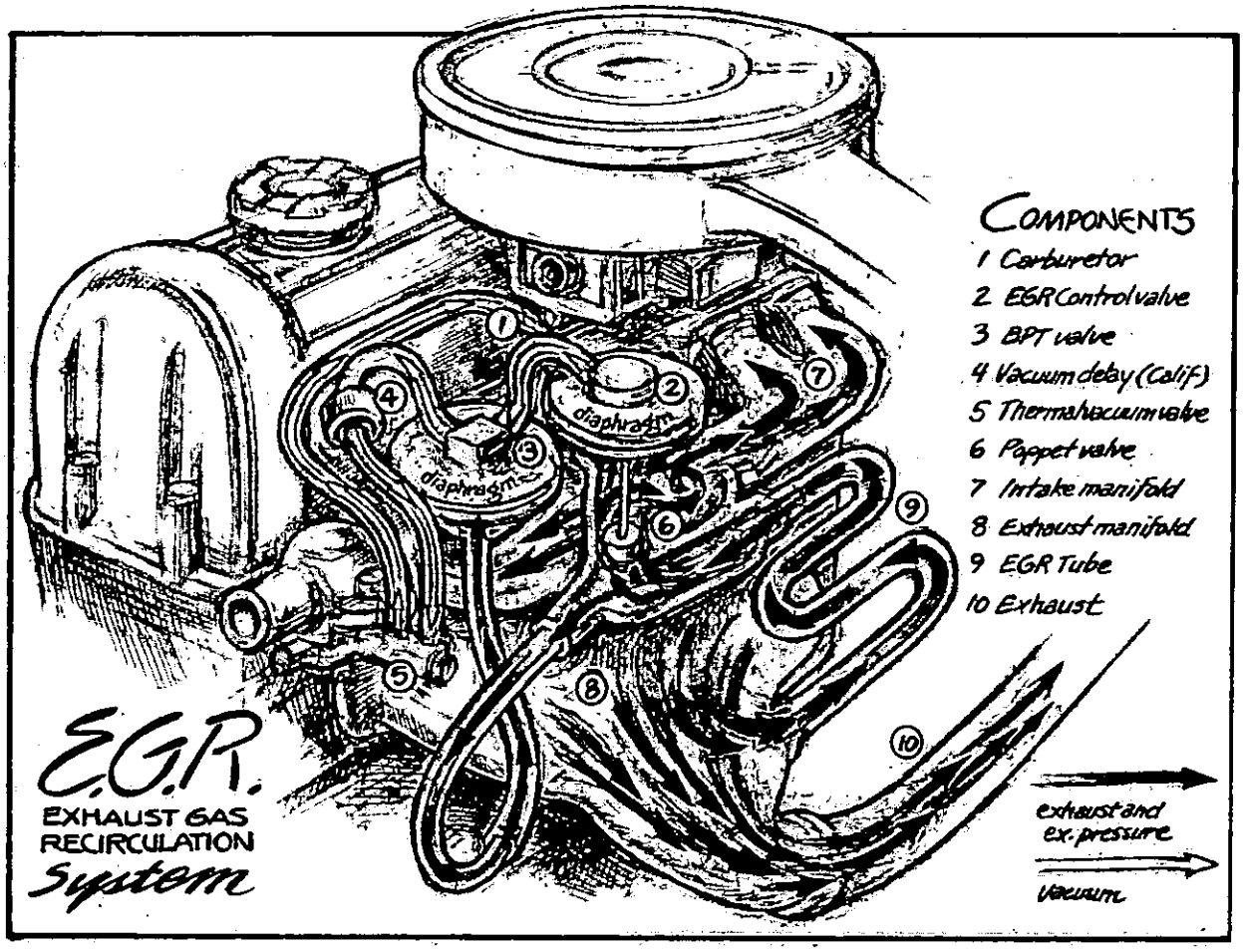
There's a small window on the top or side of the box where the numbers registering on the counter are visible. Remove a small black rubber grommet, if there is one, from a hole in the top or side of the box. The reset is operated by pushing a paper clip wire through the hole.

With the counter reset, the EGR warning light should go out. Replace the little grommet.

If you haven't serviced the control valve, do so soon. It will save you from having problems later.

Step 2: Test the EGR Circuit with the Engine Running.

Start the engine. Have your assistant operate the accelerator. Stick your finger under the top part of the valve through the cutaways and feel the flat diaphram within. This is hard to do on Z-series; you have to reach around



the back of the valve. When the engine is cold, the system should remain inoperative. Increase the engine speed to 2000-2500 rpm (mid or high speed). The diaphram should not move. If it does, refer to the test procedures in the following steps. When the engine is thoroughly warmed up, repeat the test and raise the engine speed to the specified level. The valve should open. If it doesn't, perform the following steps after you turn the engine off.

Step 3: Test the EGR Control Valve and its Housing.

It is easier to deal with this valve with the air cleaner housing removed (Ch. 6, Pt. 1, Proc. 1).

•**1977 and Later People:** Don't confuse the EGR valve with the BPT or VVT valve. Feel the underside of the valve housing. Press up on the diaphram to make sure the valve isn't stuck. Whether it moves or not, do the next step and, if necessary, remove it for inspection, cleaning, and possible replacment.

To test the valve: Locate the vacuum hose leading to the EGR control valve. Working carefully, bend back the two side clips and twist the hose off its little pipe. Attach the piece of test hose to the pipe on the EGR valve, making a good fit.

Place your fingers under the valve to feel the diaphram then suck on the end of the hose. The diaphram should move upward when very little suction is applied. It should move up and stay open for at least 30 seconds. If it does not stay open or move at all, recheck your hoses and connections. Still no luck? Remove the valve and test off the engine (Proc. 11). Reconnect any disconnected hoses if you are through with the tests.

•**1974 and Later People:** Go to Step 4.

Step 4: Test the EGR Solenoid and Water Temp Sensor.

•**1974 Models:** You can tell that you have a solenoid if there is a cylinder next to the control valve. The water

temperature sensor is located at the base (front) of the thermostat housing. Two wires connect to it. When the engine is cold, the temperature switch closes and current passes to ground. This in turn operates a relay, sending current to the EGR solenoid. When the solenoid is operated, manifold vacuum is bypassed away from the EGR control valve rendering it inoperative.

The most likely component to fail other than the EGR valve is the thermal vacuum switch. Because there aren't many models with this system still operating, I do not cover its testing. Check the wiring and hosing to the solenoid and switch if the EGR valve and manifold check out. Refer to a Factory Service Manual for more information. NOTE: All models with this type of system except 1974 610's have an electronic module that operates it.

Step 5: Test the EGR Vacuum Circuit and Thermal Vacuum Valve (TVV).

•**1975 and Later L-20B and All Z-series Engines:** Follow the vacuum hose from the EGR valve (past the BPT or away from the VVT if you have one) to the thermal vacuum valve. On L-20B engines this screws into the lower section of the thermostat housing with two plastic pipes built into a brass base. On Z-series engines the valve's screwed into the front and top of the thermostat housing. If the EGR valve doesn't function when the engine is warmed up or functions when the engine is cold, this valve is probably faulty. These valves are usually replaced when they're broken rather than due to failure.

The TVV allows vacuum to transfer to the EGR valve when the engine is hot. The engine must be cold to test this valve.

•**L-20B People Without BPT and Spark Delay Valves:** Find the rubber vacuum hose connected to the little pipe on the inside of the valve, the pipe that's closest to the engine. This hose goes to a steel pipe that runs along the side of the engine to the inside base of the carburetor. Pull the hose off the steel tube near the valve, but not at the valve. No air should pass as you suck through the hose. The valve should be closed. If suction passes, remove the valve and test it in water with a thermometer (Step 8).

•**L-20B People With BPT Valves and Spark Delay Valves:** Carefully pull off the hose at the spark delay valve or the BPT valve, closest to the thermal vacuum valve. Then do the test above.

•**Z-series People:** Your valve has three pipes. Follow the hose from the center pipe to a T-junction and pull it off the connector. Suck on the hose and air should pass easily through the valve. No air? Remove and further check the valve, (Step 8). This same test applies for spark control except that the lower hose and pipe are tested.

•**Everyone:** If the valve tests out when the engine is cold, reconnect the disconnected hose and warm up the engine. All other exposed vacuum ports should be plugged (Ch. 6, Pt. 1, Proc. 1).

When the engine is fully warmed up, turn it off. The thermal vacuum valve should now be open. Pull the hose off of the steel tube or connector again. If you have a BPT valve, disconnect that hose too. Suck on the hose. On L-series engines air should pass through the valve if the engine is warm. On Z-series engines no air should pass; the valve should be closed.

If any of the thermal vacuum valve tests fails, the valve should be removed and tested in boiling water. Repeat the tests described above. Put only the metal part of the valve in the hot water (Step 8 to remove and replace the TVV).

•**People Without BPT and Spark Delay Valves.** Turn to the EGR manifold checkouts (Proc. 10).

Step 6: Test the Back Pressure Transducer (BPT) or Venturi Vacuum (VVT) Valve.

(Do this step with a cold engine.) This little gem was designed into the EGR system to smooth out idle and high speed running.

The hose on the bottom of the valve transfers exhaust gas into the valve's diaphragm. This pipe can clog, so it should be removed and inspected. A 10mm fitting holds the pipe to the exhaust manifold. Soak the threads of this with penetrating oil, then try to loosen it. Once the fitting is loose, pull out and separate the pipe from the hose at the valve. Blow through the pipe. If it is plugged, use mechanic's wire to try and ream it out.

The BPT or VVT valve can be tested in place. It takes two people. Connect a 1ft length of 5/16in hose to the bottom pipe of the valve. **L-series People (BPT):** Connect another piece of hose to one of the top pipes. And if you have two pipes, plug the opposite one with your finger. An exceptional human might perform this

test alone. Blow and suck through the top hose. Air should pass. If it doesn't, try the other top pipe if you have it. Still nothing? The valve is plugged. If clear, blow through the bottom hose (pipe). The diaphram inside the valve should move. Have your assistant blow on the top hose. Breath should pass.

•**Z-series People (VVT):** Connect the second length of hose to the uppermost pipe. Have your helper blow through the bottom pipe while you suck on the top one. No air should pass (valve closed). Now move the bottom hose up to the pipe on the side. You suck through the top one while helper sucks through the side one. No air should pass.

•**Everyone:** If either of these tests fails, remove the BPT or VVT valve for further testing and/or replace it. If the valve works and the hoses are in good condition, reconnect the top hoses to the system. The lower pipe and hose connect the bottom of the valve to the EGR passage. Apply anti-seize compound or penetrating oil to the threads before snugging the nut.

Step 7: Remove and Test the Vacuum Delay Valve.

•**L-20B People Only:** This valve may be between the thermal vacuum valve and the BPT valve behind the distributor. One side of the plastic cylinder is brown and the other white. The brown side should face the thermal vacuum valve and the white the BPT valve. Carefully twist the hose off while holding the valve steady. This valve works to slowly bleed the vacuum pressure to the BPT and EGR control valves.

To test the valve, blow through the valve's white side. Air should pass. Next, blow through the brown side and a lesser amount of air should pass. If either of these tests fails, replace the valve. However, the system *will* function without the valve.

Reconnect the valve in the position described above.

Step 8: Remove, Test and Replace the Thermal Vacuum Valve or EGR Temperature Sensor Valve.

These valves are located on the base of the thermostat housing. On 1974 engines it's on the front side; and on 1975 L-20B engines it's on the left side. On all Z-series, it's on the right side of the engine atop the thermostat housing. They're usually only replaced if broken.

Drain a quart of coolant (cold) from the radiator (Ch. 8, Proc. 2).

•**1974 People:** Disconnect the two wires leading to the sensor at the bullet connectors.

•**1975 on People:** Gently remove the two or three hoses from the plastic pipes.

•**Everyone:** The sensor or valve can now be turned out of the housing with a 17mm wrench (22mm on Z-series) counterclockwise. Be careful not to break the pipes if you want to save the valve. Test the valve outside of the engine (Step 6). Try finding a used one at wrecking yards or go to the dealer. NOTE: Some A-series B210, F10 vac valves are interchangeable with their L-series counterparts. To be sure match the valve correctly with your local Datsun/Nissan dealer.

Put gasket sealer on the new valve's threads before installing it, making sure the valve's or sensor's threads are started straight. Turn it in clockwise and tighten only until snug. Overtightening will crack the housing.

•**Thermal Vac Valve People:** Point the pipes straight up or rearward and refit the hoses carefully. **L-series BPT:** The one close to the engine goes to the carburetor base. **Z-series VVT:** The top hose goes to the air cleaner, the middle to the EGR, and the lowest to carburetor and canister.

•**Sensor People:** Join the wires at their bullet connectors.

•**Everyone**: Refill the cooling system (Ch. 8, Proc. 2).

PROCEDURE 10: INSPECT, REMOVE, CLEAN, AND REPLACE THE EGR TRANSFER PIPE AND PASSAGE (MANIFOLD)

ion: 25,000 mile emissions control system maintenance. The passage of the EGR control valve, is plugged. There's an exhaust leak in the engine compartment. The front plug or the manifold has burned out.

Tools and Materials: EGR passage (manifold) to intake manifold gasket, 22mm soft plug (Toyota #96411-42000), basic socket set.

Remarks: L-series: In 1974 the passage is a unique shape. From 1975 on the piece remained almost the same shape; however, it changed from an aluminum alloy to cast iron in 1977. **Z-series:** Your passage is part of the intake manifold; you can't remove it. Follow through this procedure doing what you can.

The engine should be cool for this test.

Step 1: Inspect the Passage (EGR Manifold) (L-series only).

The EGR valve bolts to the EGR manifold (Proc. 1). Use a good light and your hands to feel around the bottom and sides of the EGR manifold. If the body has rotted out (as on many early models), you have to replace it with a new or used one. This is where you get exhaust leaks. On 1975-77 models, front plugs corrode and are replaceable using 22mm plugs from Toyota. Buy your parts before doing Step 2.

Step 2: Remove and Clean the EGR Transfer Tube.

•L-18 (1974) and L-20B and All Z-series People: The EGR transfer pipe also plugs up. It's often a bear to remove because of rust. Grab your penetrating oil and follow me.

On the EGR manifold end of the pipe there is a flared nut. On the exhaust manifold end there is a male flare fitting. Squirt penetrating oil onto the threads at each of these points and let it sit. I use an 8 or 10in adjustable wrench and/or (on L-18 engines) a 24mm or 15/16in open-end. A 22mm or 7/8in open-end holds the fitting that goes into the manifold. **1975 on L-20B Engines**: The fittings are 17 or 19mm. **Z series:** It's a 30mm (13/16in) female on the intake end and 24mm (15/16in) male on the exhaust end.

•L-18 and 20B: Fit a wrench to the exhaust fitting. Because of the steering column you have to fiddle with the position of the wrench. I use a short open-end combination from a VW tool kit. **Z-series:** The exhaust nut is accessible on the back side of the manifold. **Everyone:** Push the wrench down to loosen the pipe. It will inevitably be rusted tight. Use plenty of penetrating oil and patience. Turn the long fitting out. Remove the intake end of the pipe the same way. (This is also a difficult nut to crack and harder to reach on Z-series.) A pair of channel locks may help. *Do not* put excessive force on the upper fitting. The passage around it may crack.

Remove the pipe and then blow through it to check for blockage. Use a flexible but strong piece of wire to ream out the pipe if it's not completely stuck up. Tap the end of the pipe against a block of wood to clear the debris. Wire brush the rusty threads. **L-series:** You can remove the fitting on the EGR manifold either now or when the passage is removed if it's plugged. **Everyone:** Sometimes these pipes are too plugged to clear, but it is difficult to get new ones from Datsun/Nissan too. Try to get and keep the pipe clear. A VW or diesel mechanic, experienced with unplugging heat risers, might help you get it clear!

Step 3: Remove the EGR Passage (manifold).

•L-18 and L-20B Only: Loosen the PCV valve while the manifold is in place. If you intend to replace the manifold, be sure to have a new gasket called the EGR passage (or manifold) to intake manifold gasket available from Datsun/Nissan, or in some engine gasket sets. NOTE: 1974 L-18 gaskets are different.

The EGR manifold is attached to the left side of the intake manifold. The EGR control valve is mounted on top of the passage. (If the air cleaner hasn't been removed, take it off (Ch. 6, Pt. 1, Proc. 1).

•L-18 People: There are three hoses and a wire to disconnect. Start at the EGR valve. Separate the blue wire at the bullet connector and remove the vacuum hose at the solenoid valve. Working rearward pull the other vacuum hose and the PCV hose. There are four 12mm bolts to remove. Use a socket and extension.

•L-20B People: Pull the vacuum line that connects the control valve and the thermal vacuum valve away from the vacuum valve (gently, it's plastic). Behind the EGR valve on the manifold find another vacuum hose and disconnect it (this one goes to the air cleaner). Unhook any plastic twisties and the grommet in the air cleaner support. Next pull off the hose (silver) from the PCV valve by spreading and sliding back the clamp with pliers. Inside this silver hose is another large and a small hose, both of which connect to the AB valve. They are easier to pull off while you're removing the passage.

•BPT 1977 on L-20B People: The BPT valve is also plumbed onto the EGR passage, as well as the control valve hose. Remove the 10mm fitting nut with penetrating oil. If tight see Ch. 13, Pt. 1, Proc. 2. Separate the vacuum line from the T-fitting between the thermal vacuum valve and control valve. NOTE: Keep the BPT

on its bracket or with the EGR passage (manifold). Two 12mm nuts and one bolt hold the EGR manifold to the intake manifold. Loosen them, counterclockwise. Don't lose these washers and bolts. Use a hammer to tap around the main passage (manifold) to free it from the gasket.

•**L-20 B People:** Work the passage off the studs. A screwdriver carefully inserted between the passage and the manifold will coax the piece off. Most plugging occurs in the fitting end. Blow through it. Remove fitting if it's plugged. Use a 5/16in drill bit to clear the fitting. If you replace the EGR passage, all of the fittings must be changed. Note the fittings' positions; clean their threads and do not overtighten them while installing.

Step 4: Clean the EGR Passage.

•**L and Z-series People):** Remove the EGR control valve (Proc. 11).

•**1977 on L-20B Cast-iron People:** Remove the hexagonal plug in the front of the manifold to facilitate cleaning.

•**L-18 and 20B People:** Try to clean out the passageway well. Skillfully use a pocketknife to clean and scrape. If the carbon is thick, it's a drag. Clear all the ports, using whatever tool does the trick, e.g., a coathanger. Sand the mating/gasket surfaces with emery cloth.

•**1975-76 L-20B People:** If one or more of the soft plugs is corroded, it can be replaced with a 22mm soft plug. You need a hacksaw blade, a small chisel or screwdriver, a hammer, and safety glasses. Mount the passage in a vice, if possible. Cut through the plug in two places to collapse it; then chisel the piece out, without damaging the rest of the manifold. Use pliers to grab the remaining part of the plug.

Clean out the groove. Apply a coating of gasket sealer (any kind) to the edge of the new plug. Start the plug into the manifold, lips facing out. Tap it in with a large punch until it's flush with the edge of the passage.

•**All L-18 and L-20B People:** Transfer the fittings from old to new EGR passage. Take care not to overtighten them. The threads are tapered and may crack the housing.

Swap the PCV valve, which should be loose. Prepare the mating surface on the intake manifold. Although this is painstaking, a good seal is crucial.

•**L and Z-series People:** Now clean out the port(s) going into the intake manifold, removing all of the grime. I use baling wire with bent rounded ends for this. Keep the loose carbon out of the engine. Install the EGR valve now (Proc. 11).

•**L-18 and 20B People:** Prepare the manifold bolts and studs by coating their threads with a bit of anti-seize compound or penetrating oil. Account for all of the bolts, and nuts, and washers and set them aside. Line up the gasket to the studs or holes in the manifold. Insert the bolts with washers and/or start on the nuts until just contacting the passage. Tighten the fasteners evenly until snug. The passage must be flush against the manifold.

Replace the PCV valve, if removed (Proc. 2 [4]).

Step 5: Reconnect the EGR Hoses.

•**L-Series:** Do this only if the EGR and BPT valves are in place (Proc. 11).

•**L-18 People, 1974:** Connect the blue wire to the bullet connector leading to the solenoid. The vacuum hose runs to the pipe on the solenoid from the inside base of the carburetor. Another vacuum hose connects to the pipe on the top of the EGR passage (leave this off until the air cleaner is replaced). Connect the PCV valve to the crankcase blow-by hose and the clamp.

•**L-20B People:** Reconnect the vacuum hose from the manifold to the vacant pipe on the thermal vacuum valve. When the air cleaner is in place, connect the other vacuum line to the pipe fitting mounted on the EGR passage. To the inside of the PCV valve fitting install the air hose for the anti-backfire valve and a smaller vacuum hose. Both are hard to install. Push on the hose and replace the clamp.

Install the PCV valve hose and its clamp.

•**L and Z-series:** Pick up the EGR transfer tube and clean the threads of the fitting on the EGR passage and those on the male end of the tube with a wire brush; then coat each with anti-seize compound. Do likewise to the fitting(s) on the tube. The end with the nut fits the intake manifold and the smaller male end on the exhaust manifold. Get both ends started before tightening either one all the way. Draw the tube into place even-

ly as you tighten one then the other. Finish by snugging the fittings firmly with the wrenches you used to loosen them. (This can be a struggle.) Recheck all hoses and fittings. Replace the air cleaner, if removed (Ch. 6, Pt. 1, Proc. 1).

PROCEDURE 11: REMOVE, CLEAN AND REPLACE THE EXHAUST GAS RECIRCULATION (EGR) CONTROL VALVE AND BPT OR VVT VALVE

Condition: You want to maintain the system, the EGR light came on, the valve is faulty or plugged up. You have loosened the transfer tube (Proc. 10 [2]).

Tools and Materials: 12mm open/box-end wrench, medium screwdriver, EGR control valve to passage gasket, pocketknife, new control valve, if necessary.

Step 1: Remove the EGR Control Valve.

It helps to have the air cleaner housing off (Ch. 6, Pt. 1, Proc. 1). Two 12mm nuts (and washers) hold the valve to the EGR manifold. Pry back the clips and remove vacuum hose from the EGR valve.

Remove and stash the nuts and washers. **L-20B:** The air injection hose has to be displaced to remove the valve. Tap or pull the valve off the manifold.

Note the gasket under the valve may stick to either or both of the surfaces.

To test the valve, see Proc. 9.

To clean the EGR valve: Work over newspaper or a garbage can. Use a pocketknife to clean out the ports and scrape the gasket surfaces. Turn the valve upside down and find the valve stem sticking through the inlet port. If the valve is stuck, squirt penetrating oil down the stem and leave it. Try to work the shaft up and down with pliers to free it.

Scrape off the mating surface on the EGR manifold. A carefully handled razor blade works well. Keep scraps out of the manifold. Clean it as thoroughly as possible (Proc. 10 [4]). **L-series:** If the manifold is too plugged, remove and clean it (Proc. 10).

To replace the valve: Jump ahead to Step 2 after sanding off the valve and manifold mating surfaces with emery cloth. If you plan to replace the control valve, take the old one to Datsun/Nissan along with your model and year.

Step 2: Replace the EGR Control Valve.

•**L and Z-series:** You must have a new EGR valve to passage gasket. Coat the threaded manifold studs and the gasket with anti-seize compound or grease. Put the gasket over the manifold studs. Fit the control valve down over the studs until flush. Install the washers, if there are any, then tighten the nuts evenly until snug.

Slip the vacuum hose onto the solenoid (1974 People). Place the hose back on the EGR valve and pinch the clips against it.

Replace the air cleaner housing if removed (Ch. 6, Pt. 1, Proc. 1).

Step 3: Remove and Replace the BPT or VVT Valve.

•**L-20B and Z-series:** Remove the top vacuum hoses. The valve is held onto a bracket by two 8 or 10mm bolt screws. Remove these and the valve will come off. Pull off the lower hose as you do this.

To install: Put the valve in place with the upper pipe pointing toward the distributor and engine. Start the two bolts and tighten them evenly. Connect the lower hose.

PROCEDURE 12: CHECK, REMOVE AND REPLACE THE HOT/COLD AIR DUCT VACUUM MOTOR AND MAKE SEASONAL ADJUSTMENT (EARLY MODELS)

Condition: This system controls the temperature of the air entering the air cleaner housing. When the system is functioning improperly, the idle will be affected as well as mileage and emissions levels. In cold weather, carburetor icing and poor performance (stalling and hesitation, lack of power) will result as well as moisture buildup inside of the engine. If there is an annoying rattle coming from the air cleaner snout, chances are the air control flap is detached or loose.

Tools and Materials: 6in of 5/32in (4mm) vacuum hose, screwdriver.

Remarks: In this procedure you can test the vacuum motor or diaphram. I don't cover the temperature sensor because I have never found one to fail. Refer to the Factory Service Manual for further testing.

Step 1: Of What Does The System Consist ?

diaphragm **Early L-16 models versus Later Models:** You can define who you are by looking at the snout of your air cleaner. Older models have a manual control labeled summer and winter. On *summer* setting the valve should allow fresh air into the engine. On the *winter* setting, hot air via a hose from a heater on the exhaust manifold is drawn into the engine. (All other models have self-controlled systems as described below.) If this hose is missing or damaged or the flap in the snout isn't working, you will have warmup and running problems in colder, damp weather. One foot of 1½in or 2in reinforced paper duct hose (hot air hose) with clamps on either end will serve the purpose. The dealer sells the best quality and most expensive hose. Lately, it has also been available at foreign parts stores.

Although the engine will run without the system working, it will affect engine performance, wear and gas mileage. If the control (summer/winter) is stuck, apply penetrating oil to free it. The valve should be closed to the hose in summer and open to it in winter.

Later Models (1972 on) incorporated an automatic flap control that was designed to keep the temperature of the incoming air uniform. 1975 on models used a temperature sensor mounted inside the air cleaner housing to further refine the system's operation. The so-called vacuum motor (diaphragm) that controls the flap is located on the top of the air cleaner snout. On **Early Models** with this feature a vacuum hose connects the motor to the intake manifold vacuum below the carburetor. On later models the hosing passed through a temperature sensor that allowed vacuum to pass to the diaphragm when the temperature in the engine compartment was cool. The diaphram stays closed when vacuum is low, engine under load. When the engine is fully warmed up, there should be no vacuum to the motor; the hot air duct is closed and fresh air goes into the engine. The temperature in the air cleaner controls these functions. Problems with this system are usually the wrong hose placement, a leak in the hose, or a faulty diaphram causing leakage and incorrect operation.

Step 2: Test the System.

(Engine must be stone cold for this test.)

Carefully examine the vacuum hosing from under the air cleaner housing to the sensor and/or to the vacuum motor. Since there is constant vacuum to the system, a small crack will affect engine operation. Before you remove the air cleaner housing, look at the hoses you can see with the housing in place.

To test the system generally, remove the duct hose from under the inlet snout of the air cleaner by loosening the Phillips head clamp, if it's there, and pulling it down. If there's a duct connected to the front inlet of the snout, remove it by taking off the clamp or screw and pulling the duct forward.

Place your finger up into the hot air inlet at the base of the snout. You should feel the flat steel flap valve. If so, the fresh air can enter. Push up on the flap and it should move easily without binding. If you feel no flap, the hot air position is stuck on or the flap valve has been removed. Use a mirror or remove the air cleaner to look into the snout to see if the flap's stuck or missing. If the flap is closed to hot air, as it should be, start the engine. Feel up in the hot air hole immediately. The flap should be up, open to hot air. Look into the front of

the snout. The cold air should be blocked by another part of the flap valve.

As the engine warms, the hot air flap should gradually close, allowing more cold air to enter. If the hot air flap remains open, close the hood to let heat build up in the compartment. You can also remove the top of the air cleaner and heat the sensor with a hair dryer using a thermometer to read the temperature. The valve should be fully open at 131° F.

If the system isn't operating properly and the hot air flap never opens or stays open, turn off the engine. If the system works, reconnect the hoses and air cleaner parts.

Check the vacuum motor. When the engine is turned off, the cold air flap should be open, and the hot air flap closed. Remove the vacuum hose from the side of the vac motor housing. Use the tip of a screwdriver to pry back the hose. Connect a piece of 5/32in (4mm) hose over the little pipe. Suck hard on the hose. The diaphram inside the motor should move the flap valve in the air cleaner snout. If nothing happens, try again after making sure there are no leaks in the line and connections. If the diaphram responds, block off the end of the hose with your tongue or pinch the line so no suction escapes. The diaphram should hold the air flap open for 30 seconds before the spring returns the flap to the open position. Chances are that it will gradually close. If nothing happens or the flap fades fast, replace the vacuum motor. Otherwise, it's all right.

To replace the motor, see Step 3.

If the diaphram works when you test it but not when the engine is running, the hose connections are wrong or the temperature sensor is bad. Refer to the hose layout in Proc. 1 or a Factory Service Manual to replace the sensor.

Step 3: Remove and Replace the Vacuum Motor.

(This part is usually not kept in stock by the dealer.)

Disconnect the vacuum hose connected to the motor. Remove the two small Phillips screws between the vacuum motor and the air cleaner housing. Lift the bracket away from the diaphragm by unhooking the tab at the front end from its slot in the snout.

The assembly is hooked into the air flap by a curved rod. Lift and slide the assembly toward the left, driver's side of the vehicle. Shine a light into the inlet tube to see what you're doing. Look at the end of the rod on the new vacuum motor. If there is a rubber sleeve on the end of the rod, you're okay. If not, remove the sleeve from the old one and slip it onto the new. Install the new assembly with the vacuum tube pointing to the left (driver's side). The curved end of the rod has to fit into the catch in the air flap. Push the air flap closed with your finger while slipping in the rod end. Hold the diaphragm against the snout and suck on the pipe to see if the vacuum motor is working and the flap moves.

Fit the bracket (tabbed end) into its slot then down over the top of the assembly. Line up the holes and insert and tighten the two Phillips screws. Reconnect the vacuum hose to the pipe.

PROCEDURE 13: ADJUST THE BOOSTER CONTROLLED DECELERATION DEVICE (BCDD)

Condition: Your engine races instead of idles when the engine is warmed up, or it doesn't drop to the idle. You hear squealing when you decelerate. Before adjusting the BCDD, the idle speed and mixture must be set (Ch. 3, Proc. 7). Don't adjust the BCDD unless you're certain it's the problem. The choke must work properly and the throttle cable must be set so it allows the accelerator lever to return to idle.

NOTE: The Boost Controlled Deceleration Device is designed to reduce hydrocarbon emissions which are high during deceleration. If you are going down a hill in gear with your foot off the accelerator, there is high vacuum in the intake manifold that draws fuel from the idle and other ports of carburetor. Since the throttle plates are closed, only a small amount of air enters the combustion chamber resulting in an incomplete combustion. The vacuum activated BCDD and related valves do a great job of correcting the fuel air mixture to reduce emissions and improve economy when operating properly. On later L-20B and Z-series engines, the BCDD operates along with a vacuum switch that controls the fuel shutoff solenoid to further cut down on HC emissions.

Tools and Materials: A screwdriver and a 10mm wrench.

Remarks: Altitude affects the BCDD valve's operation. This procedure should be done with a tachometer and vacuum gauge; that's the way the Factory Service Manual tells you to do it. I'll tell you how to do it the quick, unofficial way.

Step 1: Find the BCDD and Remove the Air Cleaner If Necessary.

Read Proc. 1 and look at the layout procedure for location and hose configuration. If you need to remove the air cleaner, see Ch. 6, Pt. 1, Proc. 1.

Step 2: Check All Hoses in the System.

If the BCDD has any hoses connected to it, make sure they are in good condition and properly connected.

Step 3: Find the Adjustment Screw and Warm Up the Engine.

If your valve is one piece, mounted on the carburetor, the adjustment screw is in the center of the horseshoe-shaped valve housing. On early models a large slotted adjustment screw locked in place by a small setscrew must be loosened. On slightly later models there is a small plate that when loosened and turned around exposes the adjuster. On all later models, pull off the rubber cap to expose the adjustment screw.

On all models that incorporate a remote control valve on the left fender ledge (L-series) and right fender ledge (Z-series), remove the rubber cap (boot) or clip that fits over the end of the valve.

Start and warm up the engine.

Step 4: Deactivate the Dashpot.

Check to see if you have a dashpot (Ch. 3, Proc. 7). If so, loosen the lock nut and turn the dashpot away from the throttle until they no longer touch. Make sure the engine is warm and the choke flap is vertical (open). Remove the top of the air cleaner (if necessary) to check the choke.

Make sure that all of the hoses that lead to the intake manifold are plugged or properly connected. Push on the accelerator halfway until the engine roars. Keep it roaring for 3 or 4 seconds, then release the accelerator. The engine speed should drop to a high idle for 3 or 4 seconds, then to regular idle. The BCDD is operating if you hear a hissing or squealing sound coming from it. If the engine speed doesn't drop to idle consistently (and nothing's restricting the throttle linkage) and/or stays at high idle too long, the operating pressure is too low. If it doesn't work at all, the operating pressure is too high.

The adjustments are as follows:

BCDD valve on carburetor: Turn the adjustment screw *clockwise* to *decrease* the operating vacuum and *counterclockwise* to *increase* it. Don't turn the screw more than 1/8 turn at a time. Remove the screwdriver while rechecking the operation.

Remove control valve: Find the raised offset end on the outside of the valve. Fit a 10mm wrench over the flat sides of the raised piece. If the operating pressure in the valve is too high, turn the adjuster counterclockwise just a little. If the operating pressure is too low, turn the adjuster clockwise.

•**Everyone:** Try raising and lowering the engine speed again. Make the correct adjustment as needed.

If the adjustment doesn't improve the condition or if the engine will not return to idle, and you have checked all of the things mentioned in this procedure, take your problem to a pro or get a Factory Service Manual and follow it. There are other components in the system that could fail. Refer to other manuals if in difficulties.

Step 5: Replace the Rubber Adjuster Cover and Disconnect the Tachometer and Vacuum Gauge.

On the side of carburetor models, a groove in the rubber boot fits into the adjustment hole and valve cover. Or the cover slides over the adjustment screw. Or the lock nut gets tightened.

On all remote valves the rubber boot or clip fits over the adjuster end of the valve.

Give the hoses another once over to ensure that they are free of cracks and in the correct positions.

Step 6: Readjust the Engine Idle
See Ch. 3, Proc. 7.

Step 7: Readjust the dashpot (if you have one).
If you adjusted the dashpot away from the throttle, turn to Ch. 6, Pt. 1, Proc. 8.

Step 8: Replace the Air Cleaner.
See Ch. 6, Pt. 1, Proc. 1.
Once the air cleaner is in place, run the engine at various speeds checking the idle and BCDD function. Make sure all of the vacuum hosing is secure.

PROCEDURE 14: TEST THE EARLY FUEL EVAPORATION SYSTEM EFE (1975-77 L-20B Engines)

Condition: If this system sticks, you may never notice it, so it is a good idea to check it as a maintenance procedure. **WARNING:** Don't touch any part of this system unless the engine's cold.

Tools and Materials: A flashlight, penetrating oil if the valve is stuck.

Remarks: If you have a coolant bypass hose connected to the bottom of the carburetor, you won't have this device.

Step 1: Find the Counterweight and Thermostat Spring.
Stand on the driver's side of the engine compartment and find the exhaust manifold. Follow the manifold down to where it reaches the flange that connects it to the exhaust system. Work your hand up the backside of the manifold, feel for a smooth half-round chunk of iron. This is the counterweight. The round side should be up. You should be able to turn it clockwise about 30° before it stops in the open position. Let it go and the weight spring and shift should return to the closed (upper) position. Your fuel economy can be radically affected if this valve (flap) sticks in the closed position, and high emissions and engine wear will result of the valve (flap) is stuck in the open position.
The valve should also be open when the engine is hot, but you must use gloves and care so as not to burn yourself.

Step 2: Free Stuck Valve.
It's easier to reach the valve if the head and manifold are out of the vehicle, but with some patience you can reach the end of the shaft with penetrating oil and pliers to work it free. The shaft runs front to back inside the manifold; the front end is exposed on the front of the manifold.
Squirt oil from either side and wait. After a bit, try moving the flap by turning the counterweight, but do not force anything. Figure out which position the flap is stuck in then work it the opposite way. I hope you get it free!

PROCEDURE 15: LOCATE AND TEST THE OXYGEN SENSOR AND TURN OUT O_2 WARNING LIGHT (E.C.C. People Only)

Condition: You were sent here from Ch. 6, Pt. 1, or you want to know where the sensor is. You want to disconnect the O_2 sensor warning light.
Remarks: This is an important player in the E.C.C. system and shouldn't be modified unless you understand the way E.C.C. works. Disconnecting a working O_2 sensor will make the engine run full (rich) and that's bad. In this procedure I tell you how to do the basic flash test which is not the only, nor is it the definitive, way to test the sensor, but it's fun. Before you run the test the engine should be in tune and all other possible faults eliminated (Ch. 3). For complete O_2 sensor servicing, consult the Factory Service Manual and/or a professional.

When the O_2 warning light comes on it's OK to keep driving. All it means is that Nissan recommends the sensor be replaced after a certain number of miles. Unless the sensor goes bad don't replace it. (See Step 3 to turn out the light.)

Step 1: Where is the O_2 Sensor?

If the engine's hot, be careful not to get burned. Stand on the driver's side and peer into the engine compartment at the exhaust manifold. Follow it down and away from the engine to find a cylinder with a single wire coming out of it. This is the O_2 sensor. Make sure the connection is good.

Step 2: The Flash Test.

Start and run the engine until the temperature gauge reads normal. While it's warming, look under the driver's seat to find a black box. If there are two, it's the larger one. Find a little hole or window on the front of the box. Through this hole you'll see a light flash while you're running the test.

Rev the engine for 2 minutes at about 2,000 rpm. Measure this by looking at the tachometer in the dash or by reving the engine until it sounds like you're hauling a load of furniture up a hill.

Look into the little hole and count the number of times the light flashes. It should flash four times every 10 seconds.

Regardless of what the light does, if you're having engine problems, read Ch. 6, Pt. 1, Proc. 1 for further E.C.C. fun.

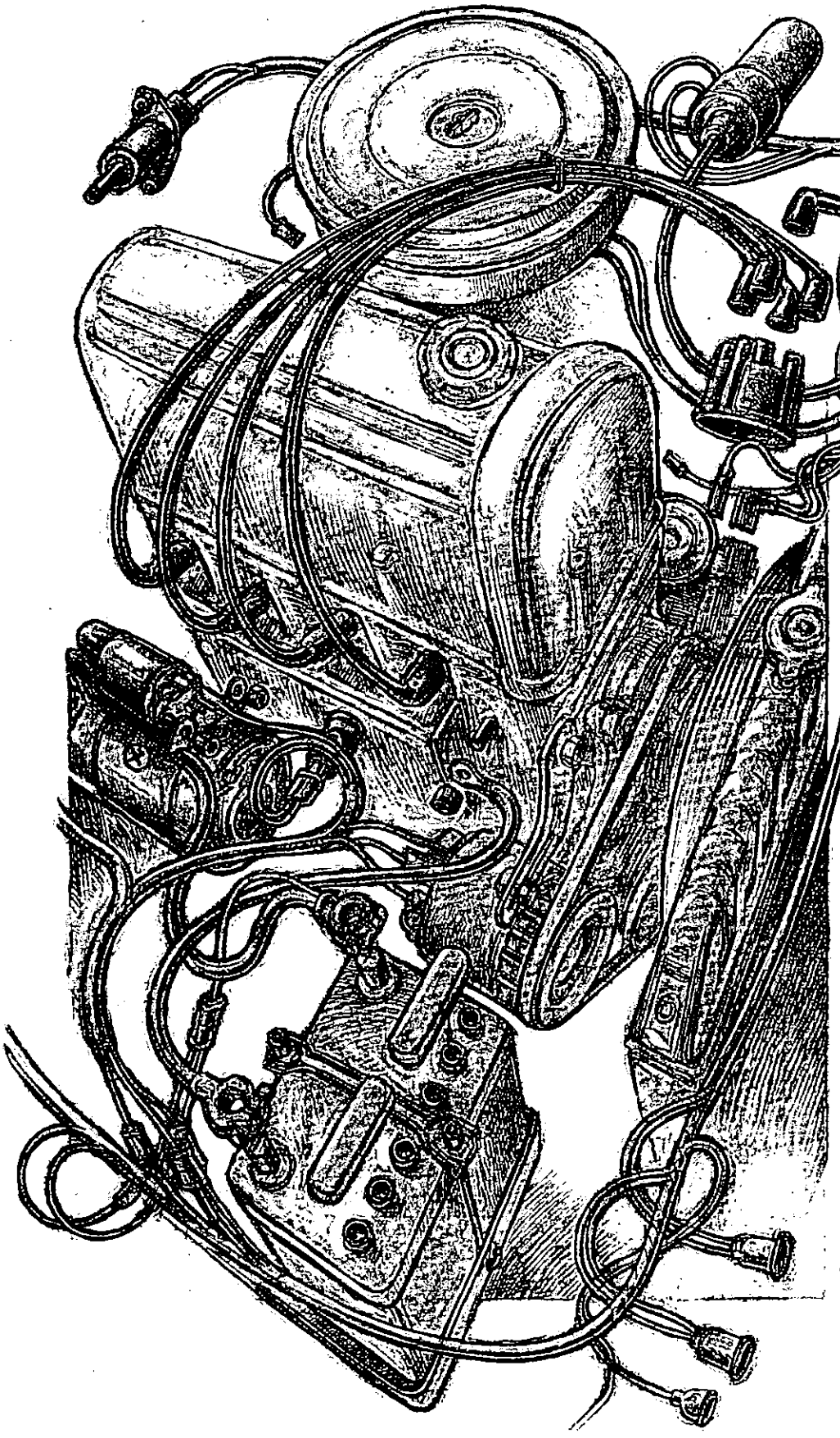
If your engine is running well, I hope you enjoyed the light show.

Step 3: To Turn Out the O_2 Sensor Light.

You have to unplug some wires at a connector under the dashboard. Look up in the corner of the dash just above the hood release handle. If you can't find the connector, go to your local Nissan dealer and have someone show you where the connector is. On California models there's one connector to deal with. The wires to it are yellow and white. On all Federal and Canada models there are two connectors: one gets disconnected at 50,000mi (its wires are yellow and white); the other is separated at 100,000mi (its wires are yellow and blue).

Take the connector apart and the dashlight should go out. If it doesn't make sure you have the right connector. Still no, then seek someone who knows how to do it.

Electrical



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CHAPTER 7
ELECTRICAL SYSTEM

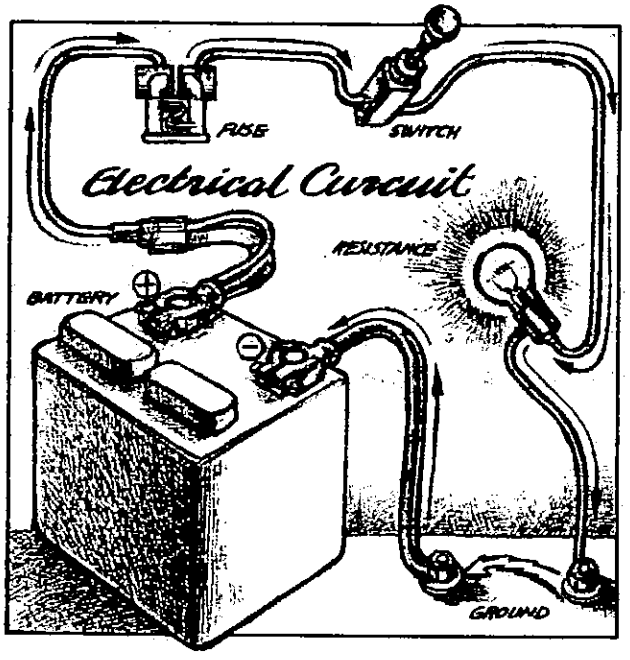
The **battery** is the heart of your vehicle's electrical system. For the components of the electrical and perhaps the fuel system to work properly, the battery has to be charged adequately. The **alternator** and **voltage regulator** are designed to manipulate and supply the battery with the electrical charge it needs.

The **cranking (starter) motor** and **solenoid** use the most electricity in the shortest time. The **headlights** are the next biggest drain.

The **ignition subsystem**, which ignites the fuel to make the engine run, also depends on the battery, while the battery depends on the engine running to recharge it.

The **circuitry** or wiring connects the whole electrical circus together. **Fuses** protect the circuits and components from surges of current (shorts and grounds). **Switches** open and close paths of current, like drawbridges, controlling the flow of electricity to the various components. A **relay** takes current from a switch, clicks closed, and makes contact like a switch, opening another path to operate a component. It's an efficient way to use small amounts of electricity to transfer larger amounts.

All these parts can malfunction. Although there is some mystery to it all, most electrical system problems can be solved logically.



WORDS YOU NEED TO KNOW

As you do the procedures, it'll help to know a little electrical terminology.

Everything in the vehicle except the alternator operates on *direct current* (DC) electricity. A *circuit* is a complete loop—an electrical pathway—from battery positive (+) to battery negative (-). *Current* is the flow of electricity through a circuit, also known as *amperage*.

Every circuit needs three basic components: a battery (the electricity source), a wire, and a *resistor* (something using power from the battery), such as a bulb, electric motor, radio, the coil, or the spark plugs. Of course, your vehicle has hundreds of these combinations in varying degrees of complexity. Regardless, never connect one battery terminal with the other unless there's some kind of resistor designed for the circuit in between. For example, don't lay a wrench between the battery posts or between the positive (+) post and vehicle body if the battery ground is connected.

An *open* is when a connection in a circuit is broken, as when a switch is turned off. A *short* is when two or more wires carrying current through different circuits touch each other. A *grounded short* is when current is routed to ground (the negative side of the system) before it gets to the bulb, gauge or motor. Ground on your Datsun/Nissan is the body, engine and chassis, and most all metal parts of the vehicle.

Resistance creates heat in a wire or light bulb. Some resistance is normal; too much resistance means not enough current gets through the circuit. *Voltage* is the amount of force pushing the current. Your battery packs a punch of 12 volts.

Most Datsun/Nissan vehicles use electronics at least in the radio and at most in the fuel/emissions microprocessor (late model 720s).

SOME BATTERY AND ELECTRICAL DO'S AND DON'TS

Battery voltage is harmless, unless you short or ground full battery voltage and get burned by the result. In fact, nothing in the electrical system, except the coil discharge (secondary ignition circuit), can harm you as long as you use general safety precautions.

To Protect You and Your Electrical System Components:

- *Don't* let a discharged battery freeze.
- *Don't* let the water (electrolyte) level drop below the separators and plates.
- *Don't* let sulfation or grime overtake the top of the battery. Keep the top, posts, and clamps clean and dry.
- *Don't* short (between posts or ground) the positive terminal to the vehicle body by laying a tool in top of the battery.
- *Don't* get battery electrolyte (water and acid mixed) on your clothes or skin. Neutralize this acid with water immediately if contact occurs.
- *Don't* pry or beat against the battery posts or case.
- *Don't* add any wonder "dopes" to batteries.
- *Don't* poke hard or sharp objects into battery cell holes.
- *Don't* reverse battery connections. Always double-check before connecting the clamps to the posts.
- *Don't* disconnect the battery with the engine running.
- *Don't* quick charge a battery with specific gravity below 1.100.
- *Don't* use a fast charger to boost-start the engine.
- *Don't* leave the voltmeter connected across the battery when starting the engine.
- *Don't* add water to battery through indicator (blue check eye) hole in the battery.
- *Always* disconnect the battery ground cable before working on the electrical system (or fuel system—electronic carb E.C.C. People).
- *Always* disconnect the battery cables before using a fast charger (10 amp or more) on the battery.

NOTE: There is more on the battery in Proc. 1-5.

ELECTRICAL SYSTEM TEST DEVICES

The two most basic testing devices are the *test light* and the *jumper wire*. Also handy are the voltmeter, ampmeter, and ohmmeter. You'll usually find the voltmeter and ohmmeter combined as an automotive volt-ohmmeter (VOM).

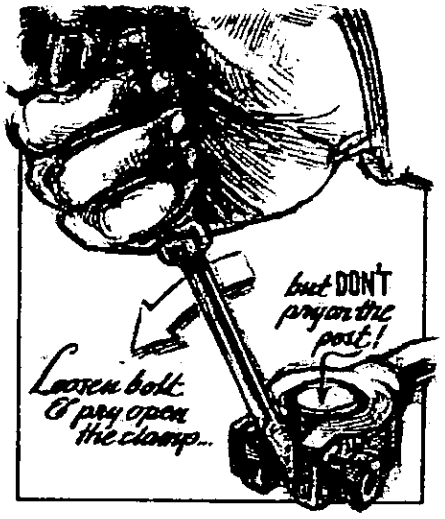
An essential item is the *wiring diagram*, the map of your Datsun/Nissan's electrical circuits. The diagram isn't in this book, but is available in other manuals at the library or in Factory Service Manuals available at the Datsun/Nissan dealer. Although it may look bewildering at first, the diagram actually makes sense. Memorize a few of the symbols representing system components, and you'll find yourself "reading" this map in no time.

Electrical work is an automotive specialty. It takes skill, common sense, some special equipment, and time to fix most electrical problems. I don't want to delude you into thinking it's easy. In theory it may be, but in practice it frequently isn't. If you run out of ideas, take what you have learned and the vehicle to a pro.

PROCEDURE 1: SERVICE, REMOVE AND INSTALL THE BATTERY

Condition: You're here from Chapter 4. The engine doesn't turn over, or the battery won't charge, or its water level is less than 3/8in above the internal plates. You have checked the alternator belt tension (Ch. 3, Proc. 8). You may only have to do one or some of the following steps.

Tools and Materials: Distilled, non-mineral-rich or rain water, battery post cleaner or sandpaper, and a pocket knife, flashlight, baking soda, vaseline. (For new clamps and cables, see Step 8.)



Remarks: Wear your safety glasses, and follow the safety Do's and Don'ts in this chapter's introduction.

Steps 7 and 8 cover cable and clamp replacement. To clean the battery clamps and terminals, do Steps 3, 6, 7 and 8. There's more about the battery in Proc. 4.

Step 1: Add Water to the Battery.

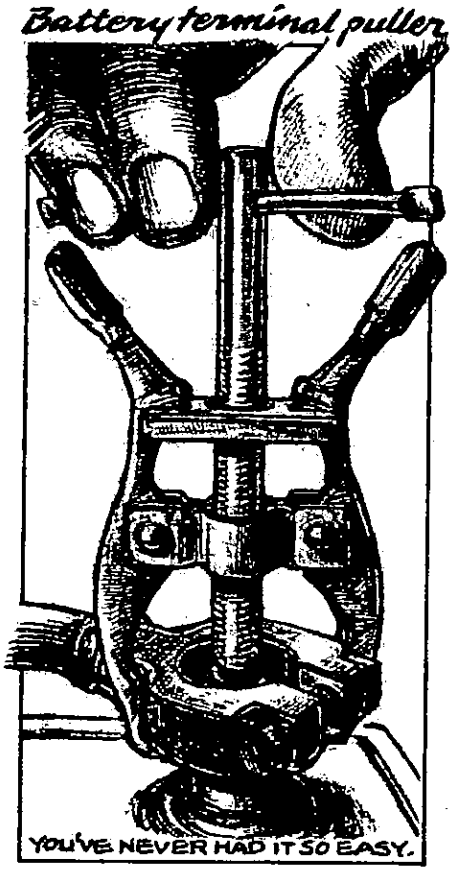
If you have removable battery cell caps, you can add water. (Don't remove the caps on most "maintenance-free" batteries. On batteries with "eyes" the color green or blue should be visible when looking down into the eye. Remove this plug only to check specific gravity, Proc. 4.)

Use mineral-free, distilled water or rain water in your battery. In a pinch, use pure (soft) drinking water with low mineral content. Use tap water if there's no alternative. Never add acid to a battery.

Use a clean spouted container or paper cup to pour in the water. Fill only to the lower edge of the cell hole. Mop up any water on top of the battery and replace the caps.

Step 2: Clean the Top of the Battery.

If too much sulfation or grime coats the top, it can short or ground the battery posts. To clean, sprinkle powdered baking soda over the top of the battery and let it sit. Use a "last time around" rag to wipe the surface clean and dry, then wipe the top clean with a dry rag. Don't get any battery filth on your clothes, in cuts, or in your eyes. Throw away the rag.



Step 3: Remove the Battery Post Clamps.

The clamps tighten around the positive and negative posts, attaching the battery to the system's positive and negative (ground) cables. There are two types of clamps. One is integral with the cable, and the other is spliced onto the cable.

Remove the negative clamp first. Some clamps are lead, some are steel. If corrosion has built up around the clamp bolt, brush it off. Find the nut end of the bolt and determine what size it is. If it's original equipment, it's 10mm. Replacement clamp nuts are usually ½ or 9/16in. Use a box-end wrench or socket to turn the nut counterclockwise. If the whole bolt turns, squirt the nut with penetrating oil, then grab the other end with a wrench or pliers. If the bolt is past its prime, it'll break and you'll have to replace the clamp (Steps 7-9).

Twist a medium, wide-bladed screwdriver between the jaws of the clamp to spread it. If you have a battery terminal puller, place the jaws around the fat sides and bottom of the clamp. Turn the center screw up enough to make the device work. If the jaws don't fit under the clamp, or you don't own this special tool, pick up a light hammer instead. Gently tap the tail end of the clamp back and forth to move it around the post enough to separate clamp from post. Don't ever beat or pry on the post. If the post moves with the clamp, the battery is telling you it needs retirement.

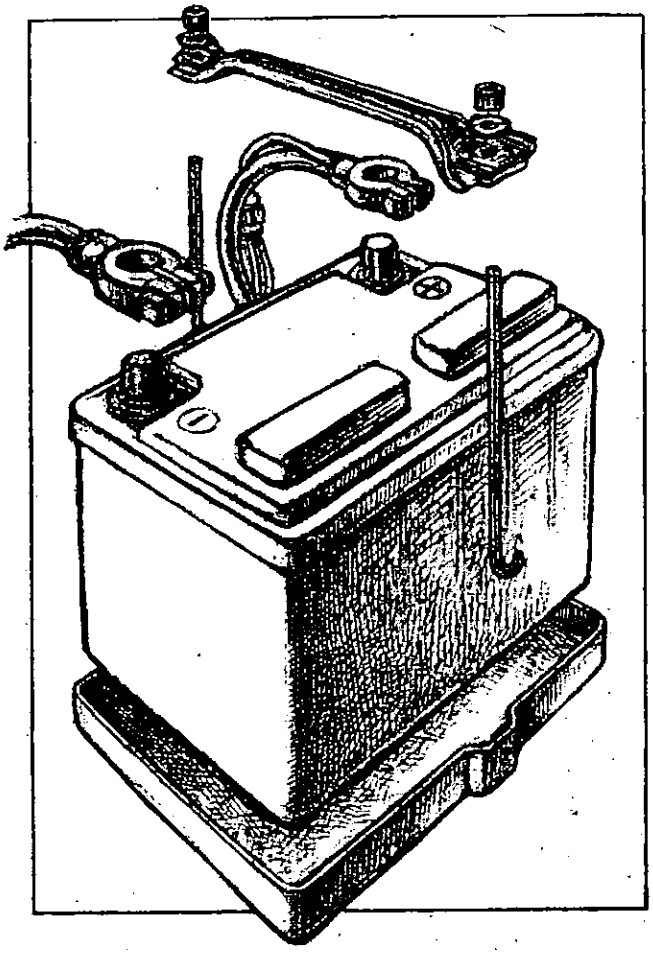
•If you are just disconnecting the battery to work on another part of the electrical system or engine, you need only disconnect the

negative clamp. Place the cable end well away from the post and cover the battery with a heavy cloth.

•If you plan to remove the battery, loosen, spread and remove the positive (+) clamp as you did the negative.

Step 4: Remove the Battery Frame and Battery.

The battery is held in place by a light rectangular or bow-shaped steel frame connected to the vehicle body by two threaded "J" bolts. These parts are likely to corrode and break. Squirt penetrating oil on the threaded ends of the bolts around the nuts before trying to remove them. Use a 10mm socket, box-end wrench or pliers to turn the hexagonal or wing nuts counterclockwise off the bolts. Remove only one of the nuts and washers completely, and just loosen the other enough to maneuver the lower end of the bolt out of its hole in the battery shelf. Lift the frame off the battery, but take care not to short it between the posts. If either bolt breaks or the frame is badly deteriorated, get a replacement from Datsun/Nissan. If the frame isn't too far gone, it can be wire-brushed or sanded and put back on.



Make a sketch or note of the positions of the positive and negative posts so you can reinstall the battery correctly.

There should be a rubber tray below the battery which can be taken out with it. Be careful: Do not let the battery come in contact with your body or clothes. The acid inside may spill if tipped.

Store the battery away from children and someplace where it will not be knocked over or discharged. Keep cardboard or wood under it if you store it on concrete or steel.

You can now test the battery further (Proc. 4), work on the engine, or replace the battery.

Step 5: Install the Battery.

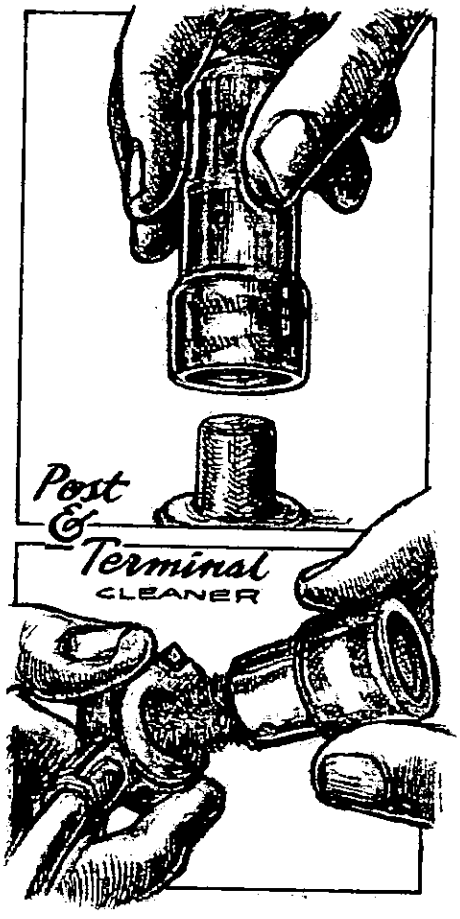
Clean off the shelf and rubber tray where the battery sits. Check your notes on which way the battery was positioned. The cables have to match up to and fit their respective posts. Install the battery with the tray in place.

Place the frame squarely around or across the top of the battery. Find the holes at the sides of the shelf and hook one of the "J" bolts into the holes in either side of it. One bolt may be longer than the other. Match them. Slip the threaded end of the free bolt up into the frame hole. Replace the rubber or steel washer, then the hexagonal or wing nut. Put a little oil or anti-seize compound on the bolt threads. Tighten the nuts evenly, a little at a time, until the battery is secure. Do not overtighten. NOTE: There should be rubber washers under the steel nut or washer to insulate the frame from the body. Make some out of old inner tube or the like.

If you want to replace a cable or clamp, jump ahead to Step 7.

Step 6: Clean the Battery Posts and Clamps.

There are inexpensive tools designed for this job. The brush type is best. It fits over the battery post and scours the buildup off the lead post. A cone-shaped brush on the other end of the tool fits inside the clamp to scour it. Brush the matching surfaces until shiny. You can also use sandpaper and a pocket knife to clean the surfaces.



You may find soggy felt rings at the bottoms of the posts. These help arrest corrosion, but they get old and deteriorate. Take them off unless they're in good condition, and use a little waterproof wheel-bearing grease or vasoline for the same purpose. Wipe some grease on and around the post.

Step 7: Reinstall the Battery Cables.

Fit the clamp over the positive post until the top of the clamp is flush with the top of the terminal. Tap it lightly with a hammer if necessary. Position the cable end of the clamp so corrosion stalactites won't form between it and the frame. Tighten the nut until the clamp is secure and won't turn on the post when pushed or tapped from side to side.

After greasing, replace the negative clamp on its post the same way and tighten it.

Now try to start the engine. If it won't start, recheck the connections.

NOTE: Add-on style clamps can corrode and cause poor or no contact between the cable (or wire) and clamp end. Remove and clean to cure.

Step 8: Replace the Complete Cables.

It's better to replace the entire cable, complete with new clamps. But splice-on clamps also work and are considerably cheaper.

If you're going to buy a new cable, measure the old one to make sure you get the correct length. Buy good quality from a parts house, wrecking yard or garage which makes them. If there is a wire (or wires) coming off one of the clamps, you'll have to get a replacement cable that has this wire. It may have to be spliced into the existing wire.

NOTE: On electronic carb E.C.C. models, do not use splice-on replacement clamps. Replace the whole cable. Go to the dealer for help.

POSITIVE CABLE: A new clamp may have to be spread to fit the positive (+) terminal. Loosen the nut enough to account for the change. Remove the 12, 13, or 14mm nut and washer on the starter motor end of the positive cable and slip it off the stud.

Replace the new cable over the stud as well as the other wire(s) eyelet, then the washer(s) and the nut. Tighten the nut until snug. Don't overtighten it.

NEGATIVE CABLE—Older L-series Models: The eyelet end goes to the rear of the starter. One of the starter bolts has to be removed (Proc. 7 [3]). **Newer L and Z-series Models:** The ground cable goes to the right side of the head (L-series) or under the thermostat housing (Z-series), held in place by a 12mm bolt. Remove the bolt and washer(s) and engine slinger (if necessary), fit the new cable, then install the washers and bolt. Tighten so the cable end is secure and doesn't turn. Don't reconnect the negative clamp until the positive cable has been attached.

Step 9: Replace the Cable Ends (splice-on style).

Cut the old clamp off the cable. Cut it next to the clamp, and cut the insulation back ½in from the end of the cable. Loosen the two bolts so you can slip the bared cable into the new clamp. Insert the cable end and tighten the bolts evenly to secure it. Install and tighten the clamps (Step 6). Read the POSITIVE CABLE instructions in the last step before fitting the new clamp over its battery post.

PROCEDURE 2: STARTING A VEHICLE WITH JUMPER CABLES

Condition: The battery is run down and the engine won't start. You have cleaned the battery terminals, checked the water in the battery and adjusted the fan belt tension. The battery cables are both hooked to the engine properly and all other connections to the battery clamps are intact.

Tools and Materials: A set of workable jumper cables, another vehicle with a 12-volt battery. Although this can be done by one person, an assistant helps and three people makes the job teamwork.

Remarks: We'll call the charged and discharged batteries "donor" and "patient."

Jumper cables are hard to connect to vehicles with side-mounted battery terminals.

Be careful not to touch the positive clamp to the body; don't touch the clamp ends together once one end of the jumper cable is connected to either battery.

If a battery is really dead, it may not be jumpable, but give it a try anyway. When jumping from a ground vehicle, like older positive ground British cars, connect the jumper cables the same way—positive to positive, negative to negative.

Step 1: Set It Up.

Position the vehicles close to one another, but don't let them touch. Park them so their batteries are close. Open the hoods and scope out the battery position locations. Make sure you know which is positive and negative on both batteries before beginning. The positive post is usually larger, with a plus (+) sign on or near it. The negative is smaller, marked by a minus (-) sign, with a cable that connects to solid metal.

Lay the jumper cables flat on the ground to separate one from the other. One cable or clamp is usually black (negative) and the other red (positive).

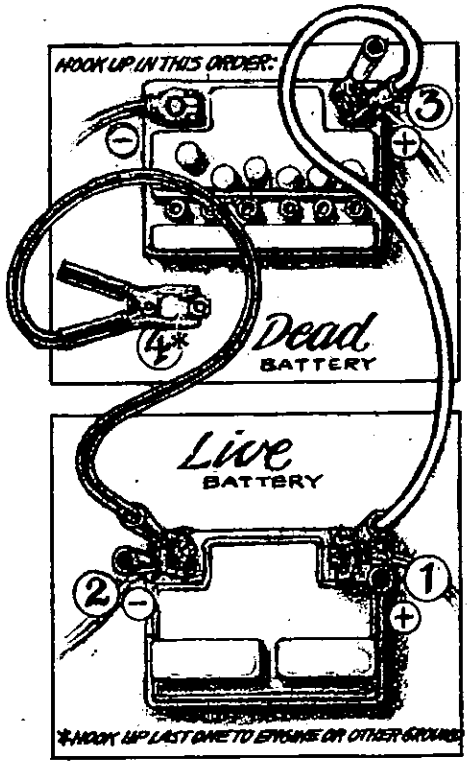
Turn off the patient's lights, blower, air-conditioner, and windshield wipers.

Step 2: Hook Up the Donor, but First.

Clamp a negative jumper cable clamp to the insulated handle or wire of its positive partner—*not* metal-to-metal. This way the clamps can't touch. NOTE: Hook up cables to batteries in the order shown: 1, 2, 3, 4.

Attach the other red (positive) clamp to the positive clamp and post of the donor's battery (1). Fit its partner, the black (negative) cable clamp, over the negative battery terminal (2). Grab each attached clamp and wiggle it to-and-fro to make a sound connection.

Before starting either vehicle, make sure both are out of gear with emergency brakes on. Do not stand in front of either vehicle.



Step 3: Hook Up the Patient.

Read all the way through this step before doing it.

Fit the free red (positive) jumper cable clamp to the positive terminal on the patient's battery (3).

Now start the donor's engine and, if possible, increase the engine speed a little (this is why it helps to have a third person). After you connect the negative clamp to the patient's battery (4), wait five or ten seconds before trying to start the patient's engine. While it is cranking, either you or the person in the sick car has to operate the throttle (or not operate it, E.C.C. people) as if starting the engine normally.

Have your helper(s) listen for commands before beginning. Make sure your jumper cables and hands are well away from the fan blades. If the engine doesn't respond to the jump, recheck all clamp connections by wiggling for better contact. Do not crank the engine for more than ten seconds each try.

Once the engine starts, remove the negative cable from the patient's battery right away. Clamp it onto the insulated part of the positive cable, then disconnect the clamps from the donor's battery. Run the engine to recharge the battery, preferably by driving the vehicle with all lights and other heavy-drain electrical devices turned off.

If the engine cranks but doesn't start, it may be because of lack of fuel, spark or ignition. Recharge the battery (Proc. 5) and go to Chapter 4.

PROCEDURE 3: STARTING A VEHICLE BY ROLLING OR PUSHING IT

Condition: The engine does not start because the battery is weak or nearly dead. (A truly dead battery won't be able to operate the ignition and fire the spark plugs. If this is your lot, recharge the battery.) You've cleaned the battery clamps and posts (Proc. 1).

If the engine is hard to start for other reasons, you'll be wasting your time trying this.

Tools and Materials: A vehicle to push you with, or a hill to roll down.

Remarks: You are going to use your vehicle's momentum to crank the engine. It is possible, but much more difficult, with automatic transmission vehicles.

Step 1: Prepare Yourself.

First make sure that the pushing vehicle matches up with the pushed one's bumper, so tail lights or rear doors don't get broken or dented. To avoid the possibility, insert a rimless automobile tire between the vehicles.

You will be pushed for a distance, then released to do your thing. Open the driver's windows on both autos and prearrange a hand signal to tell the pusher to get back and let you roll free. If possible, do this on a quiet road without traffic.

Step 2: How To Do It.

Read through this step before trying it.

Agree on a direction to be pushed. Match up the two vehicles, then take your place.

•**Manual Transmission People:** Push the clutch in, take off the emergency brake, and put the transmission into second gear. Turn on the ignition key until the lights on the dash are on. Pump the gas pedal once or pull the choke out slightly. (E.C.C. don't pump.) Have the pusher push you until you reach between 5-10 mph, then signal a release. Wait a moment, then pop the clutch and start the engine. Once it starts, quickly push the clutch right in and keep the motor running with proper throttle technique. If it doesn't start, keep it rolling and try again or get another push.

•**Automatic Transmission People:** Put the transmission in Neutral, emergency brake off and ignition switch and dash lights on. You'll need to reach at least 30 mph, then signal the pusher to release. Wait a moment to get some distance between the two vehicles, then place the gear selector into Drive and press the gas pedal slightly to get the engine running.

•**Everyone:** Once the motor is running, charge the battery by driving the vehicle for a bit with all the electrical drains off (lights, radio, heater, etc.).

PROCEDURE 4: CHECK OUT THE BATTERY

Condition: Chapter 3 sent you here, or the battery is dead—the engine won't start.

NOTE: Your battery is made up of six separate cells connected in **series.** Each cell has positive and negative

plates that are bathed in an electrolyte solution. The positive plates are made of lead peroxide, the negative ones are made of lead, and the electrolyte is 36% sulfuric acid and 64% water (together their *specific gravity* is 1.270). A reaction between the cells and the electrolyte enables a battery to retain its charge and supply current to your system. Discharging and charging in the battery depend upon the oxygen and hydrogen, and lead and sulfate radicals combining and separating.

Remarks: A battery can look fine and be wasted. In moist climates, corrosion builds up rapidly between the battery clamps and posts, creating resistance—hard starting and undercharging. In drier areas, evaporation is accelerated, causing the cells to go dry. As a battery ages, it loses its ability to react chemically to electrical charge. The more a battery is cycled (discharged and charged) the faster it approaches death—like the proverbial nine lives of a cat. So it's essential to keep the charging system, connections, and wiring in good order.

Never lay tools on top of the battery; they can short between the posts. Keep a wide-mouth jar full of water handy to further dilute battery acid if spilled or splashed on you or the vehicle. Corrosion on a battery (lead sulfate) also contains acid. **WARNINGS:** Do not smoke or make sparks around the battery, especially when charging. The hydrogen released is flammable. And wear safety glasses!

Datsun/Nissan vehicles use a 12-volt battery with top-mounted posts. A battery with too-high posts can short against the inside of the hood. This is especially true with early 510 cars.

Some "maintenance-free" batteries have "eyes" in them through which you can see the color green or blue, indicating the specific gravity is up—or the battery charged. No color means it's discharged.

Step 1: Visual Checks.

Look at the frame that fits across or around the top of the battery. It should be cleaned often to remove corrosion (Proc. 1 [2]). The nuts that hold the frame to the body should be tight enough to hold the frame and battery from shifting around.

Sulfation is the powdery white/green substance that collects around the top of the battery, frame or posts. Some sulfation is normal. Too much means there's a leak in the case, or the battery is being overcharged causing the electrolyte to bubble out of the cells. Too much electrolyte consumption also indicates overcharging.

You have to remove the vent caps to check the electrolyte level. Vent caps come in several types. Some can be individually unscrewed or pried up. A cluster cap uncovers three cells at a time.

"Maintenance-free" batteries, which claim to never need additional water (topping up), have fixed caps. On a few of these batteries you *can* remove the sealed caps to check the electrolyte level. If it isn't easy to do, don't try breaking into the cells. Ask the battery salesperson or a good electrical shop about your battery and its warranty (Proc. 5 [2]).

Look into the battery cells. You should see a clear liquid covering the tops of the plates with separators which look like pieces of thin pasta or paper between them. These should look moist, dirt-free and undamaged. If two adjoining cells are dry, there may be a leak in the case. If the levels are different or dry, no big deal—read on and add distilled water later. If all the cells are dry and there's liquid all over the place, suspect overcharging or leakage (Proc. 1 [1]). A battery that is dry in one or more cells won't hold a charge and will rapidly deteriorate. If you see little chunks lying or floating around, the innards are falling apart.

Next, check the condition of the battery posts and clamp connections (Proc. 1 [3, 6-8]). Bad connections here often cause starting problems. The clamps should be tight and clean.

Follow the cables to their engine connections, examining the condition of the rubber insulation around the copper cable. At the ends there should be tight connections between the wire and the bolt that secures it to the solenoid or the ground. Wiggle the wire to make sure it doesn't move (Proc. 1 [8]). Tape over any bare spots in the cable, and make a note to replace or repair the bad cable or connection.

Step 2: Check the Battery for Charge.

You may see the guy at the wrecking yard spread a pair of pliers apart and touch the handles to both battery posts to create a short and lots of sparks. The intensity of the fireworks is supposed to indicate the amount of charge or "juice" in the battery.

Please **don't** try this.

The best way to check your battery's condition is with a voltmeter, an hydrometer, and/or (best of all) a load tester.

The voltmeter is connected, red lead to positive and black lead to negative, and the scale set to cover 12 volts. A charged battery should show about 12.5 volts. If the battery is dead or below twelve volts, charge it (Proc. 5 [1]).

An hydrometer measures the specific gravity or percentage of acid in the electrolyte in each cell. Most service stations have this tool. The electrolyte level should be up for this test (Proc. 1 [1]). If you find it is low and you add distilled water, then charge the battery. Draw some electrolyte into the hydrometer until the insides float, and take a reading. The hydrometer reading should be between 1.230 and 1:310, and within 25 points on all cells. (These numbers will vary with temperature.)

The positive test is to charge the battery, then put a load on it to see if it holds. Most garages and electrical shops have such testers. Take your charged battery in and have it load tested—but don't be fooled into buying a battery unless you need one. Read below.

Here's another method, not quite as foolproof: Charge your battery if you can. Reconnect the battery to the engine. Turn the headlights on. Now have a friend try to start the engine with the key while you watch the lights. If they dim to nothing and the engine doesn't turn over, the battery looks bad. If the lights don't light at all, the terminal connections are no good or current isn't getting to the fusebox for some other reason (Proc. 16).

If your battery charges but runs down in a matter of hours, there could be an electrolyte leak, an internal problem, or a drain elsewhere in the electrical system. If this is your problem, leave the cable clamps off the battery when not in use and read Proc. 8.

Before buying a new or used battery, read Proc. 5.

PROCEDURE 5: PURCHASING AND CHARGING A BATTERY

Step 1: Charging a Battery.

FIRE DANGER: Make no flames or sparks around a charging battery!

There are two ways to charge a battery: let your engine and alternator do it or use an external charger. At home, people use small slow- or trickle-chargers of 2 to 16 amperes. Shops have multiple-rate chargers that can fast- or slow-charge. Avoid fast (10 minute) charges; don't exceed 40 amps. Quick charges are bad for batteries. Charging should be done as slowly as is practical. Don't let the electrolyte boil as so many garages do.

If you're charging the battery yourself with a small charger, remove the vent caps (if possible) and make sure there is enough water in the cells. **Maintenance Free People:** Try to see the electrolyte level through the translucent sides of the case.

If you are charging the battery while it's in the vehicle, disconnect both terminal clamps and clean the posts. Hook the charger leads to the correct posts, red positive and black negative. Read the charger instructions and set it to 12 volts. Plug the charger into an outlet and look at the meter if there is one. If the reading doesn't change, move the clamps around to make better contact. A discharged battery will require high amperes to begin with. The meter reading will drop as the battery takes on a charge. One-and-a-half to two amperes indicates a charged battery. Bubbles will appear in the cells as it charges. Don't let this go on too long. A bad cell will not bubble.

If you take your battery to a garage to have it charged, ask that it be charged at the lowest amperage rate possible, especially if your battery is really dead. Charging at more than 10 amps shortens battery life. If it won't take a charge, try a fast charge (not more than 40 amps) for 10 minutes then try the slow charge again. This may revive your battery. But beware, inexperienced or profit-minded service station attendants love to "crank on the amps" and quick charge batteries, sometimes forgetting them and boiling your electrical friend to death. If by circumstance, a quick charge is necessary, don't exceed 30-40 amps and never for more than 45 minutes.

Read Proc. 4 before buying a new battery.

Step 2: Purchasing a Battery.

This is a competitive market. The main thing to remember is to get a battery that fits your vehicle in height, width, and post position. All Datsun/Nissans in this book require a Group 24 battery. Take special precautions on older 510s, which have limited hood clearance.

No matter what you buy, read the guarantees carefully and shop around. Wrecking yards are often good spots to find deals on used batteries, but buy on the condition that if you load test the unit and it fails, you can bring it back. Looks can be deceiving (Proc. 1 and 4).

PROCEDURE 6: TEST THE STARTER (CRANKING) MOTOR AND SOLENOID

Condition: Engine doesn't crank or cranks slowly.

Tools and Materials: Jumper cables, voltmeter or hand-held ohmmeter (if you can get them), test light, basic tool kit.

Remarks: The starter is misnamed; it is really a cranking motor. Its operation depends on the right flow of electricity to and through it. For the engine to start it has to be spun fast enough to compress and dry the fuel air mixture. If the battery is weak and/or the starter draws too much current the ignition system may not get enough current for the engine to start. Don't crank the starter more than 30 seconds. Allow it to recover and cool after that.

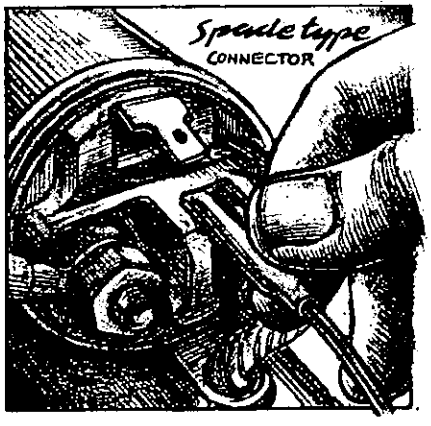
Step 1: Check the Connections to the Starter.

It's easier to work on a cold engine. All connections to and from the battery should be tight and clean (Proc. 1). Look at the starter solenoid where the positive battery cable connects. **Z-series People:** Use a good light. The solenoid's tucked in close to the engine block.

There is a spade-type connector next to the cable and nut where a smaller wire plugs in. This wire, connector and connection should be sound, firmly plugged and intact. If loose, pull off and gently pinch the wire with pliers.

Grab the starter assembly by the solenoid and wiggle it. The mounting should be tight, with both bolts in place holding the starter. If loose, see Proc. 7 (6).

Try starting the engine again. . . Still nothing? Keep reading.



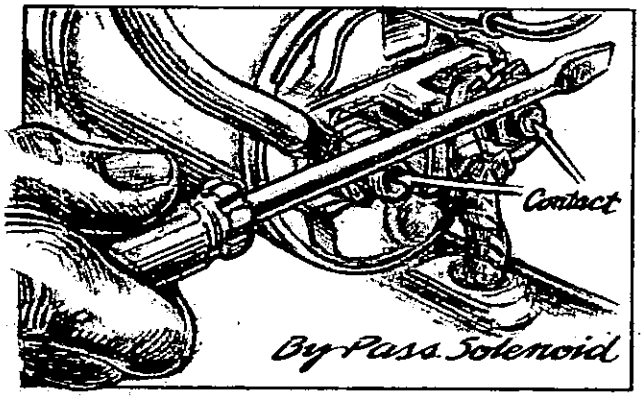
Step 2: Diagnose the Ailment.

Be sure there are no gasoline fumes around while you perform these tests. The parking brake must be on and the transmission in Neutral or Park unless told otherwise. **Automatic People:** Try these tests in Neutral and Park.

IF THE ENGINE DOES NOT CRANK:

•**Solenoid clicks but starter does not operate** (Put your ear over the starter solenoid area and listen as a friend turns the key to start position):

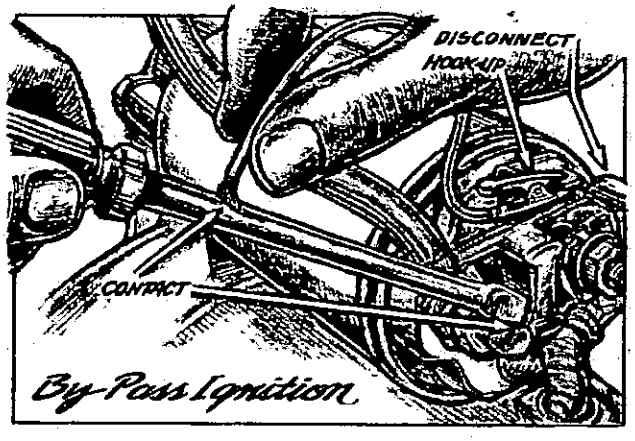
(1) Shift into fourth gear. This works only with manual transmissions. Take off the emergency brake and push the vehicle forward one foot. Put the brake on and the shifter in Neutral. Try to start it again. If it starts, there's a dead spot in the starter motor. Remove to fix it (Proc. 7).



(2) Shift into Neutral (or Park). To see if the starter motor operates, find the wires connected to the solenoid, and place a medium screwdriver against the 12, 13, or 14mm nut with the heavy wire going to the starter. Make the following connections definite. Don't jerk or touch the screwdriver to any surrounding parts. Touch the similar nut next to it with the screwdriver shaft to make contact between the two. There will be sparks, and if the starter is working it will whir and spin, indicating that the failure is in the solenoid.

Try starting the engine again. If the solenoid still clicks and the battery and connections are sound, there may be resistance in the cables. To check this, use a set of jumper cables. Clamp one cable end to the battery cable nut on the solenoid and the other end to the positive post of the battery. Clamp one end of the black cable to the rear of the starter body and the other end to the negative post of the battery. Make sure the jumper connections are good, then try starting the engine. If it goes, one or both of the battery cables are shot. Remove the jumper cables one-at-a-time to isolate the faulty one.

If both tests fail, disconnect the positive jumper at the solenoid and touch it momentarily to the other solenoid nut, and the starter should operate without cranking the engine. If this works, there is a problem in the battery-solenoid connection, either inside or out. Clean the exterior connections, try again. Then, if necessary, replace the solenoid (Proc. 7).



•Solenoid doesn't click, and starter doesn't operate:

Pull the spade connector and small wire off the solenoid. Carefully lay the flat tip side of a medium screwdriver on the inside of the nut holding the battery cable. Now carefully move the shaft toward the spade terminal and make contact. Make a definite connection.

If the starter works and turns the engine over, you have a problem in the wiring to the ignition switch, in the ignition switch, the neutral safety relay (automatics), or between the switch and the starter, or between the interlock relay (some 610 and 710 cars share this—if so, push the red button on the firewall behind the engine).

To check for current to the solenoid, connect a voltmeter positive lead or test light probe to the metal end of the tickle wire now disconnected from the solenoid. Place the other test lead from your instrument to a good ground or the battery negative post. Have an assistant turn the ignition switch to the START position. The voltmeter or light should indicate current (12 volts) through the wire. Wiggle the switch a number of times to make sure. Nothing? Then there's trouble in the wiring or the switch. See Proc. 15 (3) to further isolate the trouble.

IF THE ENGINE CRANKS SLOWLY:

This problem may be anything from a tight engine or mechanical problems to a weak battery, starter or its connections. Listen for abnormal noises while cranking. There could be resistance in the battery cables or in the solenoid, or worn, bent or faulty parts in the starter motor. Remove the starter and have it tested to find out how many amps it is drawing. 60 amps is normal under **no load** (Proc. 7).

PROCEDURE 7: REMOVE, INSTALL AND TEST STARTER (OFF ENGINE)

Condition: You have determined that the starter is faulty, or you want to get at the flywheel and ring gear or starter driveteeth.

Tools and Materials: Basic tool kit, masking tape, pen and maybe a helper.

Remarks: To look at the flywheel or starter driveteeth, you need only unbolt the starter motor from the transmission bellhousing and leave the electrical connections intact. Disconnect the negative battery clamp first.

NOTE: There are two types of starters used on Datsun/Nissan engines: standard and gear reduction. The latter is scarce and used in colder climates.

Step 1: Disconnect the Negative Battery Cable.

See Proc. 1 (3).

Step 2: Remove the Electrical Connections from the Solenoid.

Use masking tape to mark the wires you remove. Follow the positive battery cable from the battery to the solenoid. Find the wire with the spade connector on it and pull it off the solenoid. Now loosen and remove the 12, 13 or 14mm nut and lockwasher counterclockwise. Remove the cable end and other wires. Replace the washer and nut onto the stud for safekeeping. Label the wires "B" for battery.

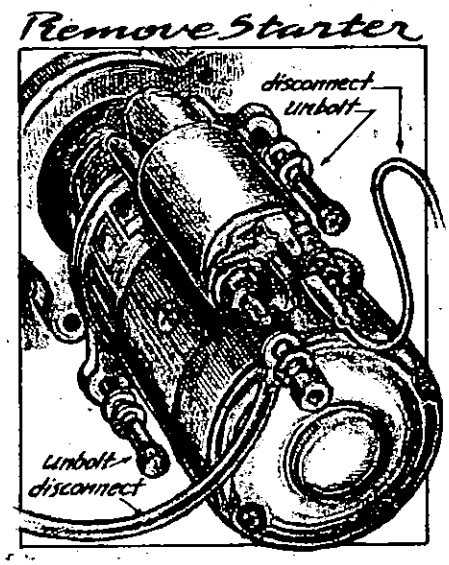
Step 3: Find, Loosen and Remove the Starter Mounting Bolts.

The starter is held in place by two bolts through holes in the transmission bellhousing. The solenoid is where the electrical connections were; the starter is larger and below the solenoid.

Find the mounting bolts. Depending upon your tools, and vehicle, you may find it easier to jack up and support the front end. Scope out the bolts and, if necessary, see Ch. 13, Pt. 1, Proc. 1 to jack and support.

Follow the starter back to where it attaches to the transmission. Find the lower bolt. Use a 14 or 17mm socket, 6in extension and ratchet on the front end and if necessary an open-end on the back. An assistant might help here. Account for the bolts and washer(s) (and nuts) as they come off.

Loosen and remove the top bolt (and nut) with washer(s) and negative battery cable (older models) or wire holder (if included). The starter assembly will begin to drop as you loosen the upper bolt. Lift the starter up and away from the engine. Store the bolts, washer, and nuts on the bolts, in the order they were removed.



Step 4: Inspection.

NOTE: As previously mentioned, there are two starter designs used on Datsun/Nissans: standard and gear reduction. Most use standard drive starters. Gear reduction types are used in cold climates and for special applications (unknown to me).

Look at the business end of the starter. The starter driveteeth should look alike, with some shiny wear on their ends. Now look at the ring gear, inside the starter hole. These teeth should be uniform all around the flywheel (or driveplate, Automatics). Examine this by cranking the engine with a 27mm or 1-1/16in wrench at the front crankshaft pulley bolt or pushing the vehicle in high gear, while watching the teeth parade along. They should be worn evenly. If sections of the ring gear are worn, the transmission and clutch have to come out, then the flywheel. **Automatic Transmission People:** You may have to move the gear around with a screwdriver

tip wedged between the teeth and the shaft pivoted against the edge of the hole.

Go back to the starter motor. Turn the starter drive counterclockwise while pulling it toward the end of the shaft. The gear should turn in a smooth spiral pattern along the shaft. Let go of the gear and it should spring back toward the motor. NOTE: These tests are specifically for standard starters; gear reduction types have a similar drive gear but, in addition, have a gear assembly.

Turn the gear clockwise, and it should turn the shaft. If either test fails, or the gear is worn, replace the starter with another. Wiggle the shaft while watching how it fits into the end of the housing. A lot of play can make the shaft bind, causing the starter to drag.

Step 5: Starter and Solenoid Tests.

The problem is usually electrical. It's easy to test a starter motor off the engine if you have a set of jumper cables and a screwdriver.

•Starter Check off of Engine:

FIRE DANGER: Make sure there are no flammables anywhere around!

Hold the starter in a vise or a friend's firm hands. Separate two ends of the cables so they don't touch. Connect the opposite ends, black (negative) and red (positive), to the battery (Proc. 2).

Clamp the free positive clamp onto the wireless nut at the front of the solenoid. Now clamp the negative cable end onto the starter housing. Nothing should happen.

Gently lay a screwdriver and/or jumper wire between the positive clamp and the little spade. The solenoid should click and the motor should whir. If nothing happens, recheck your connections (they must be tight) and try again.

If the motor operates, the drive gear should thrust toward the end of the shaft and spin with the motor. If the solenoid clicks but the motor doesn't turn, start isolating the trouble.

•Starter Motor Check: Take the positive clamp off the wireless nut and touch it to the one next to it. The motor should turn without binding or weird noises (like grinding, whining, or chattering).

•Solenoid Check: Keep everything hooked up as in the last test, but move the positive clamp to the solenoid spade just above the nuts. The solenoid should click. It doesn't have to stay in place and may jitter back and forth.

If the solenoid works and the starter doesn't, try wiggling the studs up and down. If they are loose, lightly tighten the nuts behind the connector nuts. Make sure all wires connected to the solenoid and starter motor are intact and their connections don't move around when wiggled. Retest the solenoid and motor.

Even if these tests show the starter and solenoid are working, they may not work under load, or when cranking the engine. The starter may draw too much current or the switch in the solenoid may not be able to carry enough current to crank the engine.

If you conclude that the motor or solenoid is faulty, you may want to take the pieces to an auto, electrical, or machine shop to be checked out.

You can buy new or rebuilt parts (solenoids are usually sold separately). Call around. Starters—new or rebuilt—are usually sold together. Both Datsun/Nissan and Bosch sell good quality rebuilt electrical parts; other sources vary in quality. Use your old parts for trade-in (COR). Used parts are also a good alternative. All Datsun L-series starters are interchangeable. Get a guarantee.

Further testing, disassembly, and rebuilding can be done, but are not covered in this book. Sorry.

Step 6: Replace the Starter Motor.

Find the mounting bolts, nuts, and washers and fit the starter into place. Have your helper hold it as you line up the bolt holes and hold the motor flush to the transmission.

If you took the battery negative cable end off with the top mounting bolt, slip the bolt through the end of the cable. Do not confuse this with the positive cable.

Put the upper bolt through the upper hole and the transmission. Slip on the washer(s), lockwasher last, then the nut. Tighten the bolt until the starter is flush with the transmission but not fully tight. Install the lower bolt

(washers and nuts) and tighten, using a box-end wrench and socket with extension. Both fasteners must be very tight.

If the front end is up, lower it (Ch. 13, Pt. 1, Proc. 1).

Step 7: Reconnect the Solenoid Wires.

There are two basic connections.

First, find the wires you marked with a "B". Clean the end of the cable eyelet with emery cloth and remove the nut and washer from the solenoid stud. Slip the eyelet over the stud and replace the washer and nut. Tighten this nut with a 12, 13 or 14mm wrench until the eyelet won't move and the nut is snug. Do not overtighten.

Next, find the spade connector wire. Push it onto the little spade just above the nuts. Make sure the connection is tight. Pinch the connector with pliers if necessary.

Step 8: Reconnect the Negative Battery Clamp.

See Proc. 1 (6 and 7).

Make sure the terminals and clamps are clean and in good condition.

Step 9: Test Start the Engine.

If the battery and solenoid are properly connected and the starter assembly functions, the engine should crank at normal speed and (assuming everything else is working) start.

PROCEDURE 8: TEST THE CHARGING SYSTEM

Condition: The battery doesn't hold a charge or continually discharges (or overcharges—check the regulator). The red ignition light comes on, flickers or the voltmeter shows discharge when the engine is running. You have checked that the alternator fan belt is tight, the fuses and their connections are sound, the battery is in good condition, its clamps and posts are clean and tight, and the battery cables and fusible links are in good shape (Proc. 1 and 11). You hear a squeal or squeek coming from the alternator. The choke doesn't open (alternator output affects the choke relay). The idle stays high and fuel consumption is excessive.

Tools and Materials: A DC voltmeter that will read past 16 volts is most helpful but not necessary.

Remarks: The alternator light should come on when the key is turned to ON. If it doesn't, check the bulb in the dash. If none of the dash lights goes on, look for disconnected plugs and wires (Proc. 15). I have intentionally left many diagnostic steps out of this procedure. Charging problems can be frustrating and if you don't have the right knowledge and meters, mistakes may be expensive. In most cases it's easier to have the alternator bench-tested by an expert. NOTE: Nissan has a "Tech Bulletin" (#TS81-014A) for 510 and 720 vehicles (1980 and '81). It tells how to cure flashing charge and brake warning lights under initial acceleration.

Step 1: About the Alternator and Regulator.

If you have an alternator with an integrated circuit (IC internal) regulator, there should be a blue tag on the top side of the alternator saying so. (Transistor IC regulators were installed in 1978 models.)

There are three basic alternator designs. The early type (1969-71) has a pigtail connector with four wires attached at the back of the alternator; it may be either a Mitsubishi or a Hitachi. The later models, all Hitachi (unless modified after market), have a plastic T-connector that plugs directly into the back of the alternator with two wires leading from it. Both these styles have external regulators. The third type (latest models 1978 on) is internally (solid state) regulated. All types have at least four (maybe five) wires connected to them.

To start with, check the connections at the back of the alternator. When you know which type you have, look closely at the condition of the connections, connectors, and wires. They should be tight and secure.

On all pre-1987 alternators, an 8mm nut with washers and a round locating washer acts as a diode ground, which is visible on the bottom rear side of the alternator. The locator also helps hold on the plastic diode cover. This nut and its friends should be tight and intact. The system won't charge if they are missing.

•**Pre-1978, External Regulator Models:** The regulator is mounted on the upper right fender wall. There are six multi-colored wires and a rectangular or round plastic connector attaching it to your alternator. Make sure this connection is good.

•**1978 and later IC Regulator Models:** Your solid state regulator is built into the alternator.

Step 2: What goes Wrong?

Brushes and bearings are the most common alternator charging problems. There are two brushes and two bearings. These parts wear out but are simple to replace. Nonetheless, I suggest you remove your alternator and take it to the most trustworthy auto mechanic or electrical shop to have it tested for output. It can be rebuilt but shouldn't be if it costs more than a rebuilt or used one.

Aside from brushes, there are diodes. Diodes are like one-way gates. There are six or nine in the alternator and two in IC regulators. Bad diodes drain your battery and sometimes howl. They are often replaced along with the brushes. They come in diode packs and are more expensive than brushes. Other problems, less common but possible, occur in the rotor, commutator, stator, or housing. Thorough tests not covered in this book reveal such problems.

•**IC Transistor Regulator People:** Your diodes are much more expensive. Start by checking or replacing the brushes; they tend to stick. Don't trust amateur mechanics to test or fix your electronic alternator. If in doubt, get a second opinion before spending lots of money.

•**Early (1969-71) People:** Your diodes are hard to get and replace. Get a rebuilt alternator—it's easier.

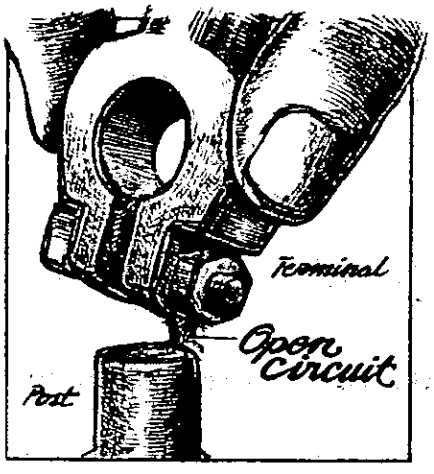
•**Everyone: Brushes** can be replaced in sets or in packs. **Diodes** are tested with an ohmmeter and have to be soldered in and out of the alternator. By spinning the alternator pulley, you can check the two roller **bearings** that tend to dry up and scream when worn out. If spinning the pulley feels rough or makes noise, a bearing is probably bad.

An alternator can be rebuilt for under $20, assuming little is wrong with it and you're treated fairly, so shop around.

The voltage regulator is another matter. It can't be bench-tested as easily as the alternator. If the alternator is working, suspect the regulator (Proc. 10).

•**IC Alternators** have the regulator built in. It can be replaced, with great care not to damage the transistors. They are only available (as far as I know) from the Datsun/Nissan dealer. You may find it's cheaper and simpler to buy a rebuilt alternator assembly. Shop around and use the old alternator for comparison.

•NOTE: Sometimes the system will charge when there is little or no load on the battery (lights and heater or air conditioner off), but not charge when under load (lights, etc., on). This kind of situation makes testing your charging system difficult. It's usually a problem in the alternator or battery.



Step 3: Check for Battery Drain (discharging).

This simple test can tell you if something external is discharging your battery. Your battery should be fully charged for this step (Proc. 5).

Disconnect the negative battery clamp and clean both it and the post (Proc. 1 [3 and 6]). Make sure all electrical switches and accessories are turned off: doors closed, key and lights off. If you have a clock, find and disconnect the fuse for it—usually a 10 amp fuse in the battery or accessory part of the fuse cluster. It helps to do this test in the dark or with a sheet over your head. The spark/arc you're looking for may be faint.

Touch the clamp to the battery post, then move it away. There should be no spark/arc when you do this. An arc means there's a drain, something is ON, or there's a short or path to ground. If you hear clicks (relays operating), a bad alternator diode(s) is probably

causing the drain. You can isolate which circuit or component is at fault by disconnecting fuses and wires then retesting for a drain each time a circuit or component is isolated from the system. You can disconnect the alternator, for instance, by unhooking its wires (Proc. 9 [2]). For more on general electrical troubleshooting, see Proc. 15.

If you don't see an arc or find a drain, try leaving the battery disconnected overnight or when you're not driving. If it still goes dead, have the battery tested.

Step 4: Charging Tests with a Voltmeter.

You need a voltmeter for this test. Set it to cover 12 volts DC. The battery has to be fully charged, electrolyte level up, and the battery's clamps and posts clean (Proc. 5).

Start the engine and connect the voltmeter leads (black to negative, red to positive). The meter should read between 13 and 15 volts. Run the engine at medium throttle (1500 rpm) and check the output again. If it increases, turn off the engine and make sure the fan belt and all the battery and fuse connections are tight. If all that is good, and the reading is below 13 volts, remove the alternator and have it tested. Some systems will work charging at 12.5 volts. If this doesn't cause your battery to run down, live with it.

If the system is charging, turn on the headlights. The meter should read no less than 12.5 volts.

If your voltage reading doesn't match these numbers, remove the alternator and have it tested.

Call around to auto electric or general repair shops and machine shops to ask if they do alternator bench testing. If you have an IC (internally regulated) alternator, tell them so. A shop that specializes in auto electric is more likely to do rebuilding than one that wants to sell you another alternator. A simple fix could save you money if stuck or worn brushes are causing the problem. Bench testing can also isolate alternator noises such as bad bearings.

On the other hand, if the diodes are also bad, it may be cheaper to get a rebuilt alternator or a used working one, assuming the one you get was rebuilt completely or has life left in it. (Rebuilt means different things to different people.)

Some alternators are so faulty they can't be rebuilt even if the test shows they're functional.

There are also replacement alternators available that aren't the original Hitachi brand but with minor modifications work as well. I have too little experience with these to judge.

•**External Regulator People:** Mechanics frequently replace the regulator when diodes are replaced (or the whole alternator). This is a good idea if your regulator is old. Otherwise, take the chance and use the regulator you have. If you are simply replacing the brushes, don't worry about the regulator.

If the alternator bench tests OK suspect the regulator. But have the brushes checked while the alternator's out. They have wear marks on them and are easy to get at. Once the alternator's back together, retest it on the bench.

When it's back in the vehicle it should charge. If not, suspect the regulator. But check all the connections first (Proc. 10).

•**IC Regulator People:** Your solid-state regulators can be replaced alone as can the brushes and diodes. It takes some judicious soldering to connect the regulator so have a pro do it. These transistor units are expensive.

PROCEDURE 9: REMOVE AND REPLACE THE ALTERNATOR, ADJUST FAN BELT TENSION, AND REPLACE FAN BELT (Air Conditioner and Air Pump People)

Condition: You suspect the alternator is malfunctioning and want to remove it for testing, replacement, or repair. Or Ch. 3 sent you here. The fan belt needs to be replaced or adjusted. (To replace the fan belt or adjust belt tension, start with Step 3.)

Tools and Materials: Basic tool kit, a long hefty screwdriver, and a new fan belt (if needed).

Remarks: It's best to remove and use your old fan belt for comparison when buying a new one; get the exact width and size. The same goes for the air conditioner and/or air pump belt. NOTE: If you have an alternator modification, note carefully how things come off.

Step 1: Disconnect the Negative Battery Clamp.

Locate the negative post of the battery, loosen and remove the negative (-) cable clamp. Set the clamp well away from the post (Proc. 1 [3]).

Step 2: Disconnect the Wiring at the Rear of the Alternator (Alternator Removal People).

Use a good light to look at the rear of the alternator. The three types of alternator(s) vary in design and amperage output.

•**Old-style Alternators** have a four-wire pigtail to a multiple prong connector that can be separated. If this is you, pull and wiggle the connector apart by holding and pulling it—not the wires—umph!

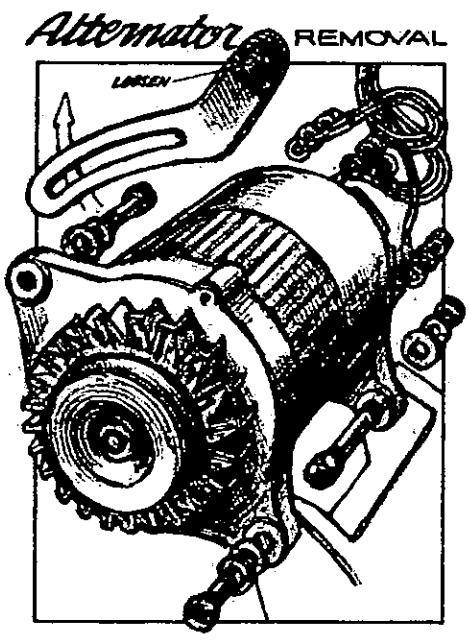
•**New-style Alternators** have a two-wire, T-connector plugged right into the alternator. Pull and wiggle this connector out backwards.

•**Everyone:** Two more wires connect to the alternator, a ground and a battery wire. There may be two each of these. Each wire is held in place by an 8mm nut or bolt. Start with the battery wire(s). This wire(s) is white-and-red or plain white. Pull back the rubber cap so the nut and stud are visible. Loosen and remove the nut, then pull the wire gently off the stud. There may be a condenser pigtail wire under the nut too; remove it and let it hang. Put the nut and washer back on the stud. With masking tape, label the wire "A" (there is also an embossed letter "A" on the back of the alternator near the stud).

If this "A" wire(s) is any color other than white or red-and-white, be suspicious and check its position.

The other, black wire(s) is the ground wire(s) with a letter "E" embossed next to its stud. Loosen the nut or bolt and washer enough to slip the connector end away from the alternator. Some models have a condenser (a little cylinder) under this nut. Remove it, put it in a baggie and retighten the nut (or bolt).

Make a note to replace or repair any frayed or broken connections.



Step 3: Loosen or Remove the Alternator Mounting Bolts.

The alternator is bolted at three points: one on top at the adjustment bar, and two below at the swivel mount.

First loosen the 14mm bolt at the adjustment bar, using the box-end wrench to turn the bolt counterclockwise, but don't remove it.

•**Fan Belt Adjustment People:** Don't remove the three alternator mounting bolts, just loosen them.

•**Car and 4WD People:** You have to remove the skid pan to get at the swivel bolts. Four or six 10mm bolts hold the pan to the body. Find and remove the bolts and put them in a baggie marked "skid pan." Set the pan aside. If you can't fit under the car, jack up the front end (Ch. 13, Pt. 1, Proc. 1).

•**Everyone:** Lie on your back looking up at the base of the alternator. Find the mount that attaches to the engine and supports the alternator at two points. Here is where the design varies from model to model.

•**510 and 610 (1969-74) Models:** Two 12mm bolts go through the alternator and into its mount. They break easily and the threads in the mount tend to strip, so if one of the heads or an entire bolt is missing, you may have to remove the mount and tap the broken bolt out or install another mount. Look into the bolt holes when the alternator is out.

•**521 and Early 620 Models:** Your mount is a steel plate. Two 12mm or 14mm bolts hold the alternator to it. The rear one has a nut and washers; the front bolt threads into a nut welded to the mount.

•**620 (1975 on) Models:** You have a cast iron mount with a swivel bolt and nut layout similar to 521 and early 620 models.

•**510, 610, 710 (1975 on), and 720 Models:** Your mounts are cast iron and bolted up at the swivel much like the early 510s.

Step 4: Loosen the Mount Bolts.

Loosen the bolts with a 12 or 17mm box-end wrench one or two turns. If there's a nut on one of the bolts, use a box-end and a socket. Think about which way you have to turn—counterclockwise. Don't force anything.

To only remove the alternator, simply take the belt off that pulley and let it hang. But inspect it first for cracks, chunks missing or fraying. Replace it if necessary.

Step 5: Remove the Fan Belt.

Push the alternator toward the engine. If it's still tight, loosen the bolts some more and push the alternator closer to the engine.

Take the belt off the alternator and crank pulleys. Now go above and pull the belt off the fan pulley. If there's nothing in the way, work the belt up through the blades. This can be tiresome.

If the air conditioner, air pump or power steering pump belt(s) is (are) in the way, see below.

•**Air Conditioner, Air and/or Power Steering Pump People:** These belts may have to be removed to get at the fan belt. They are removed differently than the fan belt. And whether or not they have to come off, they should be checked and replaced, tightened or left alone while you're doing the fan belt. For more information, see Ch. 6, Pt. 2, Proc. 4 for air pump and conditioners and Ch. 12, Proc. 13 for power steering pump. To check belt condition, see Ch. 3, Proc. 8.

•**Everyone with numbered timing indicator:** To get the belt off the crank pulley, you have to loosen and remove the lower timing indicator. Just loosen the upper 10mm bolt and pull the indicator up. Buy and replace any missing bolts, washers, and nuts.

•**Everyone:** Compare your old belt with the new one. It should be slightly shorter (less stretched). If the alternator was too far away from the engine or too close, the belt may be too long or too short. Get one that fits.

Step 6: Replace the Fan Belt.

If the air conditioner, power steering and/or air pump belts go behind the fan belt, they should be serviced and put back on their pulleys before you install the fan belt (Ch. 6, Pt. 2, Proc. 4 [4]). Some power steering details are in Ch. 12, Proc. 13.

Work the fan belt down through the fan blades and onto the pulley (skinny side down). Next fit the belt around the crankshaft pulley. Finally, work it onto the alternator pulley. Loosen and push the alternator some more if necessary to fit the new belt. Go on to Step 10 to adjust the fan belt tension. If you moved the timing indicator, realign and secure it now. Don't overtighten the 10mm bolt.

Step 7: Remove the Alternator.

If you don't have a power steering pump, remove the 14mm bolt from the adjustment bar and alternator. Next remove the 14mm bolt that holds the bar to the timing cover and lift the bar out of the way.

If you do have a power steering pump, you have to drop the alternator out from below. Put a folded towel under the truck to catch the alternator.

•**Everyone:** Thread out the mounting bolts. Keep the washers (and nut) with the bolts. Wiggle the alternator to get out stuck bolts.

Push the alternator out of the mount and support it while you go above and remove the 14mm adjuster bolt and washer if still in place. Put all the bolts together. Carefully lift the alternator forward and up or drop it down and out the bottom of the engine.

NOTE: If you can't get the alternator out because of a radiator hose or another obstruction, you may have to remove (but not destroy) the oil filter and remove the alternator rearwards. Save all the nuts, washers, and bolts from the old alternator electrical connections if you swap any parts. Compare the pulley sizes of the new and old alternators. Swap these if different. You may have to take it to a mechanic to get the nut off the shaft.

Step 8: Remove and Replace the Alternator Mount.

This is only necessary if you have to remove the mount for repair or replacement. If a mount bolt broke or is missing, check the bolt holes in the mount. If you can see or feel a broken bolt, the mount has to be removed,

the broken bolt drilled out and the hole retapped—all by someone who knows how.

The mount is attached to the engine by two or three 12mm, 14mm, or 17mm bolts. Use a socket and hefty ratchet with a short cheater pipe to loosen and remove the bolts with their washers. If any are broken off they'll be tough to tap out. Replace any missing parts. Do not let the mount fall onto your face once it's loose. Remove and repair a broken mount by welding, brazing, or replacing it with one from the wrecking yard.

To replace the alternator mount, align the mount to the bolt holes in the block and install the bolts with washers. The bolt holes for the alternator mounting go toward the front of the engine. Tighten the bolts well without breaking them.

Step 9: Replace the Alternator and its Mounting Bolts.

NOTE: It helps to have a friend.

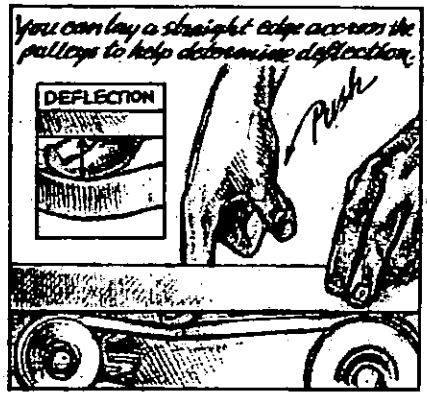
Oil the bolt threads before replacing them. Lay out the tools, bolts, nuts and washers under the engine. Working from above or below, push the alternator up into place, with the pulley forward and mounting ears downward. Lay the alternator on any available ledge or have your friend reach into the engine compartment and hold it in place.

Go above and find the adjustment bar (if removed) and its 14mm bolt. Align the adjustment bar (curved side down) with the hole in the timing cover and install the bolt fingertight. Now position the alternator so that it fits in front of the bar. Align the slot in the bar with the hole in the alternator and install the 14mm adjustment bolt with a flat washer and a lockwasher. Don't fully tighten the bolt.

Go below, swing the alternator toward the mount and tap it into place. It may take a little tapping and prying to line up the holes and install the bolts. Check the previous illustration for placement. Do not tighten the bolts yet.

Install the rear bolt with washer(s) from the rear and the front bolt from the front. Install the washer(s) and nut onto the front bolt if you have this style. Snug the bolts (holding the nut if necessary) so the alternator still swivels. If the adjustment bar is loose, make sure it's positioned so the alternator is at mid position in the adjustment slot, then tighten the timing cover bolt.

Go above and fit the fan belt over the pulleys. Make sure the alternator pulley is in line with the others. If it isn't, the alternator is incorrectly mounted.



Step 10: Adjust the Fan Belt Tension.

The lower alternator swivel bolts and upper adjustment bolt have to be loose to do this (Step 3). Don't remove the adjustment or mounting bolts, just make sure they're loose.

To adjust the fan belt tension, stand over the alternator and engine compartment and use a 10in hefty straight-tip screwdriver as a lever. Insert the screwdriver tip down behind the adjustment bracket along the front side of the alternator. Fit the tip (flat side) under the lump on the side of the timing cover and the shaft against the side of the alternator. Pry and push down on the screwdriver handle. The belt should tighten. Don't put excessive pressure against the side of the alternator.

Check **belt deflection** by pressing on the belt between the alternator and the fan pulleys. The correct tension or deflection is 15/32-19/32in (12-15mm) for an old belt or 5/16-15/32in (8-12mm) for a new one. This is worth doing right. Make sure the belt runs straight through all the pulleys. When you're ready, pick up the 14mm box-end wrench and tighten the adjustment bolt until the lockwasher flattens, so the bolt is snug.

Now go below and tighten the two swivel bolts with a wrench and socket. *Do not overtighten the 12mm style bolts.* When everything is peachy, go back up top and recheck the belt tension.

If the air conditioner, air pump and/or power steering pump belts need to be put back on, see Ch. 6, Pt. 2, Proc. 4 (4), and Ch. 12, Proc. 13.

Step 11: Reconnect the Alternator Wiring.

Identify the wires. First find the "A" or battery wire(s), which should be white or white-and-red. Remove the nut and washer and slip them over the stud marked "A". If you removed a condenser, put the pigtail wire end under the "A" wire. All connections should be clean. Replace the washer(s) and nut. Tighten the nut until it's snug with an 8mm open end.

Next find the black "E" wire(s). This one usually has a forked end that slips in under the nut or bolt and washers. Be sure you have the right place and that the forks fit between the washer and the alternator body. If you have a condenser, slip its legs (connected to its cylindrical body) under the nut too. Tighten the nut or bolt the same way as the other one.

Now find the plug with two wires connected to it. The plug fits either directly into the back of the alternator or, on old 510s, into another plug and pigtail attached to the alternator. Make the connection fit well. Double-check your connections (Proc. 8 [1]).

Step 12: Reconnect the Negative Battery Clamp.

See Proc. 1 (7).

Simply fit the clamp over the post and tighten the nut.

Step 13: Replace the Skid Pan (Car and 4WD People).

Step 14: Start and See.

Start the engine. The alternator light should go out (Proc. 8 [3] to test the output). Your problems should be solved. After running it a while, recheck the fan belt tension and bolt tightness.

PROCEDURE 10: REMOVE AND REPLACE THE VOLTAGE REGULATOR.
(External Regulator [Pre-1978] People Only; 1978 on People, see Proc. 8.)

Condition: You have done Proc. 8 and maybe 9 and have concluded that the regulator is bad. The battery is being overcharged; electrolyte is bubbling out of it.

Tools and Materials: Phillips head screwdriver, new voltage regulator.

Remarks: When both fuel and temperature gauges act up at the same time, or one headlight is dim or burns out a lot, suspect a faulty voltage regulator. Transistorized external regulators are now readily available. They are good replacements. Be sure to match your vehicle parts numbers to get the correct regulator.

Step 1: What Do You Do?

In desperation many people remove the top of the regulator to see if something looks bad. The inside may look clean while the outside has barnacles growing on it. Although this little genie looks feeble, it is indeed a wonderful component in the electrical circus. It is adjustable, but I only mess with it if the battery is being overcharged. Adjustment isn't covered in this book nor is testing. The regulator has two parts: the voltage regulator and the charge relay. One controls voltage, the other amperage. The regulator part affects the overcharge condition. Take your problem to an electrical expert or replace the regulator. NOTE: The proper voltage setting is 14.3 to 15.3 volts at 68° F with a fully-charged battery.

Step 2: Will a Used Voltage Regulator Work?

Maybe, but a new one is a better choice and may save your alternator.

Step 3: Remove the Relay Panel Cover.

On many models (610s, 710s, and new 510s) you have to remove the relay cover to get to the regulator. Found on the right fender wall inside the engine compartment, it is removable with a Phillips screwdriver.

Step 4: Remove the Regulator.

Make sure the ignition is turned off. Locate the regulator and see if there is a black ground wire attached to one of its base screws.

Loosen and remove the two Phillips screws holding the regulator to the body. Stash the screws somewhere safe. Pull back the ground wire, if attached. Find the round or rectangular plastic connector pigtailed to the regulator wiring and separate it from the rest of the wiring. Wiggle the connectors. Do not pull on the wires.

Look for any signs of exposed, burned, or frayed wires around the connector. Melting indicates other problems in the circuit. Investigate it with a wiring diagram or professional help.

Step 5: Replace the Regulator.

Make sure the plastic plug connector shape matches the wiring harness. Push the connectors together firmly. They only go together one way. Look at the wire colors to see that their positions match.

Place the regulator against the vehicle body and install the screws. Slip the ground wire into position between the base and the screw, if removed, and tighten the screws. Turn the ignition on to see that the dash lights light, then start the motor. I hope your problems are solved.

PROCEDURE 11: INSPECT, CLEAN, REMOVE AND REPLACE THE FUSIBLE LINK AND FUSE BOX

Condition: Electrical problems: Your headlights are out, other electrical accessories fail, or the engine stops and no electrical devices work. NOTE: Burned ignition fuses on electronic ignition vehicles usually are caused by a loose wire in or attached to (ground) the distributor.

Tools and Materials: Fuses, fusible link, fuse box, emery cloth, Phillips screwdriver.

Remarks: If you're suspicious that your electrical problem is serious, don't hesitate to contact an electrical specialist after reading this procedure.

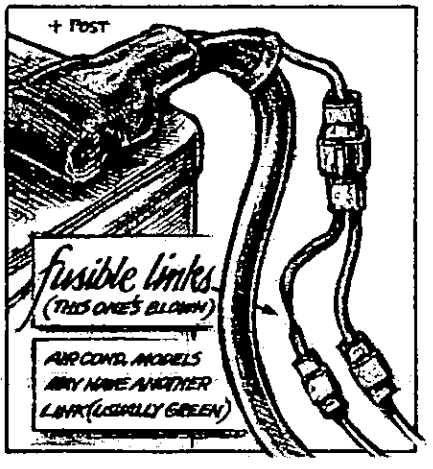
If one circuit fails, check that fuse and its contacts (Steps 4 and 5).

Step 1: What Are Fuses and Fusible Links?

The **fusible link** is a wire that links into the vehicle's main electrical circuits to protect them. On many later models there are two or three fusible links. If everything in the vehicle stops working, either the battery has become disconnected or the fusible link has burned out. In the latter case, a bared wire has probably grounded against the body. Find and repair the short before replacing the fusible link.

The **fuse box** holds **fuses** that protect the individual circuits that make up most of the electrical system. When a fuse blows, there is a problem in the circuit it covers.

See Proc. 15 for more information on causes of these malfunctions. Some vehicles have in-line fuses for individual circuits like the radio, cigarette lighter, and horn.



Step 2: Find the Fusible Link and Fuse Box.

Many early Datsuns do not use a fusible link. There is, however, a wire connecting the battery (or battery stud on the starter solenoid) to the fuse box. After 1973, most Datsuns and Nissans do. If you have a fusible link, it will be connected to a wire connected to the positive battery cable or, in 610s and 710s, on the relay panel. If the fusible link is burned, the insulation will appear to be blistered or, in the extreme, bare to the wire or broken. Fusible links supply power to and protect the fuse box, and maybe the ignition switch and headlight circuit.

The fuse box is located in one of three places. On early models the box is under the hood on a shelf on the right-hand side of the firewall. On 610 and 710 vehicles the box is in the passenger compartment in front of the right door on the side kick panel. On later model

pickups and 510s the box is under the driver's side dash or on the left side kick panel in front of the door.

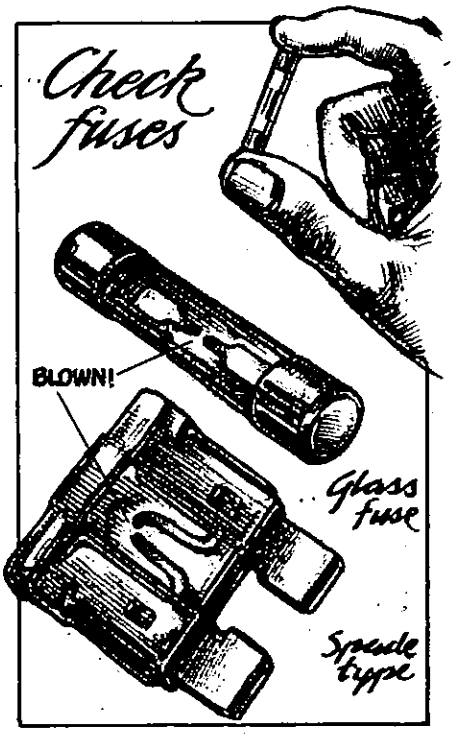
The fuses are covered by a plastic box that is removed either by prying the tabs on the ends of the cover or unscrewing or pulling up on a retainer holding it to the box. All Datsuns use glass type fuses while Nissans use plug in type. Fuse ratings and circuit locations are printed on the outside of the cover. Try to match your problem circuit with the fuse position on the cover.

Step 3: Remove and Replace the Fusible Link.

The fusible link(s) is connected to the main circuit wire at each end by a plastic connector. To remove the link, press in on the raised tab of the plastic piece or pull the wires apart.

Fusible link wire is special; it is designed to burn out before the rest of the circuit. Don't replace the link with another one until you understand the reason for its ruination. If you find the cause, and can't get a real fusible link, you can use regular 10 or 12 gauge wire temporarily. Do not use any wire larger or smaller than the one that's on there. Most fusible links are available from the dealer. You may use fusible link material, which you'll have to splice onto the original ends; it is available from many parts stores. Do not wrap the link with plastic tape. Keep the fusible link(s) separate from other wires so if it melts again it won't take another one with it.

Step 4: Check, Remove and Replace a Fuse.



You can tell a fuse is blown if the metal strip inside the glass or plastic has a break in it. Blown fuses mean that the circuit has been overloaded or there's a short. Fuses are easy to replace, but it's a waste of time if they're going to blow out right away.

Always replace a fuse with one that's the same amperage and size. Although it's tempting don't wrap a bad fuse in aluminum foil to make do. It's dangerous. Datsun/Nissans use 10, 15 and 20 amp fuses. Spare fuses are often stored in the fuse box either between the fixed fuses or under them; always carry spares. Amp ratings are stamped on the metal or plastic end of each fuse. Your owner's manual or a wiring diagram will tell you what size fuse to use for which circuit. A fuse doesn't have to be blown to stop current from flowing through the fuse box—bad contacts will do it, too.

To remove a glass type fuse, use a wooden match to pry the end of the fuse out of one of its contacts. To remove a plug-in type use your fingers or needle-nosed pliers to pull it out. Look for distortion or corrosion on the fuse box or contacts.

Replace the fuse by pressing it evenly into the contacts. Turn on the circuit after replacing the fuse. See if it blows again.

Step 5: About the Glass Type Fuse Boxes and Fuse Connectors.

In the mid-seventies Niles made a lot of fuse boxes for Datsun that had high resistance in them, which caused the plastic base to melt and distort, creating all kinds of problems. (Another theory is that the headlight main wiring has resistance causing the fusebox to get hot when the headlights are on.) Try sanding the contacts that hold the fuses (see Step 6). If that doesn't solve the heating problem, you may have to replace the entire fuse box. Buy one from the dealer or wrecking yard. If the warpage isn't so bad that the contacts come loose or close to each other, you can get by with cleaning the contacts and keeping an eye on the box. It will get hot when the lights or heater is on.

Step 6: Clean the Contacts (glass type fuse boxes only).

Disconnect the negative battery cable (Proc. 1 [3]). Remove the fuse box cover and one-by-one remove the fuses. Clean the inside of each contact with emery cloth. Bend the holders together so they will clamp the fuse ends securely. Replace the fuses. This should improve the connection and cut down on resistance. Reconnect the battery cable.

Step 7: Remove and Replace the Fuse Box.

Disconnect the negative battery cable (Proc. 1 [3]). Remove the fuse box cover. Look at the fuse layout and notice two Phillips screws sunk into the center section of the box or on either end of the box. Remove these and the box will pull away from its mounting. Unplug the clusters of wires from the back of the box and you've got it.

Replace the box with an exact duplicate. Install it by first matching the connectors to the back of the fuse box, then plugging them in. Place the box against its mounting and align the screw holes. Insert, then tighten, the two screws. Replace any missing fuses with the correct ones, then put the cover on. Finally, reconnect the negative battery cable.

PROCEDURE 12: TEST AND REPAIR THE IGNITION SYSTEM—CHECK FOR SPARK

Condition: The engine cranks but won't start; there is fuel in the tank and in the carburetor float bowl; the engine starts but won't keep running; the engine hesitates or misses obscenely while accelerating; you have tuned up (Ch. 3) yet the problems recur or persist. The transmission is in Neutral or Park and the emergency brake is on. The battery is fully charged; the headlights go on and the engine cranks fast enough to start. If the engine starts with difficulty and/or misses, check spark plug wire resistance, Step 11. You have checked the fuses, particularly the one(s) labeled "Ignition."

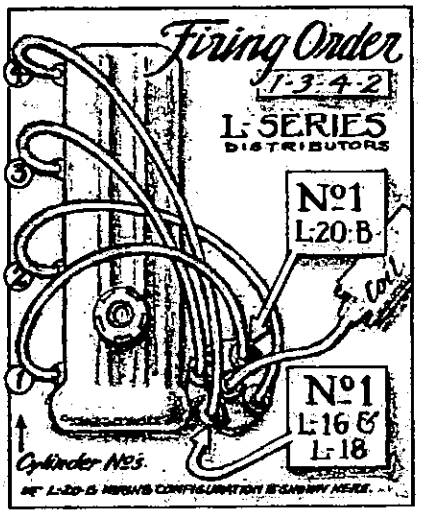
Tools and Materials: Test light, ohmmeter, screwdriver(s), 8mm socket or wrench, an assistant (electronic ignition people).

Remarks: Steve Rogers' first rule of auto mechanics is, "Check the points." Indeed it's a good place to begin troubleshooting. But you may not have points. Some California cars (1975 on) have TRIG ignition; 1978-on 510s have TRIG or IC ignition and 1977-on trucks have IC ignition.

Don't touch spark plug wires with bare hands.

People often suspect the coil when something's wrong. Coils seldom fail, don't be fooled—test first.

Remember: For an engine to run, there must be *fuel* (Ch. 6), *compression* (Ch. 3) and *spark* (Step 2 of this procedure). Each component must be delivered in the right amount, at the right time. In this procedure we'll examine *spark*. If you have a Volt/Ohmmeter and don't know how to use it, Ch. 13, Pt. 2.



Step 1: Check the Firing Order. NOTE: If your engine runs poorly or not at all, read this. If it stopped suddenly, go on to Step 2.

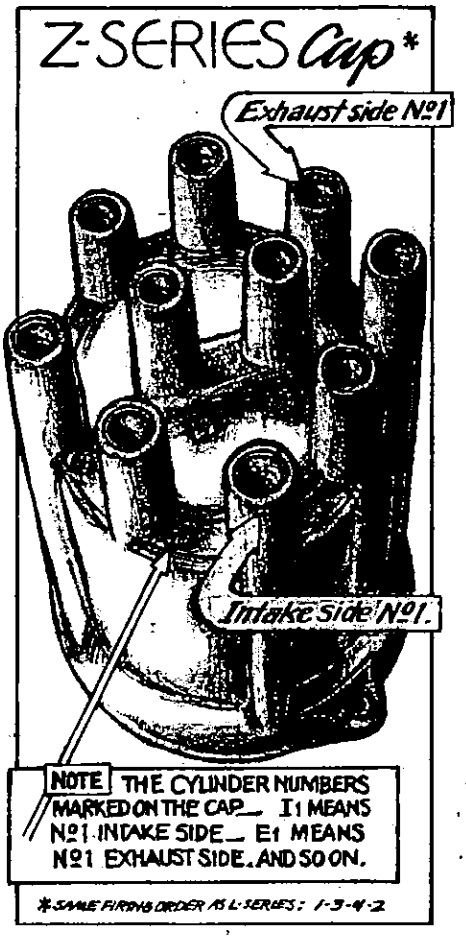
First make sure that the dash lights go on when the key is turned to the ON position. If they don't, look at the fuses and fusible link(s). Replace any fuses or wires that are blown or have bad connections (Proc. 11). Check the battery connections too (Proc. 4).

If dashlights are on, open the hood and find the distributor on the left front of the engine. The four or eight spark plug wires have to be in the proper *firing order* to run the engine smoothly. The spark plug wires connect the distributor to each of the four or eight spark plugs. The #1 spark plug(s) is the one at the front of the engine. On eight plug Z-series engines there is an intake and exhaust plug—one each side—in each cylinder. The wires should connect to the distributor in the positions illustrated for your engine. Make sure which distributor and engine you have. The wires should connect to the spark plugs #1-4, front to rear.

•L-series and 1980 510 with Four Plugs: Find the #1 wire on the distributor cap. If you count the other wires counterclockwise around the cap, they should connect to #1, 3, 4, and 2 plugs in that order.

•**Z-series Eight Plug People:** Start on the #1 intake plug wire. If your wires are the original (factory) ones, the intake wires may be labeled as intake or exhaust wires (I1, E1 and so on). They will at least be numbered #1, 2, 3, etc. There should also be letters embossed on the distributor cap next to the tower and hole where the correct wire should fit. I1 is #1 intake (right) side of engine, E1 is #1 exhaust (left) side. The two center towers are for the coil, also marked I and E. The intake coil wire cap is red. If they aren't marked, connect them the right way, as illustrated. On Z-series eight plug engines the intake and exhaust coil wires are frequently switched. The coils should be labeled.

•**Everyone:** Check coil polarity (Step 9).



Step 2: Check for Spark and Ground the Coil Wire.

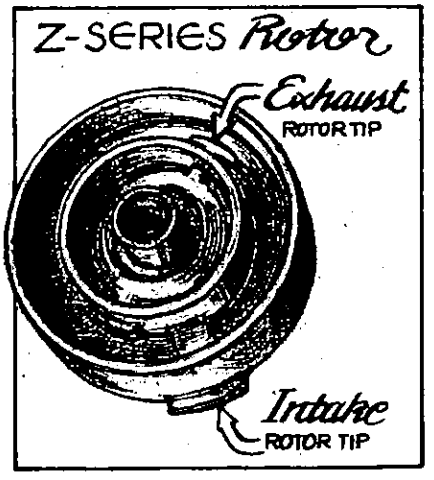
•**Electronic Ignition Models:** This step is a little hard to do alone unless you have a remote starting device (Ch. 3, Proc. 4 [3], or get an assistant).

•**Conventional Points Models:** If you're alone, remove the distributor cap and the rotor (Ch. 3, Proc. 5 [1]). Find the points. You want them closed. If they are open, put the transmission in high gear, emergency brake off if you're on flat ground, and push the vehicle enough to turn the wheels and rotate the engine until the points are closed (Ch. 3, Proc. 5 [3] for more on points layout).

•**Dual Points Models:** Test the primary points.

•**Electronic ignition models:** Your system develops a higher secondary voltage, so insulate yourself well from the wire. Also, the ignition system may shut itself off if the key has been on (not running) for more than 10 seconds. Switch the key OFF, then ON again to reset it.

•**Everyone:** Take the transmission out of gear and put the emergency brake on.



Pull the coil wire out of the center teminal of the distributor. Position the tip of the wire 3/16-¼in from a good ground—like a bare metal nut or bolt on the left fender wall—inside the engine compartment, far from the carburetor. **FIRE DANGER:** Do not perform this test if gasoline fumes or liquid are present!!! Keep your hands and hair away from the fan when cranking the engine. Wear rubber gloves. Hold the wire with a pair of insulated pliers, chopsticks or a dry, thick rag. NOTE: This is the only part of the electrical system that will shock (but not harm you) with its high voltage. If you want to ground this wire, not check the spark, tape the wire to the body.

On all engines 1975 on you can shut off fuel inside the carb to make this a safer test. Find the wires that run up to the carburetor. Unplug the red one if solitary or the whole multiple wire connector if the wires are together.

•**Everyone:** Keep your body away from the body of the vehicle. Don't stand in water. Have your assistant or remote starter crank the engine with the ignition on. If there's no spark, recheck your connections and try again. Still no spark? Go to Step 5. Spark? Go to Step 3.

•**Conventional Points People:** Ready? Turn the ignition ON. If alone do the screwdriver or toothpick trick to spread the points open. Use something non-conductive if possible (toothpick better than screwdriver) to open

the points and push the movable side of the points away from the stationary other point. As they separate, there should be a spark at the end of the coil wire. Spark? Go to Step 3. No spark? Try again. Still none? Make sure you're opening the points as described above. There should also be a little spark/arc between the points when you separate them. If there isn't, check for current to the points. If there's spark to the points but none at the end of the coil wire, go to Step 5.

Step 3: Spark? Keep Reading.

If there is a spark but it is not bright blue or strong enough to jump the ¼in to ground, there may be a weak coil, or a connection (fuse or connector), the wiring, or the ignition switch may be bad. If the engine cranks slowly, the battery may be too weak to power the starter motor and the ignition coil. Check the battery (Proc. 1). If you have strong spark, go on to Step 4.

Step 4: Check Spark To and Through Spark Plug—Which Cylinder Isn't Firing?

WARNING: FIRE DANGER!

On electronic ignition vehicles, spark plug gap and wire condition are crucial. Always make a good ground for the wire and plug when testing. Or better yet, use an old spark plug as a tester, but first remove half of the threads so more of the center, ceramic insulator that's around the center electrode is exposed. You can do this with a hacksaw.

To check and see if spark is getting to a sparkplug, use the process of elimination. If there is spark through the coil wire, you know it's getting to the distributor cap. If the engine doesn't run, see spark plug ground test below. If the engine runs, spark is getting to at least some of the spark plugs. Too much resistance or some spark leak in the distributor cap, plug wires or spark plugs will cause hard starting, misfiring and missing in some, one or all the cylinders (Step 11).

If the engine runs: To determine which cylinder is not firing, first pull all the spark plug wire caps off the plugs by pulling on the boot, not the wire. The caps should fit well (Ch. 3, Proc. 3 [2 and 8]). Leave the boots over the plugs so they're just touching the plug tops but not snapped onto them. If you made a test plug, snap it into the boot then touch its tip against the top of the spark plug. Start the engine and use your rag or insulated pliers to hold the plug wire. Do not touch your body against the vehicle during this test. One at a time, pull the wires away from the spark plug while listening to the engine. Pull the test plug off and quickly touch its tip to the side of the head. If there is no change when a certain wire is removed, that will be the cylinder that isn't firing. Good spark at a cylinder will be indicated if the engine runs rougher when that wire's removed. Repeat this with all cylinders.

•**Z-series Eight Plug People:** Ground the **exhaust** (black cap) coil wire as described in Step 1. Do the above test on the **intake** wires when they're tested reconnect the exhaust coil wire and disconnect the intake coil wire. Repeat test on exhaust plug wires.

•**Everyone:** If you have located a bad cylinder, determine if it is the wire or the plug by lifting the cap off the spark plug little by little and listening carefully for the repeated cracking/arcing sound of a spark. If you hear cracking and the cylinder isn't working, you can assume the spark plug is dead or there isn't enough compression or the right fuel-air mixture to run that cylinder. Try the spark plug ground test below.

Turn off the engine. If there is no spark to a plug(s), see Step 11.

The spark plug ground test. First, remove the spark plugs (Ch. 3, Proc. 3 [3]). If you have a test plug use it. If there's spark, check the real plug. Test the plugs one at a time.

Push the plug into the wire cap. Lay the metal part of the spark plug against the engine to ground it. Position it so that you can see the electrode gap at the business end of things. Use a remote starter or have a friend operate the ignition key, transmission in Neutral and emergency brake on. The ignition has to be ON for this test. Insulate yourself as described above. Crank the engine and look for spark at the electrode gap. It should be bright blue. A faint, weak yellow spark means trouble somewhere in the ignition primary or secondary circuits or a weak battery, or maybe a lousy plug. Try another plug in the wire. Test further.

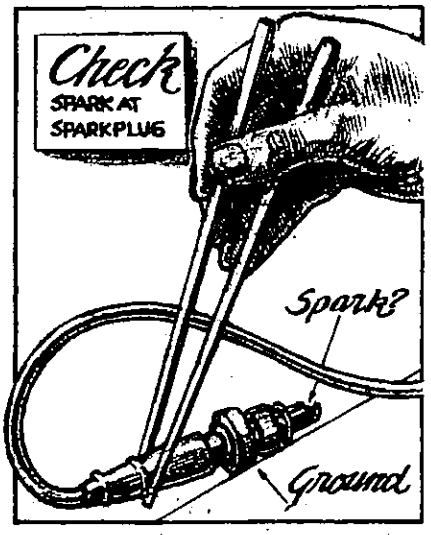
While you crank, you should feel and hear compression whoosh out the vacant spark plug holes. If there is none, see Ch. 3, Proc. 9.

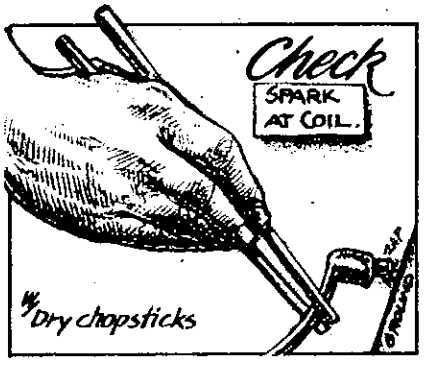
No spark at all means that the plug isn't firing or that you have a bad ground. Make a better plug-to-metal contact and try again. If there was spark to the end of the plug wire but nothing now, replace the spark plug and test again. If you had spark at the coil wire but none at any of the plugs, there's a problem in the cap or rotor.

Repeat the test on each plug. Old or fouled plugs will not produce a strong spark. Use only the correct plugs for the engine (Ch. 3, Proc. 3).

Replace the spark plugs and fit the wires firmly over their tops. Turn the key OFF.

•**Z-series Eight Plug People:** If one side (intake or exhaust) is weaker than the other, focus on the circuit involving that coil, see Step 7; or if there's no spark at either intake or exhaust, see Step 7.





Step 5: No Spark Through the Coil Wire? Check Current to the Points.

•**Automatic Transmission People:** You have a gear position switch and relay that inhibits your starting the engine in any other gear than Neutral or Park. If all other tests fail, you can bypass the switch to see if it is the culprit. It's under the vehicle on the side of the transmission. Proc. 15 tells a little about bypassing switches. The rest is up to you, but beware. Don't drive with the switch bypassed; it could be fatal. I don't tell you how to replace the inhibitor switch, but it's not that difficult.

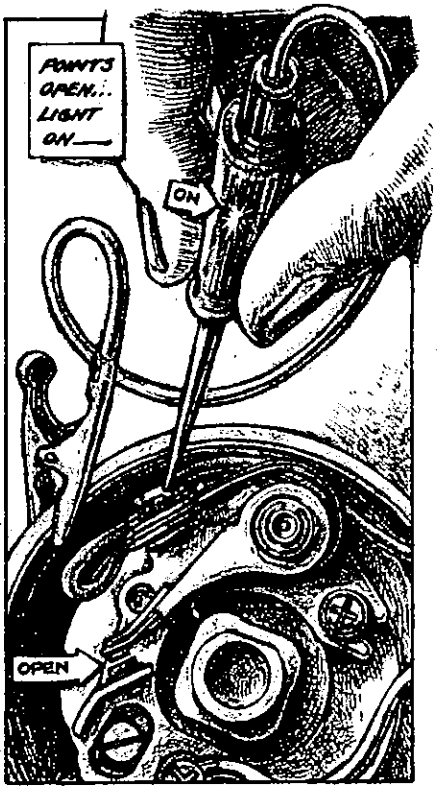
•**Electronic Ignition People:** Go on to Step 7.

•**Conventional Points People:** Remove the distributor cap (Ch. 3, Proc. 5 [1]). Turn or crank the engine until the points are in the closed position (see Step 2 of this procedure). With the key turned off, open and close the points to see if they operate correctly and check their condition (Ch. 3, Proc. 5 [3-5]). If in doubt, replace or readjust points and condenser (same procedure as above, Steps 6-15) and see if that corrects the problem.

If there are no sparks at the points, use a voltmeter or test light to determine whether there's current to the coil and points. Make sure the points are open as described in Step 2.

Ground the negative test lead of the meter or tester to the engine. Turn the key ON. Touch the positive clamp or test probe to the screw that holds the wire to the points. The light should light or the meter should read 5-9 volts. Try grounding your meter/tester to the distributor body. If current is present, check that the points are mounted well to the bottom of the distributor. If in doubt, replace the points and condenser.

If you have no reading, locate the wire connecting the distributor to the coil. Test here or wherever the wire goes into the side of the distributor. The idea is to find out where the current is interrupted by working your way away from the points. If the points are



closed, you won't get a reading. Disconnect them at the side of the distributor and retest if necessary. Clean or remake any bad connections.

If you get a reading of more than 7 volts or less than 5 volts, test the ballast resistor, where your trouble probably lies. **If you still get no volts**, move the positive probe back along the primary wire from the distributor touching all available connections. After the wire disappears into the wiring harness, move to the coil, and if covered, peel back the rubber boot. There are two primary wire terminals. Look closely at the black top of the coil near the terminals to find a *minus* or *plus* next to each terminal. Connect your positive probe to the negative terminal. You should get a reading of 5 to 7 volts. Next probe the positive terminal. If there is now a reading and not one at the negative terminal, test the coil (Step 9).

If there is no reading, test the ballast resistor, ignition switch and on back through the circuit (Step 10). Turn off the ignition when finished testing. Reinstall the rotor and distributor cap (Ch. 3, Proc. 5 [15]).

Step 6: Check the Cranking Circuit to Ignition Points Voltage.

You'll need a voltmeter to do this check.

Ground the negative test light or meter lead. Connect the positive probe to the positive (+) coil terminal. Ground the coil wire as you did in Step 2. Turn the ignition to ON and crank the engine. This is the *cranking circuit*; it's only on while you're starting the engine (the *running circuit* is on whenever the ignition is ON). The voltmeter should read between 8 and 12 volts. If the reading is less than that, you probably experienced hard starting. Similarly check the voltage back to the ignition switch to find the source of the problem. There's more on general troubleshooting in Proc. 15.

If there's no voltage, there is an *open* somewhere between the coil and the ignition switch. Recheck the fuses.

If you have voltage when cranking but not when the ignition is on, points are open and you're not cranking, check the ballast resistor (Step 10). If there's voltage the other way around, check the cranking circuit. If there's no voltage at either time, go to the ignition switch or wiring between the coil and the switch.

Step 7: Check Out the Electronic Ignition Distributor.

Do this step if there is *no* spark from the coil wire (Step 2). The battery must be fully charged.

The most common problems with electronic ignition is that the engine will not start or starts for a moment but will not continue to run. It may even be intermittent. Not running is usually due to poor connections or a bad pick-up coil. Other problems could be caused by the transistor ignition unit called the TRIG (1975 California cars, 1978-80 510s) or IC (1977-on cars and trucks). The TRIG units are located inside the passenger compartment on the left kick panel in front of the driver's door. The IC unit is screwed to the outside or inside of the distributor.

Find the wires that connect to the side of the distributor. If there's a plug pull it off, look at the connectors and pinch tighten the female wire end connector. The connectors may be only partly visible or covered with a plastic wrapping. Follow them away from the distributor. If there is a white plastic connector, separate it and reconnect it to make sure the connection is good. On all pre 1983½ systems there is a black plastic housing on top of the radiator or fender wall where the ignition wires connect to a junction block. Carefully pry up the top of this housing and find the nuts that hold the wires together. Loosen these nuts a little, then retighten them. Later IC systems have a gray plastic connector close to the front left corner of the engine compartment. Make sure it's tight.

On most later models there is also a ground wire that connects to the distributor base mount. Make sure that this is connected and fits well.

If the rest of the wiring to the distributor is in good condition, go back to Step 2 and recheck for spark from the coil wire, or try to start the engine. If you still have problems, check the stator-to-reluctor air gap (Ch. 3, Proc. 5 [14]). If that doesn't help, check the wiring in the distributor. I have found these two or three wires frayed and broken, or the connector plugs loose or disconnected. Examine these wires carefully as well as all other wires in the circuit. You'll have to remove the distributor cap to do this (Ch. 3, Proc. 5 [1]).

I only tell you how to check the pick-up coil—you'll need a volt/ohmmeter to check it. If these tests don't

uncover the problem, seek professional help or get the Factory Service Manual for your model. Electronic ignition wiring systems get complex fast.

Check the pick-up coil: TRIG and **Early IC People only**, you have a square box on the side of your distributor. Warm up the engine if possible. You need the ohmmeter to test the resistance in the pick-up coil. Remove the distributor cap and rotor and turn the ignition OFF. The ohmmeter has to be zeroed before each use. Set the ohmmeter on the X 10 scale and turn it on.

•**Early TRIG People:** Disconnect the red and green wires from the TRIG unit or at the in-line connector or junction block. Do not lose the screws.

•**Later TRIG People:** Unplug the connector at the unit or at the junction block. If unplugged, locate the red and green wires and their cavities in the connector.

•**All TRIG People:** Connect the test leads of the ohmmeter, one to each lead (red and green). The meter should read 720 ohms if the pick-up coil is okay. If the meter reads much more or less than 720 ohms, the pick-up coil is bad and should be replaced (Step 8).

•**IC People:** Unplug the wires connecting the pick-up coil inside the distributor to the IC unit outside the distributor (Step 8). Place the test probes against each of the two wires leading to the pick-up coil. Don't let them touch. A reading around 400 ohms is normal. Otherwise, replace the pick-up coil (Step 8).

•**Everyone:** Test the pick-up coil. Pick-up coils are available at the Datsun/Nissan dealer. If the pick-up coil is okay, reconnect the wires as described in Step 8.

NOTE: Before replacing the TRIG or IC unit, test the resistor dual circuit (Step 10).

Check Power Supply to IC Unit: All the electronic ignitions: Find the wires that plug into the pickup coil or IC unit. Use needlenose pliers to carefully pull off the red one, or if you have three wires, one of the end ones.

•**External IC People:** Put the positive probe in the leg of the T-shaped plug coming into the IC unit.

•**Everyone:** Put your positive test probe firmly into the female connector then ground your negative clip to the distributor side. Use the male ground spade if there is one.

Turn on the ignition. The meter should read above 11.5 volts. If it's lower or non-existent, there's trouble in the circuit or you've got the wrong wire. Try the other one. **Eight Plug Wire Z-series People**, try the plug on the other end of the IC unit. (Still low [no] voltage? See Step 9.) If the voltage is above 11.5 volts, your power supply is good.

Cranking Supply Test: Keep your test leads connected as before and ground the coil wire(s). While you crank the engine over, take a reading. It should be more than 8.6 volts. If lower than that, see Step 9 and check the wiring back to the ignition switch. Make sure the battery is strong. If above 8.6 volts, go on to the next test.

Check the Ignition Primary Circuit: Connect the positive lead of the probe to the top cavity in the T connector (outside the distributor) or the green wire of the center connector inside the distributor—the one you haven't tested yet. Turn the ignition on. Your reading should be 11.5 to 12.5 volts. Go to the next test. If it's below 11.5 volts, do Step 9.

Step 8: Remove and Replace the Pick-up Coil or IC Unit (distributor cap and rotor removed).

The pick-up coil or IC (**Internal IC People**) is inside the distributor. The two or three incoming wires connect it to the junction block (TRIG) or the inside of the distributor (IC)

•**TRIG People:** Find the junction box as described in Step 7. Remove the nuts and disconnect the wires. Don't lose the nuts. Follow the wires back to the distributor, freeing them from any retainers in between. Slip the rubber grommet that holds the wires onto the side of the distributor up and out of its slot in the housing.

•**IC People with External IC Units:** Use needlenose pliers carefully to pull the spade connectors off their male partners. You can now test or remove the pick-up coil.

•**All IC People:** You have to remove the distributor to replace the pick-up coil or IC unit. It requires disassembling some of the distributor. Take the whole distributor to a dealer or a shop to have it tested and the pick-up coil or IC unit replaced. (See Ch. 3, Proc. 5 [7] to remove the distributor.)

•**TRIG People:** Two screws hold the pick-up coil in place. Remove these screws and lift out the coil. Remove the screw and clasp holding the wires to the side of the distributor if necessary. Take the old coil with you when you get a new one.

To replace the pick-up coil, make sure it is flat against the bottom of the distributor. Replace the two setscrews but don't tighten them all the way.

•**Everyone:** Check the air gap between the pick-up coil and the rotor shaft (Ch. 3, Proc. 5 [14]) before you install the fixed distributor if removed. Retighten the setscrews when the adjustment is correct. If the distributor is out, reinstall and reconnect it (Ch. 3, Proc. 5 [13]).

•**IC people:** Reconnect the two or three pick-up coil wires to the IC unit. There are marks on the inside of the IC unit to tell you where the wires go.

•**Trig People and External IC People:** Press the rubber grommet and wires back into the side of the distributor. Replace the clasp and screw to hold the wires against the distributor body if removed. Reconnect the wires under any other clasps they may have been connected to within the engine compartment, and finally reconnect the ends to the junction block and retighten the nuts. Replace the plastic housing cap. NOTE: The eyelet sizes match the stud diameters in the junction block.

•**Everyone:** Replace the rotor and distributor cap (Ch. 3, Proc. 5 [15]). If the distributor was out of the engine, you will have to retime it (Ch. 3, Proc. 6).

Step 9: Check the Ignition Coil Primary and Secondary Resistance.

You'll need an ohmmeter for this test.

The ignition coil(s) is mounted on the left fender wall of the engine compartment. The large spark plug wire that plugs into the center of it (them) is the main feed for the secondary ignition circuit. Pull out the coil wire and, if you have one, peel back the rubber boot that fits over the top of the coil. On either side of the center terminal is a smaller terminal. Smaller wires connect to each of these; they are part of the primary circuit.

Make sure that the ignition switch is turned off. Use an 8mm wrench to remove the nuts holding the primary wires to the top of the coil. Do this one at a time and mark the wires by color with masking tape. Look for the small + or—marks on the coil top.

While you're here check the coil polarity to see if the wires are connected to the correct sides of the coil. You'll need to consult a wiring diagram to see which color wire connects where (+ or -). This is very important.

To test the primary circuit: Set the ohmmeter on the low scale. Zero the meter and place one probe on each of the primary terminals. Keep your fingers off the probe points. Make sure your meter zeros when the leads are touched together. Switch the meter to X 1 scale. The reading should be as follows:

Conventional points: 1.80—1.43 ohms
TRIG: 0.45—0.55 ohms
IC External: 0.84—1.02 ohms
IC Internal: 1.04-1.27 ohms

If you get no reading or too high a reading, replace the coil or at least try another one in its place.

To test the secondary circuit, keep one of the ohmmeter probes connected to one of the primary terminals. Place the other probe into the center terminal so that it makes contact with the metal inside. Use a screwdriver or nail as a contact if your tester probe is too big. Switch the meter to read X 1000 or K. The reading should be:

Conventional points: 11.2—16.8K (11,200-16,800) ohms
TRIG: 8.5—12.7K (8,500-12,700) ohms
IC External: 8.2—12.4K (8,200-12,400) ohms
IC Internal: 7.3—11.0K (7,300-11,000) ohms

If the secondary readings are a little lower than specified, that's okay. If they are a lot higher, the coil is weak. Replace the coil or at least have it tested with another meter.

If you have to replace the coil, be sure you get the right one. All conventional point and early TRIG units have an external resistor in the circuit and the coil is built for that. Later TRIG and all IC units do not have external resistors.

To replace the coil, mark and disconnect all of the wiring. Put the nuts and washers from the primary terminals back onto the studs. Unscrew the coil bracket from the fender wall, then loosen the bracket screw holding the coil to slip it out. Note the positions of the + and—terminals. When you've put the new coil in, do not overtighten the clamp screws, and be sure to connect the primary wires to the correct terminals.

Step 10: Check the External Resistor (Conventional point and early TRIG models only).

The wiring to and from this resistor is frequently mixed up, resulting in premature ignition point burn out. Consult a wiring diagram.

To find out whether you have an external resistor, look near the ignition coil and follow the wiring away from the coil to a rectangular white or gray metal piece mounted on the fender wall. The primary wires connect to it. Make sure the ignition is turned off.

Disconnect the wires at the resistor. You may have to pull back the rubber caps covering the terminals.

Set the ohmmeter to its low setting, zero it and place a probe on each of the terminals. The reading across the resistor should be:

Conventional points: 1.5 ohms

TRIG: 1.3 ohms

Too little, too high, or no reading at all is bad, and usually means burned points, or condenser or transistor unit. Replace the resistor with one from Datsun/Nissan or a wrecking yard.

To replace, remove the two Phillips screws holding the resistor to the body. Disconnect the wires after marking their locations. Reconnect the new resistor in the same spot. Don't overtighten the brackets on ceramic types.

Step 11: Test Spark Plug Wires for Excessive Resistance and Remove and Replace Them.

This is a part of the ignition system that should be checked regularly, and can be easily replaced. There's a wire between the coil and distributor and four, one each, go to the spark plugs. These wires carry 20,000—60,000 volts each.

If you don't have an ohmmeter, remove the cap and wires (keeping them in order) and take the lot to a shop to be tested (Ch. 3, Proc. 5 [1]).

Ohmmeter test: NOTE: Always recheck your connections and meter by touching its leads together. Remove the distributor cap (Ch. 3, Proc. 5 [1]) and pull the coil wire out of the coil. Place one meter probe against the carbon tip at the inside center of the cap and the other probe on the metal tip of the coil end of the wire. Keep your fingers off the probe tips. The reading should be under 30,000 ohms. If it is higher, pull the wire out of the distributor cap and test it alone. If the reading comes down, the cap is bad.

One at a time, pull the spark plug wires off othe spark plugs and test them by placing one meter probe against the tip inside the distributor cap that corresponds with the wire you want to test. Put the other probe into the end of the connector that fits over the spark plug. Be sure to touch the metal sleeve within. The meter should read under 30,000 ohms. If it is higher than or close to that, pull the wire out of the distributor cap and test the wire alone. If the reading is less, replace the cap. If the same, replace the wires.

It is better to replace the wires in a set. I prefer factory resistor wires, because they are the best available and fit well, although after-market wires made by a reputable American firm are acceptable. Always buy wires made to fit Datsun/Nissan L or Z-series engines. Z-series wires are really expensive. A factory (Datsun/Nissan) set costs around $100.00—no joke. Call around to parts houses. Remember you have eight plugs and wires and two coil wires.

Everyone: Replace the wires one at a time, matching the lengths of the new ones to the old (Ch. 3, Proc. 5 [2]). Datsun/Nissan factory wires are numbered to make it easy. Start the engine after replacement to make sure the firing order is right (Proc. 12 [1]).

•**Z-series:** Follow the numbers on the cap. Replace the wires and distributor cap noting the position of the cap in relation to the distributor housing (Ch. 3, Proc. 5 [15]). The intake coil wire cap is red, the exhaust side coil is black.

PROCEDURE 13: TEST DISTRIBUTOR, VACUUM AND CENTRIFUGAL ADVANCE, AND FINE TIMING ADJUSTMENT

Condition: You're here from Ch. 3 or 4. The engine is in tune but idles poorly, hesitates or misfires upon acceleration, or you can't turn the distributor enough to time the engine.

Tools and Materials: 8 and 10mm combination wrenches, timing light, some 3/16in or 5mm flexible rubber hose.

Remarks: For fine timing **(L-series people only)**, see Step 5. New and rebuilt distributors usually come with vacuum advance mechanisms.

Step 1: Checking Distributor Shaft Wear.

If you remove the distributor cap and rotor, and can wiggle the shaft from side to side, it's worn-out. Some play is acceptable but if the dwell varies more than 5° or makes the engine run poorly, replace it or have it rebuilt. This is usually due to bushing wear or a bent shaft. Many garages have machines to test distributors out of the engine. To remove the distributor, see Ch. 3, Proc. 5 (7).

Call around, you can often find a shop that does distributor rebuilding. Your shaft bushings are easy to machine and replace. Otherwise, get a new or rebuilt distributor; they aren't cheap.

Step 2: Check the Vacuum Advance and Its Hose.

The vacuum advance is mounted on the side of the distributor. There's a hose or little tube connected to it. This hose or tube eventually goes to the base of the carburetor. Follow it there. This hose may be cracked with age, especially at its connections. On 1974 and later engines, the hose goes through to the emissions control devices via some plastic hose connectors.

To check the unit, you have to remove the distributor cap. For old engines with a metal pipe connected to the advance unit, use a 10mm wrench to unscrew the squeeze nut counterclockwise. Carefully move the line out of the way. For hosed engines, pull and twist the hose off the pipe. Use a piece of (well-fitting) 3/16in or 5mm hose to slip on the little pipe or fitting. The hose should be long enough to suck on.

As you suck on the hose, watch the distributor base plate where the point set or pick-up coil or IC unit is. The whole plate should move clockwise, then stop. A pull rod connects the advance unit to the base plate. Make sure they're connected. If the base plate doesn't move, take a screwdriver and gently pry the pull rod off the little post and suck again. If the rod now moves, something is binding it in the distributor; remove the unit and take it to a shop (Ch. 3, Proc. 5 [7]). If the pull rod does not move, remove the vacuum advance. Read below.

Reconnect the pull rod to the base plate if the test is positive.

Keep the distributor cap off for the next test.

To replace the advance mechanism, pry the pull rod off the post as mentioned before. Locate two screws on the top and side of the unit between it and the distributor. Remove these screws and the unit will come away from the distributor. Take the advance with you to the dealer or junkyard to find a replacement, either threaded or plain-pipe style. Reinstall the mechanism by slipping the rod into the housing and onto the post inside. When the advance is lined up with the screw holes, install them and tighten. Retest the advance.

Step 3: Check the Centrifugal Advance Springs and Ball Bearings.

There are two weights and two springs out of sight inside the distributor. Put the rotor on the shaft. Turn the rotor counterclockwise with your fingers. It and the shaft should turn slightly. Now let the shaft go, and it should return smoothly to the rest position. If the rotor fit is sloppy, replace it.

If the shaft action isn't smooth, the distributor has to be removed and rebuilt or replaced.

Step 4. Check the Advance Mechanisms with the Timing Light.

Hook up the timing light (Ch. 3, Proc. 6). Start the engine and run it at idle to check the initial advance.

Once you have the timing established, disconnect the hose or tube to the advance mechanism and connect a piece of hose to suck on. Suck on the hose while you're watching the timing marks with the light. The suction should move the timing. The crankshaft pulley will appear to move farther to the left (driver's side, clockwise) and the engine should pick up speed. If it doesn't move, go back to Step 2. The advance should be between 6 and 20° on the crankshaft.

To check the centrifugal or mechanical advance, keep the vacuum hose disconnected and plugged. Shine the timing light on the marks and raise the engine speed to 2000 or more rpms. The marks should move as described in the previous step with an advance of 7° (Z-series), 11° (L-20B), and as much as 20° (L-16 and L-18). If the changes don't show, remove the distributor for test, rebuild or replacement.

Disconnect all test equipment and reconnect the distributor, rotor, cap and hosing if they're okay.

Step 5: Locate and Adjust the Fine Timing (L-series People Only).

There are two set screws for timing the distributor. One (10mm) is visible looking at the distributor from above. The other isn't visible unless the distributor is removed. It can be reached, however, with the distributor in place. This fine setting screw increases the distributor range. Such an increase may be necessary to get the engine properly timed. To adjust the fine timing, you have to determine which way the distributor has to go to be brought into time. Use the markings to the front or rear of the distributor baseplate to figure this out. Refer to the illustration in Ch. 3, Proc. 5 [2].

Stop the engine. Work your hand around the bottom (engine side) of the distributor baseplate until you feel an 8mm bolt head. Use a box-end wrench to loosen the bolt clockwise (remember, it's upside-down). A few turns are all it needs. Also loosen the 10mm main timing setscrew visible from above. Now you should be able to move the plate between the distributor and the mount with a little coaxing. If you want more advance, hold the distributor body while turning the plate counterclockwise. For more retard turn the plate clockwise. I like to position it carefully so the "A" and "R" (or scribe) marks on the plate are centered in relation to the mark on the mountings when the engine is in time; then I tighten the 8mm bolt when I restart the engine and time the distributor as described in Ch. 3, Proc. 3, and finally tighten the main upper set screw.

If you can't get the engine in time even with the fine adjustment, the distributor drive gear is probably off a tooth (Ch. 9, Pt. 2, Proc. 4).

PROCEDURE 14: CHECK, REMOVE, AND REPLACE THE CHOKE RELAY

Condition: The choke is always on; your engine idles high; the alternator is acting up. Check the fuses.

Tools and Materials: Test light, Phillips screwdriver (maybe).

Remarks: 1980 on 720 Truck People see Step 4.

Step 1: Is the Choke Really Staying Closed?

See Ch. 3, Proc. 7 (2).

Step 2: Locate the Choke Relay.

It is mounted on the right fender wall inside the engine compartment. On many cars the relays are located under a panel that is easily removed. The choke relay has four or six wires to it. You should use a wiring diagram to test this. But if you don't have one, match one of the incoming wires to the relay with one of the wires on the back of the alternator—a yellow or white and red one.

Pull apart the plastic connector pigtailed to the relay. Prop the choke flap open by removing the air cleaner top, then stick a medium screwdriver down the air horn. Ground the test light and start the engine. Poke the probe into the one connected to the alternator. There should be current. If there is no current, there may be a break in the circuit or the alternator is not functioning (Proc. 8).

If there is current, the alternator is operating and the relay should work. Check it with a voltmeter. If the

reading is higher than 7.5 volts or lower than 6.5, have the alternator tested. If okay, the regulator may be at fault (Proc. 10).

Excessive output can also burn out the relay.

There should also be current to one of the other wires. If there isn't, check the fuses and if this fuse is burned out, other electrical problems may be the cause.

Reconnect the plug and listen to the relay. It should click. (If it doesn't, this test won't work.) Place the test probe into the back of the connector or use a straightened paperclip stuck into the back at the blue or white-and-blue wire. There should now be current out of the relay. If there is none, and you have a black wire, put the paperclip end into this connection and place the other against a bare metal ground. Make the output test again. If nothing happens and you had adequate voltage and current, the relay is bad.

Replace the relay with one that has the same type of connector and wiring, the only one available from Datsun/Nissan. The older relays have undependable cover seals that are susceptible to corrosion. My friend Roger once replaced numerous relays; each one burned out. He finally removed the top of the relay to find the main wire burned. He soldered a heavier piece of wire over the burned one and solved the problem. I suspect there was a short or ground elsewhere in the circuit. Because these circuits are different in every model, you will need a wiring diagram to go any further.

Step 3: Remove and Replace Choke Relay.

Unplug the connector. Remove the two Phillips screws holding the relay to the vehicle body. Replace the relay with an identical match from the dealer or a wrecking yard. Reconnect the wiring and run the engine to make sure the choke now operates.

Step 4: Test the Choke Relay (1980 pickup trucks)

The relay is located above the fuse box or on the right (passenger) side kick panel. Take your truck to a Datsun/Nissan dealer and have a mechanic show you which little box is the choke relay. Remove and have it tested or test it using a Factory Service Manual.

PROCEDURE 15: TROUBLESHOOT, REMOVE, AND REPLACE MISCELLANEOUS ELECTRICAL PARTS AND SPLICE (ADD ON) WIRES AND CONNECTORS

Condition: You are having problems with burned-out fuses, light bulbs, relays, horn, heater, radio, windshield wipers and washer, stop lights, turn signals, and gauges (temperature or fuel). Do not expect miracles or much indepth information from this procedure. It is a very superficial introduction to electrical system problem solving.

Tools and Materials: Test light; voltmeter/ohmmeter (optional).

Remarks: This procedure is a catch-all for general electrical problems. There are some fundamental rules to follow while analyzing any electrical problem. With patience and a wiring diagram for your vehicle, you can work wonders. If you're serious about electrical troubleshooting, get a wiring diagram. 1975 and later Datsun Factory Service Manuals contain the best diagrams, schematics, and electrical repair procedures. Public libraries often have auto repair manuals for reference, though usually not factory publications. Other publishers either copy the factory's diagrams or make their own simplified renditions. Mitchell's Manuals, the easiest to understand, are carried in most libraries.

NOTE: People with E.C.C. (electronic carburetor) engines must be very careful not to short, ground, or disconnect main circuits when the engine's running. There is more on those circuits in Ch. 6, Pt. 1, Proc. 17.

Step 1: Basic Troubleshooting (a circuit goes dead).

The first place to look for trouble is at the fuse box or fusible link. If a fuse has blown, you must determine which circuit that fuse or link protects (Proc. 11). If fuses continue to blow, you'll have to determine where in the circuit the problem lies, which is the hard part. Look for add-on wiring like stereo, video game, or trailer

light installations. People frequently connect wires directly (under) to a fuse to get a "hot" wire for accessory power. This is a dangerous practice.

Generally speaking: The negative-ground wires are connected to metal; the body and chassis of the vehicle act as a current carrier. Make sure all of the ground wire connections are clean and tight. They are usually brown or black wires screwed to the body with eyelet ends. Spade and bullet type connectors can spread and make loose connections. Tighten these by pinching the female end with pliers. Most of the positive connector ends are shielded by plastic, so they can't touch ground or short against other wires. A careful, visual search will often uncover a loose or separated connection.

Use a test light or voltmeter to determine if there is current to a particular wire or connection. Always ground the black lead of the test instrument and place the probe or red lead into the wire in question when the switch is turned on.

Always begin troubleshooting with a charged battery. If something doesn't work, it is either not getting power or it is malfunctioning. Make sure you're reading the tester properly. Connect the correct probes to the negative and positive battery posts. The light should light or the meter should read 12 volts or more when you do this. Always recheck your ground connection when you don't get a reading.

An automobile circuit starts at the battery, passes through a fuse, then to a switch that controls when and where the power goes. From there it can go to a relay (which involves another circuit) and finally to the bulb, motor, or whatever. After that, the circuit has to be completed by going to ground (the body or chassis). The switch is sometimes placed after the bulb or motor so when the switch is closed the path to ground is completed, making the circuit; grounding through a relay is also common. To do it right, use your imagination and a good wiring diagram. For a simple wiring diagram refer to the introduction of this chapter.

To test a circuit, first go to the switch and disconnect the plastic connector leading to it. Connect the tester's ground lead to the closest bare metal. By looking at the wiring diagram and probing with the tester, you should be able to determine which wire has the power; at least one has to. If none does, the trouble is between the switch and the source. NOTE: Maybe the ignition switch needs to be turned on or the engine running to give that circuit power.

•**Conventional Ignition Points People:** If you're testing something that requires the ignition switch to be on for a long time, disconnect the primary wire to the distributor to avoid burning the points.

If there is power to the switch, reconnect the plug and turn the switch ON. Now find the component the switch controls. It should also have a plug near it. Pull apart the connector and find the wire (often the same color as the one at the switch) and plug that supplies power to the component. If there is no power, then the problem lies in the switch, wiring between the switch plug and component, or in the relay or junction box between the component and the switch. Refer to the wiring diagram.

If a switch is suspect, it can be tested with an ohmmeter. It can tell you if there is continuity (a clear path) through a switch or circuit. You can probe the connections on the back of the switch when it is in different positions to see if it does what it should.

The component or relay can be tested by supplying power to the proper plug in the connector after running a test lead from it to a live power source. Many components, however, are grounded externally, which means you'll have to connect a test lead between the outcoming ground wire in the connector and bare metal. Always connect the ground lead before setting up the positive lead. An internally grounded component is grounded by being bolted to the body or frame; it does not need an external hook-up.

Relays are tricky. In most cases they will click when power is supplied (i.e., when the switch is activated). Relays are internally and externally grounded, so testing is not uniform. Study the wiring diagram.

By using the process of elimination, you can narrow down the possibilities, first eliminating the component and the wiring. Most problems in the circuitry are opens, shorts, or grounds. Once the basic principles are understood, the wiring diagram is deciphered, and your process of elimination untangles the maze, electrical problems can usually be solved logically. This is asking a lot of both the experienced and novice mechanic. This is why electrical repair people charge plenty and troubleshooting can take time. Good luck!

Step 2: Test Tail, Side, Interior and Parking Lights, and Replace Burned-Out Light Bulbs.

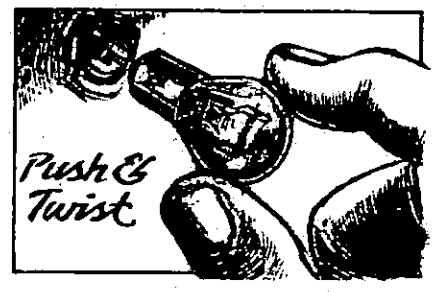
Most of the switches discussed in this step are operated without relays. The turn signal and parking lights work only when the ignition switch is turned on. The brake lights should operate whenever the pedal is depressed or burned out.

If one light in a set doesn't work, the bulb is probably burned or poorly connected. If both go out, go to its switch or a fuse. If all of the rear lights are out, check the main wiring to the rear of the vehicle. It really helps to have a wiring diagram.

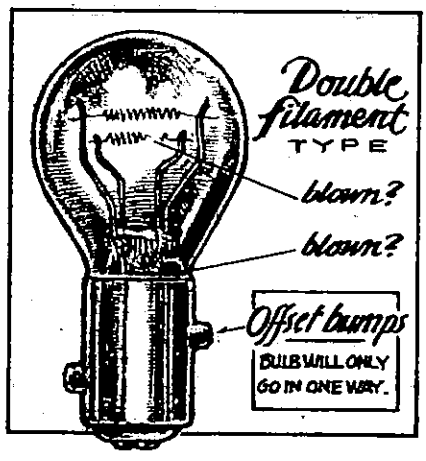
To test power to a light fixture, remove the plastic lens cover around it. They are usually held by Phillips screws.

The tail light assembly contains the back-up light and the turn signal, which are separate single-filament bulbs. There is also the stop and tail light bulb, which is a double-filament bulb.

To remove a bulb: Firmly and gently grasp the glass bulb head and press in on it. Turn it counterclockwise, and it should move. Next, pull it straight out of its socket. If the bulb turns in its socket, replace it.



Look at the inside of the glass bulb. There are one or two thin, hard-to-see coils of wire (filaments). If there is a break in a filament, the bulb is no good. A darkened bulb may also mean it's blown. Look at the metal base of the bulb for corrosion (non-shininess) on the side (ground area) and the tip on the bottom (contact point). Use a pocket knife or emery cloth to clean these points.



Now look into the socket. Make sure the power to that light is off. Look for corrosion or damage in the socket. Clean the contact points the same way.

If you have to buy a new bulb, take the old one with you to make a perfect match. Many stores carry automobile bulbs. Be sure to get the right one.

To replace a bulb: Match the tab to the slots in the socket. On double-filament bulbs, note that the offset side prongs have to line up with the matching slots in the socket.

Turn on the switch to see if the light now works. If it does, great. It doesn't? Remove the bulb. Ground your test light and carefully stick the probe into the contact in the socket's center. Don't let the probe touch the sides of the socket. The test light should glow. If there's power to the socket, the bulb must be blown or the ground from that socket is bad. Try another bulb.

If there's no power to the socket, there's a break in the circuit. Recheck the fuse and wiring to that bulb.

If an individual bulb or whole set of lights is dim, a bad ground is probably the cause.

Lights are usually grounded near their sockets. If you find a ground point, clean and reground it. It is usually a black wire screwed against the frame and subject to corrosion.

Both brake lights out: To test the brake switch, see Ch. 5, Proc. 12. Disconnect the two wires that lead to the switch and connect a jumper wire between their female contacts. The stop (tail) lights should light. If they do, the switch is bad. If they don't, check for power to one of the switch wires, and check the fuse.

Turn signals and emergency flasher are run by relays that make them blink. If the lights don't blink, stay on, or are weak, check the flasher relay. The **turn flasher relay** is round on older models and cube-shaped on later ones. It is located under the dash or plugged into the relay or fuse panel. On newer trucks the flasher relay is above the clutch and brake pedals. The **hazard relay** may look the same. There are other relays that may look just like the one you are looking for, so it's often hard to find the right one. Some are box-shaped, most are cylindrical. Non-factory replacement relays may not look the same or fit well but will work. The relay is easily unplugged or separated from two or three wires. To check power to relay, operate the turn signal or hazard switch,

and put the test light grounded probe into the connector—ignition key ON. If there is power, replace the relay. Go to Datsun/Nissan for the best-fitting relays, or ask around where you can get one.

Step 3: The Ignition Switch.

Ignition switches can have two types of trouble: mechanical, if the key is sticking or broken, or electrical, if the ignition or dash lights don't work. Check the fuses first. All switches are basically the same electrically, but the ignition switch has the biggest job as a current director. Ignition switch mechanical problems are covered in Step 4.

If there is power *to* but not *through* a switch, it's bad. If power goes through the ignition switch, check the ignition relay (and inhibitor relay—**Automatic Transmission People**); this is often mounted above the fuse box in newer vehicles. Other than the ignition switch, there are the lighting, windshield wiper, and heater motor switches, all frequently used. They work much the same way but vary in the way they are mounted and how they direct current.

The ignition switch has four positions: (1) **off**—all power is shut off; (2) **accessory**—to the left of the "off" spot; (3) **on**—should light the dash lights and give power to other switches and relays as well as send power to the distributor and coil; and (4) **start**—sends power to the solenoid and starter motor (see Proc. 6), spring-loaded so it returns to ON when the key is released. There may also be a key position that prevents the steering wheel from turning. Early ignition switches are mounted in the dashboard or next to the steering column; later switches (locking) are built into the steering column.

If your key is sticking or the key feels funny, read **Everyone** in Step 4. The ignition switch can be bypassed to start the engine, but if you have a locking steering wheel, you can start the engine without the key, but you can't drive if the steering wheel is locked or will lock when you turn it.

To hot-wire the engine: This is not recommended for electronic ignition vehicles unless a wiring diagram is used. **E.C.C. People** must not do this. Consult a professional. Locate the plastic connector closest to or in back of the ignition switch. On many vehicles you have to remove the plastic shroud around the steering column. This can be done using a small Phillips screwdriver to remove the screws that hold together the top and bottom halves of the shroud.

Unplug the connector and find the slot that connects to the largest (generally white-and-red or white) wire. Use a test light to determine if it has power to it.

Bare the ends of two 2in pieces of insulated wire. Twist the ends of both wires separately, then together, then flatten the bared wires enough to fit into a connector slot.

If you must do it: Put the transmission in Neutral. Insert the flattened ends of the jumper wire into the power slot. Take one of the other free ends and touch the other slots until you find one that makes the ignition dash lights go on and one that makes the starter motor crank. Push one into the slot to keep the dashlights on and, when you are ready to start the engine, touch the free wire to the starter slot. Pull this wire out as soon as the motor starts. Leave the dashlights wire in to keep the engine running. To stop the engine, remove the wire. You can run like this indefinitely, as long as you can steer. The hot-wire method isn't safe, though. Replace your switch with a new one from Datsun/Nissan—it's a lot easier.

Step 4: Remove, Replace, or Tighten a Loose-Fitting Ignition Switch.

•**Old Style:** There's a collar around the outside of the keyway that holds the switch in place. Some collars are plastic and some are steel. Both are removed by turning the collar counterclockwise while tapping it around with a screwdriver and hammer (chisel-fashion) or by grabbing the sides with pliers and turning. Be careful to account for all of the parts and their locations. The switch will come out when the collar is removed. Unplug the connector and the switch is free.

•**Locking Steering Wheel Style:** Remove the plastic shroud and find the wired end of the switch assembly. The assembly has two parts that are separated by removing the two small screws that hold the electrical switch to the mechanical part. First unplug the connector and then remove the screws. These are anti-theft shear bolts that you have to saw slots into or chisel out to remove. Ask a pro for help.

•**Everyone:** I recommend buying switches from Datsun/Nissan although many other styles will adapt on

the older vehicles. Locking ones are expensive and a dealer or junkyard item. NOTE: Ignition wiring is tricky. Don't make modifications unless you know what you're doing.

Mechanical problems are usually in the cylinder part of the switch. If you have troubles like this, consult a locksmith. He or she can save you from buying a complete ignition switch. In most cases, the electrical part of the assembly can be bought and screwed to the lock part.

•**Non-locking Steering Wheel Style:** Put your switch back through the dash or column mount. Retighten the collar so the switch is straight up-and-down.

•**Locking Steering Wheel Style:** Align the switch to the steering column and lock slot. Match the switch halves and insert the special shear bolts. Their tops will break off when you tighten them.

•**Everyone:** Reconnect the plastic connector. Try starting and operating the switch using all of its functions.

Replace the plastic steering column shroud by mating the two halves. Be sure to install the flasher switch (if there is one) and the wiring squarely in the shroud. Line up the screw holes, locating tits and matching holes. Hold the shroud together and insert the screws.

Note about keys: All Datsun/Nissan factory keys and cylinders are numbered. The numbers are stamped on the key and sometimes the top of the cylinder. Record these numbers. If you lose a key, go to a Datsun/Nissan dealer and ask them for a duplicate, giving the number, year, and model. They can make a match. Other key and cylinder problems can often be fixed by a locksmith.

Step 5: Understand and Locate Gauge and Horn Problems.

Both of these gauges are located on the dashboard or console. The water temperature gauge has a sender in the engine (cylinder head) that senses the coolant temperature. The fuel gauge sender sits in the gas tank and works like a float in a toilet bowl.

In both systems electrical circuits are involved and good connections are crucial.

If both gauges stop working, check the fuse box. If the fuse continues to blow, see Proc. 11. If the fuse is not blown and the connection at the fuse is sound, the trouble probably lies in the gauge voltage regulator; this is a rare problem.

If the temperature gauge indicates **hot** all the time, check the sender (Ch. 8, Proc. 8). In rare cases, the gauge itself may be faulty.

If the water temperature gauge doesn't move at all, and the engine is warmed up, check for power to the sender (Ch. 8, Proc. 8).

If the fuel gauge doesn't work and the fuses are all sound (a rare problem), there is probably a bad connection between the tank and the gauge, or the gauge is bad. Use a Factory Service Manual for further testing.

Problems with the horn are generally caused by bad connections at the horns themselves, which are located inside the engine compartment on either or both front corners. Unplug the wires and connectors and clean the contacts. Crimp the connectors with pliers to tighten the fit. If this doesn't do it, test the power to the horn wire at the disconnected end with a test light while the ignition is on and the horn button is depressed. To repair the horn switch, the steering wheel must be removed. There is also a relay in the system.

PROCEDURE 16: REMOVE AND REPLACE HEADLIGHTS AND TROUBLESHOOT AND TEST HEADLIGHT PROBLEMS

Condition: Headlights have blown out or are dim or broken; one side lights and the other doesn't; one set of beams works and the other doesn't; high or low beams work but the opposite does not.

Tools and materials: Phillips small and medium screwdrivers, voltmeter or test light if testing is necessary, new light bulb.

Remarks: Many of the tests mentioned in this procedure are not covered in this book. They are here to help you. I hope they do. Read Proc. 15 for more on troubleshooting. A burned headlight bulb usually appears black inside.

Headlight aiming is not included in this book.

Step 1: Troubleshooting.

If a headlight bulb burns out frequently or more than once, you should test the circuit instead of wasting money on bulbs. Read through the problems below to see if any of them ail you. Then read the solution.

The headlights do not come on: There probably isn't current to the bulbs. First check the fusible link(s). Next check the fuse box for burned fuses or bad connections (Proc. 11). Then check the circuitry from there to the connectors at the lights, especially the main and dimmer switches. Check the ground.

Headlights are dim/weak (all of them): This is generally due to a weak battery or excessive resistance somewhere in the circuit. If the engine won't start when the lights are on or if the lights dim as the engine cranks feebly, check the battery. Otherwise check the fusebox contacts and the wiring, especially the ground at the voltage regulator. Check the voltage at the headlight connectors with the engine running, switch on.

One headlight burns out often or is dim: This is common and is generally caused by a fault in the charging system. Start by testing the voltage at the lamp connector (Step 3) and then test the charging system (Proc. 8). The voltage regulator is often the culprit. Also carefully examine the wiring to the headlamps.

Lights cannot be switched from low to high or high to low beam, or they come on by themselves: The dimmer or main switch is at fault unless the connections to or at the headlamps are bad. Test voltage to the sockets, switch on.

Fuse blowouts or malfunctions may be caused by add-on wiring. Beware.

Step 2: Remove and Replace the Headlamp.

NOTE: High and low beam bulbs are different.

To replace the headlamp, you may have to remove the front grille. Look straight on at the grille around the edges of the lights for screws that bolt it in place. On the older 510s the grille is in three pieces, with the lights covered by the end pieces.

Look at the light and notice the screws around its edge. A ring covering the edge of the bulb has to come off. Make sure you find the screws that hold this ring and not the screws that are used for aiming. Most round headlight models have three retaining screws to be loosened and the ring turned slightly for the bulb to come out. Remove the ring with a screwdriver.

Look at the back of the bulb from inside the engine compartment. Find the plug at the back of the lamp and, while holding the bulb with one hand, pull the connector off the prongs. Remove the headlight.

Replace the bulb with one exactly like it with the same little glass nubs around the back edge. Look for the word "top" and place this up. Fit the little nubs in the slots allowed for them. When the bulb fits flush, replace the ring matching it to the screw holes and, if removed, install the screws or turn the ring into place under the screws. Tighten the set screws evenly to hold the bulb in place. Note that high and low beam bulbs are different.

Reconnect the connector at the back of the bulb by matching the prong pattern to the connector. Turn on the lights. OK? Good. Replace the grille if removed.

Step 3: Test the Voltage at the Headlight Connector.

Unplug the outer, low beam connector and set your voltmeter to a scale for 12 volts DC. NOTE: A test light can be used to determine whether current is getting to the connector, but not how much.

Turn on the headlights. Ground the negative probe or clamp and stick the positive one into one of the connector slots that has a colored wire to it. (The black wire is the ground wire.)

On the low beam setting, there should be voltage to *one* of the wires; on high beam, the other colored wire should have voltage. If there's voltage and the bulb is good, reground the black wire. If no voltage, there is a break in the circuit.

Take a meter reading. It should be no less than 10 volts. If less, the battery is undercharged or there is resistance in the light circuit.

Now test the inner, high beam bulb. There should be voltage to the colored wire on high beam. If there's no voltage and the bulb is good, there is a problem in the circuit. This reading should be just over 10 volts. Turn the lights off.

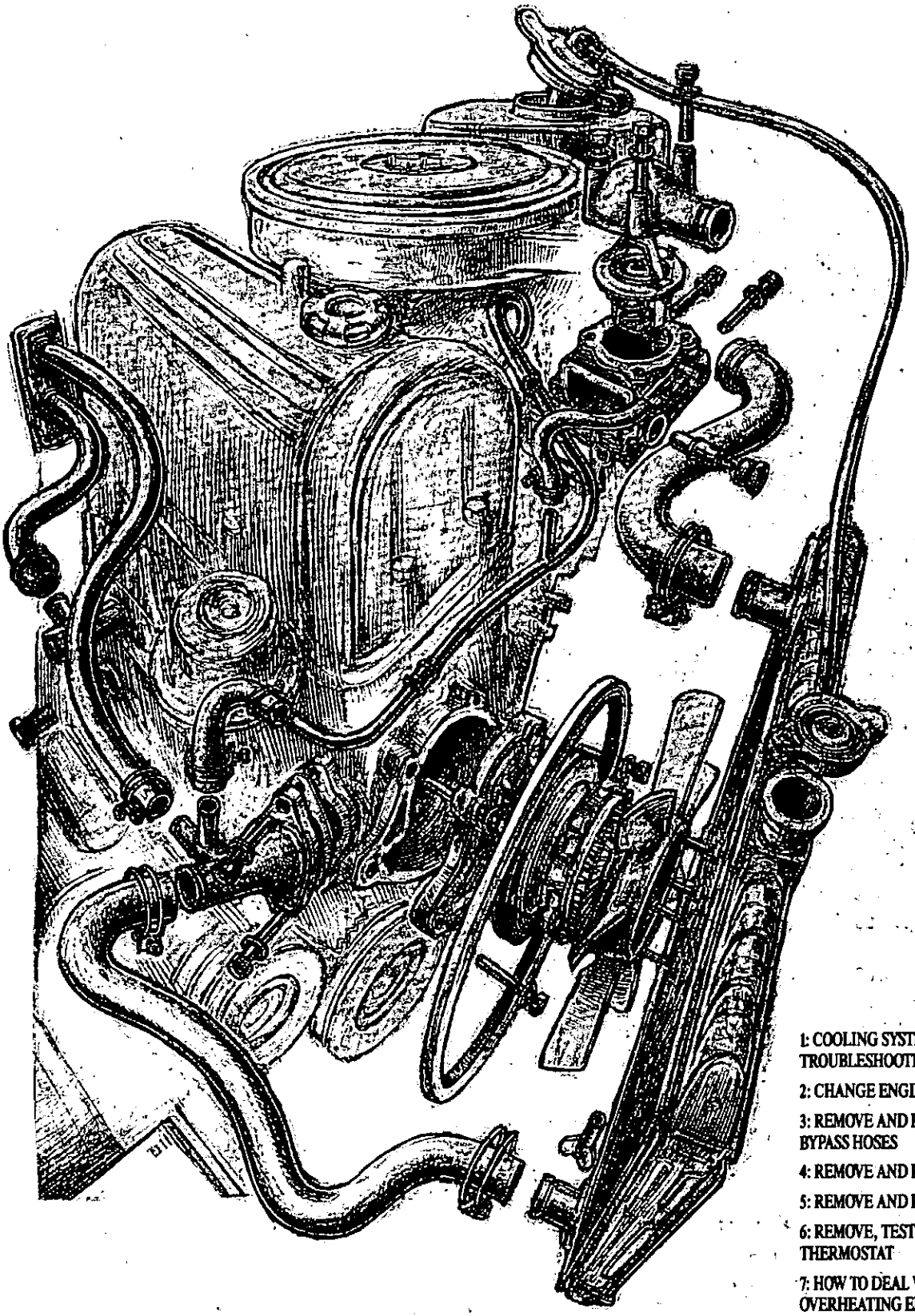
Start the engine and turn on the lights. Read the voltage at idle and higher rpms. The voltage should not exceed 12.8 volts. If it does, the problem is probably in the charging system.

Turn off the switch and the engine, and reconnect all connections if the problem is solved.

Step 4: Other Headlight Problems.

If headlight fuses continually blow, there is a short or ground in the circuitry. They can be hard to track down. This system, like most others, has a fuse, two switches (unlike most others), a relay, and resistance (the bulbs). The general checkout sequence is outlined in Proc. 15.

Cooling



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CHAPTER 8
COOLING SYSTEM

The venerable Chinese emperor K'ang-Hsi faced a dilemma. On the battlefield the newly-developed cannon barrels were warping from the excessive heat of constant use. He turned to the renowned scientist and engineer, Dr. Ku Ling, who developed a clever system of passages laced through the cannons' heavy iron barrels, through which hand-pumped water circulated. The water carried off the excess heat, and the system was a success. Naturally, it was called the Ku-Ling System. Automotive engineers may beg to differ, but it's basically the same system your Datsun/Nissan uses to dissipate the heat of combustion.

Your cooling system uses a mixture of antifreeze and water to remove "waste" heat from the engine (combustion temperatures can exceed 3,600° F). This mixture (coolant) is pumped through channels in the engine where it picks up the heat. The heated coolant then passes into the radiator where air draws off the heat from the radiator's surfaces. The fan helps the air flow through the radiator when the vehicle is at rest or low speed. The used (cooled-off) coolant then returns to the engine to pick up more heat.

When coolant condition is neglected, a part in the system fails, or a leak (internal or external) develops, the system can overheat quickly. Overheating is a condition your Datsun/Nissan fears and loathes. It can warp its aluminum cylinder head, cause internal leaks and give you headaches galore. Without potent antifreeze (60% antifreeze, 40% water) the system can freeze in cold weather or corrode. Frozen coolant in the system expands and can crack the metal of the block, rendering your engine permanently useless. Proper maintenance (see intervals in Ch. 3) can prevent these disasters.

Keep in mind before doing any check or repair on the cooling system that it will be **hot** if you've just turned off the engine. The coolant, which is under about 13 pounds of pressure, may be above the boiling point of water. Open the radiator cap while the engine's still hot and you can be seriously scalded. However, frequent cold checks of the coolant level, hose and fan belt condition are as easy as checking the engine oil level, and can save you big bucks.

The first procedure in this chapter will orient you to the parts of the cooling system and help you get to the cause of problems that commonly arise. The vital areas of the system are all easily accessible making it easy for you to keep a trained eye on its condition.

PROCEDURE 1: COOLING SYSTEM TOUR AND TROUBLESHOOTING GUIDE

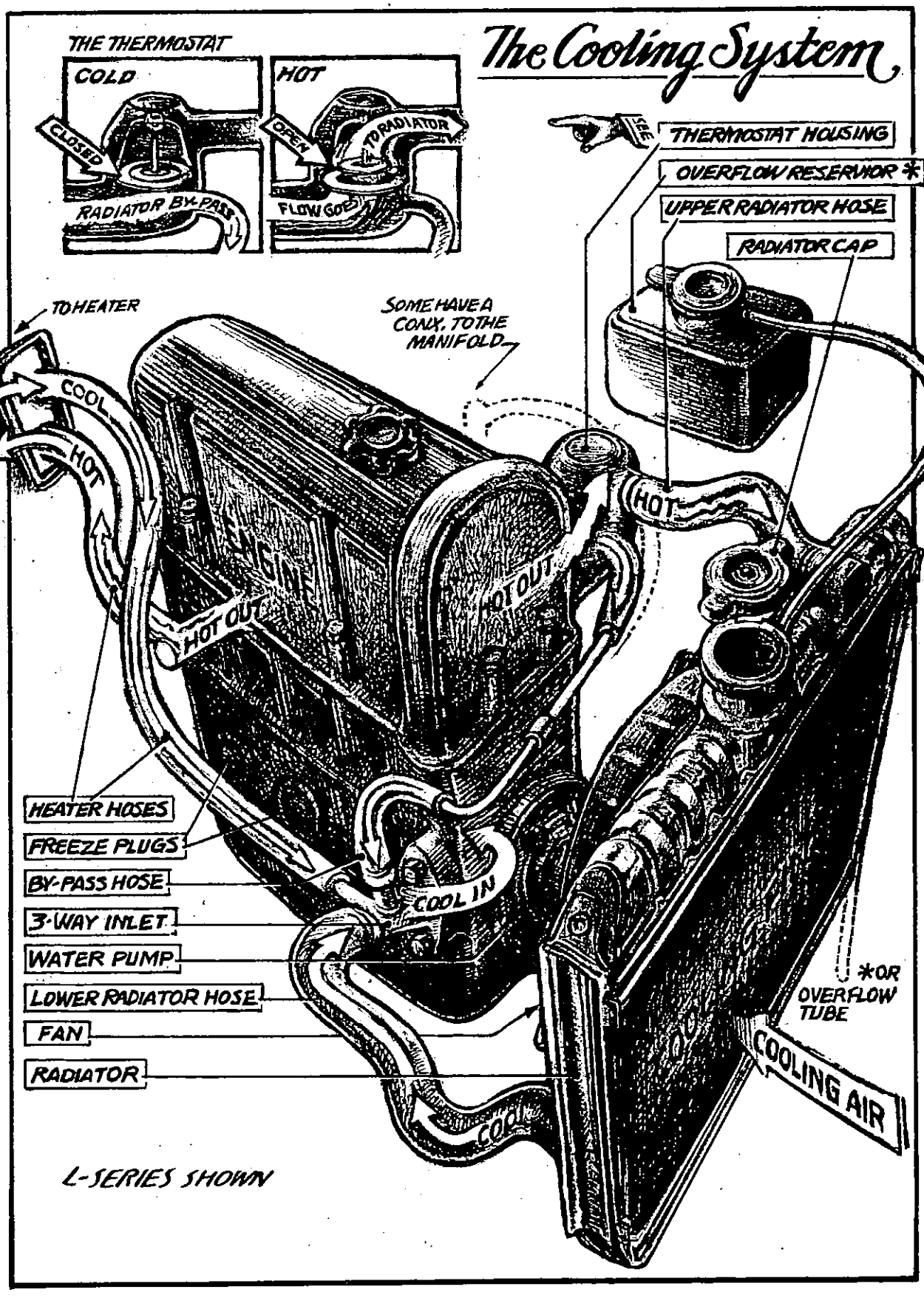
Steps 1 through 7 take you around your cooling system. Steps 8 through 15 address the components that may be the source of your particular problem. You'll be well informed about your Datsun/Nissan cooling system after reading this procedure.

Condition: You are here to learn almost everything about the cooling system. I recommend that this be done when the engine is cool enough to kiss. Engine is turned off (not running).

Tools and Materials: Pliers, regular screwdriver, 16mm socket or box-end wrench, thermostat gasket (get one from Datsun/Nissan if possible), non-hardening sealer, flashlight, friend. These tools will be used in the troubleshooting steps of this procedure.

Step 1: The Radiator.

Your radiator removes heat from the coolant that circulates through the engine. Open the hood. The radiator


The Cooling System
THE THERMOSTAT
COLD
CLOSED
RADIATOR BY-PASS
HOT
OPEN
TO RADIATOR
FLOW GOES
SEE
THERMOSTAT HOUSING
OVERFLOW RESERVOIR *
UPPER RADIATOR HOSE
RADIATOR CAP
TO HEATER
SOME HAVE A CONN. TO THE MANIFOLD
COOL
HOT
ENGINE
HOT OUT
HOT OUT
HOT
HEATER HOSES
FREEZE PLUGS
BY-PASS HOSE
3-WAY INLET
WATER PUMP
LOWER RADIATOR HOSE
FAN
RADIATOR
COOL IN
COOL
*OR OVERFLOW TUBE
COOLING AIR
L-SERIES SHOWN

Cooling

is at the front of everything but behind the grille. The **radiator cap** is easily spotted on top of the radiator. (Remove only when the engine is cool.) Notice the small **overflow tube** connected to the filler neck, just under the radiator cap. Follow this tube to the right along the top of the radiator and down its side. This tube (if in place) will either drop straight down or go to an **overflow tank** mounted on one of the fender walls nearby. Don't confuse this with the windshield washing solvent container.

Two large hoses connect the radiator to the engine. The upper hose is the **radiator inlet hose** and the lower, harder-to-see hose, is the **radiator outlet hose**.

If you have an automatic transmission, there are two smaller hoses connected to the bottom of the radiator. These hoses circulate the transmission fluid through a separate part of the radiator where it is cooled. (See Ch. 11, Pt. 1, Proc. 1, for more about these hoses.)

If you have an air conditioner you will find an additional radiator in front of the main radiator. This is part of the air conditioning system and is called the **condenser**.

•**To remove the radiator cap:** Push the cap down with the palm of your hand and turn counterclockwise until it stops, then pull the cap straight up and off of the filler neck. There's more about the cap and what you can see of the coolant later on.

Step 2: The Water Pump, Fan and Fan Belt.

Just behind the radiator is a **fan**. Looks like a fan, right? In all vehicles except some air conditioned models this fan will be plastic. Attached to the back of the radiator and somewhat covering your view of the fan there should be a plastic *shroud* that funnels air toward the fan. Is it loose or damaged? You might want to secure or replace it.

Take ahold of a fan blade and try to spin the fan. Older model Datsun fans will turn only if the fan belt is too loose. Later model fans should spin freely with some resistance. Behind the fan you'll find the **fan pulley** with the **fan belt** looping over it. Newer model people (mostly 1975 and later) fall into the **fan clutch** family.

•**Fan Clutch People:** You will notice a finned, aluminum piece between the fan and its pulley. This is the fan clutch.

•**Everyone:** For the fan and cooling system to operate properly, the fan belt has to be the correct tightness. (See Ch. 3, Proc. 8 and/or Ch. 7, Proc. 9 for more on fan belt maintenance.)

Behind the fan pulley you'll find the **water pump**. The pump is bolted to the front of the engine. The fan pulley is attached to a **shaft** that runs inside the water pump. Inside the pump is an **impeller** that forces coolant through the system when the engine is running.

Cool coolant is drawn into the water pump from the lower radiator hose and then sent straight back through the engine to pick up heat. If the coolant is hotter than 170-190° F, it's then forced through the **thermostat housing** on the top left side of the engine, into the upper radiator hose, and back down into the radiator. (When the coolant temperature is below 170-190° F, it's bypassed back to the water pump inlet, avoiding the radiator. This helps warm up the engine faster.) As the hot coolant passes down through finned tubes in the radiator it is cooled by the air passing through the radiator core. The fan helps pull air through the radiator. Radiator blockage (insects, etc.) will tend to diminish the cooling process. This can happen to the air conditioner condenser too!

You should only have to add water/coolant in small amounts infrequently. If you find the coolant level below the top of the radiator core a couple of times in succession, you probably have a leak. The entire "closed" cooling system is designed to operate under 13 pounds pressure but above atmospheric pressure when hot. This must be kept in mind when working on the system. The coolant will leak if given a chance, especially when hot.

Step 3: The Thermostat.

Follow the upper radiator hose back to the engine. The snout it connects to is the **thermostat housing** which houses the thermostat. The heated coolant flows from the cylinder head, then (in most models) into the intake manifold, into the thermostat housing, through the thermostat, then through the upper hose to the radiator.

The thermostat is a temperature sensitive valve that regulates the flow of coolant. It remains closed thus preventing flow through the radiator until the engine works up enough heat to raise coolant temperature to within an efficient operating range. If your temperature gauge reads cool the thermostat may be stuck open. If hot, it may be stuck closed.

Step 4: The Bypass Hose(s).

Every model Datsun/Nissan has some variation in the layout of these hoses but their function is the same. They connect to the thermostat housing and/or the **intake manifold** to carry coolant down to the **two or three-way water pump inlet**.

Find where the lower radiator hose connects to the engine. **L-series:** The second hose connected to this fitting, which goes back along the side of the engine, is a **heater hose**. The top smaller third hose is the **bypass hose**. Follow this up to a **pipe** that curves around the front of the engine. An additional bypass hose may connect the pipe to the front or side of the thermostat housing.

•**L-series:** If you have a water-heated intake manifold, the pipe will continue back along the left side of the head and disappear under the carburetor. In this case you'll end up with three bypass hoses. (If you're a non-water-cooled manifold person, you'll have just two bypass hoses.) The little hoses are common leak points in Datsuns, so get to know their locations well.

•**Z-series:** All of you have water-heated manifolds. The second hose, connected to the back of the two-way junction is the bypass hose. Follow it back to a fitting and the smaller heater hose under the intake manifold.

Step 5: Meet the Heater and Its Hoses.

Your heater hoses tranport warmed coolant to the heater inside the passenger compartment. Two are visible from the engine compartment. The **long one** starts at the water pump inlet junction (L-series) or under the intake manifold (Z-series). This is the heater outlet. The inlet or shorter hose connects to the back corner of the engine, same side. Both hoses go through the **firewall** into the passenger compartment. (There are also some smaller hoses around the heater which you have to go under the dashboard to meet.)

•**Z-series:** Your heater hoses may have two parts, spliced together and located between the engine and firewall.

•**Everyone:** When you push the heater control to HOT you open a valve that lets coolant flow into the **heater core**. The heater core resembles a little radiator. When the **heater fan switch** is turned on, a small fan blows air through the core where it picks up heat from the warm coolant.

Step 6: The Temperature Sender.

This device is screwed into the front lower part of the thermostat housing. A yellow or yellow and black wire connects the sender to the temperature gauge on the dash, telling you what the coolant temperature is. Most problems with the gauge not working are related to this sender or its connections. A working temperature gauge is the best judge of your engine's character. Learn to monitor the temperature gauge as you drive.

Step 7: Other Parts and Places of the Cooling System.

As I said earlier, coolant travels through the engine block and the cylinder head. Removable plugs, commonly called **freeze** or **expansion plugs**, are placed in the sides and ends of the block. There are three of them on the right side of the block, and two on the left under the manifolds, and one at either end of the block each of which is covered by the timing cover and transmission respectively. These plugs usually will not leak during the life of the engine if the coolant is properly maintained. The side plugs are accessible and replaceable if a leak should develop due to corrosion. If your coolant freezes due to a lack of antifreeze, you are in luck if the plugs are forced out by the expanding ice before ice pressure cracks the cylinders (Ch. 10, Proc. 10 [1]).

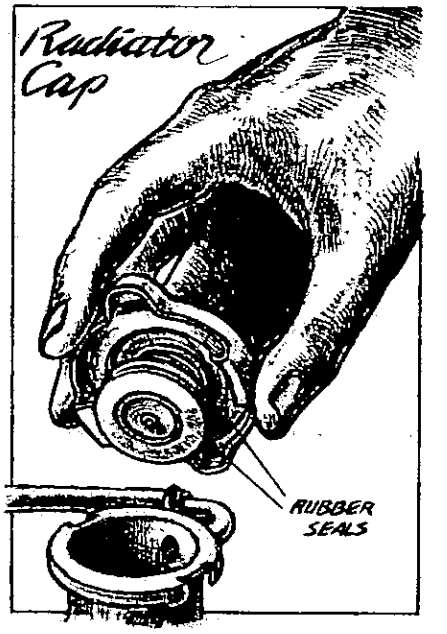
Step 8: Troubleshooting the Radiator.

Once you know the layout of the system, maintenance is a matter of checking the level of the coolant and the condition of the connections. Remember, don't remove the radiator cap when the engine is hot. The system is under pressure and the coolant can scald you.

When the cap is off the coolant level should be above the radiator **core tubes**. These may be visible as you look straight down into the filler neck. If you notice a coolant loss each time you check the level you probably have a leak and need to read this procedure. If the coolant looks clear (resembles water) or is rusty brown in color and watery, consider changing it. If the coolant looks milky, thick and oily, read Ch. 3, Proc. 1. Look at

the core tube ends for corrosion beginning to creep over them. Some corrosion is normal, too much will decrease the cooling efficiency of the radiator. A **boil out**, **rod out**, or **recore** may be necessary if the engine tends to overheat.

Look at the underside of the radiator cap. Note the rubber gasket built into it. If the gasket has deteriorated the cap should be replaced. Get a Datsun/Nissan replacement; it fits and lasts. However, if you buy an after market cap, be sure to get one with the correct pressure rating (12-13 psi).



Check the backside of the radiator. It should be uniform, without cuts in the little fins. Fan marks (arc-line indentations) indicate that the radiator may have been pushed back during an accident. If you see rust coloration on the fins, the vehicle may have been around salty sea air which can destroy a radiator core and spread rust all over the engine. In both cases watch the system closely for leaks.

Leaks can occur anywhere on the radiator and most can be repaired by professional soldering. The radiator drain plug has a rubber gasket under it that can leak if it has deteriorated or the plug is too loose.

Step 9: Troubleshooting the Water Pump, Fan, and Pulley.

Pre-1975 water pumps are mostly non-fan clutch types (except for early automatic transmission and 1974 610 models). All 1975 and later vehicles come with a silicon **fan clutch**. This device is designed to operate the fan at lower engine speeds below 2500 rpm and conserve horsepower and cut down on fan noise. At high vehicle speeds, the fan isn't needed to pass air through the radiator. You need to know which kind you've got before you do the next test.

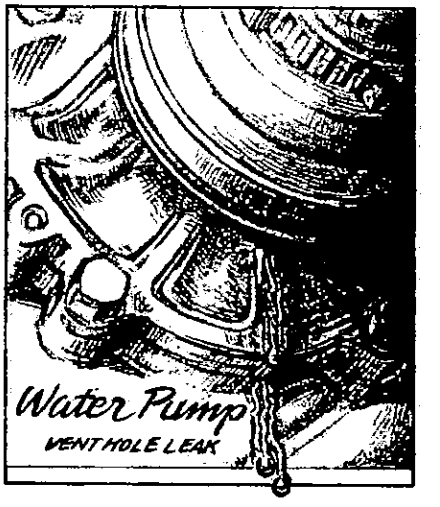
To determine the condition of your water pump, try spinning the fan blades by hand (engine off!). If you have a fan clutch the fan should spin with little resistance, when the engine is cold. As it ages the clutch may get stiff, which doesn't necessarily mean it's bad, it's just getting old like all of us.

Noisy water pumps are a sure sign of trouble. The sound is usually a grinding (like marbles in a blender), squealing, or a deep rough knocking (broken) sound. There are ways to isolate the water pump from the alternator and rest of the engine (Ch. 4). Replace a noisy water pump before it breaks.

If you do not have a fan clutch and you can turn the fan, chances are the fan belt needs adjusting. In rare cases, your pump shaft might be broken. For belt adjustment see Ch. 7, Proc. 9.

•**Everyone:** Wiggle the fan blades forward and backward. If you feel "play" in the fan, maybe the pulley is loose or there could be internal damage in the pump (Proc. 5 in this chapter). If it's solid, carry on.

The most common water pump problem is leakage from the **vent hole**. This hole is on the bottom of the pump housing. If you have a problem here you'll see coolant dripping from the underside of the pump usually when the pump is operating, engine running. To check this out closely, crawl under the front of the engine, looking up at the pump. Use a flashlight to locate the bottom of the pump. Be sure the wheels are properly blocked, transmission in Neutral and your safety glasses are in place.



OK, start the engine (or have your friend do it). Do not get your hands or face close to the moving parts at the front of the engine. If there is a leak from the vent hole you should see a trace of coolant originating from the vent hole and streaming down the front of the engine. Often a dark stain, or clean area, will be visible along the route of escaping coolant. The only true cure for this ailment is pump

replacement (Proc. 5). If your water pump leak is from somewhere else, you might find it covered in Steps 13 and 14.

Step 10: Troubleshooting the Thermostat.

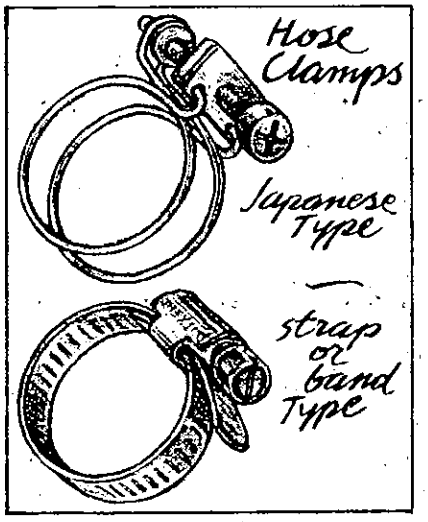
When the thermostat is working properly the temperature gauge should remain around the normal range when the engine is warmed up and running. Most often when the thermostat fails it stays partially open, never allowing the engine to fully warm up. (This can also be caused by a too-cold rated thermostat.) On the other hand, if your engine runs too hot, the thermostat may not be opening at all. Read Proc. 6 for more about the thermostat.

Step 11: Troubleshooting the Temperature Sender.

If the temperature gauge needle stays to the left of the dial even after the engine is warmed up, first check the **fuse box**. If the fuse for the instrument panel is OK, your problem could be in the **sender unit**, or its electrical connections, which are at the thermostat housing (Proc. 8).

Step 12: Check Out the Hoses and Clamps.

The most common leak points in the cooling system are around the hoses. Sudden temperature increases are usually due to an "open" in the system or near a hose. All early Datsun/Nissan hoses have rubber inside and braided cloth on the outside. The clamps that hold the hoses on at either end are wire, but they may have been replaced with different clamps.



Heater and bypass hoses are very likely to burst and are most often overlooked during an inspection. Any hose that is bulging, cracked or leaking should be replaced. A hose that feels hard or soft and bulging when you squeeze it is dying. Read over the first part of this procedure carefully to locate and check all of the hoses (Steps 1-5). One episode of severe overheating can ruin a cylinder head. I carry spare hoses on trips out of town and examine the hoses frequently.

Do you see any leaks at the ends of the hoses? Try tightening the clamp or clamps, and, if the hose isn't distorted, (maybe) stop the leak. If the wire type clamps become twisted or fall apart, replace them with *strap type clamps* available at every parts store in the country. For hard to reach places, install the smallest width clamps you can obtain.

Go to Proc. 3 in this chapter to replace a hose or hose clamp.

Step 13: Other Leak Points to Watch.

The **thermostat housing** can leak where it bolts to the head and (L-series) where the top and bottom sections meet. The **freeze plugs** can leak if corroded or improperly installed. The **radiator** has soldered points at the inlet and outlet as well as between the upper and lower tank-to-core joining points. On models with **water-heated intake manifolds**, coolant may leak down the side of the block under the intake manifold. If the **head gasket** is bad, coolant can leak into the cylinders or oil system and cause serious trouble (Ch. 9, Pt. 1). The radiator core and the heater core will develop **pinhole leaks** if punctured, rusty, or old. Understand the system and watch the coolant level and temperature gauge to protect your engine.

Step 14: General Cooling System Test.

Garages have a tool that can be put on in place of the radiator cap and pumped up to operating pressure. If the system has a leak in it, the gauge will show the drop in pressure. This test is easy and many shops will do it for you free (or for a six-pack). This device can also pressure test your radiator cap.

After your engine has run and is hot, turn it off and open the hood. A cooling system leak will often be heard as a *slow hiss*. Try to locate the hiss, then do the repair when the engine has cooled off.

Step 15: Troubleshooting the Heater Core.

The heater core, hidden under the dash of your car or truck, generally causes little trouble. If you notice a coolant leak on the floor of your vehicle, first suspect a bad hose or heater valve (cock) (Steps 5 and 12). If the hoses aren't the cause, you can then suspect the heater core. It's hard to remove and is something this book doesn't discuss. A Datsun/Nissan Factory Service Manual covers this, if you're determined to get at it yourself. But make sure it isn't at one of those hose connections first. NOTE: Leaf litter can fall through the outside air vents and cover the heater core. On many older trucks, it's easy to unclip the front of the heater (inside the vehicle) and get to the core.

Hoses that are under the dash and connect to the heater core or heater valve can be difficult to replace especially on cars (610, 710, and late model 510s) with air conditioning. There's more on this in Proc. 3 (3).

The only other reason to remove the heater core is if it is plugged by radiator stop-leak debris or corrosion. You can determine if it is by turning up the heater HEAT control and switching on the heater's fan when the engine is warmed up, temperature needle at normal. If the fan is working and no heat is produced, check that the **heat control valve** is actually open. Follow the cable from the HEAT control under the dash to either the right or left side of the heater unit where the valve is located. While looking at the valve, operate the heat control and see if the cable is moving the valve. If it is and you still have no heat from the heater, either the valve is broken or the heater core is plugged. These valves are difficult to replace and they do corrode with age. New ones are available from the Datsun/Nissan dealer. If it is likely that the core is plugged it will have to come out and be flushed or boiled out by a radiator shop. If it is leaking, it can be soldered at the same time. Since problems here are rare, I do not tell you how to remove the valve or heater core.

PROCEDURE 2: CHANGE ENGINE COOLANT/ANTIFREEZE.

Condition: You have been sent here from Ch. 3, or the color of the coolant is brownish or clear, or you've opened up the system to replace a hose, service the thermostat, remove the radiator, head, or other engine parts.

NEVER OPEN UP A HOT RADIATOR CAP OR HOSE. If you intend to reuse the coolant, the drain pan must be clean.

Tools and Materials: One gallon (L-series and 510 with Z-series) or one and two-thirds gallons (Z-series trucks) of high-quality, phosphorous-free antifreeze (for aluminum heads), one gallon of water, 14mm socket and rachet or breaker bar (3/8in drive), pliers, the replacement parts you need (hoses, clamps, drain plug and gasket, thermostats and gasket, sealer), a drain pan deep enough to hold two or three gallons of fluid. *Optional*: Wire coat hanger, toothbrush. NOTE: Antifreeze (usually ethylene glycol) is poisonous but sweet to taste. Do not leave it out where pets or children can get it. This dangerous, sweet-tasting cocktail shuts down the kidneys and can be fatal.

Remarks: To drain the cooling system thoroughly you have to drain the radiator and the block. If you are just adding antifreeze to increase the resistance to freezing, you should run the engine immediately afterwards to blend the mixture. Overheating will not be cured by changing coolant alone (see Proc. 1 for more general cooling information). In order to remove the head, radiator, most hoses, and thermostat it is only necessary to drain the radiator. To remove the timing cover, water pump, whole engine, or change coolant, drain the entire system. Contrary to popular belief, a 100% antifreeze content does not lower the coolant's freezing point; a solution of more than 60% antifreeze raises the freezing point. A 60% antifreeze, 40% water mix is ideal.

Step 1: Remove the Cap.

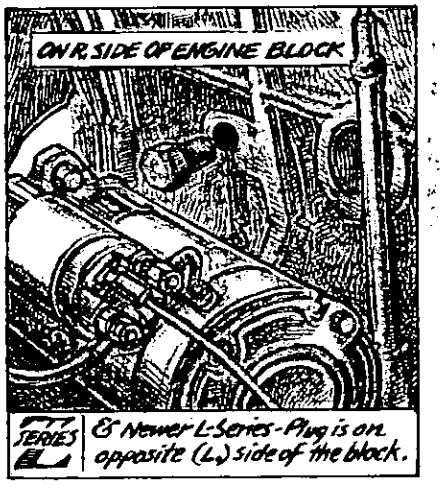
Lift the hood and locate the cap, perched on top of the radiator at the very front of the engine compartment. Make certain the engine has cooled for at least 15 minutes. Push the cap down with a rag under the palm of your hand and turn counterclockwise until it stops, then pull the cap straight up and off.

Step 2: Find the Drain Plugs.

Look down at the lower rear left side of the radiator. You'll find a white plastic or metal **winged screw plug**. On many late model cars the plug is in the bottom center of the radiator. This is really a valve that will drain coolant when opened; the more it's opened the more coolant comes out. (If this nut is broken off, you'll have to remove the radiator. If absent, there may be a metal plug in its place.)

•**L-series:** (except for 4WD L-20B trucks, see Z series below) Now follow the engine block back along its right side. Directly below the last spark plug and rear heater hose and to the inside of the **starter solenoid**, you should find a 14 or 17mm headed plug. If you can't find the plug, read Z-series below.

•**Z-series (and 4WD) People:** Your drain plug is on the left side of the block, under the rear exhaust manifold tube and next to a freeze plug and/or dip stick. This 17mm headed plug may be covered with grime. By removing this plug, taking off the radiator cap, and opening the radiator plug you can completely drain the cooling system. Before going on, go inside the vehicle and open the heater control valve to HOT.



Step 3: Drain the Coolant.

Start with the radiator plug. Place a drain pan under the drain plug. Turn the plug counterclockwise (think for a minute which way you're facing). If it sticks or is a hexagonal plug, use pliers or correct size wrench to get it started. (If the plug is broken or completely frozen, remove the lower radiator hose from the radiator instead [Proc. 4].)

As the plug comes out, coolant should begin to seep out of the slit along its edge. Turn it so the flow of coolant goes into the drain pan. This isn't always easy, due to the many obstacles below like a skid pan or steering parts. If nothing comes from your drain hole it may be restricted by *scale*. In this case, remove the plug completely and carefully poke the coat hanger into the hole to loosen the scale.

To drain thoroughly, you should also remove the block plug. Take the drain pan back to the block plug. This plug is often hard to remove. I use a 3/8in drive 14mm or 17mm socket (extension) on a ratchet or breaker bar. (When necessary, I've used a small piece of pipe slipped over the end of the ratchet to increase my leverage, but this requires extra care lest it slip off and hurt you.) On Z-series engines or other hard to reach plugs, you may have to jack up and support the vehicle and work from below. Turn the plug out counterclockwise. When the plug has been removed a flow of coolant will shoot out, unless scale restricts the hole.

Let the coolant drain out thoroughly. (See footnote at the end of this procedure.)

Step 4: Replace the Stops.

If the plug for the block has been removed, clean its threads, coat the threads with anti-seize compound, and screw it back into the block. Tighten the plug until it's snug enough not to leak.

If you've removed the radiator plug or if it's leaked before when tight, you may need to replace the **rub-**

ber gasket that should be on it. (These are available from the Datsun/Nissan dealer, as are replacement plugs.) Make sure the plug is threaded in straight as you screw it in. Turn the wings until the rubber washer contacts, then tighten slightly more with your **fingers** until snug. If any hoses or clamps were adjusted, make sure that all connections are tightened before filling the system with coolant.

Step 5: Fill the System with Coolant.

One gallon of antifreeze is sufficient to protect your motor. The rest of the space should be filled with clean water. If you have hard water where you live, consider using distilled rather than tap water.

NOTE: If you use a funnel, lift it up off the radiator filler to allow air to escape as you pour in the coolant.

Slowly pour one quart of new antifreeze into the radiator, then one quart of water. Alternate antifreeze and water. Let the liquid bubble down then recheck the level. Put in one whole gallon of antifreeze, then as much of the gallon of water as you can. The level you want is one to two inches above the rods, but below the lower lip of the filler neck. **Z-series Truck People:** With one gallon of antifreeze and one of water in the system, fill the rest up with your second gallon of antifreeze.

Leave the cap off for the moment and start the engine. As it runs keep an eye on the coolant level to see if it drops. Watch the temperature gauge needle until it reaches the normal position, then shut the motor off. Add more water if the level is down and replace the radiator cap by aligning the slots then pressing down on the cap and turning clockwise until the cap locks in place.

NOTE: If your engine (gauge) temperature climbs high and doesn't come down, turn off the engine and let it cool. Check the level when cold. There may be an air pocket in the system.

Step 6: Check for Leaks.

Run the engine one more time. Make sure the vehicle's on a dry patch of ground and check for leaks beneath the radiator, engine, and at hose connections—and water pump and thermostat housing if you dealt with those items. Watch the temperature gauge. If the needle goes to the HOT side, turn the engine off and let it cool. Once cool, carefully remove the radiator cap and check the coolant level. Air bubbles can form in the system, preventing it from completely filling with coolant on the first try.

Finally, deal with the old coolant, if you didn't get to it in Step 3. It's best to pour it into capped plastic jugs for disposal at the dump. Remember, antifreeze (usually ethylene glycol) is poisonous.

Footnote: If your coolant was exceptionally rusty, you may want to add some anti-rust inhibitor in the new coolant. This stuff is available at most auto parts stores.

PROCEDURE 3: REMOVE AND REPLACE HEATER AND BYPASS HOSES

Condition: You were sent here from Proc. 1. The hoses in question are cracked, hard, frayed, leaking, damaged, or old enough to merit replacement.

Tools and Materials: Medium Phillips and straight-blade screwdrivers, new hoses (preferably from the Datsun/Nissan dealer), new strap-type hose clamps (two for each hose being replaced). *Optional:* Flashlight, pocket knife, emery cloth.

Remarks: Datsun/Nissan sells hoses that are pre-formed to fit your vehicle. Because there are many shapes and sizes and lengths of bypass hoses, I recommend replacing yours with the factory pre-forms to ensure a proper fit.

•**L-series:** In most cases the bypass hoses can be replaced with 3/8in or 5/16in fuel line hose. The **water pump inlet bypass hose** has different diameters on each end, making creative plumbing or the factory replacement a must. Do not be fooled by appearances: A hose that *looks* like it will fit is often too short. Compare the old and new one carefully. Visually match it with the original if possible.

•**Everyone:** The heater hoses are standard 5/8in heater hoses, but the pre-formed hoses make fitting

easier, especially on late model 510s and old 521s. If your vehicle has high mileage and old hoses, I recommend carrying spares of all hoses. This is cheap insurance, and along with frequent examinations of their condition, could save your engine.

It's also a good idea to replace the old wire style hose clamps with strap type clamps when replacing hoses. Make sure the clamps fit over the hoses.

No draining is necessary to change the expansion tank hose.

NOTE: Unless you're sure which hose you need and that you can get it, remove the old hose and take it with you to match the replacement.

Step 1: Drain Off Some Coolant.

You need only drain the coolant level slightly lower than the lowest connection of the hose being removed (Proc. 2). In short, make sure the engine's cold and drain the coolant from the radiator into a clean container.

Step 2: Expose the Hose.

•**L-series:** In most cases the hose connections are easy to see, except for the bypass hose that in early and late models connects to the intake manifold beneath the carburetor. You have to remove the **air cleaner housing** to get at this one (Ch. 6, Pt. 1, Proc. 1). Refer to Proc. 1 in this chapter to understand your hose layout. Steps 4-5 deal with specific hoses, so pick the step that applies to you.

•**Z-series:** Your bypass and heater outlet hose run under the intake manifold, partly out of sight. The heater inlet hose connects on the lower back side of the block.

Step 3: Dealing with the Heater and Radiator Hoses.

NOTE: I recommend replacing your hoses with ones from Datsun/Nissan because of the fit. These hoses are pre-formed for easy routing and their wall thickness is thinner than bulk hose, which assumes a proper fit through the firewall (grommets). Z-series hoses are poorly catalogued on the dealer/factory microfiche. Therefore, you may want to call ahead to make sure they're available. Don't puncture or pry against anything under the dash or you'll be sorry.

Hoses that Go to Engine Block:

•**L-series:** A bracket usually secures the longer heater hose to the engine block at the oil dipstick tube. If necessary, remove the bracket screw with a Phillips screwdriver or 10mm socket.

•**Everyone:** Remove the front end of the longer outlet hose first. Use the proper screwdriver on the clamp screw, turning counterclockwise until the clamp can slide freely. If stuck, use penetrating oil on the clamp threads.

The rear connections of both heater hoses are accessible either from the engine compartment (if you're lucky), or up under the dashboard near the heater (if you're not). Check to see if the hoses connect to short pipes that fit through the firewall. If these pipes are there, check under the dash for the opposite end of the pipe and another length of hose.

•**Late Model 510 People:** Your inlet hose is very twisted and connects on the driver's side of the heater. Use a factory replacement hose and patience. Look on the passenger's side around the heater valve for the other connection. In the latter locations you'll need a good light and agility to get at the clamps. You'll have to remove the plastic dash panel, the console, maybe a bracket, and the heater valve to get at the hose that connects the heater valve and heater cone. (**A/C People:** You'll have a devil of a time if it's under the dash—sorry for your dilemma.) The heater valve to heater hose is a common leaker and hard to replace. The only way to get at it is to remove the heater valve, which means removing all the other pieces I mentioned above. You may want to pay someone with patience and experience to replace this miserable hose.

•**Z-series:** You may only need to replace on the hose sections if they're spliced together. The engine end usually rots first.

Make sure the clamps are really loose before fighting the hose off. Use pliers gently clamped over the stuck part of the hose to twist it free of the pipe on which it fits. Work the hose out of position. If it goes through the firewall, pull the hose into the engine compartment. Push the **grommets** out with it if they aren't fixed to the

body. Leave the clamps on the passenger compartment. (Compare the new hose with the old one. They must be the same diameter at least on the inside, slightly under 5/8in.)

The bracket on the long hose (if you have one) should now be spread and placed in the same spot on the new hose. Do the same with the grommet(s), if you have the grommet-style setup.

Check Step 6 on cleaning the pipe ends before installing the new hose. Next slip the clamps onto the hose, with the screw head positioned so it is accessible and won't get in the way of something else. Don't tighten the clamps until both ends are on their pipes and the hose is finally positioned. Got it? Now apply the screwdriver to the screw and tighten the clamps securely. Make certain the clamps are directly over the pipes so they won't slip back—i.e., ¼ to ½in from the hose end. Remount and tighten the long hose bracket and any twisties or other doodads that attach the hose to the vehicle.

Other heater hoses: You may have other heater hoses in and around the heater, beneath the dashboard. When these break or when the heater core has to come out you have some tight work to do. (**A/C People:** Call a psychic surgeon!) Look on both sides of the heater with a good light to locate the weak or leak points (signs of corrosion) and the clamps. Replace these hoses with ones that fit and don't crimp when in place. Again, the factory knows best. Follow the heater hose guidelines, and use new clamps if possible.

Radiator hoses: There are two, each with a clamp at either end. You should take the old hose with you to match up with a new one. You may also have to cut the new hose ends to fit between the radiator and engine, even factory hoses sometimes. When in place, these hoses cannot touch any body or engine parts other than the fittings. Make a note of how the old hose was placed, and if the new hose has an arrow indicating direction of flow (illustration in Proc. 1). Remove the hoses by loosening the clamps and twisting the hose. Don't pry, just twist until it comes loose, then pull it off the pipe. Install clamps (with screw head accessible) over the new hose before putting the hose onto the fitting. (Read Step 6.) Position hose and clamps before finally tightening the clamp.

Step 4: Bypass Hoses.

Follow the route of the bypass circuit from the right side of the engine at the **two or three-way junction**.

•**L-series:** You have a little hose, a crossover pipe, and another little hose. The pipe crosses the front of the engine at the head, and is probably held stable by a **bracket** attached to one of the front cover bolts or studs. It's easier to deal with the hoses after removing the nut or bolt and washer than slipping the bracket away from the engine. Keep following the plumbing around the corner and side of the head. It stops at the thermostat, unless the manifold is water-heated, in which case it continues until it stops underneath the carburetor.

Loosen the necessary hose clamps to pull the crossover pipe free and/or the hose away from the fixed fitting. Clean off the fitting (see tips in Step 6). Attention to this detail prevents leaks. Place the clamps on the new hose(s) so that you can reach the screw heads without hassle when in place. Fit the hose(s) fully onto the fixed fitting and the crossover pipe. When the hoses and pipe are in place (well fitted, hose not bent), align the bracket with the front cover. Position the clamps ¼ to ½in from the hose end, fully covering the fitting. Tighten all the clamps. Now tighten the bracket and 10mm nut or bolt, until they're snug—not too tight. Don't distort the hose.

•**Z-series:** Your rear bypass hose connection is under the manifold and difficult to reach. Loosen the clamps and pull off the hose. Clean the fittings well to ensure a tight seal (Step 7).

Fit the clamps over the hose so the screw heads will be accessible and fit the hose as evenly as possible over the fittings. Position the clamp ¼ to ½in from the hose ends so they cover the fitting then snug them down, but not so much that you distort the hose.

Step 5: Overflow (tank) Hose.

If you have either an overflow tank for your radiator or a plain drip overflow and its hose is leaking, cracked or missing, replace it. It is a **common size** that can be found at Datsun/Nissan or any parts house. Removal and replacement are straightforward: disconnect each end, remove the old hose, route the new one through guides on the radiator down or to the tank. The clamp may be a squeeze-on screw style. Don't forget the twisties if any exist.

Step 6: How to Prepare Pipe Ends to Suit New Hoses.

This is about getting the pipe ends (fittings) clean so you'll have no leaks after replacing the hose. Scale and corrosion make the metal surfaces uneven. Scrape this junk off with a pocket knife and buff with emery cloth. Lubricate the pipe end with a touch of grease for an easy fit. With the clamp in place, wiggle the hose onto the pipe, and tighten the clamp. Broken and corroded pipe ends are not unheard of. If you can't get a damaged fitting to seal properly, the fitting itself should be replaced.

Step 7: Refill the System with Coolant and Check for Leaks.

When all is snug and leakproof, refill the radiator with the coolant you drained out. Make sure your coolant is in good condition (Proc. 2 [5]). Put on the radiator cap and run the engine while keeping a close eye on the hose joints as well as the ground for leaks. If there's a leak, turn off the engine and retighten or reposition the clamps on the hoses.

As you drive, check the temperature gauge and the coolant level often, and now and then recheck the tightness of the hose clamps. Top off the radiator with water if necessary after the engine has cooled.

PROCEDURE 4: REMOVE AND REPLACE THE RADIATOR

Conditions: You need to remove the radiator because it leaks, or is plugged or damaged. You have to take off the fan, fan pulley, and water pump to get at the timing cover. Or you are pulling the engine. Before starting, make sure the engine is cool.

Tools and Materials: Screwdrivers, new hose(s) and clamps if deteriorated, emery cloth, pocket knife, antifreeze (1 gal.), clean water (1-2 gals.), 10mm and 12mm wrenches. If wire type clamps are still on the hoses, replace with the better strap type clamps.

Remarks: Vehicles with air conditioners have a condenser in front of the radiator which can't be removed. So taking the radiator out to do in-place front engine work won't help.

Step 1: Drain Radiator Coolant.

It's all in Proc. 2 of this chapter.

Step 2: Disconnect the Radiator Hoses.

You need only disconnect the upper hose at the thermostat housing and the lower hose at the water pump inlet, leaving the hoses attached to the radiator (Proc. 1 and Proc. 3).

•**Automatic Transmission Models:** There are two more hoses connected to the bottom of your radiator. Lines from your transmission bring in transmission fluid to be cooled here. These are steel lines but they hook up to the radiator with rubber hoses and clamps. Depending on how the clamps are positioned, you will either have to get underneath on your back or reach way down into the engine compartment to get at them. Loosen them as you did the other clamps. When the clamps are loose, the hoses should pull off the radiator tubes with ease. Don't worry if some transmission fluid comes out. The lines should stay in place by themselves, but after you're finished be sure to check the transmission fluid level with the engine running (Ch. 11, Pt. 1, Proc. 4).

•**Everyone:** At the top of the radiator you'll notice a small hose that plugs into the filler neck. Follow this hose along the top of the radiator. If it just goes down the side, go on to the next step. The rest of you will have to disconnect the hose from the filler neck because your vehicle is equipped with an **external overflow tank**. Unclip and push the little hose out of the way of the radiator, stored near the overflow tank.

Step 3: Remove Shroud and Maybe the Grille.

•**Pre 1974 Models (especially 510s):** If your vehicle has nuts welded to the front of the radiator frame, visible through the grille, you won't have to remove the grille, so go on to Step 4.

Remove the Grille: If the nuts aren't welded to the body but separate, you'll have to remove the grille or risk damaging it getting at the nuts. Phillips screws hold the grille to the body. Earlier models have some screws that are hard to see, but look carefully for the brackets that hold the grille to the body. These screws are larger than the screws holding the headlight chrome in place. To get the grille out the headlight screws have to come out too. Unscrew each one, and gently lift the grille free.

•**521 Pickups:** There are four screws on the top lip of the grille and two on the front between the chrome strips, one on either side. The headlight rims stay put. It is not necessary to remove the grille to get the radiator out, but it is easier, especially if you are also removing the **water pump** or **timing cover**. You may have to take off the grille for other reasons.

•**Later models:** Four or six screws hold your grille in place. They are easily removed from the top front of the grille. New age grille fasteners need only be turned ¼ turn counterclockwise. Stash the screws in a bag labeled "grille screws." Put the grille aside someplace where you won't step on it. This is a typical grille. Yours may differ slightly.

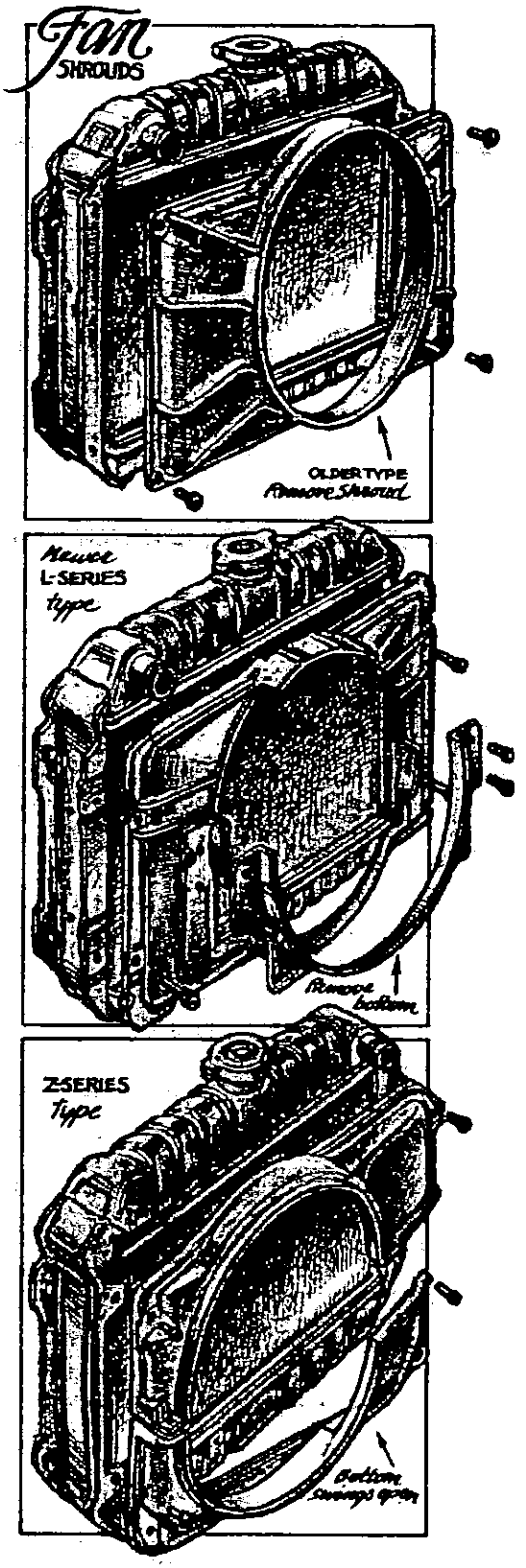
Remove the Fan Shroud: Look at the back side of the radiator. If you have a shroud, there will be a cover bolted to the radiator that funnels air back to the fan. You may find your shroud is missing (maybe part of your overheating problem). In which case, go on to Step 4 and consider getting a shroud from a wrecking yard.

Look at the bottom of the shroud. Does the shroud have a cutout in it; does it look like half of the shroud isn't there? If so, chances are you can pull the radiator with the shroud attached (go to Step 4).

If your shroud doesn't have a cutout, see if it's a split type. This kind has screws or clips holding the upper and lower sections together. Look closely. Maybe only one side has a clip to pry off. The lower half will probably be hinged. On other (more common) split designs, the sections are held together by screws. Remove these and the lower section may fall away from the radiator. If it doesn't you may have to unscrew the section from the radiator frame. Another style shroud put on late model 720s uses plastic pop-in clips that have smooth round heads and springy legs that love to self-destruct when pried out. Some dealers carry these replacements and many people simply leave the shrouds off after breaking the rascal clips.

If you have a one piece, non-cutout shroud, you'll have to remove the four screws holding it to the radiator then pull out the radiator leaving the shroud behind.

•**Everyone:** Label and bag whatever fasteners you remove for the fan shroud.



Step 4: Out Comes the Radiator.

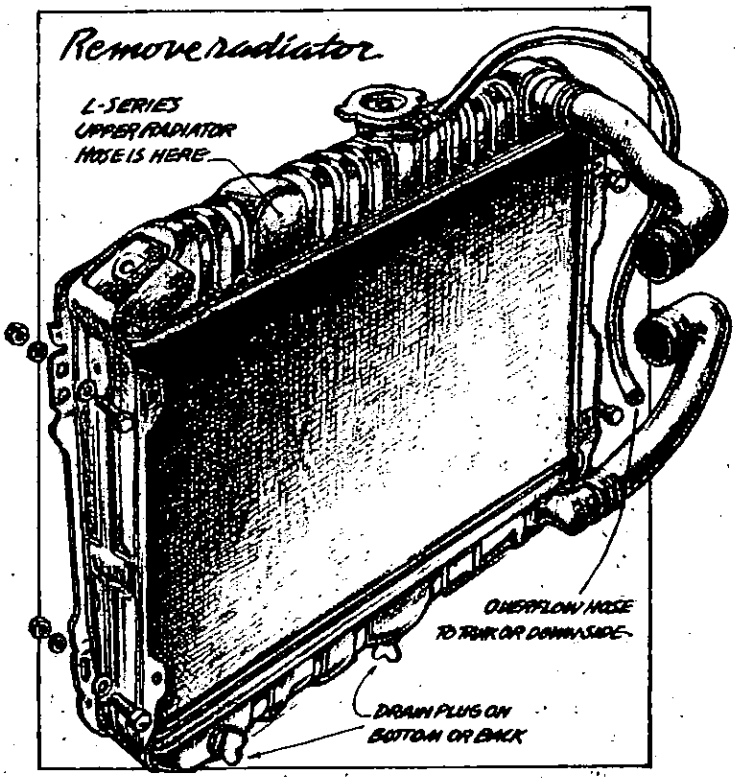
The radiator is held in place by four bolts (and nuts) which are accessible through the engine compartment on the backside of the radiator. Check the sides of the radiator for a rectangular **relay box** with wires going to it. The box is attached to one of the mounting bolts. Lone wire eyelets may also be connected on either side of the radiator. Make a note where they go.

•**Early Cars and Some Trucks:** Keep the mounting bolt head from turning with an end wrench while you remove the nut with a socket. They should be 12mm headed. Keep the washers and nuts stored on the bolts in a bag labeled "radiator."

•**1975 and Later Models and Pickups:** Use an extension and 10mm socket on a ratchet to remove the bolts. Keep the washers with their bolts bagged and labeled "radiator bolts."

•**Everyone:** Pull the radiator up and out of the engine compartment. If it catches, find out where and free it carefully. Don't damage the radiator core. If your shroud is still attached, you will have to guide the whole unit up and past the fan blades. You may have to bend the lower hose a little to keep it from catching down there.

If the radiator is going to be serviced or tested, any attached hoses and the shroud should be removed now. Most shrouds are held by small screws around the edge. Take the screws out and put 'em in your bag labeled "fan shroud." If your radiator is going to be worked on, I suggest reading the radiator rap in Proc. 1. If the **overflow hose** is not present or the rubber (plastic) is hard enough to crack, get a new one from the radiator shop or some ¼ in or 6mm clear hose from a hardware store. Take your old one to get the proper length.



Step 5: Check Radiator Hoses, Replace if Necessary.

If the radiator was serviced, chances are the hoses are already off the inlet and outlet snouts. If the hoses are deteriorated or bulge at all, replace them. Replace the wire type hose clamps with new strap style clamps.

Shapes and lengths of the hoses differ from model to model, so the best way to get the right replacement is to haul the old one to the parts store for positive identification. Check the inside diameter. And when in place, make sure there are no constricting sharp bends. Datsun/Nissan sells the best fitting replacements.

Step 6: Install Hoses onto Radiator Snouts.

The top hose goes to the top of the engine at the thermostat housing and the bottom one goes to the water pump inlet at the lower right side of the front timing cover. Slip a clamp over each hose, and put each hose on its correct snout. Leave the clamps loose for now. NOTE: Depending on your layout, you may find it easier to install the lower hose once the radiator's in place.

One more thing: There is a round flat rubber washer around the drain plug. Check both washer and plug for deterioration or damage. Replace these if necessary with new ones from Datsun/Nissan.

•**Automatic Transmission People:** Examine the ends of the transmission fluid cooler hoses. Look into the engine compartment where you disconnected the two little hoses that slipped onto a fitting in the radiator. See if there is any wear or excessive fraying at the ends of these vital hoses. If so, replace them now. Loosen the clamp at the tube end of the hose and pull the old hose off. Buy sufficient length of the same diameter hose. Cut the new pieces the same length as the old ones and slip them on over the steel lines. Install the clamps on the hoses with the screw heads accessible. Tighten the clamps, but not so tight you destroy the hose. Prepare the hose fittings on the engine end of things (Proc. 3 [6]).

Step 7: Put the Radiator in the Vehicle.

Find the bolts, washers, and nuts that hold the radiator to the body. If the shroud is off the radiator, install it. If it's a cutout type, leave the open side at the bottom of the radiator If it's a split type, install only the top half. If it's a full non-cutout type, put it over the fan against the engine so the funnel side faces rearward. The screws are bagged and labeled "fan shroud." Make sure the shroud is centered.

Pick up the radiator and carefully lower it back into the engine compartment. If you have a hinged shroud, some finesse is in order. Watch that you don't put something sharp through the core. You'll have to move the hoses around a little to get the shroud to fit around the fan blades and into place. When it is in, wiggle the lower hose into the water pump inlet on the right side of the engine. Make sure you put the hose clamp on the hose and it's loose enough to slide over the fitting. The hose should extend at least 1½in over the end of the fitting and there should be no sharp bends in the hose before the clamp is slipped into position. (You may need to shorten the hose with a sharp knife so it won't crimp but don't undercut it.) Don't tighten the clamp yet.

•**Automatic Transmission Models:** Find the loose ends of the little hoses connected to the lines from the transmission. Make sure they're clean and that clamps are on them before fitting their ends over the pipes on the bottom of the radiator. Position the screw heads of the clamps for easy access and tighten them. Make sure there are no crimps in the hoses.

•**Everyone:** Now fit the upper hose onto the thermostat snout. Is the clamp well onto the hose and loose enough to slip over the snout? Put a dab of grease around the snout and push the hose into place, far enough so there are no serious crimps and so that the clamp covers enough of the fitting and hose to seal when tightened. Do not tighten quite yet.

Step 8: Bolt it in Place.

Pick up one of the bolts (and nuts) that hold the radiator in place. Look down at the back of the radiator and line up the holes in it with the ones in the body. You may also have a small tab on each side of the radiator frame. These fit into corresponding holes in the vehicle body. The bolts will either thread into nuts fixed in the body or they'll go in from the front while you put on the matching nuts and washers from the rear. Look around the sides of the radiator for a ground wire eyelet or a rectangular **relay box**. These are held in place by one or more of the radiator bolts. Position and tighten all four of the bolts. The radiator should now be square and snugly in place. Check that the fan blades clear the shroud and radiator.

If you have a two-piece fan shroud that's not yet in place, place the lower half in under the fan and the upper half (if not in place) in from the top. Two little screws or a clip or clips hold the halves together and other screws hold the shroud to the radiator. Screw 'em in. If the shroud was removed before the radiator, it should be nearby. Align it to the radiator frame and bolt it to the back of the radiator.

Reach down under the bottom left side or reach up to the center bottom edge of the radiator and feel if the drain plug is closed. Don't overtighten it, just turn it with your fingers until snug.

Recheck all the clamps to make sure they are in place and that the hoses aren't crimped. Finally, go around and tighten all of the clamps fully.

Step 9: Replace the Grille.

All models except really old 510 cars have one piece plastic grilles. Old 510s have three-piece metal grilles. If this is you, you'll have to fit a headlight cover and the grille in place together and insert some screws. Then install the other cover before you set and tighten all the other screws.

Plastic grille models usually have little studs on the bottom that fit into matching body holes. The top side is held on by four or six screws. Newer models use weak plastic fasteners that you (may have broken) have to insert and turn ¼ turn. Find these fasteners labeled "grille screws."

Step 10: Refill Cooling System and Check for Leaks.

See Proc. 2 (5 and 6). Test for leaks, then test again. Take no chances with your cooling system.

PROCEDURE 5: REMOVE AND REPLACE THE WATER PUMP

Condition: You are here because you see coolant leaking from the water pump, or have noticed a loss and traced the source to the water pump, or the pump is making obscene sounds, or the fan clutch doesn't work, or you suspect that the pump isn't circulating coolant properly (unlikely).

Tools and Materials: 10mm and 12mm sockets and open ends, new water pump and gasket, gasket sealer (non-hardening), single edge razor knife, pocket knife, emery cloth.

Step 1: Drain Coolant and Pull Radiator.

Drain the coolant from the radiator and remove the radiator from the vehicle, using Proc. 2 (1-3) (drain only the radiator) and Proc. 4 (2-4), in this chapter. Loosen the fan belt and remove it from the water pump pulley (Ch. 7, Proc. 9 [3 and 4]).

Step 2: Remove Cooling Fan.

Datsun/Nissan fans have five to seven blades. Some fans are plastic, even fewer are steel. Early style fans are bolted to the water pump and pulley, while later fans attach to the clutch coupling.

•**Early Model People:** Bend back the little tabs holding the bolt heads with a screwdriver. These are part of the **retainers** that you'll take off when you pull out the fan hub bolts.

•**Everyone:** Use a 10mm socket to loosen and unscrew the four bolts in the hub of the fan. Mark which side of the fan is the front so you can put it back the right way. Avoid the temptation to fling the fan over your neighbor's fence. Bag and label these bolts (and retainers) "fan fittings."

•**Old Style:** If you are one of the rare few who has an old style fan clutch and the water pump is shot, learn your easiest solution by reading Step 4.

•**Everyone:** Bag and label these bolts (and retainers) "fan fittings."

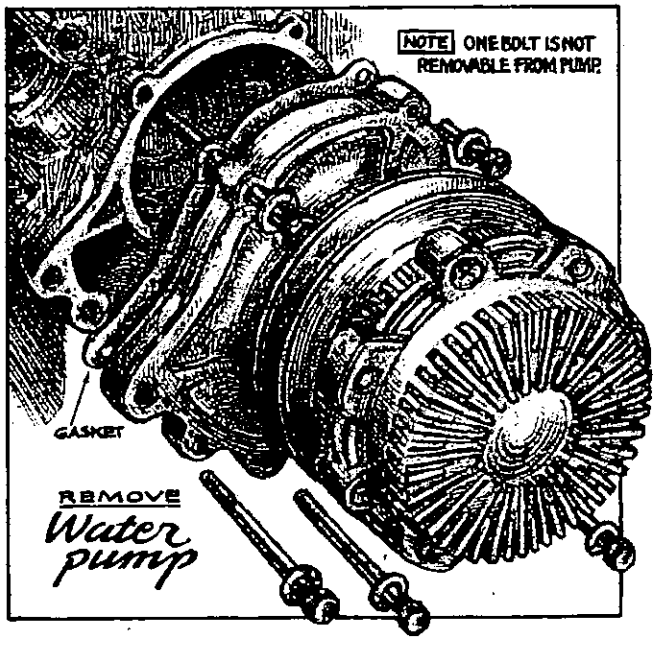
Step 3: Remove the Water Pump from Timing Cover.

Five bolts hold the water pump to the **timing cover**. If the timing cover is off of the engine, both 12mm bolts and one 10mm bolt will have been removed.

On the right lower side of the pump find two 12mm headed bolts that should come out first (they're out if your cover is off.) Measure the lengths of the bolts as they are removed and take note of their positions on the illustration.

The top and left side of the pump are held on by three 10mm headed bolts with washers (two if the timing cover is off).

•**Fan Clutch People:** Loosen the bolts enough to get the water pump wiggled off the timing cover and forward so you can turn the bolts out completely; otherwise, the pulley gets in the way. The top long 10mm bolt will remain with the water pump.



•**Everyone:** The pump comes off with gentle coaxing. Because there are **locator dowels** (pins) on the timing cover and corresponding holes on either side of the pump, wiggle up and down on the snout of the pump to get it loose. If you find you have to pry at it, use something blunt and gently work the pump away from the timing cover. NOTE: The dowel pins may come out with the pump rather than stay in the cover. Look for them. Don't replace the dowel(s) until you have cleaned off the old gasket.

•**Timing Cover Removal People:** Here's where you get off. Return now to Ch. 9, Pt. 2 and resume your procedure.

Step 4: How to Check Out and Buy a Water Pump.

When the pump is off, look at the back (impeller) side of the pump and inside the hole in the engine where the impeller fits. Here is a minor but representative view of the cooling system. Lots of rust means corrosion throughout. No rust or scale is a good sign, but you may find some. Read Proc. 1 for more on checking out the pump. If you think the pump is all right but want the security of a second opinion, compare the feel of the **shaft** and **impeller** with that of a new one at the parts store. Fan clutches getting stiff and coolant leaking from the vent hole are the most common Datsun/Nissan pump failures, so mere looks can be deceiving. Water pumps are not rebuildable by you, and some pumps are available only at the dealer. Call around first and take your old pump to the parts house when you go. Always check the box for a **new gasket** (you should get one with the new pump) and make sure that it isn't ripped or distorted.

•**Old Fan Clutchers:** Instead of installing another similar pump, the common practice is to buy a regular L-16 water pump, pulley, and fan to replace your original setup. You'll probably need one new bolt, so measure the one in your pump (6 x 1.0 x 85mm long). You may have to break off an edge of the old pump to get to the missing one. Use pliers or a hammer and punch to do this; wear safety glasses.

Step 5: Install Water Pump.

The surfaces where the gasket contacts the timing cover and pump (if not new) have to be absolutely clean or you'll have leaks. Scrape the timing cover side mating surface with a razor blade and/or your pocket knife. Be careful not to nick the aluminum or cut yourself. You'll see the two pointed dowels to clean around, which can be difficult to find if the timing cover is still on the engine. Be patient. Finish cleaning the surface with emery cloth and a clean rag. Clean the bolts, threads and all, as well as you can. A motorized wire wheel works well (wear safety glasses), but the more labor intensive wire brush method works too. Squirt the bolt threads with a little penetrating oil.

When all of the scratches are wiped and scraped away, put a light coating of gasket sealer on either side of the gasket. Careful not to tear it. Then place it onto the water pump using the bolt and dowel holes as guides to position it straight. All holes should now line up. Put the pump in place, using the pointed dowels in the timing cover to align the pump with the rest of the holes.

Once the pump is in place, clean the threads of the two 10mm headed bolts that go on the left side of the pump. Refer to the illustration when installing the bolts to get them in the right holes.

If the timing cover is off, you need only install the two left side 10mm bolts. The other 10mm bolt (fan clutchers: your bolt will just sit in place, loose) and the two 12mm bolts attach both the pump and the cover to the engine. These go on later. Tighten the 10mm headed bolts firmly or until the lockwasher flattens. Do not fully tighten them until the cover is mounted on the engine.

If the cover is on the engine, install all of the bolts but don't fully tighten them at first. Go from bolt to bolt gradually and evenly tighten them all until the lockwashers flatten and then a bit more. The pump should now be evenly mounted to the timing cover and its shaft should turn freely.

Step 6: Install the Pulley and Fan.

If you have a fan clutch, your pulley is already in place. Everyone else must place the pulley over the hub on the shaft of the water pump while you just install the fan. Pick up the fan after finding the four (or six) long 10mm bolts that hold the fan to the pump hub. Older styles have those little retainers that go on with the bolts through them.

Fan clutch people need simply put the fan in place (you marked which side is front) while the rest of you have to juggle the pulley, fan, bolts, and retainers and lining everything up with the holes in the water pump hub. Once two of the bolts are started, the rest should be hassle-free. The torque (tightness) rating for these bolts is 3-7 ft/lbs., so don't overtighten them but work around evenly from bolt to bolt until they're snug. You'll have to hold the fan blades to keep the hub from turning as you tighten the bolts. If you have retainers, bend the tab

ends over the bolt heads after the bolts are fully tightened.

•**Fan Clutch People:** The fan should now turn freely with a slight amount of drag, but without any resistance from the water pump shaft. The pulley and/or belt shouldn't turn.

•**Timing Cover Removal People:** Return now to the place where you left off in the cover installation step in Ch. 9, Pt. 2, Proc. 2 (14).

Step 7: Finishing the Job.

Put on the fan belt now, before installing the radiator. To install and tighten the belt, see Ch. 7, Proc. 9. Then go to Proc. 4 in this chapter to install the radiator.

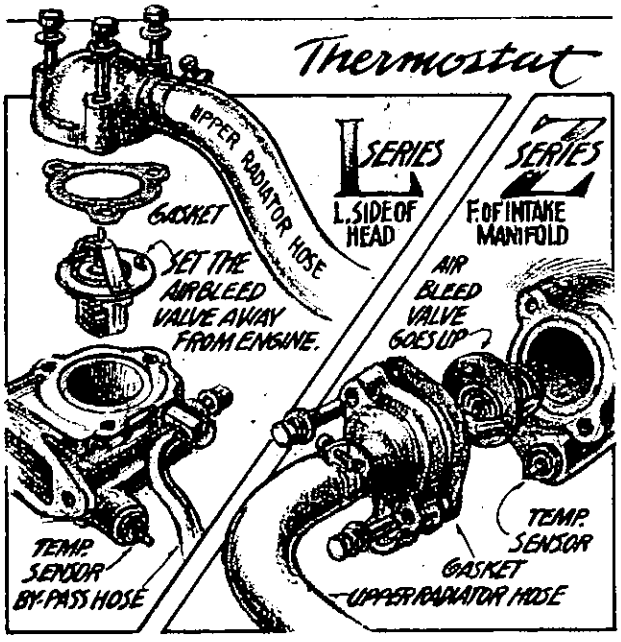
Be sure to check all hoses (for crimps and snug clamps) before adding coolant, and again for leaks after you've filled the system with coolant. After starting the engine, listen to the water pump (careful of the fan blades!). If there's no whining, clunking, grinding or leaking, you probably have a good pump. As you drive, keep an eye on the temperature gauge for other potential cooling system problems.

PROCEDURE 6: REMOVE, TEST, AND REPLACE THERMOSTAT

Condition: The engine is running too hot or too cold. Too little heat is coming from the heater (look at the temperature gauge and see if it reads on the cold side even with the engine warm). You are curious about this thermostat thing. You notice a leak from the thermostat housing. You have read Proc. 1 of this chapter. The engine must be cold to perform this procedure or you'll be burned.

Tools and Materials: 12mm socket, extension and ratchet, new thermostat gasket, anti-seize compound, 6in piece of wire (coathanger or baling wire), new thermostat, drain pan, sauce pan and scraper (pocket knife), emery cloth, wire brush or wheel, heat source (a stove), and non-hardening gasket sealer or gasket silicon.

Remarks: If your climate varies a lot you may want to switch thermostats seasonally. Various temperature rated thermostats are available. For example, Datsun/Nissan and most parts stores sell three common ones: 170° F (78° C), 180° F (82° C), and 190° F (88° C). A lower temperature thermostat valve opens sooner, keeping your running temperature lower, which may be better in the summer if the vehicle tends to run hot. The higher range is for engines that tend to run cold. The middle range is what usually comes in the new engine. Of course, the condition of the rest of the cooling system should be checked before you change the thermostat. If your radiator is plugged and needs a rod out or recore (your engine runs hot), a cooler thermostat won't help. Frequently, a cold running engine is due to a thermostat that is stuck open. Determine the cause by removing and testing this vital valve.



Step 1: Drain Some Coolant.

You need only drain a quart or two of coolant from the radiator, just enough to get the level below the thermostat housing. (See Proc. 2 if you don't know how to drain coolant.)

Step 2: Remove the Thermostat.

•**L-series:** Your thermostat housing is on the left front corner of the cylinder head. There should be a clip and bracket holding the spark plug wires together that mounts to one of the two thermostat housings bolts. Wiggle and pull this and the wire organizer on top of the cam cover off their brackets

to give yourself some working room. Put the 12mm socket and ratchet on one of the bolts and turn slowly counterclockwise until it's loose. NOTE: 1978 on pickups use a three bolt set up. Go to the other bolt(s) and do the same thing. If any of the bolts turns too hard, squirt some penetrant under its head to avoid breaking it off inside the housing.

NOTE: If there's a fuel line bracket perched over one of the bolt holes, you'll have to loosen two other fasteners. Follow the pipe to the front of the head. The pipe bracket attaches to one of the front cover studs. Remove the 10mm nut and washer, then pry the bracket forward.

Now follow the pipe back past the thermostat to a bracket attached to one of the top intake manifold bolts. Remove the 12mm bolt and washer and the pipe should be free enough for you to remove the thermostat housing top. Stash the nut, bolt, and washers somewhere safe.

•**Z-series:** Your thermostat housing is on the right front end of the intake manifold. Look on the bottom of the housing behind the lower bolt. If the battery ground cable is bolted here, undo it with a 12mm socket; let the cable hang and put the bolt back in its hole. The housing bolts (upper and lower) are also 12mm with a flat and lockwasher for each.

Once they're out keep the bolts with their washers and wire holder bracket (if removed). Safely stash or bag them labeled "thermo housing." The radiator hose and top of housing should pull away from the engine to reveal the thermostat. If the thermostat is stuck in place, use a screwdriver blade to gently pry through and under the bridge on top of the thermostat. Careful, it's delicate.

Step 3: Examine the Thermostat.

Factory designed thermostats have a rubber seat between the movable valve in the center and the body of the unit. Age deteriorates this seat, allowing the coolant to pass when it shouldn't (so your engine may run cooler than normal). If the metal housing's deteriorated, chances are the valve will stay closed (so your engine will run hotter than normal). If the valve is open when you first look at it, it is probably no good. If it's deteriorated, throw it away. A correct thermostat that works properly is important. I prefer using Datsun/Nissan factory replacements.

The temperature ratings should be stamped into the top of the thermostat. Ask the salesperson to show you where.

Step 4: Test the Thermostat.

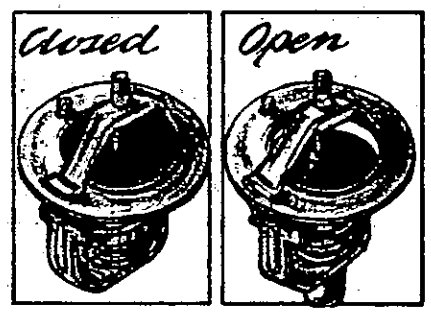
This may remind you of chemistry class. Make a small hook on the end of a small piece of wire at least 6in long. Coathanger wire is fine. Hang the bridge of the thermostat from the hook. Put enough water in a coffee can to cover the thermostat when it's dipped into it. Heat the water on the stove until it is nearly boiling. Try to keep the water just below boiling and plop the thermostat into it. Now watch. The valve in the center should begin to open, draw down toward the base. When you pull it out of the water, the valve should slowly close as it cools (5° C / 9° F) below opening temperature listed below. Fun, huh? You pass today's class.

If the thermostat operates properly, just reinstall it. If there is any doubt, replace the old one with a new one. Remember to buy a new gasket too, one that's right for your engine.

Careful: The engine may still be hot.

Thermostat rated opening temperatures:

Frigid type	Standard	Tropical Type
190° F / 80° C	180° F / 82° C	170° F / 76° C



Step 5: Put the Thermostat and New Gasket In.

The hardest part is cleaning *all* the pieces of the old gasket off the housing surface(s) and manifold (Z-series). A sharp pocket knife works well. The gasket and thermostat seating surfaces must be smooth for the new gasket to seal. Use a small screwdriver to clean out the groove where the thermostat sits. Use emery cloth to smooth off the gasket surface. Place the thermostat in the groove in the bottom part of the housing with the bridged part facing out. If the thermostat doesn't go right in, turn it.

The thermostat must fit evenly into its groove. Look at your thermostat. Does it have a little hole or a hole with a "jiggle valve" in it? If so, this has to face away from the engine (L-series) or up (Z-series). This helps air work its way to the top of the system.

•**Z-series:** If you have trouble keeping your thermostat in place during reassembly, coat the edge with a little sealer or grease then work fast to install the gasket and cover.

Now to the bolts and washers. Clean the bolt threads rust-free with a toothbrush or wire wheel and coat them with anti-seize compound. Set them aside. Pick up the gasket and coat both sides with a light, even coat of gasket sealer or silicon but not too much. Lay the gasket on the top of the thermostat, housing and holes.

•**L-series:** Now position the housing cover against the gasket with the snout facing forward and the radiator hose not crimped (if attached). Insert the bolts and washers, with the spark plug wire bracket to the rear, close to the engine.

NOTE: If you have a fuel line bracket to fit over the housing, the bracket should match up with the bolt hole closest to the engine. Fit the other brackets over the front cover and install the bolts, nuts, and washers when everything's lined up. Tighten the bolts evenly until snug; the lock washers will flatten.

•**Z-series:** You have to make sure the thermostat doesn't fall out as you fit the cover. *This is important.* When everything is lined up install the bolts and tighten until the lockwashers flatten.

Now remove the ground wire bolt and fit it through the wire's eyelet and tighten to the cover.

•**L and Z-series:** Reinstall the upper radiator hose if absent. Fit it over the snout and gently tighten the clamp.

Step 6: Refill the Cooling System.

If all your hoses are on and the **drain plug** closed, the system is sealed. Take off the radiator cap and pour in the coolant you took out. Make a note to replace it with new fluid and otherwise service the system if the stuff you're pouring in is brown or if you're using only water. Now put on the radiator cap and run the engine (Proc. 2 [5 and 6]).

Keep an eye on the temperature gauge as the engine warms up and check for leaks at the upper radiator hose and especially at the thermostat housing's mating surface. The bolts may need to be retightened—just a little. Happy heating! The temperature should read in the middle range or something else is wrong, maybe the radiator core?

PROCEDURE 7: HOW TO DEAL WITH AN OVERHEATING ENGINE

An engine that stays too hot too long will be seriously damaged (warped head, seized pistons, burned valves). This procedure will help save your engine in an emergency overheating situation.

Condition: While running, the needle of the temperature gauge rides well above normal, you hear hissing from the engine compartment, it smells steamy-hot, and/or there's hot coolant all around the engine compartment.

Tools and Materials: Garden hose and source of water, rags.

Remarks: Boiling coolant, under pressure beneath the radiator cap, can erupt and result in serious burns. *Be careful.* Don't remove the radiator cap while the engine's still hot.

Step 1: Your Temperature Gauge Needle Moves to Hot.

If the needle moves to the HOT end of the temperature gauge or someone yells, "Hey, buddy, your car is boiling over," turn off the engine and listen. If you hear hissing like a pressure cooker, look around for a nearby garden hose and faucet, or other source of water. Most service stations have a hose and water.

•**Hose and water available:** Restart the engine and get to the hose immediately. Turn on the faucet to an easy stream and point the spray into the grille of your car or truck. Don't blast the grille with a flow that would hurt someone, but get that water into the area behind the grille. This will cool down the engine slowly. Don't open the hood and directly squirt the motor—only the front of the radiator through the grille. After thirty seconds of this spraying, look again at your temperature gauge. If it is dropping down towards COLD, let it reach normal and turn off the engine. If it does not go down after one or two minutes turn off the engine and the water.

•**No hose and water:** Just turn off the engine after pulling off the road. You'll have to hope for the best. The engine will stay hot longer without the shot of water through the grille, and there's greater chance of internal damage.

•**Everyone:** If you hear or heard a hissing sound, chances are that the radiator is overflowing (due to pressure or a leak) or the hose is broken. After the hissing has subsided, open the hood. Do not touch any part of the engine or radiator.

The two most common reasons for overheating are low coolant level due to negligence or a leak (from a broken hose, leaking water pump, blown head gasket or restricted radiator). Read Proc. 1 in this chapter for more insight about the source of your problem.

Step 2: Remove Cap and Look for Leaks.

After the engine has cooled down, remove the **radiator cap**. Flip up the lever (if you have one), turn the cap slowly counterclockwise as you press on it, and lift it free, with your face well away from the hole. If the coolant level appears low, down near or below the **radiator core**, either the system was not filled properly or there is a leak someplace. Don't fill up the radiator with cold water if the engine is still hot, and don't fill it at all until you have determined where the leak is. If the leak is in the head gasket, additional water in the cylinders can cause serious damage. See Proc. 1, and for further information about the head gasket, read Ch. 9, Pt. 1.

Check these places for leaks: radiator and heater hoses, especially near their clamps; water pump; and the radiator core itself, front and back. You may have to fill the cooled vehicle with water and turn on the engine again to see water spring from the leak. (Careful not to get too near the fan and fan belts.) Don't be fooled by water or coolant that has been splashed around as you filled the radiator.

Step 3: No Leaks? What Then?

Could be a stuck **thermostat** (not serious), or a blown head gasket or a cracked head or engine block (serious). Malfunctioning thermostats sometimes make a distinct *thunk-thunk* sound, both before and after you turn off the motor (Proc. 6). To test for water in the cylinders, read Ch. 9, Pt. 1.

Step 4: A Little Friendly Advice.

Many people are sold on products that claim to stop radiator and other cooling system leaks. Some say that egg white put into the radiator does the same thing. I don't reccommend either. If you do try one of these "cures" follow this simple advice. Use a small amount rather than the whole container. These cures may work on small radiator holes but not bullet-sized ones. Once the sealer is in the system it can have plugging effects on critical holes and passages that you don't want plugged. Keep all your heater controls turned off. The sealer will travel into the **heater core** and often plug its tiny tubes, rendering the heater worthless. *Do not trust the leak-stop as a permanent cure.*

The best cure for an overheating problem is to find the exact cause. If it's not a leak (internal or external) or a bad thermostat, probably the radiator needs a boilout, rodout, or recore (see the radiator checkout step in Proc. 1). You can't do these jobs yourself, but you can save by taking the radiator out yourself and bringing it to a radiator shop (Proc. 4).

PROCEDURE 8: CHECK, REMOVE AND REPLACE TEMPERATURE SENDING UNIT

Condition: You've come here from Proc. 1 (6) of this chapter, your temperature gauge needle stays at the left even when the engine's warmed up, the thermostat's OK, and the dashboard fuse has checked out OK. Engine off and cool, hood up.

Tools and Materials: A piece of bare wire, 16mm socket or wrench, anti-seize compound, new sender unit, an assistant to watch the gauge. *Optional:* A candle.

Step 1: Checkout.

Drain two quarts of coolant from the radiator (Proc. 2 [1-4]).

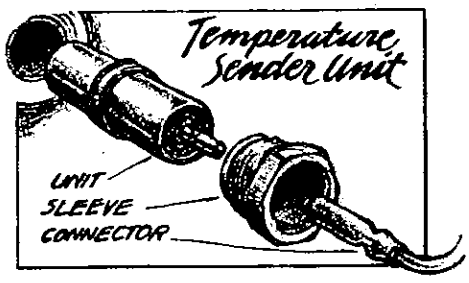
Find the sender at the front of the **thermostat housing** (L-series), or below and behind it (Z-series). A yellow wire or a yellow and black wire with a bullet connector should be plugged into a tit sticking out of the sender. Make sure this wire is connected well, not loose or disconnected. That could be the whole problem. Pull off the connector and squeeze the connector end with pliers for a tighter fit. If the connection looks corroded, scrape the tit until it's shiny. Reconnect the wire to the sender and turn the ignition ON. If the engine is hot (warm it up if it isn't) the needle should stop about midway on the gauge. If the gauge still won't register, carry on.

Unplug the wire once more. Stick one end of a piece of bared wire (same diameter, more or less, as the yellow wire, ca. 14 gauge) into the bullet connector, then hold the other end of this test wire against the metal of the engine. This grounds the temperature gauge circuit. Turn the ignition ON but do not start the engine. If the test wire connections you made are really good, the needle on the gauge should move all the way to the right (HOT). If it doesn't move to HOT the problem is in the wiring to or in the gauge itself. If the needle moves the problem is in the sender. Turn off the ignition, and carry on.

Here's how to determine if the sender is bad or if it is just not well grounded. Keep the yellow wire disconnected for now. Fit a 16mm socket or wrench over the hexagonal nut that is part of the sender, and carefully loosen the nut counterclockwise at least one full turn, then retighten until snug. Reconnect the yellow wire and turn the ignition ON. If the engine is warm, the needle should move to the right. If it does, your problem is solved. The sender was just poorly grounded. If it does not then the sender is probably faulty and should be replaced.

Step 2: Remove the Sender.

Unplug the yellow wire and remove the sender nut as described in the preceding step. The main part of the sender is now exposed. Corrosion often makes it hard to get the sender out without destroying it. In the faint chance the sender is still good, try to get it out without crushing it. First try to pull it out with your fingers; if that fails, use a pair of pliers to gently turn and pull the piece out of the housing.



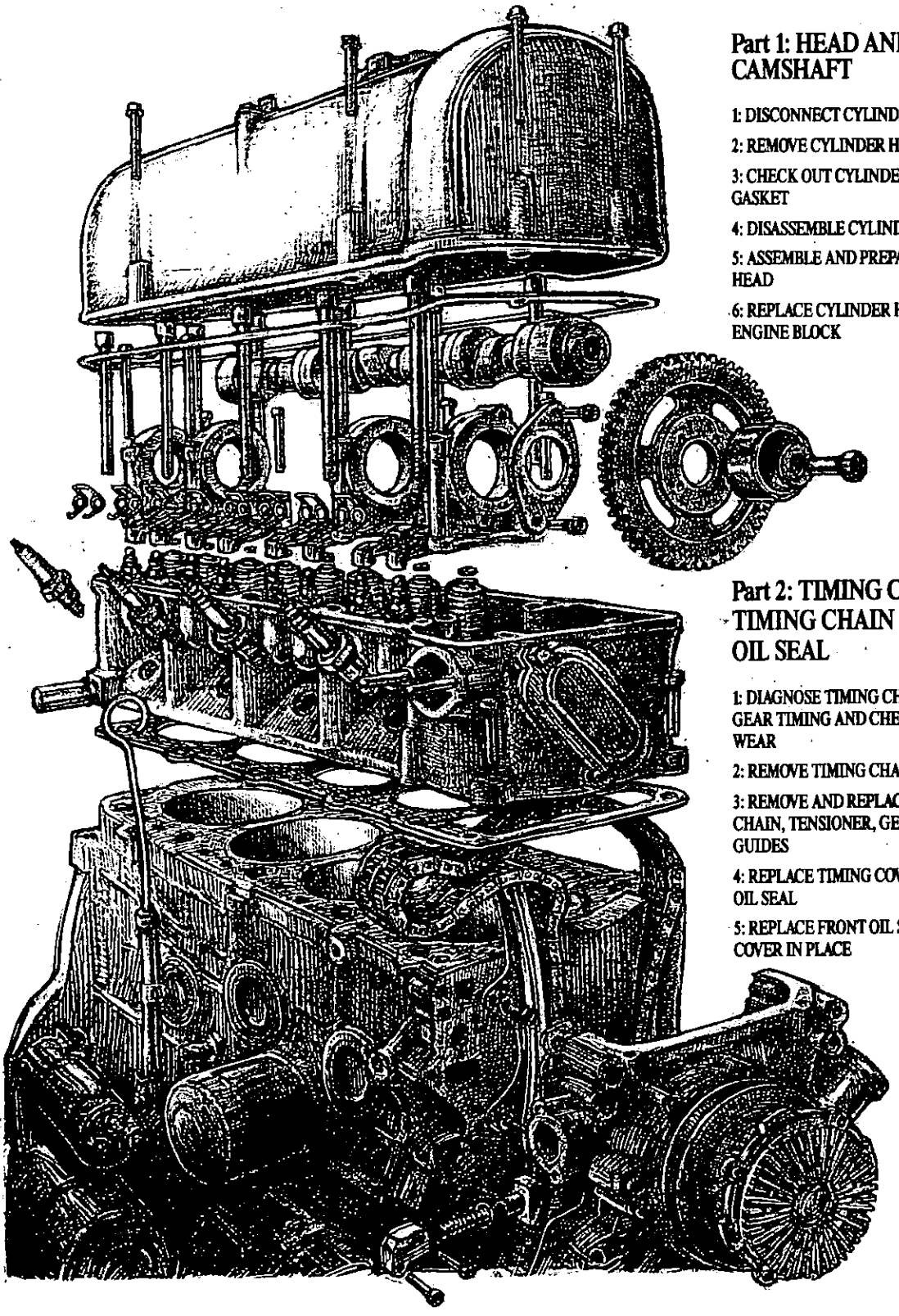
If it still gives you trouble, the top section of the thermostat housing and the thermostat will have to be removed (Proc. 6 [2]). The inner end of the sender will then be visible and, with the help of a screwdriver, you should be able to pry the sender out of its hole. If it's really stuck, don't destroy the bad sender until you have another on hand.

If you care to test it again attach the tit to the yellow wire, turn on the ignition and heat the sender with a candle until good and warm. Now rub and hold the sender against the engine to ground it and have someone look at the gauge with the ignition turned to ON. If it works now, sand the sender body with emery cloth and reinstall it, following the instructions in the next step. If it doesn't work get a new one from Datsun/Nissan. **Do not lose the nut.**

Step 3: Put in the New One.

Coat the outer surface of the new (good) sender with a touch of anti-seize compound and push it into the housing with its tit facing out. Now coat the threads of the nut with a bit of the same compound and install it over the sender. Tighten the nut until snug. Put the yellow wire connector on the tit. (If you took out the thermostat and housing, put it back together, with a new gasket, as described in Proc. 6 [5 and 6].) Fill up the cooling system. Turn on the engine and warm it up to make sure that the gauge is now working.

The Head Valves, Camshaft and Timing chain



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CHAPTER 9
THE HEAD, CAMSHAFT AND TIMING CHAIN

Part 1: HEAD AND CAMSHAFT

WHY REMOVE THE CYLINDER HEAD?

The cylinder head must be removed if your engine consumes lots of oil, e.g., 1 qt./300-500 miles (and it's not caused by a leak, [Ch. 10, Proc. 1]); or because there's a loss of compression and you have performed a valve adjustment, (Ch. 3, Proc. 4 and 9); or because there's water in the oil or oil in the water; or the engine won't run; or you can't crank it with a wrench—it's seized.

To determine accurately why your engine is burning oil, losing power or compression, won't crank over, or has oil in the water or water in the oil, you have to remove the cylinder head.

Datsun/Nissan engines usually have to be rebuilt because they burn too much oil, not because of bearing, valve or timing chain failure (unless of course they're run without oil or otherwise abused). Unless something breaks or wears out prematurely, your engine should wear out evenly. This means the valves, piston rings, timing chain, and connecting rod bearings generally wear out at the same rate. If the engine has high miles on it (80-120,000 or more), and it's never had major engine work done to it, and it's using a lot of oil, it makes sense to do a comprehensive overhaul, or at least a minor one, including a valve job, piston rings, rod bearings and timing chain components. A rebuild like this will cost you $250-500 in parts and machine work, if you do it yourself. But first ask, is the vehicle worth restoring? How are the body, the brakes, the tires, transmission, driveline, rear axle, and suspension? What could you sell it for with or without a good engine?

A common mistake people make is to do only a valve job on a high mileage, oil burning, low compression engine to find it still burns oil and has low compression right away or soon after. This is because the increased compression from the valve job causes leakage past the piston rings. In fact, oil burning is often caused by worn intake valves or guides (and seals) not rings or pistons, but if the engine's old, the rings will probably be equally or nearly as worn. That is why I suggest you do a complete job while the head is off and save yourself a lot of grief later.

If the engine isn't that old but uses a lot of oil, check for leaks (Ch. 10, Proc. 1). If leaks aren't the main cause, you may get away with simply pulling the head and doing just a valve job. This is especially true if only one or two cylinders have low compression caused by burned valves and/or a bad head gasket. Or if the head gasket's blown, you may only need to replace that and perhaps resurface the head if it's warped.

In any case you can speculate all you want, but you'll never really know why an engine's burning oil or losing compression or water until you remove the head and check things out.

If you simply don't want to rebuild the engine but want to replace it with another, Ch. 10, Proc. 7 tells you how. Whatever your fate, read through the parts of this and Ch. 10 before losing faith.

The Head Gasket: A good join between the head and the block is crucial, and the **head gasket** is there to ensure that bond. There are four big holes in the head gasket for the **cylinders**, and many more smaller holes for water (coolant) to circulate between the top and bottom of the engine. There is also a small hole on the center left side of the head gasket for oil to get up to the camshaft. The head gasket should seal these holes so the liquids and cylinder combustion gases don't leak into each other's passageways.

All the systems in the engine operate under pressure. The head gasket has to handle combustion pressures (the highest), oil pressure, and coolant pressure. When the engine isn't running, but is still hot, the cooling system retains pressure until the engine cools down.

A "blown head gasket" means that a seal between these systems has failed.

If the engine overheats, it can cause the aluminum head to warp, creating a gap between the head and the block. When this happens, the head gasket can no longer seal, so water gets into the oil, oil into the water, water into the cylinders or all of these. The best way to avoid overheating is to make sure that the cooling system is in good condition (Ch. 8, Proc. 1).

Oil or water will sometimes leak externally, and you'll see traces of the loss on the side of the engine block. An oil leak from the head gasket can be seen on the right center of the block, just below where the head and block join, or around the front and back edge of the head. Keep an eye on the fluid levels and on the ground for leaks. Once in a while a head gasket leak can be cured by simply retorquing the head (Proc. 6 [4]) something that should be done at 500 miles, then again at 12,000 miles after installing a new head gasket.

If either internal or external leakage persists, the head must be removed to solve the problem.

Another cause for oil and water mixing in the engine or entering the cylinders might be a crack in the block or head. If the coolant freezes, the expanding ice can crack the block or head.

NOTE: On many heads, especially older L-16s, the main oil passage is drilled too close to the water jacket. Many of these heads leak internally and the only solution is to replace the head or have it fixed (Proc. 4 [8]).

Most of the time, internal leakage comes from a faulty head gasket, corroded passageways, or a warped head. To be sure, remove the head and check it out carefully (Proc. 3). If it isn't severely damaged, the head can be rebuilt. If you suspect a bad head gasket and have been losing coolant, do the following Mini-Procedure. Otherwise, go on to the next section below.

Mini-Procedure: How To Check for Water in the Cylinders:

If you're losing coolant and the leak isn't external (you can't see it), the coolant must be going into the engine through the head gasket.

First do the oil-and-water check and remove the spark plugs (Ch. 3, Proc. 1, 3, and 9).

Next, disconnect the center coil wire from the distributor cap and ground it by laying the metal end of that wire against the car's body metal (Ch. 7, Proc. 12 [2]). Have a friend crank the engine with the ignition key, or hook up the remote starter and do it yourself. Stand back and watch what comes out of the spark plug holes when the engine is cranked. If nothing, there's no water in the cylinders. If water comes spurting out, the head gasket has probably blown and the head has to come off. If there is water in the cylinders, chances are the engine oil is contaminated and milky colored. **Don't** drive the vehicle and risk damaging the engine further.

If you're losing coolant gradually and you can't find an external or internal leak, read Ch. 8, Proc. 1 for more on that system. Look all around the head gasket for leaks in the seams. (L-series front left side, Z-series back end are typical spots.)

Important: If you find water in the cylinders, waste no time in removing the cylinder head, getting the coolant out, and inspecting the cylinders. Otherwise, you run the risk of corroding the cylinders or getting water into the crankcase. If there is any water in the oil, drain it immediately.

About major engine work: Most major engine work can be done without pulling out the engine. "Bottom end" problems are diagnosed with the head *and* oil pan removed. These problems are related to the block (crankshaft, connecting rods, and pistons). There's more on this in Ch. 10, Proc. 1. You can check the timing chain cam and cam gear by simply removing the cam cover. A worn timing chain will rattle when your engine's first started cold. If the chain breaks or slips, both cases are rare, your engine won't run at all. The timing chain and gang are covered in Pt. 2 of this chapter. The cam is covered in this chapter (Pt. 1, Proc. 4 [9]).

Regardless of how simple or complex a job you think or know you have to do, park your vehicle in a place where it won't be a problem if left for a long time and where it's comfortable for you to work. Indoors is best, in a garage out of the weather. Have plenty of rags, hand cleaner, solvent, and plastic baggies or similar containers for nuts, bolts, washers, and parts. Access to electricity to run lights and an electric drill is also basic for major engine work. Keep a marker and tape to label things with as well as the other tools and supplies I mention in each procedure. The key to successful engine work is organization and calm comfortable surroundings. If you end up having to remove the engine, you may need to get a hoist to the front of the vehicle. Allow yourself plenty of room to fit say a four-foot wide portable hoist into your workplace and a smooth surface to roll it on or a strong overhead beam from which to hang a chain fall. Don't fret; most of this information is repeated in

the procedures as you go along. The "bottom end" of the engine (below the head) is detailed in Ch. 10. Some of the specifics about the "bottom end" that are important to know before you start are given in the introduction and Proc. 1 and 2 of Ch. 10.

I have also written a reference list below to help guide you through a typical diagnosis, disassembly, repair and reassembly or engine rebuild.

This chapter and Ch. 10 are organized to help you remove the cylinder head with the engine still in the vehicle. Then after examining the piston tops, you can decide to either remove the engine or further diagnose it in place by removing the oil pan. NOTE: On four wheel drive trucks, it's often easier to remove the engine if "bottom end" work is necessary rather than remove the front differential, which has to be removed to reach the oil pan (in place).

Once the pan is off, you can check the crankshaft to determine if a minor in-place overhaul will work or if the engine has to be removed. (The crankshaft cannot be removed easily when the engine is in place.) The engine rebuild procedures in Ch. 10 include instructions for both in-place minor overhauling and engine-out major overhauling and a few things in between.

The timing chain components can be replaced with the engine in place or not, with the head and/or pan on or off. However, it's easier to do the job with the oil pan removed, because the timing cover is sandwiched between the head and pan with tearable gaskets between them. The timing chain and company are covered in this chapter, Pt. 2. Check them before you remove the cylinder head.

The list that follows should help guide you. The meat of engine repair information is in the introduction and Proc. 1 of this chapter as well as Proc. 1 and 2 in Ch. 10. Please read these before you reach for your tools. And if you're in doubt, consult a professional (mechanic, not psychiatrist or financial advisor) to get a second opinion. Take the symptoms and your engine's history to him or her to best describe the condition of your engine. Major engine work is expensive and time consuming no matter how you do it, so be sure you really have to before jumping in. Good luck.

Reference List: Ch. 9, (Pt. 1 and Pt. 2) and Ch. 10.

•You have read Ch. 9, Pt. 1, introduction and want to remove the cylinder head (Ch. 9, Pt. 1, Proc. 2 and Ch. 10, Proc. 1 and 2).

•You want to replace just the timing chain components (Ch. 9, Pt. 2, Proc. 1 [1 and 2], Proc. 2-4).

•You want to check the head and cam condition (Ch. 9, Pt. 1, Proc. 3 and 4).

•The cylinder head is off and you want to inspect the piston tops for signs of oil consumption or damage (Ch. 10, Proc. 2).

•The head has to go to the machine shop for resurfacing and/or a valve job. Wait on this if you plan to do bottom end (lower) engine work (Ch. 9, Pt. 1, Proc. 3 and 4).

•Only the head gasket needs to be replaced (Ch. 9, Pt. 1, Proc. 6).

•The head is off, and you want to check and/or replace the timing chain components (Ch. 9, Pt. 2, Proc. 2-4).

•You want to remove the oil pan and inspect the crankshaft and/or remove the pistons (Ch. 10, Proc. 3 and 4). **4WD People:** You have to remove the engine to get the pan off (Ch. 10, Proc. 7 [1-16] skipping the steps you may have already done). When it's out, go to Ch. 10, Proc. 3 and 4 to remove the pan and check out the crankshaft.

•You have checked the crankshaft and want to rebuild the engine in the vehicle. To remove the pistons and check the cylinders, see Ch. 10, Proc. 5 and 6. If you want to replace the timing chain, see Ch. 9, Pt. 2, Proc. 2-4.

•You have found the crankshaft and/or main bearings to be worn out, and the cylinders have to be bored oversize; you want to remove the engine from the vehicle (Ch. 10, Proc. 7 [1-16] skipping the ones you have already done).

The Engine's Still in the Vehicle

•The cylinders have been honed. The pistons and rods are new or cleaned and ready to have new rings and bearings put on. After that, the pistons and rods can be put into the block (Ch. 10, Proc. 12).

•The bottom end of the engine is together and the timing chain and cover are on the engine. You are ready

to replace the oil pick up and pan (Ch. 10, Proc. 12).

•If you haven't checked the oil pump, do so now (Ch. 10, Proc. 14).

•You have assembled the bottom end and are ready to install the cylinder head. If it's disassembled, Ch. 9, Pt. 1, Proc. 5. When it's all together, go to Ch. 9, Pt. 1, Proc. 6.

•When your engine's all together, go to Ch. 10, Proc. 15.

The Engine's Out of the Vehicle

•You just want to install another engine. Chances are you'll have to swap parts from your old engine. Study the chapters and procedures in the Table of Contents and chapter contents lists to match the parts you have to remove and replace with the procedures and steps you'll use to do it. Ch. 10, Proc. 2 [3], gives a rough idea of what used, new, or rebuilt engines come equipped with. Good luck! To replace the engine, see Ch. 10, Proc. 7 [17-26].

•You haven't yet removed the cylinder head or you want to remove the head of another engine to check it out (Ch. 9, Pt. 1, Proc. 2).

•You want to remove the oil pan to inspect the crankshaft (Ch. 10, Proc. 3).

•You want to remove the pistons and check or hone the cylinders (Ch. 10, Proc. 5 and 6). If you're taking the block to the machine shop, inspect but don't hone the cylinders.

•You want to disassemble the block to remove the main bearings and crankshaft and maybe take parts to the machine shop (Ch. 10, Proc. 8).

•To clean parts for engine reassembly, see Ch. 10, Proc. 9. Check the oil pump (Ch. 10, Proc. 14).

•You're ready to assemble the engine block (Ch. 10, Proc. 10-12). Install the timing chain and cover but not the cylinder head (Ch. 9, Pt. 2, Proc. 3 and 4).

•To install the oil pick up and pan, see Ch. 10, Proc. 13.

•Replace the oil pump (check it first if you haven't already by referring to Ch. 10, Proc. 14) (Ch. 9, Pt. 2, Proc. 4).

•You're prepared to install the engine with the cylinder head off (Ch. 10, Proc. 11).

•Assemble and replace the cylinder head (Ch. 9, Pt. 1, Proc. 5 and 6).

•Prepare the engine to run (Ch. 10, Proc. 15).

PROCEDURE 1: DISCONNECT THE CYLINDER HEAD

"The first rule to intelligent tinkering is to save all the pieces."

—Aldo Leopold

Condition: You're getting ready to work on the cylinder head or the pistons; or the engine is using lots of oil or has lost power, a complete tune-up didn't help and you checked the compression; or you've found oil in the coolant, coolant in the oil, or water in one or more of the cylinders, and you suspect a bad head gasket; or you have a burned valve, or high oil consumption because of valve, valve guide, seal or piston ring problems. You have read Ch. 10, Proc. 1 and 2.

Tools and Materials: Basic tool kit, penetrating oil, nail polish or a little paint, masking tape, and marker pen.

Remarks: How the head mounts to the engine and vehicle body varies from year-to-year and model-to-model. I've tried to mention all possibilities. If you have to disconnect a hose, wire, nut, or bolt that isn't mentioned, make a sketch and a note to remind yourself where it fits.

Step 1: Disconnect Battery Cables and Remove Battery.

See Ch. 7, Proc. 1.

Remove the **battery** to avoid shorting, but keep the negative cable connected to and with the battery. Disconnect the positive cable from the battery post. **L-series:** If your **negative battery cable** is bolted to the head, use a 12mm socket to remove the bolt and washer at the head. Then the cable and maybe the engine slinger will

be free. Keep the cable with the battery, replace the slinger and bolt into the head. **Z series:** The negative battery cable is bolted to the thermostat housing, below where the upper radiator hose connects to the engine. Use a 12mm socket and extension. Replace the bolt into the housing.

Step 2: Drain Cooling System.

See Ch. 8, Proc. 2 [2 and 3]

All you have to drain is the **radiator**, unless you intend to work on the timing cover, water pump or the rest of the engine, in which case you should drain the engine block as well.

Step 3: Remove the Air Cleaner Assembly.

See Ch. 6, Pt. 1, Proc. 1.

Also remove the **preheat hose** from where it attaches to the exhaust manifold and anything else to which it's attached. Avoid damaging this expensive-to-replace hose.

Step 4: Disconnect Cylinder Head or Manifold-to-Heater Hose at Outlet Fitting and Bypass Hose.

See Ch. 8, Proc. 3 for locations.

•**L-series:** Disconnect the **heater hose** from the right rear of the head. The hose is clamped to an elbow fitting. Also disconnect the **bypass hose** at the three-way inlet junction. This is the smallest of the three hoses connected at this junction.

•**L-16 and L-18 People:** Follow the bypass hose up to the crossover pipe and around to the hose at the base of the carburetor. Loosen the clamp close to the carburetor. Follow the pipe back to the front of the head and remove the nut and washer that holds the hose bracket in place. Work the pipe and bracket away from the head. Remove the fuel line bracket if also held by the same nut. Replace the washer and nut. Now use a screwdriver shaft to pry the hose at the carburetor base forward off its pipe, while you pull on the crossover pipe. Where the hose is free, leave it where it is; it may still be connected to the thermostat housing.

NOTE: Some coolant may spill while you do this step. **Z-series:** You have two hoses to disconnect. Follow the lower radiator hose up to the 2-way fitting at the right side of the timing cover. Another smaller hose connects to the back of this junction. Loosen its clamp then twist and pull the hose off the fitting.

Now look at the firewall behind and to the right of the engine to find the heater hoses. Follow the one that goes under the intake manifold to another water fitting. Find this clamp then loosen it and work the hose back off of the manifold fitting. Keep the clamps with their hoses tightened so they don't fall off.

Step 5: Disconnect Fuel Pump Inlet and Return Hoses and Remove Fuel Pump.

Warning: no smoking or sparking!

•**L-series: Mechanical Fuel Pumps People** (Old L-16 People see below): Disconnect the fuel outlet hose at the pump and the return hose near it. Both connect to pipes that go to the carburetor. When you have removed the pump from the head, lay it against the right fender wall, safely out of the way, but still connected to the hose that goes to the fuel filter and/or back to the gas tank (Ch. 6, Pt. 1, Proc. 10).

•**Z-series Electric Fuel Pump People:** Two hoses connect pipes on the fender wall to pipes going to the carburetor. Disconnect the hoses at the fender wall after labeling them 1 and 2 to match their pipes respectively.

•**Z-series Mechanical Fuel Pump People:** Follow the two pipes away from the pump and down. If they connect to pipes that attach to a bracket on the intake manifold, disconnect them at the pipes under the center of the intake manifold and carburetor. Label which hose comes from each pipe (1 and 2), then go to Ch. 6, Pt. 1, Proc. 10 and remove the fuel pump. If your fuel pump inlet and return hoses come directly from the pump to pipes mounted on the right fender wall, you need only disconnect the hose going directly to the carburetor.

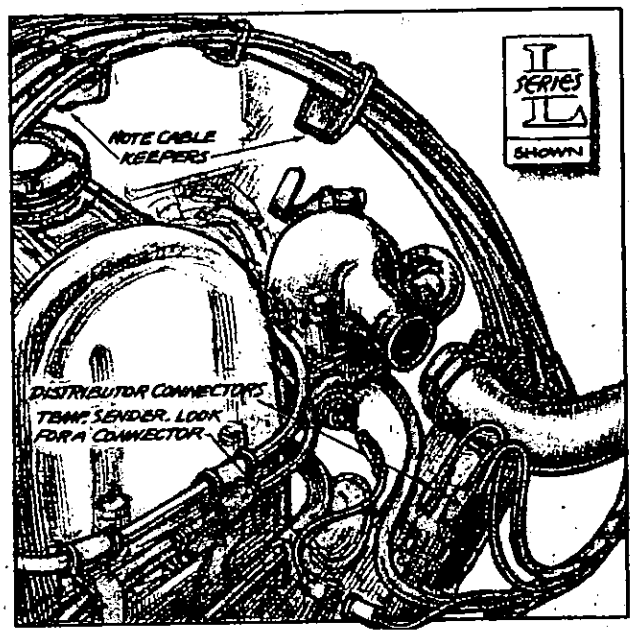
•**Z-series Electric Fuel Pump People:** Disconnect the hoses from the two pipes under the center of the intake manifold. Label the hoses 1 and 2 to match their pipe.

NOTE: If your air conditioner covers the fuel pump, leave the fuel pump in place after disconnecting the inlet and return hoses. **Old L-16 People with Two Hoses to Carb:** Disconnect the hoses at the carburetor and lay them back against the side of the engine compartment.

Step 6: Air Conditioner Idler and Power Steering Pump.

•Air Conditioner and Power Steering Pump People Only: Air conditioners in automobiles are hard to work around. Most factory installed air conditioner and power steering units are fairly sensible in mounting design, but after-market installations can be a nightmare. The idler pulley that regulates the tension for the drivebelt is often mounted to the front of the head and must be loosened for the belt to come off. The idler mounting may also attach to the timing cover, so you may have to remove the whole idler assembly, or at least the bolts that attach it to the timing cover or head.

The same problem applies to the compressor mounting. It's heavy duty and most often attached to the block and idler bracket or to the head.



•Power Steering Pump People: (See Ch. 12, Proc. 13 to remove the pump and idler).

Step 7: The Upper Radiator Hose.

To remove the hose from the thermostat housing, loosen the clamp, then twist and pull the hose off of the snout.

Check all hoses for leaks, cracks or general deterioration (Ch. 8, Proc. 3 and 4).

Step 8: Disconnect Temperature Sensor Wiring and Vacuum Solenoid Hoses, Wiring and Bracket (L and Z-series), and Temperature Sensor(s) and Manifold And Ground Wire (Z-series).

•L-series: The sensor is mounted in the bottom of the thermostat housing with a single wire (yellow) connected to it. There may be a pull-apart connector in the wire, a few inches from the sensor. Unplug the wire there or at the sensor.

Depending on the year and model there are other switch and solenoid wires to disconnect. Look on the front of the head and side of the thermostat housing.

•1973-75 Models: There might be a solenoid or a switch with wires connecting it to a wiring harness. Follow these wires to the nearest plug(s) and disconnect. There should be a solenoid next to the EGR valve with one wire to disconnect. 1973 1800s have a solenoid mounted on the side of the intake manifold to unplug.

•1975 on Models: Models with vacuum switching valves may have a solenoid mounted next to the EGR valve or on the intake manifold. Disconnect the one or two wires. On later models the wiring can be disconnected at one multiple prong connector. Label any wiring that you disconnect.

NOTE: **People with Front-Mounted Solenoids:** The solenoid bracket may be mounted to the top of the timing cover as well as to the head. Remove the necessary timing cover bolt to allow the bracket to come off with or separately from the head.

•Z-series: Find the thermostat housing. Look below it to find one or two wires connected to senders that are threaded into the housing. Carefully pull on the connector(s) to unplug it (them). Label the loose wire(s) "thermo housing."

You may have these other connector(s) to unplug. Look below the carburetor base on the right side of the intake manifold. If a 2-wire connector plugs in here, carefully pull it off. There may also be a ground wire(s) bolted to the side of the manifold. Unscrew the 10mm bolts, remove the wire(s), and replace the bolt in the manifold. Label these "carb base."

You may also have a connector below the center of the intake manifold at the water fitting. Follow these wires back to a pull-apart connector and separate them there. Label these "manifold sensor."

Move all these wires toward the fender wall, out of harm's reach.

Step 9: More Vacuum and Air Hoses.

Trace and label hose disconnections, using the illustrations in Ch. 6, Pt. 2, Proc. 1.

•**L-series:** Start from the left front corner of the head. L-16 and L-18 people have fewer hoses to consider.

1) **Distributor vacuum advance (early models L-16)** has a hose or a pipe connected by a nut. Remove it at the distributor. **1974 and later cars** with solenoid on the head, disconnect the vacuum hose at the distributor unless the solenoid is already off the head.

2) **1975 and later L-20B models** have a **carbon canister hose** connected to the same vacuum pipe as the one to which the distributor or solenoid hose connects. If not there, look on the left side of the carb for a hose to the canister. Disconnect at the pipe or carb and wrap the hose up next to the canister. Label the hose and where it came from.

3) Find any other hoses connecting the engine compartment wall to the manifold or head. For instance:

• A vacuum hose connected to a small T-junction leading to a solenoid mounted on the engine.

• A vacuum hose from the intake manifold up to the bottom of the carburetor. These connect to valves, solenoids and/or switches. Label them as they are removed from the engine end, not the engine compartment (fender wall) connection.

• On models with a **remote BCDD valve**, you'll find a hose plugged into the left side of the carburetor; unplug it and store it with the valve on the fender wall. If you have a **remote altitude compensator**, remove the two hoses from the front left corner of the carburetor and store them with the compensator on the fender wall.

• Pull the fat **PCV hose** off the PCV valve at the rear side of the carburetor base.

• If you have a **belt-driven smog pump**, a fat black hose has to come off the check valve on the air injection pipe that runs along the head.

•**Z-series:** Your vacuum hose layout varies. Federal, California, and Canadian models all used the same emissions control systems and valves, but the components evolved at different times. On cars (510 model) the components are mounted in front of the strut on the fender wall. (California 510 has a body mounted valve.) On trucks they're mounted farther back. Most changes occur in trucks in 1983½ and in 1985. Follow the instructions carefully, don't disconnect anything you don't have to, and label and record the position of everything you disconnect.

The point is to separate the hoses that connect to fittings on the engine (intake manifold and carburetor) from connectors or valves on the fender wall.

Step 10: Carburetor Connections.

Disconnect the **carburetor linkage** or throttle cable and wires, but not the whole carburetor. (Ch. 6, Proc. 5 [3-5]).

Step 11: Disconnect Brake Master Vac Hose, PCV Bracket, and Anti-Stall (FICD) Diaphragm Hoses.

NOTE: Early 510s (1968-74) and 521s and 620s 1969-72 go on to #5 (PCV hose) below.

•**L and Z-series:** Remove the black (larger) vacuum hose from the fitting at the rear intake manifold web by loosening the Phillips head hose clamp. Leave the other end of the hose connected to the bulbous Master Vac unit behind the brake master cylinder.

Z-series: Start on the right side of the engine. You may have any number of the following:

1) Altitude Compensator—(California and high altitude models) you have a rectangular box on the right (passenger side) fender wall with three or four hoses attached to it. Pry and pull the two or three hoses off the box with a screwdriver blade and your fingers. But first notice the colored lettering and check to see if it matches the colored dots on the box (front to back): blue, red, yellow. The big bottom hose is plain. If they are unmarked, use masking tape and a pen to label the hoses by number, front to rear. Remove the plain bottom hose,

which is slightly bigger. NOTE: Some vehicles may have had a high altitude kit put on, therefore, the layout may be a bit different. Label everything. You will have a vertical cylinder with two hoses connected to it. Label these "upper" and "lower" and tape them together.

2) Boost Control Unit (BCU) and Vacuum Switch (some 83½ and all 1985-on trucks don't have a BCU)—these are mounted in front of (720 People) or behind (510 People) the altitude compensator (if installed). The BCU is a bullet-shaped cylinder with two hoses on it. Disconnect the hose on the side by bending back the metal clips and then prying and pulling the hose with a screwdriver and your hand. Follow the other hose to a Y- or T-connector where the vacuum switch and BCU may go into one hose. Tape and label the first hose—BCU side and the other—BCU/Vac Switch and pull it off the Y. You may have another vac switch, so read #3 below.

Gather, label, and tape these hoses and the altitude compensator hoses (if removed) together and curl them around the front and side of the carburetor for storage.

3) Vacuum Switches and Vacuum Control Valve (some 1983½ and all 1985 on trucks)—You may have one, two, or all of these switches. All of them will be mounted on the right (passenger side) fender wall. A *vac switch* has one hose connected to it, and the *vac control* valve has two.

The control valve has two plastic pipes, one next to the other, sticking out of it.

In many cases you can do two valves with one tug by unplugging a hose at a T- or Y-connector. Remember, the point is to separate the hoses connected to the valve mounted on the fender wall from the engine (intake manifold and carburetor). Find the easiest way to do this.

Tape and label the hose and pipe from which it came, so you can easily match them later. This is particularly important for models with two switching valves. Some models have only one valve.

Bundle and tape the hoses (or hose) together and bend them (or it) around the front and side of the carburetor, out of the way. Label the bunch "control/switching valve hoses."

4) Carbon Canister and Distributor Hoses—The canister is a black plastic cylinder, mounted in the front left (driver's side) corner of the engine compartment. Follow the hoses from it down behind the distributor to pipes and across the front of the engine. NOTE: On some 1986-on models, one of these hoses may run across the front of the engine and through the engine slinger. Carefully pry this hose off its pipe at the canister and curl and store it near the carburetor.

Most or all of the canister pipes turn into hoses again on the right side of the engine, below the fuel pump. Disconnect them here. But first tape and label the hoses (and pipes) to match the pipes #1, #2 and (if necessary) #3. Squeeze off their clamps with pliers then pull and twist to remove. You should be getting better at this by now. If any of the hoses is strapped to a radiator hose or air inlet or the like, disconnect them. Tape the lot together labeled "canister/distributor hoses."

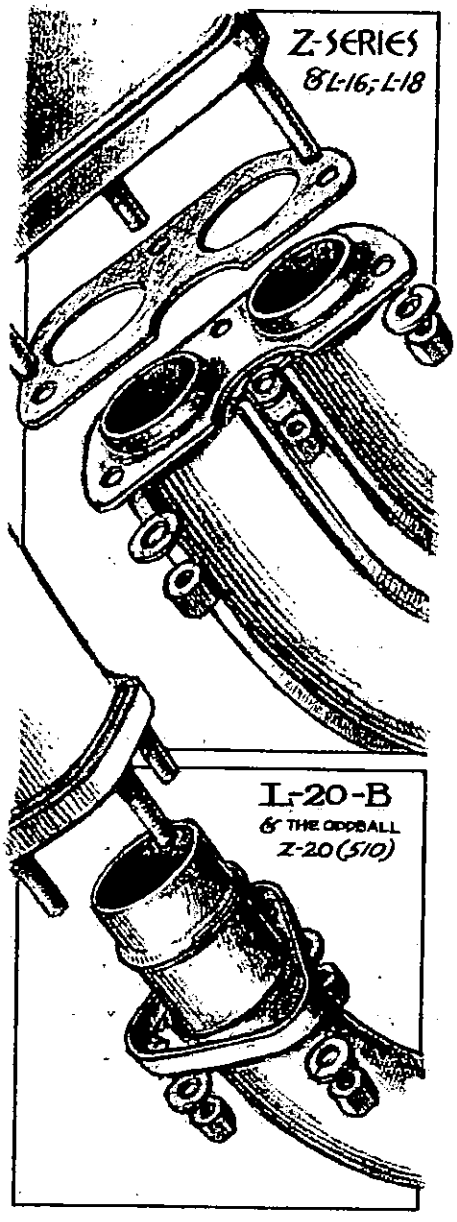
5) PCV Hose—Find the PCV hose (it's fat and black) connected to a fitting—the PCV valve—which is below the carburetor between it and the engine. Follow this hose down and back. It connects to a pipe that connects to another hose farther along. Follow the latter hose back and spread the clamp that holds it to a pipe which goes around the back of the engine. Push the clamp forward off its pipe.

6) AIS tubes (pre-1983½ California and pre-1985 Federal vehicles)—You have one or two pipes that connect the exhaust manifold to the now removed air cleaner. The pipe(s) is held in the exhaust manifold by a nut(s) that is easier to loosen while the head is still bolted to the engine. The nut(s) is 24mm and probably rusted in place. Soak the threads with penetrating oil and wait. Fit your 24mm open-end or 10 or 12in adjustable wrench on the nut and wear safety glasses and whack on the end of the wrench with a hammer if the nut(s) is stuck. Pull up, turning the nut counterclockwise. You need only loosen this (these) nut(s).

7) EGR Pipe—The EGR pipe runs around the back of the head from the rear of the exhaust manifold to behind the EGR valve behind the intake manifold. Before removing the head it's a good idea to soak the nut on the exhaust end of the pipe with penetrating oil and loosen it if you have a wrench that can reach the nut. The nut is 24mm and threads into the manifold like the EAI pipe(s) did. If you can reach and loosen it, do so. Otherwise soak it with penetrating oil and get at it when the head is off.

8) 510 cars with Z-20S California engine—look near the back right corner of the engine. Bolted to the body on the firewall find a valve with three vacuum hoses coming out of it. One at a time, pry these hoses off their

pipes with a screwdriver and label them respectively: top, side, and bottom. Tape them together and label the lot "VVT valve."



•1975 and later L-20B People: Remove and stash the 10mm bolt (label at PCV bracket) holding the PCV hose and pipe bracket to the back of the exhaust manifold, behind and below the engine slinger.

•Z-series: Find a pipe sticking up out of the rear tube of the intake manifold. Unclamp, twist, and remove the black vacuum hose connected to it.

Unbolt the PCV bracket (12mm) from the left rear side of the head. A ground wire to the firewall may connect here. Tape the bolt to the wire or bag and label it "PCV bracket (ground wire)."

•Everyone: If you have an air conditioner, pull the hose from the top or side of the FICD unit (the metal and plastic cylinder with a plunger at the back of the carburetor) and place it out of the way. **L-series:** Do the same to the hose connected to the fitting where you removed the Master Vac hose.

•Automatic Transmission People: Carefully pull off the vacuum hose connected to the the pipe on the rear of the intake manifold. This hose and pipe run back and down to the transmission. Label this hose "transmission."

Step 12: Disconnect Exhaust Manifold to Pipe Flange & Exhaust Hanger.

•L-20B and Z-series People Only (L-16 and 18 go on to next step): Jack up the driver's (left) side of the vehicle (Ch. 13, Pt. 1, Proc. 1). Raise only the front left wheel a little off of the ground then support that side well. Take a drop light underneath with you.

Lie under the engine compartment looking up at the bottom of the exhaust manifold. Find the flange where the manifold and exhaust pipe meet. Three nuts on studs hold them together tight enough to prevent leakage. Newer nuts are made of brass or stainless steel that inhibit rust. Squirt some penetrating oil on the nuts and threads. Use a 14mm (L-series) or 17mm (Z-series) socket on as many extensions as you have and maybe a universal swivel joint to reach the nuts and remove them all. If any nuts are hard to turn off, use more penetrating oil and wait. (If a stud breaks off in the manifold, keep going; it's a drag to fix, but easier with the head off.) Bag and label the nuts "exhaust manifold/flange."

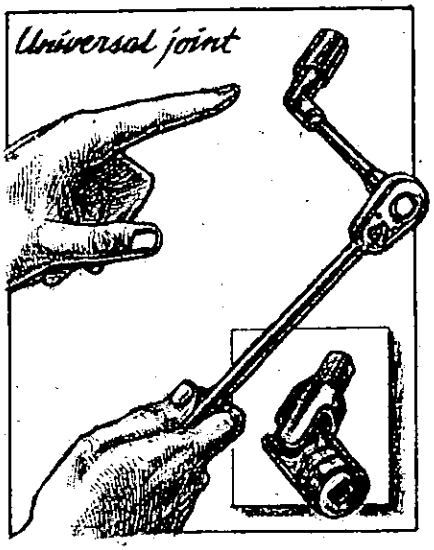
Now pull down on the exhaust pipe. Make sure the flange clamp isn't bound. If the pipe won't drop away from the manifold, follow it back to one or two bracket hanger(s) that connect(s) to the frame or crossmember. Use the necessary wrenches and sockets (12mm or 14mm) and penetrating oil to release the pipe.

Step 13: Remove Intake and Exhaust Manifolds from Head.

•**L-16 and L-18 People Only:** Follow the instructions for L-20B manifold removal with the head off (Proc. 4 [4]). Allow for your handicap of having the head still on the engine in the vehicle.

Squirt a lot of penetrating oil on the exhaust studs. All of the manifold nuts and/or bolts are usually 12mm (maybe 13mm). Use a socket and extension(s) with a universal swivel joint on the hard-to-reach fasteners. Keep track of all of the nuts, bolts and washers, where they came from and the order in which they were removed.

When all fasteners and washers are off, carefully pull the manifolds away from the head. The intake and exhaust manifolds will separate. Carefully remove the intake manifold and set it aside.



Step 14: Remove the Cam/Valve Cover and Spark Plugs

See Ch. 3, Proc. 3 [1-3] and Proc. 4 [4].

Keep the spark plug wires well out of the way. Leave the distributor cap on and flop the wires over to the left engine compartment wall.

•**Z-series:** Find the two half-moon rubber plugs, one at each end of the head, and remove them to be bagged and labeled "end plugs."

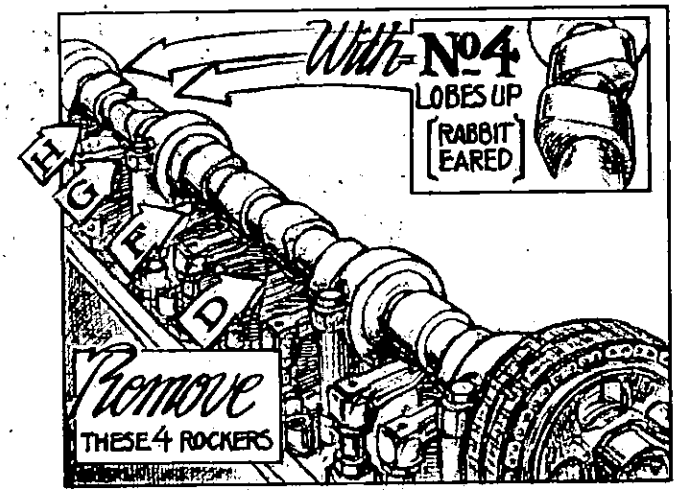
PROCEDURE 2: REMOVE THE CYLINDER HEAD

Condition: You have completed Proc. 1 above.

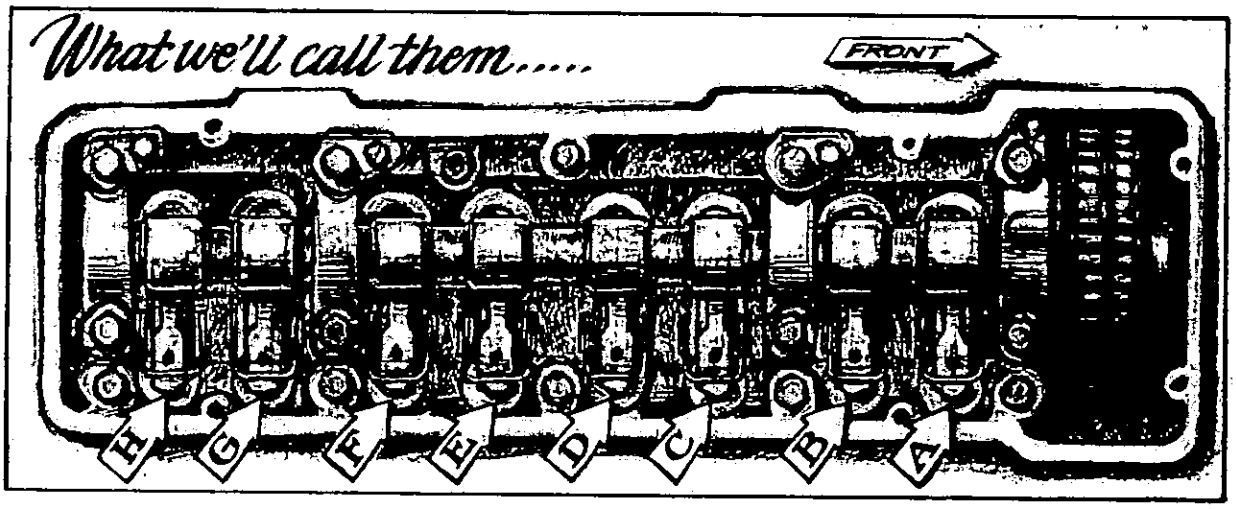
Tools and Materials: Basic tool kit, pipe cleaners, an assistant, egg carton and head bolt tool—L-series only: this is a 10mm hexagonal (Allen) wrench that's socket driven. You can buy this tool (3/8 or ½in drive) or you can make one by cutting a 10mm hex wrench with a hacksaw and fitting it into a 10mm socket. (A 6 pt. socket works better than a 12 pt.) You'll also need a timing chain blocking tool. (See Step 5 for information about how to make one.)

Step 1: Turn Engine to #4 Cylinder Top Dead Center Compression Stroke.

•**L-Series Only:** Top Dead Center of compression stroke is where the piston is at the top of the cylinder and both valves are closed. When the valve cover is off, you can see the positions of the cam lobes. You first want to crank the engine so the #4 lobes are positioned pointing up like rabbit ears. You can crank the engine (by key, remote starter, or by hand) until this position is reached.



(See Ch. 3, Proc. 4 for more on engine rotation, and Ch. 13, Pt. 1 for locating Top Dead Center.)



Step 2: Remove Rocker Hold-Down Springs, Rockers and Rocker Guides, and Loosen the Tappet Adjusters.

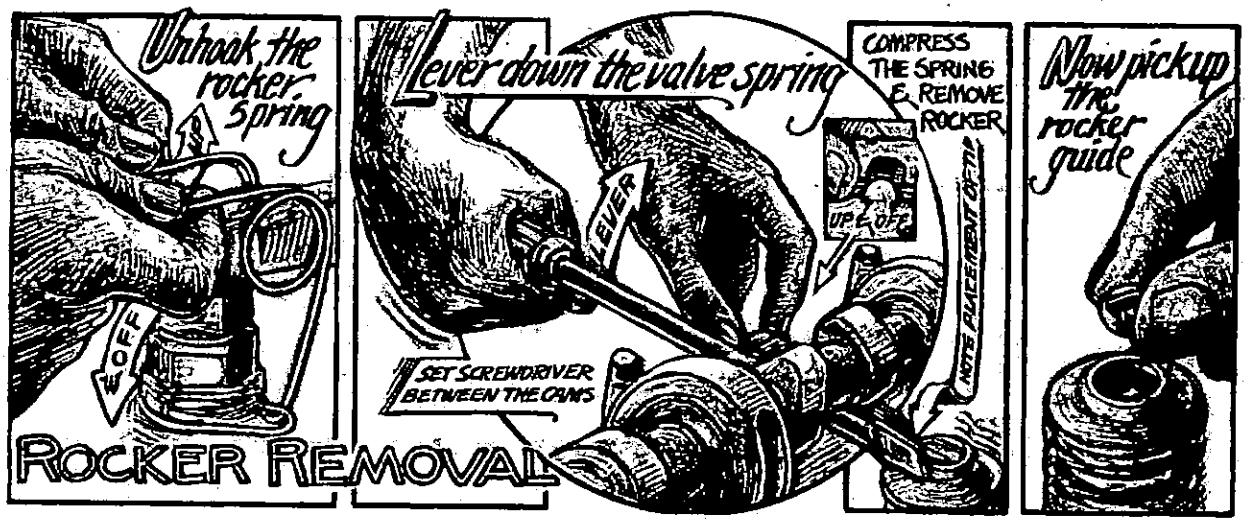
•**L-series:** Find the eight curly-cued springs on the pivot ends of the rockers. The end of each spring fits into a retainer at the bottom of each pivot. With your finger or a screwdriver, push the hooked ends of each spring out of the retainers, then lift the spring off of the rocker. The eight springs don't need to be kept in order, but should not be bent or damaged.

Start at the front cam lobe and call it **A**. The next one back is **B**, and so on. The last two lobes (#4 cylinder) are **G** and **H**. The next one forward is **F**. See Ch. 3, Proc. 4 for an illustration of the rocker layout.

Notice that **D** lobe is up like a one-eared rabbit, as is **F** lobe. That means **D, F, G,** and **H** valves are closed, so there's no pressure on these rockers.

Your job is to remove the rockers under these four cam lobes, using a long, thick-shanked screwdriver or bar. Place the tool under the cam from the right side of the engine with the screwdriver tip securely on top of the spring retainer and the shank against the camshaft (not the lobe) so the screwdriver is at an angle to the rocker. Gently pry up on the screwdriver handle, compressing the valve spring enough to lift the rocker off of the pivot and slide it out from under the cam. Store the rockers in an egg carton, labeled "D, F, G, H, etc".

Start at the rear of the cam and keep the rockers in order. When all four are off the head, remove the little



rocker guides set into the retainer on top of the valve. Store the guides with their rockers to keep them matched and in order.

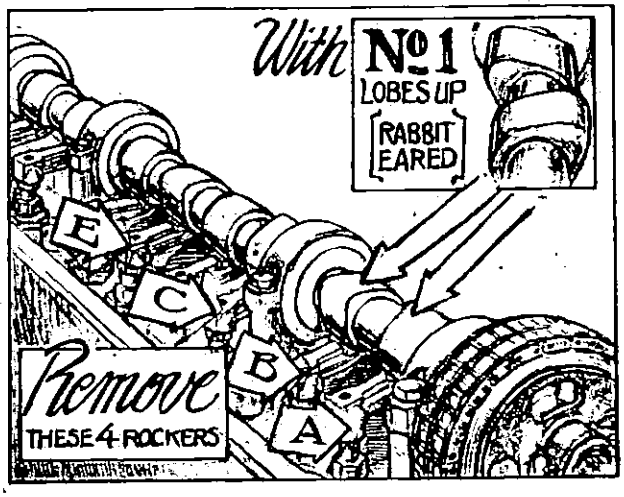
Z-series: The tappets thread into the rockers (not rods) above each of the eight valves. Loosen the lock nuts and thread the tappets up until they reach the rocker and don't touch the top of the valve (Ch. 3, Proc. 4 [7]). Keep the nuts on the tappets.

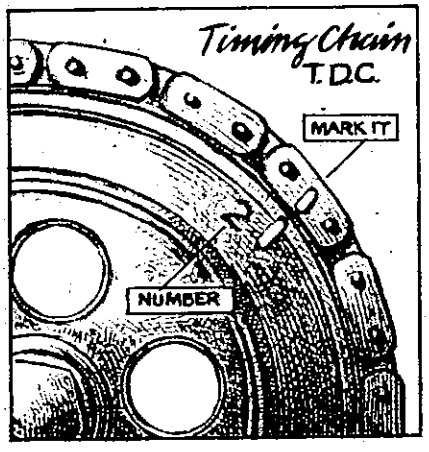
Step 3: Rotate Camshaft to #1 Cylinder Top Dead Center Compression Stroke.

•**L-Series**: When all rockers and guides are removed, turn the crankshaft clockwise with a 27mm or 1-1/16in wrench or socket until the **A** and **B** cam lobes are pointing toes-up, rabbit-eared. In this position **C** and **E** lobes are also toes-up. The timing pointer down next to the front crankshaft pulley or on the pulley should be on the 0 (zero) degrees mark (Ch. 3, Proc. 6).

Now you can remove the remaining rockers following the instructions in Step 2. Be sure to keep them in order alongside the others.

•**Z-Series**: You want to crank the engine so #1 cylinder is at TDC compression stroke. (See Ch. 3, Proc. 4 to crank the engine and Ch. 13, Pt. 1, Proc. 3 to get Top Dead Center.)





Step 4: Mark the Timing Chain to Cam Gear, Engine at Top Dead Center #1 Cylinder.

Ch. 9, Pt. 2, Proc. 1 contains an illustrated description of the timing chain and its peculiarities. You have to mark the chain in relation to the cam gear to keep the cam-to-crank timing correct. There are numbers on the cam gear (#1, #2 or #3). One of them should be on the left (driver's side) edge near the sprocket teeth. The number should correspond to one of the flat sides of a chain link. Make a mark on the link that won't wipe off and matches the sprocket number; mark or write down the number at which the gear is positioned.

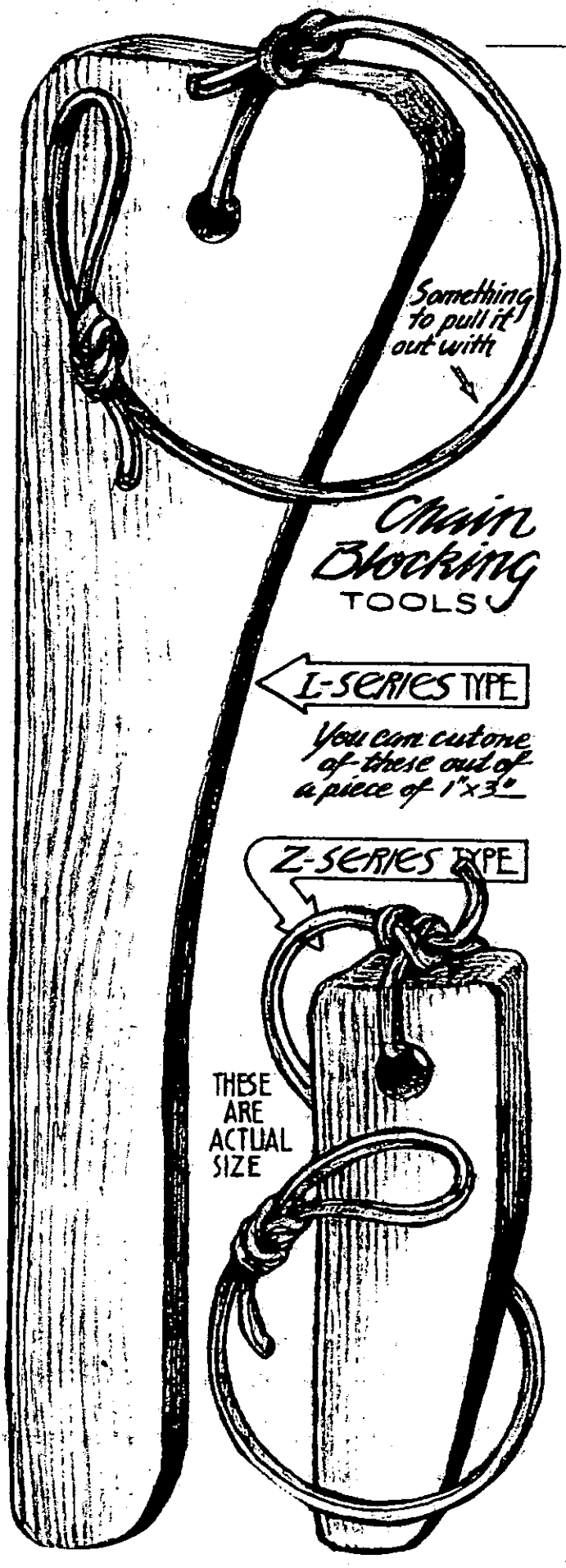
NOTE: The gear tooth and number may align between two flat chain links rather than in one. This means the chain was installed wrong (even though the timing may be correct). If the engine runs well enough, make your mark wherever the chain and gear numbers correspond. If the engine is out of cam timing, it will run poorly and have to be reset anyway.

Step 5: Insert Timing Chain Blocking Tool.

This special tool keeps the chain's tensioner from popping out of its housing when the chain is slackened. It *must* be in place unless you know you are going to replace the timing chain and/or completely disassemble the engine, in which case you can let the chain drop.

Insert the skinny end of the chain blocking tool between the links of the timing chain through the front of the head. Make sure the blocking tool is pushed down as far as possible. The curved side of the tool fits against the right (passenger) side, keeping the chain tight against the tensioner and guides. Push it down with a long screwdriver. Keep the cord (if attached) dropped down over the top edge of the cover.

The 0° mark or pointer must be aligned exactly with the mark on the front pulley.



Step 6: Loosen and Remove Cam Gear Bolt, Fuel Pump Eccentric and Cam Gear.

NOTE: To remove the cam gear and check the chain for wear, see Ch. 9, Pt. 2, Proc. 1 (2-4).

The bolt head is 19mm and pretty tight. Use a breaker bar and socket or a rachet and a pipe to increase your leverage.

•**L-18 and L-20B People**: Look at the center of the camshaft between #2 and #3 cylinders. You have two lugs cast into the shaft to put an adjustable wrench around to hold the shaft from turning. If you do this alone, don't let the wrench rest on the head without putting a rag or wood block under it.

•**L-16 and Z-series**: Place a beefy screwdriver through one of the holes in the top or right side of the cam gear so the tip is braced on top of the right front cam tower bolt, not on the aluminum of the cam tower. **Z-series:** Place the screwdriver tip flat against the inside of the cam tower. **Careful**—don't let the screwdriver handle get jammed against the top of the radiator when loosening the bolt. (NOTE: If the fuel pump is still in place, take care not to damage its lever.) If necessary, place a block of wood between the screwdriver and the metal body apron in front of the radiator for support.

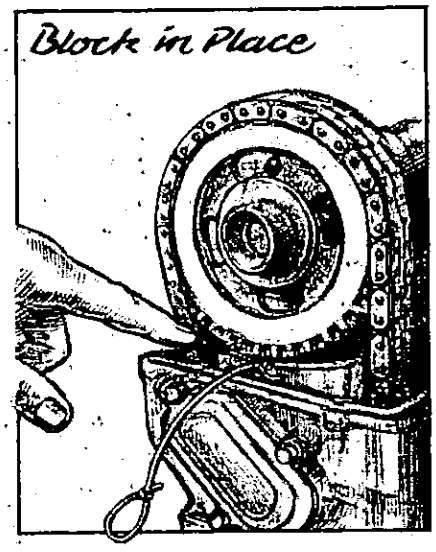
•**Everyone:** With screwdriver or wrench in place, position the socket on the cam gear bolt. Crank on the breaker bar and socket, turning counterclockwise. If the gear and chain turn slightly it's all right as long as the blocking tool is in place. Just loosen the bolt.

When the bolt is loose, remove the screwdriver and crank the engine back to align the timing mark to 0 (zero), TDC #1 if necessary. Carefully remove the bolt while keeping one hand under the front of the gear to catch the fuel pump eccentric, lockwasher, and bolt.

With a little pulling—use both hands—the cam gear will come off both the camshaft and the little dowel pin. Hold up the timing chain and work the gear away from the engine. Store the gear in a safe clean place along with the bolt, washer, and fuel pump drive.

From now on until reassembly, DO NOT ALTER THE CRANKSHAFT'S POSITION accidentally or by trying to crank the engine in your sleep. Keep the blocking tool where it is and slap

any hand that goes near it.



Step 7: Loosen and Remove Head Bolts and Head.

(Get a friend to help you lift off the head.)

Clear a place on the ground or nearby bench where you can put the head, right off of the engine.

The head is attached to the timing cover by (L-series) two 10mm-headed bolts, and (Z-series) four 10mm bolts at the bottom front edge of the head. Use an open-end wrench to remove the two or four bolts, then wrap them in masking tape and store them in a baggie labeled "head bolts."

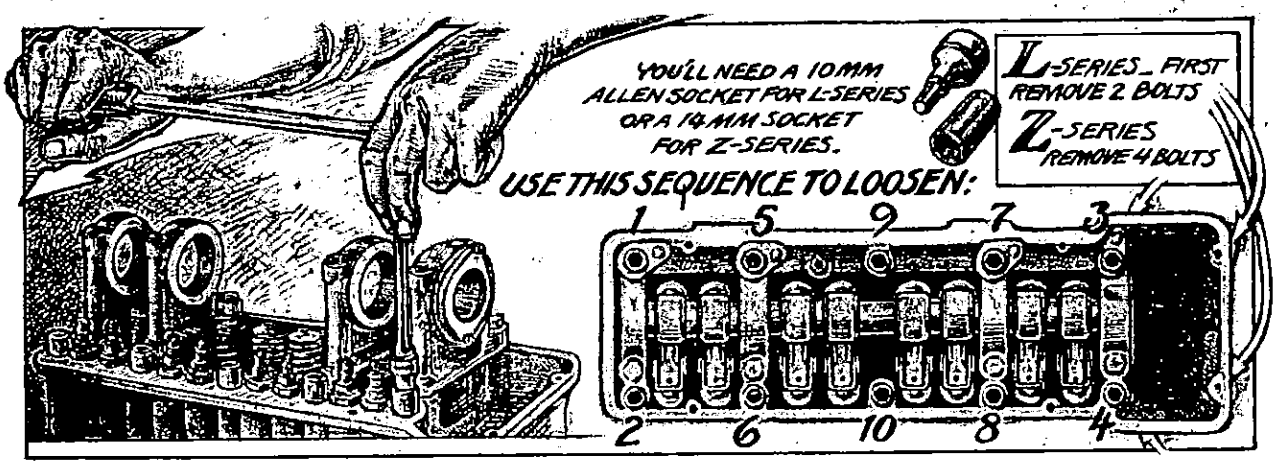
The head is held to the engine block by 10 long bolts. **L-series:** Use a small screwdriver to clean out the hexagonal holes in the bolt heads so the wrench will fit. You'll need a 10mm hexagonal (Allen) socket to remove them. **Z-series:** You'll need a 14mm socket to remove them. Attach a medium ratchet extension to the socket and a breaker bar. Make sure that the socket fits well on the bolt head before trying to loosen it. The head bolts turn out normally, counter-clockwise, but they are very tight.

There's a definite pattern to follow when loosening the 10 bolts. Follow the illustration for the proper loosening sequence.

Start with the left rear one until it is just cracked loose, then the bolt opposite it. Then go to the front of the head and loosen the front left bolt, then the one across from it, and so on, working toward the center until all of the bolts are loose. Use your strength as some of the bolts may seem quite stuck. When all 10 are loose, redo the sequence until you can begin removing them with your fingers.

Under each bolt is a flat washer. Pull the washers up with the bolts so they don't fall into the front of the engine, and keep them with the bolts in the bag labeled "head bolts."

When all 10 head bolts and the two or four little ones in the front are out, the head is free to separate from the block. If the head gasket is well-seated, the head should be stuck to the block. Do not pry between the head and the block with a screwdriver or similar blade. If necessary, get into the engine compartment and pull up on the center of the camshaft or on the manifolds. Keep the timing chain curled up on top of the blocking tool, undisturbed. If the manifolds are still attached to the head, it will be heavy and may take two of you to get it off the engine and onto the bench. Have your helper pull up on the manifolds. Lift the head straight up. Make sure you can handle it. When it comes off, be careful not to drop it. If stuck, go around it, moving hoses and whatever else may be restricting it. The head may get stuck to the block or surrounding junk, causing more hassle, but be persistent and careful.



Caution: The camshaft is loose in its towers. Don't let it slide out and crash to the floor. And don't let *anything* fall into the front of the engine.

Set the head aside carefully.

There are two 3/8in steel (sleeve) dowels, on the left (driver's) side, at each end of the head or block. They'll usually stay with the block, but may come off with the head. Before taking another breath, locate the two sleeve dowels, and with a pair of pliers (or Vise Grips, if they're really stuck) remove them and put them into a baggie labeled "parts." If either sleeve was really damaged, you'll need to replace it.

Find the oil passage hole on the right (oil filter) side of the block. The hole is midway, very close to the edge, between #2 and #3 cylinders. Put ½in of a new pipe cleaner into the hole to keep junk out of the oil passage. Don't use anything that will break off in the hole or get stuck. (See the illustration in Proc. 6 [1].)

PROCEDURE 3: CHECK OUT THE CYLINDER HEAD AND GASKET (HEAD REMOVED)

NOTE: The head is fragile! You can't be too careful. Handle it like an infant. Store and work on it on a wide, sturdy bench or close to the ground. Trust me, I have dropped and broken cylinder heads (probably because my older brother once dropped me on my baby head).

Condition: The cylinder head is off the engine; the head gasket is still stuck to the head or the block.

Step 1: Now That the Head is Off.

The tops of the pistons and the bottoms of the valves are visible. An educated eye can learn a lot from this view. (Block and piston information can be found in Ch. 10, Proc. 2.) If you've had problems with water in the oil or oil in the water, or have an engine that burns oil, scrutinize the condition of the pistons and cylinders and consider your alternatives.

Step 2: Take a Look.

The head gasket seals the passageways between the two halves of the engine. If the edges of the holes in the head gasket have deteriorated, or you see evidence of leakage between two holes next to each other, you can be pretty sure the head is warped, the head gasket is shot, or there is corrosion in the head's water passages.

Step 3: The Head Examination (phrenology).

You can tell whether the head is seriously warped with a straight, rigid metal ruler, level or rod at least 2ft long. Carefully scrape and clean off the bottom of the head so a straightedge can be laid flat against it (Proc. 6 [1]).

Place your straightedge lengthwise along the bottom center of the head. When these heads overheat, they usually bend in the center. If yours is warped, you'll see a gap between the #2 and #4 cylinders and the straightedge. Measure it with a feeler gauge. If you can fit a 0.004in feeler blade in the gap, the head should be resurfaced. If it looks level, you're in luck. If you have *any* warpage, you should have the head checked by a reputable machinist.

You'll also want to have the head resurfaced if the water ports (holes) are really corroded. This and other head and camshaft checks——valve seat pounding, valve wear, cam wear, and other less common damage—should be checked by the machinist. The head may not be reusable if it has been resurfaced once or twice before

and is now warped. If the head isn't warped and the engine wasn't burning oil, you can clean and replace it. But I suggest you take it to a machinist or mechanic to have it looked over anyway, to make sure.

PROCEDURE 4: DISASSEMBLE THE CYLINDER HEAD

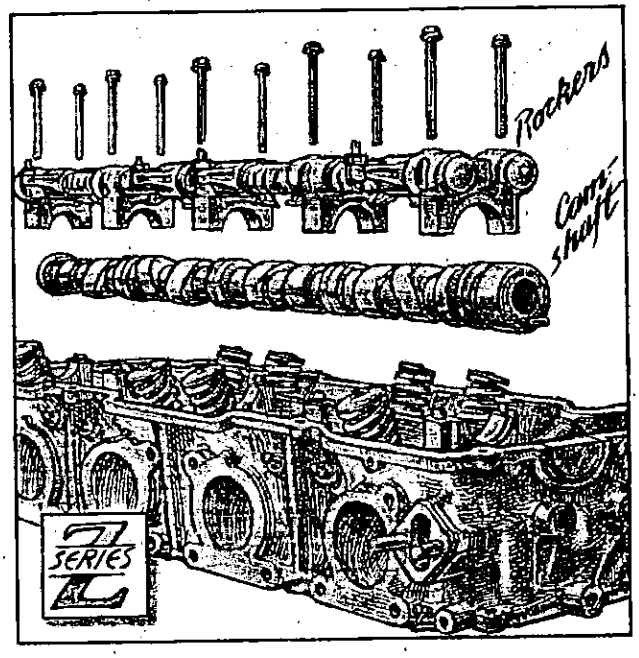
NOTE: If you're simply replacing the head gasket, go to Proc. 6.

Condition: The head is off the engine block, and you want to strip it for a trip to the machine shop or to swap parts with another head. If it is just going to be resurfaced, remove only the manifolds, unless it's really warped. Read "What the machinist should do" at the end of this procedure.

Tools and Materials: Four sandwich-sized bags or coffee cans, marker, basic tool kit.

Remarks: There are differences between earlier- and later-model L-series heads. Z-series heads are different from L-series altogether. The manifolds are off the L-16 and L-18 heads, while they're still on the L-20B and Z-series heads. The later the L-series model, the more junk you'll have to strip off. Early-model L-series people: Just pass over the details that don't apply to you.

•**L-series:** Remember—"RIGHT" is the spark plug side of the head and "LEFT" is the carburetor/manifold side. **Z-series:** "RIGHT" is the intake manifold side and "LEFT" is the exhaust manifold side.



Step 1: Remove the Camshaft.

•**L-series:** Steady the head and gently work the camshaft rearward, out through the rear cam tower. Guide the shaft straight through the towers to avoid jamming it or scratching the soft aluminum towers.

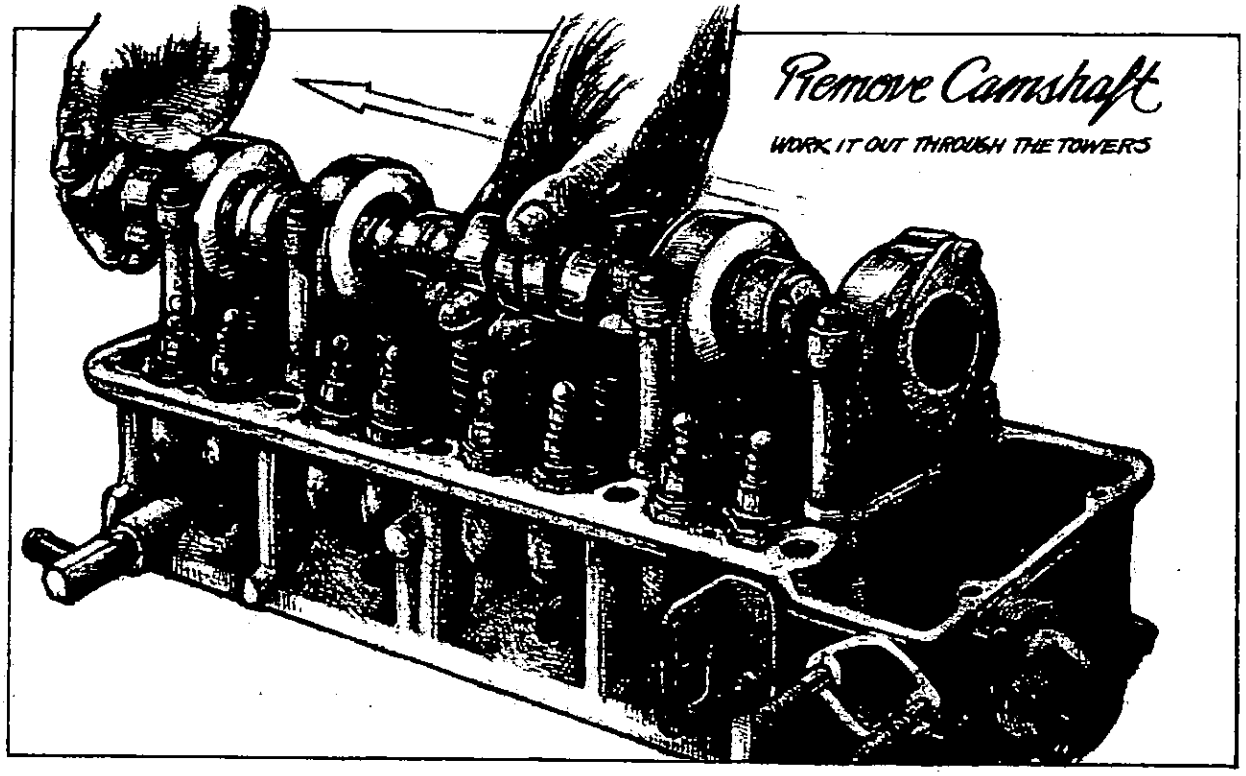
•**Z-series:** You have to remove the ten bolts that secure the valve rocker shaft assembly. Start at the two center bolts, loosening them with a 12mm socket. Loosen the bolts front to rear until all ten are free from the head. NOTE: Do not pull the front and rear two bolts out of the rocker supports; they hold the assemblies together.

When all bolts are loose, gently tap on the supports while pulling up on the rocker shafts until you can lift the whole assembly away from the cam and head. Set it safely aside, covered with a rag. Remove and store the six center bolts in a baggie labeled "rocker assembly."

The cam is now left cradled in the head, carefully pick it up.

NOTE: There are locating dowels fitted into the bolt holes which will either remain in the head or come off with the rocker supports. If any are stuck in the supports, you should remove them using a pliers or Vise-Grips as described in Step 6. Fit and tap the ones you remove back into the head after smoothing off any burrs or rough spots made by the pliers' jaws. Usually these dowels stay with the head. Make sure they are all securely in their holes and won't fall out at the machine shop.

•**Everyone:** Stash the camshaft somewhere so it won't roll onto the ground and break or get rusty. You'll want to take it with you to the machine shop.



Step 2: Remove the Fuel Vacuum and Water Plumbing.

L-16 and L-18 and all Z-series engines will have major differences from **L-20B People.**

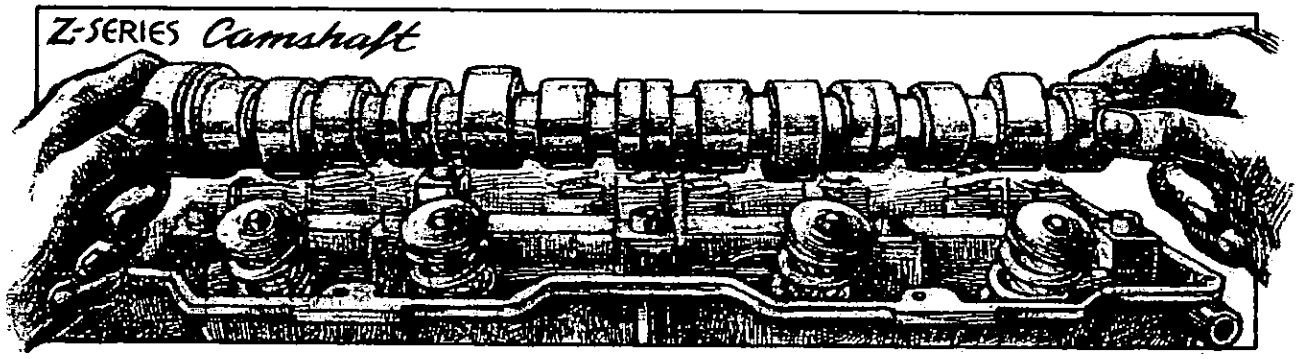
•**L-series:** Face the front of the head, and work from the left side. Start at the carburetor and follow the hoses and pipes.

NOTE: If you have an air conditioner, you may have a pulley mount bolted to the front of the head. Remove the mount and piping that usually share the front cover bolts as fasteners. (Make a sketch showing how the mount is placed before you remove it.)

The fuel and coolant pipes are secured by brackets bolted to the front of the head. Loosen and remove the 10mm nut(s) and bolt(s) holding the brackets in place. Set the fasteners aside. If you have a vacuum switching valve, it too will be mounted to the front inspection cover. Keep this valve with the nut and bolt.

Follow the pipes around to the thermostat housing, where there may be another bracket or two. If so, remove the 12mm bolt(s) from the housing top.

Now, work from the carburetor. Loosen the hose clamp holding the fuel hose to the carb inlet. On the inside base of the carburetor you should find one or two vacuum hoses connected to one or two pipes. Work them off. If there is a vacuum hose still connecting the junction to the vacuum switch on the manifold and the plumbing, disconnect it at the plumbing pipe.



Go back to the other side of the head and follow the big coolant pipe around to the right front corner or side of the head. Depending on the year, you'll have one or two hoses connected to either the thermostat housing or the front base of the carburetor—disconnect them (Ch. 8 has information on inspecting and replacing the hoses).

On all **1975 on models** there should be a fitting (valve) in the side of the thermostat housing with two vacuum hoses connected to it. Carefully work these hoses off the plastic pipes to which they're attached. Don't break these pipes or you'll need a new valve.

Once all hoses are loose and off the pipes, the whole plumbing assembly should lift off the head. Pull the fuel line off the inlet as you lift off the plumbing. Store all this out of the way. Replace all nuts and bolts you removed into their holes; keep the clamps on the hoses by tightening them in place.

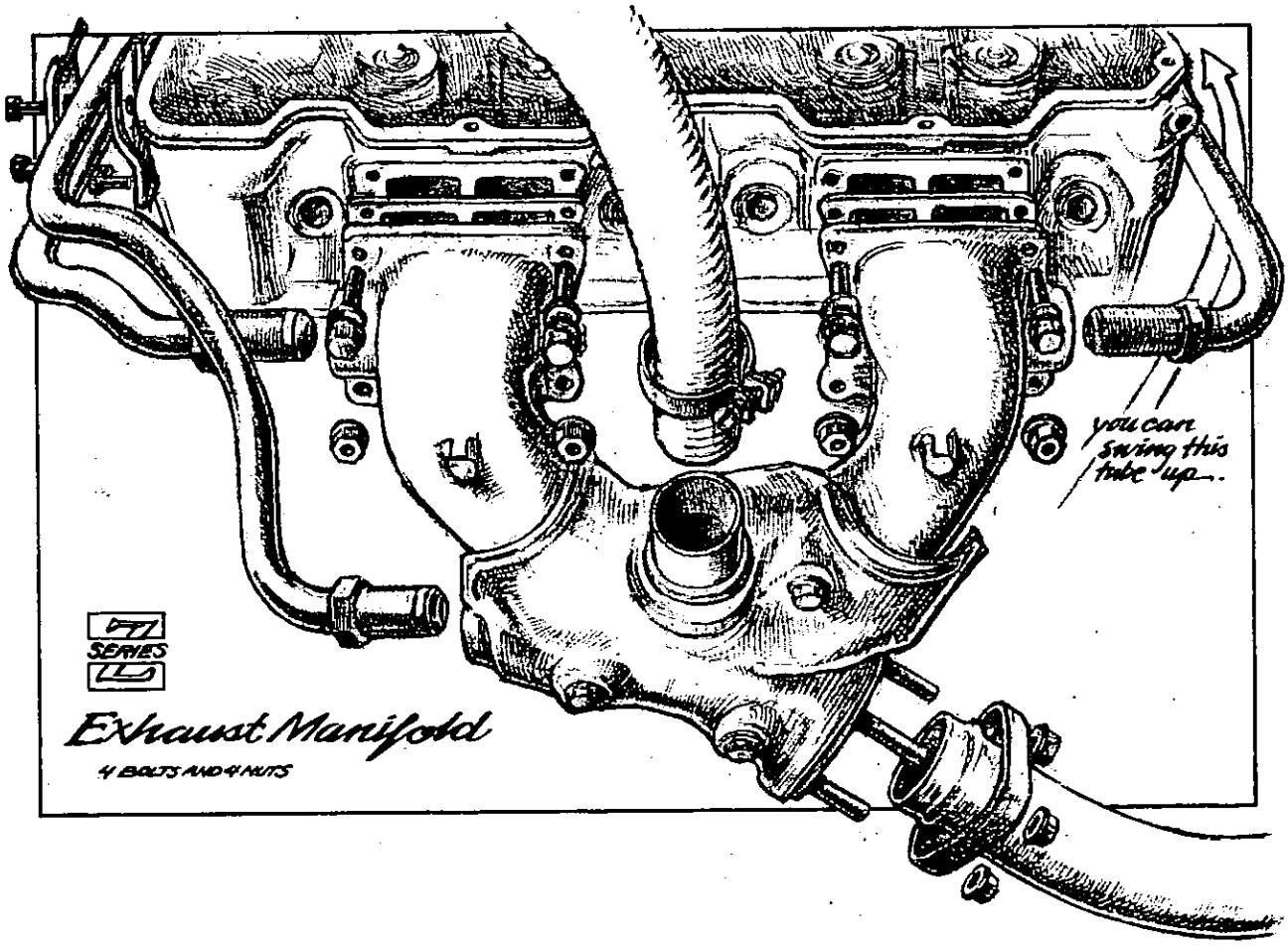
Examine all hoses (especially cooling) for cracks, hardness, or fraying, and replace if necessary. Some of the hoses are Datsun/Nissan dealer items because of their weird shapes and sizes. Get new hose clamps, too, in the right sizes.

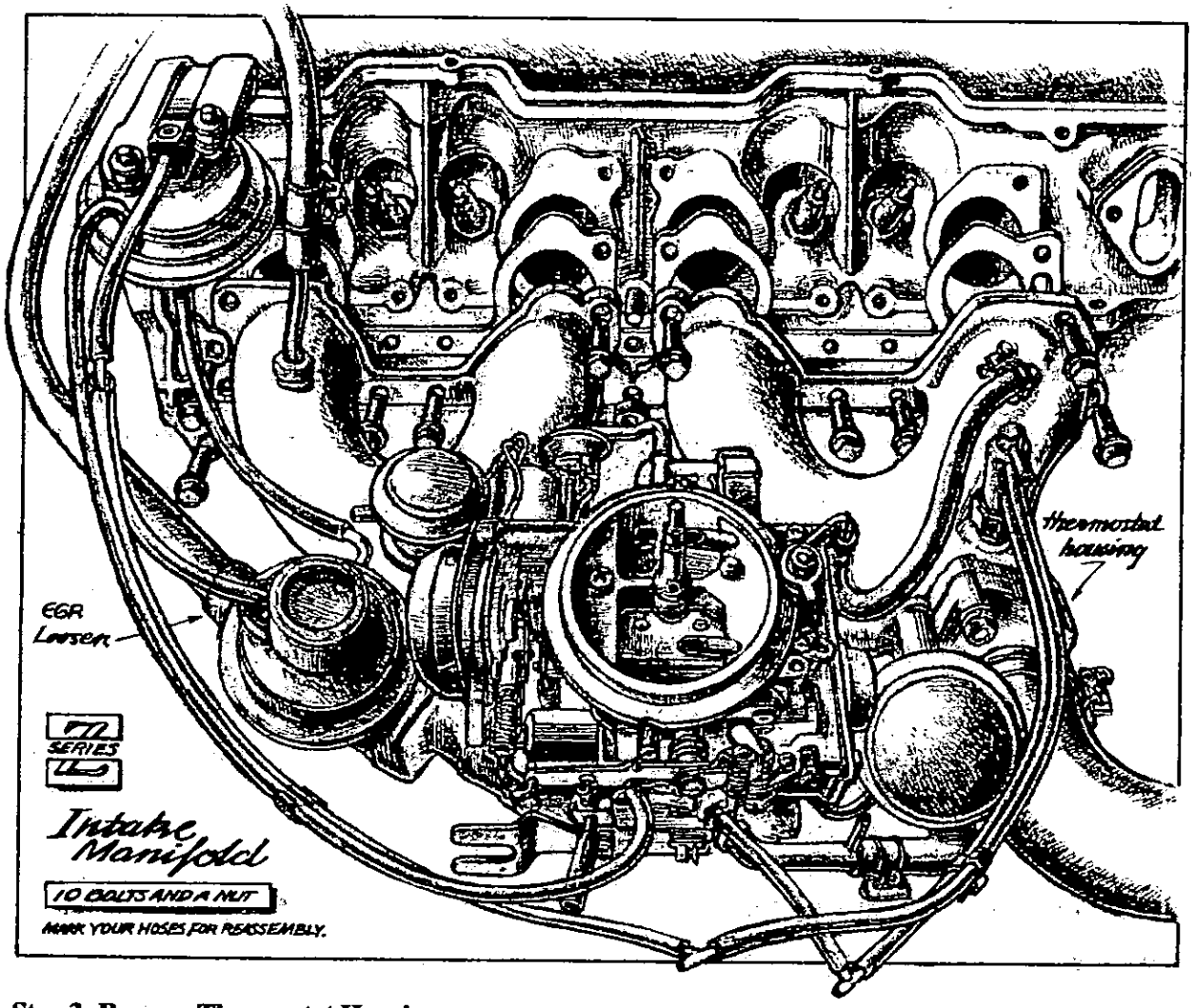
NOTE: If the fuel pump is still in place, remove it now (Ch. 6, Pt. 1, Proc. 10).

•**Z-series Power Steering Pump People:** If the power steering pump idler is still mounted on the head, remove it now. These awkward details are in Ch. 12, Proc. 13.

•**Pre-1983½ California and pre-1985 Federal vehicles with AIS pipe(s):** The EAI pipe(s) bracket has to be separated from the front of the head, so the pipe(s) and the exhaust manifold can be removed. The bolt holding the bracket to the head is 12mm. Remove it and if you have two EAI pipes, also remove the 10mm bolt that holds the bracket together. Keep the bracket pieces and 10mm bolt together, connected to one of the pipes. Replace the 12mm bolt so it's tight in the head.

If the 24mm nut(s) on the exhaust manifold is (are) loose, the pipe(s) will swing up and away from the head.





Step 3: Remove Thermostat Housing.

•**L-series People Only:** Two bolts running through the housing hold it against the head. The long front bolt is often corroded and should be removed carefully. The rear one is shorter. Keep these special bolts together in their own bag labeled "thermo housing." If the housing is stuck, give it a good tap with a hammer handle. Remove the housing and store it away. NOTE: If your coolant crossover pipe bracket connects to one of the top thermostat housing bolts, remove that bolt now, then replace it once the housing is off.

Step 4: Remove Intake and Exhaust Manifolds.

•**L-20B and Z-series People Only.**

•**L-series**: Find the 11 nuts and bolts that hold the manifolds to the head. Some of the bottom washers and bolts hold both manifolds, and you really have to work to get at them. Use penetrating oil on any rusted studs before trying to remove them.

Use a 12mm or 13mm socket, extension, swivel joint and ratchet to reach most of the nuts and bolts. A box/open-end wrench may work better on the top ones. Some of the hard-to-reach ones take some creative angling to remove. One bolt may not come all of the way out until the intake manifold is part-way off the head. Be careful not to tip the head off the bench while wrestling with the manifolds. Have a friend hold on to the head while you work.

Store the nuts and bolts in their own baggie labeled "intake manifold." If there are any brackets, like the engine slinger or the dashpot, fastened to the studs, note where they came from and store them with the bolts. The manifolds should now come off of the head with a little (or a lot of) coaxing. Tap on them with a fiber ham-

mer or wooden dowel and steel hammer if stuck.

If you disconnected a coolant hose from the base of the carburetor, the manifolds will not be connected by anything more than the EGR pipe. Otherwise the manifolds will be connected below the carburetor. Tap and pull them both off the head.

•Z-series: Find the EGR valve that's bolted to the back side of the intake manifold. A 29mm nut holds the EGR pipe to the valve. Use your 10 or 12in adjustable wrench or channel locks and patient strength (and penetrating oil) to loosen the nut counterclockwise so it's fully off its threads. If you haven't already loosened the nut on the exhaust side (24mm) do that now.

The intake manifold has ten bolts and one nut to remove. Use a box/open-end wrench, a socket and extension as well as a swivel joint to get at the fasteners and remove them counterclockwise. Put them in a container labeled "intake manifold." The VVT valve is mounted to the rear two manifold bolts by a bracket and will hang from the EGR valve and hoses once the bracket's loose. The manifold should now come away from the head with some coaxing; try using a hammer handle placed between the side and edge of the head and one of the manifold tubes. Remove and set the manifold aside to be cleaned.

The exhaust manifold is held on by four bolts on top and four nuts on the bottom. Use the socket and extension to remove them and lots of penetrating oil if they're stuck. Store these in a bag labeled "exhaust manifold." Lift the EGR pipe up so it clears the head, then pry the manifold away from the head as you did the intake. You may have to lift up the EGR pipe slightly so it clears the head.

The intake and exhaust gaskets may remain stuck to the head. If so, scrape and peel them off as much as possible.

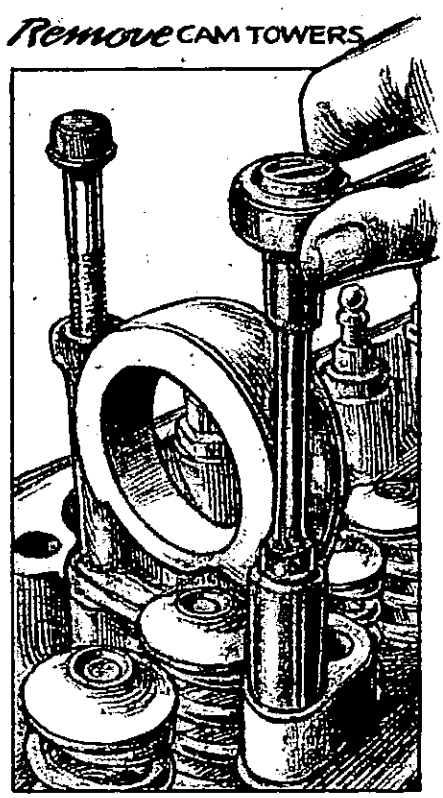
Step 5: Remove Water Outlet, Front Head Cover and Spark Plugs.

•L-series: The water outlet threads into the right rear of the head. Remove it by holding the head flat against the bench and turning the fitting out counterclockwise with a 19mm socket or wrench and good leverage. This fitting is tight. You'll probably need a friend to hold the head flat and maybe a cheater pipe over the wrench to loosen the fitting. (If you plan to have a valve job done, not a resurfacing, go on to Step 7.)

The front head cover has three points of attachment, all 10mm with washers (they may already be loose). When the fasteners are off, gently pry the cover away from the head along with its gasket. **Contest question**: What is this cover for? Prize: A trip to Disneyland in Japan courtesy of your local Datsun/Nissan dealer.

•L and Z-series: If the spark plugs are still in their holes, have a friend hold the head flat on the bench while you remove them.

•Z-series: You may have an engine slinger bolted to the front of the head. Leave it where it is unless the machinist asks you to remove it.



Step 6: Remove the Cam Towers.

•L-series Only: There are four of them. Datsun tells you not to remove them under penalty of death. But don't believe it. They're held in place by two bolts each and kept straight by dowels between the towers and the head. The cam rides directly on the inside of the towers.

Get a marking pen, masking tape, and four bags large enough to fit one cam tower each, and a 12mm socket, ratchet, and extension. It also helps to have a small piece of wood, a hammer, and a helper.

Loosen the two front cam tower bolts with a wrench, while your assistant holds the head to keep it from turning. Remove the bolts and put them aside. Then grab the tower and wiggle it front-to-back while pulling up on it. If it's stubborn, use the wood as a drift between

the tower and the hammer, tapping first on the front side, then the back side. Now and then give the tower a wiggle and pull upwards. When the tower is nearly off the head, look under it to see the round dowel positioned at each of the bolt holes, stuck in either the tower or head.

Dowel Removal: If the dowels remain in the head, use pliers to grab each dowel and gently twist to pull it out of the hole. Do not distort or brutalize the dowel in the process. Leave the ones that are in the tower (or support) where they are. Keep the dowels and bolts with the tower in the bag marked #1 for the Front Tower. Remove the following three towers the same way, one at a time, marking each bag #2, #3, and #4 in that order. Treat the cam towers like heirlooms or nuclear warheads, very delicately.

Step 7: The Naked Head. Bald is Beautiful.

When the head has been stripped, you can take it to the machine shop for resurfacing or valve work. Or, if necessary, you can replace it with a new or good used head. See Step 8 for precautions on head swapping.

If the head is coated with grime, scrape most of it off before taking it to the machine shop.

If the engine slinger is still bolted to the right or front side of the head, remove it with a 12mm socket. Replace and tighten the bolt in the head. Store the slinger in a parts baggie or box, noting where it came from.

Step 8: What Should the Machinist Do and How to Find One to Do It.

By now you probably realize that the cylinder head is overall the most sensitive and vulnerable part of your L or Z-series engine. Now that you have come this far, it behooves you to do the rest of the job right. The machine work required should be done by a machinist who knows aluminum heads, particularly Datsun/Nissan ones. Although a run-of-the-mill valve grind and resurfacing can be done by almost any shop with foreign engine experience, valve seat installation, guide replacement, or insert installation should be done by a specialist. Therefore it's wise to look around for a pro if you want the job done right.

A good way to do this is to ask a mechanic or friend, who does foreign car work, for his or her opinion. If necessary, ask a few mechanics and take a poll. Tell them your engine type and what kind of work needs to be done. NOTE: This may be a convenient time to ask for some advice regarding any problems you have had up to now. It always helps to preface such technical inquiries with an offer to pay or trade something for the help.

The following are some things that may have to be done to your cylinder head:

Remove the valves to check valve stems and faces, valve seats, and valve guides for wear. The springs (there are two, an inner and outer, for each valve) should be checked for free height, squareness, and tension.

If the valve stems and faces aren't too worn, they can be reconditioned and reused. The same goes for the valve guides in which the stem fits. An intake valve's stem-to-guide relationship is critical for oil control; too much wear means high oil consumption. The valve seats against which the valve faces must be cut or ground and lapped to match the valve face to make a tight seal for good combustion. It's possible that only some valves may have to be replaced. This is okay. If any of the seats are bad, I recommend replacing the other seats in the set, e.g., if one intake seat is bad, replace the three other intake seats too. The same goes for the exhaust seats. Many L-series heads originally came fitted with bronze alloy intake seats that tended to pound into the head with age. If they aren't too deeply imbedded, the head can be reused and new steel or sintered-iron inserts put in. Whatever, have the steel seats installed and staked in place. I know a machinist who makes his own seats and custom fits each one to its hole. He does good work. He claims the holes are never round, so custom sizing is needed.

If your valve guides are worn, you have two good options: replace them or have inserts installed. A third option, **which I do not recommend,** is to have them **knurled.** (Knurling is a process that expands metal thereby reducing the guide's inner diameter.) Ask your machinist for prices on labor to remove and replace the guides compared to having inserts installed.

You will also have to supply the machinist with valve guide seals which come in the head gasket set, assuming you're supplying the gaskets.

Resurfacing or **milling** means to cut some of the surface off the bottom (and maybe top) of the head. This should be done if the head is warped more than 0.004in on the bottom side. Furthermore, if the head is warped on the bottom, chances are it's warped that much on the top side too. This means that the camshaft, which remains straight (doesn't warp with the head), will be turning in cam towers or bores that are out of alignment. **L-series:** Your cam towers can be removed and the top of the head resurfaced so when the towers are replaced, everything's back in line. But to add to this, if more than 0.020in total is removed from the head's surface(s), cam tower/head-saver shims should be installed under the towers to make up for the slack put in the timing chain, as well as the valve lash adjustment you'll lose when the cam's brought closer to the rockers. These shims are available in 0.015in thicknesses and sold at many imported parts houses, Datsun/Nissan dealerships, and machine shops. More than one set can be installed, but you have to consider compression (see below). NOTE: If the machinist resurfaces the top of the head, he or she will have to remove the adjuster assemblies, which means more labor expense.

•**Z-series** heads don't have removable cam towers, only the top half comes off. If the top and bottom surfaces of the head are warped, you'll have to look for another head because (to my knowledge) no one makes cam-bearing inserts for these heads. Inserts would have to be installed if the cam towers were align-bored. Align-boring is a machining process that cuts an oversized bore in the cam towers, so the camshaft can turn in an axis that's parallel to the resurfaced top and bottom of the head. Align-boring makes the bore oversized, therefore inserts are needed to resize the holes to fit the camshaft. Have the machinist check the alignment of the cam towers (journals) to see if the head is warped equally on the top and bottom. Then discuss your options with him or her. If anyone comes up with a solution to this problem, please let me know.

•**Everyone:** Another reason for resurfacing the bottom side of the head is if the water jacket holes are badly corroded. This can also happen to the intake manifold and the side of the head it bolts to on engines with a coolant heated manifold. Ask your machinist to check this out.

Compression is increased when metal is cut off the bottom of the head and the head is brought closer to the piston tops. Higher compression used to be desirable because it improves performance. Unfortunately, it also creates more pollution. And if the compression gets too high, you'll have to use higher octane gas (which isn't readily available), or your engine will detonate or ping, and that's not good. There is no set rule stating how much can be milled off a head before you get into trouble, unless you get into combustion science. So let's keep it simple and say that if you're shaving off more than 0.020in, start considering these options: use lower compression pistons (assuming you're rebuilding the bottom end of the engine) or use a competition head gasket from Datsun/Nissan which is the thickest currently available (to my knowledge). The problem with this gasket is that it is made for engines with cylinders bored to 0.040in over standard, so you may be back up to too high a compression anyway. NOTE: Propane is higher octane and less polluting (Ch. 6, Pt. 1, Proc. 2).

If you're an L-16 person, get 510—1600 c.c. pistons for models 1970 and later. If you're an L-18 or L-20B person, get 1980 720—2000 c.c. pistons. Remember, the idea is to keep the compression down if you have resurfaced the bottom of the head more than 0.020in. NOTE: The 1980 720 L-20B engine was "decompressed" at the factory, so you can afford to raise it quite a bit, maybe by installing pistons other than those supplied for that year.

Talk to your machinst and/or parts supplier about the options.

Cracks—If your engine is leaking water or oil internally and the head gasket isn't the obvious culprit, consider having the head pressure tested and/or spot-checked. Few machinists do this and fewer can repair cracks if found. Cracks often occur in L-series heads between the oil passage and the water jacket. I have read about but never tried kits that remedy this ailment. Tom Monroe's informative book entitled *How to Rebuild Your Datsun/Nissan L-series Engine* spells out these options. The book is available through Datsun/Nissan, Part Number

99996-M8013, or from HP Books, (602) 888-2150.

All things considered, you may be better off getting another head, which you hope is in better shape than your old one. See Head Swapping below.

Head Swapping—Although many L and Z-series heads are interchangeable, to play it safe, replace your cylinder head with one from a similar model and year. Always get a guarantee from whomever you buy the replacement. If you want to make sure it's good, check if for warpage and have it pressure tested or spot-checked for leaks and cracks. Otherwise you may install and run it for a while to find it too is bad.

Cam Towers (L-series) and Rocker Assembly (Z-series)—Take these along to the machine shop to have them inspected for wear. **L-series:** The cam towers alone rarely need to be replaced unless the head was severely warped or they and the cam are scratched. **Z-series:** Your rocker assembly parts are probably all right, but that doesn't mean they shouldn't be checked. Individual parts are available through Datsun/Nissan. Have the machinist check the rocker to shaft wear. Keep these parts clean while transporting them.

Everyone: Before you run off to the machine shop, see Step 9 about the camshaft.

Step 9: Check the Camshaft and Take It with You to the Machine Shop.

L and Z-series cams fortunately last a long time and seldom cause problems. When one does fail, it's because either one lobe loses its hardened finish and rapidly wears out, or a few or all of the lobes get little ridges on them and gradually wear out. Also ask the machinist to measure the lobe lift (sounds like plastic surgery on the ear).

If a lobe loses its finish, it won't look as shiny as the others. So if the cam is still in the head, you'll have to inspect each lobe as you crank the engine. One bad cam lobe means the whole shaft is shot.

If some of the lobes are ridged, the cam may be usable, but only if your machinist tells you that it's okay.

NOTE: There's a chance that your cam could be worn or scratched at the towers (journals). This is a sign of poor oiling or dirt in the oil. If the whole cam is worn, then there is a main oiling problem in the block. If only one is worn or scratched, check the oil passage to that journal and your oil pump. Consult your machinist and Ch. 10, Proc. 14.

In either case, if you replace the cam with a new one (or even a used one), replace the rockers too.

•**L-series:** Unless you're really broke, replace the rocker guides (lash pads) as well as the rockers. All this can be expensive but it's important. (A good option is to buy a **used** cam, tower set, rockers, and lash pads as a set.) There's another thing which comes into play here, and that's rocker geometry. (This has nothing to do with the wear pattern of grandpa's favorite chair and the front porch floor.) It has to do with how the cam wears in relation to the rocker arm and the rocker to the rocker guide (lash pad). These relationships change after a valve job. Most of the time this doesn't make a big difference, unless you're into high-level engine building. In fact, for most jobs, I reuse the original components. But for the record and your possible interest, I mention this finite yet important detail. See Tom Monroe's book, which I refer to in Step 8 or ask your machinist for more on these points.

•**Everyone:** Take your cam to the machine shop for an inspection.

•**L-series:** If necessary, tote the rest of the team (rockers and rocker guides) along, and **keep them in order!**

Step 10: Is There Still More?

Yes. Now's when you have to decide exactly what you're going to do to the engine. If you performed the checks in Proc. 3 and read the introduction, you should know by now where you stand. You may be taking just the head or most of the engine to the machine shop for inspection and/or servicing. Or you may be simply putting the head back on.

The reference list at the end of Proc. 1 is designed to guide you from where you are to where you want to be.

While the head and/or other engine parts are away is a good time to clean dirty parts and buy what you need for assembly. Read through the procedures that pertain to you in this chapter, Pt. 2, such as replacing the timing chain, Proc. 1-3 and what's in Ch. 10. Make lists and notes for parts and questions. Your parts supplier and machinist should be happy to help you locate parts and solve problems. Don't be afraid to ask. Be thorough and

get things set up so the reassembly will be smooth. Remember, everything has to be clean and fit back into the right place when it all goes back together. The better prepared and more knowledgable you are the better.

Further Hints: Engine Rebuild, Ch. 10, Proc. 8 (12) has some lists of parts and supplies that may help you get organized.

•**About Z-series head gaskets:** Z-series head gaskets have one less coolant hole behind the #4 cylinder than L-series do. I mention this because all L and Z-series heads and blocks have holes, but many of the Z-series engines have no corresponding hole in their head gaskets whereas L-series gaskets do. Some of these head gaskets (Z-series) have been superceded by new ones; however, at this writing, the holes **still** aren't there. I have heard arguments from both sides: Some say it makes a difference, others say it doesn't. I do know that Z-series head gaskets blow at the rear of the head where the hole isn't. Some mechanics claim to have seen evidence of the #4 cylinder (piston) running hot. So, what can you do? Well, you can punch a hole in the new gasket and hope it helps. Here's how. You need the correct gasket. The Datsun/Nissan numbers are Z-20 11044-W4001; Z-22 11044-06W04; Z-24 11044-10W01. Next you need to find a gasket hole punch to cut a ½in hole. Then you need to match the gasket to the head or block and mark where to cut the hole. I recommend a talk to your machinist about the entire hole operation and proceed from there. I know you can do it without leakage, but I can't swear it does any good. . .well.

PROCEDURE 5: ASSEMBLE CYLINDER HEAD AND PREPARE FOR REPLACEMENT

Condition: The cylinder head has been disassembled and repaired or replaced. While you're waiting for the new or repaired cylinder head, you can take care of some of the dirty work necessary for correct servicing. If the head gasket only is being replaced, buy a new one from Datsun/Nissan, along with any other gaskets, hoses, nuts, bolts, or dowels you may need and only they have.

Tools and Materials: Emery cloth (medium grit), clean rags, sockets, extension and ratchet, head set (all gaskets minus valve seals which the machinist may already have), solvent, gasket scraper, thermostat and side gasket (may be in head set), cam tower shims if head was resurfaced more than 0.020in, torque wrench, penetrating oil and anti-seize compound, and an assistant if possible.

Remarks: The machine shop should have cleaned the head thoroughly, but it's a good idea to make sure. Ask them if you'll need to do any further cleaning.

Step 1: Before Assembling the Cylinder Head.

Clean the gasket mating surfaces and replace all the worn out parts. There are a few surfaces to scrape and sand: the manifolds (intake and exhaust), the thermostat/coolant outlet housing and, for L-series People, the front cover. (On L-16 and L-18 engines the exhaust manifold is probably still in the car.)

•**L-series:** Clean the front cover with solvent, then scrape and shine the flat mating surface with emery cloth. Wipe dry and find the new gasket, and set them aside.

Clean the thermostat housing with solvent and scrape off the old gasket where the housing fits against the head. There are one or two fittings threaded into the side of the housing. Take care not to damage the delicate plastic pipes or prongs sticking out of it.

•**L and Z-series:** Now is a good time to check and, if necessary, replace the thermostat and the temperature sender. This is wise insurance on a new or revitalized engine (Ch. 8, Proc. 6 and 8).

The intake and exhaust manifolds are probably the most important surfaces to make smooth. First scrape the intake manifold surfaces, and when all the gaskets are off, sand the surfaces until smooth with emery cloth. **This is important!**

Now do the cast steel exhaust manifold. Scrape and sand it until it's perfectly smooth.

•**L-series:** Two different-length bolts attach the thermostat housing to the head. Wire brush or soak and clean their threads. Find the rectangular gasket and place all the parts aside.

•**L and Z-series:** Find the nuts, washers and bolts that hold on the manifolds. Clean the threads and replace any funky nuts or bolts. Find the long manifold gasket (L-series) or gaskets (Z-series) and set all of the parts aside.

If your exhaust manifold is off, scrape and clean the mating surface where it connects to the exhaust pipe. Likewise clean the matching flange surface until it's perfectly smooth. Wire brush the stud threads and replace any broken studs after reading about stud removal in Ch. 13, Pt. 1, Proc. 2. Coat the stud threads with penetrating oil and anti-seize compound.

The camshaft and towers are next. Start by wiping the cam dry and clean. Set the cam safely aside.

•**L-series:** Wipe out the surfaces inside the cam towers and blow through the oil holes in the base of each tower to clear them. Wipe the towers with solvent, then dry and set them aside.

•**1974 and Later Models, L and Z-series:** Another area to remove and service is the EGR manifold-pipe and/or control valve(s) (Ch. 6, Pt. 2, Proc. 9-11). The same goes for the PCV valve (Ch. 6, Pt. 2, Proc. 2). If the carburetor needs work, now is the time to take it off and do what's necessary. At least tighten the four carb base nuts.

Step 2: Check and Service Early Fuel Evaporative Systems.

•**L-20B 1975 and 76 People Only:** You people with combined manifolds have a counter-weighted flap in the exhaust manifold that helps to vaporize fuel and hasten efficient engine operation during warm-up (Ch. 6, Pt. 2, Proc. 14). To keep everything in harmony, check that the weight and shaft turn and return by spring pressure when released. If the movement is stiff, squirt the shaft at both ends with penetrating oil and move it back and forth to free it.

The manifolds are separable. There are gaskets, a heat shield, and a plate between the two manifolds. You need to take them apart only if the gaskets burn out, if you replace either manifold, or if a vacuum leak develops. It's much easier to do now than later. Go to a Datsun/Nissan agency for replacement gaskets and advice.

NOTE: If you do remove the four joining bolts and separate the manifolds, be sure to follow this sequence when replacing the manifolds onto the head: first, start but do not fully tighten the four bolts that hold the two parts together in their holes. Second, install the manifolds following Step 5 in this procedure. When the manifolds are fully tightened to the head, screw in the four joining bolts all the way. This will keep everything square. Make sure that the flap and weight turn smoothly.

Step 3: Replace the Cam Towers.

•**L-series Only:** You stored these characters in four separate bags labeled #1-4. If the head was resurfaced more than 0.020in you should have one or more set(s) of shims to put under the towers.

Find the front of the head and the position of the front cam tower. Make sure the two sleeved dowels are smooth and not distorted. Sand off any roughness with emery cloth and clean the tower surface.

Insert the dowels into the holes in either the head or tower. If using shims, match one or more shims to the front tower's shape and place it (or them) onto the head, over the bolt holes. Set the front tower into place, it will only fit one way. Wiggle and tap it down until flush against the head and insert the bolts, long and short. Thread in the bolts until they touch the tower, then tighten them with a 12mm socket, torque wrench, and extension. First tighten one bolt then the other to 5 ft.lbs, then to 10 and finally to 12 ft.lbs. This is crucial.

Go on down the line installing the three other towers following the rules above. Check that the cam end plate is in place on the front of #1 cam tower. (Note the groove mark in front of the plate.) If the 10mm bolts are loose, tighten them until snug, but do not overtighten.

Step 4: Install the Water Outlet and Front Cover.

•**L-series only:** The water outlet elbow fits into the right rear side of the head, below and behind the #4 spark plug hole. Clean the threads of the fitting, put some gasket sealer on them, and turn the fitting in clockwise. Tighten it with a 19mm box-end or socket wrench until tight and so the outlet is pointing up and to the rear, just for now.

Pick up the front cover and gasket. Coat both sides of the gasket with a little sealer. Remove the nut, bolts,

and washers from the head. If the head surface is smooth, install the cover, gasket in place, and start on the washers and nuts or bolts with washers. Tighten each until snug, even though at least one of them will have to come off later.

NOTE: The mating surface(s) on the head should be as clean and smooth as the manifolds (Step 1).

Step 5: Install Intake and Exhaust Manifolds.

•**L-series:** Find the manifold gasket and put it on the head over the upper studs. If two of the gasket intake portholes are egg-shaped, put them over the front two holes; otherwise the gasket will only fit one way. Keep the nuts, washers, and bolts near at hand. Coat the threads of the studs and bolts with a little penetrating oil or anti-seize compound. Prop up the head so that the manifold side is higher than the other. The head has to be steady on the bench. Refer to Proc. 4 (4). Get an assistant if necessary.

Pick up the manifolds and line them up to the studs and ports. Once in place, start one or two of the top bolts with washers into the holes to hold the head manifolds in place.

Install all the top bolts to pull the manifolds against the head. (Don't connect the fuel/coolant pipe bracket yet.) Sort out the rest of the nut/bolt and washer combinations and start them onto or into their studs or holes. The lower ones are difficult to get started. They also need big washers to clamp both manifolds against the head. The washers go flat side in.

•**Z-series:** Find the bolt bag labeled "intake manifold." Wire brush and clean the bolt threads then lightly coat them with penetrating oil and anti-seize compound. Do the same to the center stud on the intake side of the head and to the four lower studs on the exhaust side. Set the fasteners nearby.

Start on the intake manifold by propping the head so the right side is facing you. Find the long gasket with four separate portholes in it. The extra (coolant) hole at one end of the gasket matches the hole in the front end of the head. Position the gasket and have your assistant hold it in place, as you install the intake manifold and two top bolts to hold it flush against the head. Insert the remaining seven bolts with the VVT valve bracket on the back two bolt positions and the nut on the center bottom stud. Don't fully tighten anything yet—only enough to pull the manifold flush against the head.

•**L and Z-series:** When all 11 fasteners are in place, start tightening them evenly a little at a time. You'll have to juggle a socket, swivel joint, and extension as well as an open-end wrench to get at all of the nuts and bolts. Work around the points until all are tight, then check 'em again. The torque rating is 12-15 ft.lbs. NOTE: An intake or exhaust leak could ruin your day, but a stripped bolt or stud could lead to insanity. Watch it!

•**L-20B People with Combined Manifolds:** If you have the manifolds separated, you must now tighten the four joining bolts under the carburetor and heat shield (Step 2).

•**Z-series:** The exhaust manifold needs two new gaskets. Find them and the bag labeled "exhaust manifold," which contains four nuts and four bolts. Clean the bolt threads as described and liberally coat them as well as the lower studs with anti-seize compound. Fit the gaskets to match the bolt and hole patterns against the head, then place the manifold over the studs and install the four top bolts to pull it flush against the head. Thread on the lower four nuts and start evenly tightening the eight fasteners, as you did on the intake side to 12-15 ft.lbs.

Grab the EGR pipe at the back of the exhaust manifold and work it into position behind the head so its exposed end lines up with the fitting on the EGR valve. Lube the nut and fitting with penetrant, and you guessed it, anti-seize goo. Start the nut only the fitting, then tighten it with your 10 or 12in adjustable or 29mm open-end wrench. Jump over to the opposite end of things and tighten that 24mm nut so neither it nor the other end will leak exhaust.

Step 6: Install Thermostat Housing.

•**L-series Only:** Pick up the rectangular gasket and coat both sides with gasket sealer. Place the gasket against the matching hole in front of the manifolds. Find the bag labeled "thermo bolts."

Lube the bolt threads with a touch of anti-seize compound and set them nearby. Put the housing round-side-up against the gasket, holes aligned. Install the bolts, long one front and short one rear, and turn them in until they touch the housing. Tighten evenly, one at a time, until the washers flatten—easy, now. **DANGER!**

Look down into the front of the head where the front housing bolt end is visible. If this is the correct bolt it shouldn't protrude more than 2-4mm. If it's too long, it will interfere with the timing chain guide. Use a flat washer under the bolt head or another bolt that's shorter.

Step 7: Install Vacuum, Water, and Fuel Plumbing.

•**L-series:** Round up the hoses and piping that fit around the front of the head. If any of the hoses hasn't been renewed, and needs to be, do it now. Loosen the clamps and work the hose off the pipe. Smooth the pipe-to-hose surface with emery cloth and fit the new hoses in place, clamps in place with the screw heads accessible. Snug but do not fully tighten the clamps.

Before you bolt the pipes to the head, lay the form-fitted assemblies next to the head to review their placement. Old L-16 engines have only the coolant pipe to put on. Others have a coolant pipe and two fuel lines, and later engines have vacuum pipes as well. If you had an air conditioner pulley mounted on the front of the head, find the sketch you made of its layout and how it was fastened to the head.

Start by removing the nuts (or bolts) and washers on the front cover, the intake manifold and maybe the inner thermostat housing bolt, that is, anywhere the brackets match up. Every engine has a different bracket placement; use your common sense to line the brackets up with their proper studs and holes. Install the upper fuel and vacuum pipes first. They match to the upper front cover stud or bolt, maybe the inner thermostat housing bolt, and one or two upper manifold bolts or studs. If you have a vacuum switching valve, it mounts to the lower left inspection cover stud or bolt. Install all washers, nuts, and bolts once the brackets are in place. Leave them loose until the hose ends are fitted onto their pipes.

Fit the fuel line onto the carburetor inlet, then the vacuum hoses (if you have them) onto the two pipes at the inside base of the carburetor. Follow these pipes back to the base of the thermostat housing (1975 and later) and connect the vacuum hose to the inside pipe of the EGR thermo vac. valve. While you're here, connect the vacuum hose from the EGR or BPT valve to the outer pipe of the thermo vac. valve.

The coolant plumbing goes on next. The bracket connects to the inspection cover and the hoses connect to the thermostat housing and/or the base of the carburetor. When you've replaced the bad hose(s) and figured out how the piping fits against the head, remove the proper front cover nut or bolt and slip the hose(s) onto the matching pipe(s), with the clamps in place. Install the bolt or nut, with washers, to secure the bracket to the head and tighten it until snug. Tighten the clamps when in place.

•**Z-series Power Steering Pump People:** If you removed the pump idler when stripping the head, you'll have to pay the price for steering convenience and replace the idler now. Ch. 12, Proc. 13 has these thrilling instructions.

•**Pre-1983½ California and pre-1985 Federal Vehicles:** The one or two EAI pipes, connected to the exhaust manifold, are loose and ready to swing down across the front of the head. Remove the 12mm bolt that you stored in the head. If you have two pipes, separate the bracket pieces and 10mm bolt that are attached to one of the pipes, then refit the loose half of the bracket around the pipes and secure the bracket halves together with the 10mm bolt.

Align the bracket hole with the hole in the head and install the 12mm bolt you just removed. Tighten the bolt so it's snug and no more.

Step 8: Install the Camshaft, Maybe the Fuel Pump, Other Brackets, and the Rocker Assembly.

•**L-series:** Position the head so you can install the camshaft from the back side. The front of the camshaft has the hole and dowel pin in it. Wipe it off and coat the four journals with white moly grease, STP, or at least engine oil. (See the drawing in Proc. 4 [1].)

Carefully slip the first journal through the back of the rear cam tower and push it forward. Keep the camshaft perfectly in line with the tower bores while working it forward until it's flush with the front plate and in all of the towers. It should turn easily when rotated. If it doesn't turn at all, take the whole works to the machinist for help. If it's just a little stiff to turn, take a chance and see how it does when the head is bolted to the engine. NOTE: The cam can slide out of the back of the towers. Keep the head level when handling it.

If you removed the fuel pump **after** you took off the head, or any other brackets for air conditioner junk,

replace them now. (Read Ch. 6, Pt. 1, Proc. 10 [6-7] and follow the sketch you made for the air conditioner brackets.)

•**Z-series:** Look at the top of the head to make sure the eight dowels that fit under the rocker towers are all there. If some are missing (and you know where they are), reinsert and tap them into their holes. Can't find some of them? Ask your machinist or go the Datsun/Nissan and ask for #11022-20100, which they'll probably have to order.

Clean off the top of the head, particularly the five cam-bearing surfaces. Now carefully pick up the camshaft and wipe it off with a lint-free, clean rag. Coat the five journals (not the lobes yet) with white moly grease, STP, or at least engine oil. Find the front of the shaft; it has the threaded hole in it. Notice the shoulder just behind the front cam section. This fits into a corresponding groove in the head just in front of the first bearing surface. Fit the camshaft gently into the head.

The rocker assembly should be ready to install. If it was disassembled, there's a chance it was put back together wrong and the rockers are out of order. When you install the assembly, note that the rockers all line up to the valve tops exactly. NOTE: If the tappets aren't all loose and threaded up to allow for maximum valve clearance, do that now with a 12mm open-end and screwdriver.

Turn the camshaft so the dowel on its front is **up.**

Place the rocker assembly over the cam and head so the rockers match the valve (and spring) layout. Wipe off the bottom and bearing surfaces of the supports and set the assembly in place. Thread in the front and rear bolts until they touch the supports. Find the baggie labeled "rocker assembly" and remove then wipe off the six bolts. Thread them into the head until they touch the supports. Grab your torque wrench, 12mm socket, and extension. Starting on the center two bolts, work your way outward, front then back, to tighten all 10 bolts. Do it in stages, evenly until all 10 are tightened to 15-18 ft.lbs.

PROCEDURE 6: REPLACE CYLINDER HEAD ON ENGINE BLOCK

Condition: You have finished Proc. 5 on assembling the cylinder head, so the head's together. If you did other engine work, the pistons and maybe the timing cover are in place. #1 and 4 pistons should be all the way up in their cylinders.

NOTE: If you want to replace the timing chain and **the oil pan is on,** remove and install the components and cover before installing the head (Ch. 9, Pt. 2). If your **oil pan is off**, replace the head first, then the timing components and cover and finally the oil pan.

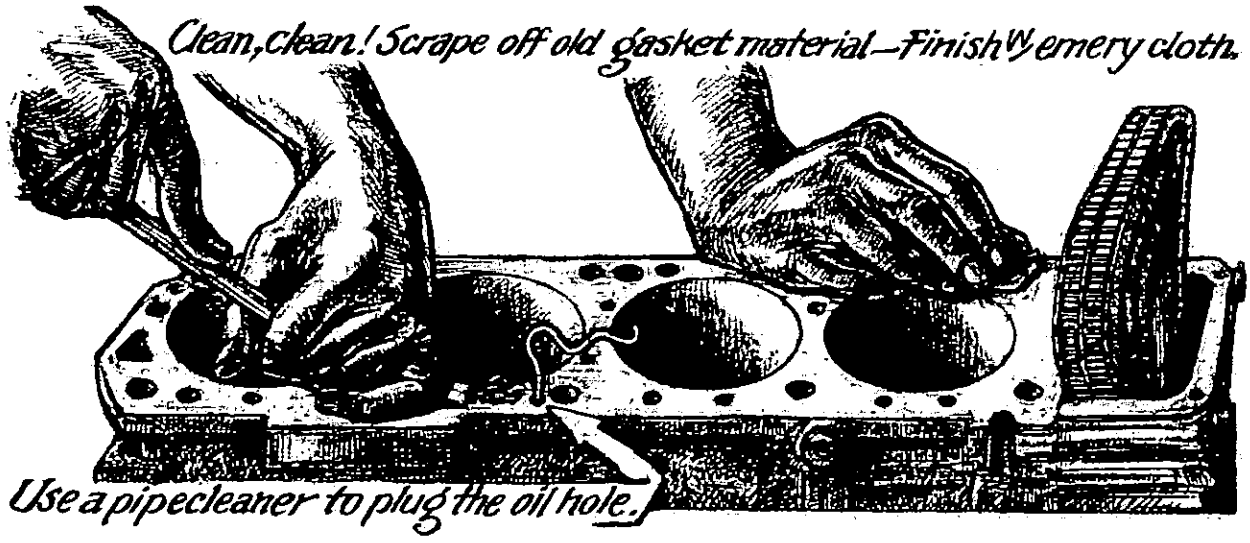
Tools and Materials: Head gasket (be sure to get the correct gasket), valve cover gasket, 10mm hexagonal socket for head bolts (L-series), emery cloth (medium grit), 10mm x 1.25 tap or thread chaser, new antifreeze (1 gal.), remote starter and basic tool kit, miscellaneous hoses and clamps as needed. **L-16 and L-18 People** also need a manifold gasket (part of the head or engine set).

Remarks: Many mechanics use a spray-on gasket sealer called High Tack or Copper Coat on head gaskets. Datsun/Nissan head gaskets come from the factory with a sticky surface, so that stuff isn't needed. If you use a sealer on your head gasket, use only what is made for that purpose and follow the instructions carefully. The highest quality non-factory head gasket I've found is the Fel-Pro Perma-Torque (Printo seal) head gasket. It's specially-coated, requires no retorque, and is more expensive than regular head gaskets.

Most important, get the right gasket for your vehicle year and engine type. If the old gasket wasn't leaking, you can assume that it is the correct one. Match it with the new one by comparing the the size and location of the holes on each.

Step 1: Prepare the Top of the Engine Block and Head Bolt Holes, Clean the Head Surface.

Make sure the pipe cleaner is in place, plugging the oil hole. Clean the top of the block where the head gasket sits, using a sharp gasket scraper to get off what may be left of the old gasket. The old gasket should come off



in one piece; save it for comparison. Use emery cloth to rub the top block surface down to where it's smooth and mostly metal shows, taking care to keep the scrapings out of the holes in the block. Taking your time to do it right, wipe the surface dry; use alcohol or paint thinner to wipe down the top of the block if it's greasy. Blow and wipe out the cylinders, and make sure the edge on top of the timing cover if in place is clean.

If the head isn't already clean, scrape it until smooth, being careful not to gouge the soft aluminum surface. When all the big debris has been removed, sand the head smooth with emery cloth and a dry rag.

If the tops of the pistons are covered with carbon, you can clean (or "decarbonize") them while still in the engine. To clean the deck or top of the block, see Ch. 10, Proc. 9.

If you have access to a 10mm x 1.25in thread chaser, I suggest that you run it down the head bolt holes. Ask the machinist or mechanic to show you how it's done if you don't already know. But first read through the Step 2.

Mop out the coolant holes in the block if they are full of coolant; the block isn't drained.

Step 2: Prepare the Head Bolts, Dowels; Install the Head Gasket and Exhaust Flange Gasket.

•**Z-series:** One more time, make sure the block and head surfaces are spotlessly clean.

Remove the pipe cleaner from the oil hole and find the two sleeved dowels that fit into the two larger counterbored head bolt holes in the block; one in the second hole from the back on the left side of the block, and the other one in the front left corner. Tap them in and pick up the head gasket. Do not touch the surface of the gasket or get it oily. Place it over the sleeve dowels so it's lined up. It fits on only one way.

Now find the 10 head bolts and (L-series) two and (Z-series) four little 10mm-headed ones. They're in a bag labeled "head bolts." The ten big ones have one flat washer each. The little ones have a lock washer each. Wire brush the bolt threads to clean them until they're spotless. If any head bolts look deteriorated or corroded in any way, replace them or have them all "miked" at a machine shop for stretch. **L-series:** Clean out the socket holes in the tops of the bolts and wipe them dry. **L and Z-series**: Slip the washers onto the bolts so the flatter side is facing the threads. Spread some engine oil on the threads and on both sides of the washers. Set the bolts aside.

•**Z-series:** Find the exhaust manifold/flange gasket. Scrape off the old gasket and install the new one over the flange pipe and bolt holes on the exhaust pipe. It should stay put.

Step 3: Final Check and Install the Cylinder Head.

When the dowels and gasket are in place, look at the timing chain if it's in place. It should be curled in the hole at the front of the head, not flopped over the side of the cover. Carefully position it so it won't get in the way as you install the head. Take a final look at the bottom of the head and wipe off any grease or grime. Double-check the position of the gasket and chain.

You'll need a friend to help with the next part, especially if you're working on an L-20B or Z-series head. NOTE: Z-series exhaust manifold studs and flange may have to fit right into and on the exhaust pipe flange and gasket.

Look around the sides of the engine to clear the way for the head. Sit with your legs in the engine compartment, positioned so that your helper can hand you the head and you can easily lower it onto the engine. Remember, it's heavy.

When you're sure of what you are doing, go for it. Hold the head by the camshaft or manifolds, without the shaft sliding out, and make sure it goes straight into position onto the block. Don't slide it around on the block. If you miss on the first try, pick the head straight up and reposition it. If the timing chain gets in the way, your helper can carefully work it through the cavity at the front of the head.

If you make a wrong move and wonder if the head gasket was damaged, pull up the head and look at the gasket. It has to be in perfect shape to work. If in doubt, get a professional opinion and/or replace it.

The head will fit into place when the dowels line up with the bolt holes in the head. The edges of the head will be even with the sides of the block and sit flat when the weight of the head is directly over the engine (L-20B heads tend to be side-heavy because of the manifolds).

Step 4: Install the Head Bolts and Torque It.

Lay all 10 head bolts on the bench. **L-series:** There are six short ones and four long ones. If two of the long bolts are longer than the others, put these two in the front and fourth holes on the left side of the head. The short bolt goes into the center hole on the left side. The long ones go in the four remaining holes on the left side.

You may have to remove the washers and place them over the holes before inserting the bolts. *Don't* let any of the washers fall into the front of the engine.

•L and Z-series: Insert and turn all the bolts down until they touch the washers and the heads are flush with the block. Pick up and insert the two or four 10mm bolts that go in the front bottom edge of the head, but don't tighten them yet. NOTE: If your timing cover isn't on, you can't install these little 10mm bolts yet. Put them back in the head bolt bag.

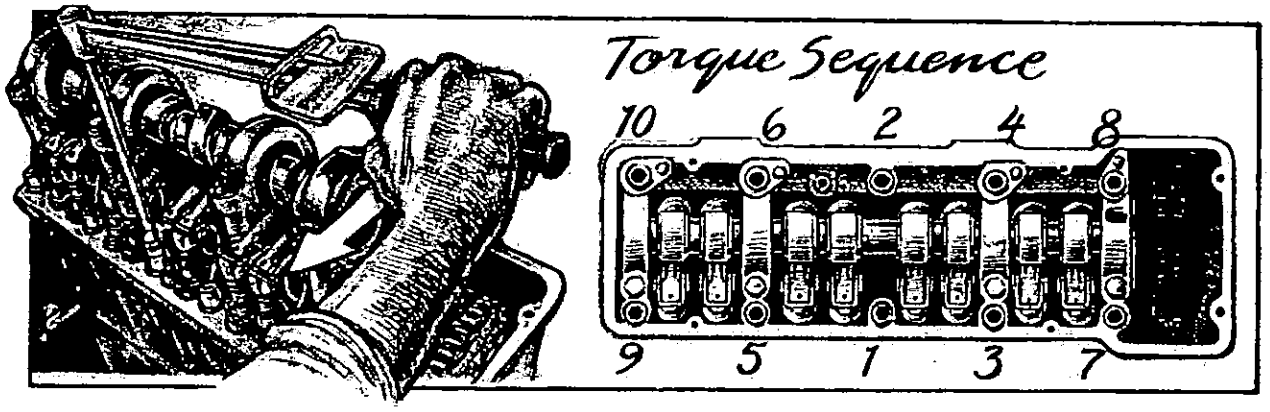
Grab the L-series 10mm hexagonal socket (Z-series 14mm socket) extension and torque wrench. Look at the illustration above showing the order to tighten the bolts. Start on the #1 bolt and tighten it 20 ft.lbs. Follow the tightening sequence until all 10 bolts are that tight. Next, tighten the two or four 10mm bolts on the front edge until they are snug, not too tight. **Z-series**: The Factory Service Manual recommends that you install the cam gear and chain now. Then once it's on finally tighten the head bolts. I don't think it matters; you do it any way you like.

Finally Tighten the Head Bolts: To finish tightening them, make two or three more passes around the bolts, bringing them up to torque gradually. Follow the chart below and the sequence illustration until the bolts are all tight.

	L-13 and 16	L-18 and 20B	Z-20,22 and 24
1st pass	12 ft.lbs	15 ft.lbs	15 ft.lbs
2nd pass	30 ft.lbs	35 ft.lbs	35 ft.lbs
3rd pass	40-45 ft.lbs	54-65 ft.lbs	54-65 ft.lbs

NOTE: I find that head bolts stay tight if they are torqued slightly above the highest rating recommended. Maybe my torque wrench is out of calibration, but I judge by feel as well as what the wrench indicates. Personal experience tells me that the maximum ratings I suggest are OK. If you don't exceed the factory recommended rating, you'll be all right. But, no matter what, don't forget to retorque the head after 500 miles (Step 24).

•Z-series: Another oriental mystery is the method for head installation prescribed in the service manuals for 1983-½ on. It goes as follows: Tighten the head bolts as described in the first part of this step, bringing them up to 58 ft.lbs Now loosen all 10 of the bolts completely as I describe in Proc. 2 (7). Then retighten the bolts



in the sequence illustrated in this step (4) without doing it gradually, but instead by bringing them up to maximum tightness in one pass. If you use this method, I suggest you tighten them in two or maybe (the normal) three passes. This loosening and retightening method may have some benefit unknown to me. I don't know of any mechanics who use it.

•**Everyone:** If any bolt doesn't feel like it's tightening, stop and remove it. Chances are it has stretched too much and should be replaced, or worse, the threads in the block are stripped. Let's hope this isn't true in your case. If it is, consult a good mechanic about replacing the head bolt or drilling and "Helicoiling"(tm) the threaded hole in the block.

Check the two or four 10mm bolts up front to make sure they are still snug (if your timing cover is on).

If your timing chain and cover are in place, go on to the Step 5. If your timing chain and cover aren't yet on the engine, but you have already removed the old chain and its partners, go to Pt. 2, Proc. 3 (7-13) of this chapter. If you have not removed the chain and its components, do all of Proc. 3 in Pt. 2.

•**Complete Engine Rebuild People:** If your oil pan is off, install the timing cover before you replace the oil pan.

Step 5: Replace the Cam Gear and Timing Chain.

(The timing cover is on and the timing chain is blocked.)

Take a look at the position of the crankshaft pulley and its relationship to the stationary timing pointer. The crankshaft pulley should be at the top dead center (TDC) mark.

Pick up the loose end of the chain and find the marked link. If the cam gear isn't clean, do it now. Then look at the numbers on the outside front edge of the gear chain near the teeth. You made a note of the number the chain was on before you disassembled it.

Ch. 9, Pt. 2, Proc. 3 (10) tells you how to line up the chain and gear and get the gear onto the end of the cam shaft. Return here when the gear is fully tightened to the cam.

Step 6: Install the Rocker Guides (Lash Pads), Rockers, and Hold-Down Springs.

•**L-series Only:** Find all eight rocker guides and rockers. Clean the guides and install them one at a time on top of the valve springs in order. Now wipe off the rockers, keeping them in order.

The lobes for #1 cylinder (**A** and **B**) should be rabbit-eared (see the illustration and information on removing the rocker in Proc. 2 [2]. Use the same method to replace the rockers.) Before you pick up the hefty screwdriver, figure out at which angle you will install the rocker and turn the rocker guide, on top of the valve spring, so the rocker can slip right into it.

Install **A**, **B**, **C**, and **E** rockers. After they're in, crank the engine with a wrench on the front pulley or by operating the starter motor so #4 cylinder is at TDC (**H** and **G** lobes are rabbit-eared) and install **H**, **G**, **F**, and **D** rockers.

Make a final check that the rockers are installed correctly.

Step 7: Install the Hold-Down Springs.

•**L-series Only:** Make sure all eight springs are clean. Fit each spring over a rocker so the curl is toward the cam. Clip the bent ends of the springs onto the wings of the wire piece under the adjuster assembly. Now lift the saddle part of each spring up into the groove on the end of the rocker.

Step 8: Install the Intake and Exhaust Manifolds onto Head.

•**L-16 and L-18 People Only:** Find the manifold gasket in the set. Make sure the manifold surfaces are thoroughly clean and ready to mate. Find and clean up the 11 manifold nut, bolt, and washer sets. The rusted nuts fit the studs, and the bolts with thick washers fit on the bottom where the intake and exhaust manifolds share a fastener.

Your exhaust manifold is in the engine compartment, your intake manifold is either there or on the bench. Follow the instructions in Proc. 5 (5) for installing L-20B manifolds. Take care to tighten the nuts and bolts equally to pull the manifolds against the head evenly.

If you need to separate the exhaust pipe flanges for any reason, see Ch. 11, Pt. 1, Proc. 8 (9) and Proc. 12 (11).

Step 9: Connect Exhaust Downpipe to Manifold Flange and Vehicle Body (L-20B people).

The left front of the vehicle has to be raised and supported. Find the bag with nuts labeled "exhaust manifold/flange." Refer to the illustration in Proc. 1 (12). From under the engine, look up at the exhaust manifold flange.

•**L-20B and Z-series 510 People:** Find the flange inside the exhaust pipe and work it up toward the top of the pipe. Lift and work the pipe up to the manifold flange, keeping the pipe flange near the top end from binding.

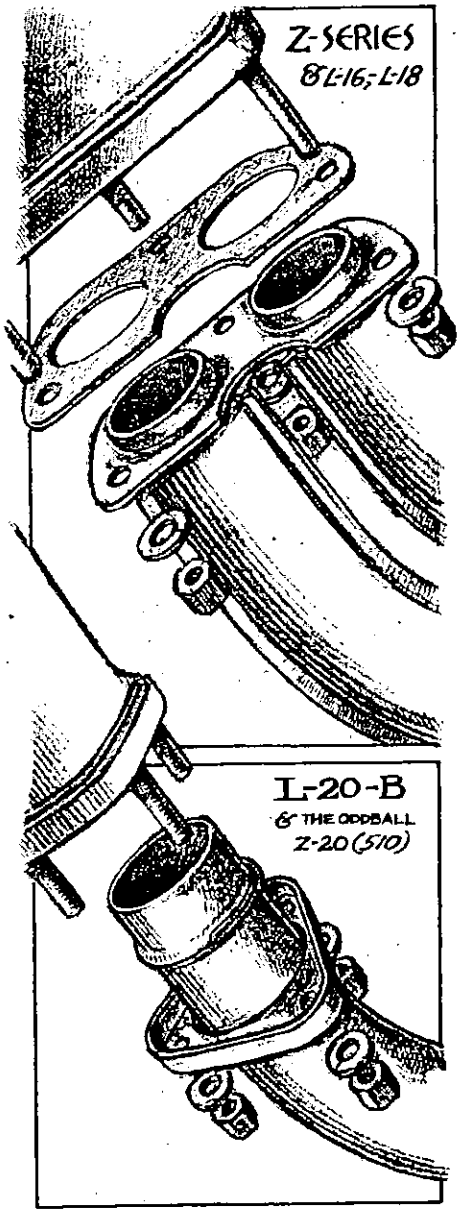
•**Z-series and 720 Truck People:** Your flange is part of the exhaust pipe and probably close to the manifold. If you installed the gasket, it should already be on the pipe flange. If not, insert the gasket now. You may have to unbolt the exhaust pipe from a pipe-to-body bracket, drop the flange away from the manifold and make space between the flanges to fit the gasket.

The gasket fits only one way, over the pipe and bolt holes. Make sure the flange surface is perfectly smooth and install the gasket and position the pipe flange up against the manifold flange.

Start one of the flange nuts on a stud to hold the pipe in place.

NOTE: Nissan recalled these flange nuts because they often come loose. If you use the old ones, make them tight, listen for exhaust leaks and check them frequently. Don't overtighten the new style nuts, just make them tight. They have locking claws on one end and tend to get stuck. The flat side of the nut goes toward the flange, the claws toward the end of the stud. Another option is to use 8mm lockwashers with the original nuts. Whichever you use, put anti-seize compound on the studs.

•**L and Z-series:** Fit the pipe into the manifold and the flange over the studs if not already there. The nuts are usually brass or stainless steel and longer than regular nuts and sometimes have different threads. Use penetrating oil or anti-seize compound on the threads. Connect some extensions and maybe the universal swivel on-



to the ratchet and 12mm, 14mm, or 17mm socket (deep, if possible). Tighten the nuts evenly a little at a time to pull the pipes straight into the manifold. Tighten until snug but not too tight.

Follow the pipe back and fit the brackets (if disconnected) to the hangers. Install the nuts, bolts, and washers with penetrating oil and make sure that the pipe isn't touching the body or drivetrain.

Caution: Replace or repair the exhaust system if it is leaking or damaged (Ch. 3, Proc. 12).

Step 10: Connect and Adjust the Throttle Linkage, Wires to the Carburetor and Choke Cable, and Miscellaneous Hoses and Brackets.

Most carburetor connections are at the back of the carb. Turn to Ch. 6, Pt. 1, Proc. 6 (6-8) to connect the throttle cable or linkage, manual choke cable or choke wire, and solenoid wires.

When the throttle cable (if you have one) is connected, you need to adjust it (Ch. 6, Pt. 1, Proc. 4 [5]).

•**L-16 People:** If you have a manual choke, there's a cable to connect. If you have an automatic choke, there's at least one electrical wire to reconnect and maybe three wires to plug together. (See Ch. 6, Pt. 1, Proc. 6 [6 and 7].)

•**L and Z-series:** Later model air conditioner people may have some skinny vacuum hoses to connect to the rear intake manifold web: one to the black plastic cylinder at the back of the carburetor, and the other to the switch on the firewall.

Most models, except early 510s and 521s, have a Master Vac brake booster hose to connect to a pipe on the rear intake manifold tube. If the hose is in good condition, slip it onto the fitting and tighten the clamp. A poor connection in this hose will cause a serious vacuum leak, so check it for damage and clamp it well.

•**L-20B people:** Find the short 10mm bolt and the bracket that holds the PCV pipe rigid. The bracket sticks up near the back of the exhaust manifold. This hard-to-get-started bolt threads through the bracket into the rear engine slinger. If trying to put it on drives you crazy, leave it off.

•**Z-series:** The PCV pipe comes out the left side of the engine block before it goes around and up the other side to the intake manifold where it connects to a rubber hose. Work this hose onto the pipe then spread and move the clamp back over the hose and pipe.

Follow the pipe back around the left side of the head. The bolt is bagged and labeled "PCV bracket," or it's taped to a ground wire that you may have removed with it. Install the 12mm bolt through the wire eyelet (if there is one) and then through the bracket into the head. Tighten the bolt until it's snug.

Follow the PCV pipe up to the intake manifold where another rubber hose connects. This hose should be connected and clamped to the PCV valve.

NOTE: If you worked on the engine block or otherwise removed the 10mm bolt and PCV bracket on the right side of the block, reconnect them now.

•**Automatic Transmission People:** A vacuum hose connects to a pipe coming up from under the firewall to a fitting on the rear intake manifold pipe.

Step 11: The Rest of the Vacuum and Hose Connections.

NOTE: There are hose and pipe layouts in Ch. 6, Pt. 2, Proc. 1. Use these and your labeling to put it all back together.

L-series: Early L-16 engines have a rigid vacuum advance line still connected to the carburetor. Connect the loose end to the distributor with a 10mm open-end wrench. All other models have at least a rubber hose to connect, from the side of the carburetor to the side of the distributor. If the hose has a T-junction, look for the hose connected to the vacuum switch on the front of the head or on the manifold. The hose you wrapped up near the carbon canister (mounted in the corner of the engine compartment) is attached to the "purge" marked on the top of the canister; connect it to the T. If your carbon canister hose didn't connect to a T, there should be an open pipe sticking out of the side of the carburetor base.

On those 1974-75 models that have a little solenoid mounted on the front left corner of the head, the vacuum hose to the distributor runs through the solenoid. The solenoid may be on the bench. If so, hook it up to the hoses and wires and let it hang until the valve cover is replaced. Connect the other end of that hose to the distributor.

Check the other hose to the solenoid and rejoin the wire connections by following the wire harness from the solenoid to the nearby plug(s).

•**1975 on Models:** You may have disconnected some hoses from switches and valves mounted on the engine compartment wall. I hope you labeled these. They will either connect to a vacant T or Y-junction, directly to the intake manifold, or directly to a switch on the manifold. Check all the hoses and connections. The manifold connections go either to the outside base of the carburetor or to a fitting on one of the front webs of the intake manifold.

If you have a remote BCDD solenoid valve, a hose will run from it to the outside of the carburetor. (See Ch. 6, Pt. 2 for diagrams showing how to identify this part.)

Find the PCV hose that connects a pipe on the engine block to the PCV valve at the back of the carburetor base and manifold. You should have a wire clamp to fit back over the hose. Make a note to check the PCV valve when the engine is running (Ch. 6, Pt. 2, Proc. 2). While you're here, look around to see if there are any open pipes or hoses that connect to the intake manifold. If there are, make sure that there isn't a hose nearby that's disconnected. On most models there will be an exposed pipe below the carburetor. You will probably want to run the engine with the air cleaner off to make final adjustments, so you'll have to plug this with a piece of hose with a bolt or golf tee stuck into it. This will prevent a vacuum leak. Look around for any other exposed pipes or hoses that connect to the intake manifold and hook them up too.

If you have a belt-driven air (smog) pump, connect the hose to the check valve in front of the carburetor and behind the thermostat housing. Tighten the hose clamp.

•**Z-series:** If you have any doubts about where these hoses connect, consult Ch. 6, Pt. 2, Proc. 1. Most of these hoses should now be stored around the carburetor or intake manifold. Canadian vehicles may vary in hose and valve layout.

1) **Pre-1983½ California and pre-1985 Federal Vehicles:** AIS pipes—You have one or two of these pipes attached to the exhaust manifold. Use your 24mm or 10 or 12in adjustable wrench to tighten this (these) nut(s) clockwise into the manifold.

2) **Carbon Canister and Distributor Hoses:** You labeled these "Canister Hoses." They are off of and lying near the carburetor. Connect the hoses to the vacant pipes below the fuel pump on the right front corner of the head. Connect them as you labeled them #1, 2, and maybe 3. NOTE: On some 1986 models, one of the hoses was routed through the front engine slinger. (If this slinger was removed, replace it now.) Reroute the hose through the slinger hole then connect it to the vacant pipe on the canister mounted in the left front corner of the engine compartment.

Check that all these hoses go somewhere and connect to something.

3) **BCU and Vacuum Switch (some 1983½ and all 1985 on trucks don't have a BCU):** You labeled these two hoses "BCU side" and "BCU/Vac Switch." Connect the former to the side (under the clips) of the BCU, which is bullet-shaped. The BCU/Vac Switch hose goes to a T or Y-connector, which joins those two valves.

4) **Vacuum Switches and Vacuum Control Valve (some 1983½ on and all 1985 trucks):** These hoses should be bundled around the carburetor, labeled "Control/Switching Valve Hoses." The valves are mounted on the right fender wall. You labeled these hoses with letters that correspond to the pipes (connectors or valves) to which they connect. Match and reconnect these hoses. Make sure all electrical plug connections to the valves (switches) are intact.

5) **Altitude Compensator (California and high altitude models):** If you have a high altitude kit, there's a vertical cylinder with two pipes mounted on the right fender wall. If you have a regular high altitude package, there's a rectangular box with three or four pipes on it. In either case, you taped and wrapped these hoses together near the carburetor. They should be color-coded or labeled to match their position on the valve. Carefully push them onto their pipes.

6) **510 Cars with Z-20S California Engine:** You odd people have a BPT valve mounted on the fire wall. Three hoses connect to the valve as labeled "top, side, and bottom." You bundled them all together with a label "VVT valve." Find and hook them up to the valve.

•**Everyone:** You'll have to run the engine with the air cleaner off to get it started, so any disconnected vacuum hoses that are exposed directly to the intake manifold vacuum must be plugged. There's an unplug-

ged hose behind the anti-backfire valve you'll have to plug with a small bolt, golf tee, or the like. There may also be a hose leading directly to a fitting on the front of the intake manifold. Plug this.

Look around through the maze of hoses to trace their connections to see if any are disconnected, especially the ones going directly to the intake manifold fittings. Now's a good time to identify and reconnect any other emissions hoses that you may have unplugged by accident (Ch. 6, Pt. 2, Proc. 1).

Step 12: Connect the Temperature Sender Wire and Other Switch or Solenoid Wires and Hoses; Connect Temp Sensor(s), Manifold Heater, and Ground Wire.

•**L-series:** The temperature sensor screws into the thermostat housing (see Ch. 8 for the exact location). One wire leads to it and plugs either into a connector or directly into the sensor tip. Use pliers to crimp the bullet connector if it fits loosely.

If any other wires or hoses are still disconnected and you can't see where they go, look for help in Ch. 6, Pt. 2, Proc. 1.

•**Z-series:** You have some disconnected wires with plugs or an eyelet somewhere on the right fenderwall. Find the one labeled "thermo housing" and connect it (or them) to the senders(s) or pigtail connector(s) attached to the side of the thermostat housing.

If you disconnected some wires at the carburetor base, look for a two-prong connector labeled **"Carb Base"** and plug it into its mate. There may also be an eyelet with one or two ground wires on it. Remove the unoccupied 10mm bolt from the manifold and resecure the eyelet.

Another sensor may be under the manifold labeled **"Manifold Sensor"** awaiting its connector.

Recheck all your connections.

Step 13: Replace the Air Conditioner Idler and Belt.

You only need to do this if you have an after-market air conditioner in the vehicle. It's a good thing you took notes on where the idler was mounted when you removed it. You may have to remove a few nuts and bolts to get it back into position, usually at the front and right side of the head.

When the idler is in place, reinstall its drivebelt following the instructions in Ch. 6, Pt. 2, Proc. 4. Check all the other belts too, while you're at it.

Step 14: Replace the Fuel Pump and Hoses.

You may not have removed the pump, but if you did, replace it now. It may be still connected to the inlet hose and sitting on the fender wall. Go to Ch. 6, Pt. 1, Proc. 10 for guidance in replacing the fuel pump and fuel lines, including the inlet hose, the fuel return, and the fuel outlet.

•**L-series Mechanical Fuel Pump, L-16 and L-18 People:** If you are an old L-16, you have an inlet hose and a fuel return hose going to the carburetor. Check them and replace if necessary. You may also have to fit the hose(s) from the fuel pump to the carburetor. Models vary in hose routing. Since you have the manifolds off the head, the hoses will have to be reinstalled and checked for leaks when the engine is running (Ch. 6, Pt. 1, Proc. 2).

L-20B People: Connect the fuel return hose and pump outlet hose to the pipes going to the carburetor if they're not already.

•**Electric Fuel Pump People:** Reconnect the fuel lines to and from the carburetor. You labeled these #1 and #2 for easy matching (check the hose routing in Ch. 6, Pt. 1). Also replace the fuel pump hole cover in the front left side of the head or simply remove the plate and replace the gaskets. Install the gaskets and insulator the same way they are installed on the fuel pump as described in Ch. 6, Pt. 1, Proc. 10.

•**Z-series Mechanical Fuel Pump People:** If you have a bracket with two pipes attached to the intake manifold, connect the two hoses labeled #1 and #2 to their rightful pipes. If your fuel hoses attach directly to the firewall, your pump is already on the head.

Make sure your hose connections are all made to the right pipes.

•**Electric Fuel Pump People:** You disconnected the fuel hoses from pipes under the intake manifold. Match them to the correct pipes, refit, and secure them.

Step 15: Reconnect the Coolant Bypass Hose.

•**L-16 and L-18 People:** You removed the bypass hose(s) and crossover pipe. Find it and determine which end goes to the three-way junction on the lower right front of the engine. This hose end is bigger than the other one or two which may go to the thermostat housing and/or below the carburetor. Work from the carburetor toward the three-way junction, connecting the hoses to pipes and brackets. Position the pipe onto the front of the head so the bracket lines up with one of the three studs on the front cover. Remove the nut or bolt if necessary. Pick up the fuel pipe, if it isn't already on the head, and figure out which bracket goes on first. Install the brackets in their proper order and tighten the 10mm nut or bolt with washer until snug. Install the hoses, clamps in place, over the bypass pipes below the carburetor and at the three-way coolant junction. Do the same with the fuel line at the fuel pump and at the carburetor inlet. (For more specifics, see Ch. 8, Proc. 3 or Ch. 6, Pt. 1, Proc. 10.)

•**L-20B People:** If you haven't yet replaced the coolant bypass hoses, now's your last chance (Ch. 8, Proc. 3). When that's all squared away and you're ready to attach the crossover pipe to the head, start below the carburetor with that hose if it's there (1977 on). Then follow the pipe around, and connect a hose to the thermostat housing if there is one.

Go back to find a bracket that may be waiting to be fitted under one of the intake manifold bolts, as well as the bracket that may be over the thermostat housing, and finally the one on the cover on the front of the head. Remove the bolts under these brackets, line up the holes, and retighten the bolts.

The bypass hose should be connected to the crossover pipe at the lower right side of the engine. If the hose clamp is in place, slip the hose over the pipe sticking up, then position and tighten the clamp. Now all the hose(s) and brackets on the pipe should be in place, clamp(s) tight.

Step 16: Reconnect the Heater Hose to the Elbow.

•**L-series:** Find the vacant elbow fitting on the back right of the head. The heater hose should be nearby, begging to be put back on. Make sure the hose clamp is in place and the elbow pipe is smooth—not covered with scale. Install the hose and tighten the clamp.

•**Z-series:** There should be two hoses under the intake manifold below the carburetor. The front hose connects to a pipe at the three-way junction, which is bolted to the side of the timing cover. Install it, then find the heater hose that goes from the firewall to the fitting under the manifold and install that.

Tighten both clamps until secure.

•**Everyone:** If any of these hoses is deteriorated or soft, save yourself hassle and expense later by replacing them now. (For more on cooling system hoses, see Ch. 8, Proc. 3.)

Step 17: Reconnect the Battery Ground Wire, Engine Slinger, and Battery.

If your battery is out, clean its terminals and install it now (Ch. 7, Proc. 1).

•**L-series:** All L-16 and some L-18 engines have the ground wire connected to the back of the starter motor. If this isn't you, find the wire which you should have stashed with the battery. The slinger, if removed, should be in a baggie or box. Remove the 12mm bolt from the right side of the head and position the slinger line-side-up, lining up the bolt hole with the hole in the head. Next, line up the small end of the cable, install the 12mm bolt and washer and tighten until snug (not too tight, please).

•**Z-series:** Your negative cable should be with the battery or near it. It connects at the engine below the thermostat housing. Remove the 12mm bolt and reattach the cable there.

Step 18: Reconnect the Upper Radiator Hose.

See Ch. 8, Proc. 4.

You removed the upper radiator hose from the thermostat housing. It is easy to connect but should be replaced if swollen, cracked, or otherwise deteriorated.

Step 19: Refill the Cooling System.

See Ch. 8, Proc. 5.

When all cooling connections are sound and the radiator drain plug is closed, refill the system with the right liquid. When it's full, keep your eyes open for leaks.

Step 20: Adjust the Valves (cold), Replace the Cam Cover Gasket, and the Cover.

See Ch. 3 Proc. 4 (5-10).

Before you install the cam cover, coat the cam lobes with moly grease or pour engine oil over the camshaft to cover all of the lobes and rockers. Pour some oil over the timing chain and cam gear too.

Step 21: Adjust and Replace the Spark Plugs and Wires.

Spark plug checkout and replacement information is in Ch. 3, Proc. 3 (4-8). NOTE: If you rebuilt the engine, leave the spark plugs out until you have made sure there is adequate oil pressure. (See Ch. 10, Proc. 15.)

Step 22: Get the Engine Started.

NOTE: Read the precautions in Ch. 10, Proc. 15. Most of this information is for engine rebuilders, but it also might help those of you who have done only head and/or timing chain work.

When there's oil in the engine and water in the radiator and all tools and wires are away from the fan blades, you can start the engine. If all of the electrical connections are sound, it should turn over. After the carburetor is full of fuel and the gas pedal has been pumped a few times, the engine should start. Make sure the coil wire is intact between the coil and the distributor cap.

If you have problems starting the engine or keeping it running, go to Ch. 4 for help.

When the engine starts, make sure all the dash warning lights go out, then go back to the engine compartment to check for oil and water leaks that may occur at any hose connections that you disturbed. Retighten clamps with the engine stopped if necessary. Keep an eye on the engine temperature; after a few minutes of running, let the engine cool, recheck the coolant level, and top it up if necessary. Run the engine some more until it is fully warmed up, then shut it off and read the next step.

If the engine doesn't run well, check for vacuum leaks (listen for hissing sounds). If the distributor was removed or any of the carburetor settings were disturbed, you'll have to retune the engine.

NOTE: If you had oil in the water or water in the oil (bad head gasket) you'll want to change the coolant soon and/or the oil to rinse the system(s) (Ch. 8, Proc. 2 and/or Ch. 3, Proc. 2.)

Step 23: Readjust the Valves (hot).

See Ch. 3, Proc. 4.

You may not feel like doing this, but it will save your valves.

Step 24: Retorque and Readjust.

After **500 miles** you'll have to retorque the cylinder head bolts and reset the valves. The retorque has to be done when the engine is stone cold. The valves should be readjusted hot. Adjust them, then leave the cam cover off to cool the engine and retorque the head.

The procedure for retorquing is the same as for regular torquing (which should be done every 12,000 miles), except that you start off with head bolts that are already tight so you have to loosen and retighten each head bolt, one at a time.

First remove the cam cover (Ch. 3, Proc. 4). Loosen the #1 head bolt just a little (counterclockwise); then retighten the bolt with a torque wrench to the torque listed for your engine. Following the tightening sequence illustrated in Proc. 6 (4), repeat the loosening and retightening on the rest of the bolts in the proper order. When all ten bolts are tight, replace the cam cover (Ch. 3, Proc. 4).

Part 2: TIMING COVER, TIMING CHAIN & FRONT OIL SEAL

This part of Chapter 9 deals with the front of the engine: the timing chain, the two gears it runs (one on the camshaft and one on the crankshaft), the timing chain's components, and the timing cover. The timing chain, situated at the front of the engine, syncronizes the cam and crank shafts.

Many overhead camshaft engines have rubber timing belts, but L or Z-series engines have a double-roller steel timing chain. I understand that aside from being a sturdy engine component, these chains are popular with the heavy metal people, who chrome them and wear them as belts, bracelets, and neckties. You may be driving a jewelry store and not even know it.

PROCEDURE 1: DIAGNOSE TIMING CHAIN TROUBLES, RESET CAM GEAR TIMING, AND CHECK THE CAMSHAFT FOR WEAR

Condition: You hear rattling coming from the front of the engine when you first start it cold, or when it is idling, or you're here for routine maintenance and want to check out the condition of the timing chain.

Tools and Materials: Basic tool kit, cam cover gasket, 27mm or 1-1/16in socket or open-end wrench or large adjustable wrench.

Remarks: Like everything else in your engine, the timing chain and gears wear out. A timing chain should wear almost as long as the engine, depending on how well the engine has been maintained. Timing chain stretch (it's actually wear) is helped along by poor maintenance, e.g., not changing the oil often enough. You'll first notice the chain rattling for a while when the engine is started cold, until the oil pressure pushes the tensioner out against the chain to take up the slack. As the wear increases, you'll hear the rattle any time the oil pressure is low, which is mostly at idle. When the chain is shot, it will rattle all the time.

If you hear the rattling all the time, you might want to adjust the valves (hot) while the cam cover is off the engine (Ch. 3). It's a good idea to examine the chain and gears each time you adjust the valves.

A chain can "stretch" a little and not be worn out. A stretched chain will change the valve timing slightly and can be corrected by resetting the cam-gear-to-timing chain position. I'll explain how in the following steps.

Step 1: Remove the Cam Cover

See Ch. 3, Proc. 4.

Step 2: Check for Obvious Signs of Chain Wear.

NOTE: Z-series chains are less exposed then L-series.

When the **cam cover** is off, you can see the top part of the **timing chain**. Take a look at the left (driver's) side of the chain and the flat inside of the cylinder head, just above the top of the guide, next to the chain. If the chain is really sloppy or stretched, you might see some wear where it has been hitting the head.

Another place to look for chain troubles is at the **chain rollers**, those shiny round pieces evenly spaced between the links. When the gear teeth get worn, their edges get sharp and tend to break or scar the rollers.

If any of these places show wear, consider replacing the timing chain only if the engine itself is worth it. You can determine whether your engine's worth restoring piecemeal, completely or not at all by reading the Introduction and Proc. 1, Pt. 1.

Step 3: Find TDC #1 Cylinder Compression Stroke and Check for Chain Wear.

To check timing chain adjustment, you must set the engine with #1 cylinder at exactly Top Dead Center of the compression stroke, an important point of reference. Make sure that the transmission is in Neutral and

the wheels blocked or the emergency brake ON and remove the spark plugs Ch. 3, Proc. 3. **Z-series:** You need only remove four plugs.

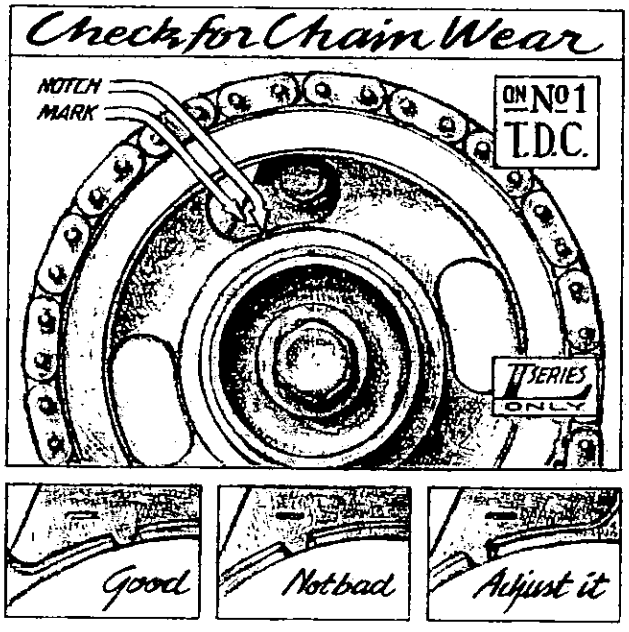
If your vehicle is pre-1974, you may be able to turn the crankshaft simply by applying hand pressure to the fan belt between the fan pulley and the alternator while pulling or pushing on the fan blades with your right hand. If it doesn't work—the fan spins—use the regular method.

To turn and set the crankshaft position precisely, fit a 27mm or 1-1/16in wrench or socket, or a large adjustable wrench, on the bolt in the center of the crankshaft front pulley. Turn it from underneath the front of the engine or from above, whichever is easier (see Ch. 13, Pt. 1, Proc. 3). Some car and truck people may have to remove the skid pan under the front of the engine (Proc. 2 [9]).

Find Top Dead Center (TDC). Watch the two front camshaft lobes and turn the crankshaft until they are both pointing up like rabbit ears (L-series) or both down (Z-series). NOTE: There is a detailed description of this in Ch. 13, Pt. 1, Proc. 3.

Look down around the top of the crankshaft pulley to find the ignition timing indicator and mark(s) cut into the edge of the pulley. The position and style of indicator differ; check the illustration to determine which model and engine you have. Find the "O" on the indicator or large groove on the pulley. Turn the crankshaft *counterclockwise* a little way past that point and stop. Slowly move the crankshaft back *clockwise* to take up the slack until the groove is even with the "O" or indicator (pointer). If you hear a *slap* or see *play* in the chain while changing your direction of rotation, there is slack in the chain. A new chain and components will have little or no slack, unless the head has been resurfaced (Pt. 1, Proc. 4[8]).

When the engine is at exactly TDC, the left (driver's) side of the chain should be taut. If it isn't, try again.



Look behind the cam gear through one of the holes cast into the gear. Find the plate bolted to the front of the cam tower. There is a tiny oblong mark in the plate, right where the back edge of the cam gear meets the plate. There is also a groove cut into that back edge of the gear. And, on the front of the gear, right where the fuel pump drive mounts against it, you should see the tops of some numbers—#1, 2. or 3. The numbers correspond to gear positions in relation to the camshaft and chain. Each position the gear is moved changes the cam timing by 4°. Initially, the gear is set on the #1 (L-16) or #2 (L-18, L-20B, and Z-20, 22, and 24) position.

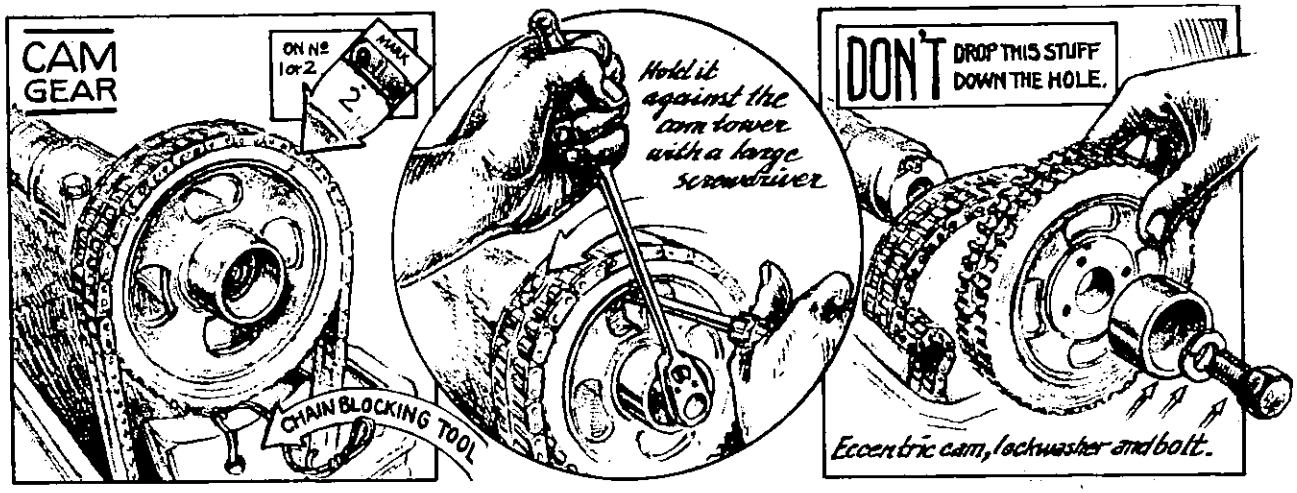
If the top of number #1, 2, or 3 is visible and the V-groove is to the left (driver's side) or directly below the oblong mark, the timing chain does not need to be adjusted; however, if the V-groove is to the right (passenger) of the oblong mark, adjustment is needed.

If adjustment is necessary, now might be a good time to do it.

Step 4: Change the Position of the Cam Gear (cam gear timing).

You need a timing chain blocking tool for this step. If you remove the cam gear without this tool, you'll have to do major work. For instructions on how to fit the tool and remove the cam gear, turn to Pt. 1, Proc. 2 (3-6) and the rest of this step. You can leave the fuel pump in place, but be very careful not to break the arm while loosening the bolt and removing the gear.

When the gear is separated from the chain, look at the numbers on the edge of the gear, near the teeth. You want to replace the gear matching the next highest number—2 or 3—with the marked link. When you've got



that figured out, slip the gear under the chain and fit the tooth next to the corresponding number into the marked link. Pull the gear and chain up toward the front of the camshaft. Lift the gear up onto the end of the cam. The shoulder on the back of the gear must fit over the front of the cam, and the dowel in the cam must fit into the hole in the gear. If you have trouble getting the gear up onto the camshaft, place a long screwdriver through the hole in the gear with the tip against the front cam tower to force the gear up and into place. If the dowel hole won't line up with the pin, you may have to use your channel-lock pliers to turn the camshaft until the hole and the dowel match up.

When the gear is all the way on the camshaft, find the fuel pump drive eccentric and the 19mm bolt with its lockwasher. Install these pieces by following the instructions in Proc. 3 (10). Be very careful not to break the fuel pump arm. When the bolt is tight, you can remove the chain blocking tool.

Step 5: Check the Camshaft for Wear.
See Pt. 1, Proc. 4 (9).

Step 6: Replace the Cam Cover
See Ch. 3, Proc. 4 (10 and 11).

PROCEDURE 2: REMOVE THE TIMING CHAIN AND COVER

Condition: The timing chain needs to be replaced.

Tools and Materials: Basic tool kit, large straight-bladed screwdriver, 27mm or 1-1/16in socket (and breaker bar and cheater pipe [Ch. 13, Pt. 2]), nut and bolt baggies, masking tape, marker pen, 1 gallon of solvent or kerosene, an assistant, medium grit emery cloth.

Remarks: When the timing cover is removed and replaced with the head and oil pan still on the engine, you run the risk of tearing the gaskets that seal between the cover and head (above) and/or pan (below), especially the pan gasket. The cover is tightly sandwiched between them. Therefore, be extra careful if you're pulling off the cover with the gaskets still bolted to the engine.

If you're doing major work, follow the assembly sequence carefully, which is head on first, cover second and oil pan last.

Step 1: Drain the Cooling System Completely and Remove the Radiator.
See Ch. 8, Proc. 4 (1-4).

Step 2: Remove the Negative Battery Cable.

See Ch. 7, Proc. 1 (3).

Remove only the negative cable and cover the battery with a dry rag.

Step 3: Remove the Fuel Pump.

See Ch. 6, Pt. 1, Proc. 10.

Step 4: Remove the Fan Belt, Fan and Pulley.

See Ch. 7, Proc. 9 (3 and 4).

If your engine has additional belts for the smog (air) pump and the air conditioner compressor, see Ch. 6, Pt. 2, Proc. 4. For Power Steering Pump belt, see Ch. 12, Proc. 13.

Step 5: Remove the Cam Cover.

See Ch. 3, Proc. 4 (4).

Step 6: Remove the Spark Plugs.

See Ch. 3, Proc. 3 (1-3). **Z-series People with Eight Plugs:** Remove only four, one from each cylinder.

Step 7: Position the Engine at #1 TDC and Remove the Distributor.

See Ch. 13, Pt. 1, Proc. 3 and Ch. 3, Proc. 5 (7).

Step 8: Remove the Water Pump Inlet Fitting.

Find the snout from which you removed the lower radiator hose on the right side of the timing cover at the front of the engine. One or two other hoses are still there. One goes rearward to the heater outlet and the other (L-series) goes to a pipe that crosses in front of the head. Loosen the clamps and remove the hose(s). Examine the hose(s) and clamps, and if it's (they're) old, replace it (them) (Ch. 8, Proc. 1 and 3).

To remove the snout from the timing cover, take out the two 12mm bolts above and below the snout with a socket and extension. The fitting should come free with some light tapping and pulling. Put the bolts and fitting in a baggie labeled "inlet fitting."

Step 9: Remove the Oil Pump and Skid (splash) Pan.

•**510, 610, 710, and 720:** The oil pump is at the bottom right hand corner of the engine, held to the timing cover by four 12mm-headed bolts.

Get down on your back and peer up at the front end of the engine. If there's a **skid pan** (510, 610, 710, and 4WD)—a wide steel cover—under the front part of the engine, you'd have to remove it; otherwise, you'll be able to see up past the front of the engine.

If you have a skid pan, use your 10 or 12mm socket and extension to loosen or remove the four or six bolts that hold it in place. Support the pan as you loosen the last two bolts. Keep the bolts and washers together in a baggie labeled "Skid Pan." Set the pan on the parts pile.

The oil pump is square, with four 12mm bolts on its bottom side. There's a gasket between it and the timing cover. Use the socket and extension to loosen and remove three of the bolts with their washers, both flat and lock. Loosen the fourth bolt and leave it in place to keep the pump from falling out. The pump will be full of engine oil, so watch out for the flood when it comes off (4WD People, see below). When you have a grip on the pump, take out the last bolt and the pump should come out at an angle. If it's stuck, twist it until it comes loose.

•**Early 4WD People:** Because you have a differential under the engine, you may have to jack up the engine slightly to get the oil pump out. Do this by removing the right motor mount nut (Ch. 10, Proc. 7 [15]), then place a block of wood between the right side of the oil pan and the jack and raise it high enough to make clearance. But first try to remove the oil pump as the engine sets to see if the pump will clear. Lower the engine once the pump and spindle are out.

•**Everyone:** The drive spindle should come out with it. If it doesn't, you'll have to reach into the pump hole and pull it straight out. Get up and dump the oil out of the pump and bag it, the four bolts, their washers and the spindle labeled "oil pump and spindle." Set them aside unless you want to check them for wear now (Ch. 10, Proc. 14).

Step 10: Remove the Crankshaft Pulley.

The crankshaft pulley is attached to the front of the engine by a large (27mm or 1-1/16in) bolt and washer. To loosen the crank pulley bolt, you need to lock up the crankshaft to keep it from turning and use the proper socket and breaker bar. The best way to lock up the shaft is to remove the starter motor (Ch. 7, Proc. 7.) and lock up the flywheel with a large, straight-tipped screwdriver.

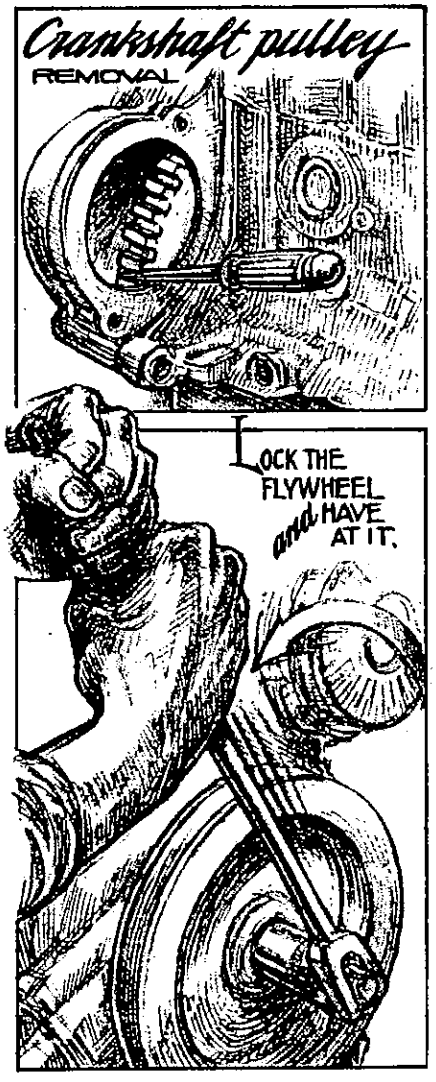
When the starter motor is out, you'll see an edge of the flywheel and its teeth. Have your assistant position the screwdriver so the tip is between two teeth and its shaft is against the bottom of the starter motor hole. **Z-series**: You may find it easier to jack and support the front end and position the screwdriver from underneath.

Fit the socket squarely onto the pulley bolt. Position the breaker bar handle so it is pointing to one o'clock as you face the engine.

First making sure your helper has a firm grip on the screwdriver, pull the socket and bar to the left (counterclockwise). Watch your hands so that the socket won't slip off the pulley bolt. If the bolt won't budge, use a cheater pipe to coax it along (Ch. 13, Pt. 1, Proc. 2). When the bolt comes loose, remove the tools and thread it out by hand. The washer should follow.

Now reach down, put your hands on both sides of the crankshaft pulley and try to pull it off the shaft. You'll probably have to wiggle it from side to side a little. If it doesn't come by hand, put a bar or the long screwdriver between the timing cover and the pulley and pry a little on each side to work the pulley forward.

Before you completely remove the pulley, grab it and turn it one way or the other to return the pulley position to the Top Dead Center mark on the pointer and pulley. Now you can slip the pulley the rest of the way off the shaft. Set it on the parts pile to examine for wear later. NOTE: If the pulley won't come off, try tapping it with a hammer. If it still doesn't move, you may have to use a puller (Ch. 13, Pt. 1, Proc. 2).

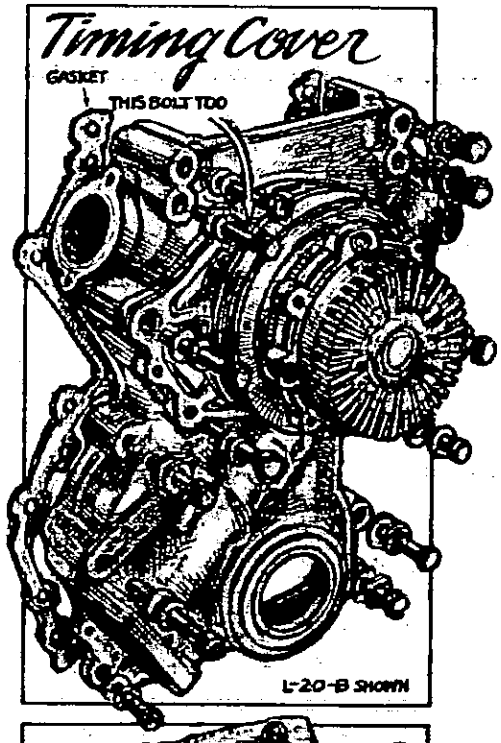


Step 11: Examine and Fix a Worn Crankshaft Pulley.

Wipe off the shiny snout on the pulley. This part fits into the engine and rubs against the front main oil seal. The snout (shaft) can become grooved and cause an oil leak. Rub your finger along the length of the shaft. If you feel a groove or see one, take the pulley to a machine shop and ask them to put a shaft repair sleeve over the worn shaft. A few companies make these sleeves that are sold through bearings supply stores and machine shops. Your shaft diameter is between 1.887 and 1.893in. Consult your machinist about the shaft's condition and how to install such a sleeve.

Step 12: Remove the Timing Cover.

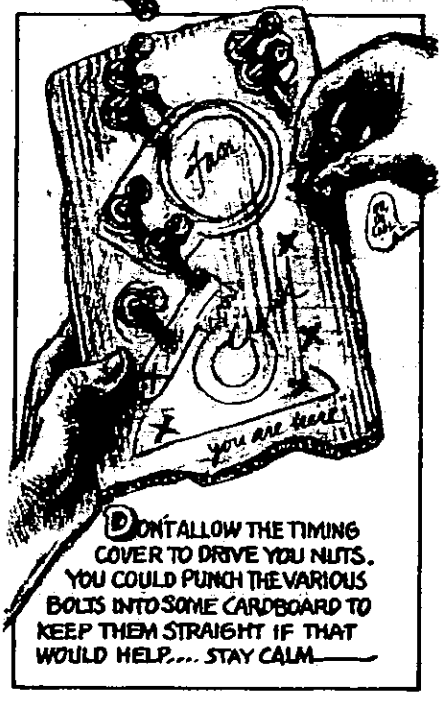
First study the illustration for the bolt locations on the sides of the cover so you can find and get to them. There are also two bolts (L-series) or four (Z-series) on the top edge of the head if the cylinder head is still on the engine. Look down at the top front edge where the bolts go through the head and into the timing cover. Use your 10mm open-end or socket, if you can, to get at them. Put the bolts with their washers in their own baggie labeled "top cover bolts."



Next, if the oil pan is still on the engine, you have to remove six of the front oil pan bolts. Grab the 10mm socket and extension, then lie on your back, feet facing forward. Find the oil pan (the bottommost part of the engine) and remove the six 10mm bolts around the front edge of the pan. You may need to clean off some of the grease that inevitably covers them. Put the bolts and washers in a baggie labeled "oil pan."

Clear a 1ft space on your bench. As you remove the bolts, arrange them in a formation matching the shape of the timing cover. Or draw the shape of the timing cover on a sheet of stiff paper and punch the bolts through the paper in the pattern to match the cover. Their lengths are different, so they'll have to go back in the right places. Emperor Hirohito mandated this design to infuriate American mechanics after he surrendered in 1945. (Another case of Hirohito's revenge.)

The next bolts to retrieve are the 10mm ones around the sides of the cover. Start at the bottom. There is one on each bottom corner. The one on the right-hand side is a little hard to spot.



•**Z-series Power Steering Pump People:** Your pump and its idler pulley will be bolted to the cover. The details on their removal are in Ch. 12, Proc. 13.

•**All Z-series People:** You have vacuum pipe brackets bolted to the cover. One is on the left side (third bolt down) and one is on the right (second bolt down). If you haven't yet disconnected the vacuum hoses that connect to these pipes on the right side, do that now as described in Pt. 1, Proc. 1 (11).

•**L and Z-series People:** You may have other brackets and added ones not installed by the factory that are held on by cover bolts. As you remove them or any others mentioned here, tape the bolts with masking tape and label each one describing what it held. If you have an after-market air conditioner, you'll have endless other spacers and frustrations to deal with before you can get the cover off. Make a sketch of the position of everything.

Work your way up the left (driver's) side of the cover. The next bolt and the one above that are also 10mm. On L-series engines with air (smog) pumps, one of these bolts may hold the lower part of the air pump bracket. Remove and line up the bolts in their positions on the bench.

Next remove the 10mm bolt on the top right of the water pump. It is long on **L-20B and Z-series** and cannot be removed. It will have to stay in the pump and cover, but fully loosen it first. **L-16 and 18 People**: Put this bolt in its position on the bench.

Get your 12mm socket and extension ready. On the right side of the cover, find a 12mm bolt above the bottommost bolt position. The timing indicator may be there; it will stay on the cover, held by a 10mm bolt.

Next remove the two 12mm bolts on the right side of the water pump, but ignore the two other 10mm bolts around the left side. Put the bolts in the center of the bench pattern.

Now find one or two more 12mm bolts on the top right corner of the cover. The alternator bracket is attached here and will come off when one of the bolts is pulled out, if it's not still connected to the alternator. Reach over the top of the timing cover to remove one or two other 12mm bolts on that corner, and another 12mm bolt right below it. If any of the bolts holds the smog pump or air-conditioner bracket, you may have to loosen or remove the bracket or mount to get the bolt out and free the cover.

Some of the cover bolts have lock and flat washers; keep them on the bolts and lay the bolts, in order, on the bench. Check around the edges of the cover to make sure that you removed all of the bolts. Now the water pump is only attached to the cover by two 10mm bolts. Leave them alone, they will come off with the cover.

Don't try to move the cover side-to-side as you remove it. Depending upon the sealer last used to fix the cover in place, it may be hard to get off. First, try to pull it out by grabbing the front of the water pump. If the oil pan or head is off, you can get your fingers behind the timing cover to help pull it off or tap it with a soft hammer. Pull the cover straight out. A little coolant may spill out of the back of the cover. Try not to get coolant in the oil pan if it's still on the engine.

Caution: If the head or pan is still in place, be careful to pull the cover straight out so the head gasket and oil pan gasket, on the top and bottom surfaces of the timing cover, aren't damaged.

Step 13: How to Clean the Timing Cover and Its Gasket Surfaces.

The timing cover is one of the most trying parts of the engine to clean. To save yourself trouble, put enough solvent in a drain pan to cover the timing cover when it's laid flat in the pan and let it soak for awhile.

When you clean it, use a coarse wire scrubbing pad and a scraper to knock off the outside grease, and a razor blade to scrape off the gasket surfaces—top, back, and bottom. All the old gasket has to come off. *Don't gouge the aluminum cover where the gaskets fit.* Don't worry about the varnish stains on the inside of the cover, just wipe out as much of the brown stain as you can.

When you've done that, sand the gasket surfaces smooth with emery cloth. Give the cover a final rinse in clean solvent and or a strong spray of warm water. Then dry it off with a clean rag.

You removed the water pump inlet from the right side of the timing cover. You should have a gasket for it (or get one—see Procedure 3). Scrape the surface of the inlet, which may still be attached to the heater and bypass hoses, until smooth. Do the same for the matching surface on the cover.

If you have a new gasket that fits between the distributor base and the timing cover, you may want to remove the housing (two 10mm bolts), clean off the mating surfaces, and replace the gasket. If you don't have a new gasket, leave it alone.

If you plan to replace the gasket or the water pump, now's a good time to do it (Ch. 8, Proc. 5).

Step 14: Check the Head Gasket and Oil Pan Gasket.

If you removed the timing cover with the head or oil pan in place, you may have ripped or damaged either of those gaskets. If you don't intend to remove them, you're in a tough spot.

If the head gasket was damaged, it will probably be a little distorted or bent out of shape. You can probably straighten the front of the gasket, taking care not to bend it again when you replace the timing cover.

The oil pan gasket tends to rip. If this happens, you can sometimes glue it back in place with **hardening** gasket sealer and let it set. Then, just before you put the timing cover back on, coat the top side of the oil pan gasket with **non-hardening** sealer and hope that the ripped gasket stays put and does its job when you replace the timing cover. Go to a parts store for these sealers.

If the gaskets are badly ripped, you have to remove the head or pan to replace them.

PROCEDURE 3: REMOVE AND REPLACE THE TIMING CHAIN, TENSIONER, GEARS, AND GUIDES

Caution: Once the timing chain has been disconnected from the engine, *do not turn the camshaft or crankshaft* any more than very slightly in either direction or you may cause piston and valve damage, if the cylinder head is still on the engine.

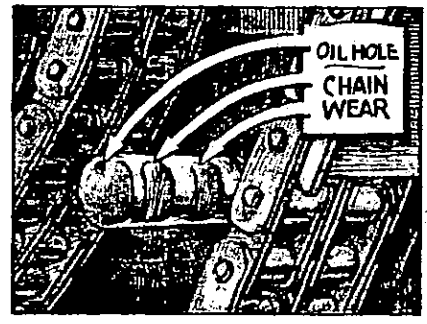
Condition: The timing cover is off and the chain is exposed. You have concluded that the chain, tensioner, gears and/or guides have to be replaced. (I strongly recommend that you replace the gears, tensioner, and guides along with the chain.)

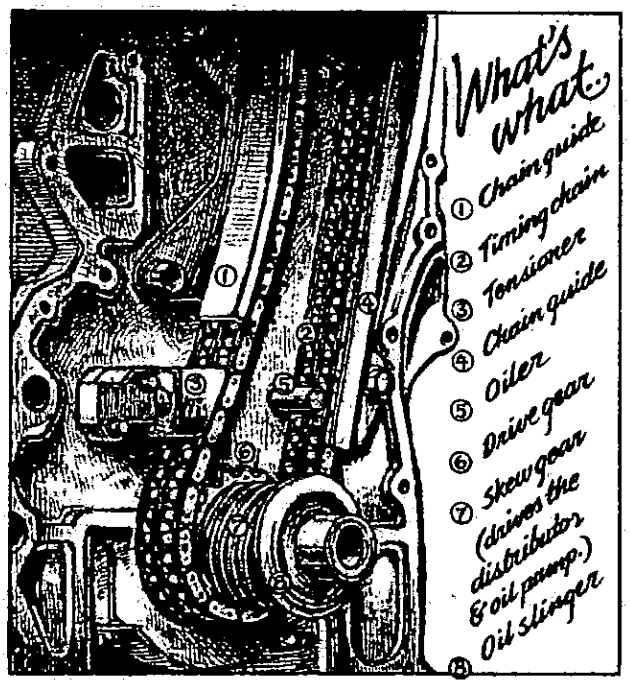
Tools and Materials: Basic tool kit, new timing chain, straight and maybe curved guides, tensioner, front oil seal, timing cover gaskets, water pump inlet gasket, distributor base to timing cover gasket maybe, oil spray nozzle (if necessary) and oil pump to timing cover gasket (Step 4), a stout screwdriver, soft or brass hammer or steel hammer, and wooden dowel.

Step 1: The Oil Spray Nozzle.

NOTE: Many L-20B and Z-series engines don't have this nozzle. Check to be sure if it's there.

Follow the left, straight side of the chain down to where it contacts with the crank gear. Just above that point and inside the chain, you'll see the **oil spray nozzle**, a little cylinder sticking out of the engine. When the chain gets sloppy it hits against the left side of the nozzle, causing wear. If there is wear, look closely to see if the chain has cut grooves in the nozzle. And if so, have the grooves cut into the hole through the center of the nozzle. If the nozzle is worn through, you should replace it. New nozzles are available from Datsun/Nissan or sometimes in after market kits. Nozzle replacement instructions are in Step 5 below.





Step 2: Remove the Pieces.

Remove the camshaft gear if it's still bolted to the cam. These instructions are found in Pt. 1, Proc. 2 (3 and 6). Before you pull the cam gear off of the cam, note how the chain tensioner looks when in place and compare reality to the illustration. The chain tensioner will pop out when the cam gear is removed.

Start removing the chain by removing the **chain tensioner**, on the right side of the chain at the bottom. The spring and fiber block have already come partway or all the way out of the tensioner housing. Set them aside. The tensioner housing fastens to the engine with two 10mm bolts. Remove the bolts and put them in a baggie labeled "tensioner." There may be a gasket behind the tensioner. Carefully scrape it off with a blade and keep it with the tensioner bolts.

The **chain guides** are also held in place with two 10mm bolts each. The curved guide is on the

right side, and the straight one is on the left. Take the curved one off first and keep the bolts in a baggie labeled "curved guide." Lay the guide aside and work on the left, straight one. Bag and label these "straight guide" bolts.

The chain can now be disconnected from the crank gear and set aside. If you plan to reuse the chain for any reason, put it in a container and cover it with oil.

Step 3: Remove the Oil Slinger, Oil Pump, Distributor Spindle Drivegear, and the Crankshaft Gear.

Find the rectangular key sticking out of the front end of the crankshaft. This key keeps the front pulley, which you removed, in place on the shaft. Behind the key sits the **oil slinger**, a rounded lipped steel piece that keeps oil off of the front seal.

To remove the slinger, turn it so the keyway cut into the slinger lines up with the key in the crankshaft. Then pull the slinger forward off the shaft..Once that's done, the gears, which are usually a little stuck, have to come off. First try to pull the **brass or white metal skew gear** off by hand. If this fails, try tapping it forward with a soft or brass hammer. If you don't have a soft hammer, use a steel hammer and piece of wooden dowel. Also try fitting a screwdriver behind the gears and prying the gear forward, but take care not to score the soft gear teeth. Set the gear aside.

Remove the **crankshaft gear** the same way as the brass gear, by tapping it. If you're going to replace it, you can use a steel hammer to tap it off.

If the sprocket gear refuses to come off, there's another method you can use if you have a butane or propane torch. Heat the gear by passing the flame over and around it to expand it. It only takes a little bit of heat—about thirty seconds' worth. The trick is to heat the gear evenly without also heating the crankshaft. When hot, tap or pry the gear forward off of the shaft, but *don't touch the hot gear!*

Step 4: Get the Replacement Parts You Need.

Independent parts dealers often sell a box containing all the necessary parts—cover gaskets, front seal, gears, tensioner, guides, and timing chain. The oil pump gasket, spray nozzle, distributor, and water inlet gaskets may not be included. If not, get them from Datsun/Nissan. Some kits also include a new oil spray nozzle, the steel cylindrical piece described in Step 1. Check the parts in the kit and compare them to the list above. The quality of these kit parts varies. If you buy the parts from Datsun/Nissan, something I prefer to do because of their fine quality, the pieces are sold separately, not as a kit. The same is true for many other non-kit, non-dealer suppliers.

Be sure you get the right chain. If you know your engine type and vehicle year, you can't go wrong. If in doubt, take the old gears and chain to the parts store for comparison. If you want to remove the water pump, to replace or check it, get a water pump gasket too. Another thing you may need is a sleeve; check the crankshaft pulley for wear (Proc. 2[10]). If you're rebuilding the engine and want to remove the crankshaft, you can do it now if the flywheel is off (Ch. 10, Proc. 8).

Step 5: Remove and Replace with a New One the Oil Spray Nozzle.

•**Nozzle People Only:** If Step 1 tipped you off that the nozzle is damaged, replace it now. Don't remove the nozzle until you have a new one.

Clamp your Vise Grips around the nozzle and turn it clockwise, then counterclockwise. It should move. Work the nozzle forward out of the engine block. Take the new nozzle and, with the oil hole positioned as in the illustration in Step 1, start it into the block. Fully install it with a few light hammer taps.

Step 6: Scrape the Old Timing Cover Gasket Off the Engine Block.

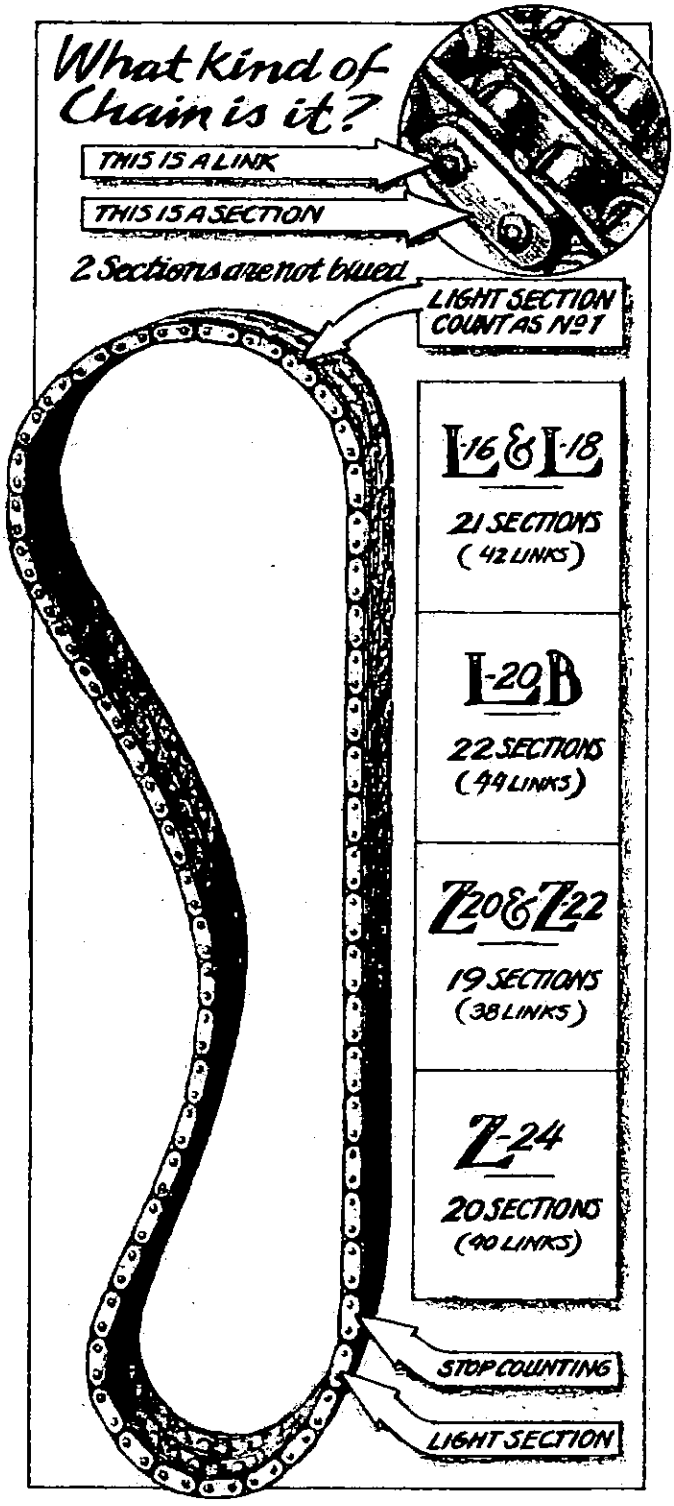
Use a razor blade to scrape the old gasket off of the block. It takes time, but you should do it thoroughly to prevent leaks later. Be careful not to drop pieces of the old gasket into the oil pan as you scrape, or damage the head or oil pan gasket with the razor blade if either or both of them are in place. When all the old gasket is off, sand the gasket surfaces smooth with emery cloth.

NOTE: If the head and/or oil pan are off the engine stop here and wait until the head has been installed, see Pt. 1, Proc. 6. If the head or pan is on, go to Step 7 below.

Step 7: Install Crankshaft Gear, Distributor and Oil Pump Drive Gears, and the Oil Slinger.

Make sure there are three rectangular "woodruff" keys at the front end of the crankshaft, flat or parallel to the crankshaft; otherwise the gears will not slide on.

The crankshaft gear is the smaller of the two gears you're going to replace. On one side of the crankshaft gear is a small punch mark that coincides with a gear tooth. This timing mark must face outward. Before you slip the gear over the end of the crankshaft, make sure that it is clean and that the three woodruff keys are in place, pointing straight up in the 12 o'clock position. If you need to turn the crankshaft (only a little bit unless the head's off), you can slip the front pulley over the keys and use the pulley to turn the shaft. The gear will only fit on the crankshaft when the keyway inside the gear lines up with the keys in the shaft. You may have to tap the gear lightly with a soft hammer to get it started home. The small punch mark (dimple) should be visible on the left side of the gear-driver's side.



Step 8: Install the Straight Timing Chain Guide.

Find the two chain guides—one straight and the other curved. For this step I will call the left side of the engine the "drive side" and the right side (which is to *your* left as you face the engine) the "slack side." The straight chain guide goes on the drive side. The curved guide and tensioner go on the slack side.

Put the guide bolts in baggies labeled "straight guide" and "curved guide" bolts. Find and clean the straight guide bolts, which have only lockwashers on them. Position the guide, rubber side toward the center of the engine, aligning the holes in the guide to the threaded holes in the engine.

The top of the guide (the long end) will slip up into the front cavity of the head against the chain if the head is on the engine. Start the bolts into their holes and tighten them until snug and the lockwashers flatten out. Do not overtighten them.

Step 9: Install the Timing Chain.

Match the position of the crankshaft with the position of the camshaft. You will match that punch mark on the camshaft gear which will line up with another marked link on the timing chain. There will be 42 chain links (21 sections) on L-16 and L-18 engines, or 44 links (22 sections) on L-20B engines, 38 links (19 sections) Z-20 and Z-22, or 40 links (20 sections) Z-24 engines, when everything is finally set up. The punch mark on the crank gear should be close to the 3 o'clock position.

•Head and/or Oil Pan On-the-Engine People: Pick up the cam gear and new timing chain. Find the punch marks and numbers #1, 2, and 3 on the outside (front) of the cam gear. The timing chain should have two sections (**L-series:** 42 or 44 links apart, **Z-series:** 38 or 40 links) which are a lighter shade than the rest. If the chain has no marked sections, you'll have to count them out yourself. Hold the cam gear with the numbered side facing you. Hang the chain in front of you so the marked links are on *your* right. Drape the chain over the gear so the #1 (L-16 and L-18) or #2 (L-20B and all Z-series) marked gear tooth is on your right at about 2 o'clock. Fit the links of the topmost timing mark (section) on the chain over the #1 or #2 marked tooth of the gear. The timing mark (section) on the chain, on *your* lower right, will eventually fit over the marked gear tooth on the crankshaft gear.

If the chain has no marks, hang it over the cam gear so the numbered gear tooth fits between a two links. Count down the chain from the link (the round pin that connects the sections) just below the marked gear tooth on the cam, 42 or 44 links (L-series) or 38 or 40 links (Z-series), and mark this section with some paint or a file scratch. The marked crankshaft gear tooth will fit within this section, exactly 42, 44, 38, or 40 links between the marked gear teeth. If the head is on, slip the chain down and through the front of the head with the marked links on *your* right. Line up the lower link with the punch mark on the crank gear. Keep tension on the marked side of the chain. NOTE: Make sure you have counted the correct number of links for your engine type (see the Introduction at the front of this book for engine identification).

•Head-Off-the-Engine People: Because the head isn't on your engine, you'll have to fit the timing chain on the crank gear with the marks matched. Have a friend hold the chain taut while you install the curved chain guide (Step 12). Then, with the chain still held by your assistant—*and the crank gear marks matched*—insert the chain blocking tool to keep the chain from falling down. You can use the cam gear to hold the chain up and give you an idea of how the marks should match. After the blocking tool is in place, remove the cam gear and put it aside until the head is on. The chain can stay flopped down over the blocking tool and guides. When the curved guide and the blocking tool are where they should be, install the tensioner (Step 13). Skip Step 10 until the head is on.

Step 10: Install the Cam Gear.

The dowel pin sticking out of the front of the camshaft will fit into a hole on the inside of the cam gear. There are three holes in the cam gear, each corresponding to one of those numbered gear teeth on the front of the gear. With a new chain, you are concerned with the #1 or #2 camshaft position. Put an old chain on the way it came off, as you marked it. Locate the dowel pin and #1 or #2 hole in the gear.

Lift the camshaft gear up onto the front of the camshaft. The dowel pin should fit over the #1 or #2 dowel pinhole. If you have trouble fitting the gear onto the dowel pin, clamp channel-locks on the middle (not shiny) part of the camshaft to turn it one way or the other, aligning the dowel pin to the hole. Once lined up, the little shoulder on the gear should fit over the end of the camshaft and remain there by itself. Remember, keep tension on the marked side of the chain. Check that the gear is flush to the camshaft and that the marks are all exactly where they should be. Recount the links between the gear teeth if your chain doesn't have marked sections. This is *really* important.

Now find the fuel pump drive (an offset round piece) and cam gear retaining bolt and washer. Clean these pieces and put the bolt with its washer through the hole in the fuel pump drive. Put the flat side of the drive against the cam gear and start threading the bolt into the cam. Look for the little numbers under the back of the fuel pump drive that correspond to the dowel holes. Only the tops of the numbers will be visible. Turn the fuel pump drive around until the top of the number, which is matched to the timing chain mark, is most visible.

The cam gear bolt is 19mm. The torque is pretty high, 85-115 ft.lbs, so use a breaker bar and socket. Go back and read Pt. 1, Proc. 2 (6) to see how to keep the cam and gear from turning. The only difference is that you'll be turning clockwise to tighten, therefore you'll have to position the wrench or screwdriver on the opposite (left) side of the head. You'll have to turn the gear and chain clockwise to get the wrench or screwdriver to lock against the head or cam tower. Your assistant can hold the screwdriver while you work the breaker bar.

Tighten the bolt as much as you can, making sure the wrench or screwdriver is locking the gear properly and the tool isn't damaging the head, cam tower, or the top of the radiator (if it's in place). You'll feel it when

you can't get the cam gear bolt any tighter. The washer behind the cam gear should be flat. You may have to turn the whole camshaft counterclockwise a little before you can remove the wrench or driver.

If your timing cover is off, the engine, the curved guide, tensioner, drive gear, and oil slinger probably need to be installed. Go on to the next steps and install them. If your timing cover is on the engine, return to Pt. 1, Proc. 6 (5).

Step 11: Install the Distributor/Oil Pump Drive Gear and Oil Slinger, and Take Up Chain Slack.

Find the drive gear. It's a brass or white metal "skew" type gear and can be correctly installed only one way. On the inside edge of the gear, you'll notice one side is chamfered or more angled than the other. This side goes on toward the crankshaft or rearward. Align the slot in the gear with the keys in the shaft and tap the gear home with a soft hammer or wooden dowel.

The oil slinger fits on the shaft with the dished part facing rearward toward the gears. Align its slot with the keys, and when it's on, turn it to keep it in place.

Slip the crankshaft pulley over the crankshaft snout with the keyway and keys aligned. With the pulley in place you can turn the crankshaft by hand, but wait. Put your 19mm socket on the cam gear bolt, then turn both the cam and the crank *counterclockwise* about an inch. Remove the 19mm socket and slowly turn the pulley clockwise until the three keyways are at the 12 o'clock with all slack taken out of the timing chains left (drive) side. Remove the pulley. The engine should be at #1 cylinder TDC.

Step 12: Install the Curved Timing Chain Guide.

The curved guide goes against the right (slack) side. **L-series:** The long end goes up. **Z-series:** The top of the guide is flush with the block deck top. Find the bolts in the baggie you marked "curved guide." There should be flat and lock washers on each one. The bottom hole in the guide should have two settings (a figure-eight cutout) drilled into it. Put the bolt into the hole closest to the outside edge of the guide. Start the bottom bolt into its hole and tighten until the washer just touches the guide. Push the guide from the top against the chain while you install and tighten the upper bolts (4-7 ft.lbs—that's not much). Now tighten the lower bolt. There should be a small gap between the bottom of the guide and the chain.

Step 13: Install the Timing Chain Tensioner.

The new tensioner comes in three parts (five including the gasket behind the tensioner, which is not necessary and a round black washer around the chromed sleeve next to the rider). Engine oil pressure and the coil spring keep the black rubber rider pushed out against the chain, taking up the slack on the lower part of the chain. Smear some sealer on the gasket (if you have one) and match it up with the back, drilled side of the tensioner.

Find and clean the two tensioner bolts (and tensioner parts if you're using the old one) and keep them handy. Put the spring into the chromed sleeve attached to the black rubber rider. Hold the tensioner in your left hand with the drilled side toward the block and the oil hole on top. Put the spring into the hole and turn the rider so the thick part of the rubber is up.

Now you have to fit the tensioner, rider and all, against the chain, and compress the spring and rider while you move the tensioner housing toward the chain and line up the bolt holes with the holes in the engine. Don't let go or the parts will fly. When you're sure the holes are lined up, start the bolts into their holes. Tighten the bolts evenly until the lockwashers flatten but not too tight. With a new chain, tensioner and guides, the rider should be flush with its housing. Clearance is zero when the assembly is installed. It may have more clearance if the head was resurfaced and (L-series) a shim kit wasn't installed.

Recheck the timing marks on the gears and chain to make sure nothing changed when you weren't looking. Think back over what you did. Are all the guide bolts tight as well as the tensioner, and the camshaft gear bolt? Take a look at the whole scene and compare it to the illustrations.

Try rotating the crankshaft by turning the crankshaft pulley bolt clockwise with a 27mm or 1-1/16in wrench or socket. Turn it one full rotation. NOTE: It will be much easier to turn if the spark plugs are out. If the *engine* is out of the vehicle, be careful not to roll it over when doing this.

The engine may seem hard to turn especially if it is new. Stiffness is okay as long as the rotation is smooth. If it binds or locks up, stop—something's wrong. Recheck the valve to piston (or crank) timing or how the rocker assembly is bolted to the head. Don't force anything.

It turns without a hitch? Rotate the engine back (counterclockwise) until the timing marks are where they should be as described in Step 9.

Good job!

PROCEDURE 4: REPLACE THE TIMING COVER AND FRONT OIL SEAL

Condition: You've completed Proc. 3; the timing chain, gears, guides and tensioner are on the engine, and the camshaft and crankshaft are properly timed.

Tools and Materials: Basic tool kit, timing chain blocking tool (if your cylinder head is off the engine), 1-1/16in or 27mm socket and a breaker bar, maybe a cheater bar, an assistant, grease, water pump inlet gasket, and cam cover gasket.

Step 1: Clean the Timing Cover and Remove the Front Oil Seal.

If you haven't already soaked and cleaned the timing cover (Proc. 2 [13]), do it now. As hard as this cover is to clean, it's got to be done well, which means getting into all those nooks and crannies. I sympathize.

The cover bolts should all be neatly organized on the bench in the order you removed them. You should have two long, thin gaskets for the timing cover, a new front main oil seal, a water pump inlet gasket, a distributor-mount-to-timing-cover-gasket, and maybe an "O" ring that fits around the distributor shaft.

The front main oil seal fits into the hole where the crankshaft sticks through the timing cover. It is press-fitted and should knock out easily. Push the old one out from inside by laying the cover face down over the edge of the bench so the seal will fall free when punched out with a screwdriver. (See the illustration in Proc. 5 [4].)

NOTE: **L-16 and Some L-18 People:** take care not to damage or bend the **timing pointer**, the sharp arrow or sawtoothed-shaped thing held on the front of the cover by a Phillips screw.

Before you install the new seal, sand out the inside of the cavity with emery cloth and wipe it clean. Take one last look at the gasket surfaces on the timing cover. They should be really smooth—top, bottom, and especially the back side. Do the same for the matching surface of the engine block. When the cover is ready, lay it on its back and find the new oil seal.

Coat the outside edge of the new seal with a little bit of silicon or other sealer, then press it into place with your thumbs—flat side (with numbers) facing out. You may need to push the seal home with a flat piece of wood tapped with a hammer until it's flush with the outside of the cover. Pack a little bit of non-fiber grease all around and between the inner lips of the seal.

Turn the cover over on its face and wipe off any excess grit on the gasket surfaces. Pick up the two long side gaskets and match them to the cover to make sure they fit it exactly. Coat both sides of both gaskets with sealer and carefully position them against the engine block, lined up with the proper holes. If the head and oil pan are on the engine, the ends of the gaskets should fit neatly against them. The cover gaskets should be on the two pointed dowels sticking out of the block, and should stay in place.

•Head and/or oil Pan Gaskets On-the-Engine People: When you install the cover, the top must fit under the head gasket without destroying it. The same goes for the oil pan gasket on the bottom. It takes a little skill and a lot of luck, and it helps to have a friend hold the head gasket up while you perform the feat. I use a touch of #2 sealer smeared on the bottom of the head gasket and top of the oil pan gasket to help slide the cover in.

Install the cover parallel to the engine block, not tipped at all. *Watch what's going on all the time.* Pick up the cover and take a deep breath. Start it between the head and oil pan gaskets, then work it toward the block. Ooohso easy now. When it's in between the gaskets, you may have to tap the cover all around to get it moving. Watch those gaskets like a hawk watches a lame rabbit.

•**Head On, Oil Pan Off-the-Engine People:** Make sure the front of the head gasket doesn't get bent. The cover should go on without a hitch. You may have to tap it lightly to get it over the dowels.

•**Everyone:** If you haven't already cleaned (wire brushed or wire wheeled) the bolts that hold the timing cover to the engine, do so now. It is important that every thread is clean and that all of the corrosion on the rest of the bolts is scraped off. Lightly coat the threads with anti-seize compound when they're clean. Do one bolt at a time so they don't get mixed up.

Before you start installing the cover bolts, check that the timing cover gaskets are still in place, visible but not sticking out of the sides of the cover.

Step 2: Install the Timing Cover Bolts.

These 10mm and 12mm bolts and their washers should be waiting, clean and in order, on your bench. Refer to Proc. 2 (12) for the pattern and cover removal information.

Get all the bolts started in the holes. Work your way up the sides of the cover, inserting each bolt from the pattern you made on the bench or piece of stiff paper. The sizes of the holes in the cover and thickness will give you a clue as to bolt diameter and length. If you have an air conditioner, smog pump, or power steering pump the brackets usually share some of the timing cover bolts.

•**L and Z-series:** You may have one or more of these bolt-ons. Position the bracket next to the cover to match and align the bolt hole locations. You may have to remove some of the bolts you already put in. Read the labels you made and/or the sketch to replace the bolt-ons. After-market air conditioners are the worst to replace, so good luck. The alternator adjustment bracket goes under the top (L-16 and L-18 engines) or second (L-20B and Z-series engines) 12mm bolt, down on the right side of the cover. On old L-16 and L-18 engines, the timing indicator attaches to some of the cover bolts.

•**Z-series:** You have two vacuum brackets to attach. These are flopped over on the right side of the engine. Position the pipes and align the brackets; the left side bracket fits under the third bolt down, the right side fits under the second bolt down on that side. You will now have to reconnect the two or three vacuum hoses below the fuel pump to the vacant pipes (Pt. 1, Proc. 6 [14]). **Power Steering Pump People:** Refer to Ch. 12, Proc. 13 for details on your bolt-ups.

Just start the bolts into the holes but don't tighten any of them yet. Don't forget the bolts that go through the water pump in the center of the cover. Be sure to get those two top 10mm bolts that go through the head and into the timing cover. The same goes for the six front oil pan bolts you removed (if the pan isn't on the engine, ignore this). Remember the front oil pan bolts. These bolts should be bagged, labeled, and stashed somewhere nearby.

Next, lightly tighten all the 12mm bolts until they begin to resist, then make a pass over all the 10mm cover bolts, but do not fully tighten any of them yet. Continue alternating between the 12mm and 10mm bolts, always starting with the top two 10mm head/cover bolts. Tighten all the bolts evenly but DON'T tighten any of the 10mm bolts as tight as the 12mm bolts.

Triple-check that you've tightened all the bolts and that the cover is flush against the block all the way around. Okay? Now you can finally begin to tighten the bolts—first the 12mm, then the 10mm bolts.

Step 3: Install the Crankshaft Pulley.

NOTE: If the head is off the engine, install it (Pt. 1, Proc. 6) before you do this step. Otherwise the risk is high that you'll mess up the timing. After the cam gear and chain are on, come back here.

Find the pulley and the large bolt-and-washer combination that hold the pulley to the front end of the crankshaft. These parts should be clean. Be sure to clean out the little "V" groove or grooves cut into the outside edge of the pulley, which act as ignition timing marks for engine tuning. You can make them more visible by painting them with a light-colored paint. If you haven't already roughed up the pulley snout (oil seal surface) with emery cloth, do so now. If you sleeved it, install as is.

Find the keyway inside the snout that fits over the nose of the crankshaft. Line up the keyway to the keys in the crankshaft and slide or tap it on. The top of the key should be level with the end of the crankshaft. If the keyway is lined up, the pulley will slide right on, making a "thunk" when it reaches the oil slinger.

Pick up the 27mm or 1-1/16in bolt and large flat washer. Clean the bolt's threads and start it into the crankshaft. I recommend that you use a socket and breaker bar. Be careful when torquing this bolt not to flip the engine off the bench.

You'll need a helper to get you through this one. If you remember taking the bolt off, you'll recall how to insert the large screwdriver in between two of the flywheel teeth through the starter motor hole. The crankshaft will try to turn clockwise when you tighten the bolt, so place the tip of the driver between the teeth near the top of the hole to keep it from turning (see the illustration in Proc. 2 [10]).

When your assistant is ready, and you have the socket on the bolt, gently begin to tighten it clockwise. Tell your assistant each time you are going to put muscle into the bolt so he or she doesn't let the screwdriver slip causing you to smash against the body. The torque on this bolt is 113-130 ft.lbs., which is *tight*. I use a cheater pipe over a good quality breaker bar. You can feel when the bolt is tight.

Voila—the timing chain is in.

If your oil pick up screen and pan are off, reinstall them now (Ch. 10, Proc. 13).

Step 4: Gather Together the Oil Pump, Its Gasket, and the Drive Spindle.

•**4WD People:** You may have to loosen and remove the right motor mount nut and washers then jack up that side of the engine to install the oil pump, if the engine's in the vehicle (Ch. 10, Proc. 7 [15]) to get at the mounts. Jack up the engine by putting a block of wood under the oil pan on the right side. Raise it only high enough to get the spindle and pump in. Lower and retighten the motor mount (Ch. 10, Proc. 11 [2]).

•**Everyone:** Find the gasket that fits between the oil pump and the timing cover. It's odd-shaped, comes in the engine gasket set, and is considerably thicker than the one that seals the two halves of the pump together. Pick up the **drive spindle**, about six inches long with a skew gear toward one end. Clean the spindle with solvent and wipe it dry. Coat the smooth bearing surfaces on either side of the skew gear with oil or grease. Find a small punch mark next to the gear on the long side of the spindle. Hold the oil pump upside down so the cylindrical sleeve end is up, and locate an oil hole drilled diagonally into the sleeve near its end. Put the short end of the spindle into the oil pump sleeve. Match the key on the end of the spindle with the slot down inside the sleeve. (This will connect the spindle to the internal oil pump gear.) Rotate the spindle around in the pump until the punch mark and drilled hole are aligned.

Figure out how the gasket matches the pump configuration and the pump matches the timing cover, then set the pump gasket and spindle aside. Now make sure that the crankshaft is at TDC of the #1 cylinder. You can turn the crankshaft from the front pulley bolt. If the pulley has one notch in it, align that with the 0° mark on the indicator. If your pulley has numerous notches, align the biggest or second from the right (passenger) to the pointer. (If necessary, see Ch. 13, Pt. 1, Proc. 3 about TDC.)

Step 5: Install the Oil Pump and Drive Spindle.

NOTE: If the engine has been apart completely, fill the oil pump half full with clean motor oil before installing it.

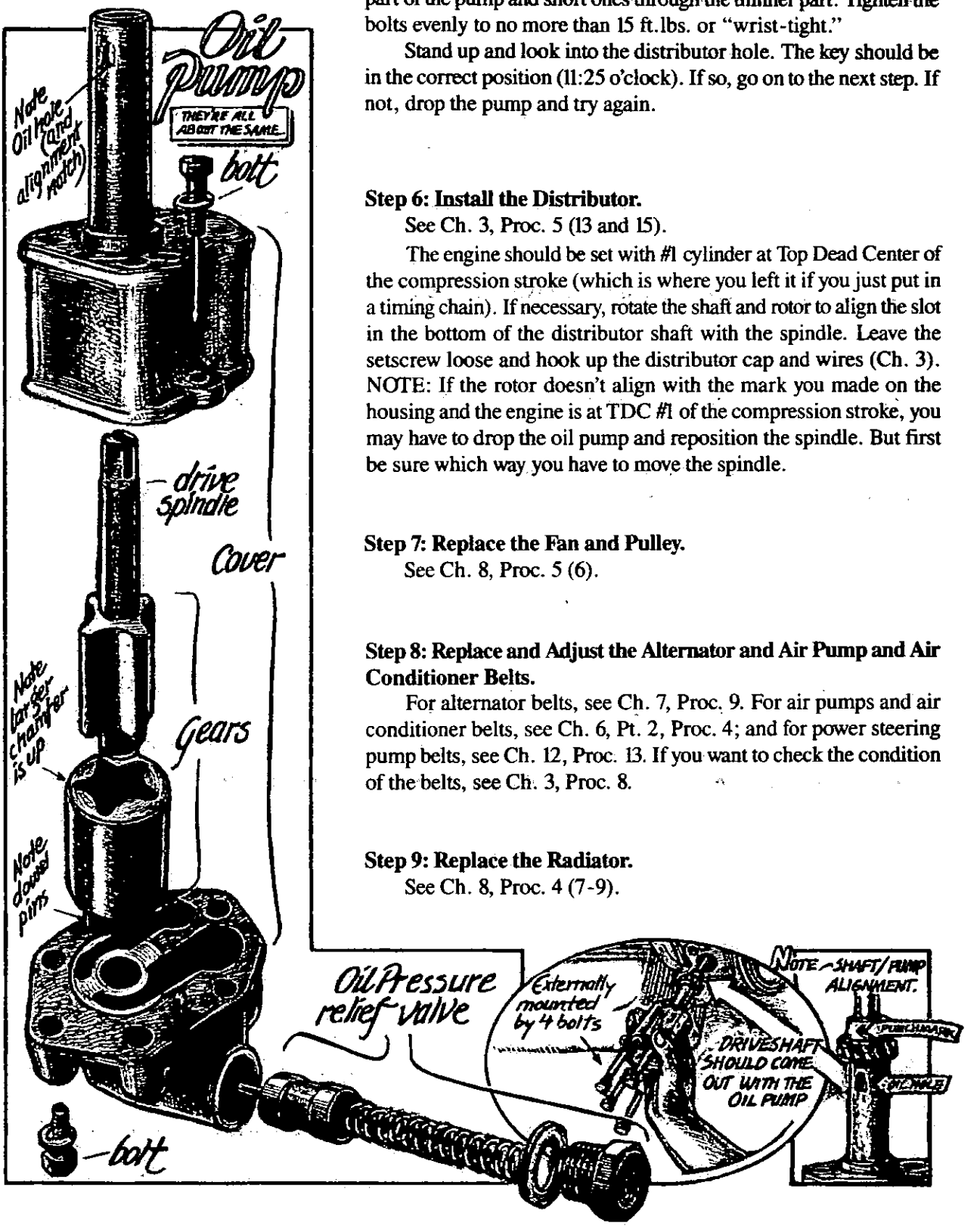
Look at the exposed skinny end of the spindle. The key in it drives the distributor. The key's position has to be correct for the engine to run. When the pump and spindle are in the engine, the key at the top will appear to be at the 11:25 o'clock position. You can see it by looking down into the distributor hole from the left side of the engine. Pretend the front of the engine is parallel with the 12:00 o'clock position. If the gear is one tooth off, the key angle will be nowhere near 11:25.

When you're ready, find the four 12mm bolts (with a flat and lock washer on each bolt) for the oil pump, in a baggie marked "oil pump bolts." Which bolts go where will be obvious from the thickness of the pump. Lay the pump, gasket, and spindle under the right front of the engine. Lie on your back with a 12mm socket, extension, and ratchet. Recheck the position of the spindle and drilling marks and install the gasket. Wipe off the surface of the timing cover; it has to be perfectly smooth. Look at the shape of the pump and turn it so the

holes match the holes in the timing cover. Tilt the pump at an angle and recheck the marks. Now turn the spindle 3/16in clockwise (to the right). Carefully slip the spindle up into the engine and push the pump flush with the timing cover.

Hold the pump against the cover, align the gasket, and install the four bolts, long ones through the thick part of the pump and short ones through the thinner part. Tighten the bolts evenly to no more than 15 ft.lbs. or "wrist-tight."

Stand up and look into the distributor hole. The key should be in the correct position (11:25 o'clock). If so, go on to the next step. If not, drop the pump and try again.



Step 6: Install the Distributor.

See Ch. 3, Proc. 5 (13 and 15).

The engine should be set with #1 cylinder at Top Dead Center of the compression stroke (which is where you left it if you just put in a timing chain). If necessary, rotate the shaft and rotor to align the slot in the bottom of the distributor shaft with the spindle. Leave the setscrew loose and hook up the distributor cap and wires (Ch. 3). NOTE: If the rotor doesn't align with the mark you made on the housing and the engine is at TDC #1 of the compression stroke, you may have to drop the oil pump and reposition the spindle. But first be sure which way you have to move the spindle.

Step 7: Replace the Fan and Pulley.

See Ch. 8, Proc. 5 (6).

Step 8: Replace and Adjust the Alternator and Air Pump and Air Conditioner Belts.

For alternator belts, see Ch. 7, Proc. 9. For air pumps and air conditioner belts, see Ch. 6, Pt. 2, Proc. 4; and for power steering pump belts, see Ch. 12, Proc. 13. If you want to check the condition of the belts, see Ch. 3, Proc. 8.

Step 9: Replace the Radiator.

See Ch. 8, Proc. 4 (7-9).

Step 10: Replace the Water Pump Inlet and Hoses.

The water pump inlet may still be connected to the long heater hose on the right side of the engine compartment. If you didn't scrape the old gasket off the mating side of the inlet, do it now. Coat the new gasket with some gasket sealer and find the two 12mm bolts in the baggie marked "water pump inlet." Lightly coat the threads of these bolts with anti-seize compound. Stick the gasket on the inlet and match the inlet with the hole in the side of the timing cover. Install the bolts and washers, tightening them with a socket until snug. Install the heater, radiator, and maybe bypass hose if necessary. Make sure the hose clamps are secure.

Step 11: Refill the Cooling System.

See Ch. 8, Proc. 2 (5 and 6).

Step 12: Replace the Skid Pan.

•**Car, 4WD and Some 2WD Truck People Only**: The pan should be around your house somewhere along with a baggie labeled "skid pan" with four or six bolts in it. You've probably tripped over it a time or two.

Line up the pan against or under the bolt holes and flanges it's attached to and install the bolts. Watch that you get the rear of the pan in correctly, especially on older models. Tighten the bolts with a 10mm or 12mm socket until snug.

Step 13: Replace the Cam Cover.

See Ch. 3, Proc. 4 (10).

The cover should be cleaned before it is replaced. You should also have a new gasket for it if the old one is shot.

Step 14: Reconnect the Spark Plug Wires and Replace the Spark Plugs.

See Ch. 3, Proc. 3 (4-8).

Step 15: Change the Motor Oil.

See Ch. 3, Proc. 2.

Do this if you have any gasket scraps or bugs in the oil, or if there isn't any oil in the crankcase, or if the oil needs to be changed anyway.

Step 16: You're Ready to Run.

The only problem you might have starting the engine is getting the ignition timing set so it will run. If you installed the distributor close to where you removed it, the engine should start. If all the wires are connected and there is spark (Ch. 7, Proc. 12) the engine should run, but you may have to turn the distributor to change the timing as you (or your assistant) tries to start the engine. When it starts, make sure the oil light goes out and reset the timing (Ch. 3, Proc. 6).

Check for leaks when the engine is running. Leave the hood open and look around. The cooling system is the biggest culprit. Recheck the coolant level as described in Ch. 8, Proc. 2.

PROCEDURE 5: REPLACE FRONT OIL SEAL, TIMING COVER IN PLACE

Condition: You have an your oil leak from the front seal.

Tools and Materials: Basic tool kit, 27mm or 1-1/16in socket and breaker bar, medium and long screwdrivers, silicon sealant or other hardening sealer, new front oil seal (a shaft sleeve if the pulley shaft is worn).

Remarks: Front oil seal replacement may not solve your problem. I have often replaced these seals on older engines for people who, after the seal is replaced, discovered that the main cause of their oil consumption was burning.

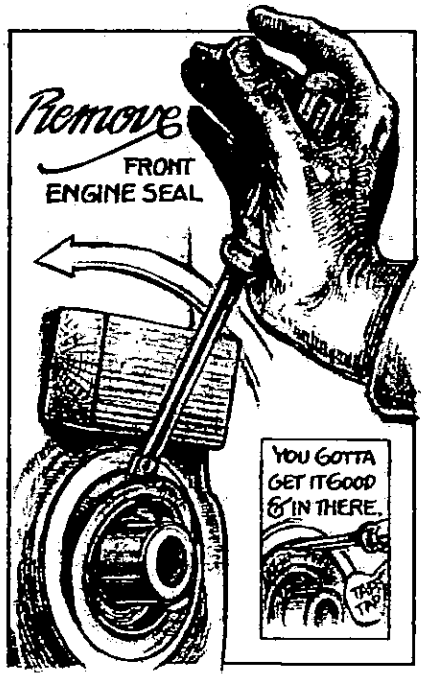
Step 1: Drain and Remove the Radiator.

See Ch. 8, Proc. 4 (1-5).

This isn't necessary if you remove the fan shroud and are careful not to damage the radiator.

Step 2: Loosen and Remove Alternator Belt and, if Fitted, Air Pump, Air Conditioner or Power Steering Pump Belt.

For the alternator belt, see Ch. 7, Proc. 9; for the air pump and air conditioner belts see Ch. 6, Pt. 2, Proc 4; and for the power steering pump belt, see Ch. 12, Proc. 13.



Step 3: Loosen Bolt and Remove Front Crankshaft Pulley.

See Proc. 2 (10 and 11).

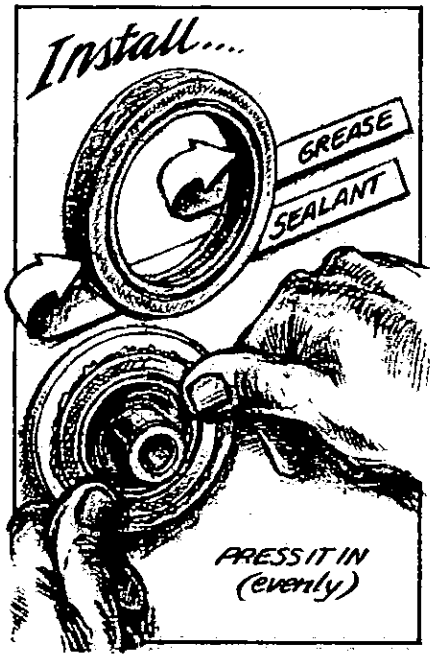
Step 4: Remove the Front Oil Seal.

The oil seal is pressed into the timing cover. Working from above, lever the seal out of the cover with a medium to long screwdriver. Use the crankshaft snout or a block of wood as the fulcrum. The screwdriver tip should be placed in or behind the seal. Push the lever handle toward the engine to move the seal a little bit. Reposition the tip to move it further. Keep prying until the seal comes out.

Step 5: Install New Front Oil Seal.

Wipe out the cavity where the seal fits with a clean rag. Sand off any burrs from around the edges or inside the hole with emery cloth. There should be a light coating of grease on the inside diameter of the seal; if there is none, put a dab on your finger and wipe it between the lips. Open the silicon or other hardening sealer and coat the outside diameter of the seal, just enough to hold the seal in place. None on the inside, mind you.

Before the sealant has a chance to harden, start the seal into the cavity flat or closed side forward, facing you. Use your thumbs to push the seal into place. If you can't get it started, tap around the seal with a hammer. Install the seal evenly, making sure it is flush with the cover.



Step 6: Install the Crankshaft Pulley, Washer and Bolt.

See Proc. 4 (3).

Step 7: Replace the Alternator, and if applicable, the Air Pump, Air Conditioner and/or Power Steering Belts.

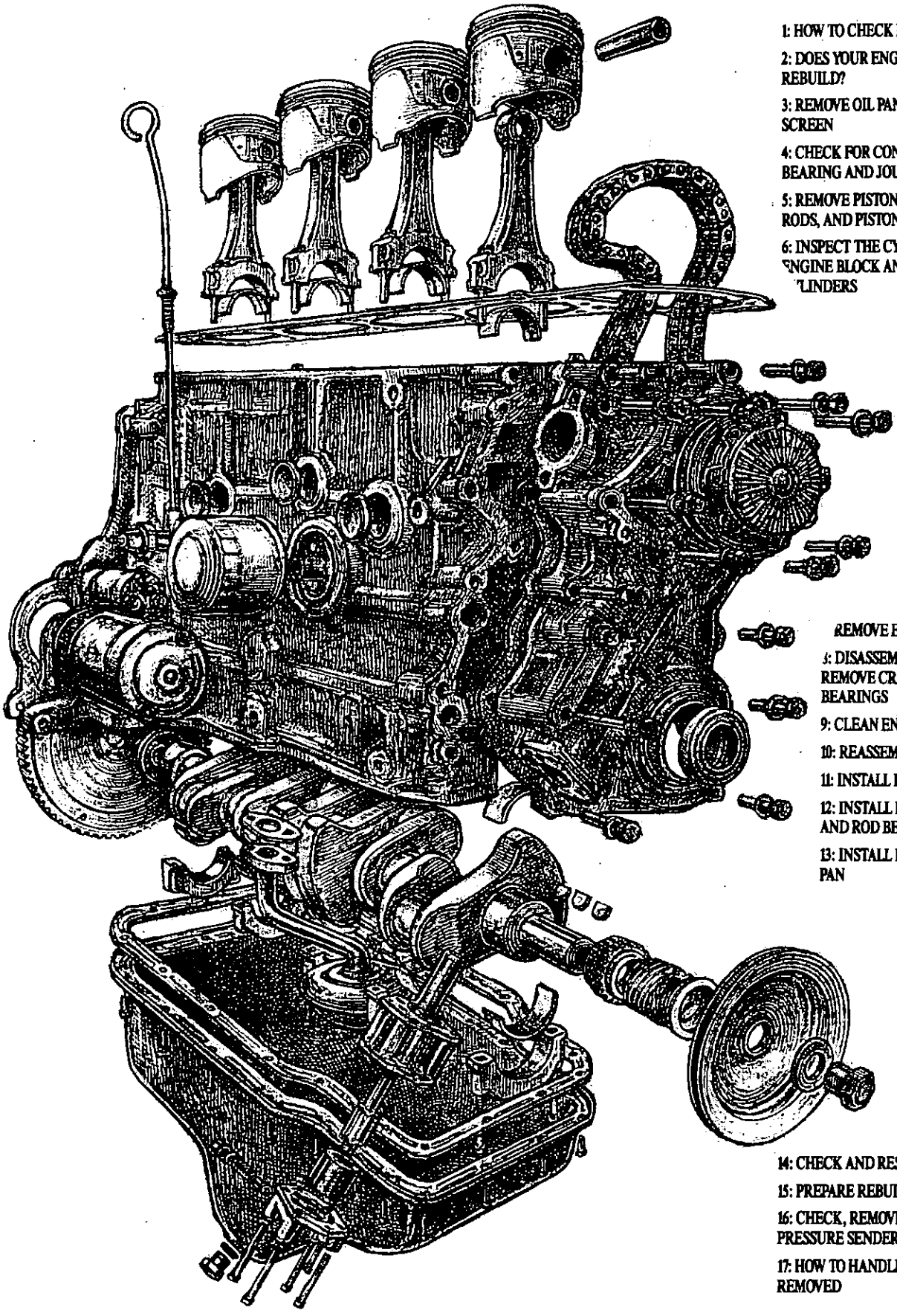
For the alternator belt, see Ch. 7, Proc. 9; for air pump and/or air conditioner belt(s), see Ch. 6, Pt. 2, Proc. 4; and for power steering pump belts, see Ch. 12, Proc. 13.

Step 8: Replace and Fill the Radiator.

See Ch. 8, Proc. 4 (6-10).

If you removed only the shroud, replace that.

Engine Rebuild



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CHAPTER 10
ENGINE BLOCK: REBUILD AND LUBRICATION

To the beginner an engine rebuild seems the most difficult of all auto repair jobs. It is indeed one of the longest and most involved, but taken step-by-step it is no harder than a tune-up and probably more satisfying. The important thing to remember is that **you can do it.** It is no more than a step-by-step process that, if done properly, will bring successful results.

An engine rebuild is a process of logic. It can be a lesson on how your engine works, one that will entertain you for miles. It is an exercise that should be done carefully one step at a time, doing each one completely until the whole comes together to make a running engine.

The sequence for dismantling and reassembling an engine varies with the job. How far you disassemble it and what you rebuild depends on what you find out is wrong (and right) and how complete a job you want to do. This chapter is written to complement Ch. 9, Pt. 1 and 2. Most of the diagnostic and overall engine information is given there. The first step is to remove the head. Once it's off you will be sent here to inspect the bottom end. All this can be done without removing the engine—except on 4WD trucks (unfortunately your front differential is in the way of the oil pan, so you'll have to pull the engine to remove it). Everyone will have to pull the engine to remove the crankshaft, because it's unnecessarily painful to remove with the engine in place.

Fortunately, Datsun/Nissans have five stout main bearing bottom ends. Chances are that after inspecting and removing the pistons, you'll find the cylinders to be only slightly tapered and honable. So after inspecting a main bearing or two, you determine the engine only needs a minor (in-place) overhaul, which usually includes pistons, rings, timing chain, rod bearings, valve work and all new gaskets. But before you don your designer monkey suit, reconsider the symptoms and alternatives.

The symptoms that tell you your engine is over-the-hill are excessive oil consumption (burning, not leaking, oil); loss of power; disturbing noises deep inside the engine, like ghosts knocking; and rough running that can't be cured by a tune-up.

A lot depends on what has (or hasn't) been done to the engine, or if it's worn out or broken. Datsun/Nissan engines are reliable; they have a reputation for staying together unless misused or improperly maintained or repaired. The more you know about the history of the engine and vehicle, the better. Study any available service records. Play detective.

There are those times when an engine dies the worst of all deaths—it blows up. It seizes and stops running or something internal lets go and breaks loose. It's usually a connecting rod bearing that seizes or causes the engine to throw a rod. But this is not likely to happen to your car or truck if you keep oil in the crankcase and don't drive it when it makes obscene noises.

If the oil light flickers or stays on all the time, there is low or no oil pressure. TURN OFF THE ENGINE! Make sure that there is oil in the crankcase, and if there isn't, find out why not.

The worst of all deaths can take you and your engine by surprise. It might be a *blown engine*, a *thrown* or *bent rod*, or a *broken timing chain*. These things can usually be avoided by routine maintenance, not running the engine dry (or low on oil), or simply by not taking a trip across the country with a noisy, sick engine. But if you're reading this on a lonely Montana roadside, asking yourself, "Why me?"—have faith. Read through the prescribed procedures and steps before abandoning your vehicle (or your body).

If you have a thrown rod, the engine probably can't be cranked with the starter motor or by hand. If it is

really thrown, the rod may be sticking through the side of the engine block.

If the timing chain has broken, the engine may still turn over but not operate the valves. To check this, remove the cam cover and see if the chain is still attached to the cam gear, and if it turns the cam when the engine is cranked, see Ch. 9, Pt. 1 and 2.

Figuring out what's wrong with your engine takes common sense, auto-intuition, and an understanding of how the engine works and where the components are inside it. Rebuilding an engine for the first time is the best way to understand one.

But before you jump for your monkey suit and wrenches, look for insights (Ch. 2 and Ch. 9, Pt. 1, Proc. 1). If you're in doubt, get a second opinion.

Rebuilding is expensive in time and money, no matter how you do it. The alternatives to doing it yourself are to buy a new or used engine or a newly rebuilt engine. A lot depends on how much time, patience, and money you have and the condition of your vehicle. Do you have a place to work, or do you have the money to have someone else do it for you? Is the vehicle worth putting $300-1500 into?

Check around for prices on new and used engines from Japan. They are generally reliable and sold through many mechanics and parts stores. Get a guarantee!

If you buy a used engine, the guarantee should ensure that it runs, doesn't leak water or oil, and doesn't smoke or knock. Check the mileage of the vehicle it comes out of, if possible. Ask whoever sells you the engine whether there is a COR charge on your old engine. If so, pay it and get a receipt with a guarantee that you'll get your money back when you return the old engine.

The pre-1975 engines (L-16 and L-18) are different in hook-up and size from the 1975 and later L-20B engines; 1980 on NAPS-Z engines are unlike the L-series engines in how they bolt-up. Even though inside all these engines are alike, to make it easy on yourself, stick close to your vehicle's year and model rating. (See Engine and Body Identification in the introduction of this book.) L-16 and L-18 engines can be swapped with each other. L-20B engines are very different and Z-series are even more different. The oil pans on car and truck engines, especially 4WD, are not the same shape, so you may have to put *your* oil pan and maybe oil pick-up screen on the replacement engine.

If you're a little nervous about tackling a project like this, remember that people have done it from scratch knowing less than you do. Remember, all you need are time, some money, patience, and close attention to the instructions. You can rent or borrow the few special tools you'll need.

Now let's try to figure out what's wrong with your engine.

PROCEDURE 1: HOW AND WHERE TO CHECK FOR OIL LEAKS

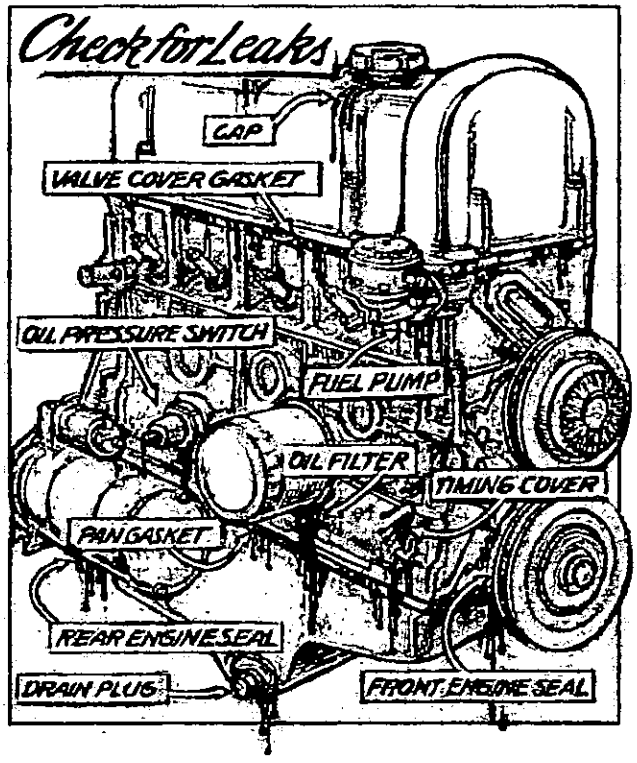
Condition: Your engine has been consuming a lot of oil, there are stains left on your driveway, or you want to check for major leaks before rebuilding the engine.

Tools and Materials: A work light and rag.

Remarks: Oil is the blood of the engine. For the lubrication system to work, the oil has to reduce friction between moving parts and the oil pump has to keep the oil flowing under pressure throughout the engine.

The engine is a container, sealed by gaskets and seals that should keep the oil, coolant, and combustion pressure inside. Anywhere there is a gasket, seal or plug, a leak can occur. Coolant leaks are covered in Ch. 8, and combustion leaks in Ch. 9, Pt. 1. Common places for oil leaks are:

- At the front and rear main oil seals
- At the oil pressure sending switch
- Between the fuel pump and the head
- Around the timing cover
- The oil pan gasket
- Between the oil filter and the block



Step 1: Check Out Oil Leaks.

When **oil seals** get old and worn out, they start to leak. Excessive crankcase pressure, too much oil in the crankcase, or improper seal installation can cause seals to leak prematurely.

The **front seal** is behind the crankshaft pulley. Look at the timing cover behind the pulley. If it is covered with oil, the seal may be leaking a little; if it's wet and clean, it may be leaking a lot. A really bad front seal will drip a lot of oil when the engine is just sitting there idling. This seal can be easily replaced (Ch 9, Pt. 2, Proc. 5).

The **rear oil seal** is only accessible if the transmission or engine is removed. Look under the back of the engine, where the engine and transmission join. You may have to jack the front end up (Ch. 13, Pt. 1, Proc. 1). If oil is dripping from the rear seam, wipe some off and smell it. If it's transmission oil, it will smell like sulphur. Engine oil has little odor. You can live with a rear oil seal leak until it gets really bad.

If there is too much crankcase pressure, then both seals will probably leak. Usually this is caused by a bad PCV valve. (Ch. 6, Pt. 2, Proc. 2).

Step 2: Check the Oil Pressure Sender.

Look at your dashboard or console. Do you have an oil pressure gauge or simply a light? If you have an oil pressure gauge, your sender is larger and less likely to leak; light senders are notorious leakers.

The oil pressure sender is a simple item to check for leaks and replace. Look on the right side of the engine block behind the oil filter. On Z-series engines it's under the intake manifold and a bit harder to see. There is a wire connected to the sender. Wipe your finger along the bottom, skinny end of the sender. If you wipe off any oil, the sender is leaking. It's a good idea to check this often. Occasionally the sender threads leak requiring some sealer.

To replace the sender, see Proc. 16.

Step 3: Check Between the Fuel Pump and the Head.

Oil tends to collect there and maybe leak, especially on L-series heads. Find the pump on the right front side of the head. If you have an electric fuel pump, there will be a cover in place of the regular fuel pump. To fix a leak here, you'll have to remove the pump and replace the insulator gasket (Ch. 6, Pt. 1, Proc. 10).

Step 4: Where Else?

Other leak points include the timing cover gaskets, the oil pump and the oil pan gasket. Look all around the edges of the timing cover for signs of dampness and/or grime. The same goes for the oil pan under the engine. Don't try to cure the leak by overtightening the bolts on either cover. Such leaks are usually *caused* by overtightening, incorrect assembly, or breaking a bolt or two. If you do try to tighten anything, do it evenly and gently. If the leak persists, you'll have to remove the cover or pan and change the gasket; but before you do that, make sure that the engine isn't worn-out and burning oil.

If the oil filter is leaking, it's probably because it was installed incorrectly. It will leak at the bottom edge where it meets the block. To replace it, see Ch. 3, Proc. 2.

Besides these checks, you should look under the engine and on the ground for signs of fluid leakage. Trace the source of these signs before they develop into something worse.

PROCEDURE 2: DOES YOUR ENGINE NEED A REBUILD?

Condition: Your engine is noisy or it burns a lot of oil. Something is wrong.

Tools and Materials: A designer monkey suit.

Remarks: Always get a second opinion before doing anything major to your engine.

The first part of this procedure discusses the symptoms with the engine all together. The second part deals with a semi-disassembled diagnosis. If the head is off the engine, start this procedure from Step 6. Read Ch. 9, Pt. 1, introduction to get a complete understanding of your engine's ailments.

Step 1: Is the Engine Burning Oil?

When engine oil get into the combustion chamber(s) it is burned along with the fuel. Oil burning will foul the spark plugs and eventually affect the engine's performance.

Oil gets into the combustion chambers when valve guides and seals wear out and let the oil leak past them into the combustion chamber(s). This happens in the cylinder head.

When the piston rings and cylinders wear, oil gets splashed and drawn up past the pistons into the combustion chambers. This happens in the engine block.

Blue-white smoke coming out of the tailpipe when the engine is running is a sign of burning oil. If it's worse when the engine is still cold, after the engine has been idling a while, or when you decelerate, it's a sign of worn valve guides. If it smokes less when it's warm, and runs a little better, the pistons may be worn out. If it smokes all the time, the rings and/or pistons are bad.

Datsuns can burn a lot of oil and not appear to smoke much or even foul plugs. A good test is to warm up the engine and, while it is idling, put a clean white rag over the end of the tailpipe for a minute, rev the engine a few times, then look at it. If you see a black, wet, oily residue, it's burning oil. Wipe your finger inside of the pipe. If that feels oily (not dry or powdery), the engine is burning oil. You can also look at the spark plugs for more clues (Ch. 3, Proc. 3). And while they are out, read the next step.

Step 2: Check the Compression.

While the spark plugs are out, you ought to check the compression. This is covered in Ch. 3, Proc. 9. If the compression is low in one or more of the cylinders, the engine will run roughly or lack power. This test will also help you pinpoint a dead or weak cylinder. Low or no compression is caused by the valves and rings not sealing properly (the engine is worn out) or by a hole in the combustion chamber (a broken piston or burned valve). Either condition means that major work is needed.

Step 3: Consider Your Options.

The four cylinders work as a team and should all be about equal in performance. If your car or truck is worth putting money into, you should do a thorough rebuild job. If it isn't worth much, just do what it takes to keep it running. This is often the difference between a **major** and a **minor** overhaul, or replacing one piston instead of all of them.

Often just a **valve job** is done on an engine. This means only the top half of the sealed combustion chamber is tightened up. If an engine has low mileage and burns oil, there's a good chance that only the valve seals and guides need to be replaced. In this case, you can get away with a valve job alone. When a valve job is done on an older engine and the piston rings aren't replaced, the renewed compression often puts strain on the rings causing them to lose their sealing ability. This is one reason why it helps to know the history of the engine.

The final test is made when the head is off the engine.

There are two types of overhauls: major and minor. The only way you can tell which one you'll need is to remove the cylinder head and maybe the oil pan to examine the internal parts. Before you do all that, take your case to a professional and get a second opinion. If you conclude that the engine needs to come apart, remove the head.

Ask a professional auto mechanic or machinist for help if you get stuck.

Step 4: Remove the Cylinder Head.

See Ch. 9, Pt. 1, Proc. 2 and 3.

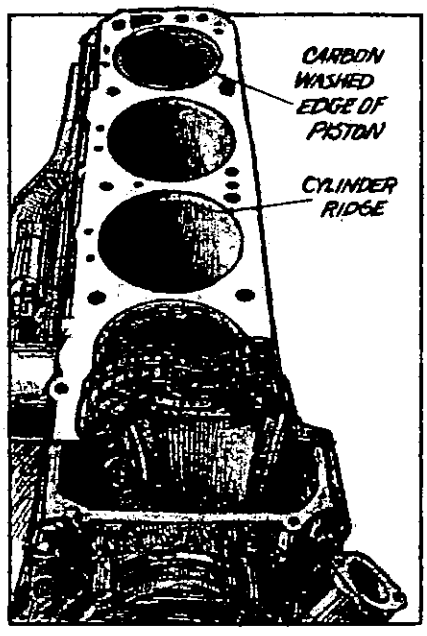
This is a big job. When the head is off the engine, come back here.

Step 5: Check Out the Tops of the Pistons.

With the head off, you can see the tops of all four pistons. Look closely. Are there any holes in them or are the edges broken? If either of these problems is yours, the piston in question has to be replaced.

If the edges of the pistons are cleaner than the centers, you can be sure that the oil rings are worn out. In this case, the pistons in question have to come out and be checked. If the whole piston top is clean and you have been losing coolant, you may have a leaky head gasket.

Rub your finger up the edge of one of the cylinders in which the piston is down. If you feel a ridge at the top of the cylinder, there is some cylinder wear or carbon build-up. It can be better checked when the pistons are out. Try scraping it off with a pocket knife. If it scrapes off, it's carbon. If the ridge is more than a little and not carbon, you'll have to rent or borrow a tool called a *ridge reamer* to cut it down to get the pistons out. Datsun/Nissan blocks rarely need it; they taper or wear very little. I'm told this is because they have a lot of nickel in them. This is also why you can successfully rebuild these engines without having to bore them. If I haven't bored you by now, you should have a good idea of what has to be done to fix your engine.



Step 6: What About the Timing Chain?

The other part of the engine that wears out at about the same time as the pistons, rings and valves is the timing chain. Read Ch. 9, Pt. 2 on timing chain adjustment and replacement. I suggest you replace the timing chain and its family while doing other major engine work.

Step 7: Get Ready to Work.

If you plan to get into major work, be prepared to do a thorough job. All this work takes time, no matter how experienced you are at doing mechanics. You'll be way ahead if you prepare a sound working space for yourself—a place where there isn't the pressure of the car being towed or the truck being vandalized. If you are warm and secure while doing the work, the ordeal will be much saner. An important element of engine rebuilding is to keep things clean—including yourself. There is more about this in Ch. 9, Pt. 1.

PROCEDURE 3: REMOVE THE OIL PAN AND PICKUP SCREEN

Condition: You need to remove the oil pan to replace the gasket, remove the pistons or check the rod and main bearings. **4WD People:** You'll have to pull out the engine to remove the pan (Proc. 7). When the engine's out, remove the pan (Proc. 17).

Tools and Materials: Basic tool kit, baggies and labels. **Car People:** short piece (1-1½ ft) of 2 x 4, telescoping jack (or better) to raise the transmission and engine a few inches.

Remarks: Because of differences in frame design, car and pickup truck oil pans do not come out of the vehicle the same way, so you have to follow different instructions. **Car People** means sedans, hatchbacks and station wagons.

Step 1: Jack, Chock and Block

See Ch. 13, Pt. 1, Proc. 1.

Raise the front of the vehicle high enough so you can slide under the engine with one foot of clearance between your chest and the oil pan.

Step 2: Drain the Engine Oil.

See Ch. 3, Proc. 2 (1).

Also remove the dipstick and stash it with the pan when out.

Step 3: Remove the Skid Pan.

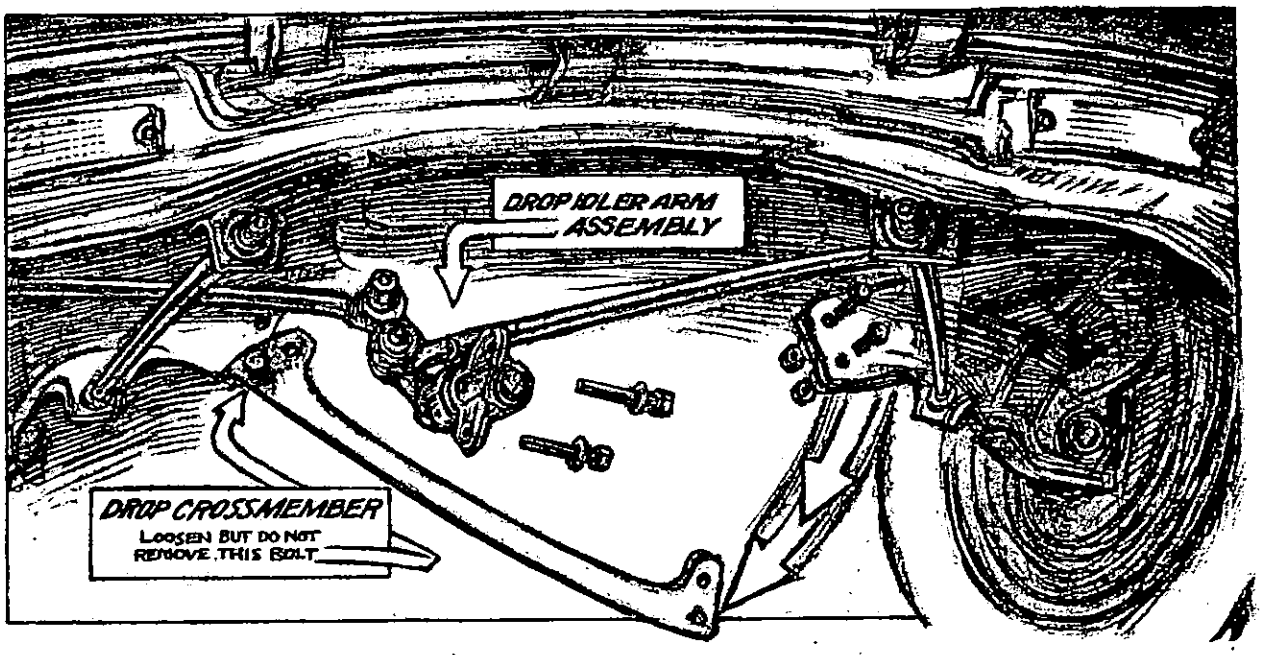
Leave the pan off and either replace the bolts in their holes or stash them in a baggie labeled "skid pan." The pan is under the front of the engine. It is held on by four or six 10 or 12mm bolts with washers. Remove these and work the pan away from the frame.

Step 4: Disconnect the Motor Mounts and Raise the Engine

•**Car People Only:** Find the motor mounts, one on each side of the engine, attached to the car's frame. Look closely at the mount on the right side of the block. A bracket connects the block to the mount. A 14mm nut and washer hold this bracket to the motor mount. Use a socket, extension and ratchet to remove this nut and then pull off the washer. Repeat this step on the mount on the other side of the block. Put the nuts in a baggie labeled "motor mounts."

Crawl under the car with your jack and 2 x 4. Position the jack under the transmission, between the drain plug and where the engine and transmission join. Put the 2 x 4 on top of the jack. Raise the jack slowly until the engine and transmission begin to move. Make sure the engine and transmission, not the entire car, are moving up as you operate the jack. The engine brackets should be moving off the motor mount studs.

Keep lifting the engine and transmission until the top front of the transmission touches the car's body. That's as high as you can take it. The car should still be fully supported by the jack studs.



Step 5: Drop the Steering Idler Assembly

See Ch. 12, Proc. 11.

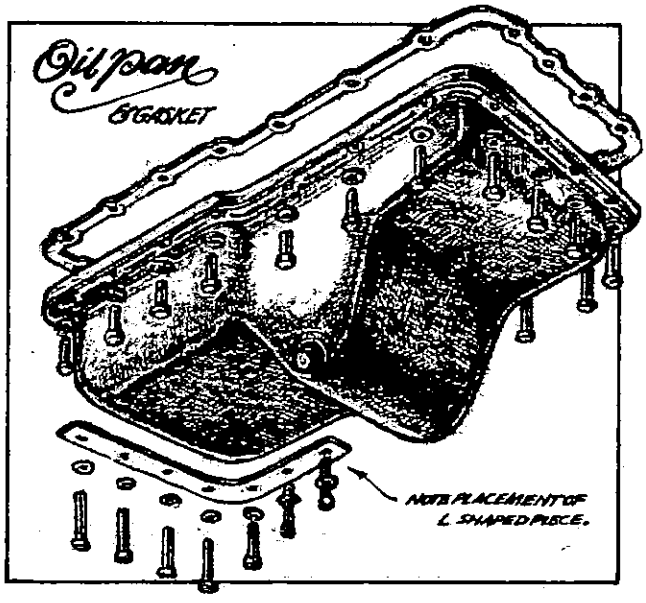
Car and Pickup People: The idler assembly is under the right side of the engine. Remove the two nuts and bolts that hold the idler in place and the idler and steering parts can be carefully lowered away from the oil pan. **WARNING:** Don't let the idler fall in your face!

Step 6: Drop the Front Crossmember

Pickups Only: The crossmember connects the truck's frame under the engine. Four 19mm bolts hold the member to the frame, two on each side. Remove the two bolts on the left side, and only the bottom one on the right side. The remaining bolt must be loosened enough so the member can swing down and away from the bottom of the oil pan.

Use a rachet, a 19mm socket, and a box-end wrench to loosen the nuts. Remove three nuts and their washers. Use the punch and hammer to drive the three bolts out of the bracket and crossmember. Put the washers and nuts back on the bolts and into a baggie labeled "crossmember."

The crossmember should now drop, maybe with a little prying away from the frame. If the truck is high enough and the remaining bolt loose enough, the member will clear the floor and hang vertically under the truck.



Step 7: Remove the Oil Pan and Oil Pickup Screen.

The oil pan is bolted to the bottom of the block by 22 10mm bolts and washers. You may have to scrape off some grime to get a socket onto the bolt heads. You'll also need to attach a swivel joint between the extension and the socket to get at some of the bolts.

These bolts aren't very tight. First loosen them with the ratchet, then screw them the rest of the way out with just the socket and swivel connected to the extension. Put all 22 bolts in a baggie labeled "oil pan bolts."

NOTE: On all later model engines, there is an L-shaped metal piece that fits around the right back edge of the pan, held on by the bolts. If the bracket's there, remove it.

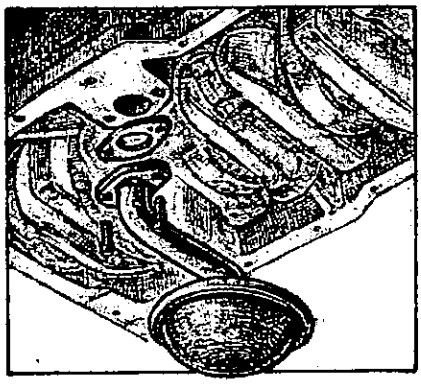
The pan should now come off with a little coaxing to unstick it. Work from the top, through the engine compartment. Use a hammer and medium screwdriver. Put the tip of the screwdriver at an angle between the top edge of the oil pan and the engine block. Tap the end of the screwdriver a few times to get a gap started. All the pan bolts have to be removed.

•**Automatic Transmission People:** Two or more brackets hold the cooler lines to the oil pan. Carefully work these lines to the side and clear of the oil pan. Watch the lines for fluid leaks.

•**Everyone:** If you can, gently pry between the pan and the block, not the block and timing cover. Try not to bend the pan too much. If it is stubborn, try another spot. Pry all around the edges until you can get your fingers into the pan. Go below and work the pan free. Pickup truck pans will drop straight down; car pans have to be dropped back and maneuvered rearward. If it gets hung up and your timing chain is out or will be, turn the crankshaft to position the pistons midway in the cylinders. Set the pan aside.

The insides of the engine are now visible.

Find the oil pickup screen—the round thing with a screen on the bottom. The whole piece bolts up to a hole in the block which connects to the oil pump inlet. The oil pump draws oil through this screen and circulates it throughout the engine. The oil strainer is bolted to the block by two 12mm bolts and washers. Four wheel drive engines have a bracket and a third 12mm bolt. Use a socket and extension to remove the bolts counterclockwise. Pull the pickup screen off. Put it in the oil pan and the bolts in a baggie labeled "pickup screen."



PROCEDURE 4: CHECK FOR CONNECTING ROD, MAIN BEARING AND JOURNAL WEAR

Condition: You are here to check for crankshaft and bearing wear, to find out whether the engine can be rebuilt, and whether you'll need to take it out of the vehicle to do the job.

The cylinder head is probably off the engine. The oil pan is off.

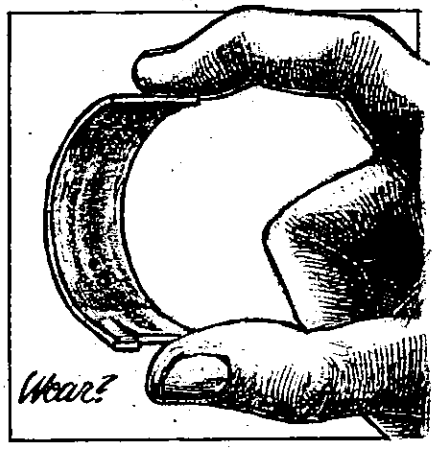
Tools and Materials: Basic tool kit, green plastigage (0.001-0.003), and a 1-2in micrometer (optional).

Step 1: Remove Connecting Rod Caps and Do a Visual Check.

Inspect at least the two center rod bearings and, if possible, all four. Remove the nuts and caps to expose the bearings and crankshaft (Proc. 5 [1]).

If you are checking the main bearings, go to Proc. 8 (4).

Of the several ways to check the **journal** (crankshaft bearing surface) and **bearing** wear, the visual method is easiest. Use a good light to examine the bearing shell. It should be uniform in color without any copper showing through its smooth surface. There should be no scratches or pits in the gray surface coating. A normal bearing is smooth and even in color.



Rub your thumb over the bearing surface to feel for imperfections. Do the same to the shiny journal surface, across and along it. The journal should feel smooth, without ridges or scratches.

If the bearing is worn, you should replace all four sets as well as the piston rings. Even if they don't look worn, and the journals are all right, you should replace the bearings along with piston parts (a minor rebuild). If the journal is badly scratched or grooved, go straight to the main bearings and check them. You might be considering a major rebuild (or engine transplant) by now. If the journals are deformed, the crankshaft *must* be reground (a major rebuild).

Step 2: The Micrometer and Bearing Size Checks.

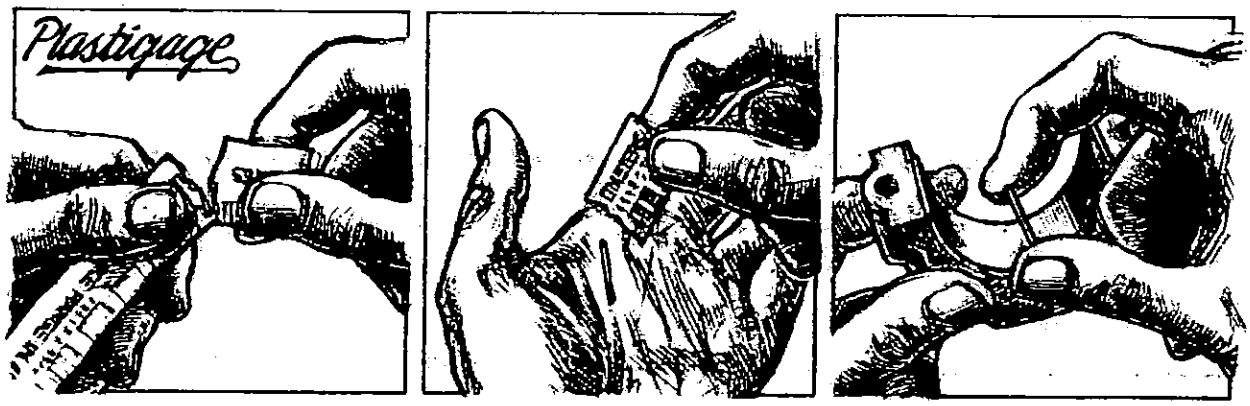
Connecting Rod and Main Bearing People:

•**Rod People:** If you have a micrometer, you can measure the diameter of the journal precisely. The rod journal should measure 1.9670—1.9675in (49.961—49.974mm). If the diameter measurement is much smaller, the crankshaft may have been machined undersize.

Make the measurement all round and front-to-back. The difference between your largest and smallest measurements should not exceed 0.0012in (0.03mm). This difference is called *out-of-round* and *taper.*

When the engine is *in place*, you can only get the micrometer around the connecting rod journal, not the mains.

•**Rod and Main People:** Remove the bearing from the cap (Proc. 8 [mains] or Proc. 12 [rods]). *Do not scratch the bearing(s).* On the back of the bearing you might see some numbers—"0.010", "0.020" or "0.030"—indicating (in thousandths of an inch) how much the crankshaft was ground. "Std." means standard size, which means it has never been ground. Use the same specifications, less the number marked on the bearing, to figure how much it has been worn. If standard, figure nothing.

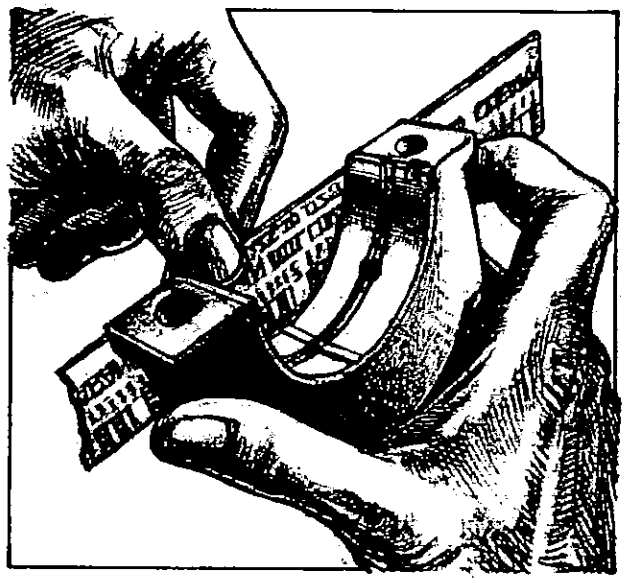


Replacement bearings have to match the size of the crankshaft journal. Put the bearing back into its cap if you removed it.

Step 3: The Plastigage Check.

Plastigage is a thin, green, threadlike material you put between the bearing and the journal, then tighten them together. It is housed inside a paper envelope. The stripes on the side of the wrapping are used to measure the results. The amount the plastigage is compressed tells you how much (or little) oil clearance there is between the bearing and the journal. Too much means wear. Too little means not enough clearance.

This test is most important when you check the *main bearings*, because if they show wear, then the engine has to be pulled out and the crankshaft removed to replace the bearings or remachine the crank.



Plastigage should also be used with new rod and main bearings to tell you that the oil clearance is adequate, i.e., not too small. The bearing cap of the bearing and journal you are testing must be removed to do the test.

The plastigage procedure is the same for the rod bearings and all other mains as for the main bearing cap (shown in the illustration). Do not remove the rear main bearing cap.

Wipe your hands, the bearing and the journal clean. Tear one inch off the end of the plastigage envelope. Carefully drop the plastic piece out of the wrapper and lay it across the bearing as shown. Keep the piece in place as you replace the bearing and cap onto the crankshaft. The cap must go back on in the same direction it came off so the arrow on the main bearing cap is forward or the numbers on the connecting rod bearings match. The plastigage thread must stay across the bearing.

Replace the nuts or bolts and retighten them as directed in Proc. 10 (mains) and Proc. 12 (rods). Do not turn the crankshaft.

Loosen and remove the cap as you did in Proc. 5 (rods) and Proc. 8 (mains). The plastigage will stick to either the journal or the bearing, and look like a flat worm. Compare the widest point on the plastigage with the stripes on the envelope. The normal width will be between 0.0008-0.0026in (.0.020-0.066mm) for mains or rods. The allowable clearance is 0.0047in (0.12mm) beyond the green plastigage scale. If it is that much, or a lot skinnier than the thinnest stripe, the main bearings should be replaced. Redo the test to make sure.

For rod bearings, the new rod bearing may take up the difference.

Be sure to scrape *all* of the plastigage off of the bearing and journal (with your fingernail) before replacing the cap.

Step 4: What Else?

Usually, in engines that have been maintained, the main bearing will be fine and a **minor** (in-place) **rebuild** will do the trick. If there is any question about the condition of the bearing(s), take it to a mechanic or machinist for an opinion.

If the main bearings don't pass the plastigage and visual tests, you'll have to pull the engine and perform a major rebuild (or replace the engine). Proc. 7 tells you how to pull the engine.

Replace the main bearing caps (Proc. 10 [5]) if they look all right and carry on with the **minor** (in-place) **rebuild**.

NOTE: If you heard heavy knocking (engine running) and didn't find any major crankshaft wear, consult a machinist. It may be the piston pins.

PROCEDURE 5: REMOVE PISTONS, CONNECTING RODS, AND PISTON RINGS; CHECK PISTONS AND RODS

Condition: You are checking for cylinder and piston wear, replacing pistons or rod bearings, or further disassembling the engine.

Tools and Materials: Basic tool kit, feeler gauges, extension, ratchet, 17 or 19mm and 12 or 14mm sockets, fiber or steel hammer (and wood block).

Remarks: If the cylinders are damaged and reboring is necessary, the pistons *have* to be replaced; however, if boring isn't needed and the pistons are okay, the old ones may be reused.

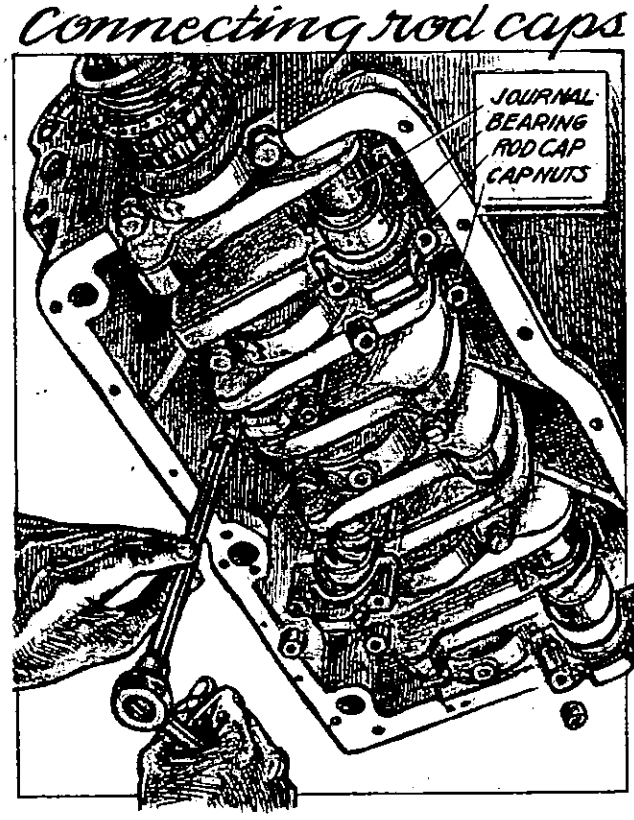
Step 1: Remove the Connecting Rod Caps.

The crankshaft runs the length of the engine inside the block, held to the bottom of the block by five **main bearing caps**. Locate them by looking first at the front, then the rear, bottom of the block. Each main cap is secured by two 17mm or 19mm bolts—ten bolts in all, five on each side of the crankshaft. Between the main bearing caps are four connecting rod caps that attach the pistons and connecting rods to the crankshaft. The connecting rod throws are offset so that as the crank rotates, the pistons take turns going up and down in sets 1 and 4, 2 and 3.

Look at the connecting rod caps on the bottom end of the connecting rod. On each rod are two studs with nuts. These nuts are special, so don't lose them.

•If you removed the timing chain, you can rotate the crankshaft any way you want to. If you plan to remove the timing cover and chain, wait until after you've checked the two center rod bearings and a couple of the main bearings.

•If the timing chain is in place and you don't



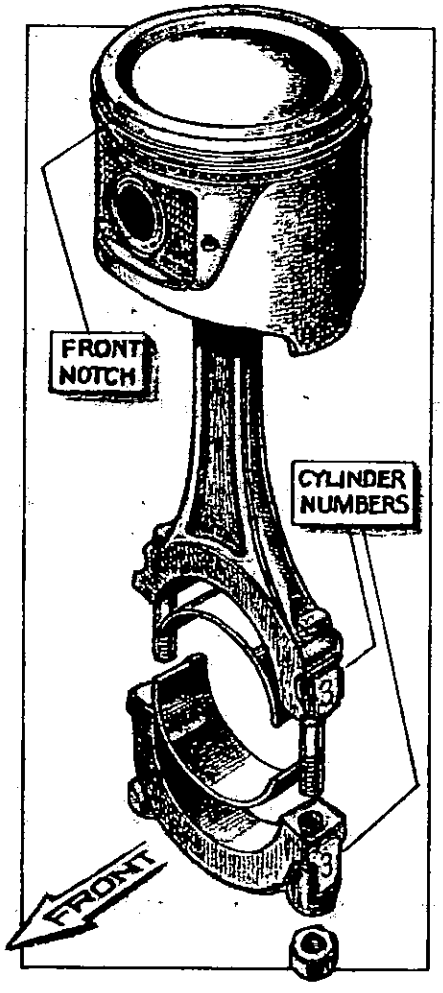
plan to remove it, *do not turn the crankshaft even an inch.*

The first and last pistons are at the topmost positions in their cylinders, and the two center pistons and connecting rods are at their bottom positions. You'll need an extension on the ratchet with a 12mm or 14mm socket to loosen the nuts on the connecting rod caps. If you can't turn the crankshaft (because the timing chain is in place), you'll have to work on the caps where they are.

Start on one of the nuts on #2 rod cap and position the ratchet so you have the best leverage possible without turning the crankshaft. Loosen and remove the nuts, and put them aside for now.

Using your fiber or steel hammer and a block of wood, tap lightly on the flat ends of the lower half of the connecting rod cap. Don't hit the studs or crankshaft. Put your fingers around the cap and pull it straight down, wiggling it side-to-side. Inside the cap should be a gray-colored bearing shell. If it is not with the bearing, it's probably still stuck on the crankshaft journal. If so, pull the bearing shell off the crankshaft and slip it back into the cap (Proc. 12 [3] if necessary). Keep the cap, bearing shell, and nuts close at hand.

If you plan to check the oil clearance with plastigage (Proc. 4), do it now.



Step 2: Check for Cylinder Ridge.

Cylinder Ridge is not a place in the Smokey Mountains.

It is a condition engines sometimes get when the cylinders wear out. Fortunately, Datsun/Nissan cylinders are hard and seldom get serious ridge.

Look into the two exposed cylinders, the ones where the pistons are down. Rub a finger up the right and left side of the cylinder wall. When you get to the top edge of the hole, look for a slight lip or ridge, especially of the right side.

If the ridge is more than the thickness of a standard-size wire paperclip, it will cause damage when you remove the piston. If there is a ridge, you'll have to rent or borrow a *ridge reamer* to cut down the ridge before removing the piston(s).

The ridge may be light carbon that you can scrape off with a knife. Try it. If you have to cut all of the cylinders' ridges, the crankshaft has to be rotated to lower the two "up" pistons, which means that the timing cover and chain must be removed.

Fortunately, it is rare for Datsun/Nissan blocks to get severe ridge. There is more on cylinders in Proc. 6.

Step 3: Remove the Pistons and Rods.

Get a friend to grab the pistons as you push them up out the top of the block. If you're alone, don't let the pistons fly out and break. Use a hammer handle, a wooden dowel, or your thumbs to get the rods started. Put rod nuts on the bolts to keep them from flying out of the rods.

Do not scratch the crankshaft with the rod bolts or any other part of the connecting rod.

The upper bearing shell may stick to the shaft and not the rod, so look for it and keep it with the rod.

When you get the piston and rod out of the block, pick up the

matching rod cap and put it back on the rod bolts. Note the matching number, stamped on the side of the rod and cap. When you put the engine back together, these numbers will be important. Put the nuts back on the bolts so they don't get lost, and store the pistons in a box, tops down. Handle these parts with special care. Don't bang the pistons or dent the rods.

Step 4: The Visual Piston Check.

The information you learn from this step will let you make an informed decision on whether to replace the piston rings using the pistons you just removed after honing the cylinders, to replace the pistons and rings with new ones in standard sizes after honing the cylinders, or to replace the pistons and rings in an oversize after removing the engine block and having it bored by a machine shop. With the last two options you have to have new pistons installed on the connecting rods.

You will examine the pistons and measure the ring lands (grooves) to determine if the pistons are reusable. Even if the pistons are in good shape, if the engine has a lot of miles on it and you have the money, I recommend replacing the old pistons with new, standard-sized ones. I have learned from experience that many more miles can be gained by using new pistons on high mileage engines, even if the old pistons are good. The cylinders have to be within specification, otherwise boring is necessary. The information you get from this and the following steps should be used along with the information gleaned from Proc. 6.

Always install new piston rings—chrome or moly; avoid using cast iron rings.

Look around the top edge of each piston to check for cracks or chips. There may be a small notch in the front side of the piston. That's okay. Turn the piston around, looking at the sections between the rings (these are called **ring lands**). There should be no chunks missing from them.

Now look at the bottom edges of the pistons. The long sides are called skirts; they should be flawless. Piston discoloration and scratching are signs of overheating. These and signs of chipping and cracking mean "throw the piston out." If a piston is damaged and you're sure the others pass the test, you can replace just the one, or even two. But a full set is best. This is a place where you don't want to cut corners.

Before going any further, give the cylinders a quick, close look. If any of them have severe scratches up and down them, you may need to bore the cylinders. Shallow scratches can usually be honed out. You'll only know for sure after the honing process. Scratches probably mean broken piston rings. Pitting or smearing means corrosion or bad metal. (See Proc. 6 for more on cylinders.) NOTE: If the cylinder walls are discolored, not shiny, certain flaws in the surface may be hard to see. Therefore, you may have to hone the cylinders before truly seeing the cylinder surface (Proc. 6).

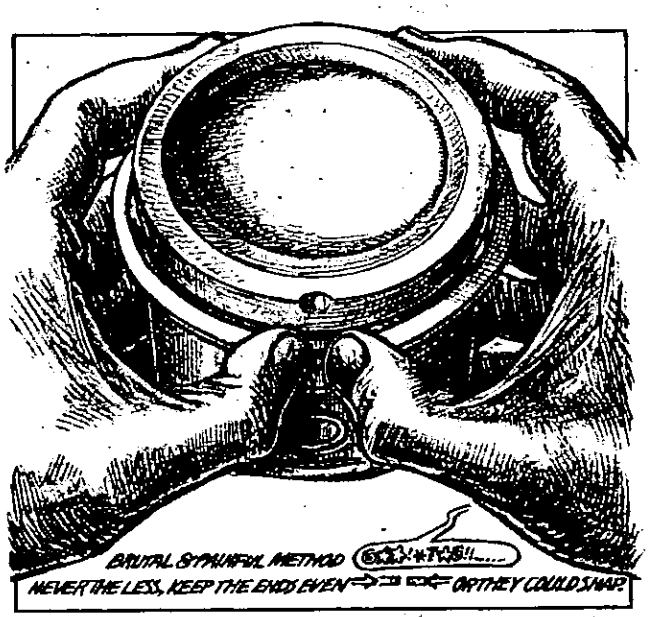
Step 5: Remove the Rings and Clean the Grooves.

NOTE: A piston ring land is the section of the piston on which the ring rests and which separates the ring's grooves.

Remove the piston rings. Work over a cloth or a bench. Clamp the connecting rod in a vice or flat against the bench; hang the piston off the side or have somebody hold the piston upright. Protect the rod with a rag. A tool called a *ring expander* makes ring work easy. If you don't have one, use your thumbs, but do not scratch the pistons. Keep the top and second rings separate.

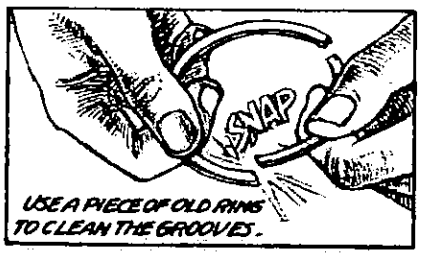
Start on the top ring and find its ends. Put a thumb on either side and spread the ring apart as you might an oyster shell. It's okay if you break the ring, but try to preserve at least one of the top two rings out of the whole lot.

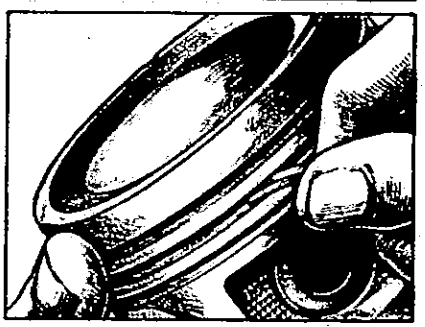
The second ring comes off like the top one but



the lower one may be different. If three-piece, see Proc. 11 and remove the upper and lower rail, then the expander, without scratching the piston.

The grooves housing the rings get carbon build-up. There is a tool to clean them, but an old ring works just about as well. Take one of the top two rings and break it. You'll need a 2in piece. Hold the piston securely while you use an end of the broken ring to scrape the carbon out of the groove. Do not gouge the aluminum piston. The process takes time. If the carbon is really hard, you may want to soak the pistons upside down in water overnight before continuing (Step 7). Don't submerge the piston any deeper than the grooves. All the carbon has to come out. When you see the aluminum inside the groove, it's clean. This is a time-consuming, repetitious job that should be done carefully and well.





Do the top two grooves of one piston, then read Step 6. If that piston checks out, clean another and then check it. If one piston has a worn ring land, replace the lot.

•If all the pistons pass, go on to the next procedure to check the cylinders. If they pass, return here and finish cleaning the pistons.

Step 6: Measure the Pistons.

Wipe off a top ring. Slip the outside edge of the ring into the top piston groove and measure the *side clearance* between the top of the ring and the top of the groove with a feeler gauge. This clearance should be between 0.0018 and 0.0031in (0.045 to 0.078mm) **L-16 and L-18**, or 0.0016 to 0.0029in (0.040 to 0.073mm) **L-20B and Z-series** engines. If there is too much clearance (more than 0.004in), chances are the pistons are no good. To make sure, go to a machinist and check the measurement with a new piston ring. If the measurement is close, and the pistons have low mileage on them, ask the machinist or parts person to let you try it with a new ring, a new ring may give you a better measurement.

Go to the second ring. Measure it the same way, using different specifications and an old second ring. The side clearance should be between 0.001 and 0.0025in (0.025 to 0.063mm) **L-16 and L-18**, 0.0012 and 0.0028in (0.030 to 0.070mm) **L-20B and Z-series** engines. The same "if" applies to the second ring as to the top ring.

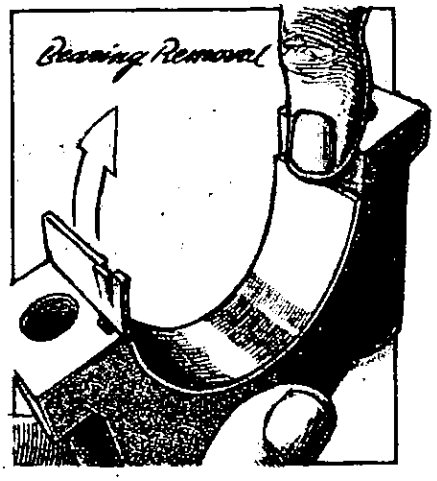
Worn-out pistons don't mean you'll have to bore the cylinders, only that the pistons and rings must be replaced. Take any questions to an automotive machine shop, but first measure the cylinders (Proc. 6). When you go to the machinist ask him or her to check for piston pin wear and thrust wear. Even if pistons check out, I recommend using new ones. After many miles pistons start to wear even if they don't show it now.

Step 7: Clean the Pistons and Rods.

Pistons are easily damaged, scratched or blemished. Handle them like eggs and don't use anything abrasive to clean their sides. The tops, though, can be buffed with a medium-to-soft wire wheel on a drill or grinder.

To soften the baked-on carbon and glaze, leave the pistons' grooves submerged upside down in water overnight before cleaning. The same goes for cleaning the ring grooves.

The rods can also be soaked in solvent and wiped dry. Use pipe cleaners or compressed air to clean out the oil hole in the side of the connecting rod. Remove all the bearing shells before cleaning the rods. Press the shells out with your fingers or a screwdriver tip, working from the end (not the side) of the bearing.



Step 8: More on the Rods and New Pistons.

If you're replacing pistons, the machinist should press the old pins out of the piston and rod, rebuild and recondition the rods, and install four new pistons. A helpful machine shop is your best tool in an engine rebuild.

If you don't have a piston ring expander, or lack confidence in your ability to install the expensive and easily-broken rings by the feeler gauge method (Proc. 12), ask the machinist to put them on the pistons for you.

Engines can usually be bored oversize when the cylinders are worn. Oversized pistons are common in increments of 0.010, 0.020, 0.030in, with 0.020in being the first oversize. Rings usually come with piston sets, but ask the salesperson to make sure; they have to match the piston size. Three-piece rings are your best bet. Use moly or chrome compression rings. Moly rings seat fast but are expensive. Chrome or chrome-edged compression rings are what the dealer sells, they are good rings. Don't use quick-seating, fast-wearing fully cast-iron rings. Always stick with the same brand of rings in a set for all four pistons. (Review the major shopping list in Proc. 8.)

A note to **L-16 People:** If your engine was built before August 1971 (8/71), you have 8mm connecting rod bolts. Later models came with 9mm rod bolts. While the 8mm bolts work, they have been known to break, usually during engine reassembly. If you have the 8mm bolts, have them measured for stretch or consider replacing the rods with the later L-16 or L-18 ones. Or have the rod bolt holes drilled larger, then replace the old bolts with new or good used 9mm bolts and nuts.

PROCEDURE 6: INSPECT THE CYLINDERS AND ENGINE BLOCK AND HONE THE CYLINDERS

Condition: You are here to check and maybe hone the cylinders. The head is off and the pistons and rods are out of the engine. You may have already determined that the engine is rebuildable *in place* and the main bearings and crankshaft are okay.

Tools and Materials: Feeler gauges, one used second piston ring, an inspection light, pencil and paper, some clean, absorbent, lint-free rags, solvent and engine oil, an adjustable, three-arm cylinder hone or slightly less than 3½in bottle brush hone (they vary by manufacturer's size). I recommend the bottle brush or ball-type hone. Most rental outlets carry these tools. Use a 280-300-grit stone for chrome rings and a 400-grit stone for moly rings.

Remarks: Read through and do the first two steps, then decide whether or not you can hone the cylinders and rebuild the engine in place.

Step 1: The Inspection.

Wipe the cylinders clean and look closely at them. The main upper portion of each cylinder should be shiny where the piston rings run up and down. The bottom of the cylinder will look discolored because this part isn't worn.

All the cylinders should look alike. You may see some cross-hatch or light diagonal scratches in the cylinder, a sign that the last hone job is still visible.

Look closely at the cylinder walls, one hole at a time. If there are scratches up and down the wall, you probably had a broken ring in that cylinder. How deep is the scratch? Light scratching can usually be removed by honing. If your fingernail catches in it, think rebore. A closer look might reveal a block cracked from freezing (Ch. 8, Proc. 1). A crack looks darker, may be rusty, and is more serious.

Scoring appears as discolored stripes up and down the cylinders. If the cylinders are badly scored, the pistons probably are too. If honing can take the scores out, replace the pistons and move on. Otherwise reboring is needed. Keep reading.

Occasionally a cylinder sleeve will deteriorate from corrosion. This is an ugly condition that, if caught before the damage gets too deep, can be honed out. But if allowed to advance, it will require that the block be bored. If you have water in the cylinders, i.e., a bad head gasket, inspect and hone the cylinders as soon as possible before corrosion gets a foothold. Rust never sleeps.

NOTE: If your nail catches on a groove or a scratch, look closer. Try rubbing a broken piston ring along the surface. Horizontal scratches are worse than vertical ones; they break rings and damage pistons.

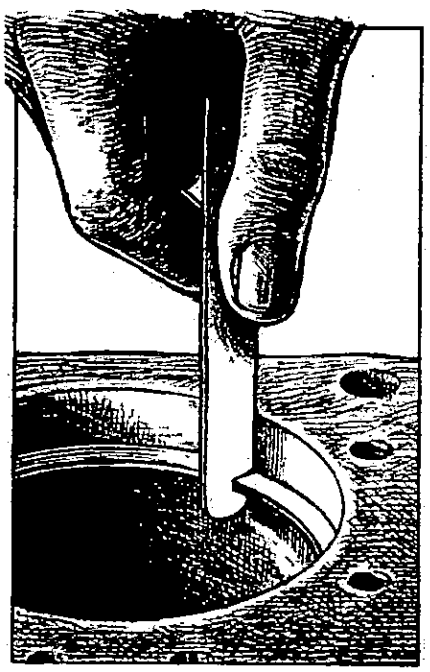
Sometimes you don't notice minor flaws until the cylinder has been honed. Pitting or a flaw in the metal will look darker than a honed cylinder. Out of money or out of necessity? Engines have been assembled with such blemishes in the cylinder. I don't recommend this practice. Have a pro look at the walls if you're in doubt. To do the job right, rebore the cylinders.

Step 2: Measure for Wear.

NOTE: This step should be used to check for cylinder wear and new ring end gap.

Cylinders wear *out-of-round* and they *taper*. You have to find out if they are too worn and need to be rebored.

Cylinder wear should be checked with an *inside micrometer*. If you can't get one, squeeze an old second-groove piston ring into the front cylinder parallel to the top of the block, as it would be if still on the piston. Now take a piston and put it upside-down into the cylinder to push the ring straight down an inch from the top of the hole. The ring ends should be parallel to each other with a small gap between them.



Start pulling out blades on your feeler gauge and fitting them into the gap between the ring ends until one fits and the next bigger one doesn't. Write down the size of this blade, say, 0.014in. Record all your measurements by cylinder number.

Now, using the piston, push the ring down to the bottom of the worn (shiny) part of the cylinder and take another measurement. Figure the difference (subtract the gap sizes) between the first and last measurements. Multiply the difference of each cylinder's measurement (ring gap) by 0.30. This number will be the amount of taper in the given cylinder. For example, if your top measurement (ring gap) is 0.014 and the bottom measurement is 0.015in, the difference is 0.001in, thus 0.001 x 0.30 = 0.0003in of taper. This is less than ½ of one thousandth of an inch (0.0005in), which is very acceptable. More than four thousandths of an inch (0.004in) taper is too much in my book. I suggest you rebore an engine with this much taper.

Many people claim 0.006in or even 0.008in is acceptable. In a real patch-up situation you could do a "minor" rebuild on such a motor. Otherwise you should rebore it. This much difference in cylinder size makes the rings expand and contract too much, accelerating wear.

When you've made your measurements, carefully remove the test ring straight up and out of the cylinder. Get your fingers or fist under

the ring to remove it square to the cylinder without twisting it.

Without a micrometer, all you can make is a visual out-of round check. Careful inspection should reveal more visible wear in the right and left sides of the cylinder walls, where the piston thrust is. A new cylinder looks uniform all around.

•**New Ring People:** The new top and second piston rings should be checked for end gap. Check the oil ring if you have a one piece ring. You do this the same way you check for cylinder wear, by pushing the new ring down into the hole using the top of a piston as a plunger. Install the ring and check the gap. The top ring gap should be between 0.0098in and 0.0157in (0.25mm to 0.40mm), and the second ring 0.0118in to 0.0197in (0.30mm to 0.50mm). If the oil ring is in one piece, measure it: 0.00118in and 0.0354in (0.30mm to 0.90mm). The rule is that there should be 0.004in per inch of bore, e.g., 0.004 x 3 = 0.012. Okay!

If the gaps don't fall between these measurements, take the new rings and your measurements to the machinist or parts store and ask for another brand or have the machinist file them for you.

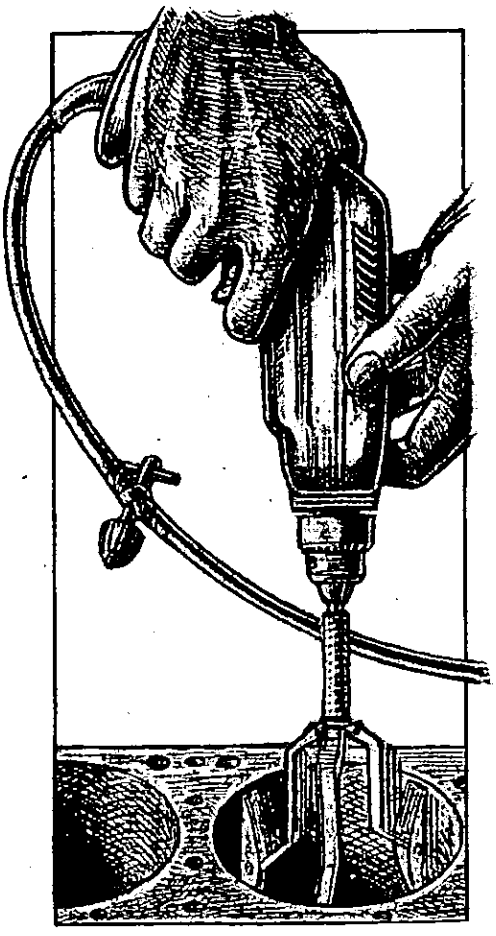
Step 3: Prepare to Hone the Cylinders.

FIRE DANGER: Open a door or window and use a fan to circulate air past the drill as you hone to avoid igniting flammable fumes with the electric drill.

Caution: Follow directions absolutely. Improper honing can seriously damage your engine.

Mix one-half cup of 30wt. engine oil with five tablespoons of solvent or kerosene (*not* gasoline) to coat the cylinders when you hone. Push a clean rag down into a cylinder so it covers the naked crankshaft journal below. If you can turn the crankshaft (with the timing chain removed), position the journal so it's down. Lay the rag flat, as far down into the hole as possible. You don't want the hone to touch the rag or crankshaft when it's turning in the hole.

Connect the hone and drill as directed by the manufacturer or owner. If you're using the three-arm type, don't adjust the arms out too tight—just so they contact the walls and then a little tighter.



Step 4: Hone the Cylinders.

Read carefully before doing.

Lightly coat the cylinder walls with the oil mixture. The honing stones should break the surface glaze over to the cylinder wall and renew the surface.

You want to finish your job with a uniform cylinder that has no vertical or horizontal scratches. The hone will, however, leave a desired *cross-hatch* in the wall. This is a pattern of diagonal scratches, ideally at a 60° angle from vertical (30° from horizontal).

Caution: Take special care to know how deep you can run the hone down into the cylinder before hitting the crankshaft. Too deep and you'll damage the honing tool and/or crankshaft.

Run the drill at medium-to-fast speed while you stroke the revolving hone brush briskly up and down the entire cylinder five times. Don't drag the stopped brush or stones up the hole. Remove the hone while it's still moving. Wipe the cylinder dry and inspect it.

If necessary, wipe the hole dry, reapply the oil mixture and rehone. You can repeat this many times with a ball type hone without doing any damage. If the scratches will not hone out, consult an expert. Remember, horizontal scratches or grooves are much worse than a shallow vertical scratch. Ultimately, you are the judge. This is life.

Repeat this with all 4 cylinders. Try to keep the amount you hone each cylinder equal to the next. Then wipe them dry. Remove the rags and wipe off the crankshaft. Put clean, absorbent rags in their place.

Step 5: The Finished Hole.

When the honing is finished, clean the cylinder walls with soap, warm water and a white rag. Cover the crankshaft to keep it dry. Mix only a *little bit* of soap in the water. Use a damp rag to swab out the grit. Keep wiping until the rag comes out clean, then wipe the cylinder dry.

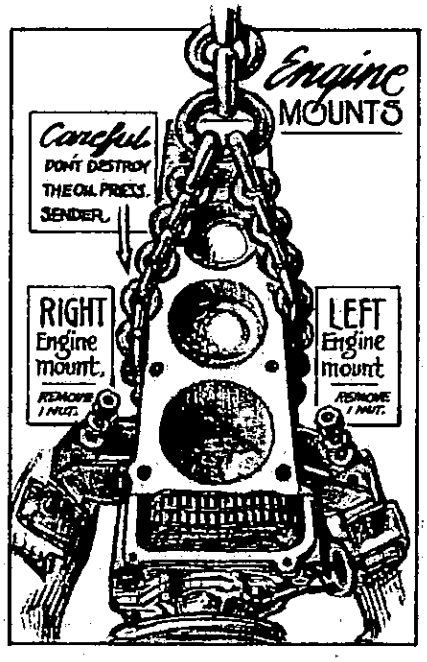
Coat the honed cylinder with fresh engine oil or penetrating oil and remove the rags covering the crankshaft. Wipe off the naked crankshaft journals and coat them with oil.

PROCEDURE 7: REMOVE THE ENGINE

Condition: The engine is coming out to be replaced, rebuilt, or anything in between. The cylinder head and oil pan are probably off the engine. **4WD:** Your pan is still on or you may be replacing the clutch.

If you plan to remove the engine with the cylinder head still on it, you'll have to disconnect all wires, cables, and hoses that attach the engine to the vehicle (Ch. 9, Pt. 1, Proc. 1).

Tools and Materials: A strong chain and cable, a safe means of hoisting the engine out, jack, stands and blocks, something to scribe with (like a nail or light-colored paint), an oil drain pan, a strong low bench or a steel milk crate to lower the engine onto, the basic tool kit, and a helper, masking tape and pen.



Remarks: If you plan to do time-consuming, extensive work, park the car or truck where it won't get in the way and will be as convenient as possible. Consider your comfort and state of mind. The less you move the engine once it is out, the better, so plan to position the vehicle as close to the work place as possible. Start early in the day to give yourself much more time to do the job than you think it will take just in case something goes awry. Nothing's more frustrating than working after dark out in the street trying to get a rented hoist back to the agency before it closes. If it comes to renting or borrowing hoisting equipment or any other tool, save time by doing all of the steps up to the one you need the tool for before going to get it. Ask the agency how to use the hoist and chain or cable that you'll need to wrap around the engine.

Unless otherwise specified, "right side" means passenger side, and "left" is left when sitting in the driver's seat.

The best help you could have is a faithful and patient assistant to read this manual to you and offer much-needed support at times of despair.

There are two ways to remove an engine: with the transmission or by itself. In this procedure, I'll tell you how to remove the engine without the transmission.

If you want to remove both the engine and the transmission, read Ch. 11, Pt. 1, Proc. 8. If you remove both, the whole unit has to be tipped at a serious angle to get it out through the engine compartment, so you'll need a high-lifting, very strong hoist.

Unless you have to repair the transmission, the only reason to pull it with the engine is that it's easier to rejoin the two out of the vehicle. Read Proc. 17 for tips on handing your engine out of the vehicle.

Step 1: Remove the Hood.

Open the hood so it stays up by itself. At the bottom rear (inside) are two steel hinges held on by four 10mm headed bolts, two on each side. If your hood is held up by a rod supporting the front end of the hood, turn your attention to the hinge on the right side. If your hood is supported by a spring-loaded catch, either side will do.

Scribe (draw) around the edges of each hinge, marking its position on the hood so it will go back on just

so. The hood is hard to handle because of its size, so have your helper steady the weight once the bolts are loosened. He or she should put one hand on the bottom and one hand on the side of the hood, like moving a painting. You also have to remove the support rod from its runner or hole before the hood will lift off. Lay the bolts aside until the hood is off, then screw them with their washers back into the holes.

Step 2: Disconnect the Battery Cables and Bracket and Remove the Battery.
See Ch. 7, Proc. 1 (3 and 4).

Step 3: Drain the Cooling System, Remove the Radiator and Fan, Maybe the Pulley and Alternator Belt (only if timing cover is on the engine).
See Ch. 8, Proc. 4 (1-5) and Proc. 5 (2).

Step 4: Remove the Air Cleaner Housing.
See Ch. 6, Pt. 1, Proc. 1 (1-5).

Step 5: Remove the Starter Motor and Alternator.
See Ch. 7, Proc. 7 (1-3) and Proc. 9 (1-7).
Tape these wires together and label them respectively.
If the timing cover is off, the starter motor and the alternator bracket may be off too. That's good.

Step 6: Drain the Engine Oil.
See Ch. 3, Proc. 2 (1).
You may have drained it already.

Step 7: Disconnect Wires From Right Side of Engine.
First find the **oil pressure sender** (Proc. 15 [1]) and disconnect the wire connected to it. Label this wire "OP sender." The wire should be part of the same harness as the starter wires. Try to move the whole slew of wires to the side, out of the way so they don't get damaged. On some models the wires are held in place by a plastic twist that wraps around the heater hose. There may be another bundle of wires going back toward the transmission across the starter and solenoid. Make sure this harness won't get in the way of engine removal. On some models, the positive battery cable to the starter is separate from the rest of the wires on this side. Undo the plastic twist after disconnecting the oil and solenoid tickle wires; then pull all of them away from the engine and store it aside for safekeeping.

Now move your attention to the front right side of the engine. Move the alternator wires to the side—out of the way.

•**Z-series:** All models after 1983½ have an O_2 sensor plugged into the exhaust manifold. Find this on the left side of the engine, follow its wire to a connector and separate. Label both ends "O_2 sensor."

Step 8: Remove Heater Inlet Hose from Three-way Junction.
•**L-series**: This is the hose that runs the length of the engine. It starts at the three-way junction, where you disconnected the lower radiator hose and bypass hose, and goes through the firewall behind the engine.

Loosen the clamp on the front end of the hose and work the hose back to where it may be clamped to the dipstick bracket. A 10mm Phillips screw holds the bracket in place. Remove it and the hose should bend away from the engine.

•**Z-series:** Your heater outlet hose has probably been disconnected with the head. It connects under the intake manifold at the rear of a two-pipe fitting. The heater inlet hose is further back connected to a pipe fitting in the side of the block. Loosen the hose clamp and work the hose off the fitting.

•**Everyone:** If the hose is brittle, it will break and should be removed and replaced (Ch. 8, Proc. 3). Keep the hose out of the way when you remove the engine.

Step 9: Remove the Distributor.

See Ch. 3, Proc. 5 (7).

If the timing cover is already off the engine, the distributor is too.

Step 10: Remove the Air Conditioner Compressor from the Engine (Air Conditioned Models Only).

Caution: Never cut or disconnect the hoses connected to the compressor.

If the head is off, you may have already removed some of the air conditioner hardware. Remove the belt from the compressor (Ch. 6, Pt. 2, Proc. 4) to loosen the drivebelt, then remove the compressor from the engine.

There are many different compressor mountings, so study yours. Remove the adjuster bolt from the bar, if you have the non-idler pulley type, then take the compressor off the mount bolted to the engine. You may have to loosen and move the air pump adjusting bar to get at the compressor. Before the compressor is free, have your assistant support its weight, then carefully lift it away from the engine. Support the compressor with a piece of wire or rope attached to it and one of the hood hinges still connected to its hoses and pipes.

Step 11: Remove the Air (smog) Pump and Power Steering Pump.

L-series: See Ch. 6, Pt. 2, Proc. 8 (1-3). **Z-series (with power steering):** See Ch. 12, Proc. 13.

Step 12: Jack Up the Vehicle.

See Ch. 13, Pt. 1, Proc. 1.

Get at least the front wheels off the ground. If you use a cherry-picker hoist, its feet will have to fit under the front tires if they are still on.

You need to get under the engine to disconnect the necessary fasteners. After all that is done, lower the front end if you want to.

Step 13: Drop the Idler Arm Assembly and Cross Rod.

See Ch. 12, Proc. 11.

Trucks Only: This step is only necessary if the oil pan is still on the engine.

Step 14: Unbolt the Engine from the Transmission.

If you plan to remove the transmission with the engine, leave them bolted together. Disconnect the transmission from the frame and driveline (Ch. 11, Pt. 1, Proc. 8 [1-15]). Don't remove your transmission support until ready to pull the engine. If you want to pull the engine alone, see Ch. 11, Pt. 1, Proc. 8 (13-17).

•**4WD People:** To remove the transmission with the engine, you'll have to lower but not remove the front differential. The plan is to drop the front of the differential so the oil pan and transmission will clear it. You'll have to disconnect the front driveshaft flanges at both the differential and the transfer, the four rear mounting bolts holding the differential to the rear crossmember, and the front differential mounting bolt after supporting the differential with a jack. The unit can then be lowered and rest on the front crossmember. You may have to drop the rear differential crossmember to get the engine out but wait until you're in the process of hoisting to see if the engine and transmission will clear or not. All the differential removal information is in Ch. 11, Pt. 1, Proc. 16.

Step 15: Separate the Motor Mounts.

There is a motor mount on each side of the engine block. Find the single nut on each side that holds the rubberized mount (on the frame) to the bracket (on the engine).

The nuts, 14mm or 17mm in size, have lockwashers and often washers. Use a socket and swivel joint or open-end to remove both nuts and washers. Store the hardware in a baggie marked "motor mounts."

Some models have an insulator plate on the left mount. Note how it is positioned and mark it with a forward arrow for reassembly.

Step 16: Attach the Chains or Cables to Remove the Engine.

Because the head is off, you'll have to run the chain or cable around the bottom of the engine and join it securely over the top to the hoist. If the head is on, you can loop the chain or cable through the slingers at the front and rear of the head.

Make sure the chain or cable you use will support the engine's weight. Adjust the hoist and chain to raise the engine high enough to get it out of the vehicle.

When you get the hoist hooked up, lift the engine high enough to get the bracket off the motor mount studs, then support the transmission's weight by raising the jack or shimming the block under it, and pull both the engine and transmission. Lower the transmission support.

Now lower the engine a bit and pull forward, away from the transmission, far enough for the transmission's input shaft to clear the clutch. (Automatic transmissions are easier to clear.)

When the engine is a few inches away from the transmission, recheck your chain-to-hoist connection and start raising the engine again, making sure the front end doesn't damage or bind against the body. Slowly raise it high enough to clear the compartment, then move the hoist or the vehicle until the engine is over the floor.

Put a milk crate or the like under the motor, then lower it onto this support. *Don't* get under the hanging engine and *do* lower it right away. Put blocks under the motor mount brackets. If the pan is still on, you'll need a wide bench or space to roll the engine around on (Proc. 17). To remove your pan and pick-up see Proc. 3. If your transmission is still attached, see Ch. 11, Pt. 1, Proc. 8 (13-18) and Proc. 17 for tips.

If you plan to strip the block for the machine shop, go on to Proc. 8.

PROCEDURE 8: DISASSEMBLE ENGINE BLOCK, REMOVE CRANKSHAFT AND MAIN BEARINGS; TAKE ENGINE TO THE MACHINE SHOP AND BUY PARTS.

Condition: You are here to check for main bearing wear, to remove the crankshaft and main bearings, or to completely disassemble the engine block for reboring and/or rebuilding. The oil pan is off.

Tools and Materials: Center punch (and hammer) or fingernail polish or paint, basic tool kit, and an assistant.

Remarks: If you are here to check the main bearings with plastigage, jump ahead to Step 4 and remove the bearing caps.

Step 1: Position the Block.

Find a comfortable place to work. A sturdy bench indoors is ideal. The cylinder head is off the engine so it's easier to move around. Get your assistant to help you roll the block over so the crankshaft is up (Proc. 17).

Step 2: Remove the Clutch and Flywheel or Driveplate, Spacer Plate and Rear Main Oil Seal.

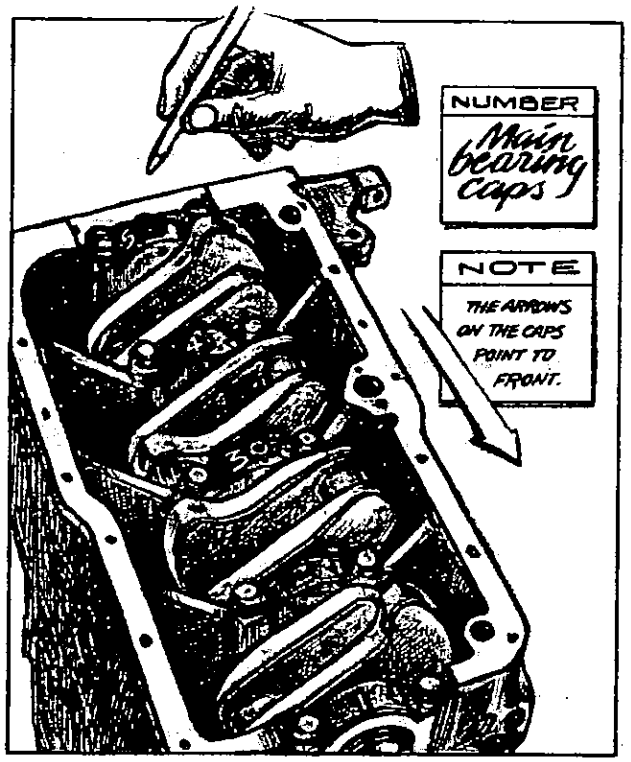
See Ch. 11, Pt. 1, Proc. 9 and 10.

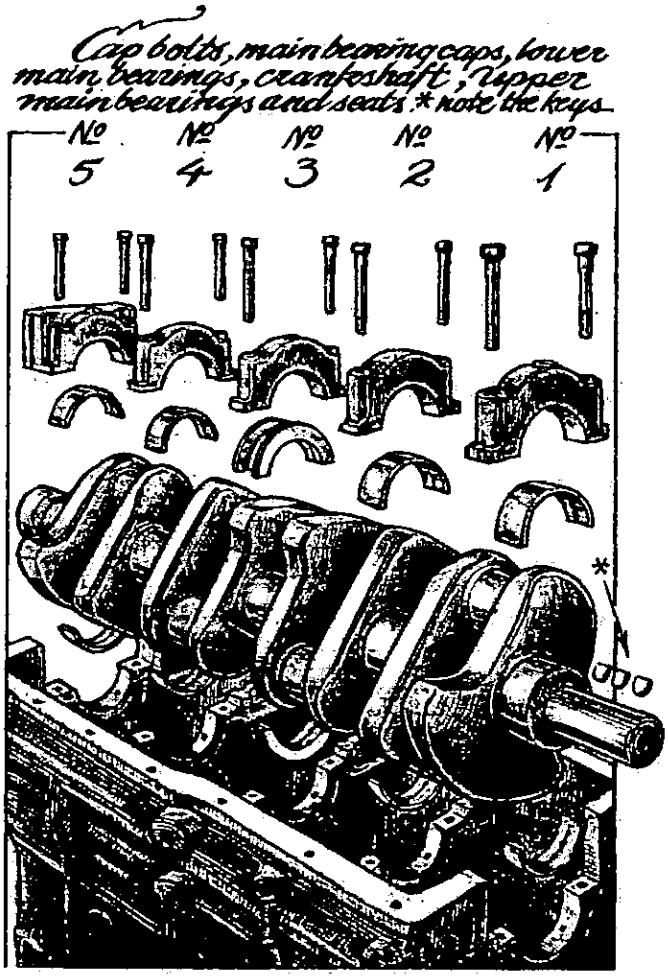
Your assistant has to hold down the block for this step. While the engine's out is a good time to do clutch work. If the oil pan is off, you can wedge a 2 x 4 between the crankshaft and the block to keep the crank from turning. Just don't tip the block off the bench. Be careful.

Step 3: Remove the Front Pulley, Timing Cover, and Timing Chain Parts.

See Ch. 9, Pt. 2, Proc. 2 (8-12) and Proc. 3 (1-3).

If they are already off the engine, go on to the next step. If they're still on, you can keep the crank from turning as described above.





Step 4: Identify and Mark the Main Bearing Caps.

Five main bearing caps hold the crankshaft in the block. Each cap is held in place by two 17mm or 19mm bolts. Before removing the bearing caps, use a center punch or some paint to mark them #1 through #5. The arrows cast into each cap identify front from rear. Start with the front cap, the one near the snout end of the crankshaft.

Step 5: Remove the Caps.

The bolts are tight, so use a breaker bar and socket. Position yourself and your assistant so the block won't flip off the bench and hurt someone. The bolts come out counterclockwise. If you're under the engine, watch your knuckles.

•**Engine-out People:** Start at the #5 cap (rear), then the #1 (front). Next do #4, then #2 and finally the #3 cap (center). When all of the bolts are loose, remove them and set all 10 aside.

•**Plastigage/Wear Check People:** You will remove the three center caps. Mark them, then read the rest of this step.

When the bolts have been removed, attack the bearing caps. Notice that the front, middle and rear caps are recessed into the block. These three are harder to remove than the other two. Start with the rear cap by tapping it front-and-back with a small steel hammer, wiggling the cap enough to start it away from the block. If you still have trouble, put the bolts back into the caps until they reach the block, but don't thread them in. (The #3 and #5 caps are drilled and tapped for a 8mm x 1.25 bolt. One of the timing cover bolts you removed will fit, so use it as a lever to remove these caps.) Use the bolts as levers, moving them forward and back while working the bearing cap away from the crankshaft. Don't pry the caps off. You will damage the crankshaft.

Remove the #3 and #1 caps the same way. Line the caps along the bench in their order, out of harm's way.

The #2 and #4 caps are not recessed and should come off easily. Make sure the five caps are marked in order.

Look at the crankshaft journals where the bearing caps were. If there are any bearing shells left on the surfaces, remove and set them next to the caps.

Step 6: Remove the Crankshaft.

The crankshaft can now be removed from the block. It is the spine of the engine, so handle it with utmost care. Make a place for it on the bench near the engine or some other safe place out of the weather. It's heavy, so get prepared before lifting it out of the block. Most of all, don't drop it. You may need to lift one end and then the other before the crank comes unstuck from the block. Be especially careful not to scratch the shiny parts (the journals). Datsun/Nissan cranks are notoriously well-made and often don't need to be machined, so keep it in good shape.

The other halves of the main bearing shells will either come out with the crankshaft or stay in the block. Get the shells out of the block by pressing on one end so they slide out of their positions. Set them next to the caps. The center main bearing has shoulders on it to make up for end play. It may need to be tapped out by a screwdriver and hammer. Be careful not to mar the block when doing this.

Step 7: What to Do?

If you plan to have machine work done or wonder about the condition of the block, go on to the next step and strip it. If you're going to rebuild the engine without taking the block or crankshaft to the machine shop, read the check-out steps in Proc. 5 and 6 and do whatever is necessary (with the block out of the vehicle). After the cylinders are honed, clean the block (Proc. 9) and replace the crankshaft (Proc. 10). It's a good idea to have the crankshaft measured, and maybe the cylinders, to make sure. In which case you'll want to take it all to the machine shop.

Step 8: Strip the Block for the Machine Shop.

Before taking the block to the shop for service, remove everything that isn't directly bolted to the block, plus some of the freeze plugs. You can leave the alternator, air (smog) pump, and air compressor mounts on, unless the machinist wants them removed.

Take the motor mount brackets off with a 14, 17, or 19mm socket, and mark them "left" or "right." The left one is longer. Put the bolts and washers in a baggie labeled "motor mount parts" and keep them with the brackets.

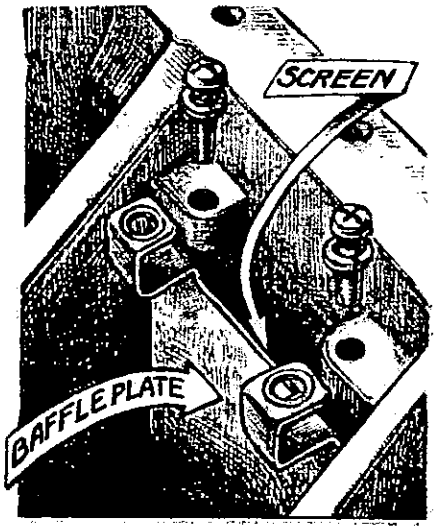
Remove the oil pressure sender (Proc. 16 [2]) and put it in a baggie labeled "OP sender."

The dipstick tube, crankcase vent pipe, and oil filter nipple can stay with the block, but make sure that they aren't loose. Don't damage them when transporting the block.

Step 9: Remove the Baffle and Screen.

These are inside the block, opposite where the crankcase vent pipe sticks out. The baffle is held into the block by two Phillips bolts. They're tight, and their heads are very soft and tend to strip. Use a #2 Phillips screwdriver, screwdriver socket, or, if they strip, the Vise Grips. First try clamping your Vise Grips around the screwdriver shaft to help remove the bolts. If the heads get really chewed up, you'll have to drill and tap them out (Ch. 13, Pt. 1, Proc. 2, or have the machinist do it). Replace damaged bolts with ones available from the parts list.

When the screws are out, lift off the baffle plate to see the screen. You may need a piece of wire to hook and pull out the screen. Stash the screen, baffle and bolts in a baggie. To clean the screen, go to Proc. 9.



Step 10: Remove the Freeze Plugs.

There are seven of them. The five along the sides of the block are easy to get out, but the two at the ends are much harder to remove. Fortunately, these two don't corrode the way the others do.

As you remove the plugs, be careful; the cylinder liners are right behind them, so pay attention. Place a medium-sized punch, drift or straight screwdriver against the back inside corner of one of the five side plugs. You want to spin the plug on an axis like a revolving door.

Tap the driving tool hard enough to move the plug. Try to work it so that one end of the plug sticks out enough to be grabbed with pliers and pulled out of its hole. This is more difficult if the engine is still in the vehicle. If the plug falls back into the block, grab it with pliers and work it out, but don't pry against the cylinder wall behind it.

Remove the rest of the plugs the same way, but leave the two end plugs alone. Ask the machinist to remove them if the others looked really corroded on the inside. To install the new plugs go to Proc. 10 (1).

Step 11: The Machine Shop.

The block is now stripped and ready for the machinist. If it's going to be rebored, replace the main bearing caps and bolts (minus the bearing shells) or take them with the block to the shop. Take the pistons and rods, and the crankshaft too. The cylinder head no doubt needs work, so read the instructions in Ch. 9, Pt. 1 and haul it to the shop.

Take your time to find a machine shop with a good reputation, even if its prices are a little higher. A helpful auto machine shop can be a great ally, so don't be afraid to ask dumb questions—or smart ones, either (Ch. 9, Pt. 1, Proc. 4 [8-10]).

Use the parts list in the next step as well as the machinist's advice to get what you need. The machinist may tell you the crank is all right, not cracked or worn. If so, ask him or her to polish it. Make sure the three woodruff keys are in place in the shaft's snout, and leave them there for the machinist to deal with.

Have him or her check the block closely for cracks and warpage, especially if you had any water in the oil or vice versa. If *you* buy the pistons and bearings, get the correct sizes from the machinist.

While the machine work is being done, it is a good time to clean parts (the worst part of the job) (Proc. 9).

MACHINE SHOP LIST

(Cylinder Head People: See head and cam info below).

Engine block:

Check for cylinder bore wear.

Examine cylinders for cracks, serious corrosion pitting, ridging, and warp.

Look for external rust, a sign of water leakage.

Clean and hone or bore oversize. (Ask the machinist to **chamfer** the tops of the cylinders after finishing them.)

Crankshaft:

Measure for wear at main bearing and connecting rod journals.

Check for cracks.
Regrind or polish the journals.
Examine for metal fatigue or serious pitting.

Pistons and rings:
Measure for wear or replace.

Cylinder head and cam:
(See Ch. 9, Pt. 1, Proc. 4 [8-10].) You'll want to take the valve seals out of the gasket set for the machinist to rebuild the head.

Connecting rods:
Balance and recondition, and install new pistons (Proc. 5).
Pre 8/71 L-16 People: Check your rod bolts (8mm) or replace them with 9mm (drill rods) or replace rods.

Clutch, flywheel, and transmission:
(See Ch. 11, Pt. 1, Proc. 9, 10 and 11.)

Step 12: Lining Up the Parts.

Automotive machine shops are often connected with parts stores or supply their own parts. I recommend original factory parts from Datsun/Nissan, but other brands also work well. Discuss the options with your machinist, using the following list as a guide. Many of these parts are repeated in the individual procedures. If you are doing just head work, you will not need all or most of the parts/services listed. Go down the list and find the asterisked (*) parts you may need.

•Pistons (if necessary) Std. 0.010in, 0.020in, 0.030in, etc.
•Piston rings (if not supplied)—chrome or moly (not cast iron).
•Connecting rod and main bearings—Std. 0.010in, 0.020in, 0.030in, etc. (The sizes for either may differ so ask the machinist to write them down for you.)
(*)Full engine rebuild gasket set or specific gaskets from the Datsun/Nissan agency. (See Ch. 9, Pt. 1, Proc. 6, for remarks about the head gasket). Head people may only need head set plus individual "dealer" gaskets.
•Timing chain, tensioner assembly, chain guides, and sprockets. These parts are often sold in a kit from Japan (Ch. 9, Pt. 2, Proc. 3).
•Clutch parts (if necessary). Match the new parts with the old to make sure (Ch. 11, Pt. 1, Proc. 9).
•New throw-out bearing and transmission seals (Ch. 11, Pt. 1, Proc. 11).
(*)Parts for the head that are listed in Ch. 9, Pt. 1, Proc. 4 and 5.
(*)Spark plug wires (Ch. 7, Proc. 12).
(*)Points, condensor cap and rotor—tune-up parts (Ch. 3, Proc. 3, 5, 8 and 10).
(*)Air filter if the old one is dirty (Ch. 3, Proc. 7).
(*)New Radiator, heater and bypass hoses, and clamps (Ch. 8, Proc. 3 and 4).
(*)New thermostat (if necessary) (Ch. 8, Proc. 6).
(*)Fan belt (Ch. 7, Proc. 9). Other belts for Air Conditioner, air pump or power steering pump.
•Speedi sleeve for front pulley (if necessary) (Ch. 9, Pt. 2, Proc. 2[11]).
•Two new 6mm x 1 x 12mm bolts and lock washers for the oil baffle. Get hexagonal heads rather than Phillips heads.
(*)Vacuum and fuel hoses. Take old one to match.
•Hose Clamps—Strap type to replace wire originals. Use hose to get correct size.

Parts you may need to get from Datsun/Nissan:

(*)Fuel pump spacer with gaskets attached (separate gaskets included in engine gasket set).
(*)Dowel(s) between the head and block #11053-73400 (if the others were damaged).
•Dowels between cam tower or rocker assembly and head #11022-21000 (if damaged).
•EGR valve and manifold gasket (may be in gasket set).
•Pilot bushing for the end of the crankshaft.
•Oil pump inner gasket—the really thin one #15025-21000 (Proc. 14).
•Transmission front gasket and seal; rear transmission seal.
(*)Three locating dowels for the flywheel-to-clutch pressure plate.
•½ moon valve cover seals #11051-WU401(Z-series).
•Any nuts or bolts, like manifold studs or exhaust pipe bolts—6mm x 1 and 8mm x 1.25 nuts, bolts and washers are common (Ch. 13, Pt. 2).
(*)720(Z-series) exhaust flange nuts #20602-P6700 (*)Any special hoses like PCV and other emission control, vacuum hoses.
•Cooling—radiator, bypass, or heater hoses.
•PCV valve, smog pump check valve, EAI or AIS reed valve filters or O_2 sensor (Ch. 6, Pt. 2, Proc. 6).
•Alternator, air pump, or air conditioner belts.
•Oil pressure sender (if leaking or not working).
(*)Temperature sender (if damaged or not workable).
(*)Freeze plugs—40mm.
•Exhaust pipe to manifold gasket (Z-series) #20711-W7100, (L-16 and 18) #20711-A0800; take the old one with you.

Parts that must be checked before reassembling the engine:

•Oil pump (Proc. 14 and Datsun/Nissan parts list for gasket).

Parts that you could easily repair, check or service while the engine is disassembled:

•Carburetor. If it's working well, don't mess with it.
•Water pump. Check for external leakage (Ch. 8, Proc. 1 [9]).
•Radiator (Ch. 8, Proc. 1 [8]). (If there was oil in the coolant, have the radiator flushed.)
•Alternator. Have a shop bench-test it (Ch. 7, Proc. 8).
•EGR valve and manifold (Ch. 6, Pt. 2, Proc. 10).
•Transmission front seal and gasket or cooler hoses (Ch. 11, Proc. 4 or 11).
•Emissions control filters (Ch. 6, Pt. 2, Proc. 2-7).

Miscellaneous supplies:

•One to two gallons of solvent or kerosene—*NOT GASOLINE*—to clean parts. Discard used solvent as you would engine oil—not in the backyard or storm sewer (Ch. 3, Proc. 2).
•A wide, clean drain pan in which to clean parts.
•Medium grit emery cloth for general use. A few feet or sheets will do.
•Green plastigage for measuring oil clearance between the crankshaft and bearings.
•A stiff parts brush to clean parts.
•Plenty of absorbent rags.
•Single-edge razor blades and a gasket scraper or putty knife.
•Steel wool—the big-gauge stuff, not the fine or soaped kind.
•Anti-seize compound.
•Can of STP or tube of white Lubriplate grease.
•Non-hardening (#2) gasket sealer, tube or can.
•Torque wrench that measures up to 100 ft.lbs

PROCEDURE 9: CLEAN ENGINE BLOCK AND PARTS

Tools and Materials: Solvent, drain pan, gasket scraper, emery cloth, razor blades, pipe cleaners, parts cleaning brush, absorbent rags, newspaper, engine oil, compressed air (a luxury, not a necessity), water supply with a hose and spray nozzle, steel wool (not the kitchen kind, but the stuff that holds together).

Remarks: If you are taking the head and/or block to the machine shop, they'll probably be cleaned in a hot tank. Ask the machinist if any further cleaning is necessary. Metal filings and dust are common leftovers after machinework has been done.

Step 1: The Job.

WARNING: Solvent is a poison, absorbed through your skin and lungs, so ventilate the area and wear your rubber gloves.

Choose a well-ventilated place to work. If possible, locate outside where you can clean and spray the parts off. Take lots of breaks.

Arrange all parts in one area and wash them with solvent, then let them soak. Scrub them with steel wool to loosen the outer layer of grease. Use the brush to get the inside of the block and reach hard-to-get spots.

Clean the outsides of the parts, then the insides (unless they aren't going to be disassembled). Use water to blast off heavy grease and rinse off solvent, but keep in mind that cylinder bores, camshaft lobes, crankshaft journals, pistons and rods, electrical and fuel components don't like conductive, rust-forming water. Let the machine shop clean the head and block, if possible.

If you do spray the block, be sure to wipe the cylinders dry right away. Hone the block after the first major wash and rinse. Wash everything except the cylinder walls again thoroughly with solvent after you have honed the cylinders (Proc. 6 [3-4]).

Compressed air is ideal for blowing out the holes in the block and blasting grease out of hard-to-reach spots. Use it if you have it (wear safety glasses), or go to a service station and ask them for the privilege. To clean the block, blow through the five holes in the main bearing saddles and the small hole where you put the pipe cleaner on the top right side. These are oil holes, and it's very important to keep them clear. The same goes for the hole where the oil pick-up screen bolts to the block. If you can't get compressed air, use pipe cleaners then penetrating oil to get as much out of the holes as you can. Flush all passages then let them drain. Remember, oil attracts dust. Cover your finished work.

Clean the inside of the block until your rag stays spotless when wiped over the surfaces. If the engine is in the vehicle, you'll have to work on your back. Reach as much of the block's innards as possible with the solvent brush and rag. Other parts and gasket surfaces are handled the same way, as described in the next steps.

Step 2: Parts to Clean.

- The block (maybe).
- Pistons and rods (maybe).
- Timing cover and water pump.
- Oil pan, oil pick-up screen and oil pump.
- Engine-to-transmission spacer plate.
- Intake manifold (Ch. 9, Pt. 1, Proc. 5 [1]).
- Alternator and starter.
- Motor mount brackets.
- Fuel pump.
- Transmission bellhousing (Ch. 11, Pt. 1, Proc. 11).
- Cam cover.
- Head parts (Ch. 9, Pt. 1, Proc. 5).
- Air cleaner housing.
- Oil pump (Proc. 14, this chapter).

•Nuts, bolts, and washers. (Don't mix them together or forget where they go. Clean their threads with a wire brush and solvent.)
•Skid pan.
•Engine compartment (if it's greasy).

Step 3: Prepare the Gasket Surfaces.

Work from the top down. Clean the top of the block with a scraper and emery cloth (Ch. 9, Pt. 1, Proc. 6 [1]); and the timing cover and its matching surfaces (Ch. 9, Pt. 2, Proc. 2 [13], and Proc. 4 [1]). Prepare the bottom of the block and oil pan as described in Proc. 13. Also clean and sand the oil pick-up surface on the bottom of the block.

Cover the clean parts to keep off dust and moisture. Coat the cylinders, cam lobes, and cylinder journals with oil; cover the prepared areas to keep out dust and dandruff. But first, take a moment to pause and admire your work.

All this preparation takes what little glory there is out of mechanics but makes for a well-built engine.

PROCEDURE 10: REASSEMBLE THE ENGINE—INSTALL THE CRANKSHAFT, MAIN BEARINGS, FREEZE PLUGS, AND MISCELLANEOUS OTHER PARTS

Condition: The engine block has been disassembled and cleaned, machine work or honing has been done, and the new parts are at hand. Your old replaceable parts are clean and organized. The three woodruff keys should be in the snout (front) end of the crankshaft.

Tools and Materials: Torque wrench, clean rags, non-hardening (#2) sealant, engine oil, STP or Lubriplate grease, emery cloth, mechanics hammer, 6in of 5/8in wooden dowel, feeler gauges, an assistant, rear main oil seal and side seals (probably in your full gasket set), five 40mm freeze plugs, main bearings, two new baffle plate screws, 6mm x 1 x 12mm bolts and lockwashers.

Remarks: The pre-rebuild jitters are normal, so don't get spooked by all those pieces. Take it one step at a time until it's complete. Don't judge your own competence by the amount of time it takes you to do a step. Just do it—carefully and completely.

The concepts to keep in mind are *cleanliness* and *proper fit*, so the end product works and positive sealing keeps the oil in the engine. You are toning up the body of the machine with new parts and remachined surfaces, so you want to keep it's insides clean. Fit is also critical so the compression, oil pressure, and friction will be optimal. When it's all back together and powering you around, you don't want great oil leaks to affect your otherwise peaceful state of mind, so tune your senses to nothing less than perfection with a slight degree of "make-do" and you'll get through any mechanical task with success. We're off.

Caution: When working around the engine block, make sure your bench is sturdy. Can you jump up and down on it? "Safety first" to avoid breaking the engine or you.

Remember, "right" means passenger side, and "left" means driver's side.

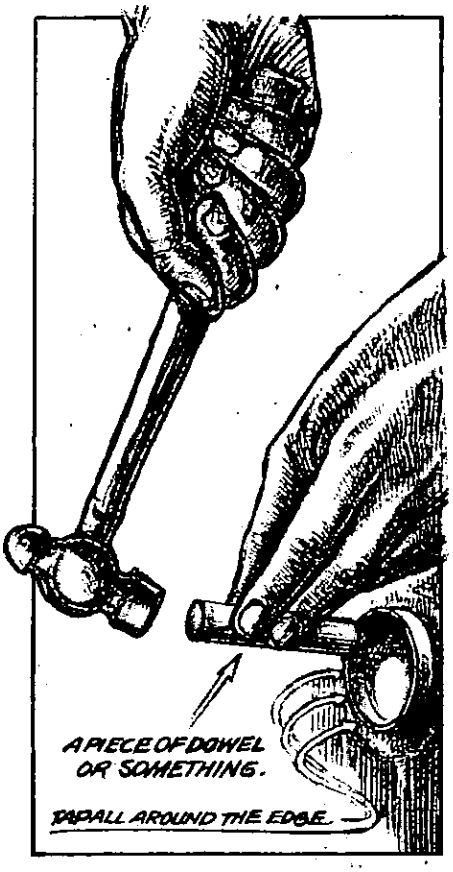
Step 1: Install the Freeze Plugs.

Examine the holes where the plugs go, focusing on the outside edges. Look and feel for burrs or sharp points that may catch on the plug as it slips in. Use emery cloth to smooth down the edges.

Find and pick up a plug. Coat its outside edges with non-hardening sealer or a little automotive silicon sealer. It goes in flat side first. Get it started straight and continue until the outer lip is flush with the block. The metal plug is soft and will buckle, puncture or tear easily, so use a wooden dowel, brass drift, or wide punch, e.g., a smooth-ended 1in galvanized pipe or socket that fits close to the plug's wall. Carefully yet firmly tap in the plugs. You may have to lay a piece of wood across the plug and hammer against it to get a stubborn plug started.

The crucial move is the first one—get the plug started in straight. After it's started, keep tapping the plug in until its lip edge is flush with the block, but no farther. The point of no return is slightly past the edge, so go easy.

Repeat this step to install all the plugs. If you damage a plug or hammer one in more than 1/16in from the edge of the block, knock it out and start again with a new one.



Step 2: Install the Oil Screen Baffle.

Carefully turn the block upside down onto something flat and sturdy. The screen fits into the cavity on the inner, left side of the block. The left side is the side with the tube sticking out. The screen is accordioned and one side is cut at an angle to fit into the block. Install the screen with the small end pointed down. It will sit nicely in place. Do not force or stuff it too far into the block. (See Proc. 8 [9] for illustration.)

The baffle plate has two little bent tabs with holes in them. These tabs allow you to hang the baffle on the block so the bolt holes are matched. Fiddle around until the plate fits as it should, flush against the block. Install the new bolts and lockwashers and snug them until the washers flatten—not too tight.

Step 3: Install the Main Bearing Shells.

NOTE: If the crankshaft was turned, the size of the bearing must match the amount in thousandths of an inch that it was machined down. If the crank was never machined, the bearings would be standard ("Std"). Check that all the bearings are marked the same.

Get together the five main bearing caps. You numbered them as you removed them. Numbers 1, 3, and 5 are obvious by their different sizes and shapes. The other two caps look alike. See that the old bearing shells are removed and the caps wiped clean.

The rear main bearing cap, #5, has slots on its sides. If you can't see them, chances are the old side seals are still in place. Pop the two seals out with a thin screwdriver. Scrape and clean the slots thoroughly. Get the new side seals out of the gasket set (there may be two steel shim strips too) and put them aside for the moment.

Line up your main bearing caps on the bench in order, #1 through #5. Find the box of new main bearings and open it up. Do not touch the new bearing surfaces or drop them on the floor. Handle them like photographs. Acid from your fingers can corrode their soft surfaces.

In all, there are three different sizes of bearings. The differences are in shape and width: #2 and #4 bearings are the same; #1 and #5 are wider than the others. The thrust bearing (#3) has shoulders on it. Bearing #1 is different from #5 because it has two holes in it—one big and one small. Compare the width of the bearing shells to the cap and the saddle. Most bearing sets are packed to be taken out in pairs. Pay attention to their order. If some of the shells aren't grooved, put the grooved ones in the block and #1 cap, the plain ones in caps #2 through #5. Separate the shells for the block from the shells for the caps and arrange them next to the caps. If the package has been broken open, scrutinize your bearings. Are they all there? Are they the right ones? Any of them damaged?

Align the oil holes in the bearings to the block. Both sides of the bearings have holes, but only one side lines up to an oil hole. Wipe the block and cap saddles for the final time. NOTE: As you do this and the next two steps, refer to the illustration in Proc. 8 (5) for details.

As you install the bearing shells, see that they go in straight so the sides align with the sides of the saddles and the tabs fit into the cutouts. Install the bearings for #1 position in both block and cap. Remember the bearing

with two holes in it goes in #1 saddle-block side not cap. Note the matching holes in the block. Find the #2 bearing and repeat the process on down the line. Set the caps aside in their order. Once all the shells are in place, you're just about ready to install the crankshaft.

But first, find the 10 bolts (no washers) that hold the main bearing caps in place. Clean the threads, if you haven't yet, so they look new, then coat the threads with engine oil. Make sure the bolt holes and the recesses where the bearing caps fit into the block are perfectly clean. Set the bolts nearby, and ready the STP or Lubriplate grease.

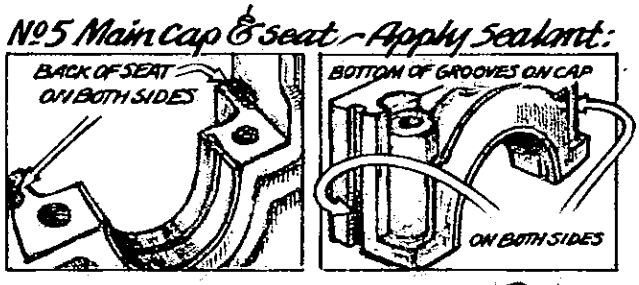
Step 4: Install the Crankshaft.

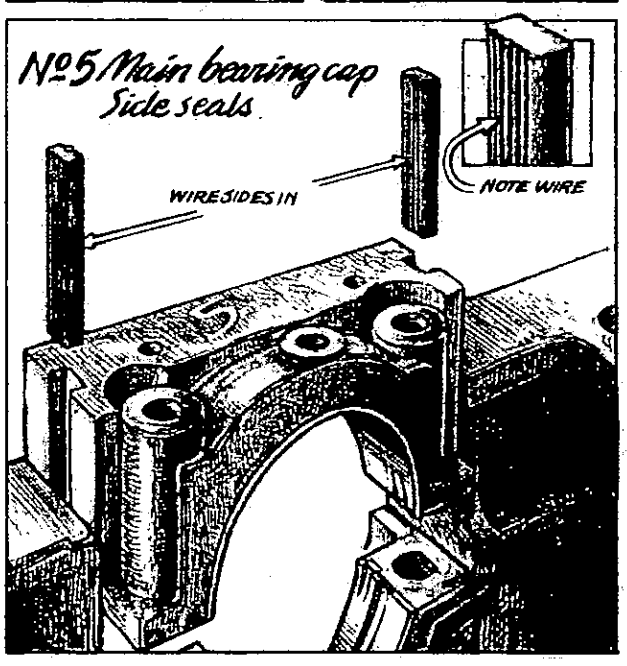
Don't let anything distract you during this step. It's important that the bearings and journals stay clean. Before you install the crankshaft, look where the rear main bearing cap fits in the block. Put a bead of sealant along the inside corners next to where the rear main seal cut-out is. Repeat on the opposite side. Put ⅞ in beads in the corners toward the rear of the block where the bearing cap, block, side and main seals congregate. See the top panel of the drawing in Step 6.

Set the crankshaft nearby. Position it with the front end (snout with the woodruff keys) aiming the same way as the front of the block. Notice which crank journals (shiny parts) are main and which are connecting rod journals. All the mains are in line, whereas the connecting rod journals are offset. When you're sure that you could set the shaft in place without any hangups, spread a liberal amount of STP or Lubriplate grease (at least engine oil) on each of the five bearings in the block with your fingers. The oil will protect the bearings.

Pick up the crankshaft by its ends and carefully guide the main bearing journals into their bearings.

In place? Good.





Step 5: Install the Main Bearing Caps and Rear Main Seal.

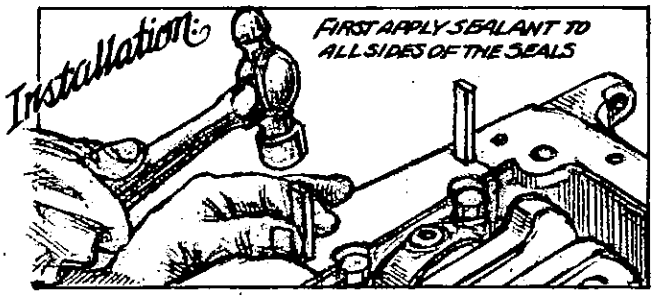
NOTE: Quickly inspect the caps' mating surfaces. If there are any burrs or irregularities in them, lightly file them smooth with a fine metal file. Don't get filings on the bearing.

Pick up the #3 main bearing cap. Smear that bearing shell with oil and set it into the block with the little arrow pointing toward the front of the block (crankshaft snout). Before you tap the cap into place, align the bolt holes using the bolts as guides, starting with #3 on the center bearing cap. Tap the cap with a hammer and wooden dowel so that it starts into the block, and continue snugging the cap down with a 17mm or 19mm socket until the bearing cap just meets the block. Do not tighten any farther. If the bolts offer resistance and wiggling them doesn't help, something is amiss, so back off and try to align the holes with the bolts again.

Before tapping the cap down all the way, try pushing the crank forward and aft to position the bearing. If you feel resistance while installing the cap, the bearing doesn't fit over the crank, so back off and call the machinist.

Once #3 is down, do #2, #4, and #1 in that order. Number 5 has no arrow, but is distinguishable by its shape.

Read through this part before doing it. Dig the large round oil seal out of the gasket set. It's easier to install this rear main oil seal before putting on the #5 main bearing cap. If the inner lips (that touch the crankshaft) of the seal aren't filled with grease, fill between them with oil or moly grease. Now coat the opposite outside edge that fits into the block with sealer.



Carefully fit the seal over the crankshaft with the flat numbered side facing you. It may be a little difficult to fit between the shaft and the block. Push the seal until it is flush with the back of the block. Make sure it's square and parallel to its bore. NOTE: If there is a groove worn in the surface where crankshaft and seal meet, move the seal in a bit past flush so the seal's lips mate to a fresh surface.

Before you install the #5 cap, put a bead of sealant along each side seal slot. The flat side of the cap is the rear. You'll have to really tap this cap down, so make certain the bolt holes are lined up properly. The sides of the cap should match the sides of the block. Don't damage the seal as you install the cap.

When all the caps are in place, and the bolts are started into their holes, try turning the crankshaft. It should turn freely. If it doesn't, it is binding somewhere, in which case loosen and wiggle the caps. Try again. If it's still tight, call the machinist.

Step 6: Install the Side Seals.

When the #5 cap is flush with the block, install the side seals. They usually have little ridges or lips on them. These go toward the block. If one side is slightly wider than the other, install that side toward the block. Coat the seals with gasket sealant and carefully tap them into their slots. Don't bend the seals by beating the daylights out of them; gently tap them down until they bottom out and protrude a little above the top of the block. If you have two steel shim strips left over, tap them between the cap and the seal. If one side of the shim is bevelled, put this toward the cap. Use a small screwdriver tip to tap the shims as far down as you can. If the ends of the seals protrude more than 1/16in above the block, trim them off evenly with a razor blade.

Step 7: Center the Crankshaft and Torque the Main Bearings.

Fit a medium screwdriver tip between the front of the **center** main bearing cap and the crankshaft web. Pry the crankshaft forward. Now go to the opposite back side of the cap and pry the crank rearward to center it. Then, each time you tighten the center main bearing cap, have your assistant fit a medium screwdriver tip between the front of the center main cap and the crankshaft web. As you tighten the center main cap bolts, have him or her pry the crankshaft forward. Now you can start to torque the main bearing caps.

Beginning with the center bearing, start to tighten the bolts with the torque wrench and 17mm or 19mm socket. Have your assistant steady the block as you tighten them. As always, don't bring the bolts up to full torque (tightness) on the first tightening. Tighten to about 25 ft.lbs on #3 bolts, then tighten up #2 bolts to 25 ft.lbs, then do #4, working outward to #1 and #5. After each cap is tightened, try turning the crankshaft. It should rotate free of resistance.

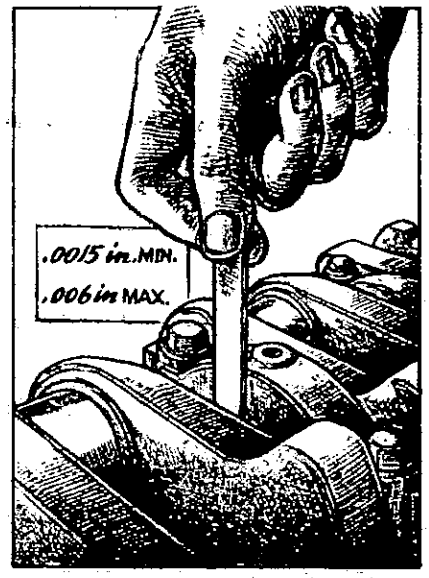
After one pass across the ten bolts, do it again—three times in all, until you reach 33—42 ft.lbs. Check each time to see that the crankshaft turns freely.

Step 8: Check Crankshaft End Play.

The crankshaft not only moves around (radial motion) but also moves ever so slightly front-to-rear (axial motion). When the crankshaft is spinning at 3000 revolutions per minute (rpm), it needs this end play; otherwise the engine would seize and stop running. This "end play" is governed by the #3 main bearing, the one with the shoulders on it.

If you look closely on either side of the #3 main bearing, those shoulders will appear to rub against the webs (offset parts) of the crankshaft. End play is checked by inserting a feeler gauge between a #3 main bearing shoulder and the web on the crankshaft. If you move the shaft forward by prying it as you did in Step 7, you'll see a slight shift—0.0015in to 0.006in. Try fitting a 0.003in feeler blade between the back shoulder of the bearing and the crankshaft next to it. If the 0.003in doesn't fit, try the 0.002in or 0.0015in. If the 0.0015in doesn't fit, consult your machinist after checking that the crank and main bearings are in right. If these blades fit, try larger sizes up to 0.006in. Retap and remeasure end play if your readings are questionable. More than likely, you are within specifications, so smile and follow through.

Spin the shaft again. Its full rotation should be smooth.



Crankshaft Endplay
CHECK ALONGSIDE Nº 3 MAIN.

Step 9: Install the Pilot Bushing.

See Ch. 11, Pt. 1, Proc. 9 (8).

Step 10: Install the Rear Main Oil Seal, Spacer Plate, and Flywheel or Driveplate.

See Ch. 11, Pt. 1, Proc. 10 (7 and 8).

Have your assistant steady the block while you torque the flywheel bolts. Instead of the method described in Proc. 10 to lock the crankshaft from turning, you can wedge a hammer handle, wrapped in rags, between one of the crankshaft journals and the left side of the block. Be careful, and remove the hammer, rags and any debris from the block when the flywheel is on.

Step 11: Replace the Clutch Disc and Pressure Plate.

See Ch. 11, Pt. 1, Proc. 9 (11-12).

Step 12: Replace the Motor Mount Brackets.

You stashed the brackets together with their bolts and washers, labeled "motor mounts." Find them and decide which ones go on the left and right side of the block. The longer, stretched out bracket goes on the left. If the block is upside down, the bracket should curve toward you. Look at the mounts in the engine compartment to position the brackets and line up the two holes with the matching holes in the block.

Install the bolts and washers and tighten the bolts with a 14, 17, or 19mm socket.

Refer to the illustration in Proc. 7.

Step 13: Replace the Oil Pressure Sender.

See Proc. 16.

Step 14: Reassemble the Engine While it is Out of the Vehicle.

This step is for **4WD people** and those who want to completely reassemble their engine out of the vehicle.

You four wheelers have to do this step (at least install the pistons and the oil pan because the front differential is in the way). So before going any farther, do Proc. 12, installing the pistons, etc. After that you have to decide if you want to put on the head and/or the timing chain assembly and the timing cover before or after the oil pan. Read on.

Once the crankshaft is in and the flywheel and clutch are on, it's easier to rebuild the engine in this order: (1) pistons, rings and rod bearings—Ch. 10, Proc. 12; (2) the cylinder head—Ch. 9, Pt. 1, Proc. 5 and 6; (3) the timing components and cover—Ch. 9, Pt. 2, Proc. 3 and 4; (4) the oil pick-up screen and oil pan—Ch. 10, Proc. 13; and (5) read Proc. 17 at the end of this chapter to learn how to handle an engine once it's out of the vehicle and dangerously heavy.

The advantage of assembling the engine without the cylinder head while it's out of the vehicle is to avoid the top-heavy weight of the engine with the head on it. All this depends on your ability to handle and hoist a complete engine. I tell you how to assemble it without the head in Ch. 9, Pt. 2, Proc. 3 and 4. If weight isn't of concern to you, follow the complete assembly sequence as outlined in the beginning of this note. Then install the complete engine.

PROCEDURE 11: INSTALL THE ENGINE

Condition: The engine is out of the vehicle. You've completed a major rebuild, or you're putting in a new engine.

Tools and Materials: Hoist (chain fall or cherry picker type), chain or cable, basic tool kit, jack and jack stands (if necessary), an assistant.

Remarks: The cylinder head and the oil pan may be off the engine. The flywheel and clutch have to be bolted in place with the throw-out lever and bearing installed. If you have an automatic, the driveplate should be attached to the crankshaft and the torque convertor should be fitted inside the transmission bellhousing. If your transmission is out, you'll want to install it with the engine. Bolt them together now. All these details are covered in Ch. 11, Pt. 1.

Think safety while doing these steps, and remember, you need a good chain or cable, a proper hoist and a trustworthy friend.

Caution: Never put yourself or your body parts under a hanging engine or transmission.

Step 1: Prepare to Install the Engine.

If the cylinder head is on the engine, look for the two sling brackets bolted to the head, one on the front right side or front and the other on the left rear side. They're flat, with oblong holes stamped out of them. Run a chain or cable through the holes, leaving enough slack to connect the hoist.

If you have no slingers or the cylinder head isn't on the engine, make a sling with two loops of chain or cable underneath the engine. Either way, the chain or cable has to be connected *securely*. The trick is to position the chain at the right places so the engine tilts slightly down to the rear, and so the hoist can raise the engine high enough to clear the top of the engine compartment. (If the transmission is connected, the height and tilt are much greater.) Be especially careful when dealing with the heavy engine, keeping your fingers and toes well away from anywhere they could get trapped and crushed. (See precautions in Proc. 17.)

Raise the engine until it's hanging from the hoist.

If the engine isn't at the proper angle (front-to-rear), change the position of the hoist connection; the rear of the engine should be lower than the front. Also look at how level the engine is from side to side. When finally in, it will lean slightly to the right (L-series) or to the left (Z-series). Adjust the chains until everything is close

enough and you are satisfied that the installation will be safe and as simple as possible.

If you had a metal insulator on the left motor mount, install that with the engine.

Step 2: Lift and Bolt the Engine Into Place.

Keep an eye on the chain-to-hoist connection as you lift the engine into the compartment. Take your time and be careful.

When the engine or transmission is over the engine compartment, start lowering it into place. Watch that the front of the crankshaft doesn't bind and the clutch, flywheel or driveplate doesn't hang up on the transmission if it's still in the vehicle.

•**Transmission in Vehicle People:** Aim the back of the crankshaft toward the transmission input shaft. Be clear about where the input shaft has to fit through the center of the clutch. Automatic People have it easier; you need only get the block and transmission housing to match. The other considerations are the motor mount brackets. Aim these toward the studs on the mounts.

The hardest part is getting the input shaft splines into the clutch disc splines. Ch. 11, Pt. 1, Proc. 12, details how to install the transmission when the engine is in place. You are doing the opposite, but the problem is the same. Read that procedure and apply it to your task. If you're working with an assistant, make your moves clear to each other.

It sometimes helps to raise or lower the transmission and/or the engine to get them to mesh. When the input shaft enters its hole, push the engine rearward—and feel relief. But don't relax yet. Grab a transmission bolt (or two) labeled "engine to transmission" and start it into one of the engine-to-transmission holes to hold them together.

•**Transmission on Engine and Out of Vehicle People:** You'll have to raise the engine high enough to get the transmission into the engine compartment by maybe lifting the tail section up while the engine hangs. Be careful. As you lower and move the assembly down and back, aim the tail section into the transmission tunnel. As the engine gets closer to the motor mounts, you'll have to get underneath the vehicle to lift the transmission tail section up and over the crossmember. Use a movable floor jack to support the weight if you have one. 4WD People have to work the tranny over or around the front differential and the transfer case. This all applies to 4WD trucks. Car People have to support the transmission to level it and the engine. Everyone has to coordinate the alignment of the motor mounts and not get hurt in the process.

Don't tighten any mounting nuts or bolts until all mounts and mounting holes are matched and properly fitted. (See Ch. 11, Pt. 1, Proc. 12 to reconnect the transmission and its relative.)

•**4WD People:** You'll now have to raise and remount the front differential. It helps to have a jack, but a muscular helper can do the same thing. You'll want to align the mountings and insert the various nuts and bolts but not tighten them until the mountings are all in position. The nuts and bolts of concern are the front differential mounting and bolt, the rear differential crossmember if you removed it, the rear mounting ones (four of them), and finally the driveshaft connecting the differential and the transfer (Ch. 11, Pt. 1, Proc. 16).

•**Everyone:** Look at the motor mounts. The holes in the brackets ought to be on or close to the mount studs. You often have to move the engine around by hand or with a pry bar to get the hole and stud to match.

NOTE: If you have trouble aligning the motor mounts and brackets, try to raise the engine a bit to get at and remove the right mount from the vehicle. It's held on by two 14mm bolts. Once off, fit this to the bracket on the engine so it's secure but not fully tightened. Lower the engine and align the left mount stud to the bracket then start threading on the nut. Leave the nut loose. Jump over to the right side and work the two 14mm bolts back into the frame through the mount. When it's all lined-up, lower the engine and tighten the bolts and nuts as directed.

When the engine's in place, put the washers and nuts on the studs but don't tighten them yet. Continue bolting the engine and transmission together if necessary as described in Ch. 11, Pt. 1, Proc. 12.

Remove the chains and hoisting equipment.

When the transmission and engine are matched and fully in place, you can tighten the motor mount nuts. Use a 14 or 17mm socket and make sure the nuts are fully tightened. Recheck all your connection points to make sure they're all secure.

Step 3: Replace the Air Conditioner Compressor.

Whatever the air conditioner's design, it's replaced in the reverse order that it came off.

Start by attaching the compressor to the mount. Then attach the compressor to the adjustment bracket if you have one. Your assistant can be a great help by holding the monster while you fasten it to the engine. Make sure the hoses aren't crimped and the wire to the compressor is connected.

Step 4: Replace the Air/Smog Pump.

See Ch. 6, Pt. 2, Proc. 8.

Leave the belt off until later.

Step 5: Replace the Heater Inlet Hose.

See Ch. 8, Proc. 3.

Either replace the hose or reattach the old one to the three-way junction. Don't forget to hook the bracket around the hose and bolt it to the dipstick (L-series).

Step 6: Replace the Starter Motor, Alternator, and Distributor.

See Ch. 7, Proc. 7 and 9.

If the timing cover and/or crankshaft pulley is off, leave the starter motor out. You can install the alternator, but leave the adjuster bracket and belt off until the cover is back on. If the timing cover and/or the head is off, wait to install the distributor until Proc. 14. Otherwise, see Ch. 3, Proc. 5 on how to replace the distributor. Either way, come back here when you're done.

Step 7: Reconnect the Wires on the Right Side of the Engine.

First go for the oil pressure sender. The sender wire may be harnessed with other wires nearby. The wire pushes onto the little bullet or spade connector(s) sticking out of the sender. Crimp the bullet connector if necessary.

The other wires go to the starter motor and alternator. Leave them alone if the starter or alternator is out, and reconnect them if they are in place (Ch. 7, Proc. 7 [7] and Proc. 9 [11]).

•**Z-series:** If you disconnected a wire (plug) from the O_2 sensor on the exhaust (left side of engine) manifold, you labeled it "O_2 sensor." Reconnect these two halves.

•**Everyone:** Route the wires so they are out of the way. The harness may attach to the engine with a plastic twist that is bound to the heater hose.

If the cylinder head is on, you can reconnect its hoses and wires by reading Ch. 9, Pt. 1, Proc. 6, starting wherever you left off.

Step 8: Replace the Fan (and Maybe the Pulley), the Alternator Belt, the Radiator, and Refill the Cooling System.

See Ch. 8, Proc. 2, 4, 5.

If the timing cover is off, wait to do all of this until it and the cylinder head are back on. Replace any hoses that look or feel worn out.

Step 9: Replace the Hood and Skid Pan.

Have your assistant help you bring the hood over to the vehicle. Find the four bolts that hold the hood in place and keep them close by. You scribed where the hinges matched the hood, so when the bolts are in and tight enough to keep the hood from moving you can align the hinges to the marks. Make sure you get the support rod back into place. Tighten the bolts and make sure that the hood closes properly. Readjust the hinge positions if necessary.

WHEN THE ENGINE IS IN, follow this sequence to reassemble it if necessary.

•Install the pistons—Proc. 12.

•Replace the cylinder head—Ch. 9, Pt. 1, Proc. 6.
•Replace the timing chain and cover—Ch. 9, Pt. 2, Proc. 3 and Proc. 4.
•Replace the oil pick-up and oil pan—Proc. 13.

Before you start the rebuilt engine, read the comments in Proc. 15 of this chapter and the end of Ch. 9, Pt. 1, Proc. 6.

PROCEDURE 12: INSTALL PISTON RINGS, PISTONS, AND ROD BEARINGS

Condition: The pistons (new or old) are on the connecting rods. You have new rings to match the pistons and new connecting rod bearings to match the crankshaft. The cylinders have been prepared (honed or rebored) and the connecting rods are clean.

Tools and Materials: Piston rings, rod bearings, engine oil (and squirt can), a piston ring expander and a piston ring compressor (rent, borrow or buy them), feeler gauges, masking or plastic tape, a clean coffee can.

Remarks: I highly recommend that you buy or rent a ring expander to install the rings. Step 2 tells you how to do it with feeler gauges if you don't have an expander. Do not confuse the *ring expander* with the *spring expander*, when used in this procedure.

Step 1: Set the Scene and Check Ring End Gap and Side Clearance.

Set-up: If you have a vise, lay a rag over the jaws and clamp the connecting rod flat between them. Stand the piston upright. Start with #1 piston (the number 1, 2, 3, or 4 is stamped on the bearing cap and big end of each connecting rod).

If you don't have a vise, have your assistant steady the piston while you install the rings.

Stuff clean rags up in under the piston to keep it from flopping against the rod while you install the rings, or rest the bottom on something softer than aluminum to steady it.

Ring end gap is checked with the new ring fit into the cylinder but off the piston. Go back to Proc. 6 (2) and follow what **New Ring People** should do. If the rings don't match the specifications listed, consult a machinist.

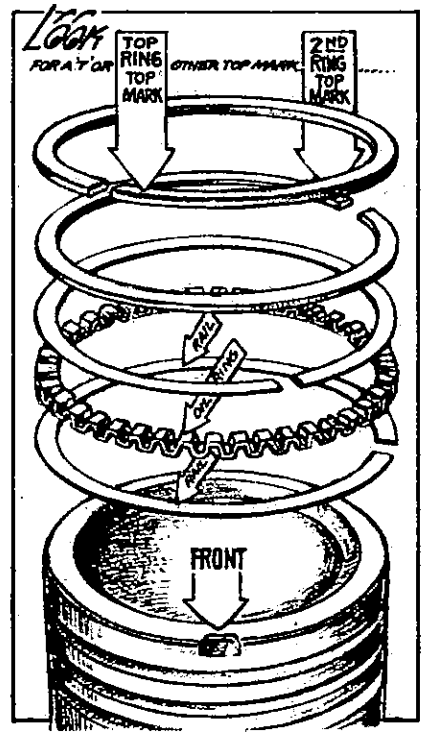
It's a good idea to recheck ring side clearance with the new pistons and rings (Proc. 5 [6]). Return here when you're satisfied; see a machinist if you're not.

Step 2: Install Piston Rings.

Bring out the new set of rings, keeping them in separate groups of three. The sets are usually wrapped or boxed together, with an instruction sheet. Read those instructions well and focus on the positioning of the rings. People too often install rings improperly and end up with no compression, scratched cylinder walls, or gross oil consumption.

If there aren't any instructions, examine the two top compression rings, #1 and #2. (Don't confuse these with the two shiny rails that are part of three-piece oil rings.) The compression rings usually have a *dot*, the word *top* or a *number or letter* stamped on them, to indicate their top side. If there are no markings or you can't understand the instructions (often in Japanese), consult a machinist. Don't be shy. This is vital. NOTE: Carefully inspect the piston grooves (bands). They must be clean. Use a rag or pipe cleaner to wipe them out before installing the rings.

Here's where the ring expander comes in. An inexpensive ring expander may cost less than renting one, certainly less than buying a new set of rings if one breaks or if you wreck a piston.



•**Old Piston People:** Make sure all the ring grooves and holes in the grooves are completely free of deposits, or else the new rings won't seat properly!

•**Everyone:** Handle everything with care and take your time. Start with the bottom or oil ring on #1 piston. The sides of the rod caps are numbered 1-4. Don't confuse these numbers with others often stamped on the opposite side. The bottom ring is in two or three pieces. A round crinkled piece of steel acts as an *expander spring*, holding two thin rails (rings) or one big ring with two ridges against the cylinder walls. The expander spring has painted ends, little plastic nibs, or just plain (unpainted) bent up ends on each end of it. You want the ends to touch but not overlap each other. Slip this expander spring over the piston top and into the bottom groove. Follow installation instructions if supplied, and see that the two ends touch the way they should.

Slip on those thin top and bottom rails. Install the bottom rail first by starting one end in under the expander spring one inch to the left of the touching ends. You can twist these thin rails a little. Wind that rail in between the groove and the bottom of the expander spring. When in place, the expander ends have to touch, *not overlap*.

Repeat this move with the upper rail but start it one inch to the right of the expander spring ends. Recheck the ends—*they can't overlap*. If you have a two-piece ring, simply slip the spring into the lower groove, ends touching, then slip the outer ring over it, spreading it with the ring expander or using the feeler gauge method described below.

The two top compression rings are the tough ones. Double check which side is top and face it up. Spread the rings just enough to get them over the pistons, but don't let them twist. That's when they break. This is reason enough to use a ring expander. If you don't have the right tool, read through this part, then find the feeler gauge instructions below. Be sure you clear the piston sides when sliding the ring over it; otherwise the ends will scratch the soft aluminum. These rings have to go on with the top marks *up* and the rings in the correct grooves. Fit the ring ends securely into the expander tool and gently expand the ring. When you can use the tool (try it on an old ring) jump ahead to **Everyone**.

•**Feeler Gauge Method** (you need an assistant): The oil ring is in place unless it is the two-piece kind. Read through this before trying it.

Take two feeler gauges out of the holder—two you don't use very much, like the 0.015 and the 0.017in. Have your helper hold the blades side by side, lengthwise, against the piston. They should cover the ring grooves and project a bit above the top of the piston.

Now pick up the correct ring and hold the gap over the blades. Carefully tip the ring and place the ends against the outside of the blades slightly below the top of the piston. Lever the opposite side of the ring down while the ends expand across the blades. Don't scratch the piston. Keep the blades in place until all the rings are on.

To remove the gauges, make sure the rings are parallel with the grooves and slowly pull the blades out one at a time.

Feeler Gauge METHOD BE CAREFUL NOT TO TWIST THE RINGS.

•**Everyone:** Start with the second compression ring or the oil ring (if two-piece). If the ring is positioned marked side up, carefully expand the ring into its groove. Take lots of deep breaths as you gradually expand the ring over the piston. Expand the ring enough so the inside ring ends clear the sides of the piston.

Repeat this process with all the rings and pistons. The two compression rings should turn freely. The rails

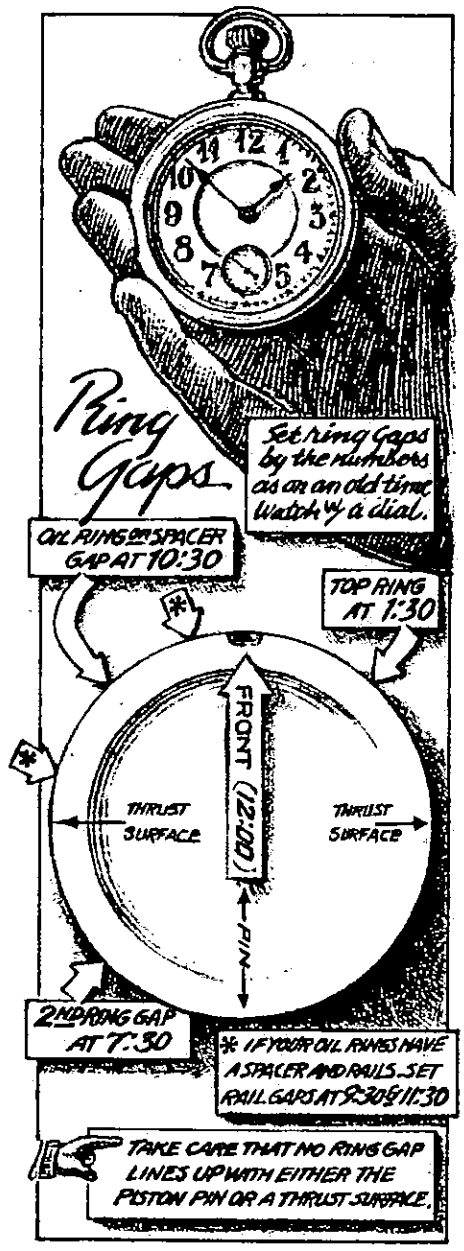
on the bottom ring should move if turned with your fingernail, with the expander rails touching. Lay the assembled piston on a soft, clean rag.

Step 3: Install the Connecting Rod Bearing Shells.

Find the #1 piston and connecting rod. The numbers, stamped on one side of the cap and rod, correspond to the piston order. Open the packages of bearings. All eight of them are the same size, but install them out of the box in sequence 1, 2, 3, 4, etc. Give yourself lots of room to work.

When handling the bearing shells, do not touch the cupped or inside part with your fingers. Look at the connecting rod where the bearing fits. You will see a small cut out where the tab on each bearing fits. The corresponding groove on the cap is opposite but matches. Also note the oil hole in the bearing which will line up with an oil hole in the connecting rod.

Fit the bearing shells into place, first wiping the rod, cap and back side of the bearing clean. Slip the tabless end into the curve and press down on the ends of the bearings to flush them up to the edges of the cap and rod. The tab should fit evenly into its groove and the shell should be even with the width of the cap. Keep the cap and rod with matching numbers next to each other with the nuts close by. *These are special nuts, so don't use anything else.* The rod bolts (also special) tend to slip out, but are easily tapped back into place, so keep track of them. Repeat this step on all the pistons.



Step 4: Install the Pistons and Rods into the Cylinder Block.

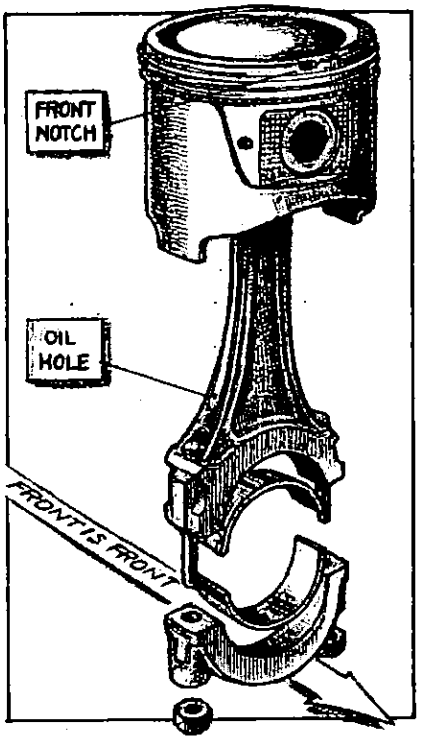
If the timing chain is off the engine, rotate the crankshaft so the front throw (bearing journal), #1 cylinder position on the crankshaft, is facing downwards. Otherwise, leave it where it is. (If the timing chain is in place and blocked, do not turn the crankshaft.)

Put some tape around the bolt (stud) threads on the connecting rod (the caps are now off). Wrap enough tape on the studs so they won't push out of the rod. The tape also prevents you from scratching the crankshaft journals with the bolt ends.

Pour a cup of engine oil into a clean coffee can and set it nearby. Familiarize yourself with the ring compressor you begged, borrowed or rented. The most common type has bands around it that you tighten around the rings to compress them. A little gear and pawl hold and lock the springs from expanding. A lever releases the spring. Practice until you are familiar with the tool's operation. You'll want to position the compressor so the springs (bands) are directly over the piston rings and the tightening control is accessible for easy action.

Note in the illustration that the ring ends (gaps) are staggered around the piston. Also note where the front mark on the piston is. Almost every brand of piston has a notch, arrow, or mark to indicate forward. The definitive position indicator is the oil hole on the connecting rod. If you look down on the piston top with the forward mark pointing away from you, the oil hole should be on your right. If this isn't so, take the pistons and rods back to the machinist and have them repositioned.

Position the two top ring gaps opposite each other. Looking down on the top of the piston, imagine the front of the piston as 12 o'clock. Turn the top ring so the gap is between 1 and 2 o'clock and the second ring gap is between 7 and 8 o'clock. The oil ring spacer



and spring gaps should be set at 9:30, 10:30, and 11:30. The rings should be in these positions when inside their cylinders. Pay attention to maintaining these positions as you use the ring compressor and install the rings.

Now practice expanding the ring compressor. I use my left fist to spread it wider than the piston and my right hand to control the lever and tightening device. It's easy if a helper holds the piston steady as you adjust the compressor, check ring position, and finally position the tool square to the piston. But wait, first dunk the piston in the coffee can to coat it and the rings with engine oil. Make sure the ring compressor is really clean. Keep a clean rag handy. The oil on the pistons will attract grit and dust quicker than a toddler.

Set the compressor to one side, wide open ready to go. Pick up #1 piston and recheck the position of the rings. Okay? Slip the ring compressor over the top of the piston. Watch that you don't upset the position of those all-important ring gaps.

Pick up and position the compressor directly over the rings so it sits squarely (not cocked) over the bottom ring. Tighten the tool until it is flush against the piston, and the rings are fully compressed against the inside of the ring grooves. The bottom ring has to be covered and fully compressed or you won't get the assembly into the cylinder.

When the compressor is on correctly, first check the *front* position of the piston—the mark, arrow, letter or word. Second, see that the small oil hole in the connecting rod (above the rod bolt and up the rod a little) is facing the *right hand* side of the block when the piston faces forward. Third, check the numbers at the base of the connecting rods to make sure the pistons are in order. These numbers will end up on the *left* side of the crankshaft.

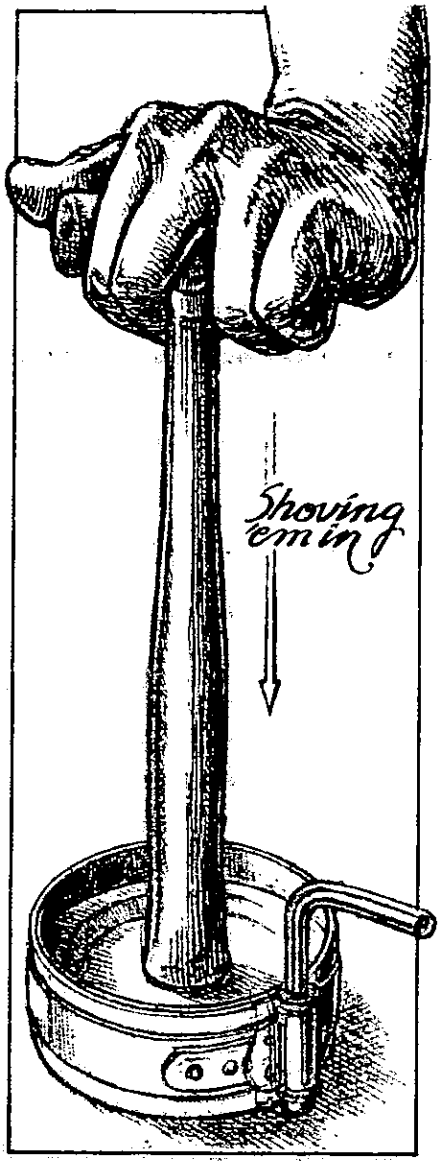
•**Engine Out of Vehicle People:** You can position the block so the top (deck) is parallel to the edge of the bench or raised slightly so the pistons will fit easily into the cylinders. You want to be able to reach around into the underside of the block and guide the connecting rod through the cylinder and over the crankshaft. Because the back end of the block is wider, you'll need to prop up the front end to keep it level. Be careful, the block is heavy. NOTE: Hold up the connecting rods to keep them from scratching the cylinder walls while you install them. Have your assistant work from the underside of the block. Your piston installation is like "engine in vehicle people's" otherwise.

•**Everyone:** Wipe out the cylinders and smear a little engine oil all over the cylinder wall. Put a little more on the rod bearing, then insert the bottom of the connecting rod into the #1 cylinder with the piston mark forward, taking care not to scratch the cylinder walls. The base of the rod should be crosswise to the crankshaft. The piston front mark is straight forward and the side of the piston is square to the top of the block and cylinder. Push the piston down until the ring compressor bottoms out against the top of the block. Now recheck the tightness and position of the ring compressor, it has to be covering the oil ring fully. Make sure the rings are fully compressed by carefully retightening the adjuster.

Have your helper lie down under the engine and guide the bottom of the rod over the crankshaft as you install the piston. Keep an eye on the piston's position so the rod goes straight over the crank. Don't let the rod bearing shell fall out.

Start tapping the top of the piston—short, light taps with a hammer handle square on the top of the piston. The assembly should slide into the cylinder. *If you feel resistance,* STOP! Make sure none of the rings are hanging up on the block. If they do, loosen and reposition the compressor. Watch that the connecting rod is going over the crankshaft squarely and that those bolts aren't hitting anything. The piston will go right in if the compressor is tight. Keep checking it.

When the rod meets the crankshaft, you will hear a solid clunk.



Step 5: Replace the Connecting Rod Cap; Check Oil Clearance.

If you're the careful type and have green plastigage, check the oil clearance of each rod journal (Proc. 4 [3]) as you install the four caps. Mechanics will often only check two of the journals, if any.

Take all the tape off the rod studs and pick up the cap. Check the numbers and make sure the numbered sides are matched (left-hand side). Smear oil on the rod bearing surface and install the cap over the studs, triple-checking the numbers location and bearing position.

Pick up the eight nuts you stashed in the "connecting rod nut" baggie. Remember these are special nuts, so don't use anything else. Turn the nuts on by hand and tighten them evenly, side by side, with a socket and ratchet, but not fully tight yet. Use the torque wrench to tighten each nut gradually in steps to 25 ft.lbs (8mm rod bolt people) or 37-40 ft.lbs (9 mm rod bolt people or most everyone from 8/71 on). Be sure you're reading the wrench properly.

After #1 is torqued, install #2 piston (Step 4) and torque it. This piston will go all the way down if you can't turn the crank. Don't forget to oil the cylinders and bearings, checking for proper ring gap location and position of piston and rod. Keep your wits together until all of the piston rods and caps are in. Follow Step 4 exactly. Please don't get sloppy.

If the timing chain is out (not blocked in place), you can turn the crankshaft to position the crankshaft throw of the cylinder you're working on *down* by putting the front pulley bolt in the crank and wrenching clockwise. Feel for binding or resistance, i.e., something not fitting as it should. The sound and feel of pistons and rings dragging against the cylinder walls is normal. If the crank turns over smoothly a number of times with all the pistons installed, no rough spots, you're that much closer to a running start.

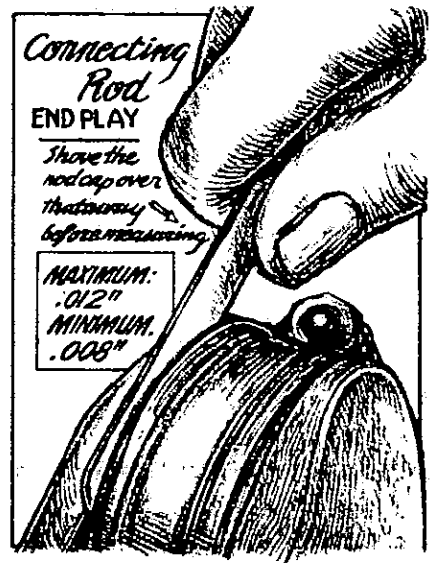
If you have any doubt, call the machinist for advice.

Step 6: Check the Connecting Rod End Play.

This is a quick and important step to assure that there's enough play between each of the connecting rods and the crankshaft. The clearance should be between 0.008in and 0.012in, so grab your feeler gauges.

Insert a 0.008in gauge (blade) between the side of each connecting rod cap and the edge of the crankshaft. You may have to push the rod one way or the other to make a gap for the blade. If the 0.008in fits, try the next bigger size. If anything over 0.012in fits, something is wrong. If any feeler blade thinner than 0.008in fits, there isn't enough *end play*. In either case, consult the machinist for advice. Your end play readings will most likely be in the ballpark.

Turn the crankshaft again, if you can, to make sure it isn't binding. While you're at it, check that those numbers stamped on the left side of the rod and cap are in fact on the left side of the crankshaft. This is the same side as the oil baffle and screen (Proc. 8 [9]).



PROCEDURE 13: INSTALL THE PICK-UP SCREEN AND OIL PAN

Condition: The pistons, piston rings, connecting rods, and bearings are in. The cylinder head and timing cover may be on or the head is off, the cover is on and the timing chain is blocked by the special tool. You have thoroughly cleaned the oil pan and pick-up screen. (If not, turn to Proc. 9 and do it now.) **4WD People:** Your engine is out or if it is in, the front differential has been removed.

Tools and Materials: New oil pan gasket, new pick-up screen gasket, hammer and punch (if gasket surface isn't straight), Phillips screwdriver, non-hardening gasket sealer, basic tool kit, safety glasses.

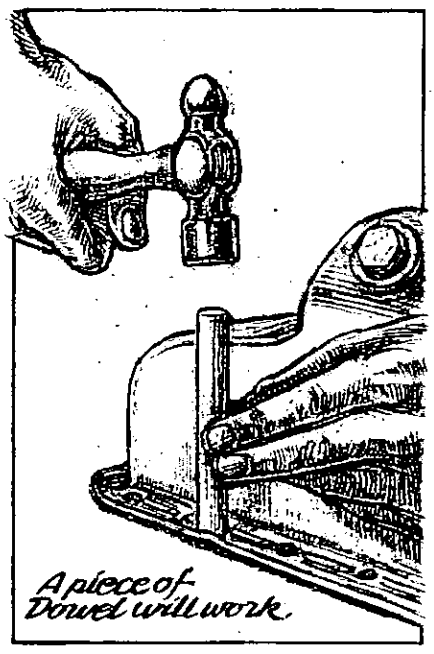
Step 1: Install the Oil Pick-up Screen and Gasket.

Find the oil pick-up. It is mushroom-shaped and has a round screen at one end. On the other end is a flange that bolts to the bottom of the block on the same side as the oil pump. Looking at the pickup, you'll notice a curve to it. It mounts so the screen is under and in line with the crankshaft. (4WD engines have a bracket and an additional bolt mounting the strainer to a hole in the block.)

Find the oblong gasket that fits the flange and the two (or three) short bolts with washers that hold the pick-up screen (and bracket) in place. Lightly coat both sides of the gasket with sealer to hold it in position as you install the pick-up and bolts. Tighten the bolts with a 12mm socket until the lockwashers contact (no more than 8 ft.lbs).

Step 2: Check the Oil Pan Gasket Surface.

Make sure all of the old gasket is off the pan and eyeball the surface to see if it is close to level. If for some reason it isn't, put on your safety glasses and lay the pan top down on a smooth flat surface to carefully straighten it from the underside with a hammer and punch to level the really bad spots. Wipe out the inside of the pan so it's very clean.



Step 3: Prepare the Block and Oil Pan Gasket.

Set the pan so the gasket surface is up. Find the new oil pan gasket and figure out which way it fits on the pan. Spread a light even coating of sealer on both sides of the gasket. Carefully lay the sticky gasket on the pan, properly positioned. All bolt holes must be in line with the holes in the pan. Don't run to watch your favorite soap opera just yet; the sticky sealer acts like fly paper, so get the pan on fast.

Take one last look inside the block for loose debris before closing it all up. Is the baffle plate on correctly? Did you torque all the bolts and rod nuts? Are there any loose tools inside the patient? Okay—find the 22 10mm bolts and washers, labeled "oil pan bolts." On most L-18 and L-20B engines, there is an L-shaped metal piece too. Slide the pan, the bolts, the L-shaped piece, a 10mm socket, extension, swivel and ratchet, a small Phillips screwdriver, the sealer, and yourself under the front of the engine head-first.

When you're comfortable, take a final look at the gasket surface around the bottom of the block. It must be clean, smooth, and dry. If it isn't, use emery cloth and a rag to get it that way.

Grab the sealer. Put a dab of it on the front of the block—one on each side—where the timing cover and block join. Look at the back of the block and put a dab on each side where the rear main bearing cap fits into the block. You installed the side seals there.

Now for the pan. If the engine's in place, proceed. On trucks, the pan will fit straight up against the block. On cars, you have to maneuver the pan over the crossmember from the back of the engine, front-first, with skill and patience.

Keep the gasket in place and prevent dirt from falling into the pan. Match the pan and gasket holes with the holes in the block. Use a skinny tipped screwdriver to align them if off-center. Install a bolt in each side of the pan, in the center, to hold it in place. If you have the L-shaped metal piece, fit it on the back corner, right side of the pan, long side along the back of the pan. Pick out the seven longer bolts and put them in to hold the metal piece. Install the rest of the bolts, but don't tighten any of them yet.

•**Automatic Transmission People:** A couple of the bolts hold transmission fluid pipe brackets to the pan. Find the pipes and brackets and match them with the holes.

•**Everyone:** You have to tighten the pan bolts evenly or the pan will leak. Work around the pan, using whatever combination of socket, extension and swivel you have to to do the job. The torque for these bolts is only 5 ft.lbs, so don't overdo it and break one. They're difficult to extract.

When that's done, slide out and install the dipstick. If the engine is in the vehicle, go on to the next step. If it is out of the vehicle, you can install the engine now (Proc. 11 of this chapter).

Step 4: Replace the Front Crossmember.

•**Trucks Only:** The crossmember is hanging down under the right side of the engine. Move it up into its slot on the left. Find the three 19mm bolts labeled "crossmember" and remove the nuts and washers. Push one of the bolts through a hole on the left and one through the vacant hole on the right. You may have to hammer the bolts in—not too hard though. If one or more bolts won't fit through, wait until you have lowered the truck to install them.

When all the bolts are in, install the washers and nuts. Tighten them with a socket and wrench, as tight as you can.

Step 5: Replace the Steering Idler Assembly.

See Proc. 3 (5) and Ch. 12, Proc. 11.

The idler fits into the right side of the frame. (See Proc. 3 [5] in this chapter for an illustration).

Step 6: Lower the Vehicle.

See Ch. 13, Pt. 1, Proc. 1.

You can keep it up until it's ready to run if you want, unless it's too high for you to work on from above.

NOTE: If you have done the next procedure and/or the oil pump is off the engine and ready to install, turn to Ch. 9, Pt. 2, Proc. 4 (4-6). Otherwise do Proc. 14 next.

PROCEDURE 14: CHECK AND RESTORE THE OIL PUMP

Condition: You should do this in any minor or major engine rebuild. You can skip this procedure if you're using a new pump. You are here from Ch. 9, Pt. 2, Proc. 2 (9).

Tools and Materials: 10mm socket, ratchet and extension, 24mm or 15/16in socket (open-end or adjustable wrench will also work), soft hammer, sharp pocket knife, single-edged razor blade, pencil type magnet, feeler gauges, straight edge, an assistant or a vise, oil pump internal gasket available only from your Datsun/Nissan dealer, part #15025-21000.

Remarks: Most pumps are reusable unless the engine has been poorly maintained, perhaps too few oil changes or something worn out or broken within the engine.

Step 1: Dismantle the Pump.

Work over a rag on a bench to catch falling parts.

Clean the outside of the pump well with solvent. If you don't have a vise or clamp of some kind, have your assistant hold the pump solid as you jerk on the various bolts in taking it apart. Take care not to drop the pump or its precision parts.

Find the big bolt (plug) on the top half of the pump. Also find the two small bolts, one on each half, that hold the pump together. If you use a vise to hold the pump, wrap a rag around it to protect its soft aluminum body.

The big plug covers the oil pressure regulator valve and is pretty tight. Use a box-end wrench, socket, or crescent wrench to loosen it counterclockwise. There may be some shim washers that fit inside the plug between it and the spring. The spring will tend to "boing" out, so unscrew the plug gingerly. There should definitely be a big external washer around the plug. Keep the washer (and shim) with the plug. The spring will come out easily, but the spool valve (a little round steel part) will stay stuck down in the pump. Poke the magnet or your little finger into the hole to get it out. If it's stuck, you may have to wait and pry it out from behind once the pump cover is off. Examine the spring for distortion and the spool for scoring, pitting, or rust. If there is a lot of rust, consider buying a new pump. NOTE: There may be a shim washer inside the spool to shim the spring. Save it with the rest.

Remove the two 10mm bolts that hold the pump together. When the bolts are out, set them aside with their washers. The cover tends to stick to the pump body even after the bolts are removed. Parts in the pump will fall out if you're not careful. Position the pump shaft-end-down and work over your bench.

To remove the cover, you'll have to tap on it a little, with a fiber hammer or steel hammer and wood dowel. Don't gouge the soft aluminum or force anything between the cover and body. If all else fails, try hitting the cover against a block of wood as you would a jar to free the lid. Pull the cover off the pump body.

Reinsert the pressure regulator valve spool into the cover. Put your thumb over the plughole and shake the cover from side to side. The spool should move freely. If it is really stuck, have a pro check it out.

Step 2: Check the Pump and Spindle for Wear.

Inside the pump housing you will find the makings of a rotor-style internal gear pump. Examine the inside of the cover for wear. There will probably be some circular grooves in it which aren't of great concern unless they are deep. Rub your thumb across them to check. If in doubt, a machinist can tell you what's acceptable or too damaged (worn). Usually they're okay.

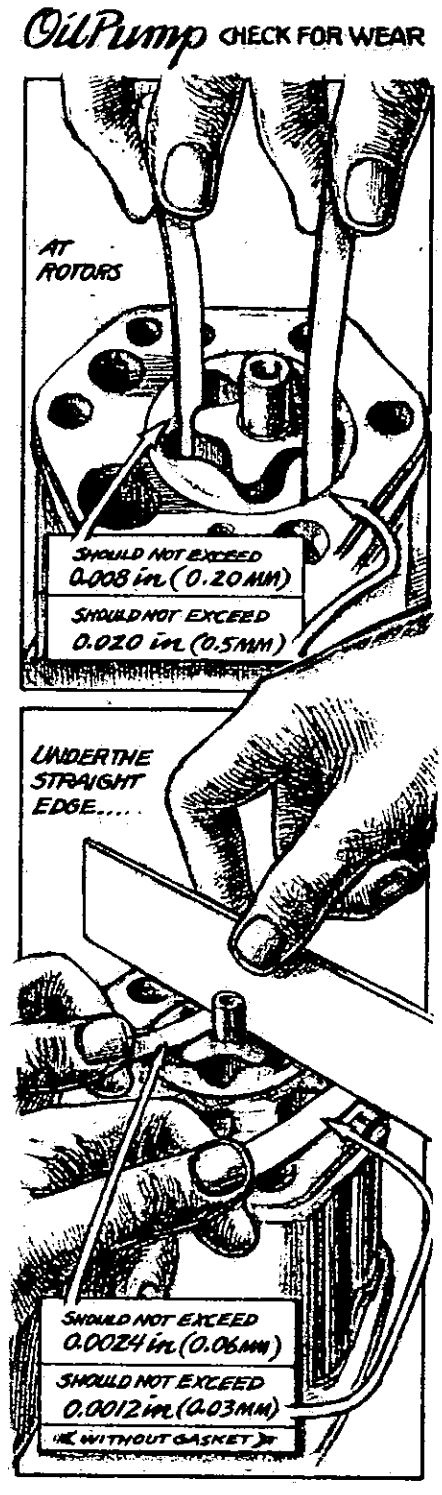
You can find out with feeler gauges whether the pump is within wear specifications and still serviceable. The **rotor** is the gear in the middle; the **ring** meshes around the outside of the rotor. Select the 0.007in feeler gauge blade. You want to measure the space between the rotor teeth and the ring when the two are in contact. 0.008in is the maximum clearance allowed, but start with the 0.007in blade. If the blade is too wide, turn it so it will fit. If the 0.007in doesn't fit, try the next smaller sizes—0.006in, then 0.005in—just to see what the pump's condition is. The clearance should be between 0.0016 and 0.003in.

Next try to fit a 0.010in feeler blade between the outside of the ring and the pump body. If it fits, the pump is too worn and you'll need a new (or good used) one. The clearance should be between 0.006 and 0.0083in.

Another wear point is between the gears and the pump cover. Check this "end float" by laying a straightedge across the top of the pump body and gears. Then try to insert the 0.005in blade between the straightedge and the gears. If it goes in, the pump's no good. NOTE: All the old gasket should be scraped off the pump body before making this check (Step 3).

The last check is a visual one. Pull the rotor and ring out of the pump body, but first look for an arrow or punch mark on the ring, for it must be fitted in the same way it came out. Check the surfaces of the ring and rotor as well as the body walls. If there are any scratches or score marks, ones that catch your fingernail when dragged across them, consider replacing the pump. Set the parts aside on a soft rag. Have a pro check out the internal parts if you are in doubt.

Check the Oil Pump/Distributor Drive Spindle: The spindle turns in the timing cover, its bearing surface, which can wear and cause excessive play. It is unusual for this to go bad, but check it anyway. Insert the spindle into the cover from the bottom right where the oil pump fits. The keyed end goes in first. The spindle has to fit through the sleeve-like bearing hole next to the oil seal hole; its axis will be diagonal to the cover. When the spindle is in all the way, the gear will be against the bearing. Wiggle the spindle back and forth. If there is more than a little play, take the cover and spindle to a pro who can measure the play (wear) with micrometers. The maximum is 0.006in. If it's more than that, you'll have to replace the cover.



Step 3: Clean the Pump Parts.

Clean the pump body with solvent until it's spotless. Scrape the old gasket off the two mating surfaces until they're perfectly smooth with a single-edged razor blade. Be careful not to gouge the soft aluminum. See that the inlet and outlet holes are free of grit and debris before starting reassembly. The pump's innards must be spotless.

Step 4: Reassemble the Oil Pump.

Wipe the ring and rotor clean with a soft rag, then coat them with a smear of oil. Set them back into the pump housing just as they were removed with the arrows or punch marks down into the housing, out of sight. You'll need two gaskets. The thin gasket goes between the body and cover for now and the thicker one between the pump and the timing cover (engine) for later. Match and line up the thin gasket on the pump body. Wipe the cover clean, including the pressure regulator hole. Squirt some oil in between the ring and the rotor, *but not on the gasket*. Don't use any sealer on this gasket. Put the two halves together, lining up the little dowel pins with their corresponding holes. The gasket fits only one way. Make sure the gasket is correctly fitted to the body before capping it off.

Replace the two screws and washers, one threaded into each half of the pump. Tighten the screws finger-tight. The torque value is 10 ft.lbs for these bolts. I don't use a torque wrench, but alternate from bolt to bolt until the washers are flush and then some.

Set the oil pump on its side so the pressure regulator hole is facing upward. Squirt some oil down into the cavity. The regulator spool valve goes in tip-first, shallow (hollow) side out facing you. Put in the spring next. If you have a shim (looks like a flat washer), coat it with grease and put it in the plug cavity. Slip the spring into the regulator valve, then put in the plug and big external washer. You may have to use some force to overcome the spring pressure and get the plug started in its threads. **Caution:** Don't crossthread this plug. You should feel very little resistance when installing the cap and only spring pressure when pushing it in. Tighten the plug with the 24mm or 15/16in wrench or socket so it won't loosen or leak. The torque is 21 to 25 ft.lbs. That's pretty snug, but don't overdo it.

Set aside the pump covered with a clean rag so it doesn't get contaminated or damaged. If you want to replace the oil pump now, go to Ch. 9, Pt. 2, Proc. 4 (4 and 5).

PROCEDURE 15: PREPARE THE REBUILT ENGINE TO RUN

Condition: You have completed all procedures in Ch. 9, Pt. 1 and 2, and Ch 10, so the engine is assembled. The battery is well-charged (Ch. 7, Proc. 1 and 5). There is fuel in the gas tank and all hoses and wires are connected (except the air cleaner hoses). The spark plugs are out of their holes. There is gear oil (manual trans.) or transmission fluid (auto. trans.) in the transmission (Ch. 11, Pt. 1, Proc. 3 or 4).

Tools and Materials: 5 quarts of engine oil—30 wt. detergent, a new oil filter (if not already installed), 1 gal. antifreeze/coolant and 1¾ gallons water, a remote starter or an assistant.

Step 1: Fill the Engine with Oil.

If you haven't already installed a new oil filter or bought oil, see Ch. 3, Proc. 2, then return here.

Before adding any oil to the engine, check that the oil drain plug at the bottom of the oil pan is tight. Four quarts will show FULL on the dipstick. After the engine runs, you can add the rest to fill the crankcase.

Step 2: Add Water and Antifreeze/Coolant to the Radiator.

See Ch. 8, Proc. 2.

Use good quality antifreeze/coolant, suitable for aluminum engines, and watch out for leaks.

Step 3: Ground the Coil Wire or Connect the Remote Starter Before Cranking the Engine.

Disconnect the center wire (wires, most Z-series) from the distributor cap and tape it (them) or lay it (them) on a bare metal bolt or body part for a good ground, well away from the carburetor or possible fuel leaks (Ch. 3, Proc. 6 [2] and Ch. 7, Proc. 12 [2]). It *must* stay grounded while you crank the engine. If you have a remote starter, use it (Ch. 3, Proc. 4). If you don't have a remote starter, have your assistant sit in the driver's seat and operate the key. NOTE: If it's easier for you to disconnect the **primary** wire(s) to the distributor, do that rather than grounding the coil wire.

Step 4: Check for Oil Pressure and Correct Coolant Level.

Without any compression (spark plugs out) the engine should crank easily. Get the oil pressure up high enough to make the oil light go out or the gauge to start moving. This way, when the engine starts you'll be sure there is enough pressure to protect the new parts. After the oil pressure is up to snuff, recheck the coolant level in the radiator and add some if needed. There should also be enough fuel in the floatbowl of the carburetor to run the engine. This cranking method kills three birds with one stone, i.e., checking out the systems (cranking, water, and fuel) while preparing the engine to run.

If you have a remote starter, you will do the cranking while watching the engine. If you have an assistant, have him or her sit in the driver's seat, ready to turn the ignition key when you signal "stop" (key turned completely off) and "crank," while you stand over the engine, senses attuned. The transmission should be in Neutral, the emergency brake on, and the wheels chocked.

With oil in the crankcase, the oil pressure should be up after a minute or so of cranking. The oil pump has to pick up the oil and circulate it throughout the galleys and journals in the engine before there is enough pressure to trip the sender and put out the light or move the needle in the gauge. No oil pressure? See note below.

As it cranks, the engine should sound normal except for the whooshing sound as the pistons force air out the spark plug holes. Keep an eye on the oil light or gauge. When it goes out or moves up a bit, you can stop cranking. Look at all the fuel and coolant hose connections for leaks.

When the oil pressure is up, you're ready to start. Take the radiator cap off and look at the level of the coolant. If it's low, top it up and replace the cap.

NOTE: If you can't get any oil pressure, you may have to remove the oil pump and prime it with oil (Ch. 9, Pt. 2, Proc. 2 [9] and Proc. 4 [4 and 5]).

Step 5: Install the Spark Plugs and Sparkplug Wires, Reconnect the Coil Wire.

See Ch. 3, Proc. 3 (7 and 8). Plug vacuum hoses with air cleaner off (Ch. 6, Pt. 1, Proc. 1).

Make sure the firing order is correct and the wires are in their proper firing order. Replace the coil wire(s) into the distributor cap.

Step 6: The Finishing Touches and Starting the Engine.

Do a final check of the vital fluids. The oil level should be on full or just a little above full. The coolant level should be a few inches over the fins inside the radiator. The vehicle should be blocked and in Neutral or Park. Either your helper must operate the throttle from the driver's seat, or you, with the remote starter, must do it from the back of the carburetor. Pump the accelerator pedal a few times to get fuel down into the intake manifold (don't over-pump). You should hear fuel squirting inside the carburetor when the accelerator is operated (if not, see Ch. 4).

•**Manual Choke People:** Open the choke, pull out the knob.

•**Automatic Choke People:** Push the flap at the top of the carburetor open while operating the throttle.

•**Everyone:** Put on your safety glasses and watch the cap. You may have to advance the ignition timing to start the engine. To do this, loosen the timing bolt (Ch. 3, Proc. 6). You may need to turn the distributor clockwise. But before you move it, mark the *timed* position on the baseplate of the distributor (Ch. 3, Proc. 5 [7]).

Look around one last time. Take a breath and start the engine. If the battery is strong and you connected everything up as it should be, the motor should start.

If the engine doesn't start right away, don't lose your head.

If the engine doesn't stay running but shows promise, tell the assistant to stop cranking and take his/her hand off the key while you place yourself at the left front corner of the vehicle and turn the distributor clockwise while the engine's cranking, keeping hair, hands, neckties, and wires out of the way of the fan at all times. Make absolutely sure that your helper in the driver's seat can hear and understand everything you say.

If it runs a little then quits, try changing the timing some more. Don't keep the starter motor cranking any more than 20 seconds at a try. Tell your assistant not to flutter the accelerator pedal any more than normal during starting or the engine will flood.

When the engine runs by itself with a little throttle action from your helper, have him or her watch temperature gauge and the oil and charge lights or gauge while you remain up front keeping an eye out for leaks. Let the engine run one minute; then turn it off and check the fluid levels. Look under the engine at the front and rear of the oil pan water or oil drips. Look around the hose clamps connections for other water leaks. If you see any drips at all, find out where they are coming from and shut the engine down right away. Go to the source of the problem and fix it.

Restart the engine and run it at a speed higher than idle (2000-2500 rpm) until it warms up to normal operating temperature as indicated on the temperature gauge. It shouldn't go any higher than a little past normal. If the indicator tends toward the hot side, turn the engine off, let it cool down, and check the coolant level. If the coolant level is up to the top, see Ch. 8 for troubleshooting steps.

Step 7: Fine Tune and Hot Adjust the New Engine.

See Ch. 3, Proc. 4 and 6.

Fine set the dwell and timing **(Non-Electronic Ignition People)**, and do a **hot** valve adjustment. After that, you can do a fine carburetor adjustment.

Step 8: Install the Air Cleaner.

See Ch. 6, Pt. 1, Proc. 1.

Step 9: Before You Drive and Breaking In the New Engine.

There are different ways to seat piston rings. My method is to cruise at 30 mph, then gradually accelerate to 55 mph. Then drop the speed to 30 and repeat the acceleration/deceleration process ten times. I learned this from a Hastings Rings package and it makes me feel good to do it.

I also recommend you change the oil and filter and readjust the valves after about 500 miles and again at 1,500 miles. Do a dwell and timing check at 1,500 miles. From then on, just do regular maintenance (Ch. 3).

It's best to keep below 55 mph during the first 1,500 miles. Don't over-rev the engine or push it up hills in too high a gear. Drive as you normally do, and don't ever let the engine idle too long at one time. When the engine is cold, run it above idle until it will go down the road without sputtering, then drive it at moderate speeds. Avoid *loading* a cold engine—like driving up a steep hill first thing in the morning. Never run the engine at freeway speeds when it is cold. And above all, keep your engine in tune. Now that you know how it all fits together, respect it. Listen and watch for signs.

On the first few drives with a new engine, check and recheck all the fittings and connections over and over again and listen to it. Check the oil and water for level and condition every time you drive. Be aware of noises and engine performance. The new engine may point out problems in carburetion or new noises you haven't heard before.

It usually takes a few thousand miles to break-in an engine. If you did all the steps right, the engine shouldn't leak or burn oil. Some burning is expected during break-in, but not great puffs of smoke; this means something's wrong—maybe you installed a ring upside down. After 1,500 miles or so, the engine should have maximum power and stable oil consumption; a little (one quart each oil change—2,500 miles) is acceptable. (See Ch. 9, Pt. 1, Proc. 6 [22] for more.)

When you do the 500-mile oil change and head retorque, also check the oil pan and timing cover bolts as well as the nuts and bolts on the intake and exhaust manifolds. Do not overtighten the oil pan bolts!

Good luck!

PROCEDURE 16: CHECK, REMOVE, AND REPLACE THE OIL PRESSURE SENDER

Condition: You are losing a lot of oil and it's leaking from the sender. The oil pressure light on your dash doesn't light when the key is switched ON. Or the gauge doesn't register when the engine is running. If the gauge registers high pressure all the time, the gauge is probably bad unless there's a ground in the wire somewhere between the sender and the gauge.

Tools and Materials: If the light or gauge doesn't work use a piece of jumper wire to connect the sender connector to the engine (a ground) using alligator clips and, if necessary, splice on a new bullet connector.

If the sender is leaking or you find it doesn't work get a new sender from Datsun/Nissan. You'll need 26mm or 1in (12 point) socket (non-gauge people) or channel lock pliers, or 14mm open-end wrench (gauge people).

Remarks: If the engine is low on oil or the oil pressure drops into the danger area, don't run it. You'll then have to check the oil pressure with a gauge with the correct size fitting to get into the sender hole in the block. Make sure you have enough oil in the engine. Light type senders tend to leak from between the metal and plastic sections. (See Proc. 1 to check for engine oil leaks.)

Step 1: Test the Electrical Circuit to the Sender.

If your light doesn't come on or the gauge doesn't work, test the circuit.

Look at the illustration to find the sender on the right center of the engine block behind the oil filter. One or two wires with a bullet or T-connector are attached to the sender. Make sure the connector is well attached. If not, that could be the problem, so wiggle or tighten the connection.

•**Z-series:** Your sender is a little hard to see. Stand on the right side of the vehicle and tip your head to the right. Bend down and peer behind the battery, under the forward side of the intake manifold and behind the oil filter. There lies the sender, screwed into the side of the engine block.

•**Everyone:** If your dash light doesn't go on when the key is on (engine not running), pull the connector and wire(s) off the sender. Turn the ignition to ON and put one end of your jumper wire into the connector (the metal sleeve part) or the Yellow and Green wire on two wire connectors, and ground the other bared end against a shiny metal part of the engine.

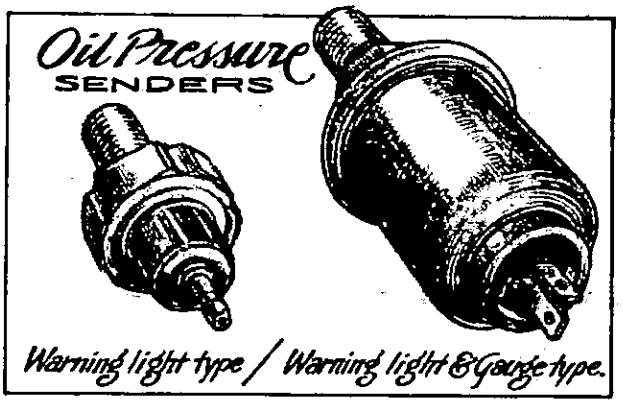
The dashlight should light or the gauge should move. On gauge models, if the needle doesn't move, try grounding the other wire.

If you get no response, recheck your test wire connections. Still nothing? Check the dash light bulb or wiring between the sender and the dash.

If the light goes on or stays on all the time and there is enough oil pressure, or the light doesn't come on when everything is connected, the sender is faulty. Replace it.

Step 2: Remove and Replace the Oil Pressure Sender.

•**Non-gauge People:** Disconnect the wire to the sender. Use a 26mm or 1 in socket, or a pair of channel lock pliers, to turn the sender counterclockwise out of the engine block. **Z-series:** You may need to use an extension and swivel with your socket.



Replace the sender by threading the new one carefully into the hole. Don't get dirt stuck in the hole. Turn it in by hand, then tighten it until snug, not flush, with a socket or channel lock pliers. **Z-series:** It's hard to find this hole and get the sender started. Take your time.

•**Everyone:** Reconnect the bullet connector. Make sure the fit is snug and squeeze it if necessary. If it still feels loose, replace it.

•**Gauge People:** Find the hexagonal fitting between the sender and the engine block. Fit your 14mm open-end wrench on the fitting and turn it counterclockwise to remove the sender. **Z-series:** It's hard to find the hole and get the sender started.

•**Everyone:** Replace it by starting the threads in straight, square to the block. Tighten the sender until snug. Reconnect the two-wire connector and boot over the sender.

PROCEDURE 17: HOW TO HANDLE AN ENGINE WHEN IT IS REMOVED FROM THE CAR OR TRUCK

Condition: You have removed or plan to remove your engine. It may be fully assembled with the head, timing components, piston assemblies and/or oil pan still on. The transmission may remain **in place**, or you can remove it along with the motor.

Remarks: It is easier and safer to work on an engine stand, but it isn't essential. You can do all rebuild work on a sturdy bench or even the floor as long as you're careful not to crush yourself or drop and damage the engine.

I suggest that the head and pistons be removed and reinstalled while the engine is in the vehicle (Ch. 9, Pt. 1 and 2, and Ch. 10). This makes the engine lighter and easier to handle when it's out.

Step 1: Be Careful!

The point of this procedure is to impress you with the need for safety, so you damage neither yourself nor your engine. Strong hoisting equipment, a sturdy bench or engine stand and clear communication between you and your assistant(s) are basic musts.

If you use an engine stand, make sure you understand how it works and have all the pieces to mount the engine to it before pulling the engine out of the vehicle. If you plan to use a bench, have lots of short pieces of 2x4 or 4x4 lumber to prop the engine block with. If you're pulling the transmission along with the engine and/or the engine with the head still on, get one or two friends to help steady the awkward assembly. And above all, if you don't use an engine stand, make sure the bench is strong, sturdy and big enough to handle the weight of

an engine; you'll have to move the engine around a few times during the rebuild.

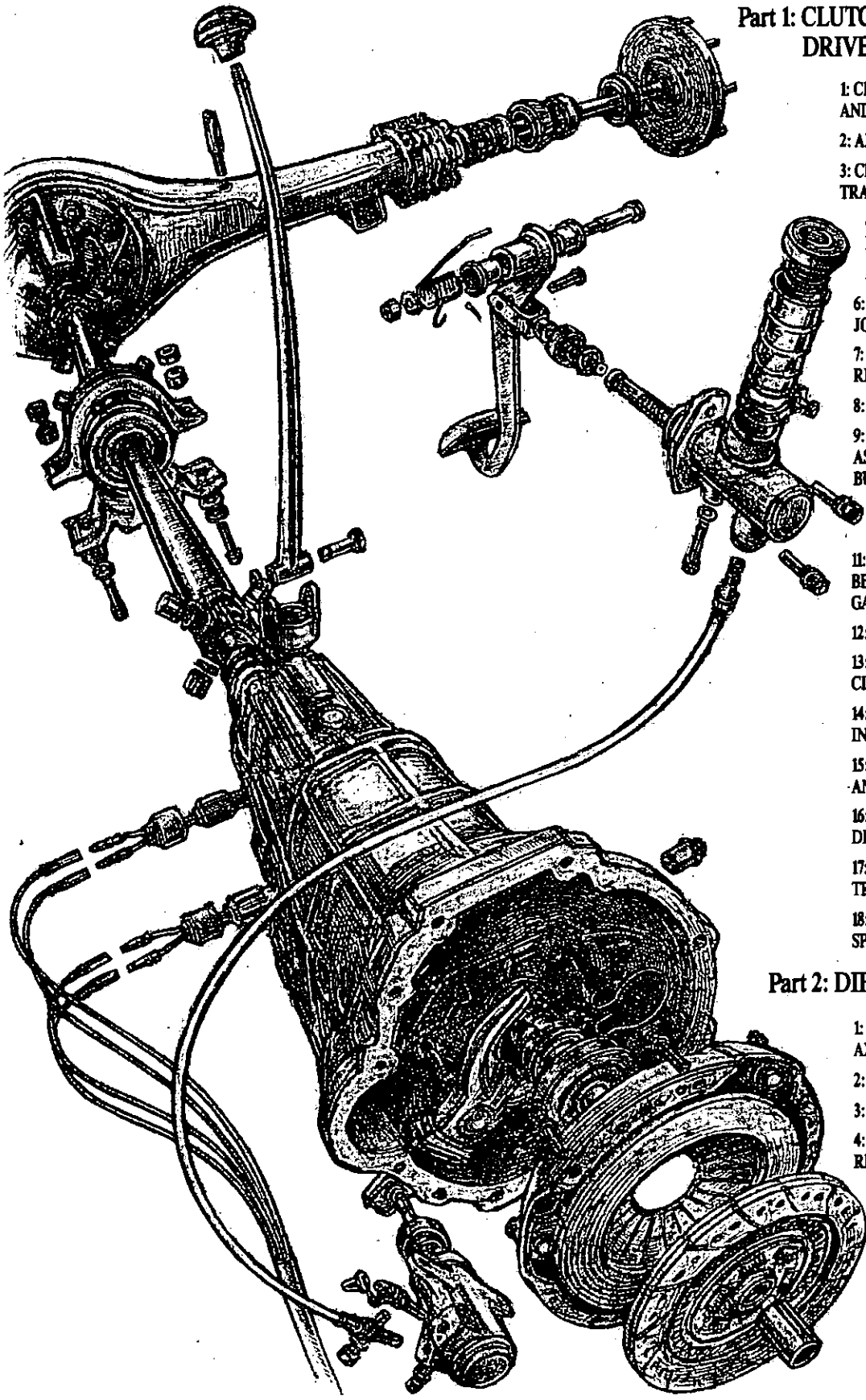
Step 2: Other Tips.

When you do move and reposition the engine on the bench, think through every move before doing it. Don't rush. I once dumped a motor off a bench and broke the cylinder head by not thinking and hurrying unnecessarily.

Wait until you have someone to help you. Another set of eyes often sees a potential problem (and solution) you may not, and another set of muscles often saves a do-it-yourselfer from injury.

What more can I say? Be Careful!

Clutch, Transmission, Driveshaft and Rear axle



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CHAPTER 11
DRIVETRAIN

Part 1: CLUTCH, TRANSMISSION, AND DRIVELINE

I remember as a child riding in old Ramblers and Fords listening for the pauses when a shift would take place. The frequency of those up and down shifts accompanied the endless rolling hills of western Pennsylvania. Expressions like "riding the clutch" and "double declutch" rambled around my curious brain as I watched my father or mother press in the mysterious pedal and move that fascinating lever up and down the steering column. How does a clutch work, burn, or slip, I wondered, humming along as the engine revolutions increased pending the shift. When I finally saw a clutch, I was no more enlightened than I was watching my father's foot. The clutch was one thing, the transmission another, yet somehow the two were connected . . .

PROCEDURE 1: CHECK OUT THE CLUTCH, TRANSMISSION, AND DRIVELINE

Condition: The take off or shifting of your vehicle isn't as it should be. Nothing or very little happens when you accelerate. You get no response from the clutch pedal, there is brake fluid all over the driver's floor or under the transmission, there are noises when shifting, idling, or all of the time. You suspect the clutch, transmission, or driveline.

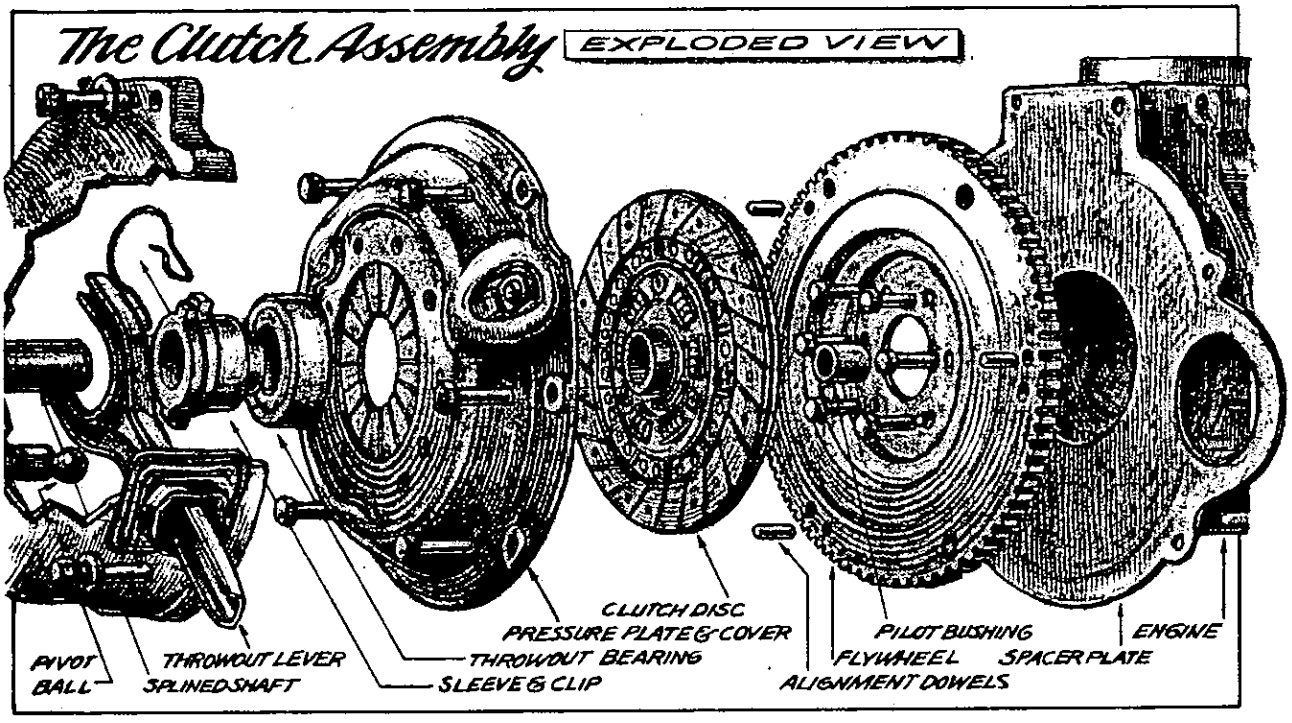
Remarks: In this section, I frequently refer to the transmission as the tranny, Manual transmission—MT, and Automatic transmission—AT.

Step 1: What's going on down there?

•**Automatic People:** Read through the manual information and then your own stuff later on.

•**Manual Transmission People:** Your Datsun has four or five on the floor. With different gear combinations and throttle positions, the engine's power can be suited to the load and highway conditions. When you push down on the **clutch pedal**, you move a **piston** into the **clutch master cylinder**. As the piston moves, it forces **brake fluid** through a **steel line** which connects to the **slave cylinder**. The fluid then acts against another piston that pushes against a **rod** and then the **throwout lever**. Part of this lever is outside of the transmission and the rest is inside. The end *inside* the transmission pushes forward to operate the clutch assembly.

When the **engine** is running, the **crankshaft** in the *bottom of the engine* is turning. When the clutch pedal is *up*, clutch engaged, the crankshaft is connected through the **flywheel** and clutch to the transmission. When the pedal is *down*, clutch disengaged, the engine and transmission are no longer connected. When you *shift* gears, the pedal must be in. The clutch assembly is bolted to the flywheel which is bolted to the crankshaft. Remember the *whole* clutch assembly turns with the crankshaft and flywheel when the pedal is up. There is a **throwout bearing** on the inside of the throwout lever that contacts the **pressure plate** when the clutch is disengaged. The throwout bearing turns with the pressure plate, flywheel, and crankshaft. The pressure plate is spring loaded so when the clutch is engaged, pedal up, the plate sandwiches the **clutch disc** against the flywheel. When the clutch is disengaged the spring pressure is relieved and the disc is separated from the rest of the clutch assembly. The disc has *teeth* or *splines* on its center. The **input shaft** of the transmission fits into these gear teeth so that



the clutch disc can turn with the transmission input shaft. If the transmission is in Neutral, the engine is running and the clutch pedal is up, the input shaft of the transmission will be turning with the engine. But since it is in Neutral the power transfer goes no further than the transmission, so the vehicle does not move. When it is in gear, power is directed through the transmission and then to the rear wheels via the **driveshaft** and **rear axles**. In 4WD vehicles the power goes through the **transfer case** then on to the driveshaft and rear end. When in 4WD, power also goes via the transfer case and the other driveshaft to the front differential, axles, and wheels.

As you motor along, merrily shifting gears, many wondrous parts come into play. Your conditioned response to the sounds of the engine tells you to shift. When you push in the clutch pedal and let off the gas, the clutch disc no longer turns with the engine. The disc can move back and forth slightly on the input shaft splines. This allows it to get away from the flywheel and pressure plate. As you move the **gear shifter** into gear, special **rings**, **blocks**, and **synchronizing hubs** inside the transmission slow the gears so they can mesh smoothly. There is a special oil in the transmission that lubricates all of this. When you lift up the clutch pedal, the spring loaded pressure plate moves forward against the clutch disc. Little coil springs in the clutch disc allow the center of the disc to absorb the intense twisting force (torque) laid on it when the engine links up with the transmission and driveline. Sudden unbalanced spastic shifting results in wear throughout, especially in the clutch assembly.

The driveshaft connects the transmission and the **rear end** (differential and axles). The shaft is tubular with two or three flexible joints in it to account for the angle between the transmission and rear end. These are called **universal joints**. On shafts with *three* U-joints there is a bearing called a **carrier bearing** that helps support the shaft. Because of the tremendous twisting force and weight that the shaft transmits, the joints can wear out and need replacement. An out-of-balance driveshaft can cause vibration. 4WD trucks have other driveshafts and U-joints between the transfer assembly and front differential. There are four other spider joints in the front axles, two in each axle.

•**Automatic Transmission People:** There are *two* types of automatic transmissions available in Datsun/Nissan cars and trucks. The early cars came with the **Borg Warner T-35** and both early and late with the **Jatco 3N71B or L3N71B** transmission. Both of the transmissions use **Dexron Type transmission fluid**, *not Ford fluid* which is the other common type of fluid available. Both of the transmissions have three forward gear positions, plus Neutral, Reverse, and Park.

The Borg Warner transmission has a cable operated **kickdown** that shifts to a lower gear when the ac-

celerator pedal is depressed beyond a certain point. The Jatco transmission will downshift if the *intake manifold vacuum* drops below a certain point or when the accelerator pedal is pressed close to the floor. The latter function is operated by a **downshift switch** controlled by the pedal and the former one by a **vacuum module**. Each of the transmissions has peculiarities that I'll briefly discuss in this step. Maintenance of the transmission can be found in Proc. 4.

The automatic transmission consists of a **torque converter** which takes the place of a standard transmission clutch. The converter connects the engine and transmission by means of a fluid lock. As you *increase* the speed of the engine, the transmission fluid centrifugally locks the components of the torque converter.

The *shifting* and *gear ratios* are also controlled by *fluid pressure*. A **pump** forces fluid through the circuitry within the transmission. Fluctuating fluid pressure and shifter position activate **valves** that in turn *lock* and *unlock* **gear assemblies** known as planetary gears. These fascinating devices take the place of regular gears in the manual transmission. Adjustment and rebuilding of the transmission should be left to a qualified service garage.

Step 2: So you have a problem?

The key to troubleshooting clutch, transmission, and driveline problems is to understand with what you are dealing. The most common complaint concerning the clutch on Datsun/Nissans is slippage, when the clutch disc doesn't keep the engine and transmission working together, or hard shifting, when the pressure plate won't stop the disc. Transmission problems cannot be generalized, and driveline trouble is usually due to bad U-joints or a worn carrier bearing. Since many drivetrain related ailments can be diagnosed by an experienced ear on a simple test drive, it may be to your advantage to get another person's opinion after your own diagnosis. Garage service managers may do this for little or no cost and save you lots of time. 4WD problems are covered in Proc. 15.

•**Automatic Transmission People:** Most complaints can be traced to low fluid, a condition that causes poor and erratic shifting. Fluid loss is either caused by a leaking seal or gasket or by burning which means that you have a bad vacuum modulator. In the case of burning, you will have noticed very white smoke coming out of the exhaust pipe when the engine is running. To learn more about these things read Proc. 4. Other automatic transmission problems and remedies are not covered in this book. Read through the rest of this procedure to make sure that it is indeed the transmission (or torque converter) and not something else. All you can really do with this book is to service, remove, and replace the transmission. I recommend that you have a couple of experts give you their opinions if the problem still persists after you have worked through Proc. 4. Many automatic transmission problems can be cured by a simple adjustment. Consult an expert.

Step 3: Check the Fluid Level of the Manual Transmission Clutch Hydraulic System.

Raise the hood and find the clutch fluid reservoir (Ch. 3, Proc. 2 [7]). The level should be up and the fluid should be translucent. If the level is low, there is probably a leak in the system. If it is dark, the fluid is contaminated or old and should be changed. If there is no fluid at all, you have a leak. If the reservoir is dry or the fluid is old, turn to Proc. 2 (2) and bleed the system. If the reservoir is dry and there's fluid all over the floor under the pedals, see Proc. 14. If the fluid level is just low, top it up with any DOT 3 or 4 brake fluid. If the clutch doesn't work well after that, read this step then jump ahead to Steps 8 and 9.

Problems concerning the clutch and related to the hydraulic system range from difficulty in shifting to slippage, dragging, and grabbing upon takeoff. Even if the fluid level in the reservoir is up, worn piston parts in the cylinders or plugged holes restricting fluid flow could cause any of these symptoms. Before jumping to conclusions, finish this procedure.

Many 1981 and 1982 vehicles had problems with pulsation or buzzing at high speeds when the clutch was depressed. A dampener kit can be installed to cure this. Ask your Datsun/Nissan dealer for "Tech. Bulletin" #TS81067.

Step 4: From the Driver's Seat.

•**4WD People:** Put your tranfer shifter into 2 High (2H).

•**Everyone:** Sit in the driver's seat. Push down the clutch pedal and feel the resistance. If there is none or if the pedal doesn't fully return to the top, you probably have a leak in the master cylinder, the lines to the slave cylinder or in the slave cylinder in which case jump ahead to Steps 7-10 of this procedure. If the pedal doesn't return properly, the return spring for the pedal may not be working. If the pedal moves down a long way before you feel resistance, the master cylinder may not be working properly. In either case go to Steps 7-10.

There are three simple tests you can make sitting in the driver's seat with the vehicle in place. Start and warm up the engine. Stop bopping and turn down the radio. Put the transmission in Neutral and the emergency brake on. If the transmission is stuck in gear, you'll have to remove it and have it repaired or replaced (Proc. 8). Push the clutch pedal in to the floor. If there is a rough sound or a whine when you do this, the throw out bearing is probably worn out or getting that way, which means that the transmission has to eventually be pulled out. Keep testing. If everything sounds good you can assume the throw-out bearing is okay. Now pull the clutch out slowly. If you hear a rough sound as the pedal comes out, a bearing or gears in the transmission may be bad. This is something you can live with if it doesn't get worse by the day. Check the transmission oil level next time the vehicle is jacked up, Proc. 3 of this chapter. If the noise is bad or you hear scraping sounds, the problem could be related to the clutch, read on.

If you can't shift into any gear or only when the engine is turned off, check out Steps 7-10.

If you have trouble shifting into all gears with the clutch pressed in and the engine running, you should make sure the throw-out lever is working (Steps 7-9) and if it is the problem, it's likely the pilot bushing or a worn-out or rusty clutch assembly. Keep reading through this procedure.

The next test is for clutch slippage. Put the emergency brake on and block at least two of the wheels. Push the clutch in and shift into fourth or fifth gear. Slowly lift the pedal until it begins to engage. If the clutch is healthy, the engine will begin to slow down and stall as the pedal is raised. If the engine speed drops slightly, but the motor continues to run when the pedal is all of the way up, the clutch disc is slipping between the flywheel and pressure plate. You can assume then that the clutch needs adjustment or probably replacement. There is another test for slippage in Step 5.

Those of you who are still in the dark about what's happening with your clutch, keep reading.

Step 5: Take a Test Drive.

•**4WD People:** Your front hubs should be unlocked and the transfer shifter in 2H. You have to try isolating the problem while taking into account your 4WD train (Proc. 15 and 16).

•**Everyone:** Now for the road test. Park the vehicle on a level piece of road. Put the transmission in first gear and lift the clutch. A correctly adjusted clutch should make the vehicle move when the pedal is between 3-3¾ in from the top of its travel. Drive off normally. If you hear a clunking as the car or truck begins to move, you may have a bad universal joint, loose or worn engine mount, or the exhaust system or something else is hitting against the body. Try the same test in reverse. You should run through the Checkout Procedure, vehicle jacked up, to check out the rest of the drivetrain if these noises exist. **510 and 610 Sedan People, 1969-76:** Since you have U-joints in the rear axles, refer to Rear Axle (Ch. 11, Pt. 2, Proc. 1).

Stop and start off again. If the takeoff isn't quite as smooth as it should be or grabs when the pedal is lifted, the problem is probably in the linkage between the pedal and the clutch or in the clutch assembly. Keep going and shift into second. If the shifter doesn't go into gear easily, the pedal is out of adjustment, the clutch is faulty, or the transmission is worn or wearing. Shift into third and then back down into second. If the transmission synchronizers or gears are bad, the shift will be rough or grind a little. If the shift is not smooth the synchronizer may be bad. If there is noise in a certain gear then that gear may be chewed up. Repeat the downshift test in first, second and third gears at the respective speeds. If it is rough in all gears, keep reading. But before you jump to any conclusions about the transmission, bleed the clutch.

Bad bearings in the transmission are difficult to differ from driveline or rear end noises unless the sounds are in particular gears. Bad gears in the transmission will grind and get worse by the mile. If you have a truck with three U-joints or a 610 wagon, growl or whirr at nearly all speeds in all gears is probably a bad carrier bear-

ing. Vibrations can be devils to figure out. Other sounds may be connected with the rear end. These troubleshooting steps are covered in Ch. 11, Pt. 2, Proc. 1.

If the transmission jumps out of gear and the shifter feels as though it is fully engaged, the problem is in the transmission. If you have a 5-speed and fifth gear and/or reverse gear goes out, a shaft nut has probably come loose. In any of these cases transmission removal is called for (Proc. 8).

Now go up a hill and stop at the steepest part. Put the shifter into first gear and slowly lift the clutch and release the brake as you would normally when taking off on a hill. If the clutch is working properly, not slipping, you will begin to move as the clutch engages. If it is slipping, the engine speed will rise but you won't move forward right away or not at all. If you continue to drive the car or truck with the clutch slipping, it will damage the flywheel and pressure plate. If the vehicle responds well when the clutch is released, the clutch is probably okay! If you hear clunking or "judder" (vibration), you have a worn driveline (Step 11) or bad clutch.

Step 6: Other Noises and Symptoms.

Station wagons telegraph sounds throughout the interior of the car, especially rear end hums and whines. Trucks transfer noises in a peculiar way too, especially if there is a camper shell on the back. When troubleshooting sounds, take into consideration the tire to highway noise that is generally audible at speeds in excess of twenty miles per hour. Rattles and, as I mentioned previously, exhaust vibration can deceive even the most trained ear. Be sure to determine the exact time and frequency of the symptoms before performing the checkout procedure with the vehicle jacked up. Don't forget to take advantage of the local Datsun/Nissan service manager. Always get a second opinion. 4WD problems occur when the transfer shifter is in 4L or 4H.

Step 7: Jack Up the Vehicle.

Refer to Ch. 13, Pt. 1, Proc. 1 for the correct and safest way to jack and support your vehicle. Be sure that the surface you jack on is level and that an assistant is present while you work under the vehicle to help in the checkout and chaperone you.

Step 8: Examine the Hydraulics.

The vehicle is jacked and blocked safely. You may need a light and something to lie on. Slide under the right side of the vehicle just behind the right front wheel. Locate the front of the transmission. Continue halfway up the right side of the transmission and move back slightly to find a rubber hose connected to a steel cylinder. This is the slave cylinder. A steel rod connects the cylinder to the throwout lever.

You want to check if brake fluid is leaking from the slave cylinder. You can live with a minor leak by adding fluid to the reservoir but the leak will only get worse. If you are losing fluid and the slave cylinder isn't leaking, check the rubber hose, steel lines, and connections between it and the master cylinder.

Step 9: Watch the Throw-Out Lever Work.

Have your assistant sit in the driver's seat and pump the clutch pedal slowly up and down. The throw-out lever should move 5/8-¾in (16-19mm). Have the assistant release the pedal. Hold the rod between your thumb and fingers and move it forward and back. There should be a slight bit of play between the lever and the slave cylinder. If the lever didn't travel far enough or there is more than 1/10in (2.5mm) of play in the rod or if it didn't move at all, bleed and adjust the master and slave cylinders (Proc. 2).

If bleeding fails to operate the slave cylinder then the master cylinder should be rebuilt. If the lever is slow to return and a good bleeding doesn't solve the problem, there is blockage in either the hydraulic system or the mechanical binding between the clutch pedal and master cylinder. To determine if the throw-out lever is binding, watch the lever and rod when the pedal is lifted. If the rod retracts and the lever doesn't, then the problem is in the throw-out mechanism and the transmission has to be removed to free it up. A rusted mechanism will squeek as the lever moves.

•**510 (1968-73) and 521 Models:** You have a return spring between the lever and the slave cylinder. If this spring is missing, the lever may not return properly. You also have an adjustable rod. If there was more than 1/10in, or less than 1/12in, play between the rod and the lever, bleeding and adjustment are needed.

•**610, 710, 620, 720 and 510 (1978 on) Models:** The slave cylinder self-adjusts to compensate for clutch wear. The only adjustment is between the pedal and the master cylinder.

•**Everyone:** Roll out from under the rig for a quick check in the pedal area.

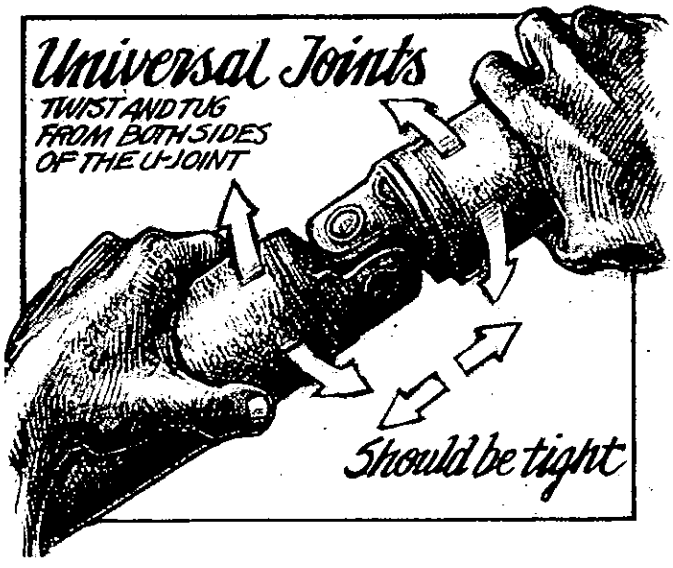
Step 10: Watch the Pedal Operate the Master Cylinder and Pedal Play.

Escort your assistant out of the driver's seat. Take a look (and a light) up under the dashboard. Follow the clutch pedal arm up to where it links to a clevis, maybe a spring and farther up the fulcrum point. Later model trucks have a spring around the fulcrum. Make sure that the spring is in place. If the pedal return felt weak, the spring may be at fault. Locate the clevis that attaches the pedal to the rod. The rod connects to the master cylinder through a rubber boot. (The master cylinder mounts against and through the firewall.) Look for fluid right where the rod goes into the boot. The piston inside of the cylinder will leak with age. This may not affect the operation of the clutch until it becomes excessive. Eventually the cylinder will fail however, with a flood of fluid into the passenger compartment and perhaps your trouser cuff as the pedal hits the floor. If the leak is bad, see Proc. 13.

There must also be sufficient "free play" between the rod and the piston inside of the master cylinder. To check this, press on the pedal with one hand while watching the action of the clevis and the rod. There should be a slight bit of free play before the rod contacts the piston; the piston, however, isn't visible. Another check is to wiggle the rod back and forth with the pedal up. If no play is evident or if the clutch slips refer to Proc. 2.

Step 11: Check Out the Driveshaft.

Go back under the vehicle. Follow the transmission back until it turns into the driveshaft tube. Notice that there is a sleeve that covers the end of the transmission. Oil dripping off the end of the transmission indicates a leaking rear transmission seal. If there is a lot of oil thrown around the area (up on the underside of the body), check the transmission oil level while you're here (Proc. 3 [MT] or 4 [AT]).



Find the universal joint a few inches behind the rear of the transmission. If you heard a clunking at takeoff or acceleration, you should be particularly interested in checking out the U-joints.

Look carefully at each of the four flat sides of the joint. These are the bearing caps. When a bearing goes bad, it will often spread rust-colored dust around the cap and yoke.

Hold the driveshaft steady with one hand in front and one hand behind the universal joint. Twist the shafts in opposite directions as hard as you can. Keep your hands in the same position. Turn the shaft so you are facing one of the bearing caps. Hold one hand steady while pulling and pushing with the other. Turn the shaft 90° and repeat the test. If there is any more than the slightest amount of play between the shafts (or if rust dust is visible), the U-joint is wearing or worn out.

Work your way along the shaft rearward and repeat the check on the one or two other joint(s).

•**610 wagon, 521, 620, and 720 (long bed) Models:** At mid-point along the shaft there is a carrier bearing in front of the central U-joint. The bearing is mounted in a rubber insulator.

Hold the driveshaft close to the carrier bearing and mount. Push the shaft up and down to make sure that it is securely fastened to the body and frame. The rubber insulator will allow the shaft to move a little. As the rubber ages it will separate from the bearing. On 521s the rubber can be replaced separately from the bearing. On later trucks they are one piece. Sometimes the insulator deteriorates before the bearing fails. If the mounting nuts are loose, tighten them (Proc. 5). If you suspect that the bearing is bad, remove the driveshaft and spin it. If it's noisy, replace it (Proc. 7).

•**Everyone:** Now look at the flange(s) where the shaft connects to the differential and, in the case of a two-section driveline, just behind the carrier bearing. Check that there are four bolts, nuts, and washers in each flange and that they are all tight.

Now follow the tubular part of the shaft forward and back to check for dents or bends. If the shaft is damaged, your best bet is to find a used one at the wrecking yard or buy a new one.

If you don't have anything else to do while the vehicle's up, lower it (Ch. 13, Pt. 1, Proc. 1). If you want to check and/or change the transmission oil, see Proc. 3 or 4. To bleed and adjust the clutch, see Proc. 2. **4WD People**, see Proc. 15 to check out other components in your drivetrain.

PROCEDURE 2: ADJUST AND BLEED THE CLUTCH SYSTEM

Condition: The clutch operation is suspect. You have come here from troubleshooting and/or another clutch procedure.

Tools and Materials: An assistant for bleeding, (one pint) brake fluid (DOT 3 or 4), safety glasses, 10mm box-end wrench, and bleeder jar (Ch. 5, Proc. 2).

Remarks: Brake fluid is toxic—keep it off of your body and paint, and away from curious children. Wear safety glasses and keep some water handy to wash off spilled brake fluid.

Step 1: Jack Up the Vehicle, Right Side Only.

This information can be found in Ch. 13, Pt. 1, Proc. 1.

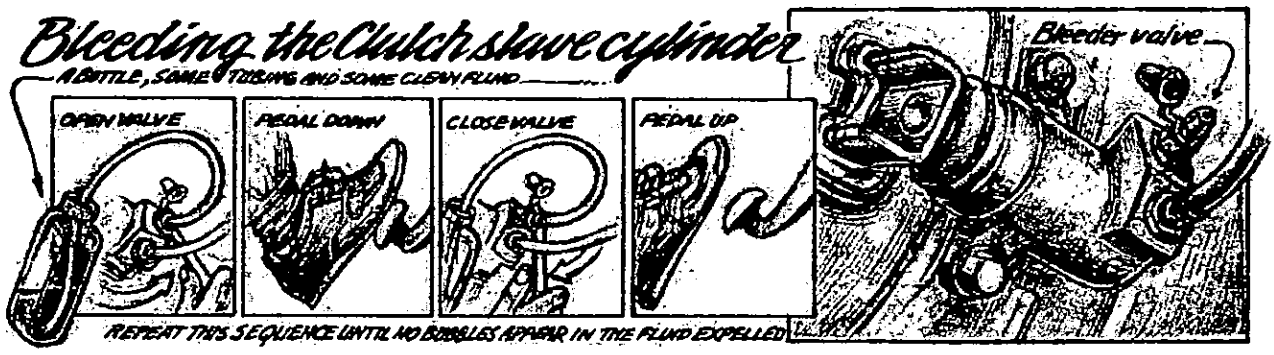
Step 2: Bleed the Clutch.

NOTE: If the reservoir continually goes dry you have a leak and bleeding is only a temporary cure.

•**720 People:** If you have a clutch dampener, it is mounted on the firewall behind the right rear of the engine. Bleed it as you would the slave cylinder but **before** bleeding the slave cylinder.

•**Everyone:** Before adding any new fluid, take a moment to clean out the bottom of the reservoir. It isn't necessary; in fact most shops would say forget it but it does make a difference (Proc. 13 [5]). Return here. Locate the clutch master cylinder and reservoir and remove the cap. Add enough fluid to bring the level up to the high mark. One person has to keep an eye on the fluid level and operate the clutch pedal while the other works below at the slave cylinder.

Seat the assistant in the driver's seat. Take a 10mm open-end and bleeder bottle with clear hose under the vehicle. Find the slave cylinder and bleeder valve on its front end and place the box-end of the 10mm wrench over the valve's nipple end. To bleed the system, have your assistant pump the clutch pedal a few times, then stop with his or her foot pressed to the floor. When the pumping stops, open the bleeder valve and let out the



old fluid and air. Before lifting the pedal, make sure there is fluid in the bleeder line or close the valve to prevent air from entering the system. Check the fluid level and top it up before the reservoir goes dry. Repeat the bleeding sequence until the fluid is clear and bubble-free. If the reservoir goes dry, start the process over. When the bleeding is finished, snug the valve closed. Replace the reservoir cap and clean up your mess.

Step 3: Check and Adjust the Clutch Throw-Out Lever Free Play.

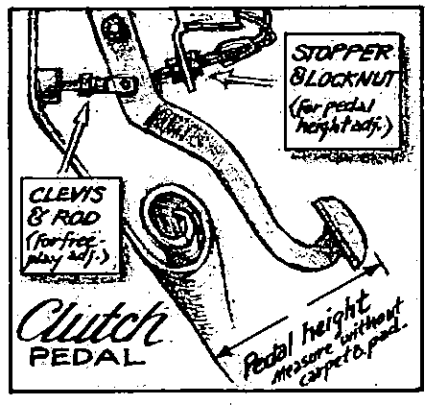
•610, 710, 620, 720 and 1978 on 510 Models: There is no adjustment you can make on your pushrod, but while you are here, take a look anyway. Grab the rod between your thumb and fingers and move it back and forth and side to side. You should feel a little play which tells you that there is no pressure on the internal clutch parts. If there is no play, check the adjustment between the pedal and master cylinder. If the play is excessive, more than 1/8in (3.5mm), the clutch may be extremely worn or the slave cylinder adjustment spring may be weak. If the clutch operates well and there is too much play, you can live with it. In any case, go on to the next step.

•510 and 521 Models: Unhook the spring between the lever and slave cylinder. Grab the rod between the lever and slave cylinder. Grab the rod between your thumb and fingers and move the rod back and forth to determine how much play exists. There should be slightly less than 1/10in (2.5mm) between the rod and lever. If there is no play or too much distance between the parts, adjust the rod. Otherwise reconnect the spring and carry on with the next step.

Take a 12mm open-end, an adjustable wrench, a small screwdriver and penetrating oil under the vehicle. Squirt some oil on the two nuts on the rod between the throw-out lever and the slave cylinder. The nut closest to the lever has two flats on it. The lock nut in front of the adjustment nut is normal. Put a wrench on each of the nuts and loosen the lock nut counterclockwise. Turn the nut back three turns. Put a wrench on the adjusting nut and turn it one way or the other to increase or decrease the play between the rod and the lever. If the threaded rod turns with the nut, find the screwdriver slot at the rear end of the rod where you can hold the rod from turning. Turn the adjuster nut until there is slightly less than 1/10in (2.5mm) of play. Hold the adjustment nut steady while tightening the lock nut against it. Check the adjustment again. Okay? Reconnect the spring to the lever and slave cylinder body. If there is so much play that there is not enough rod left to adjust, then the clutch disc is probably completely worn out or the hydraulic system has failed.

Step 4: Check and Adjust Clutch Pedal Height.

This adjustment usually is needed only after the master and/or slave cylinder has been rebuilt or replaced, or after the clutch has been taken apart. Look at the clutch pedal and find where the pedal arm connects to the clevis and rod. On the back side, the pedal arm rests on the pedal stop. This pedal stop determines the distance between the floor and the flat part of the pedal foot pad when the pedal is up. This measurement varies from model to model. The carpet has to be pulled up to uncover the bare floor. The measurement is between the plane of the pedal (rubber pad in place) where your foot touches and the sloped section of floor below. Look at the distance from a side view.



510 (1968-73) = 8.150-8.224in (207-209mm)
510 (1978-81) = 6.35-6.57in (161-167mm)
610 = 6.89in (175mm)
710 = 7.09in (180mm)
521 = 6.42in (163mm)
620 = 6.02in (153mm)
720 (to 1983½) = 6.73-7.96in (173-177mm)
720(1983½-on) = 7.05-7.44in (179-189mm)

NOTE: If two numbers are given, extend the rod length until the maximum height is reached, then adjust the height to the lower number with the pedal stop.

To adjust the pedal stop, loosen the lock nut on the front or rear side of the support piece that retains the stop. When the 12 or 14mm nut is loose, the stop can be turned to increase (rearward) or decrease (forward) the pedal stroke. Retighten the nut after the adjustment is right. If the pedal height can't be increased, see Step 5 and increase the rod length. Now check free play (Step 5).

Step 5: Check and Adjust Clutch Master Cylinder Free Play.

This is the distance from where the pedal is at rest and where the pedal is when the rod begins to push in the master cylinder piston. If you suspect that there is no play at all, take the rod between your thumb and fingers. The pedal must be up all the way. Move the rod forward and back, then side to side. If there is some play between the pedal and piston, the rod will move a little. If it doesn't move, the adjustment is too tight. Push on the pedal with your hand while watching the action of the rod. If it helps, the rubber boot over the end of the cylinder may be peeled back to see rod and piston. The distance between the pedal at rest and the pedal when the rod contacts the piston should be:

510 (1958-73) = 0.10in (2.5mm)
510 (1978-81), 610, 710, 720 (to 1983½)= 0.04=0.20 (1.5mm)
521 and 620 = 0.02-0.12in (1-3mm)
720 (1983½ on) = 0.04-0.06 (1-1.5mm)

To adjust the rod, loosen the 12 or 14mm lock nut in front of the clevis a few turns, then turn the rod clockwise to decrease play or counterclockwise to increase it. When the correct adjustment is reached, retighten the lock nut. If adjustment is impossible because the rod has run out of thread, the chances are that the master cylinder needs to be rebuilt or replaced.

In extreme cases there may be binding in the operation of the clutch pedal parts. In which case, disassembly may be necessary. Because this is highly unlikely, it is not covered in this book. If you feel roughness or squeaking in the clutch operation, try squirting the joints with penetrating oil. If after adjustment you can't get into reverse without grinding, without adjusting out all of the free play, recheck the pedal height (Step 4).

PROCEDURE 3: CHECK, DRAIN, AND REPLACE THE TRANSMISSION OIL

Condition: You are here for maintenance, you are curious what the oil and its level look like. You may be checking all the gear oil levels: rear differential and 4WD transfer and front differential oils (Ch. 11, Pt. 2, Proc. 7) and Proc. 16 and 17 in this chapter.

Tools and Materials: 17mm open-end, hammer, ½in drive ratchet or breaker bar, drain pan, 2 quarts 80/90 wt. gear oil, funnel with snout to fit a garden or 3/8in heater hose, 3-4 ft of hose.

Remarks: You may find it is less expensive and easier to have a quick lube place change this oil for you. If the filler plug is hard to remove, take the job to someone with the right tool before you chew the plug head down to nothing.

Step 1: Chock, Jack, and Block.

You need only raise and block the front of the vehicle (Ch. 13, Pt. 1, Proc. 1).

Step 2: Remove the Filler Plug and Check the Oil Level.

Lie under the left side of the transmission. Run the flat of your hand along the left side of the transmission case to find a square-headed plug. On 720 models the plug is on the right side.

Fit the 17mm open-end over the plug and push the wrench backward, counterclockwise. If it's too tight, hold the wrench steady at the top and whack the bottom with your ball peen hammer.

To check oil level and condition, remove the plug and immediately check the oil level. If it's too full, the oil will be oozing out of the filler hole. If you can't see oil coming out, put your finger into the hole. The oil should be level with the bottom of the hole. If the level is low, you'll have to hook your finger so it dips below the in-

ner edge of the hole to feel for it. Account for the angle of the vehicle. If the oil level is slightly low, don't worry. If it's really low, look for a leak (see Proc. 1) and repair and/or top up the oil level.

The transmission oil should be changed every 30,000 miles under normal driving conditions. Most oil will be clear brown in color when dripping from your finger. When the oil is well over the hill it will look black.

If you plan to change the oil go to Step 3. If you want to just add oil go to Step 4. If you're replacing the plug, see Step 5.

Step 3: Change the Gear Oil.

The drain plug is at the bottom of the transmission. It has a ½in square recess in it. Use a ½in drive ratchet or breaker bar to loosen the plug, turning counterclockwise, then stop.

Set the drain pan directly below the plug and slowly turn it out. Hold onto the plug so the oil hits the pan and not you.

Many models have a magnetic drain plug that will pick up ferrous particles. The amount of particles stuck to the plug can give you an idea of how much gear and bearing wear has taken place. Particles and metallic colored streaks in the oil will tell the same thing.

Wipe the plug clean and set it aside. When all of the oil has drained out replace the plug and tighten it well.

Step 4: Fill the Gear Box.

Connect the hose to the funnel's snout. Stand next to the left fender and stick the hose down between the brake master cylinder and the steering column so it is aimed toward the filler hole. Go below and push the hose into the filler hole. Then go back to the funnel.

Open the oil container and slowly pour some into the funnel without pulling out the hose or overflowing the funnel.

If the transmission was empty, it will take less than two quarts. If you are just topping it off, you'll have to keep checking the level. When you think it is almost full, let all of the oil drain out of the funnel and hose. Pick up a rag and carefully pull the hose out of the filler hole. Watch out for oil that's still in the hose; it's vile stuff.

Recheck the oil level and add some if necessary.

Step 5: Replace the Filler Plug.

When the transmission is full, replace the plug and tighten it with the 17mm wrench. Don't overtighten, just snug it. Clean up your mess.

•**4WD People:** If you haven't checked the transfer and front differential oils for a while, do it now—and also the rear differential.

Step 6: Lower the Vehicle.

Ch. 13, Pt. 1, Proc. 1.

PROCEDURE 4: CHECK AUTOMATIC TRANSMISSION FLUID LEVEL AND CONDITION, DRAIN, REPLACE, AND TOP OFF FLUID; REMOVE AND REPLACE VACUUM MODULATOR; EXAMINE HOSES TO COOLER

Condition: You are here for maintenance purposes, the fluid needs to be checked or topped off or the vacuum modulator is faulty, or the inhibitor switch is causing the engine not to start.

Tools and Materials: Clean rag, Dexron Type II automatic transmission fluid, new vacuum modulator, transmission pan gasket (Jatco people who are draining the sump) available from Datsun, #2 non-hardening gasket sealer, and funnel and skinny hose (Ch. 13, Pt. 2).

Remarks: I don't go into transmission repair or even diagnosis in depth. Take your problems to experts to get as many opinions as possible after reading through this procedure.

Step 1: Check Transmission Fluid Level and Condition.

The transmission dipstick is located on the rear right side of the engine compartment. Start the engine and drive the vehicle, if possible, until it is thoroughly warmed up. Manually shift the gear selector using all the gears. Place the selector in Park position and open the hood. Withdraw the dipstick and wipe off the end with a clean rag. Find the L and H marks that indicate low and high fluid points. Slip the stick back in and quickly withdraw it (engine running). The fluid level should be within these marks. If it is high and you have a BW type transmission, put on the emergency brake and chock the front wheels; then place the selector into Drive and reread the stick. It should be within the marks. If the reading is low, read on and, if good, check the level frequently. If the fluid is too high, drive around a bit and recheck the level. The excessive fluid should be drained out.

The condition of the fluid is important. If the fluid's color is red or green, it is probably in good condition. Different brands are different colors, however, most are red. If the fluid is dark and oily looking and the transmission is performing unevenly, burnt clutches or bands may be the cause. If the transmission works all right change the fluid. I change automatic transmission fluid every 24,000 miles or so.

Turn off the engine.

Step 2: Drain and/or Replace Transmission Fluid (transmission warm).

If you are adding fluid read through to the end of this step. To drain the fluid jack up the vehicle and support it following the advice in Ch. 13, Pt. 1, Proc. 1. Get a drain pan. The older BW type transmissions have a drain plug. On the Jatco transmissions you have to remove a pan to let out the fluid.

•**BW People:** Use a 21mm socket or crescent wrench to remove the drain plug. Keep the drain pan directly under the hole and let the fluid fully drain. Replace the plug and tighten it until snug. Go to the filling step.

•**Jatco People:** Go to Datsun/Nissan and buy the transmission pan gasket for your model and year. Go under the transmission with a ratchet, short extension, and 10mm socket. Work your way around the bottom edge of the pan removing the 10mm bolts. There are three or more retainers attached to the pan bolts that hold cooler pipes and wires in place. Note where these are positioned. Leave a couple of bolts in place on one end of the pan so the fluid doesn't spill on you. The pan is probably stuck and will have to be gently pried off with a screwdriver. But before doing that, place the drain pan below the corner you first pry off. When the fluid has started, remove the last bolts and hold up the pan until it has drained.

Pull off the pan completely and clean it with solvent and thoroughly scrape off the gasket. This has to be really clean as does the mating surface on the bottom of the transmission.

When all of the fluid is out and the pan is clean, coat the pan's gasket surface with sealer and line up the new gasket with the holes.

Scoot back under the vehicle, position the pan and insert the bolts with their washers. Do not begin tightening the pan screws until all are in place (including the retainers). Once all the screws are touching the pan start around tightening them until snug and lockwashers are flattened. If you intend to examine and/or replace the cooler hoses do so now before filling (Step 5).

Step 3: Top Up and/or Fill the Transmission with Fluid.

Use Dexron, not Ford Type F, automatic transmission fluid. I prefer not to mix brands but in a pinch any brand of Dexron will do. Keep the fluid and surrounding area clean.

Remove the dipstick. The fluid has to go down that little pipe so you'll need a small funnel and snout. If the transmission is empty, put in one quart before running the engine. If topping up, add small amounts to avoid overfilling.

The specifications for total capacity include the torque convertor which is not empty unless it's been removed, so ignore what you may read. You should not need any more than two quarts (2 qts.) of fluid to refill the transmission. Run the engine and insert the dipstick to check the level. Recheck after some hard driving. Discard the old fluid at the recycling center or service station.

Step 4: Test, Remove and Replace the Vacuum Modulator, Downshift Switch, and Information about the Inhibitor Switch.

The **vacuum modulator** downshifts the transmission when the engine is under extreme load. When this fails it is usually obvious by the white smoke billowing out of the tailpipe and excessive transmission fluid consumption.

If this is you, raise the front of the car and support it (Ch 13, Pt. 1, Proc. 1). Crawl under the left side of the transmission and look for a round capsule about 2in in diameter. It has a small hose (not wires) connected to it. Pull this hose off. If transmission fluid pours out of the hose your vacuum module (capsule) is shot. To replace it grab the sides of the module with channel lock pliers and turn it counterclockwise and remove. You'll have to get a replacement from the Datsun/Nissan dealer. Thread this in clockwise until tight then snug with pliers and replace the hose.

Refer to Ch. 7, Proc. 15, if you don't know basic electrical troubleshooting.

The **downshift solenoid** is next to the vacuum modulator (see above). This could be at fault if your transmission doesn't downshift properly. The solenoid is operated electrically by a switch that should click when the ignition is turned on and the accelerator pedal is pressed to the floor. To locate the switch follow the pedal to its rod and the switch will be under that. If you didn't hear a click, disconnect the wires to the switch and put a jumper wire between the connectors running to the switch to bypass the switch. With the ignition on you should hear the solenoid click when the contact is made. If it doesn't, check for current to one of the wires you jumped. Still nothing? Track down the problem with a wiring diagram. If you heard a click, then the switch is probably bad. If you had current to the switch and no click when jumped, then the solenoid below is either disconnected by a bad connection, or open in the wiring, or the solenoid is no good.

NOTE: There is a rod length specification for solenoids on 720s transmissions. Consult a Factory Service Manual at your Datsun/Nissan dealer for details.

To replace the solenoid, follow the module instructions at the beginning of this step, but disconnect the wires first.

I do not cover **inhibitor switch** testing. When it fails either the wiring to it on the right side of the transmission is bad, or the Park position of the shift linkage is out of adjustment (try holding the shift lever *hard* in Park), or the switch is bad. Do not drive a vehicle with a bypassed inhibitor switch. Go to a transmission shop or the dealer for help. Good luck!

Step 5: Check, Remove, and Replace the Transmission Cooler Hoses.

On the rear lower section of the engine radiator there are two hoses that carry transmission fluid to the radiator to cool the fluid and protect the transmission. Cracks or loose connections will cause leaks that will be noticed when spots of fluid appear on the ground.

Examine the hoses by wiping them clean and looking for cracks in the rubber. If the ends of the hoses near the clamps are frayed you can trim off the old part and reposition and retighten the clamps. The hoses connect to steel lines that go back to the transmission. These lines should also be straight.

If the hoses have to be replaced loosen the clamps and pull the hoses off of the lines. Catch drips in a drain pan. There should be round rubber bumpers on the hoses that will slide off. Take the old hoses with you to a parts store and buy the new equivalent. Use flat band type clamps on the ends. Recheck the fluid level upon completion.

PROCEDURE 5: REMOVE AND REPLACE THE DRIVESHAFT (Transmission Output)

Condition: All of you except 521 Truck People (1969-72) have to drain the transmission oil (Proc. 3 [3]). You are here to remove the transmission (and engine), the differential, transfer (4WD), repair the driveshaft U-joints and/or carrier bearing. NOTE: By raising just the rear of the vehicle, you may be able to shift the oil level forward enough so draining isn't necessary. Try it!

Tools and Materials: 12, 13, 14 or 17mm open-end wrench, medium length screwdriver, nail polish or paint,

safety glasses, drain pan. **521, 610, 620, and 720 2WD Models with carrier bearing:** You'll also need a 12 and 14 mm socket wrench and 14 mm open-end.

Remarks: Before you replace any rusted bolts, clean their threads and squirt or dab them with penetrating oil or anti-seize. 720 short bed trucks do not have carrier bearings.

•**4WD People:** You have three driveshafts. The one you're removing here links the transmission and transfer. The other two are similar and covered in Proc. 15 and 16.

Step 1: Chock, Jack and Block Rear of Vehicle.

See Ch. 13, Pt. 1, Proc. 1.

•**4W Drivers:** You can do this without jacking it up but to be comfortable, jack up both front and rear.

Step 2: Disconnect the Emergency Brake Cable (510 and 610 Models only).

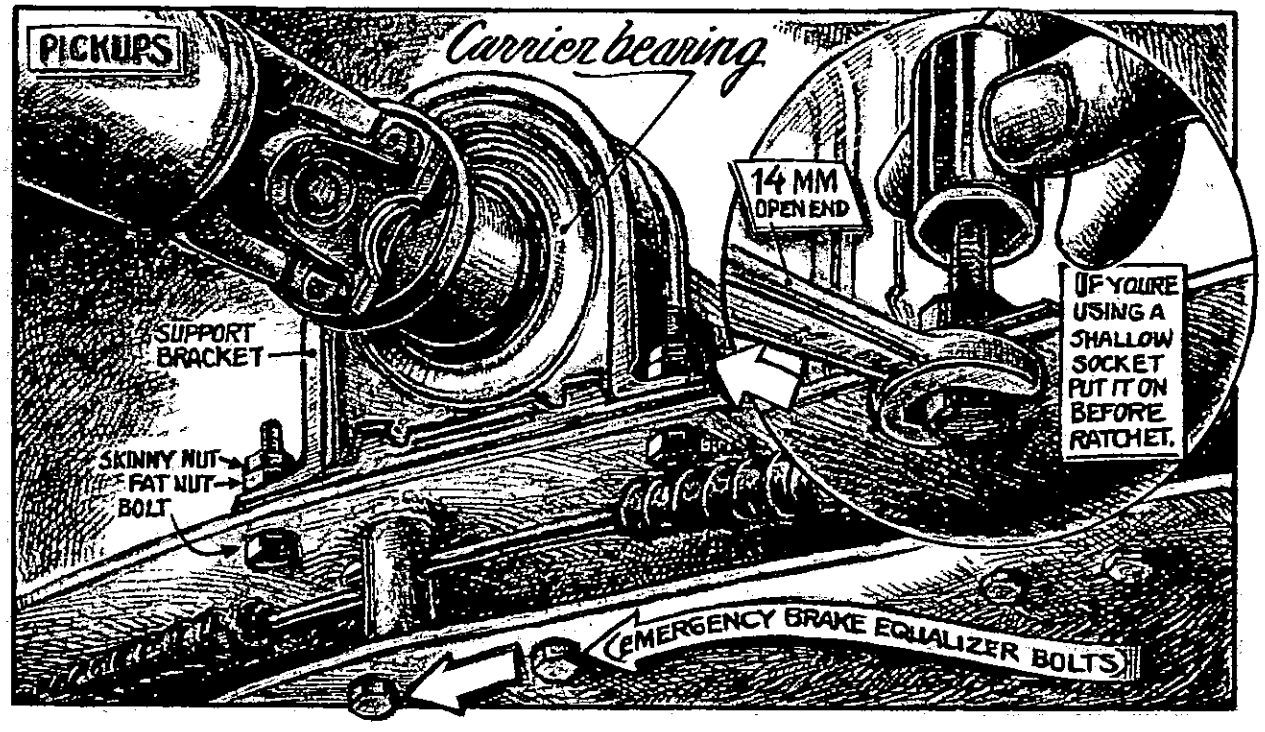
•**510 and 610 Sedan Models:** You have to drop the emergency brake cable. Release the emergency brake. A bracket located immediately behind the rear of the transmission attaches the emergency brake cable to the body. Remove the wedge clip that holds the cable to the bracket by prying against the clip with the shaft of a screwdriver. Don't lose the clip. Pull the cable out of the bracket.

Step 3: Disconnect Carrier Bearing Support.

•**610 Station Wagon, 521, 620 and some 720 (not 4WD**—you go on to Step 4) **Models:** Your models have three joint driveshafts with a center bearing support.

•**All Trucks**: (521s are slightly different—bolts instead of nuts. Read through the following.) The bracket is bolted to the top of the main chassis cross-piece. There are two nuts on the top of either bolt. Remove the nuts. Place the 14mm socket on the top nut and remove it. If the socket isn't a deep style, the ratchet drive won't fit fully into the socket when you loosen the lower nut; thus it is necessary to place the socket over the nut before fitting the ratchet into the drive hole as far as you can. Hold the bolt below with a 14mm open-end.

•**620, 720 Models—1975 on:** You may find that loosening the emergency brake balance lever (two 12mm bolts) gives you more room to work. Do this by removing the two 12mm bolts and washers from the middle and



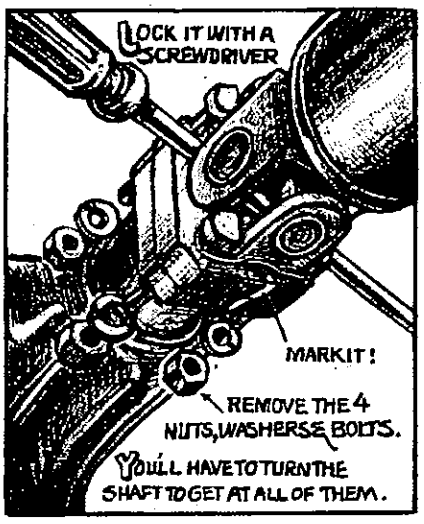
bottom of the crossmember. Move the bracket aside and reinstall the bolts in the crossmember for safekeeping.

•**Truck People:** Lift the driveshaft up and remove the carrier bearing support, top and bottom pieces. Store these where they won't be damaged, along with the bolts, nuts, and washers.

•**610 Wagon People:** There are two 14mm bolts that hold the support to the body. Don't confuse them with two nuts and bolts that are to the inside of them holding the two halves of the support bracket together. Just loosen, but do not yet remove, the bolts.

Step 4: Disconnect Rear Driveshaft Flange.

Move back to where the driveshaft connects to the differential or transfer (4WD). Take some paint or chalk and make a visible mark (that won't rub off) across each half of the driveshaft flange. If the rear of the vehicle is jacked up, transmission in Neutral and the transfer in 2H (4WD), and the emergency brake off, the rear wheels and driveshaft will turn. Push a screwdriver (medium) diagonally through the universal joint assembly. Turn the driveshaft until one of the nuts on the rear of the flange is accessible. Hold or brace the screwdriver to keep the driveshaft from turning while you loosen the nut. Change the position of the screwdriver and shaft to loosen and remove the rest of the nuts. Push the bolts forward and out. **Caution:** Don't let the shaft fall on your face.



These nuts, washers, and bolts should be kept together. They are special. Pull the driveshaft forward and down to separate the flanges. Bag and label the nuts, bolts and washers "rear driveshaft" (2WD People) and "tranny to transfer" (4WD).

Step 5: Pull Driveshaft out of Transmission.

•**Truck People:** You have to juggle the driveshaft off the crossmember while plugging the rear of the transmission (if you have a carrier bearing).

•**610 Wagon Models:** The support bracket is still connected to the body. Support the weight of the driveshaft while screwing out the two bolts. Put the two bolts and washers back into the holes.

•**521 People:** The driveshaft is fastened to a flange at the transmission. Remove these four nuts and bolts the same as you did the rear ones. Be sure to mark the flanges before separation. Bag and label these "front flange to tranny".

•**Everyone:** Be careful that the drive line does not smash you in the face. Do not pull the shaft out of the transmission too suddenly and hurt yourself. Use both hands to maneuver the shaft out.

Drop and drag the shaft away from the vehicle. Treat it with care for it is balanced. Try not to bounce it around.

•**Pre 1983½ 4WD, 720 People:** The shaft may be very difficult to get in and out. Be patient, you have my condolences.

Step 6: Install Front of Driveshaft.

Lay the driveshaft flange bolts within reach. Lube their threads for fast installation.

When you removed the driveshaft, you marked the rear flange in relation to the "companion" flange on the differential. You want to make sure that the two marks match when putting them back together. Find the four special nuts, bolts and washers which you bagged and labeled "rear drive shaft" (2WD) or "transmission to transfer" (4WD).

•**610 Wagon People:** You have two other bolts that hold the carrier support bracket to the body.

•**Pickup People with Carrier Bearing (no 4WD):** You have two nuts *and* bolts plus two or four washers, all stored with the carrier support bracket. Set these close at hand.

•**521, 620, 720 Trucks:** Lift the driveshaft and carrier bearing up and over the crossmember.

•**521 Trucks:** Clean the front flanges and install the bolts from the front. Install the washers and nuts following rear flange instructions (Step 8), then go on to Step 7.

•**Everyone** (except 521 people): NOTE: Read before doing. Wipe off the front sleeve on the driveshaft. Slip the driveshaft snout over the rear seal and onto the splined output shaft. You may have to turn the driveshaft to mesh the splines before it slips in. Trucks with carrier bearings: Don't let the shaft get hung up on the crossmember. Wiggle the shaft until it slips in all of the way. Make a note to add any oil that was lost from the transmission. 4WD People, go on to Step 8.

Step 7: Install Carrier Bearing Bracket.

•**610 Wagons:** Lift up the center of the driveshaft so the bolt holes in the carrier bearing bracket line up to the corresponding holes in the car body and finger tighten the bolts with washers. See that the bracket sits flush against the body. Use a 14mm socket to tighten the bolts so that the bracket is drawn up evenly and the washers are flush, then tug to make sure they won't walk out.

•**521 and 620:** Pick up the support bracket pieces and look at them. On one foot of the arch-shaped support there is a tab sticking down. On the flatter bottom half of the support there is a hole for the tab to fit. Because of this, the support fits together only one way; furthermore, there is a hole in the cross-member for the tab to fit. Lift the driveshaft off the crossmember and slide the bottom of the support under the carrier bearing with the tab hole on the left side. The bearing insulator ring will fit nicely into the groove(s) in the support.

•**521 People:** The insulator's shape matches the shape of the bracket. Position the pieces. Fit the lockwasher, then the flat washer, over the bolts and install the bolts through the carrier bracket and into the crossmembers from the top. Use penetrating oil on the threads if sticky.

•**620 People:** Place the upper half of the support over the insulator so it aligns with the tab hole and lower bracket. See that the support pieces are flush with each other and the crossmember. When the holes on the sides of the bracket are lined up with the holes in the crossmember, install the bolts with a lockwasher (if one), and/or a flat washer on the head side under the crossmember with the thread sticking up. Put on the other flat washer, then the lockwasher, and finally one of the longer nuts. Tighten the nut with the ratchet drive (only part way in the socket). Keep the bolt heads from turning with a 14mm open-end until you are sure they won't come out. Repeat on the other bolt. Install the smaller top nuts and tighten them against the first ones. If you removed the left side emergency brake equalizer piece, replace it now with the two 12mm bolts and washers mounted through the crossmember.

Step 8: Connect Rear Flange to Differential.

Lift up the rear of the shaft to meet the companion flange. The marks have to match. If necessary, turn the rear wheels to turn the flange to line up the marks (emergency brake off). Find the four 12, 13, 14 or 17mm nuts, washers and bolts. These bolts are special. If you replace them, use only grade 5 or 8 bolts. Get special fitting type bolts from Datsun/Nissan.

Install the four bolts from the front. Put on the bolts, then slide on the washer, and finally the nut from the backside.

The bolt head shouldn't turn because of a cutout in the driveshaft flange. Use an open end to tighten the nuts. You may find it easier to put the driveshaft (transmission in Neutral) transfer in 2H (4WD) to get to the nuts. Insert a screwdriver to tighten the bolts evenly, working your way around the flange until the washers flatten and the nuts are snug.

•**510 and 610 Sedan People:** You had to drop the emergency brake cable to gain access to the rear flanges of the driveshaft. Replace the cable in the bracket on the right side of the underbody. Tap the forked clip into the groove in the cable end, with bent end of the clip down.

If you have greaseable U-joints, now's a good time to lube them (Ch. 3, Proc. 11).

Step 9: Lower the vehicle.

Jack and remove the stands, lower the vehicle and remove the chocks.

PROCEDURE 6: REMOVE AND REPLACE THE DRIVESHAFT UNIVERSAL JOINTS

Condition: You hear or feel a clicking (knocking) or vibration at take off, as you pick up higher speeds, or in reverse. You've checked the drive shaft (Proc. 1 [11]). **1969-75 510 and 610 Sedan People:** Have you checked your rear axle half shafts lately (Ch. 11, Pt. 2, Proc. 1 and 6)?

•**4WD People:** You have many shafts, with U and spider joints. The driveshaft U-joints are all alike; the spider joints (front axles) are different. Proc. 15 tells more. (See Remarks below.)

Tools and Materials: Same as Proc. 5.

Remarks: I have chosen to leave out the details of U-joint removal and replacement after long hours of deliberation and soul-searching. It is a procedure that mechanically inexperienced people have trouble with and a mechanic or farmer with a vise can do the work in little time. Call around for estimates.

Step 1: Remove the Driveshaft.

For 510 and 610 sedan rear axle info see Ch. 11, Pt. 2, Proc. 6. For 4WD transfer and front axle shafts, see Proc. 15.

This information can be found in Proc. 5. But first, read through this step if you are listed below. If you're not, go to Step 2.

•**521, 620 and Carrier Bearing 2WD 720s (no 4WD) and 610 Station Wagon Models:** You have a two-piece, three U-joint driveshaft and may not have to remove the complete shaft. If you are fixing the rear or middle U-joint, you need only remove the rear half of the driveshaft. Disconnect the rear flange, then disconnect the next one forward the same way (Proc. 7, [3]). Be sure to mark which end is front with paint.

Step 2: Buy the Part and Get the Work Done.

Datsun/Nissan U-joints are easy to find in most parts stores. Ask the person doing the work where you should buy the part. Prices will vary, so call around. Please don't damage the driveshaft while it's out.

Step 3: Reassemble the Two-Piece Driveshaft.

•**521, 620 and Carrier Bearing 720s (2WD) and 610 Station Wagons Only:** If you separated the rear section of the driveshaft, read Proc. 7 (10). Connect the front flange first then the rear as instructed.

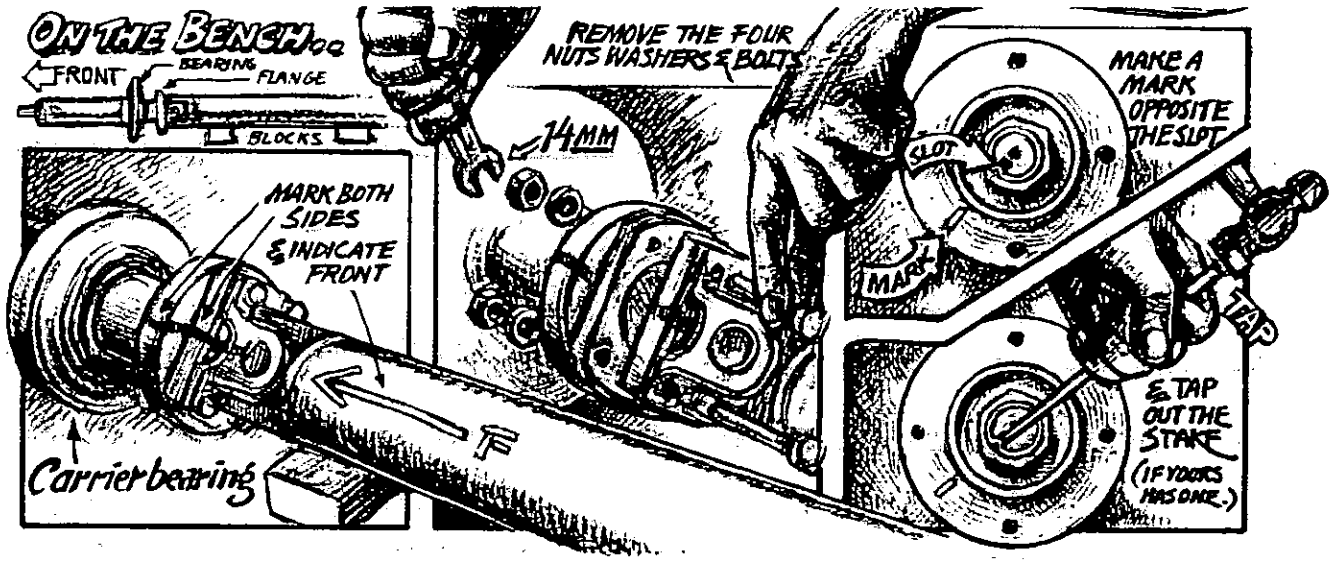
Step 4: Install the Driveshaft.

See Proc. 5 (6) on. For 510, 610 sedan rear axle shafts, see Ch. 11, Pt. 2, Proc. 6, and 4WD transfer shafts, see Proc. 16 and 17. Front 4WD axles, see Proc. 15.

PROCEDURE 7: DISASSEMBLE AND REPLACE DRIVESHAFT CARRIER BEARING

Condition: The driveshaft is producing a whining or growling sound when the truck is in motion. You want to check it or already know from troubleshooting that the carrier bearing is faulty.

Tools and Materials: 27mm or 1-1/16in socket, breaker bar, cheater bar to fit over breaker bar, large 16in pry bar or screwdriver, an assistant, safety glasses, hammer, brass or steel drift, multi-purpose grease, new or good used carrier bearing. A used one is good if the insulator hasn't separated from the bearing and if the bearing isn't noisy or rough when spun.



•**521 and 620 People:** Your assemblies are somewhat different. 521s have a separate bearing and insulator. On 521s and 610s the nut will be a different size and tightness.

•**Everyone:** Wear safety glasses during this procedure.

Step 1: Jack Up Vehicle and Remove Driveshaft.

See Proc. 5 (1-5).

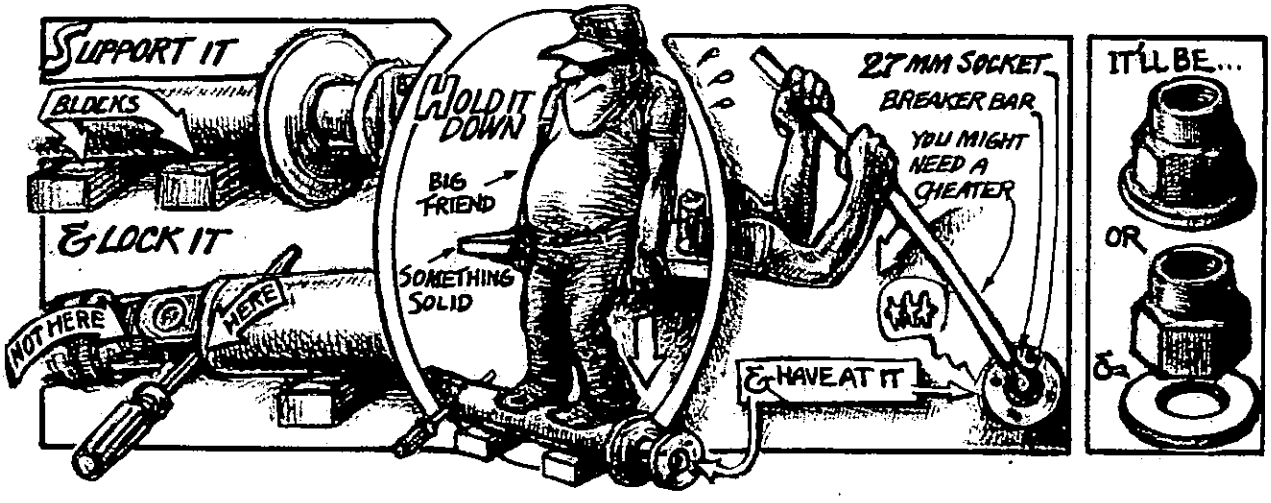
Step 2: Remove Carrier Bearing Bracket.

•**610 Wagon Models Only**: Use a 14mm socket and wrench to remove the two bolts, nuts, and washers and separate the bracket.

Step 3: Separate Driveshaft at Center Flange.

The driveshaft is not a vaulting pole or baseball bat, so handle it with care. Don't put any more than shaft weight on the rubber insulator around the carrier bearing.

Use nail polish or paint to mark across the flanges so they can be matched for reassembly. Also put an arrow or "F" indicating front on the rear half-shaft. Loosen and remove the four 12mm nuts, washers, and bolts from the flanges just behind the carrier bearing. Pull the driveshafts apart. •**Truck People Only:** Find the slot in the stud in the center of the round flange and mark its relation to the flange. Note that the edge of the nut is staked into the slot. Your mission is to straighten the staked part of the nut with a punch or old Phillips screwdriver so the nut will clear the slotway.



Step 4: Loosen the Nut.

This nut is tight. Support the front of the shaft so the carrier is off the ground. To keep the shaft from turning, place a bar or screwdriver through the U-joint journal at the front end of the shaft, as shown. Position the shaft so that your assistant isn't putting any weight on the carrier bearing insulator.

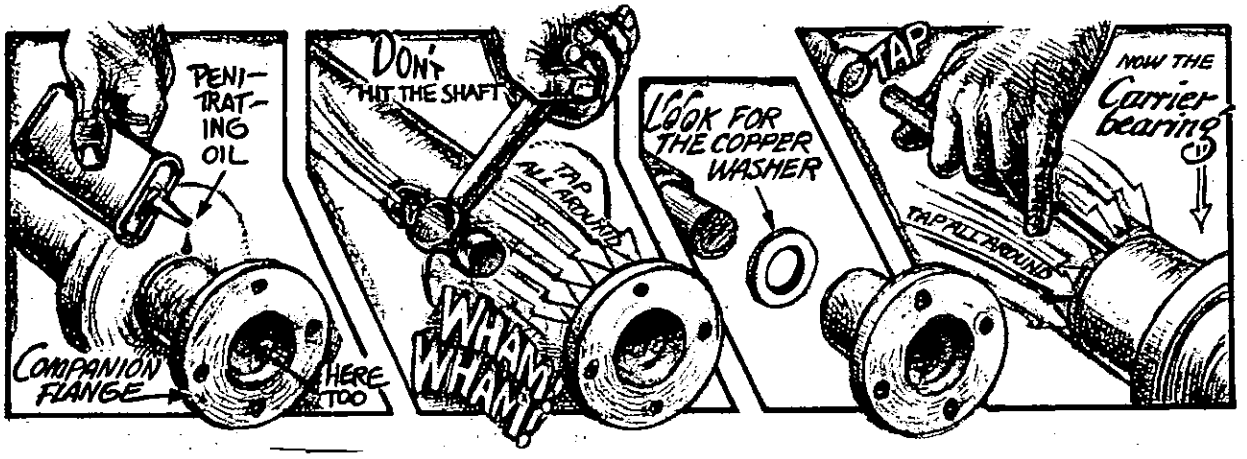
Put the socket on the breaker bar and have the cheater pipe close at hand. When everything is in position, turn the nut counterclockwise. If the shaft turns, reposition your helper and/or the locking tool. If the nut doesn't move, reach for the cheater pipe and slip it over the end of the breaker bar to increase your leverage (Ch. 13, Pt. 1, Proc. 2). When loose, remove the nut. It will be one of two designs, with or without a washer. If it doesn't have a shoulder, the washer will be stuck in the flange.

Step 5: Remove the Companion Flange.

Invert the shaft so the flange end is up. Squirt a touch of penetrating oil in between the flange and shaft. Good. Have your assistant steady the shaft on the bench or supports. Wear safety goggles.

Tap on the front side of the flange hard enough to wake up your helper. Keep turning the shaft so you hit all around the flange. The flange should eventually come off; if it doesn't, you will have to take the section to the machinist, mechanic, or rent a two-jaw puller to remove it. If you got it, set the flange aside.

Look for a copper washer under the flange. Put the washer in the parts can. There is no washer on 521s and 610s and maybe some 720s.



Step 6: Remove the Carrier Bearing.

There is a gap between the driveshaft and the bearing sleeve. Use a brass drift or steel punch and medium hammer. Carefully place the punch at an angle against the edge of the bearing sleeve. Use firm blows to remove the assembly, turning the shaft round and round. Do not hit and damage the driveshaft tube. If the bearing refuses to budge, take the section to a Datsun/Nissan dealer or a machine shop and ask for help.

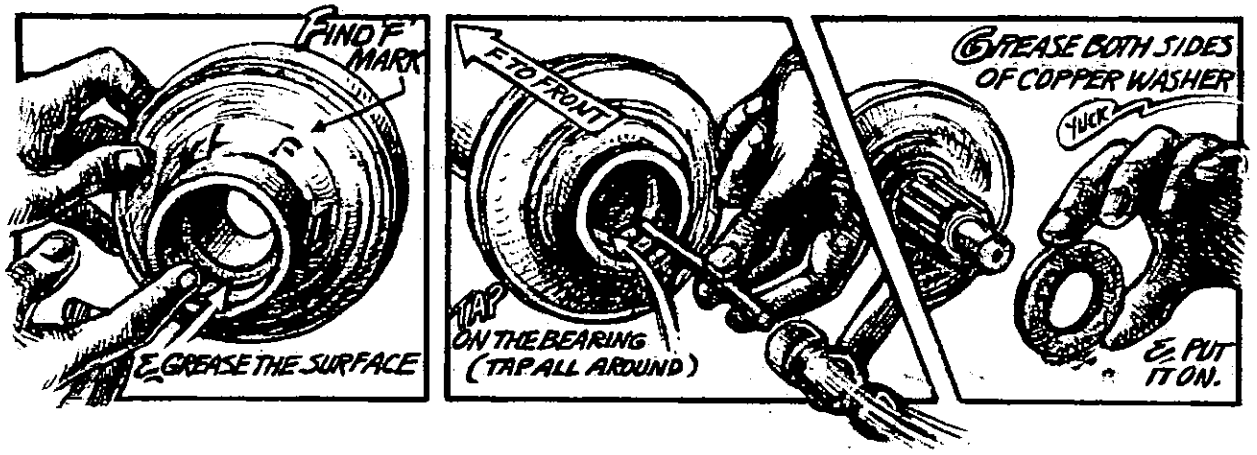
Step 7: Purchasing the Carrier Bearing.

- **610 and 620 People:** The bearing and insulator come as a single unit, not available in any other way.
- **521 People:** The bearing and insulator are separate and can be purchased that way.

Step 8: Install Carrier Bearing Assembly.

The new bearing is marked with an "F" on the cupped side of the insulator. This indicates front (as in front of the truck).

- **521 People:** The bearing goes on either way.
- **Everyone:** Coat the front inner part of the new bearing with some of the grease. Slip the bearing, "F" side first, over the end and onto the shaft. Tap the bearing on farther with a steel punch or brass drift placed against the inner edge of the bearing. Work round and round. When the bearing backs up against the bottom of the shaft,



it will stop. So will you. Spin the insulator to make sure the bearing turns freely.

•**521 People:** Slip the rubber insulator over the bearing ring.

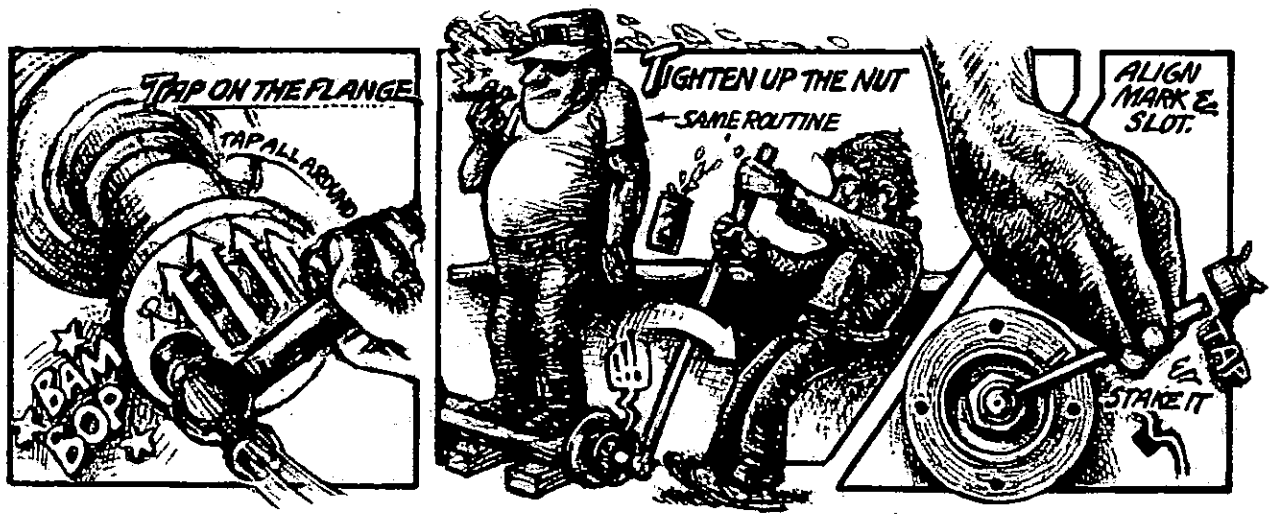
Step 9: Replace the Companion Flange.

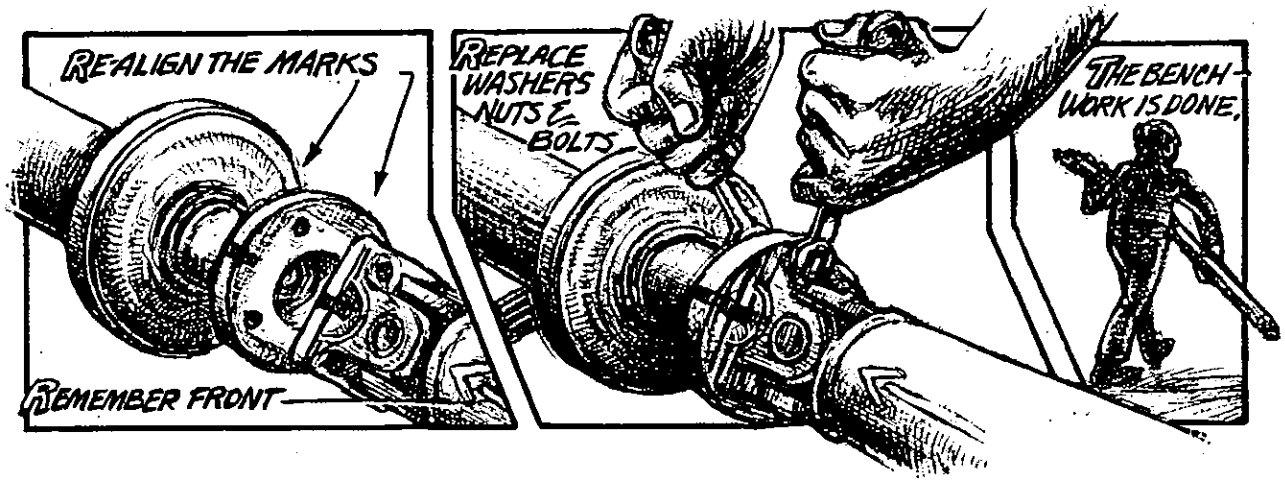
Pick up the copper washer and coat it with grease, then slip it over the end of the shaft and against the bearing (not for 521s or 610s). Pick up the companion flange and look for the mark you made to indicate the flange's position to the slot in the shaft. Squirt a little penetrating oil on the splines of the shaft and install the flange, small end first. Make sure the mark is aligned with the slot. Tap the flange all around to get it on. Find the 27mm nut and washer (if washer style). Slip the washer (if one) and then the nut onto the shaft. Thread the nut on as far as you can by hand.

Get yourself and assistant ready to tighten the nut. Place the locking bar or screwdriver in between the U-joint journal as before, but this time on the right side as you face the shaft. Tighten the nut clockwise with the socket until it resists. Put your back into it and feel it really tighten. If you have the nut and washer type, put a lot of pressure on the breaker bar. If you have the built-in washer type nut, use the cheater pipe. Tighten the nut until it stops.

The nut should be close to torque when the staked edge of the nut nears the slot in the shaft. If the old stake is too bent up, move the nut farther onto an untouched section.

•**Truck People Only:** Use an old screwdriver, a punch or a chisel and hammer to stake the nut into the slot. Safety glasses on? Stake the edge of the nut above the slot. Stop when there is enough of the edge staked in the slot to keep the nut from turning out.





Step 10: Reconnect the First and Second Shafts.

Pick out the four flange bolts, nuts, and washers. Lay the short and long driveshafts end to end. Determine which end of the long shaft is the front by looking for the arrow or "F" you inscribed on it. Realign the marks on the round and square flanges and push the two together. Insert the bolts from the rear, then the washers and nuts. Tighten the nuts with a 12mm open-end until all four lockwashers are flat and the nuts are tight. The flanges should be flush to one another.

Step 11: Replace Carrier Bearing Bracket.

610 Models Only: Place the bracket pieces around the bearing and insert the bolts from the top, then the washer(s) and nut from the bottom. Tighten with a 14mm socket and wrench.

Step 12: Replace the Driveshaft.

See Proc. 5 (6-8).

PROCEDURE 8: REMOVE THE TRANSMISSION

Condition: The transmission needs to be replaced or repaired. Either the clutch or the flywheel, or the rear main engine seal, or the front transmission seal, is being replaced.

If you want to disconnect the transmission to pull it out with the engine, do Steps 1-11. If you're pulling the engine alone, without the transmission, do Steps 14-16.

Tools and Materials: A sturdy rolling floor jack, a telescope (your vehicle jack will do) or scissors jack, block of wood (short 2 x 4), drain pan, 8ft piece of thin (strong) rope, an 8-16in piece of 1 x 2in or a thick wooden dowel, safety glasses, and your basic tool set (Ch. 13, Pt. 2). Most important is a strong reliable assistant.

Remarks: The transmission is heavy and awkward to remove. It is one of those jobs that can make you hate doing auto mechanics and put ice packs on your bruised head. A rolling floor jack and a strong friend are essential. Two great assistants that stand out in my mind are my brother Paul and Bob "Bruiser" Alfone. Their brute strength and stamina have made many tasks a lot easier. Strong or weak, use your head and work slowly. Never lie directly under the transmission or assume that your helper has it under control when you don't. Communicate, and be careful. Wear safety glasses when working under the vehicle. Don't let the transmission hang without support.

•**Manual Transmission People:** Before starting a clutch job, make sure you can get all the parts you could possibly need, or at least know where to buy them. Proc. 9 (7) has details about buying clutch parts.

NOTE: Clutch jobs can be done without dropping the transmission (Step 10).

Step 1: Jack and Block Vehicle.

See Ch. 13, Pt. 1, Proc. 1, and pay special attention to the safety information included. Support the vehicle at four points as high and well as possible.

Step 2: Disconnect the Negative Battery Cable and Remove the Starter Motor.

These procedures are found in Ch. 7, Proc. 1 (cable) and Proc. 7 (starter)

Step 3: Remove the Driveshaft and Drain the Transmission.

See Proc. 5 (1-5), and Proc. 3 (3).

Step 4: Remove the Console.

•**Automatics and 1978 on 4-speed 510s:** Go on to Step 5.

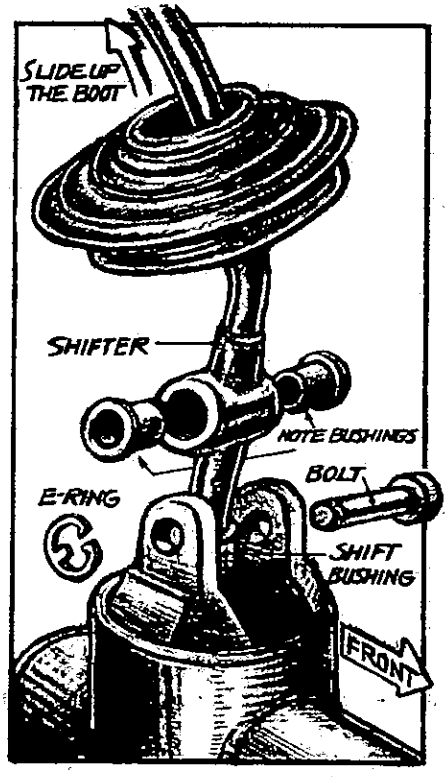
Remove the shifter knob by turning it off the stick counterclockwise. Place the shifter in first gear with the stick type emergency brake lever raised.

•**610 and 710 Models:** Read through the following instructions and use the information that applies to you.

•**620 Models with Console and 720 Without Armrest:** There are two or four Phillips screws on the sides of the console that hold it to the console bracket and two or more behind the shift lever; remove these. Pull the console up and away from the shifter and stash the screws in a container labeled "console."

•**720 Models with Armrest:** The console and armrest are separate. Open the armrest box and find the rubber plug in the bottom of it. Remove this plug and the Phillips screw beneath it. Locate the two screws at the front of the armrest and remove them. The center rest will now lift up and off of the floor. Remove the screws at rear and sides of the console box. When the screws are removed, the console will lift up along with the gauges, wires still connected. Keep the screws and rubber plug in a container labeled "console."

•**510 Models with Console:** You have one of two styles. Either way, work from the rear of the console. If your unit is one piece, find the plug in the bottom of the tray and remove it. Then remove the screw. If your console is two-piece, remove the two screws at the rear edge of the emergency brake cover. **Both 510 Models:** There is a screw (or screws) under that little plastic lid in the center of the console. Carefully work the lid out of the console (from the rear) and remove the screw. There are two more screws at the side of the console. Put them in a parts baggie labeled "console" and lift the console up and off of the floor.



Step 5: Disconnect the Shifter Control (manual transmission).

Put the shifter in Neutral. **All 4-speed Car People, 521, and pre 1974 (10/73) 620 People:** Get a 12mm and 14mm open end. **1974 (10/73) on Trucks and All 5-speed Cars and Trucks:** You need only a medium sized screwdriver. **510 and 521 Models:** Feel around the bottom of the boot. The edge is either wedged around the body metal or screwed down by a plate. Push the boot up away from the lip or remove the screws and pull the boot up the shifter.

•**All 510 4-speeds, 521, 610, 620 up to 1974 (10/73), and 710 Models:** There is a nut screwed on the bottom of the shift lever. Use feel to find and fix the 14mm open-end wrench to it. Turn the nut clockwise as you're looking down at the wrench. If the lever turns, fit a 12mm open-end on the cutout in the lever just above where it goes into the control.

Pull up on the shifter and catch the washer that fits above the nut. Put the nut, lower washer, and little tabbed upper washer with the lever. Be sure the lower rubber bushing hasn't fallen out of the shifter control. If it has, stash it with the lever.

•620 and 720 Models: Find the back edge of the carpet under the front of the seat. Carefully peel the mat up, starting at the corners and work toward the center. If you cannot peel, find the edge of the carpet, remove the Phillips screws and strip holding the carpet in place under the bottom door jamb — one side only. When one or both sides of the mat are free, pick it up and over the shifter.

•1974 on Pickup Models: There is a black metal cover on the transmission tunnel. There are four to eight Phillips screws around its edge. Remove them and slide the cover and boot up and over the shift lever. Bag the screws labeled "shifter cover."

•510 5-speed, 620 1974 (10/73) on, and 720 Models: There is a small boot that slips over the top of the shifter control. Pinch the boot above its base, slide it off the control and then up the shifter.

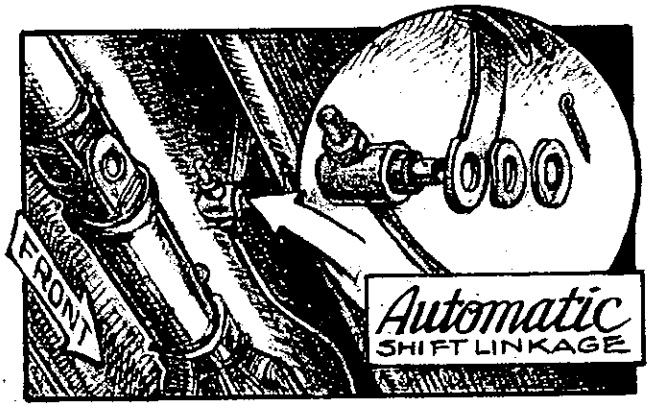
A pin fits through the lever and control. An "E" clip holds the pin in place. Remove the clip by turning it until the gap is visible. Carefully push the clip off the pin with the end of a straight screwdriver. Don't let the clip fall or otherwise get lost. Wiggle and tap the pin out of the control and shifter. The shifter will now lift up and away from the transmission control. Put the pin back in through the lever and attach the clip.

• Automatic People:

•510 (1969-73) and 521 Models: You may have a column or floor shift. (**Floor Shift People:** Go to the next section of this step.) The column shift linkage is disconnected at the left side of the transmission. You will need a pair of pliers, a screwdriver, a 17mm open-end wrench, and a 12mm socket extension and ratchet.

First remove the downshift cable, which connects to a pivot attached to the side of the transmission. Turn the pivot and unhook the end of the cable from it. Follow the cable up to a bracket and disconnect it.

Follow along the driver's side of the transmission until you find a swivel piece that fits between the transmission and the chassis. There are two rods attached to it. Each of these rods is held to the piece by a cotter pin and a washer. Remove both cotter pins and washers, then push the rod out of the swivel. Put the washer and the cotter pin back on the rods for safekeeping. Turn your eyes to the two bolts that hold the swivel to the chassis. Use the socket and ratchet to remove the bolts and washers. There is a spring between the swivel and the transmission which comes out when the swivel is disconnected. Put the bolts and washers back in the swivel and the spring and various smaller parts in the container labeled "shifter parts."

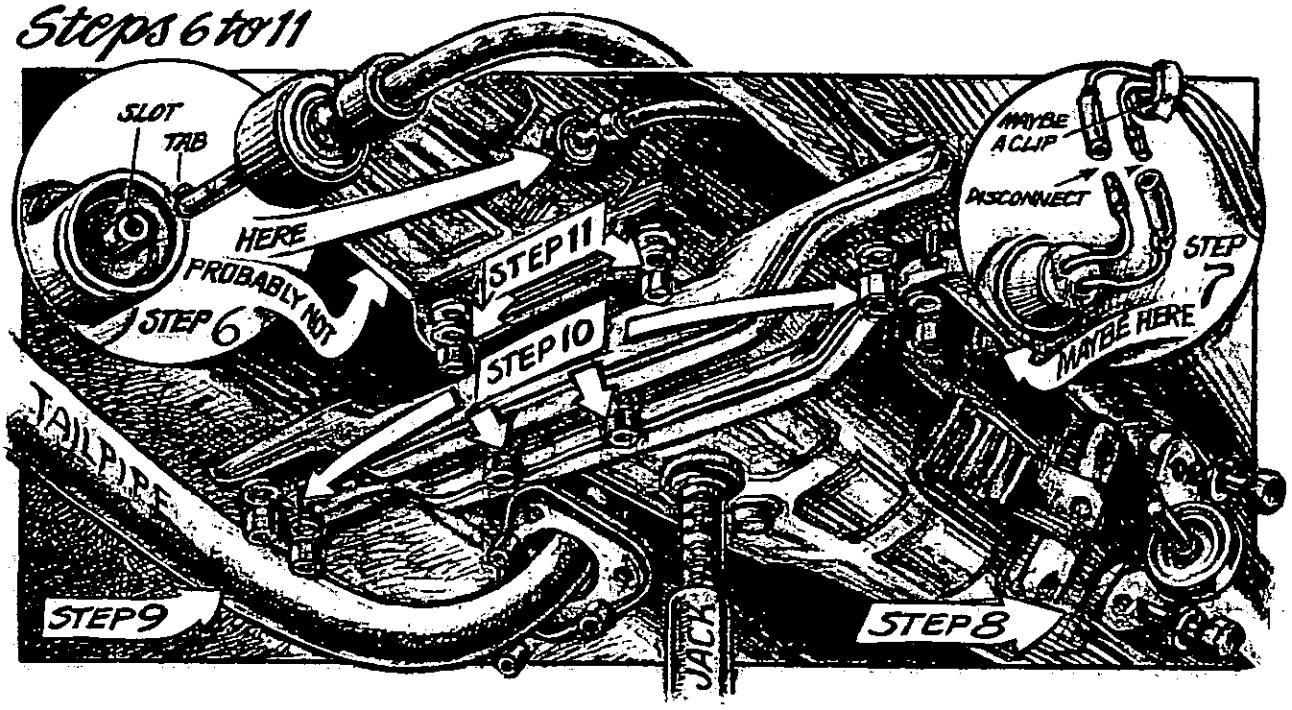


•Everyone: Find the side of the transmission with two pipes connected to it. The two pipe ends have round fittings with bolts through them. Loosen these bolts with a 17mm open end. When you pull the bolts out watch for two flat washers, one on either side of the fitting. Keep the washers and bolts in a baggie labeled "fluid tubes." Place a drip pan to catch any fluid that may be left in the lines. You will probably also have to disconnect the lines farther forward where they may be bolted to the transmission or to the engine by oil pan bolts. Remove the bolts and brackets and the lines will hang free. Go up to the bottom of the radiator and unclamp the hoses and lines there. Replace the bracket bolts into their holes. Put the lines aside where they won't get brutalized. Get new hoses if yours are funky.

•510, 610, 710, and 720 People (with floor shifts): The shift linkage is operated by a rod running forward along the left side of the transmission. Find where the rod connects to a vertical lever that's attached to the transmission. Remove the cotter pin or clip that holds the rod to this lever with a screwdriver or pliers. Then remove the washer(s) and plastic bushing and the rod will slide out of the lever. Put the loose parts back on the rod for safekeeping.

•**Everyone:** On the left side of the transmission find a single pipe running to a round capsule. Disconnect the hose at this capsule and follow the pipe up to the engine. Disconnect any brackets you find and finally the hose at the other end of the pipe at the intake manifold. Stash the pipe and replace the brackets.

From the engine compartment, remove the dipstick. Go below again with a 10mm wrench and remove the dipstick tube that sticks out the right side of the transmission. There's an O-ring under the tube. Keep it in the transmission or bag it with the 10mm bolt labeled "dip stick." Store the tube and dipstick with the fluid tubes.



Step 6: Disconnect Speedometer Cable from Transmission.

•**4WD People:** You may need to remove the cable from the transfer to give yourself clearance. Find the cable and the transfer then disconnect the cable as described below.

•**Everyone:** Turn to Proc. 18 (2) to disconnect the speedometer from the transmission (or transfer) and unclip it from under the body.

Step 7: Disconnect Wires from the Transmission.

Depending upon the year and model, you will have anywhere from two to eight wires connected to the transmission. Usually there are one, two, or three sets of two wires on the right side and one set on the left. Each of the wires has a push-pull connector where it can be separated by pulling the two halves apart. The plastic covered terminals are matched, so don't worry about reconnecting them correctly later. Unhook wire(s) from clips and move them out of the way so they don't get destroyed. Look again to make sure you found all of the wires and clip holders.

•**Automatic people:** Proceed to Step 9.

Step 8: Remove the Clutch Slave Cylinder.

Manual Transmission Models Only: Find the clutch slave cylinder on the right front side of the transmission.

•**510 and 521 People, 1969-73:** Remove the spring which hooks the cylinder and the lever.

•**Everyone:** Using a 14 or 17mm socket, remove the two bolts and (maybe) washers that mount the cylinder to the side of the transmission. As you remove the cylinder, hold onto the rod that sticks out of the dust boot. Keep this rod with the slave cylinder if possible; otherwise, bag and label it "clutch slave." Screw the bolts and washers back into the transmission. If you're swapping the transmission for another, bag the bolts with the slave

rod. The cylinder stays connected to the flexible hose. Lay it up on something nearby so it isn't hanging with the dust boot (rod) end down. See the clutch slave cylinder checkout (Proc. 1 [8]), if the hose or dust boot is damaged or leaking brake fluid.

Step 9: Disconnect the Exhaust Pipe from the Exhaust Manifold.

Follow the pipe up the left side to where it connects to the manifold with three nuts on rusted studs. Squirt these studs with lots of penetrating oil, then go away for a while. When you return, hit them again with the magic juice.

Put together a couple of extensions, a swivel and 12, 14, or 17mm socket. When the socket is well placed on a nut gently turn it off. If there is any resistance, lubricate it again. You do not want to break these studs. Take the old nuts to Datsun/Nissan and get some new ones if they look corroded or are missing. Z-series truck nuts tend to loosen. See the dealer for special claw style nuts, #20602-P6700 (ca. $2.00 each). **L-16, 18, and Z-series All Except 510 (1980 on):** You need to replace the gasket between the pipes whenever they've separated. To get the right gasket take the old one to the dealer or a well-stocked parts store for positive identification (matching).

•**Everyone:** Follow the pipe back and unbolt or unhook any brackets so the transmission can be moved back and down to drop it. This is especially true with cars and many add-on exhaust systems.

If you have a bracket that supports the exhaust pipe and connects to the transmission mount, remove the two 14mm bolts that hold the bracket and screw into the mount. There are steel and rubber washers under the bolts and rubber ones between the bracket and crossmember. Put them all in a baggie labeled "exhaust bracket." Drop the exhaust pipe down.

Step 10: Remove the Transmission Crossmember and Mount.

Caution: It is important that you have something ready to support the transmission before dropping the crossmember; use the jack you rented or borrowed. For the sake of safety, try to understand the operation of the jack before using it.

Make sure that your jack will balance the transmission's weight. Raise and position the jack under the center of the transmission. Now look at the crossmember underneath the rear half of the transmission. It bolts to the transmission mount and the frame or body in two places on either side.

•**4WD People:** Look on the upper right side of the transmission case for a pipe with a small black hose connecting it to the frame and another pipe. If there, twist and pull this hose off the frame pipe.

Some of you may have a small shock absorber between the right rear of the transmission mount (bracket) and the crossmember. If so, remove the 12mm nut and washer from the bracket (top) end and pry the shock rearward. Leave the bottom end attached to the crossmember. Put the upper nut back on its stud.

If you want to drop the transmission by itself or pull it with the engine, you'll have to drop or at least move the front differential. Do this now by reading Proc. 16 (3), then return here.

•**Later Model 620 and all 2WD and 4WD Manual Transmission People:** You don't need to drop the transmission to do a clutch job. You can get at the clutch by simply moving the transmission back until it safely rests on the crossmembers. The clutch and flywheel are then exposed. By doing it this way, you don't have to remove the front differential or handle the tranny as much, nor do you have to do all of this procedure. Specific differences are listed below. Whether you drop the transmission or simply pull it back depends on your tools and skill. Whatever you do, be careful — make sure your transmission is well-supported while it's perched on the crossmembers.

•**521 Models:** Your crossmember attaches to the frame with only two bolts with washers. The bolts go up into the frame through holes at the rear of the crossmember. The crossmember can be removed with the rest of the transmission. Bag and label the bolts and washers "crossmember to frame." Go on to Step 12.

•**Everyone Except 521 People:** NOTE: Trucks have a fixed crossmember behind the removable one, so don't confuse them. The crossmember is attached to the body or frame by four 14mm or 17mm bolts (and nuts). The crossmember is bolted to the tranny (rear mount) by either two or four 12mm or 14mm nuts or bolts. Look at the center of the crossmember. On some cars there is a cast iron mount under the crossmember. On most 720 trucks, there's an exhaust bracket sandwiched in the mount. Mark the crossmember with an arrow to indicate "Front." When the bolts are removed don't let the casting, if there, fall on you. Use a socket to loosen, but do

not remove, the two or four center bolts. Now position the jack under the center of the transmission supporting it well. Remove the four crossmember to body or frame bolts (and nuts). Trucks have 17mm nuts below with a bolt head you have to hold on top (17mm or 19mm). The weight of the transmission will now be resting on the jack. When the body/frame bolts, washers, and nuts are out, remove the bolts from the center of the crossmember. Keep a hand on the crossmember to take the weight. Mark which side is front and set it aside. Bag and label the center bolts "crossmember to mount," and the four crossmember bolts and washers (and nuts) "crossmember to frame." The transmission is now free from the frame (body), supported by the jack and engine, so be careful.

Step 11: Remove the Transmission Insulated Mount

All Trucks: The mount is the unit that connects the transmission and crossmember. Mark which side of the mount is the front. Hold onto the mount and remove the two 17mm or 19mm nuts and washers. Push the bolts up and out of the transmission. Put the nuts and washers back on the bolts and bag them labeled "mount to tranny."

Step 12: Last Checks and Maneuvers.

Before crawling out from underneath, take another look to make sure there is nothing keeping the transmission from coming out, like wires or cables still connected or in the way. Now roll out.

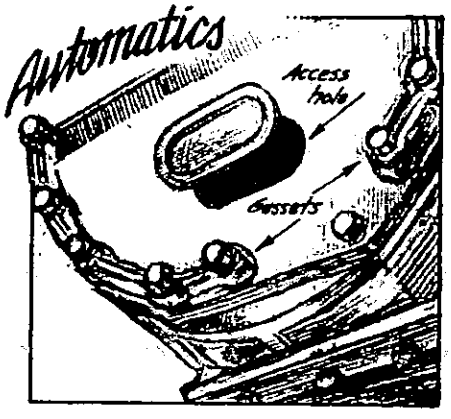
•**Car People:** Go on to the next step.

•**Truck People:** Tie together the ends of an 8ft piece of rope and make a strong knot. Drop one looped end of the rope through the hole in the floor, around the tail shaft of the transmission, and back up through the hole. Slip the 2ft piece of 1 x 2 through the looped ends of the rope and twist the handle a few times to take up the rope's slack. Move the rope in front of the cast part of the tail shaft where the insulated mount was (is) bolted. The rope and handle will now act as a sling when your assistant sits over the hole in the floor and helps pull back and/or lower the transmission.

To drop the transmission you may need to cut and peel back some metal from the back of the hole in the floor. This is definitely true for 620s, 1974 (10/73 on). Push the seat back as far as you can and hacksaw or snip along a 2½in wide section, 1 to 2in long. Use pliers to bend this up to allow some extra room in the back of the transmission. It also helps to bend up the sides of the hole near the back. All this can be straightened later, believe me.

Step 13: Remove the Clutch and Dust Cover, and Support the Engine.

Grab a 12mm and 14mm open-end wrench, or 10mm for most early models. Follow the transmission forward to where it joins the engine. Look at the part of the transmission that is lower than the back of the engine. On the front side of the transmission housing there is a metal cover that protects the flywheel. It is held on by four bolts or secured by two nuts and bolts that may be different sizes or may be just 10mm headed bolts. You may have to scrape off grease to find them. Cars with gussets (see next step) have only one nut and bolt to remove. Use a wrench or a wrench and socket to remove the bolts (and nuts) and washers. Put them in a baggie labeled "dust cover bolts." **One and Two-Bolt People:** Go on to the next step. **Everyone Else:** Pry the cover away from the transmission and lay it somewhere safe.



Step 14: Disconnect Torque Converter from Driveplate

• **Automatic Transmission People Only:** Look at the front of the transmission where the spacer place hangs below the back of the engine, then find the big oval rubber plug in the center of that plate. If it's there, remove it.

• **Everyone:** There are four bolts that hold the driveplate and torque converter together. You have to remove these so the converter will come out with the transmission. Work from the engine compartment. Find the starter motor hole and insert a stout screwdriver tip between two of the teeth on the edge of the driveplate. Use the edge

of the hole in the housing to lever and turn the driveplate. Have your assistant watch from below until one of the bolts is visible. Use a 17mm or 14mm socket and ratchet to remove the bolt counterclockwise. Repeat the turning and bolt removal with the remaining three bolts. Stash the bolts (and washers) in a bag labeled "torque converter." If you can see the driveplate, use paint or fingernail polish to mark the torque converter to driveplate alignment. If you can't see the driveplate, carry on.

Step 15: Remove the Engine and Transmission Mounting Bolts.

Open the hood and cuff the 14mm open-end wrench. Work from the right side of the engine compartment. Find the back of the engine where it mates with the transmission. On the right side under the heater hoses, find a 14mm bolt on the transmission side. Use the box-end wrench to remove the bolt. It may be easier to get this bolt from below so try either way. On **L-20B** and **Z-series** engines the top bolts are hard to get and tight. **L-16s** and **L-18s** aren't as difficult. A wire clip may come off with this bolt.

The other top bolt is on the left side, more to the center of the engine. **L-20B and Z-series Models:** The bolt is almost always a struggle to remove because it is tight and difficult to reach. Work either from above or on your back under the exhaust pipe. The bolt is almost impossible to see, much less reach with a wrench. It may help to lower the jack(s) under the transmission and engine a few mm to get a better purchase. Good luck. Start a bag labeled "transmission to engine bolts."

Now get down under the vehicle again. Take a 14mm open-end and a 14mm socket, extension and ratchet with you.

•**510 Automatics (1978 on), 610 Sedans, Hardtops, and All 710 Models:** Lie on your back and look up at the rear of the engine and the front of the transmission. You'll see two cast iron gussets, one on either side. Seven 14mm bolts hold the gussets in place.

Unscrew and remove the lower transmission bolts first. Hold onto the gusset as you remove the upper bolts. Be careful you don't get a gusset in the face. Mark the gussets "right" and "left" and put them on the parts pile. Put the washers and bolts in a bag labeled "gussets."

•**All Models:** There are two remaining bolts to remove, one on either side of the transmission housing. They thread forward into the engine block through the transmission. Stash these with the other transmission bolts. It's now possible to muscle the brute away from the engine, so slide out from under the vehicle and read the next step carefully.

If you're pulling the engine and not the transmission, put a jack under the transmission before lifting the engine.

Step 16: Support the Engine and More.

Before you disconnect the transmission you must support the engine from underneath the oil pan. The standard vehicle jack or a common telescope jack (with a block of wood between the jack and oil pan) will do. Or you can wedge a piece of wood under the oil pan, between it and the crossmember that's below the engine.

Once the transmission is separated from the engine, the block of wood or jack and the motor mounts will be the only things holding up the engine, so be careful not to kick it out of place. If you find that there isn't any room for you to work with all of the safety stands in the way, have a friend put on the brakes while you loosen the lug nuts and remove the left front wheel.

Step 17: Remove the Transmission.

NOTE: **Truck People:** If you're here to replace the clutch, you may not need to pull the transmission out. You need only pull the transmission back far enough to work on the clutch. The transmission must be safely supported, though. See Step 10 to see who you are.

•**4WD People:** If you intend to drop the transmission, the front differential must be removed first (Proc. 16).

•**Everyone:** Never lie directly under or let any part of your body be vulnerable if the transmission falls.

Place the jack under the center of the case securely. Be sure you're familiar with the operation of the jack.

As I noted before, the weight and position of the transmission makes its removal dangerous. Two strong people and a good rolling jack make the job a lot easier and safer.

•**Truck People:** The assistant should handle the rope through the hole while you operate the jack and work below.

•**Car People:** One person should operate and pull the jack while the other calls the shots and watches the removal close up.

•**Everyone:** Before you disengage the transmission from the engine, the tranny must first be pulled straight rearward about 6 in. before being lowered. Constantly recheck that the engine support and transmission jack are in place. Work slowly and carefully from here on.

•**521, 620, and 720 Models:** The assistant has to raise the tail section of the transmission enough to clear the stationary crossmember until the front housing and input shaft clear the clutch parts. One person should lift the tail section above the crossmember while the other person pulls the jack rearward, moving the transmission away from the engine. Now is when you can support the transmission and get at the clutch.

DANGER: Watch that the jack doesn't slip from under the transmission allowing the monster to fall.

Once the front of the transmission input shaft is away from the clutch, steady the transmission and gently tip it forward. At the same time, lower the jack gradually and twist the whole works clockwise while keeping the tailshaft up above the crossmember. Move the transmission and the jack at the same time to avoid pushing the beast off the jack.

Because of the torsion bars (those black round steel rods running lengthwise on either side) and anchor bolts (above the crossmember) the transmission may have to be angled around a bit so it can be lowered and slid forward. **Truck People:** If you're not pulling the transmission completely out, rest it on the crossmember and support it with a jack. When the front input shaft is back far enough to lower, start letting the transmission down. It may take a few tries to avoid binding the top of the transmission housing on the clutch and the tail section sticking on the body crossmember and anchor bolts. Take your time. Be patient and don't force anything for safety's sake. This is when you truckers may want to modify that sheet metal around the shifter hole (end of Step 12).

•**All Cars, No Trucks:** When the transmission has been pulled far enough rearward for the input shaft to clear the clutch, it can be lowered. On certain models, the shift linkage may bind against the body transmission tunnel. In this case, the rear of the transmission will have to be lowered slightly once the front of the unit is a few inches from the engine. But be careful not to lower the rear end too much and bind the input shaft in the clutch. Also be careful not to move the transmission without moving the jack equally or it may fall off of the jack. When the linkage is clear of the body, pull the transmission rearward far enough so the front input shaft of the transmission will clear the rear of the engine. At this time, the gearbox can be slowly lowered to the ground.

•**Truck People:** If you're not removing the transmission it should be safely supported, so you can work on the clutch (Proc. 9).

•**All Models:** Once the transmission has been lowered, if you're removing it completely, either roll it out from under the vehicle on the jack or take it off of the jack and slide it out. If you plan to do clutch work, go on to Proc. 9 and 11. When the transmission is out check for leaking front seals by looking at the inside of the front housing. If it is black and oily looking with dust mixed in, the front transmission seal is probably leaking (Proc. 11, Manual People Only).

•**Automatic People:** If you haven't yet done it, make a mark on the driveplate and one on the torque converter indicating the position of the two parts when they were bolted together.

Step 18: Remove the Torque Converter

•**Automatics Only:** If you're taking the transmission away to be worked on, leave the **torque converter** in place; just don't tip the transmission forward. The mechanic should inspect the converter along with everything else. If you have to take the converter off, remove it with both hands, pulling toward you. Hold on well, because it's heavy. When the converter is off prop it up to keep the fluid inside from pouring out (Proc. 9).

While the transmission's out, check the driveplate and ring gear teeth, and replace the pilot bushing (Proc. 9 [9]).

Make certain you have and don't lose the splined transmission input shaft. It should still be in the splined sleeve (pump drive) in the center of the transmission at the bell housing end. It's removable, so don't lose it.

Many Datsun/Nissan transmissions are interchangeable by swapping bell housings and/or rear seals. Consult interchange books and the dealer microfiche. If you do buy a used tranny, get one that hasn't been sitting for ages. Auto transmission seals tend to dry out when not lubricated. Front and rear seal removal and replacement are in Proc. 11.

PROCEDURE 9: REMOVE AND REPLACE THE CLUTCH ASSEMBLY, FLYWHEEL, AND PILOT BUSHING; CHECK TORQUE CONVERTER

Condition: You have performed the checkout procedure and determined that the clutch assembly, flywheel, engine rear main seal, pilot bushing, or any combination of these parts may be at fault. The transmission is out or at least pulled back away from the engine. You want to visually check the torque converter.

Tools and Materials: 12mm socket extension and ratchet, torque wrench, hammer, hacksaw blade or keyhole saw (or 5/8in dowel and grease [Step 9]), pilot bushing, clutch pressure plate, clutch disc, throw-out bearing, clutch alignment tool (see Remarks below), three flywheel dowels (from Datsun/Nissan if flywheel is turned), and isoprophyl alcohol or lacquer thinner.

Remarks: When working on the back of the engine, lie with your head supported under the rear of the engine and your feet sticking forward. There are subtle differences in pressure plates and clutch discs so remove the old ones and take them along with your model number and production date to the store. Be skeptical, the parts you remove may not be the correct ones. Clutch alignment can be done by eye, but using a special tool saves frustration. These tools can be rented, most American (non-metric) types work. To be sure, take your new pilot bushing to the rental store to fit the tool's end into the bushing. Many parts stores sell wood or plastic alignment tools. Get one that fits L or Z-series engines, not the smaller Datsun/Nissan engines.

•**Truck People:** If you didn't completely remove the transmission, you'll have to work on the clutch (and flywheel) in the small space between the engine and transmission. Be careful not to hurt yourself or knock the transmission off its jack (support).

Step 1: Remove the Transmission.

See Proc. 8 in this chapter. It must be performed fully to get at the clutch assembly and flywheel and torque converter.

Step 2: Remove the Pressure Plate.

The **clutch assembly** is bolted to the **flywheel** by six (special) bolts with washers. The **clutch disc** is sandwiched between the **pressure plate** and the flywheel. Before removing the six bolts and washers, mark the position of the pressure plate in relation to the flywheel by putting a dab of paint or nail polish on a flat edge of the cover and a matching mark on the flywheel. If the cover has been reused it will be installed in the same position.

The pressure plate is spring-loaded. It won't jump out at you or send springs into your face, but there is a correct way of relieving the tension. The bolts should be loosened a little at a time, using a criss-cross pattern from bolt to bolt until the pressure is relieved.

Use a 12mm socket and ratchet to get at the bolts. If the flywheel turns before you can loosen the bolts, install one of the transmission bolts, then place a screwdriver shaft against the bolt and tip between two of the gear teeth on the edge of the flywheel. This will keep it from turning as you loosen the bolts. When the bolts are loose enough to turn by hand hold the pressure plate so that it doesn't suddenly fall as the last bolt is removed. Be careful, the clutch will come apart in two pieces. If the pressure plate doesn't come right off the flywheel when the last bolt is removed, hold onto it and lightly pry under its edge with a screwdriver to work it back. **Caution:**

The pressure plate is heavy and the clutch disc will fall out after it.

Lay the parts aside and look for three small dowel pins stuck around the face of the flywheel; they should remain in the flywheel. Store the six bolts together labeled "clutch cover."

Step 3: Examine the Clutch Parts.

Take a look at the outer bonded surface of the clutch disc. If it is oily and/or burned, it will be dark and streaked. If worn out, the rivets that hold the bonding to the backing will be close to the surface of the bonding. The little coil springs in the center section of the disc should all be in good condition, not rusted or loose. A disc may appear only slightly worn or burned, yet slip or make the transmission hard to shift because the pressure plate is weak. The clutch disc may slip from transmission or engine oil contamination caused by leaking seals. Take a good look at the smooth surface of the pressure plate. Lay a straight edge across it. If there's a concave gap toward the center, the pressure plate's no good. If the disc rivets were exposed, the surface will *undoubtedly* be grooved. Turn the pressure plate over and look at the flat fingers around the center. There'll be a shiny round area where the throw-out bearing made contact but the shiny part shouldn't be grooved. Keep all this information in mind for later.

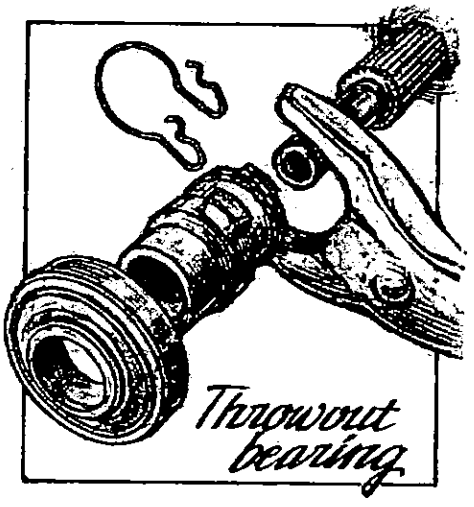
Step 4: Check the Surface of the Flywheel and Pilot Bushing.

Get back under and face the flywheel. Look at the surface where the clutch disc rubbed. Use a good light to look for discoloration (blue-gray instead of shiny silver) or heat-checking. Heat-checking usually accompanies discoloration; it looks like a bunch of little fractures or cracks all over the flywheel face. Rub your thumb across the surface to check for grooving. If discoloration, heat checks, or grooves are evident, the flywheel has to come off and be machined smooth. While you're here, take a look at the outer ring gear around the edge of the flywheel. Look at both sides (front and back) of the gear to check for wear. The teeth should be even all the way around the gear. If in doubt, see Ch.7, Proc. 7 for further ring gear checks.

To identify the pilot bushing: The center of the flywheel is cut out so you can see the back of the crankshaft. In the center of the shaft there's a hole where the input shaft of the transmission fits. A replaceable **pilot bushing** is in this hole. This should be replaced with every clutch or automatic transmission job.

Step 5: Check the Throw-out Bearing.

The throw-out bearing is connected to the throwout lever. Look at the input shaft inside the front of the transmission. The throw-out bearing fits over the shaft and is moved forward by the throw-out lever that pivots on a ball that isn't visible. The bearing spins when it contacts the fingers in the pressure plate if the engine is running. When the fingers are pushed in, the clutch is disengaged. If the throw-out bearing had been faulty, you would have heard a whining or grinding sound whenever the clutch pedal was depressed, engine running. If the throw-out sleeve lacks lubricant, the pedal may have felt stiff and sluggish or clutch action was noisy.



To check the bearing, place your fingers against the front surface of the bearing and push the bearing rearward until the lever stops. While pressing hard against the bearing, rotate it back and forth. It should turn easily and feel smooth. Now spin the bearing and listen for rough, dry, or inconsistent sounds. Even if the bearing feels good, replace it along with any other clutch parts.

Now look all around the inside of the transmission case. Most likely it will be oily with clutch particles mixed in. The oil is probably from the transmission. This means that the front transmission seal has been leaking, in which case the seal should be replaced. If the inside of the housing is dry, don't worry about it.

Hold the outer end of the lever with one hand and the bearing with the other. Move the lever back and forth to watch the action. If the inside of the sleeve is dry, it will bind as it slides fore and aft.

Step 6: What to Do Next.

Watch the clutch work with a critical eye. Because you have gone through the pains of getting the thing apart you should carefully consider the alternatives. If the engine or body are on the way to auto heaven and the flywheel and pressure plate are smooth and straight, and you didn't wear out the clutch disc in a short time, and this isn't the third disc you have installed using this pressure plate, a clutch disc and pilot bushing replacement may be all you should replace. But if the rest of your jalopy is in good shape, e.g., the body, engine and transmission, it is smart to do a complete job. This includes machining the flywheel (if necessary), replacing the rear-engine main oil seal if leaking, and replacing the pilot bushing, pressure plate (often called a clutch cover), clutch disc, and throwout bearing. Also if it's leaking, you should replace the front and rear transmission seals and the front transmission gasket.

Although this sounds like more than you bargained for, it's well worth it if the vehicle is in good shape. If you can afford it, at least replace the pressure plate. Too often people, trying to save a buck, replace only the disc to find out later that the old pressure plate can't handle it and the transmission won't go into gear.

Step 7: What to Buy and How to Buy It.

Call around for the best prices; consider quality before jumping on the lowest prices. Datsun/Nissan sells the best quality clutch components, which I recommend. Otherwise, a reputable parts house and machine shop recommended by a local foreign garage will do. If you decide to remove and/or machine the flywheel, take a good look at the rear main engine oil seal when it's off. If any clutch parts are replaced, the pilot bushing should be changed too. Take all of your old clutch parts to the store for trade-in and/or match-up. The bushings, seals, and gasket are usually dealer items. I generally don't use rebuilt clutch parts unless the vehicle doesn't merit new stuff. When shopping for parts ask if they are new or rebuilt. Also inquire about the warranty policy on everything you buy. I've often pulled apart original clutch assemblies that appear to be in good condition but don't cut the mustard. The appearance of a pressure plate, disc, and throwout bearing can be deceiving. If you think or know that the clutch assembly is original with many miles of service, replace it as a set. If the engine has been rebuilt and the clutch never replaced, then the rear engine oil seal and clutch parts are probably original. Look for stampings or stickers on the pressure plate. If you intend to save the vehicle and maybe rebuild the engine without pulling it out, then go ahead and invest the time and money to do the total clutch job. This is the same rap I give my customers. Whatever, don't reinstall a clutch disc if there is less than 0.012in (0.3mm) of friction surface as measured from the rivet to the lining surface.

If you can't figure out what to do, go to a trusted garage or machine shop with the old parts and politely ask for a second opinion. Parts that you can usually only get from the Datsun/Nissan dealer are the following: pilot bushing, front and rear transmission seals, front transmission gasket, and rear engine oil seal. Everything else can be easily found at almost any automotive parts house. Tell them the year, model and transmission type of your vehicle. NOTE: A replacement throw-out bearing that fits onto a cast iron collar is better than the kind that comes with a plastic collar.

Step 8: Remove the Flywheel.

If you determined that the flywheel was bad because of missing teeth or a need to be remachined, or the rear main oil seal is leaking (oil dripping from rear of engine) the flywheel has to be removed (Proc. 10). When the seal and flywheel are back in place, return here and proceed. If you aren't removing the flywheel, continue on.

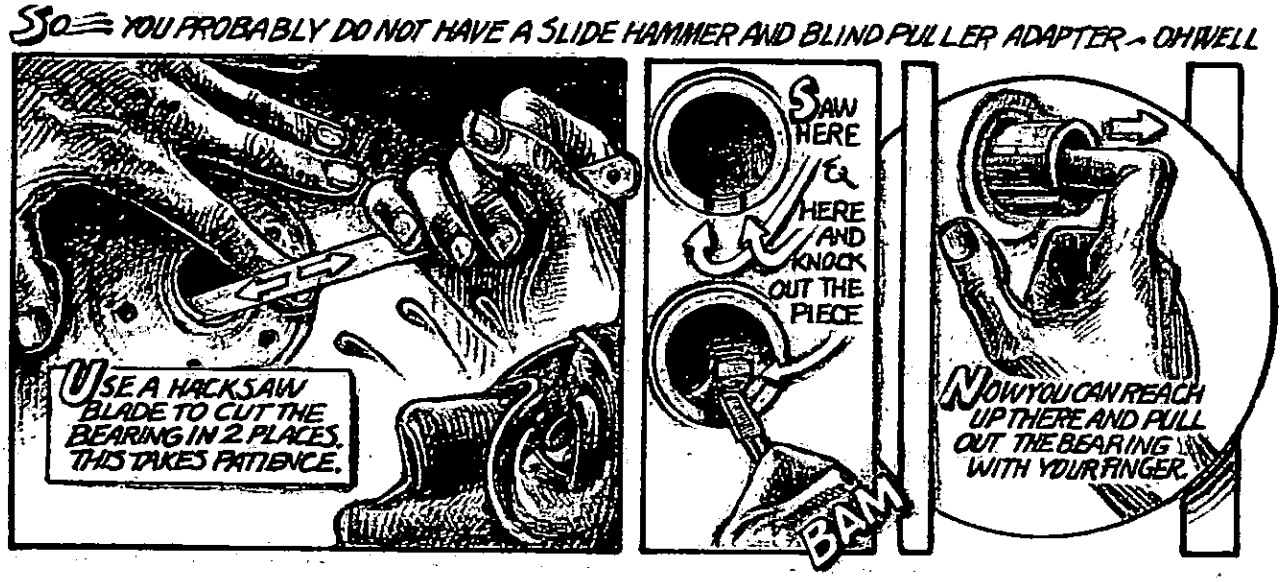
Step 9: Remove and Replace the Transmission Pilot Bushing.

(Wear safety glasses.)

This can be done with the flywheel (driveplate) in place.

The pilot bushing is pressed into the little hole in the center of the crankshaft. It is bronze colored and hard to see without a good light. The best way to get it out is with a blind bearing puller and slide hammer. If you don't have these tools, try one of the two following methods.

The easier method, which works if your bearing isn't too worn, requires some grease (vaseline's OK), a short piece of 5/8in dowel and a hammer. Soak one end of the dowel in penetrating oil to swell it until it fits tightly



inside the pilot bushing. Pack the cavity (hole) at the end of the crankshaft (where the bearing fits) with grease. Stuff it in until the cavity is nearly full. Now stick the dowel into the bearing. The plan is to tap on the dowel, compress the grease, and force it out the pilot bushing. You can also do this with a 5/8in tapping tool and a small ball bearing, but that's another story. If the grease/dowel method doesn't work, try the hacksaw trick below.

For this you need a hacksaw blade, screwdriver (or chisel) and hammer. Cut the bushing with the hacksaw blade or keyhole saw. NOTE: If you have a small sharp chisel and are good with it, try that. The hacksaw method takes some patience. Use a good quality blade off of the saw frame. A keyhole saw with a steel cutting blade does exactly the same thing. There is very little room to move the blade, so use short strong strokes. Insert the end of the blade into the pilot hole, toothed side against the inside of the bushing. Make your cuts straight along the length of the bushing. Make two cuts through the bushing ½in apart. When you've cut through the bushing in two places (watch that you don't cut into the steel of the crankshaft), the bushing will collapse. Put the tip of a screwdriver under the cutout piece then tap and pry the piece up. If the cutout shatters, keep working at it until the bushing is loose enough to pull out with your fingers or pliers. Make sure that *all* of the bushing pieces or grease are cleaned out of the hole. If there are any gouges in the hole, use emery cloth wrapped around your finger to smooth it out before going on. It's not really necessary but good practice to soak the new bushing in engine oil for ½ hour before installation. Pick up the new bushing and your hammer. Hold the new bushing squarely in front of the hole. Using the butt end of the hammer handle get the bushing started. If you start it straight and square, the bushing should tap in easily.

Check and recheck the position after each tap. Watch that the end of the bushing doesn't balloon out of the hole. Install the bushing until it is flush with the rear face of the crankshaft. Then find a socket that is the same diameter as the bushing and place the flat end of the socket against the bushing and tap it until the bushing is even with the inside of the beveled edge of the hole or 0.157in (4.0mm) from the flat end of the crankshaft. Drag your finger back along the inside of the bushing hole. If there is distortion, sand off the high points with emery cloth until the edge of the hole is even with the rest of the bushing. If there is any distortion at all, you will play hell trying to install the transmission. If there is any permanent damage to the bushing, remove it and start over with a new one. Try inserting the clutch alignment tool to see if there's distortion.

Step 10: Replace the Flywheel (if removed).

See Proc. 10 (8).

Step 11: Check Disc to Spline Fit and Sand Pressure Plate Surface.

Pick up the clutch disc without getting grease/oil on the friction surface; slide the center hub of the disc over the end of the transmission input shaft. The disc should slide freely over the shaft. If the disc doesn't fit

over the splines, try cleaning the grooves between the splines. Still no fit? Take the disc back to the parts place and demand a new one.

If you're using the same pressure plate, use some coarse emery cloth to sand the smooth contact surface in a figure 8 pattern.

Step 12: Bolt Pressure Plate and Clutch Disc to Flywheel.

NOTE: Although not absolutely necessary, it helps to have a clutch alignment tool to center the disc with the pilot hole.

If you are using the same pressure plate you removed, find the marks you made on the flywheel and pressure plate. Look and feel around the face of the flywheel to make sure that the three dowel pins are installed.

Find the three dowel sized holes around the outer edge of the pressure plate. The flywheel has to be turned to match up the holes with the dowels. Use alcohol (not solvent) to clean off the face of the flywheel and pressure plate. Set the clutch bolts close by. Pick up the aligning tool, put the small end through the clutch disc hub with *the snout side of the hub facing you (rearward)*. Lay the disc against the flywheel with the small end of the tool in the pilot hole. Center the disc with whatever means the tool provides. Hold the disc in place as you pick up the pressure plate and place it over the disc and tool.

Line up the holes in the edge of the pressure plate with the dowels and bolt holes in the flywheel. If you're using the old pressure plate, match the mark on it with the one on the flywheel. Start two clutch bolts through the plate and into the flywheel to hold the pressure plate in place. Do not tighten these bolts yet. If the dowel holes look as though they will align with the dowels, install the rest of the bolts and washers loosely. Otherwise, reposition the plate. Use a 12mm socket to tighten the bolts, tightening them one or two turns with each pass. Stop when the clutch disc can be moved just slightly, but doesn't slip down when you let go.

Step 13: Center the Clutch Disc and Torque the Bolts.

NOTE: It's a good idea to read through this step before doing it.

Use a good light. The center of the disc has to be dead center with the pilot hole and the fingers of the pressure plate. The plan is to align the friction surface of the disc with the pressure plate face and center the disc hole with the pilot bushing. You'll have to remove and replace the aligning tool to do this. Lie with your feet forward and head parallel to the center of the clutch hub. I close one eye to sight in the center point at the very front of the pilot hole, then I line up the inside of the bushing so its full length is equally visible. Now you will be centered, so keep your head steady. Blinking is not permitted. The disc has to be positioned so it is centered with the pilot hole and fingers of the pressure plate. If the pressure plate isn't too tight the tool will move the disc a little bit. Once this has been checked and rechecked you may begin tightening the bolts. Working in a crisscross pattern, make a few turns at a time, watching that the dowels are lining up and the pressure plate is being drawn evenly toward the flywheel. Stop tightening when the edges of the pressure plate contact the flywheel all around. Recheck the position of the disc. Centered? Are the dowels in place? Is everything even? Good.

If you don't have a torque wrench, you must read carefully. The torque value for 510 (1969-73) is 18 ft.lbs; 610, 710, 521, 620, 720 and 510 (1978 on) is 12-15 ft.lbs. Tighten the bolts evenly, a little at a time; do not overtighten them. Without the torque wrench, tighten the bolts, in a crisscross pattern a little at a time until they begin to feel tight. Once they feel this way, go gently. Do not overtighten or the bolts will break. You will feel when they "sink in." Stop at this point. Remove the aligning tool.

Look at the fingers of the pressure plate. If they are not level all around something is wrong. Remove the pressure plate and have it checked or replaced.

Step 14: Replace the Transmission.

See Proc. 12 in this chapter.

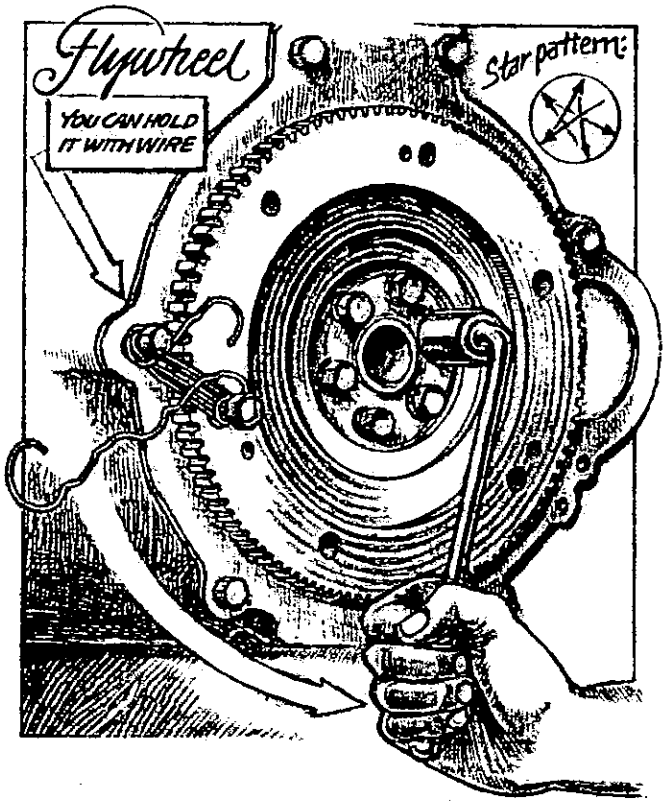
Step 15: Remove and Replace Throw-out Bearing and If Necessary the Transmission Seals and Gasket.

See Proc. 11 in this chapter.

Step 16: Visually Examine the Torque Converter.

Automatic Transmission People Only: The surface of the snout on the transmission side of the converter must be smooth without excessive grooving, scratches, or burrs in it. If the grooves are too deep you'll have to replace the converter unless it can be sleeved; consult a machinist. If the surface is OK, sand it with emery cloth to get a diagonal cross-hatch on it, then wipe it off clean with alcohol or lacquer thinner.

Other internal torque converter checks have to be made by a pro. Take the converter along with your symptoms to someone who is "savvy" for advice.



PROCEDURE 10: REMOVE AND INSTALL THE FLYWHEEL OR DRIVEPLATE

Condition: The flywheel needs resurfacing, the rear oil seal leaks or the ring gear is damaged. The transmission and clutch (or torque converter) have been removed.

Tools and Materials: 17mm socket (L-16 and L-18 models), 19mm socket (L-20 and Z-series models), a long hefty screwdriver, center punch or nail polish, hammer, medium screwdriver, emery cloth, silicon or non-hardening gasket cement, short 5/8in wooden dowel, 2ft bailing or mechanic's wire, rear oil seal if leaking, Loctite—thread sealer, torque wrench.

Remarks: If you have a flywheel locking tool, use it instead of the wire loop described in this procedure.

•**Truck People:** If you didn't completely remove your tranny, taking off the flywheel can be a little harder. Have an assistant hold onto the flywheel's weight as you remove the last bolt.

Step 1: Mark the Flywheel and Crankshaft.

To keep the flywheel and crankshaft in balance, you have to mark them so they go back together the way they came apart. Do this with a centerpunch, paint, or nail polish. Make a mark next to the pilot bushing hole on the exposed part of the crankshaft and a corresponding mark on the flywheel.

Step 2: Remove the Flywheel.

Pick out one of the clutch cover (or torque converter) bolts and screw it all the way into one of the six (or four) holes in the flywheel (or driveplate). Now pick out one of the transmission-to-engine mounting bolts and screw that into the lower left hole (the one with the sleeved dowel) in the back edge of the engine. Turn the flywheel (or driveplate) until the clutch (or torque converter) bolt is 2-3in to the left of the transmission bolt. Now wrap five or six turns of wire between the two bolts and twist the ends together securely. The wire loop will keep the flywheel from turning as you loosen the flywheel bolts.

Fit the 17mm or 19mm socket over each of the bolts and turn them counterclockwise until loose. Watch that the wire doesn't break and be careful not to slip off the bolt. Remove and store the bolts labeled "flywheel." Remove the locking wire and bolts.

•**Automatic People:** Remove the round plate under the bolts. Remove the converter spacer from the back of the crankshaft.

•**Everyone:** The flywheel (not driveplate) is heavier than you imagine, so prepare yourself for the weight by holding onto it with two hands. Take care not to drop it on you or the floor.

Step 3: Resurface Flywheel and Remove Steel Dowel Pins

Manual Transmissions Only: The flywheel or driveplate can now be hauled to the machine shop for resurfacing or ring gear replacement.

The three little dowel pins in the flywheel have to be removed before resurfacing. Ask the machinist to remove the pins for you. If the pins are missing or damaged, new ones are usually available from your local Datsun agency. The part number is 12313-10600.

Flywheel resurfacing is quick and necessary for good clutch service. If possible, have the flywheel ground rather than lathe cut, especially if it is heat damaged. Make sure that the three dowel pins are back in the flywheel and with a merry "Thanks again," head home.

Step 4: Remove the Rear Spacer Plate.

If you want to remove and clean the spacer plate do it now. Pull and wiggle the plate off the back of the engine. Leave it off if you are replacing the rear oil seal. Otherwise slap the spacer plate back on over the solid dowel (top right) and sleeved dowel (lower left) when it's clean, positioned so the starter motor hole is on the right side. Make sure the dowels are pressed fully into the block.

Step 5: Check for Rear Oil Seal Leak.

The rear oil seal fits between the engine block and crankshaft. If this seal is leaking there will be oil seeping between the bottom of the crankshaft and the lower lip of the seal. Oil will also be thrown around the back of the engine and the spacer plate. If the seal is leaking it should be replaced (a simple job). If it's not (the area is dry), leave it alone.

If you aren't replacing the seal, go on to Step 8. Rear main seals are sold singly by most parts stores or your friendly Datsun/Nissan dealer.

Step 6: Remove the Rear Engine Oil Seal.

NOTE: Be careful. Use a good light when doing this task.

Tap the tip of a medium straight screwdriver between the outer edge of the seal at the top and the edge of the engine block. Do not damage the steel around the outside of the seal. The tip need only be inserted far enough to get a bite on the seal to pry it out. Wipe the crankshaft and oil seal cavity. Rub down any high spots or burrs around the inside of the cavity with emery cloth, then wipe the cavity and crankshaft dry.

Step 7: Install the Rear Engine Oil Seal.

Match the new seal with the old one. Coat the inner lips with clean engine oil. Next smear the outer edge with a very light coat of silicon or gasket sealer.

The seal has to fit over the shaft square and straight with the flat side of the seal facing rearward. Slip the seal over the shaft and into the cavity with your thumbs. It has to go in so it's flush with the block. Place the 5/8in dowel against the seal face and tap the seal into the cavity, constantly moving the dowel position around the seal. Make sure that the seal goes in straight, not crooked. Stop when the seal is flush with the back of the block. Replace the rear spacer plate if removed. Match its shape with the back of the block and bolt hole positions. Fit it over the dowels, so it's flush with the block.

Step 8: Replace the Flywheel and Driveplate.

NOTE: Remove and replace the pilot bushing first (Proc. 9 [9]).

Pick out the five or six stubby 17 or 19mm flywheel bolts and wipe their threads dry.

•**Automatic People:** Install the six hole converter spacer on the back of the crankshaft.

•**Everyone:** Put a drop of Loctite on the threads of each bolt.

Find the punch or paint mark you made at the center of the flywheel. Then identify the corresponding mark

on the end of the crankshaft. Keep the six bolts close at hand and lift the flywheel (or driveplate) up onto the crankshaft with the marks and bolt holes aligned.

•**Automatic People:** Hold the thin shim against the driveplate while you install the first two driveplate bolts.

•**Everyone:** Install the six bolts finger tight. Screw one of the clutch pressure plate bolts into the flywheel. Screw one of the lower left transmission bolts into the engine block, then turn the flywheel so the clutch bolt is slightly above the transmission bolt. Loop the locking wire between the bolts five or more times, as described in Step 2, then twist the ends together. Get the 17mm or 19mm socket on the breaker bar.

These flywheel bolts have to be **tight**. If a torque wrench is available, tighten the bolts with separate lockwasher 69-76 ft.lbs (without lockwasher 101-116 ft.lbs). If a torque wrench isn't available, tighten the bolts as much as possible without breaking them. Keep an eye on the wire loop. Don't break your knuckles. Please be careful. You can now install the clutch—**Manual People** if the pilot bushing is in place (Proc. 9 [9-13]), then transmission (Proc. 12). Or the torque converter and transmission—**Automatic People** (Proc. 9 [16], and Proc. 12).

PROCEDURE 11: REMOVE AND REPLACE THROW-OUT BEARING, TRANSMISSION SEALS, AND GASKET

Condition: The transmission is out of the vehicle, i.e., separate from the engine. The transmission is leaking and/or the throw-out bearing is going to be replaced along with other clutch parts. If the engine is out, the front of the transmission housing is accessible. The transmission has no oil in it.

Tools and Materials: Newspaper, solvent, scraper, solvent brush and rags, new front input shaft seal #13042-A8600 **(Automatic Transmission)**, #32114-44000 and cover gasket **(Manual Transmission)**, rear transmission seal #32136-40100, new throw-out lever boot (if necessary), new throw-out bearing if necessary. If you have a plastic collar type of throw-out bearing, get a cast metal one from a junk yard or Datsun/Nissan as well as a new throw-out bearing.

Remarks: Automatic Transmission People: For front seal information (Step 3); for rear seal advice (Step 4). **Manual People:** This is for all of you. The front transmission seal is the same as some Toyota front end tranny seals and is often available from a foreign car parts store. **Truck People:** If your tranny is hanging on the crossmember below, you'll have to work at weird angles and be very careful not to get hurt. Follow the instructions and do the best you can.

Step 1: Remove Throw-Out Bearing Assembly.

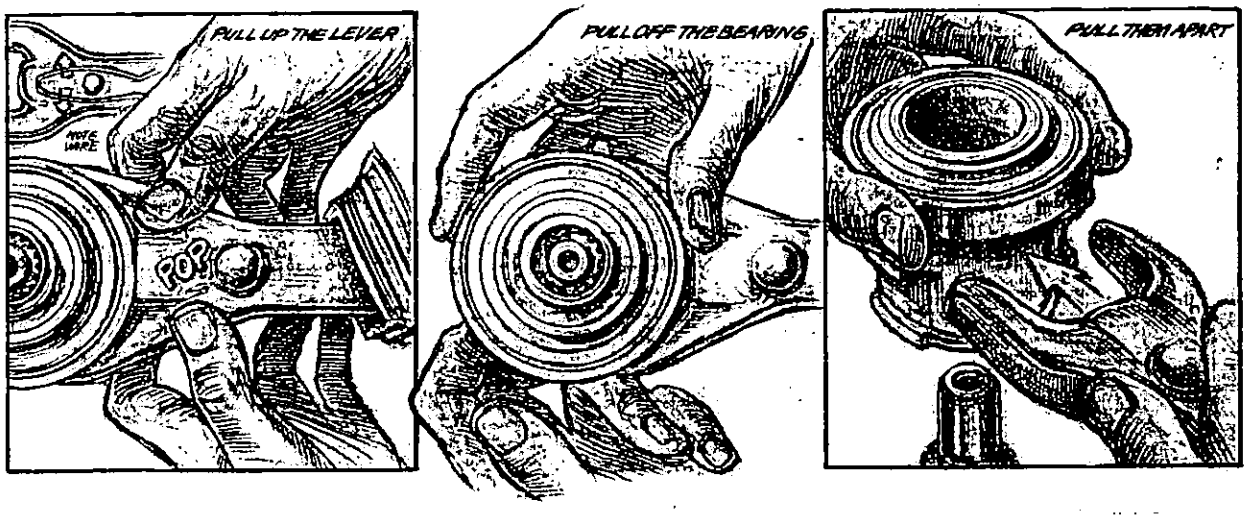
•**Manual Transmission Only:** The throw-out bearing and collar slide over the transmission front cover and input shaft. They are linked to the throw-out lever by a special spring. The lever pivots on a ball mounted to the front cover (not visible) and fits through a boot in the side of the case.

Set the transmission on a wide, flat, sturdy surface. Reach in behind the throw-out lever to feel two wires on either side of the pivot ball. Spread these wires and pull the lever away from the ball. Now the lever, bearing, and collar can be worked through the housing and off of the front cover. The bearing, collar, and special spring will slide sideways away from the throw-out lever. Keep the wire clip in the throw-out lever, with the lever.

If you are replacing the throw-out bearing, remove the special spring by sliding it sideways off the collar. Do not lose or damage it. Scratch the collar with a screwdriver blade to determine if it is plastic or cast iron. If plastic (not common), the bearing has been replaced and the original collar discarded, so you either have to get a metal collar and bearing or a new bearing with a plastic collar. To replace the bearing, you have to push the old one off the collar and press a new one on. If the collar is cast metal, get a new bearing and proceed.

Step 2: Remove the Front Shaft Cover from the Transmission Case.

(Do this if the tranny input shaft is leaking or just for grins.) If the bellhousing is filthy, consider cleaning it first (Step 5).



Find the five 12mm bolts that hold the front cover to the main housing. Use your socket, ratchet, and extension to remove the five bolts with washers. Stash them all together.

Remove the rubber dust boot in the side of the transmission housing. Tip and support the transmission so the dustboot hole is up, and insert a screwdriver or punch through the hole with the tip against the back of the pivot ball. Lightly tap the punch with a hammer to coax the cover away from the housing. Stop when the cover can be pulled off by hand. The gasket will probably stick and tear as you pull the cover off. NOTE: On some models there is a round shim in front of the counter shaft bearing. This is in a cavity below the shaft. Look and feel carefully for the shim in front of the bearing or in the cover. Store the shim with the bolts.

Step 3: Replace Front Transmission Seal and Gasket.

Look into the back side of the cover to find the rubber lip seal. Lightly clamp the cover in a vise or otherwise steady it. Be careful not to score the front cover sleeve. Push a screwdriver tip underneath the seal to pry and force it out of the cover. Save the old seal for comparison. Now diligently scrape the old gasket off of the cover and the transmission housing. Don't mar the aluminum housing or let grit fall into the bearings. Clean off the outside of the cover and smooth the outer surface of the shaft sleeve with emery cloth.

Wipe around the inside of the seal hole and coat the *outside* edge of the seal with gasket sealer or silicon (not the front face). Insert the new seal with the flat side forward (down) and the open back side facing you. If the seal is square to the cover, press it into place with your thumbs or tap it with a hammer and a flat piece of wood laid across the edges of the seal, until the top of the seal is flush with the cover. If the old seal is not badly distorted, use it (flat side up) to tap the new one on into the cover, then throw it away.

Now wipe a little grease around the inner lips of the seal. Find the new cover gasket and *lightly* coat both sides of it with gasket sealer. Slip the gasket over the front shaft and onto the housing so the holes and edges match. Pick out the shim if one was removed. Wipe it clean and coat it with grease. Position it in the smaller cavity in the cover and make sure it stays put by itself. Slip the cover over the input shaft, sleeve forward, lining up the holes and edges as you go. Make sure the shim (if any) is in place and not off center. When the cover is flush, start the five bolts and washers. Three of the bolts are long and two short. The thickness of the cover determines where the different lengths go. Tighten them a little at a time, working around the cover, until all five are snug.

•**Automatic People:** Your front seal is around the input hole. Pry it out carefully with a medium screwdriver. Wipe the hole dry and coat the outside edge of the new seal with silicon or gasket sealer. Press the seal in with the flat side facing you until it's flush with the case.

Step 4: Replace the Rear Transmission Seal.

•**521 Truck People:** The rear flange nut has to be removed to reach the seal. Hold the flange from turning with large pliers or a chain wrench. The nut is 21 or 22mm. Tap the flange off with a hammer.

•**Everyone:** The rear seal is pried out of the housing by placing the tip of a screwdriver between the seal and the housing. Gently tap the screwdriver a little way in before carefully prying it up. Take care not to break the casting around the seal. Coat the outer edge (not side) of the seal with sealant, then the inner lips with a light coat of grease. Install the seal open side in, flat side out facing you. Use your thumbs to start it into the housing. When started, use a hammer and the old seal to drive it in until it's flush with the edge of the housing. Do not tap directly against the new seal. Watch that it goes in straight and ends up even with the housing.

Step 5: Clean the Bellhousing.

This is no fun but important. Put a load of newspaper or a pan under the housing to catch the used solvent. Swab the inside of the bellhousing with solvent to dissolve the grease, then wipe it clean.

Step 6: Remove the Old and Install the New Throw-Out Bearing.

If you purchased a throw-out bearing that is pre-installed on a collar, you can skip this step and go on to the next.

The inner part of the bearing is pressed onto the collar. You need a vise or two short pieces of 2 x 4 and a socket or pipe 1½in in diameter. Place the wood blocks sideways, upright and parallel to one another. Set the collar down between them so that the bearing rests (collar side) on top of the wooden blocks. The bottom of the collar has to have at least 1in of clearance between it and the table surface. Place the socket or pipe against the center of the collar, not the bearing. The fit has to be right for this work. Put on your safety glasses. Pound on the socket or pipe hard enough to separate the bearing from the collar until the collar drops away from the bearing.

Clean out the grease from the inner bore of the collar and wipe dry. The face of the bearing is slightly rounded and is separate from the center and flat back of the bearing. The proper way to do this is to press or pound the bearing on from the center race. Do this if you have the tools. I have also used the common method written below successfully. Choose one but wear safety glasses. Place the bearing face down on a flat surface on top of a thick rag. The flat back side of the bearing will be facing you. Place the collar on top of the bearing so that it is square and centered with the hole in the bearing. Lay a block of wood on the top of the collar. Use decisive blows to tap the collar into the bearing. The collar is fully installed when the inner race and collar are flush. Take a dollop of grease on your finger and rub it around the deeper, step-cut section inside the collar. Do not put on more than enough to fill the recess including the inner diameter. Wipe any excess off the collar or bearing.

Step 7: Install the Throw-out Lever and Bearing Assembly.

Clean up the throw-out lever, inside and out.

Turn the lever so the hollow side is facing you. Notice the wire spring inside of the lever. Two ends of this spring are curved to fit into slots in the sides of the lever, the other end in a slot near the fork. Make sure that it is in place. Wipe out and put a dab of grease in the indentation on the hollow side of the lever.

See that the rubber dust boot is fitted into the side of the transmission housing. If removed, install it so that most of the boot is outside of the housing (510, and 610 up to 1975—boot goes inward) and the tongue cutout in the center of the boot is facing toward the front of the transmission. Find the horseshoe-shaped special spring you took off the throw-out bearing collar. Slip the spring into the groove in the collar, just under the tabs, positioned so curved ends (curved side touching) are on top of the tabs, not on the bearing side.

Now pick up the lever. Put a dab of grease on each of the shiny forked tips on its smooth side. Line up the throw-out lever with the flat side toward the **back** of the bearing and collar. Slide the forked tips of the lever evenly between the curved spring ends and the rear of the collar tabs.

Aim and slide the small end of the lever into the transmission housing toward the dustboot. At the same time fit the collar over the cover sleeve. Push the lever rearward so the spring in its back side clips over the pivot ball on the cover. When the lever's in place, it will stay put when gently pulled toward you. Move the lever back and forth from outside the housing to assure that it pivots and the collar travels smoothly over the sleeve on the cover. Put a dab of grease in the little indentation on the small outside end of the lever. Voila!

PROCEDURE 12: INSTALL TRANSMISSION

Condition: The flywheel or driveplate is properly tightened, the clutch assembly is aligned and tightened. The throw-out bearing or torque converter seals and cover are in place. If you're installing the transmission attached to the engine, do so as described in Ch. 10, Proc. 11.

NOTE: **Truck People**: If your transmission is hanging (just pulled back from the engine), you can do Step 1, then jump ahead to **All Models** in Step 3.

Tools and Materials: Everything in transmission removal (Proc. 6), exhaust manifold flange gasket (if applicable) and flange stud nuts (if necessary); gear oil 80-90 wt. or Dexron type transmission fluid (Proc. 3[MT] or 4[AT]).

Remarks: I remember lying in the dust under an old Ford truck one hot summer day, struggling, with a friend, to install a very heavy transmission. John Muir sat in the cab controlling the shifter and overseeing the event. Through a hole in the floor I watched John's cigarette, mouth and jowls come alive whenever he cracked jokes and barked orders. Lacking the proper jack and strength, we frequently stopped to complain about our discomfort. At one of these intermissions John growled, "What's wrong with you guys? Why, I used to put in two of these things each day before breakfast, by myself." Challenged by onlookers guffaws and John's credibility we perked up and quickly muscled the beast into place.

•**4WD People:** If you didn't drop the transmission (it's resting on the crossmembers), you don't need to do all this procedure; just read through it all, gleaning what pertains to you.

•**Everyone:** A dab of penetrating oil or anti-seize compound on bolt threads facilitates reassembly.

Step 1: Ensure That the Torque Converter or Throw-out Bearing Assembly is Installed Properly.

•**Automatic People:** The torque converter holds transmission fluid. If it is old or some spilled out of the converter, refill it now. Use Dexron type fluid only. If you want to drain the converter, empty it snout side down into a pan until all the fluid drains out. To refill it, pour fluid into the snout, occasionally tipping the converter up vertical. The fluid level should come level to the edge of the snout. Make sure the input shaft is in the hole. Look at the snout end of the torque converter. There are two flat notches or tabs there that fit into matching notches in the transmission. Put some tranny fluid on the lips of the seal that's in the housing as well as the snout. Work the converter over the transmission input shaft. Turn the converter one way then the other until it meshes (clunks) into place. When properly positioned, the front of the converter bolt hole lugs should be recessed 0.846in (21.5mm) behind the face of the bellhousing. Place a ruler or straight edge across the front mating surface of the transmission and measure to one of the four converter bolt holes. If the distance is too short, try remeshing the converter. NOTE: This measurement is for JATCO transmissions only. Don't force the converter or try to install the transmission if the converter doesn't mesh. Consult an expert if you're stumped.

•**Manual People:** Ensure that the throw-out bearing is in and working (Proc. 11 [7]).

Step 2: Position the Transmission and Prepare the Fastening Parts for Installation.

Hints: When the transmission is in place you will want to work fast to attach it to the engine and frame (body). It's a good idea to keep one or two of the engine/transmission bolts close at hand to install as soon as the two are together. Before rolling or sliding the transmission under the vehicle, put a dab of grease on the tip of the transmission input shaft.

•**Pickup Models:** Place the transmission on the jack once the tail section is over the stationary crossmember.

•**All Manual Transmission Models:** The transmission input shaft has to clear the clutch parts on its way straight into the center of the disc and pilot bearing. Truck people have to get the tail section up over the stationary crossmember, then up and back to line up the input shaft. Car people have it easier.

•**Everyone:** Think Safety! If the pilot bearing inner diameter isn't perfectly round and smooth, the input shaft will get hung up (Proc. 9 [9]).

•**Automatic Transmission People:** Match up the paint marks you made on the driveplate and torque converter as close as you can while the transmission's still out.

Step 3: Raise and Mate the Transmission With the Engine.

Caution: This step should be done with two people and a good jack. Read through it before beginning. As you raise the transmission (manual) into place, watch the relationship between the shifter hole in the floorboards and the shifter control as well as the position of the input shaft and transmission housing to the rear of the engine and the body. Watch that the input shaft doesn't catch on something and offset the transmission.

•**Truck People:** Rig up the rope and handle around the tail section and through the hole in the floor as described in Proc. 8 (12). One person below and one pulling up on the rope will pull the tail section up onto the crossmember between the anchor bolts. Keep the front of the housing on the ground. The fit is tight. When ready, lift the front of the transmission onto the jack. Don't let the tail slip off of the crossmember when moving the transmission. As you raise the front of the transmission carefully, turn the housing counterclockwise to clear the torsion bars. Keep the rope hooked up until the crossmember is replaced.

•**All Models:** Raise the transmission, holding it as level as possible. Make sure it doesn't bind or anything. Keep your eye on where the input shaft is going. When it is high enough to line up with the engine, carefully push the whole works, jack and all, toward the engine while aiming the input shaft toward the bullseye. Once the shaft has been started into the rear of the engine, look at the back of the engine block and the front surface of the transmission housing. These must be parallel. At this time the transmission may be carefully moved from side to side, raised, or lowered. The engine can also be shifted up or down on its jack. When all of the parts are aligned and square to each other, push the transmission in for the final setting. If there is any binding or resistance, look all around the transmission to see where it is hanging up; a wire, a cable or the shift linkage may be in the way. If it is hanging up and has to be reinstalled, reverse the procedure carefully and start over. The housing and rear of the engine have to be parallel all around. If the transmission refuses to go completely flush with the engine (as usual) and there is nothing obviously in the way, try this: Turn the outer edge of the flywheel or driveplate, visible between the transmission and engine or through the starter hole. Use the tip of a medium sized flat screwdriver to pry between the gear teeth. You can turn the flywheel or driveplate just a little to help align the spline teeth. After each turn, try pushing the transmission into the engine. They seldom go together the first time so keep trying and don't loose your cool. You'll feel great relief when the gearbox finally slips into the engine. Don't worry if there is a ¼in gap left; the bolts will pull them together. Insert the two side bolts and washers through the transmission and into the engine, one on each side. Tighten the bolts, a little at a time. This should draw the transmission evenly toward the engine, not all the way yet.

•**Truck People:** Keep the rope hooked up until the crossmember is replaced.

Step 4: Install the Rest of the Transmission Bolts.

Install the two top 14mm bolts and washers. Working from the engine compartment or underbelly, install the top right bolt (with wire clip) and then the top left one (this is the hard-to-find hole) on L-20B and Z-series engines). First finger-tighten, then wrench all four of the bolts evenly until the transmission and engine are together. Lower the jacks if the top bolts are hard to get at. Be patient and get all of the bolts tight. NOTE: If the transmission and engine won't mate, don't force anything. Back off the bolts, then reangle or reposition the transmission (or engine), and try again.

Step 5: Install Driveplate to Torque Converter Bolts.

•**Automatics Only:** You'll probably have to turn the driveplate in either direction to align the paint marks you scribed on the driveplate and torque converter (if visible) and/or closest bolt holes. Turn the driveplate with a stout screwdriver tip wedged between the gear teeth. The best access is from the engine compartment, through the starter motor hole. Or, if you have a 27mm (1-1/16in) wrench and can reach the front crank pulley bolt, turn the engine with that. Lying below, your assistant can tell you when the marks and four bolt holes line up.

Insert the four special bolts (and washers) labeled "torque converter" into their holes by turning the engine and torque converter as described above. The torque for these bolts is 29-36 ft.lbs., or tight without breaking

them. Keep the plate from turning with the screwdriver if necessary. If you have an access hole, replace the rubber plug now.

Step 6: Install Flywheel (or Driveplate) Dust Cover and Bolts or Lower Housing to Rear Plate Bolts.

•**People with Flywheel (or driveplate) Still Exposed:** Find and clean the half-moon shaped cover and the four matching 10mm bolts that hold the cover over the lower edge of the transmission. Position it so the holes align. It fits only one way. Slide the top of the cover behind the rear edge of the engine oil pan. Install and tighten the 10mm bolts.

•**All Other Models:** Install the one or two 12mm bolts with washers through the lower edge of the transmission from the rear, then install and tighten the nuts. (The second flat washer, if one, goes on the bolt side.) **Car People with Gussets:** You have one bolt and nut that fits in the left (driver's side) bottom hole.

Step 7: Install the Transmission/Engine Gussets.

510 (1978 on), 610 Sedan and Hardtop, and All 710 Models Only: Find and clean off the two cast gussets that fit between the engine and transmission. Find the seven 14mm bolts. The longer gusset goes on the right (passenger) side and the smaller on the left (driver's) side. Slip the upper end of each gusset over the steering cross rod. Align the holes and insert the bolts fingertight. When they're both in place, fully tighten the bolts with a socket and ratchet.

Step 8: Install the Transmission Mount.

•**Car and 521 People:** If you removed the mount, read through this step. Otherwise, skip it.

•**Truck Models:** Find the mount and the two 17mm or 19mm mount to transmission bolts. Position the mount with the mark you drew on the front side. Align the holes or slots in the transmission to the holes in the mount. Insert the bolts from above, positioned so their special heads fit against the case, then fit the flat washers, lockwashers and nuts from below. Tighten the nuts with a socket, extension and ratchet or whatever fits. Both nuts tight? Good.

Step 9: Install Transmission Crossmember.

Find the crossmember, the two or four crossmember-to-frame bolts and the two nuts or bolts and washers that connect the crossmember to the mount. The crossmember only fits one way. You marked front with an arrow. Hold it up against the mount and thread on the washers and bolts or nuts finger-tight.

Adjust the height of the jack and transmission so the crossmember fits against and matches the outer bolt holes in the body or frame. Screw all the bolts up into the body (cars) or through the frame from above. These bolts should each have a flat washer and lockwasher. Next install nut from below (trucks) and tighten it well with a 14mm or 17mm socket. Finally tighten the two transmission mount-to-crossmember nuts or bolts.

When the crossmember is fully installed, remove the jack(s) along with the rope (if used).

•**4WD People:** If you disconnected a small shock absorber from a stud on the rear of the transmission mount bracket, remove the nut (and washer) and swing the small shock up and over the stud. Install the (washer and) nut then tighten until snug (12mm).

Step 10: Replace the Driveshaft.

See Proc. 5 (6).

Step 11: Reconnect the Exhaust Pipe to the Manifold.

•**L-16 and L-18 and All Z-series Except 510 1980 on People:** Use a strip of emery cloth and scraper to smooth out the mating surfaces. You have to use a new gasket here and new nuts if you have them. Wire brush the threads of the studs and coat them with anti-seize compound or penetrating oil. Install the gasket and lift and fit the pipe up over the studs. **L-20B and 510 1980:** You have a movable flange to slide up the pipe into place. **Everyone:** Lift and support the rest of the pipe. Start all three of the nuts before tightening. Tighten the nuts even-

ly until the pipe flange is snug and even against the manifold. Do not overtighten.

Make sure the pipe doesn't rub against the body and that it isn't badly rusted and leaking. Find the brackets (if any) that attach the exhaust pipe to the body. There are many possibilites here. Your pipe may be hooked by rubber hangers or attached by bolt(s), washers and nut(s). On 720 trucks there are two brackets held by 12 and 14mm bolts. Replace the rubber washers under the bolts and between the bracket and its mount.

Step 12: Replace Clutch Slave Cylinder.

•**Manual Transmission Models Only:** The two 14 or 17mm slave cylinder bolts and (maybe) washers should be screwed into the right side of the transmission or put in a baggie. Find the cylinder that's hanging nearby and the rod. Make sure the rod is in the boot end of the cylinder with the adjustable or rounded end out. Route the hose on the inside of the torsion bars (trucks only). Put the cylinders flat side against the transmission. NOTE: Be careful not to leave a twist in the flexible line.

Push the rod fully into the cylinder. The exposed end of the rod fits against the indentation of the throw-out lever. Install and tighten the bolts until they are snug and the lockwashers flattened. **Adjustable Rod Models:** Find the return spring and hook one end in the throw-out lever and one in the slave cylinder.

Step 13: Reconnect Wires to the Transmission.

Depending on the year and model of your vehicle, there will be between two and eight wires to connect. Most later models have at least one set of two wires, the back-up lights and, if a 5-speed, a set of overdrive wires. Both sets are on the right side of the transmission. Match the push or pull-apart connector only to the wire on which it fits. Find these connectors and wires, and join them firmly. Automatics have as many as three sets of two wires on the right and one set on the left side.

•**4WD People:** If you disconnected a vent hose at the front right side of the transmission, reconnect it to the vacant pipe on the frame now.

Step 14: Reconnect Automatic Transmission Vacuum Linkage, Fluid Lines, and Dipstick Tube.

•**Automatic Transmission People Only:** Look for a vacuum modulator on the left side of the transmission. You would have removed a small hose from it. There is a steel pipe attached to the hose that goes up to the engine (intake manifold). Reconnect the hose at the transmission and the steel pipe to the brackets between there and the engine. These connections have to be leakproof. Make sure the hose isn't cracked.

The fluid lines connect the transmission to the radiator. You stored them nearby. Take the lines and your wrenches below. The transmission connections are composed of a banjo fitting with a washer on either side of it and a hollow bolt that passes through the fitting and into the transmission. Clean these connections and make them tight, but do not overdo it. See Proc. 1 and 4 for more on checking out the lines. Reconnect the fluid lines and brackets under the transmission then follow them to the bottom of the radiator. Match them up with and slip them onto the radiator pipes before tightening the clamps.

Find the dipstick tube and its O-ring and bolt, which may still be in the transmission. The tube fits into a hole on the right side. The O-ring fits in a cutout in the hole and the 10mm bolt holds it all together. When that's on, insert the dipstick from above.

Step 15: Reconnect the Speedometer Cable.

See Proc. 18 (3).

Step 16: Reconnect the Shifting Lever.

•**Manual Transmission People:** Work from the passenger compartment.

•**All 4-speed Car People, 521, and pre-1974 (10/73) 620 People:** The shift lever fits through the control that is attached to the transmission. Two rubber bushings support the shifter in the control, one on the top and one on the bottom. The bottom one may be with the shifter; reinsert it into the control from the lower side. Remove the nut and round washer from the lever. Leave the tabbed washer on the lever. Push the shifter down through the control. Make sure the lower bushing is in place and nimbly slip on the round washer, then the nut,

from below. When the nut is finger tight, align the tabbed washer with the cutout in the control and tighten the nut until the shifter is secure. Use a 12mm and a 14mm open-end. **620, 720, and 510 (1975 on) Models:** There is a plastic socket on the bottom of the shifter that fits into the transmission control. Put a dab of grease on the socket and install it. Find the pin and E-clip and push the pin through the control from the left side. Line the E-clip up with the groove in the pin and without dropping it, snap it down into place with the screwdriver tip.

Fit the small round dust boot over the shifter and stretch it over the top of the control. If you bent up the floor metal, bend and pound it even with the rest of the hole. Reposition the metal cover plate and line it up to the screwholes. Loosely insert all of the four to eight Phillips screws, then tighten until snug. Go on to Step 17.

•**Automatic Transmission People: 510 (1968-73) and 521 Models:** If you have a floor shift, go on to the next section of this step. Otherwise you have a column shift. Find the downshift cable and attach it to the bracket on the side of the transmission, then fit the cable end into the pivot. Find the swivel piece and spring and fit them between the chassis and transmission. Install and tighten the two washers and bolts. Remove the cotter pins and washers from the shift rods and fit them into the swivel, then replace the washers and pins. Make sure that the shifter works smoothly. **510, 610, 710, 620, and 720 (with floor shift) Models:** The linkage rod is hanging on the left side of the transmission. It attaches to the vertical lever on the transmission. Remove the pin or clip and one washer and plastic bushing from the rod; and fit it into the hole in the top of the lever and then add the bushing. Next slip on the washer and finally the clip or pin over or through the rod.

•**All Models:** Slip the upper boot over the shifter and work the groove in the base of the boot over the edge of the body metal in the floor. If you had to raise the floor mat to reach the boot, replace it now.

Step 17: Reinstall the Console (if removed).

Place the shift lever in first gear and lift the emergency brake handle. **610 and 710 Models:** Read through the following instructions and use what applies to you. **620 Models with Console Box and 720 Without Armrest:** Find the two Phillips screws that mount the console to the floor. Slip the console over the shift lever and onto the bracket. Align the holes in the floor and install the screws. Tighten them with a Phillips screwdriver. **720 Models With Armrest:** The console is held in place by four Phillips screws, one on each side and two at the rear. Install and tighten the four screws until snug. Drop the center armrest into place behind the console (over the bracket). Insert two screws through the front and one through the inside of the armrest compartment. Replace the rubber plug over the screw inside of the box. **510 Models with Console:** Place the console over the shifter and emergency brake lever. Align the holes into the console with the side holes in the bracket. Insert the Phillips screws on either side and one in the center of the console. If part of the console goes over the emergency brake handle there is another screw in the tray at the rear. Tighten the screws until they are snug and replace the rubber plug inside the tray. Replace the rectangular plastic lid that fits onto the center or rear of the console. There is also a screw(s) under that little plastic lid in the center of the console. Replace the lid.

Step 18: Reinstall the Starter Motor and Reconnect the Battery Ground Strap.

See Ch. 7, Proc. 7 (6).

Step 19: Refill Transmission with Oil or Fluid.

See Proc. 3 (Manual) or Proc. 4 (Automatic).

Step 20: Reinstall the Front Differential

4WD People: See Proc. 16 (4).

Step 21: Reinstall Left Front Wheel (if removed) and Lower Vehicle to Ground.

See Ch. 13, Pt. 1, Proc. 1.

Step 22: Bleed and Adjust the Clutch.

Manual: Check, bleed and adjust the clutch if necessary (Proc. 2).

Drive the vehicle, shifting through the gears. Stop and shift into reverse. If it grinds, shifts with difficulty,

engages too soon or slips, recheck your adjustment.

PROCEDURE 13: REMOVE, REBUILD, AND REPLACE THE CLUTCH MASTER CYLINDER

Condition: The clutch pedal feels mushy, you have adjusted the slave cylinder rod and checked the slave cylinder and the master cylinder for fluid leaks. The master cylinder isn't working at all. You have adjusted the master cylinder rod, if all else fails. There is fluid on the floor under the foot pedals; it's coming from the clutch master cylinder.

Tools and Materials: Screwdriver, safety glasses, 10mm and 12mm open-end, brake fluid, bleeder hose and bottle (Ch. 13, Pt. 2).

Remarks: Before beginning this procedure, call around to see if a clutch master cylinder is available at Datsun/Nissan or other agency. Order one if necessary. Cylinders are rebuildable. I do not cover the procedure in this book for safety reasons.

Step 1: Drain Clutch Hydraulic Reservoir.

NOTE: Do not get fluid on your car paint; wear safety glasses to protect your eyes. The clutch master cylinder is attached to the firewall at the far left on the driver's side. Remove the reservoir cap. If there is fluid inside, find the bleeder nipple on the side of the cylinder and, with the box-end 10mm wrench, loosen the nipple one full turn. Hook up the bleeder line and bottle, then pump the clutch pedal furiously until the reservoir is empty. If there is no bleeder nipple on the cylinder, use a rag to soak the fluid from the reservoir.

Step 2: Disconnect Clevis from Clutch Pedal.

Go down on the clutch pedal. Follow the pedal up to the clevis and rod that goes forward through the firewall. There's a pin connecting the clevis to the clutch pedal. Remove the cotter pin or clip that holds the clevis pin in place. The pin can be turned around to make the cotter pin or clip more accessible. Push the pin out of the clevis and pedal arm. Store the pieces together and go back into the engine compartment.

Step 3: Loosen the Steel Fluid Line from the Master Cylinder.

Find the steel line threaded into the master cylinder. The fitting might be hard to remove without a special line wrench. Try to loosen the fitting with a 10mm open-end, turning it counterclockwise. Do not round the edges of the nut. Use penetrating oil. If too tight, try the Vise Grips method found in Ch. 13, Pt. 1 or get the special wrench. It may be easier to work on the fitting when the cylinder is off of the firewall. When the fitting comes loose, thread it fully out of the cylinder until the line is free. Carefully lift and bend the line upward, away from the cylinder, then stop.

Step 4: Remove the Cylinder from the Firewall.

The cylinder is bolted to the firewall by two 12mm nuts and lockwashers. Use a box-end wrench. Place the nuts and washers aside. The cylinder will now pull forward and off the studs.

•Line-Still-Connected-to-the-Cylinder People: Slowly pull the cylinder forward and off of the studs while gently bending the line. Once off the studs the cylinder can be gently lifted up, bending the line with it. Do not bend the line at only one place. Distribute the bend through a section of the line. When the cylinder is in a position to get a wrench on the fitting, have a friend hold the wrench while you gently clamp the Vise Grips over the fitting (Ch. 13, Pt. 1, Proc. 2). When loose, remove the Vise Grips and continue threading out the fitting.

Step 5: Shop for a New Cylinder.

Most well-stocked foreign parts stores carry Datsun/Nissan clutch master cylinders. If you're really in a jam you can buy a used one or have your old one rebuilt by a reputable garage; however, I do not recommend either of these two suggestions.

Step 6: Refit the Master Cylinder to the Firewall.

Install the push rod and/or the clevis if necessary.

Turn the clevis so the forks are parallel with the reservoir. Hold the cylinder with the reservoir upright and install the rod through the firewall. Fit the cylinder onto the studs, then look in the passenger compartment to make sure that the clevis is lined up with the clutch pedal arm. Install and tighten the two lock washers and nuts. Carefully bend the steel brake line down and push it into the threaded hole in the cylinder. Make sure that the fitting is square and the line is fully into the cylinder before turning in the fitting. When in place, tighten the fitting until snug.

Get down near the pedals and lie on your back looking at the clevis connection. Line the clevis up to the hole in the pedal arm and insert the clevis pin from the left side. Find the hole in the pin, then insert the cotter pin or clip.

Step 7: Fill the Reservoir, Bleed the System, and Adjust the Clutch.

See Proc. 2.

PROCEDURE 14: REMOVE, DISASSEMBLE, AND INSTALL CLUTCH SLAVE CYLINDER

Condition: The slave cylinder is leaking; you have read Procedure 1 and know where the slave cylinder is.

Tools and Materials: Basic tool kit, drain pan, newspaper, brake fluid, emery cloth, pipe cleaners, slave cylinder rebuild kit (see Step 4).

Step 1: Chock, Jack, and Block.

You only need to raise the right side of the vehicle high enough so that you can slide under and work comfortably. (Ch. 13, Pt. 1, Proc. 1).

Step 2: Loosen Flexible Hose at Slave Cylinder.

Roll under the right side and find the slave cylinder. Find the end of the hose that connects to the cylinder and wipe off the fitting where the two join. Pick up the 17mm open-end and fit it squarely around the fitting. Just loosen the fitting, counterclockwise, then stop.

Step 3: Remove the Return Spring (if necessary) and Unbolt the Slave Cylinder.

Use the 14 or 17mm socket to remove the two bolts and (maybe) washers that hold the cylinder to the transmission, turning them counterclockwise. Unhook the return spring (if necessary) from the cylinder. Let it hang from the lever. Try to keep the rod with the cylinder. Stash the bolts back in their holes when the cylinder is free. Set a drain pan under the hose to catch drips when the cylinder is removed.

Turn the cylinder off the fitting and hose. There is a copper washer between the fitting and cylinder. Find the washer, remove it, and store it in a container. Turn the cylinder over and allow it to drain.

Step 4: Disassemble and Check the Slave Cylinder.

Unless the cylinder is frozen (rusted), it can probably be rebuilt. If you plan to install a new cylinder, skip ahead to Step 6. Otherwise, you want to rebuild the one you have. Take the cylinder over to the bench. Spread out a sheet of newspaper to work on.

Peel the rubber boot off the edge of the cylinder and separate it and the rod. The piston will be visible inside of the cylinder.

•**510 (1978 on), 610, 710, 620, and 720 Models:** Push against the piston until it compresses and release it fast. With luck, the spring will force the piston out. If it doesn't, wipe off the area around the hose hole, and with the bleed screw closed, blow hard enough into the hole to force the piston, seal, and spring out of the cylinder together.

•**Old 510s, and 521 Models:** Clean around the inner edge of the cylinder and look for a wire retainer clip. If there is one, find the end of it and pry the wire out and up off the groove. If there is no clip visible, try to press on the side of the piston to pull it out of the cylinder. If this doesn't work, the piston is stuck in the cylinder. Frozen pistons are hard to get out.

•**Everyone:** If you just can't get the piston out, take the cylinder to a garage or service station and kindly ask someone to blow the piston out with compressed air.

Wipe out and examine the inside wall of the cylinder for pitting or rust. Some discoloration isn't that bad. The slave cylinder is rebuildable, unless it's pitted, scored, or rusted deeply.

Look on the outside of the cylinder for the name NABCO or TOKICO. The parts person may want to know which one it is.

Step 5: Clean and Rebuild the Slave Cylinder.

Spread the parts out on a piece of newspaper. Clean the grime off of the outside of the cylinder. Pick up a clean cloth rag and a screwdriver. Use the rag around the screwdriver tip to scrape down the bottom of the cylinder without scratching the wall. Rinse it out with clean brake fluid. Next, wrap a 2in piece of emery cloth around your finger. Wet the inside of the cylinder with brake fluid. Sand the cylinder wall by moving your finger in and out while rotating the cylinder. Change positions to cover the entire surface of the cylinder, then rinse with brake fluid and wipe dry. Your sanding pattern should be even throughout.

Remove the bleeder valve with a 10mm open-end. Clean the cylinder holes and the holes in the nipple with a pipe cleaner. Blow through the nipple to ensure that it is clear. Set the cylinder and nipple aside.

Pick up the piston parts. If there is a spring attached to the piston, turn and remove it. Pry under the bottom or closed side of the piston cup and stretch it over and off the piston. Sand the outside of the piston with emery cloth, then clean out the groove where the cup fits. Rinse and wipe the piston clean. Pick out the new piston cup and coat it with brake fluid, then stretch it over the small end of the piston, flat side first, so the cup is facing you. Do not rip the piston cup. Make sure that it is fully seated in the groove, then coat it with brake fluid.

If you removed a spring, clean it carefully and replace it over the cup end of the piston, small end first.

Pour a little brake fluid into the cylinder and slosh it around. Insert the piston assembly and spring (if included) into the cylinder, cup end first. Twist the piston gently to fit the piston cup evenly into the hole. Push the assembly into the cylinder until the edge of the piston is even with the edge of the cylinder. Separate the old dust boot and rod. If the rod is threaded with two nuts on it, yours is classified as adjustable.

•**Adjustable Models:** Loosen the adjustment nuts. Use a 12mm open end on the rounded nut and a 12mm open-end on the rounded nut and a 12mm open-end on the lock nut next to the rounded nut. Once loose, turn the nuts up and down the full length of the thread, using a little penetrating oil to smooth the action. Position the rounded nut halfway down the threaded part of the rod. Do not tighten the lock nut yet.

•**All Models:** Insert the rod, non-threaded or thin, smaller end first through the top of the new dust boot. The hole in the boot will fit around the little groove in the rod. Put a dab of grease on the piston end of the rod and put it into the cylinder. Pry the boot over the outside edge of the cylinder.

Remove the old bleeder valve cover. Slip the new cover onto the second groove. The cap part should curve up and over the end of the valve.

Step 6: Reconnect the Flexible Hydraulic Hose to the Slave Cylinder.

Take the 17mm open-end, 14mm socket, ratchet and some grease under the vehicle. Find the flexible hose and the copper flat washer. Wipe off the end of the hose and fit the washer over the threads. Turn the cylinder onto the threaded fitting until it contacts the washer. Don't tighten it yet.

Step 7: Remount the Cylinder and Tighten Flexible Hose Fitting.

Remove the two 14 or 17mm bolts and (maybe) washers from the transmission. Put a dab of grease on the end of the rod or on the adjustable nut. Position the cylinder against the transmission so the flexible hose curves smoothly, not twisted or crimped.

•**Truck People:** The hose should run between the torsion bar and the transmission.

•**Non-Adjustable Models:** The end of the rod has to be positioned in the rounded-out part of the throw-out lever.

•**Adjustable Rod Models:** The end of the rod goes through the throw-out lever and the rounded part fits against the lever. Turn the nuts halfway down the rod.

•**Everyone:** Match the cylinder with the holes in the transmission. Insert and tighten the bolts with the 14mm or 17mm socket.

Pick up the 17mm open-end and fit it over the hose fitting. Turn the fitting clockwise until snug. Do not overtighten. There shouldn't be any bind in the hose. If you have a return spring, reconnect it between the throw-out lever and cylinder body.

Step 8: Bleed and Adjust the Hydraulic Clutch Assembly.

See Proc. 2. Make sure the piston rod operates the throw-out lever properly, and the transmission shifts as it should.

Step 9: Lower the Vehicle.

See Ch. 13, Pt. 1, Proc. 1.

PROCEDURE 15: 4WD—ITS MAINTENANCE, PROBLEMS AND CURES, UNDERSTANDING THE FRONT AXLES AND CV JOINTS, AND INSPECTING THE LOT

Condition: You are here to learn more about your 4WD and its maintenance. You are having difficulty getting the 4WD to work or you hear noises when it's in operation.

Remarks: This book doesn't go into depth about 4WD repair. It does however outline maintenance and provide tips on how to keep your 4WD alive. Datsun/Nissan builds durable, time-tested 4x4 vehicles. All the 4x4s covered in this book are trucks. Their design has improved through the years, covered, beginning in 1980. The first Datsun 4x4 trucks sold had an L-20B engine and were fraught with problems. Ask Peter, our devoted illustrator—he has one. All models work the same way. The placement of the components and bolt sizes change slightly in different years but not enough to get upset about. All these trucks have the same front independent axle design. This means that the front axles can move up and down separately, making for a smoother ride. The disadvantage of this style, compared to rigid front axles, is that the axles, joints, and bearings are more vulnerable. You can avoid damaging these expensive to repair components by driving sensibly and doing careful maintenance.

Step 1: How does 4WD Work?

This story begins in Proc. 1 of this chapter. The flow of power through the transmission is identical to 2WD but it differs after that. In 4WD vehicles the driveshaft doesn't go directly to the rear differential as in 2WD; it goes to the transfer. The transfer acts like a switch. It has four shift positions: **2H, N, 4L, and 4H.** When in 2H, power goes from the transfer to the rear differential; there should be no power to the front differential. When in N, the truck shouldn't move; the link between the transmission and wheels (2 or 4) is interrupted. When in 4L, all four wheels will turn if the front hubs are engaged (locked), and the power transfer is as low as you can go. When in 4H (and the hubs are locked), you can drive all four wheels at higher speeds. In the latter two transfer positions power is directed to the rear differential and the front differential through driveshafts with U-joints just like the ones described in Proc. 1.

When the power reaches the front differential it is distributed to the front wheels the same way it is to the rear wheels by the rear differential (Ch. 11, Pt. 2, Proc. 1). In fact, the front differential in your 4x4 is identical in design to that used in old 510 and 610 sedans as well as Z-cars, except the gear ratios in your truck's differential are different than in cars.

The front driveaxles—often called halfshafts—work like independent rear suspension axles used on the cars mentioned above, however, instead of two U-joints per axle, there are two Constant Velocity (CV) joints

per axle (four in all). (Technically speaking the outer joints are Birfield Joints and the inner joints are Tripod or spider type joints.) You can easily see the boots covering these joints by looking under the front of your truck.

After power passes through the axles it goes to the front wheels via hefty front wheel bearings mounted inside the wheel bearing housings. There is one more link that's necessary before the wheels can move: The front hubs have to be engaged. The hub lock mechanism is a screw type clutch that is activated by either turning the control at the end of each hub (axle) to **lock**, or it is done automatically (on trucks with automatically operated hubs) when the transfer is shifted into 4L or 4H. NOTE: Don't drive in 2H with the hubs engaged. Read your owner's manual about operating in 2 and 4WD.

Step 2: How to Maintain Your Four Wheel Vehicle's Drivetrain.

There is more to maintain on a 4WD vehicle than on a 2x2. You have two more gearboxes in addition to the transmission and rear differential: the transfer and the front differential. The oil levels and condition should be checked regularly as you would the transmission and rear differential. The oil should be changed every 30,000 miles or sooner if you drive hard and in extremely dirty areas. The front differential oil can last longer if 4WD is seldom used. For more on the transfer and front differential, see Proc. 16 and 17.

The front axles are the most vulnerable element in your drivetrain. There are four rubber boots (two on each axle) that are easily seen by following the axles inward from the wheels, so look for a boot on the end of each axle. These boots will remain supple and last a long time if not ripped by driving over big rocks, cacti, or barbed wire. But if you insist on abusing your truck and destroying what's left of nature, that's your karma. Mother Nature may have the last laugh though.

Axles get bent when smashed into rocks or the like. In fact most mechanical damage is done when the driver is reckless or fails to take care of a problem before it gets worse. Ripped boots are a case in point. When a CV boot starts to tear, grease seeps out and contamination creeps in. Soon the expensive to repair CV joint gives up the ghost and starts moaning like one. You can save plenty of dough by fixing a boot as soon as you see it beginning to rip (seep) (Step 5).

You four wheelers also have different front wheel bearings that aren't as easy to get at and service as those on two-wheel drive rigs. I don't include a procedure on how to work on your 4WD front wheel bearings or hubs. It isn't beyond an amateur's ability to work on these components, but it does require some special tools and lots of words to explain. Consult the Factory Service Manual for your truck.

Step 3: Some General Bits of 4x4 Information.

1980 and 1981 trucks came with lousy front wheel bearing housing seals. (Usually the truck has to be driven through water or mud that's deeper than its axles before they'll leak.) These leaky axle seals let contamination into the housing, which rapidly contaminates and "eats" the wheel bearings. If this is your lot, have your friendly Datsun/Nissan service garage install the correct seals (and bearings). These 1980-81 seals were "recalled," i.e., the dealer would replace the seals and whatever was ruined by the leakage. This so called recall is no longer in effect, so I'm told. Whatever, don't ignore front wheel noise (see Steps 4 and 5.)

Many trucks have driveline vibration and noise problems at slow speeds under load, caused by the transmission to transfer driveshaft or at higher speeds, caused by the tranny to transfer to rear differential shaft. These problems can be remedied by consulting the Nissan "Tech. Bulletin" #TS84-001, available from your Datsun/Nissan dealer. Another driveline vibration can often be cured by positioning hose clamps at strategic points on the culprit driveline(s). Talk to your local 4x4 expert.

I know a man who had to replace his front wheel bearings. While the assemblies were apart, he tapped, drilled, and inserted a grease fitting into each bearing housing. This way he could keep the bearings lubricated. It's a great idea that isn't explored further in this book.

Step 4: Troubleshooting 4WD Problems.

Most 4WD problems are caused by driver abuse. Peter, the illustrator of this book, bought a 4x4 that was used in the Oklahoma oil fields. Fortunately (remarkably) the four wheel drivetrain still works. The transmission, on the other hand, was shot, so we rebuilt it. Its insides looked like those roughnecks forgot to use the clutch

for downshifting.

This procedure should be done along with Proc. 1, keeping in mind that you have all this extra drivetrain to consider. 4WD problems can generally be isolated from the rest of the vehicle because they happen when the transfer is in 4L or 4H. There are exceptions—read on.

NOTE: When you hear ominous noises anywhere in the drivetrain, investigate; simple fixes frequently develop into expensive repairs.

Nothing happens at all when transfer is shifted into gear and the transmission is in gear and the clutch is engaged (up): You have ruled out other drivetrain problems covered in Proc. 1; you have checked the oil condition and level in Proc. 16. Park the truck, stop the engine, and engage the emergency brake. Crawl under the right side of the truck and have someone operate the transfer shifter while you watch it and the shaft it connects to on the right side of the transfer. If the shaft moves with the shifter, you can assume there's something wrong inside the transfer (Proc. 17). We'll also assume that the driveline connecting the transfer to the front differential is all there. If the shifter doesn't move the shaft, make sure the pin and its nut and washer are in place. If loose, tighten the nut and try again (Proc. 17).

The transfer shifter is stuck in gear or won't go into gear: Try rocking the truck forward and back while it's in fourth or fifth gear. Try moving the transfer shifter at the same time. If it works, suspect some wear in the transfer shift mechanism and check its oil level (Proc. 17). It may happen again when you least expect it. If it stays stuck, remove the transfer for repair (Proc. 17).

If the transfer shifter won't shift directly from 2H or 4L (truck stopped), try shifting the lever into 4H and drive it until the 4WD indicator light comes on. Now try shifting into 4L. Still no go? Consult a 4WD specialist.

The transfer jumps out of gear: Check that the shifter has free range and isn't bound against the console, or part of that tree you ran over last weekend isn't jammed under the truck. Make sure the transfer mounts are tight and that nothing's bent (Proc. 17). If all fails, you probably have transfer internal problems and it has to be removed (a transferectomy) (Proc. 17).

Noises: These are difficult to pinpoint. Make sure the oil in all four gear boxes is in good shape and the levels are up. Proc. 3 (MT) and 4 (AT) cover the transmission, Proc. 16 and 17 the transfer and front differential, and Ch. 11, Pt. 2, Proc. 7 the rear differential.

Mechanics often raise and support the vehicle and run the truck in gear while listening for the source of the noise. I don't recommend this unless you really know what you're doing. Other methods are described below.

Transfer noises are often confused with transmission noises. Read Proc. 1 to become familiar with transmission problems, then come back here to work your way through the rest of your drivetrain.

It may help to have an assistant drive the truck while you move around and listen from the cab and bed to isolate the source of the noise. Remember, if the problem occurs only in 4L or 4H, chances are it's in the front wheel drivetrain. Transfer noises can usually be heard in the cab or felt through the shifter. Bearing noise starts as a grumble, then worsens to a sizzling or grating sound. Gear noises change in pitch and can frequently be isolated to the specific gear by determining in which gear the sound is.

Noises in the transfer to front differential driveshaft are often felt (and heard) as vibrations (Step 3). To check the driveshaft further, see Proc. 1 (11).

Front differential noises are similar to rear differential noises. Read through the rest of this step and the next, then read Ch. 11, Pt. 2, Proc. 1, for info about differential behavior and troubleshooting. To remove the front differential, see Proc. 16 of this chapter.

The front axles have CV joints covered by rubber boots. Problems in these axles are usually heard under power load in 4WD, especially when you're turning. Turning noises sound like grinding or skipping sounds and may also be noticed in 2WDrive but not as much. See Step 5 to do some visual checks.

Front wheel bearing noises can usually be heard all the time. You can jack up the truck and spin the wheel and listen to the hub to isolate which side the noise is coming from (more on this in Step 5).

As you perform these steps make careful observations, then armed with this insight, seek a second opinion from a 4WD expert. Remember, most 4WD problems stem from poor maintenance and abuse.

Step 5: Examine the Front Drive Axles, Front Wheel Bearings, and Front Hubs.

The CV joints and axle shafts should be checked with the wheels on then off the ground. For a quick check of the boots, crawl under the front end and find the axles. The rubber boots covering the joints are on both ends of each axle. Look at them closely. If grease or grime has collected on a boot, suspect a tear in the rubber. A ripped boot should be replaced immediately (see note below). If the boot looks cracked (not torn) or dry, you may want to replace it or at least keep an eye on it—see note below. Torn boots let grease out and contamination in. You can save an expensive CV joint by fixing the boot before this happens. Rub your hand around and over the boot. It should be supple without tears or holes in it. There should be bands holding the boot tightly to the axle, one at either end of the boot.

NOTE: There are products on the market to spray or wipe on rubber parts to protect them. Ask your local parts suppliers what they sell. These products are especially useful to keep CV joint boots healthy. Apply as directed.

There are also snap-together boots available for vehicles with CV joints, which allow you to replace a boot without having to remove the axle. I haven't yet found a company that makes these for your truck, however. Let me know if *you* do, If you find a ripped boot, fix it immediately. Don't drive and take the chance of ruining the joint. I don't cover axle repair in this book. If you use "in-place" replacement boots, be sure to inspect the CV joint carefully as described below, looking for damage and wear. When it's clean, repack the bearing with 3.53oz. (100g.) molybdinum disulphide grease, following the boot manufacturer's instructions.

To check out front driveaxles and joints, grab an axle and move it fore and aft, feeling for play. Some is normal, but looseness you can hear is bad. Look closely to determine if the play is in the CV joint, differential, or the hub. Now move the axle side to side (end to end). Again, a little play is all right, a lot means trouble.

Now jack up and support the truck's front end. Repeat the previous axle tests but this time rotate the axles to test for play in different positions. Also look closely at the boots and their seams that are more visible as the shaft turns.

To check the wheel bearings and hubs: Spin the wheels and listen for noises coming from the hub. Bearing noise rounds rough.

Put the transfer in N and the hubs in **Free (Manual Hub People).** Hold the axle so it can't turn and have your assistant spin the wheel. The wheel should turn and the axle should stay still. Now put the hub in **Lock** and spin the wheel. The shaft should turn. Repeat this on the opposite wheel.

If you have trouble in either of these areas, consult an expert or your local Datsun/Nissan service department.

PROCEDURE 16: TO REMOVE AND REPLACE 4WD FRONT DIFFERENTIAL; CHECK, DRAIN, AND REFILL IT WITH OIL

Condition: You are here for maintenance to change the gear oil. You need to drop or move the differential to get out the engine and/or transmission. The differential is being replaced.

Tools and Materials: To remove the differential: A strong friend, a floor jack, or both; the basic tool kit plus 22mm or 7/8in socket and a ratchet to fit it and paint or nail polish. To change gear oil: 2-1/8 pt. (1 liter) 80-90 wt. gear oil, ½in drive ratchet to remove the plugs, a drain pan, and a medium sized funnel, and 3-4ft of garden hose.

Remarks: To remove the differential, start with Step 3.

Step 1: Check, Drain, and Refill Differential Gear Oil.

Remove the skid pan that bolts to the frontmost underside of the truck. There are six 10mm bolts to remove. Hold the pan up as you remove the last two bolts, label these bolts "skid pan."

The differential fill plug is on the front side of the case. It's recessed and fits a ½in drive if cleaned out. Remove the plug clockwise.

Before you stick your greasy finger into the oil, read Proc. 3 (2), the part about checking the oil's level and condition. Everything there pertains to your differential. If you want to change your oil, read through Proc. 3 (2-4); however, note the differential takes less oil than the transmission. After that come back here to replace the square filler plug only until it's snug.

While you're down here, check the vent tube that connects to the top of the case at a pipe. It it's broken off, get a replacement and see that the pipe isn't plugged. Replace the skid pan but don't overtighten its bolts.

Step 2: Check for Leaks.

There are five possible leak points: At each of the two filler plugs mentioned in Step 1 and at these seals, one behind each of the axle flanges and one in front of the input shaft. If the case is dirty, wipe it off and then drive awhile to check for oil accumulation at these points. You can remove the plugs and put gasket sealer on their threads as described in Step 1. I don't tell you how to replace the seals however. You'll have to remove the differential (Step 3) or take the truck elsewhere to have it done. If there's a bad leak, check the vent pipe and hose mentioned in Step 1.

Step 3: Remove the Front Differential.

NOTE: **Automatic Front Hub People:** Drive your truck in 4L or 4H before you work on it.

First, jack up the front of the truck and support it well. Then disconnect the transfer to front differential driveshaft from the flange at the back of the differential. Follow the instructions given in Proc. 5 to mark and match the flanges and remove the bolts, then return here.

Second, disconnect the axles on either side of the case. Put the hubs into **Lock** position. Mark the flanges as you did the driveshaft and remove the six bolts on each flange with a 14mm wrench. Put the box-end on the bolt and turn the wheel clockwise until the wrench binds against the back of the crossmember. Now continue to rotate the wheel until the bolt breaks loose. Repeat this on all the bolts. I thank Lane Hice for this helpful Tech Tip. These bolts are special so bag and label them "driveshaft." Drop the shafts gently down to rest in limbo. Pull off the vent pipe that's connected to a pipe on top of the case.

Third, loosen and remove the front mount bolt. Its head is on the left side in front of the differential. This bolt has a 22mm head and holds the front mount to the front crossmember. Remove the nut and washer from the right side using a socket and a wrench to hold the other end if necessary. When the nut's off, position a jack or support under the case, put your safety glasses on and tap the bolt out of the mount brackets with a punch and hammer.

Fourth, take a look at what you want to do. If you just want to move the differential to get the engine or transmission out, you might only need to remove the four rear differential bracket bolts and move it out of the way. Or maybe you'll only have to take out the two bolts holding the round crossmember to the frame and slide the differential forward or back on the torsion bars. It all depends on what you're trying to do and the shape of your engine's oil pan. You be the judge, but be careful.

To drop the differential: Try removing the four rear bracket bolts first and if you can't get it out, remove the two crossmember bolts.

To remove the four bracket bolts: These bolts come out in sets attached at the heads with saddle straps. You can see them from the bottom. Each bolt has a nut on the top end. Remove the nuts clockwise. Tap the bolts down and out of the differential. Keep the bolts with the nuts labeled "differential rear bracket." Now, if you pry the front of the differential rearward, out of its mount (it must be supported), you'll be able to move it side to side or back and forth. You can even try to lower it by sliding it rearward to clear the front crossmember then down and forward. If it binds, stop and resupport the case then drop the round crossmember as described below.

To drop the two round crossmembers from the frame: Support the differential well. There are two 22mm bolts with nuts on the front end. Remove the nuts and washers then tap the bolts out to the rear. Bag and label the nuts, bolts, and washers "crossmember to frame." The crossmember can now be pried out of the frame brackets. It will rest on the torsion bars but can be slid back and out from under the differential if properly supported. Now you can lower the differential by pulling it back and down.

Step 4: Replace the Front Differential.

Find all the bolts and nuts you removed. Get your hammer and punch ready. Spray the bolts with a little penetrating oil for easier installation. Just how you install the differential depends on what you disconnected. Basically you need to get the tail section up on the round crossmember then lift the main part up and forward over that crossmember and into its front bracket.

If it's securely sitting on the rear crossmember, lift it so the front bracket holes align and tap in the bolt from the left side. Install the washer and nut but don't tighten it. Now put on the four rear bracket bolts. They fit in from the bottom, one saddling the bracket on the front side and one on the rear side of the crossmember. Thread and tighten on the nuts until they're touching the case.

If the crossmember is out of the frame, you'll have to lift it into its brackets with a jack or your strong assistant. Insert the two crossmember to frame bolts in from the rear, then the washers and finally the nuts. Tighten these until the washers flatten and then a little. Now move to the front crossmember nut and tighten it the same way. When they're all happy tighten the bracket nuts.

Do the same to the driveshaft flanges at the rear of the differential. Install the bolts from the rear side; install the washers and nuts. Snug to tighten with a wrench. For more on driveshafts, see Proc. 5.

Match the driveaxles' paint marks to those on the side differential flanges and install the six bolts in each flange. It's really important to tighten these evenly so the flanges are flush with each other. Make them tight but not overly tight. Reconnect the vent tube to its pipe on top of the case.

Drain and/or refill the differential as described in Step 1 if necessary.

Lower the truck (Ch. 13, Pt. 1, Proc. 1).

PROCEDURE 17: TO REMOVE AND REPLACE 4WD TRANSFER; AND CHECK, DRAIN, AND REFILL IT WITH OIL

Condtion: You are here for maintenance to check oil level, drain and refill the gearbox. You need to drop the transfer to remove the transmission or because the transfer has given up the ghost, the truck needs a transferectomy. You want to check for oil leaks.

Tools and Materials: To remove the transfer you need a basic tool kit, a sturdy jack, and an assistant. To change gear oil get a 1½ qt. (1.4 liter) 80-90 wt. gear oil, a ½in drive ratchet or bar to remove the plugs, a drain pan, a medium-sized funnel, and 3-4ft of garden or heater hose.

Remarks: To remove the transfer, jump ahead to Step 3.

Step 1: Check, Drain, and Refill the Transfer Gear Oil.

Crawl under the left side of the truck. Find the transfer. You can't miss it for it has three driveshafts connected to it. On the left side of the transfer case find two plugs with square recessed holes in them.

Pick up the ½in drive ratchet or bar and remove the upper (fill) plug clockwise. Turn to Proc. 3, Step 2—the part about checking the oil's level and condition—and read it. If you want to change the oil, you'll have to remove the rock guard (the plate that's under the transfer). To do this, read the first part of Step 3 then return here. Now jump back to Proc. 3 (3-4), noting that your transfer takes less oil then the transmission. When the transfer is full, replace the fill plug without overtightening it—just until it's snug. Replace the rock guard (if removed) as described in Step 4.

Before calling it quits, take a look at the vent pipe on the top and back of the case. The hose should be in good shape and the pipe not bent.

Step 2: Check for Leaks.

There are three oil seals in the transfer where the shafts stick out. For information on looking for leaks, see Proc. 16 (2). Most of the differential info in Step 2 applies to the transfer. I don't cover transfer seal replacement in this book.

Step 3: Remove the 4WD Transfer.

Jack up the truck at four points so its mid-section is high enough for you to drop the transfer (Ch. 13, Pt. 1, Proc. 1). Come back here for more fun.

Next remove the rock guard, which is that thing under the transfer with four legs holding it to the frame. Use a 17mm socket to remove the bolts, rear two first. Remove the front two then slip the guard forward and down. Label the bolts "rock guard."

Disconnect the driveshafts. There are three of them held together with nuts and bolts; they all may be 14mm or some may be 17mm. Read Proc. 5 for instructions on marking and unbolting the flanges. This is very important. NOTE: These are special bolts. Bag and label them separately, noting from which shaft they came.

Find and disconnect the vent hose as mentioned in Step 1, by gently pulling it off the pipe. Now go for the shifter control that's on the right side of the case. It is possible to lower the transfer without disconnecting the shifter, but it's tricky, so unless you have a good jack and helper do it the official way. There's a pin through the base of the shifter holding it onto the cross shaft. Find the 12mm nut on the other side of the pin and loosen it until it's only on the pin by a few turns. Soak the pin with penetrating oil then tap it downward, tapping on the nut end. When the nut touches, remove it and its washer then drive the pin out all the way with a nail or small punch. Bag and label these pieces "shifter control." Now pry the shifter away from the case. You may have to pull the shifter up through the floor from above along with its boot.

Next remove the speedometer cable on the right rear side (Proc. 18 [2]). Disconnect only the end that connects to the transfer, then come back here.

Disconnect the negative battery clamp (Ch. 7, Proc. 1), then come back and unplug the 4WD switch (two wires) on the right side of the case.

Loosen (don't remove) the six nuts holding the three mount brackets to the side of the case—17mm. Find and remove the 14mm nuts from the three transfer mount bolts. There are two brackets on the right lower side of the case and one on the upper left rear side of the case. Stash and label these nuts "transfer mount." Now position the jack under the center of the case and get your wide-awake helper to steady the gearbox when it's ready to drop. Use your punch to drive the bolts out forward and put them with the nuts. When you're ready for action, pry between the brackets and the frame and the transfer will drop. But wait, if it looks like the exhaust pipe is going to interfere with the transfer's removal you'll have to disconnect one or more of the two brackets connecting it to the frame.

Carefully lower the transfer down and off the jack.

Step 4: Replace the Transfer.

The front of the transfer has two flanges. The bottom side of the transfer is the longer one with a flange on either end. Safely position the transfer on the jack and have your assistant steady it as you raise it into place with the round ends of the brackets fitted to the frame. Install it immediately and tap in the three bolts through the bracket and mounts from the front. If necessary, move the brackets slightly to align the holes. Thread on the nuts (washers first) and tighten until snug. Remove the jack and tighten the six nuts holding the brackets to the case.

Find the two wires that connect the 4WD switch and rejoin them. Now reconnect the speedometer cable (Proc. 18 [3]). If you don't have other major work to do, reconnect the negative battery cable. Identify and prepare the driveshaft nuts, bolts, and washers. The bolts all go in from the shaft side of the flange with the washers on the nut side. Match the flange marks you made and connect them with the bolts. For more on driveshafts and tightening the bolts, see Proc. 5 (6). Reconnect the vent tube on top of the case to its pipe.

Reinstall the shifter on the right side of the case where the cross shaft sticks out. Notice a cutout in the shaft and squirt some penetrating oil over its end. Slide the shifter over the end of the shaft so the pin hole lines up with the cutout in the shaft. Install that pin from the bottom threaded end first. Put on the washer then the nut and tighten it until the pin pulls up into the shifter and shaft, then snug it tight.

Ahh, the rock guard. Grab this Spartan's shield and find its bolts. The legs that have plates on them go toward the front. First slip the back two legs up and on top of the perches made for them and install two bolts, not tight though. Hold up the front of the guard to align and install the last two. Tighten all four. If you had to unbolt the exhaust brackets, reposition them now.

If necessary, refill the transfer with oil as described in Step 1.
Lower the truck (Ch. 13, Pt. 1, Proc. 1).

PROCEDURE 18: TO TEST, REMOVE, AND REPLACE THE SPEEDOMETER CABLE

Condition: You are here to disconnect the cable from the transmission, to test if the cable or drive gear is broken, and to remove and replace the cable and housing.

Tools and Materials: 18mm open-end or adjustable wrench, new speedometer cable if necessary.

Remarks: Speedometer cables come as a unit composed of the cable and housing. They aren't cheap and are only available from Datsun/Nissan. I don't cover drivegear replacement because it seldom fails; it's usually the cable that breaks. If you think the drivegear is broken, consult your local Datsun/Nissan dealer.

Step 1: Test to Determine Why the Speedometer Doesn't Work.

You'll often be warned of impending speedometer cable failure by a whirring noise that sounds like it's coming from the dashboard, especially in cold weather.

To test the cable, disconnect the cable housing nut from the back of the speedometer. On newer vehicles it's hard to get your hand up behind and through the mass of wires and cables under the dash. Identify the cable housing that runs up through the engine compartment and firewall from the left underside of the vehicle. Then follow it into the passenger compartment through the maze to the back (actually front) of the speedometer.

There a nut holds the housing and cable in place. Try turning it counterclockwise to loosen and pull it back away from the speedometer. If it's tight, you'll have to grab and turn it with pliers until it's finger loose.

Find the free cable end inside the housing (nut). If it's broken, it may be stuck in the speedometer. Don't pull the cable out of the housing, but push it as far as possible into the housing. Now take a drive to see if the cable turns. Do this while you or a friend reaches under the dash to touch the exposed cable.

If the cable doesn't turn while you're moving, either the cable or the drivegear is broken. If it is turning and the speedometer doesn't work, it's probably the speedometer that's bad. You may want to reposition the cable and try again (Step 3). I don't cover speedometer removal or repair in this book.

Leave the nut off the speedometer if you plan to test it further and fix the cable.

Step 2: Remove the Speedometer Cable.

First remove the nut from the back of the speedometer as described in Step 1. Then go under the hood to find where the cable housing goes through the firewall. There's a grommet insulating the cable housing from the body. Pry out the grommet and pull the cable end out into the engine compartment. Follow the housing down to where it's clipped to the body and unfasten it.

Jack up the vehicle from the front (4WD don't really need to do this). Get it high enough so you can reach the transmission tail shaft.

Follow the cable housing back along the body, freeing it from captivity by unclipping it wherever necessary. On 2WD vehicles the cable connects to the transmission tail housing, and on 4WD vehicles it connects to the transfer.

To disconnect the speedometer cable from the transmission or transfer: Use an adjustable or 18mm wrench to loosen the nut counterclockwise. You'll see the cable inside the housing once it's pulled away from the transmission or transfer. If the cable is broken, it may stay stuck in the drivegear.

If you're simply disconnecting the cable, account for the rubber washer inside the nut. Don't lose it.

If you're replacing the cable, it should now be free. You have to buy the housing and cable together as a unit. As far as I know, it's only available from Datsun/Nissan.

Step 3: Replace or Reinstall the Speedometer Cable.

Reconnect the cable to the transmission or transfer. A new cable has caps covering its ends. On an old cable

the cable end is already exposed. Remove the cap (if there) on the drive end. Notice the little ear on one side of the exposed cable end. This has to fit into a key way in the drive gear. Turn and slip the cable into the drive gear so it fits, and screw on the nut to secure the housing. If you had to bend back some clips to move the housing, refasten them now as described below.

If you're installing a new cable, route the housing along under the vehicle and over the crossmember(s), refastening it to the body with the flexible clips that held the old one.

Route it up along the front of the firewall on the left side and push it through the hole into the passenger compartment.

Crawl in under the dash and remove the little cap to expose the cable end. Aim and fit the squared cable end into the back of the speedometer. You may have to turn the cable slightly to slip in the cable. Slide the nut over the threaded mount. Hold the housing perpendicular to the hole and thread on the nut until finger-tight. That's it. Now go back under the hood and fit the grommet into the firewall. Use penetrating oil and a small screwdriver to ease the tight fit. Now you'll have no excuses for breaking the speed limit.

Part 2: DIFFERENTIAL/REAR AXLE

This chapter covers the final component in your Datsun/Nissan's drivetrain: the differential/rear axle assembly; also known as the rear end, third member, or final drive.

If you periodically check and change its oil, this interesting assembly of bearings, gears, and shafts could be trouble-free for the life of the vehicle. However, if you neglect its maintenance and/or frequently drive through deep water, don't be surprised if one day the rear end starts to harmonize with that Barry Manilow tape you just bought, sizzle like lard in a hot skillet, or chatter like ice cubes in a food processor.

But don't despair. As unnerving as these symptoms may be, they are within your power to fix (and prevent). Proc. 1 will help you ease into the world of final drive.

PROCEDURE 1: DIAGNOSE DIFFERENTIAL REAR AXLE PROBLEMS

Condition: You hear noises coming from the area of the rear end of the vehicle. Keep in mind that many problems thought to be differential/rear axle malfunctions are related to the clutch, transmission, and/or driveline or wheels and tires. Consequently, this procedure often makes reference to Ch. 11, Pt. 1.

Tools and Materials: An assistant, jack, and jack stands.

Step 1: What Are You Dealing With?

The rear axle or differential assembly is everything in the drivetrain after the driveshaft. This includes bearings, gears, and axle shafts. Because it is located so far from the driver, problems are often difficult to discern. This makes troubleshooting a headache. Before assuming that you have rear end troubles, make sure that your tires are all in order. Snow treads, especially with studs, can sound frightful on certain roads. Out-of-round tires make your rig do the bunny hop.

Inflate the tires to correct pressures and take a quick look around and under the vehicle. Pieces of wire, tree parts, or rocks caught between stationary and moving parts will cause odd noises. Also examine the shock absorbers and exhaust system. Often after an off-the-road trip you'll pick up the most curious debris or dislocate an exhaust hanger. Pull off the hub caps (Ch. 13, Pt. 1, Proc. 1) to check for rocks or loose lug nuts. Leave the hub caps off while troubleshooting.

Step 2: Test Drive the Vehicle "With Your Ears On."

To give you an idea what to look for, let's go on a joy ride to get oriented. But first, check the obvious sources. The hub caps are off and the lug nuts are tight. Tire pressure is normal and the tires are matched and in good condition. (See Ch. 12, Proc. 1 and 2.) Check inside the trunk and remove any baby buggies, beer bottles, or bowling balls. Before starting on the test drive start the engine and raise the engine speed while stationary with the gear shift in Neutral, clutch in and then out. This is to make sure that the noises aren't coming from somewhere else like the exhaust system or engine. While you go through this step, you may also want to perform the clutch, transmission, and driveline checks (Ch. 11, Pt. 1, Proc. 1).

Now go out on the road. The best tests are made when the vehicle is thoroughly warmed up and run on various road surfaces. Tire noises can be pinpointed if the sound varies on different types of pavement. Rattles are best heard on bumpy roads as are clunks, indicating something loose such as an exhaust pipe or shock absorber. Rattles and clunks are best found once the vehicle is jacked up and visually gone over.

Find a good road with room to stop and some straightaways and corners. Stop the vehicle and read the next paragraph. A clunk upon takeoff could be a bad universal joint (Ch. 11, Pt. 1, Proc. 1), something loose elsewhere in the driveline, or excessive play between the pinion and ring gear in the rear end.

•**510 and 610 Sedans 1969-1977:** U-joints in the rear axles when worn will make this noise.

•**Everyone:** Skips and loud clunks can mean chipped gears or a broken axle, which are rare cases. Open the windows and increase speed from takeoff to about 20 mph. Let off the gas and coast slowly. If a sizzling or grating sound is obvious, hit the brakes gradually. If the sound goes or fades away, you may have a bad wheel bearing. Try to determine whether the sound is coming from the front or rear. Worn rear wheel bearings make a horrible, rough sound and should be dealt with right away. When the vehicle is off the ground, you can check the individual wheels for sounds. Accelerate normally up through the gears, taking note at which speed and gear the abnormal noises begin. During acceleration the drivegear (pinion gear) in the differential is thrust slightly rearward against the ring gear. Heavy whirring or grating sounds upon acceleration indicate gear wear, improper mesh, or worn pinion bearings.

Take the speed up to 55 mph or higher. Note the speed at which the noise begins. Station wagons are great for developing hums around 45 mph that decrease around 60 mph. Much of this fault is due to the box shape of the stationwagon plus a poor undercoating that disguises drive train and road noise. Some of those in the know claim that the cut of the pinion and ring gear causes the noise; they can run for years without the noise getting worse, or better. If a pinion bearing(s) is going bad, the grinding howl will increase until you want to jump out the door at 60. If it gets worse, consider getting another opinion and/or replace the assembly.

Slow down until the vehicle is "floating." This is when there is no acceleration on the drive train and no coasting when the engine compression resists the roll of the wheels. Float is in between power loading and coasting when there is little pressure on the pinion and ring gear. If the howl, hum, grate or sizzle occurs during float, suspect pinion bearing wear. When the car or truck is coasting, not floating, the pinion gear moves slightly forward in relation to the ring gear. Noise at this point can also be between these gears.

Take a few corners, or better yet go round in circles in both directions (not at the same time, you dolt). Be sure to eliminate front wheel rubbing sounds from rear end noises. When a differential makes noises on turns, you can suspect, although quite rare, bad side bearings or differential gears. Now slow to about 25 mph on a straightaway. Quickly lift your foot off the accelerator, then put it back. Doing this, you'll create and take up slack in the drivetrain. If a light clunk or slap is heard, there is backlash between splines in the driveshaft, play between the pinion and ring gear, worn driveshaft U-joints, worn spider gears, or a loose nut causing internal play. You can better check out this when the vehicle's jacked up.

Turn onto a straight road and accelerate to around 50 mph. Now let the vehicle coast in Neutral (**Manual Transmission People Only**). If a vibration or growl is heard, suspect a bad rear wheel axle bearing, the most common rear axle bearing to wear out.

If you are still in the dark and want to be more thorough, try this. Tire noise can be eliminated temporarily by raising the pressure in the tires to 50 psi and then driving for a few miles. If the noise diminishes, you may assume the tires to be the problem. Another thing to keep in mind is that if the noises continued throughout the tests consistently, front wheel bearings may be at fault. This is also something that should be checked once the vehicle is raised off the ground.

Drive the vehicle home or to a mechanic who will give you a second opinion. Keep in mind what the symptoms are and when they occur.

NOTE: Be sure to reduce the tire pressure to normal once the test has been completed.

Step 3: Jack, Chock, and Block the Vehicle and Check the Oil Level.

Full instructions are found in Ch. 13, Pt. 1, Proc. 1. To check differential oil, see Proc. 7.

Step 4: Check Out the Rear End With the Vehicle Raised, Wheels Off the Ground.

•**Rigid Rear End People Only** 510 and 610 sedans 1969-77, go to Step 5.

Place the shift lever in Neutral and the emergency brake off. Start with the rear wheels. Spin each wheel by hand while listening for rough or grating sounds that differ from the sound of lightly rubbing brakes. If abnormal sounds are heard, remove the wheel while putting on the emergency brake or brakes to lock the wheel as you loosen and remove the lug nuts. Continue spinning with the wheel removed and the brake off. If the noise is still present, turn to Ch. 5, Proc. 4, and remove the brake drum of whichever wheel you suspect.

With the drum off, the axle flange is exposed. By holding the studs or gripping behind the flange, you can

push, then pull the axle in and out. Next try to move the axle up and down and side to side to feel for play. If there is any play in either of these tests and roughness when the axle is rotated, you can be sure that the wheel bearing in that wheel is damaged (Proc. 1). While you're here, it would be a good idea to run through Ch. 5, Proc. 1, 4, and 8, which include information about leaking rear axle seals.

Step 5: Roll Under the Vehicle for a Look at the Belly.

Take a light and slide under the rear axle. Locate the point at which the driveshaft enters the differential. Notice that the two matched flanges joining the driveshaft and the input shaft of the differential are held together by four bolts and nuts. The input flange (the rear one) is held onto the differential shaft by a nut which is visible once the flanges are separated. There's an oil seal in the housing that can leak. A leak is serious if the loss of oil is more than a pint a year. A bad leak will result in a streak of wet-looking oil on the body above the front of the differential. If the oil loss isn't great and the differential is operating properly, you need not worry.

The front differential seal can be replaced easily. If you found this seal, as well as the axle seals, leaking, a plugged breather may be the problem. To check this, look along the top of the differential housing to find a small cylinder with a cap over the top of it. On 4WD trucks there's a pipe with a hose connected to it. If this cap gets crushed or dirt plugs it up, or the hose gets crimped, pressure can build up in the housing and cause leakage. The best way to remedy this is to unscrew the breather with a pliers, clean it out under the cap with a paper clip and replace it. If in good condition, the 4WD hose shouldn't get clogged.

The next thing you can check is backlash. Have an assistant hold one of the axles to keep it from turning while you grab the driveshaft and twist it one way and then the other. You'll hear the pinion gear teeth meet as the side gear and the spider gears contact the side gears and axles. If you turn the driveshaft more than a ¼in before contact is made, there is probably excessive backlash between the ring and pinion. This backlash will eventually cause further problems, but for now you can live with it, we hope.

•510 and 610 Sedan Models: You have independent rear suspension. These rear ends are famous for their durability. The most common trouble is the rear axle shaft universal joints wearing out. Identify the shafts (tubes) running from the differential to each rear wheel. Inspect the universal joints by twisting each axle shaft one way then the other, watching each joint to see if it is loose. Next push and pull, up and down on the shaft near the U-joint. Ideally, there should be no play in the joints. If there is, examine the rest of the joints to determine what a good joint should feel like. Worn axle joints will make a clunking sound, especially upon takeoff. Also look at the flanges that bolt the shafts to the differential and the wheel to make sure all the bolts and nuts are tight and in place. Proc. 6 covers axle removal and U-joint service. Check for loose mounting bolts. Look at where the differential housing mounts into the suspension member and is held in by four long bolts. They should be tight. A support piece bolts across the rear of the housing. It, too, should be secure.

•510, 610 Wagons and 521, 620, and 720 Models: Locate the points where the leaf springs mount onto the body of the vehicle. At these places, all of the bolts should be in place and tight. It is not uncommon for the U-bolts that connect the leaf springs to the differential housing to become loose. They can be tightened with a 17 or 19mm socket. Tighten the four nuts evenly. Look at the springs to see if any are loose or cracked. Check the entire rear axle housing for cracks or other damage. You can also grab a wheel or backplate, then wiggle the axle end fore and aft to check for housing looseness. If any looseness is found, do not fully tighten the mounting bolts until the vehicle is lowered, full weight on the ground. **510 Sedan and Hatchback 1978 on:** You can check out the rear end assembly much the same way as the wagon people, except that instead of leaf springs you have coil springs and in place of the leaf spring mounts there are upper and lower links. These link ends are mounted in rubber, which can wear out and cause looseness and knocking during acceleration and deceleration. I don't cover their replacement in this book.

Step 6: Replace the Wheels and Lower the Vehicle.

If you have come to no conclusions, go through Ch. 11, Pt. 1, Proc. 1, as well as a quick exhaust system check (Ch. 3, Proc. 12). Lower the vehicle once the wheels and lug nuts have been replaced (Ch. 13, Pt. 1, Proc. 1).

PROCEDURE 2: REMOVE AND REPLACE REAR AXLE, AXLE BEARING, SEAL AND BACKPLATE: 510, 610, 710, 521, 620 AND 720 MODELS (all except 1969-1975 510 and 610 sedans—Independent Rear Suspension)

Condition: You have run through the checkout procedure for brake or rear axle and concluded that the axle must be removed to inspect and service the axle, bearing, differential, or grease seals.

Tools and Materials: Two 8mm x 1.25 bolts to remove brake drum, if tapped, basic tool kit, safety glasses, solvent, wheel bearing grease, 1¼in. pipe cap or punch and hammer, new axle seals, new bearing, maybe new axle too.

Remarks: Innerside means the side opposite the wheel end of the axle. If necessary, this procedure could be done in conjunction with rear brake work.

Step 1: Jack, Chock, and Block the Rear of the Vehicle.
See Ch. 13, Pt. 1, Proc. 1.

Step 2: Remove Rear Brake Drum.
See Ch. 5, Proc. 4 (2).

Step 3: Disconnect the Emergency Brake Linkage and Brake Line.
•**510, 610 and 710:** Refer to Ch. 5, Proc. 8 (6) to disconnect the emergency brake cable and brake line.
•**510 1978 on:** You have a spring to disconnect as well as the cable. The brake line comes out like all the rest (as previously described).
•**Truck People:** See Ch. 5, Proc. 8 (6), to disconnect the brake line only.

Step 4: Remove the Backplate to Axle Housing Nuts or Bolts and Brake Parts.
NOTE: To people who are performing this step from the differential procedure, it isn't necessary to pull the axles completely out of the housing but only 4-6in.

•**510, 610, 710 Models:** Find the flange on the end of the axle. It's square with four lug bolts sticking out of it. There are two holes in the flange that allow access to the nuts behind it that secure the backplate. Turn the axle until one of these nuts is visible through the hole.

Put a 12 or 14mm socket on an extension and loosen the four nuts through the holes, five turns or so. If necessary, hold the nut or bolt head on the inner side of the housing with a box-end wrench. Now put a hand on either side of the axle flange and pull it toward you. If you are lucky, the axle will slide out of the housing as far as it can until restricted by the four nuts and bolts. If the axle doesn't budge, see Step 5. If the axle pulled out, finish loosening the nuts and/or bolts and slowly pull the axle shaft and backplate straight out of the housing and proceed to Step 6. Take care to notice if there are some paper thin metal shims between the housing and the backplate. There is a slit in the shims. Watch that they do not rip or wrinkle and keep them together.

•**521, 620, and 720 Models:** If you intend to pull your axle out completely or remove the whole housing, you'll have to disassemble the brake shoes and disconnect the emergency brake cable from its lever (Ch. 5, Proc. 8 [3 and 4] and part of [11] to get the lever off the rear shoe).

When the lever and cable are free, maneuver the spring that holds the cable onto the lever forward and withdraw its slugged end from the lever.

Now you can tap the cable housing out of the backplate with a punch and hammer.

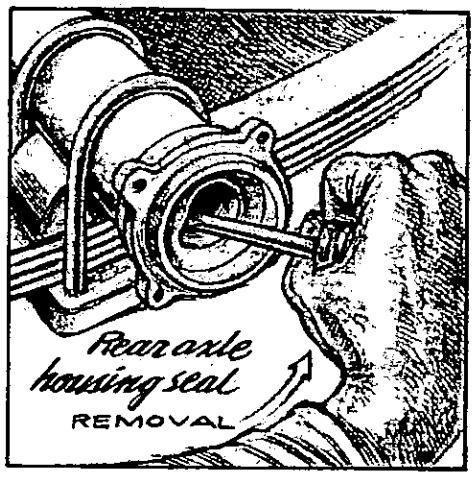
On the inner side of the backplate around the axle housing you'll find four locking nuts. If there is a lot of dirt covering the nuts, scrape it off. Then loosen and remove the nuts with a 17mm box-end wrench, and stash them in the hubcap or parts container. Place a hand on either side of the axle flange and pull the axle toward you, not too far though. Usually, these axles come out easily, but if it's stubborn, go on to Step 5.

As you pull out the axle, notice if there are some paper thin metal shims between the backplate and the axle

housing. These shims are slit on the top side and shouldn't be torn elsewhere or wrinkled. Carefully separate the innermost shim from the housing to keep it together with its mates. There may not be any shims at all. Continue pulling the axle straight out of the housing and set it aside, taking care not to get grease on the brake shoes if still attached.

Step 5: Hammer the Axle out of the Housing.

Wear your safety glasses. If the axle is tight into the housing, the brake shoes have to be removed and the axle flange pounded out. Or, if you have an old wheel rim minus a tire, bolt it to the flange and pound on the rim from the inner side. **510, 610 and 710s** are generally tighter than trucks. When the axle's loose, remove the four nuts (and washers) holding the backplate and flange together. Store them.



Use a medium-sized hammer while still wearing your safety glasses. Position yourself so you have the best, most accurate swing. Without damaging the light gauge steel backplate, pound from the inner or backside of the axle flange. At the same time, you must change the angle at which you hammer the flange, working round, coaxing the axle and bearing out of the housing. Watch the backplate and swing forcefully and accurately. Do not hit the lug bolts on the outside of the flange.

•**Truck People:** Your flange is round and closer to the backplate which means more care should be taken when beating the flange. Your angle will have to be more from the top of the flange than the back or inside of it.

•**Everyone:** The axle will eventually start to move out. Have patience and persevere. If it simply won't, read the note below. When the axle starts to come off, look between the backplate and the housing to see if there are any thin metal shims sticking to the housing side of things. The shims are split on one side. If so, use a thin screwdriver or knife blade to separate the shims from the housing. There are studs in the housing. Keep the shims on that side. Once the axle can be removed by hand, pull it from the housing straight out toward you. Don't let the end of the axle drag coming out of the housing. If you nicked the edge of the backplate with the hammer, carefully straighten it with a pair of pliers and/or screwdriver tip.

NOTE: The proper tool for this job is a slide hammer with a two- or three-jawed or axle flange attachment. The jaws will fit through the holes in the flange (cars) or around or on top of the flange (trucks). Call around to tool rental places and ask them to show you how it's used.

Step 6: Account for the Shims and Axles.

Look carefully at the housing and the backplate where the two parts join. Those thin shims, if present, should be on either part. If they are all stuck on the housing side on studs, great, leave them there. If they are on the backplate, remove them by carefully peeling the bottom shim off with a blade. If on the studs, lift the shims straight up and off without damaging them. Keep the shims from that axle together and out of harm's reach. If the shims are ripped, you can reuse them if the tear points match and they're not too wrinkled.

Keep the axles and shims separate if both are removed. Label them "right" or "left" side.

Step 7: Where to Go from Here.

If the brake parts are off the backplate, and you're replacing the bearing, clean the whole outer end of the axle in solvent before taking it to the machinist for reassembly. If you removed the axle to replace only the seal, proceed to Step 8. If you plan to remove the bearing or backplate, the next step has to be done with an hydraulic

press at a machine shop (cars). Include the Datsun/Nissan bearing and seal number(s) below for your shopping ease. If brake shoes are attached to the backplate, be sure to keep them clean. Do not touch shoes with greasy hands.

•**510, 610, and 710 People:** Any time the bearing is removed, you'll need a new retaining collar. Your Datsun/Nissan dealer has this part (#43255-18000). If the bearing is to be replaced, ask for #43215-H5000. You also need a new seal #43252-H1000 for each side axle removed.

•**521, 620, and 720 People:** You need two seals per axle removed if the bearing is coming off. For the inner seal the number is #38212-73000 and for the outer seal #43232-B5000. The bearing number is #40210-B5000. Datsun/Nissan has the parts you need. You can probably do all the work yourself as described in Proc. 3. Read through the rest of this step so you'll know what to do if you can't.

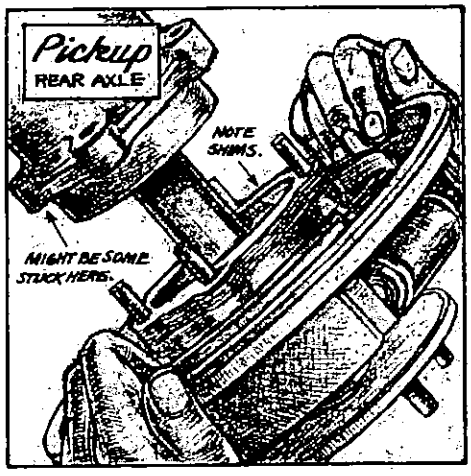
•**Everyone:** Call around to machine shops for estimates.

•**510, 610, and 710 People:** Ask the machine shop if they have a bearing separator that's thin enough to fit your needs.

•**Everyone:** They may need to measure your shaft to get the right bearing if you can't. Give the bearing(s) (if you have them) and axle(s) to the person doing the press work. Have the machinist pack the bearing(s) with the proper grease before assembling.

Step 8: Remove and Replace Axle Housing Grease and Oil Seal.

The axle housing seal is pressed into the end of the axle housing. The seal does two things: it keeps oil in the housing and grease in the bearing. Put a medium screwdriver tip under the seal's inside edge and pry the seal out. When it's out far enough grab and remove the seal with pliers. Examine the inside of the housing where the seal sat. Sand down any rough spots with emery cloth and wipe out the cavity with a rag. Make sure the new seal is the same size and shape as the old one.



You want to install the seal into the housing evenly all around, one of two ways. On all cars a 1¼in outer diameter pipe plug socket, or other similar round non-sharp object (something resembling the old seal) fits perfectly over the outer edge of the seal with the open-end toward seal. Using a flat-tipped punch, first press the seal into the housing with your fingers enough so that it stays. Then carefully, with a punch and hammer, tap around the edge of the seal working it into the housing by placing the punch tip against the flat face of the seal. In either case the seal must go into the housing without being damaged (distorted) in any way. The seal will stop when it's against the inside shoulder in the housing.

Step 9: Replace the Axle.

Find the shims you removed (if any) from between the backplate and housing and carefully wipe off any dirt or oil. If the shims are still on the housing studs, or you have no shims, skip to the next paragraph. If the shims are separate, install them over the axle and four studs: **Truck People**—on the inside face of the backplate; **Car People**—on the axle housing. Place the slits in the shims upward. Look at the brake parts or position of the brake adjuster on the backplate to determine which way is up.

NOTE: If the shims are in pieces, use grease to hold them together.

•**Car People:** The adjuster is on the top.

•**Truck People:** The adjuster is on the bottom.

•**Everyone:** Put a smear of grease on the splined end of the axle shaft. Pick up the backplate and axle and

guide the splined end of the shaft carefully into the housing without the weight of the axle resting on or rubbing the seal as it goes in. When the bearing is nearly into the housing, you have to aim the splined end of the shaft to fit into the side gears which you can't see. Do this by lifting and centering the backplate while working the shaft into the side gears.

•**Car People:** Push the four housing bolts through the backplate. The flat side of the head on these bolts goes toward the axle housing tube.

•**Truck People:** Check that the four bolts are pushed all the way through the backplate.

Turn the backplate to align the holes in the housing or backplate with the bolts. If the other end of the shaft is in the side gears, the axle should go into the housing until it reaches the bearing.

If the bolts had washers with them, the bolts have to be pushed through far enough to fit the washer and the nut. If the bearing does not fit easily into the housing, pound the outer end of the axle with a block of wood and a hammer, keeping the bolts lined up with the holes until the axle slips in. Once flush, insert the nuts and washers or locking nuts (flat end toward the backplate or housing). Tighten them, evenly, working around either through the holes in the axle flange (**cars**—with a socket) or from the inner side of the housing (**trucks**—with a wrench). Tighten the fasteners as tight as you can without standing on the wrench. Spin the axle to see that it turns freely.

Step 10: Reassemble Brake Parts.

If your brake assembly is still connected to the backplate, you need not perform this step; go on to Step 11. If your brakes were disassembled, turn to Ch, 5, Proc. 8 (10-13).

•**Truck People:** If your emergency brake cable was disconnected, you'll have to reinsert it through the hole in the backplate, then slip the spring over the cable end and compress it (with an assistant's help) enough to fit the slugged end into the bent end of the lever. See Ch. 5, Proc. 8 (11-13) for an illustration and how to replace the lever, shoes, and drum.

•**Car People:** Reconnect your emergency brake cable (Ch. 5, Proc. 8 [10]).

Step 11: Reconnect Brake Line and Bleed Rear Brakes.

See Ch. 5, Proc. 9 and Proc. 2 (1-3).

Step 12: Check Differential Fluid Level.

See Proc. 7 in this chapter.

Step 13: Lower Vehicle, Tighten Lug Nuts and Install Hub Caps.

See Ch. 13, Pt. 1, Proc. 1.

PROCEDURE 3: REMOVE REAR AXLE BEARING AND SEALS (521, 620 and 720 Trucks)

Condition: You have read Proc. 1 and believe a rear wheel bearing(s) is bad or a grease seal is leaking.

Tools and Materials: 5in steel punch or brass drift hammer and flat piece of wood—the harder the better (sturdy plywood is good), emery cloth, safety glasses, heavy duty wheel bearing grease, non-hardening sealer, an assistant, outer seal #43232-B5000, inner seal #38212-073000, bearing #40210-B5000.

Remarks: You may not be able to do this procedure yourself and end up taking the axle to a machine shop to have the bearing removed. On the other hand, it's worth a try. Don't contaminate your brake shoes with oil or grease if they're still on the backplate.

Step 1: Remove Axle.

See Proc. 2 (1-6).

Step 2: Remove Bearing Lock Nut.

Wear safety glasses. Clear off a space on the ground or bench. Set the axle with the backplate end down and the splined end sticking up. Follow the axle down to where it disappears into the backplate. Around the base of the axle you'll find a nut with slots in it. Wipe it off and look at the starred washer under the nut. One of the tabs in the washer is bent up into one of the slots in the nut. Use a screwdriver tip to bend the tab out until it's even with the rest of the tabs. The nut can now be loosened.

Have an assistant hold the backplate from turning. Pick up your punch and hammer. Position the punch in one of the slots, angled so you can hammer the nut counterclockwise. Move your punch from slot to slot, pounding and working around the nut until loose. It will then turn off the threaded part of the axle.

Under the nut there are two washers, a starred one and a flat one. Both have center tabs that match a key way in the axle shaft. Pull the nut and washers straight up and off the shaft. Stash them somewhere safe.

Step 3: Remove the Bearing and Inner Race.

This is the part that sometimes requires a puller or press but usually does not. Lay a flat block of wood on the floor. Without greasing the brake shoes, turn the axle so the brake parts are facing upward. Hold the backplate firmly with both hands while you stand above the block of wood. The idea is to force the splined end of the axle shaft down against the block of wood, and free the bearing from the shaft. Keep a grip on the backplate once the bearing lets go. You'll know when because the bearing will slide down the shaft. Keep trying, changing your hold on the backplate and moving round and round. If the bearing won't budge, you'll have to go to a machine shop for help.

If the bearing came off, place it and the backplate on the bench with the axle shaft flange end down. Look at where the shaft gets thicker near the flange. You may need to wipe it off to see a spacer ring that fits around the shaft. If it's on the shaft, leave it where it is. If the spacer isn't on the shaft, it might well be with the backplate. If so, remove it from the center seal in the backplate and put it on the shaft. NOTE: The spacer is tapered on one side. This side fits on the shaft facing the flanged end.

Step 4: Remove the Axle-Bearing Outer Race.

Turn the backplate so the brake parts or outer side of the plate is down. Find the rubber grease seal that's fitted into the center hub of the backplate. Remove it by placing a small punch or screwdriver tip against the seal and tapping around the inside of the seal to force it out of the backplate hub.

Turn the plate over so the brake side faces up. Feel inside of the hub for the outer bearing race, smooth tapered steel band that's press-fitted into the hub. Remove the race with a medium-sized punch and hammer placed in various positions on the race's upper edge (Ch. 12, Proc. 3). Take care not to damage the inner surface of the hub while removing the race. Pound the race out evenly by working around it. Put the seal and the race with the other bearing parts.

Step 5: What Next?

I have sometimes found the hub housing where the bearing race fits to be slightly oversized, causing the race to turn inside it or the new one to fit loosely. If it's spun in the hub heat marks will be visible. And, if the hub isn't ruined, you can make the race fit tightly with a Loctite product called Locweld available from parts stores. This product is also what you'll need if the new race fits loosely in the hub. Ask a machinist for advice.

The part numbers listed at the beginning of this procedure are Datsun/Nissan numbers. They are repeated in Proc. 2 and all but the outer seal are available from other sources. Take the parts and hub with you when you go shopping and save the old bearing race for later.

Step 6: Install the Outer Grease Seal and Recheck the Spacer.

Lay the backplate, brake side up, on the bench. Pick up the new outer seal which is the larger of the two new seals. Lightly coat the outside edge, the one that fits into the hub with sealer. Clean inside the hub near the outer edge. Notice that one side of the seal is open and the other is closed or flat. Place the seal over the hub with the closed side facing you. Keep a hammer and punch close at hand. Start the seal into the hub squarely

with your thumbs pushing hard. When you can push no longer, pick up the hammer and punch and carefully start tapping the punch against the flat side of the seal near the edge, working your way around without damaging the seal. It must go in evenly until it's flush with the edge of the hub. Once the seal's in place, wipe a little grease around and into the lips of the seal. If the outer race has already been installed, jump ahead to Step 8.

Make sure the spacer mentioned in Step 3 is properly positioned on the axle.

Step 7: Replace the Outer Bearing Race.

Lay the backplate brake side down. Wipe out the part of the hub where the bearing race fits. Unwrap the new bearing and separate the outer race from the assembly, taking care not to get the new parts dirty. Notice that the race is tapered on the inner wall. One side is thicker than the other. The thick side fits down into the hub. You can use the old race as a driver. Lay the new race squarely in the hub. Pick up the old race and set it, thin side down, on top of the new one. Place a block of wood on top of the old race and use the hammer to hit the wood block directly in the center and above the races. Use solid blows, checking after the first few to see that the new race is going in properly. Keep pounding the new race into place until it contacts the shoulder in the hub. Check to make sure the new race is fully installed and wipe the area clean.

Step 8: Put the Bearing and Inner Race on the Axle Shaft.

Look at the flange (big) end of the axle to find a 1in-wide, steel collar. This collar slides over the axle with a snug fit. The outer grease seal fits over this so the collar's surface has to be smooth to ensure a good seal. Clean off the surface with a strip of emery cloth, then wipe dry with a rag.

If the collar was off the axle, see that it is installed correctly. The collar has a tapered end which has to face the flanged end of the axle. Make sure the square side of the collar is facing the splined end of the axle. The tapered end will be difficult to see, since you're facing the opposite direction. Use Locweld if the collar fits loosely.

Lay the axle with the outer end down. Pick up the backplate and slip it over the axle, brake side down. Install it straight over the shaft so not to damage the outer seal. The backplate should fit squarely against the big end of the shaft, seal around the collar.

Take a large dollop of wheel bearing grease in the palm of your hand. Pick up the new axle bearing and begin forcing grease into it by pushing the bearing against the grease and your palm. Fill the bearing entirely with grease. Leave not a cranny unfilled (Ch. 12, Proc. 3). Without getting the freshly packed bearing dirty, take a fingerful of grease and fill the area in the backplate just below the outer race. Now wipe the smooth part of the axle off just below where the threads end and pick up the bearing. Slip it (tapered side down) over the axle as far as it will go. Pick up the old bearing and slip it over the axle and onto the top of the new bearing.
Pick up the punch or brass drift and hammer to tap on the inner race of the old bearing. Reposition the punch with each hammer stroke to work the new bearing onto the shaft. Make sure the bearing is making progress. NOTE: There are threads on the shaft above the section where the new bearing will seat. Take care not to damage these in any way.

When the bearing is in place it will be in full contact with the outer race. Remove the old bearing and discard it.

Step 9: Install the Bearing Washers and Nut.

Wear safety glasses. Now find the flat washer, starred washer, and slotted nut. Clean these pieces well and set aside. Find the groove in the axle that fits a tab in each of the washers. Pick up the flat washer and notice that there's a square and a rounded edge to it. Place the washer rounded edge first over and down onto the bearing with the tab lined up with the groove. Now install the starred washer with the stars pointing upward over the shaft, tab aligned with the groove. The slotted nut also has two different sides to it. One side's edge is rounded a little more than the other. This rounded side goes down toward the bearing and washers. Slip the nut over the axle shaft and start threading it on clockwise, making darn sure that it's going on straight.

When the nut is too tight for fingers, place the tip of the punch into the slots in the nut and tap the nut clockwise. When it contacts the washer, keep tapping, moving the punch from slot to slot. Have your assistant

hold the backplate steady as you tighten the nut. Don't let hard blows on the punch crush the corners of the slots too much.

When the nut is tight, it won't move any more and further tapping will destroy the nut. Give it a few final whacks to assure the nut is tight and that one of the stars on the washer lines up with one of the slots in the nut. Try not to line up the previously used tab in the washer. When you're satisfied, pick up a screwdriver to pry and tap the washer tab fully into a matching slot in the nut. Clean any bits of metal or junk from around the bearing assembly. Take another dollop of grease and lightly coat the area between the bearing and the nut and wipe off your hands.

Step 10: Reinstall the Rear Axle.

Once it's all together, turn to Proc. 2 (8) and finish.

PROCEDURE 4: REMOVE THE DIFFERENTIAL ON RIGID REAR AXLE CARS AND TRUCKS (all but I.R.S. Early 510 Sedans and 610 Sedans and 4WD Trucks)

Condition: You have determined that the sound you hear or the problem you're out to fix is in the rear end. Proc. 1 and/or a professional opinion sent you here. You can get the parts you need to finish the job.

Tools and Materials: Basic tool kit, drain pan, safety glasses, an assistant, 1 liter or 2-1/8 pints (cars) or 1.25 liter or 2-5/8 pints (trucks) of 80-90 wt. gear oil, silicon or non-hardening gasket sealer, one new differential housing-to-case gasket.

Remarks: Rear axle problems are usually caused by bad axle bearings (Proc. 2 and 3) or worn bearings or gears in the differential. If the latter is your lot, you need only replace the differential gear assembly. This procedure tells you how to do that without removing the whole "third member," axles, and housing. This method doesn't require a floor jack and takes less strength.

Step 1: Jack, Chock, and Block.

See Ch. 13, Pt. 1, Proc. 1.

Step 2: Drain the Housing of Oil.

See Proc. 7.

Step 3: Loosen Brake Line Junction from Housing.

Look at the rear of the axle housing on the top right or front side and notice where a flexible rubber brake line connects to a junction block, then T's into steel lines that run to each of the rear wheels. The junction block is held to the housing by a 10 or 12mm bolt. Scrape off any dirt and fit a socket over the bolt (**cars**); on **trucks** there is a nut and washer on a stud. Turn the bolt or nut counterclockwise. Don't let the steel brake lines get bent. Carefully lift the junction block off the housing enough to replace the bolt in its hole or nut on its stud for safekeeping.

Follow each of the steel lines to its wheel and find the clips that secure the lines against the housing. Carefully pry and bend the clips down so the lines will clear them when moved. The idea is to make enough room for the steel lines to stretch when you pull the axles and backplates outward. With extremely rusted lines you'll be walking a tightrope above a jeering crowd of alligators for they tend to be corroded and break.

Step 4: Pull the Axles Out of the Differential Gears.

This step is covered in Proc. 2 (2-5), but read this step first. There are two things you must keep in mind. First, you don't have to disconnect the brake line from the backplate. You may only need to disconnect the emergency brake cable equalizer mounting to get enough slack in the cable. Second, do not pull the axles out all the way. You'll know the end of the shaft is out of the differential when the shaft drops inside the housing and

feels as though it is no longer supported on the inner end. All the while, watch the brake lines and, if necessary, carefully bend the left one down where it humps over the center of the housing. When both of the axles are free go on to the next step. If worse comes to worst, you can disconnect those beastly lines at the backplate.

Step 5: Disconnect the Driveshaft from the Differential.

See Ch. 11, Pt. 1, Proc. 5. Check the U-joints for wear while you're at it (Ch. 11, Pt. 1, Proc. 1).

Step 6: Loosen and Remove the Differential Gear Mounting Nuts and Washers.

Wear safety glasses. There are eight 12 or 14mm nuts and washers around the front edge of the differential housing that are probably covered with grime. Use a socket to loosen and remove them counterclockwise. Leave two of the nuts loose on the ends of their studs.

Place a drain pan under the differential to catch what little oil is left in the case. Pick up a large screwdriver and hammer. Position yourself behind the differential and place the tip of the screwdriver at 30—45° angle against the top edge of the differential housing.

The idea is to tap on the hammer enough to start moving the housing away from the case and off the studs. Tap on one side and then the other. Don't damage the housing!

When the housing begins to move and you can fit the screwdriver tip between the surfaces, pry the housing away from the case without pushing it off the studs.

Find the local drunk or your neighbor with all of the good ideas, to help you lower the assembly to the ground. It is heavier than it looks. First, remove the remaining two nuts and washers and stash them with the others. Get a grip on the assembly and slide it forward off the studs. Handle it carefully and watch your fingers, toes, and nose.

Step 7: Where to Go and What to Do.

Your alternatives are to have the differential rebuilt or to install a used one. If howling was the trouble, rebuilding yours may not be a great idea unless you are sure where the trouble lies. A damaged one can be repaired if the broken parts can be removed and good ones installed. A broken housing (and/or case) is best replaced with a used one. Used Datsun/Nissan rear ends are available at many wrecking yards. Check the interchange books at the yard or Datsun/Nissan parts numbers to see if the replacement will match your needs. You may have to buy the whole rear end housing, axles, and all instead of just the differential. In this case, you may be able to keep the old parts for spares. Try to get a differential from a car or truck with low miles on it and/or one with clear (not black) oil in it if possible. Get a written guarantee against noise and defects.

The gasket between the case and housing has to be replaced as well as the gear oil. The gasket is a Datsun/Nissan dealer item. Ask for a differential housing-to-case gasket for your vehicle.

Also get one or two liters of 80-90 wt. gear oil (see Tools and Materials this procedure).

Step 8: Replace the Differential.

The old gasket has to be scraped off the housing and the case. You'll need a knife or similar tool to scrape between the studs and get off all the old gasket. When both the surfaces are gasket free (really clean) and the assembly is ready, find your assistant and roll under the vehicle with a rag, 12 or 14mm socket and ratchet plus gasket and sealer. Wipe out any oil and debris from the bottom of the case. Smear a light coat of sealer over both sides of the gasket, then place it over the studs and against the housing. Hail your assistant and position the gear assembly under the case. The differential fits in with the ring gear, the large gear, on the left or driver's side. There are seams cast into the outside of the housing. The bottom seam is flat and the top seam has an edge. Make sure no chicken feathers or bones are in the gears, then lift the assembly up and onto the studs. Keep the seams straight up and down and the ring gear perpendicular to the axles. Hold the unit in place and thread on the two top nuts after replacing the washers. Install the remaining six washers and nuts finger tip. Pick up the ratchet and tighten all of the nuts, each a little at a time, in a crisscross pattern. Draw the housing against the case evenly and gradually. Tighten the nuts until the lockwashers are flush or until they're all snug. Now turn the input flange in both directions; if it binds, something is wrong. Remove the housing. Otherwise you've done it!

Step 9: Replace the Axle Shafts.

If you pulled the axles out of the housing completely, turn to Proc. 2 (9-11). If you pulled the axles only part way out and the brake lines are still connected to the backplates, pay close attention. Position yourself facing the end of an axle. You have to be careful and steady to manipulate the axle to fit the inside end of the shaft into the side bearing and gears. Poke your head into the wheel well to get an overview of the axle housing and backplate. Watch that you don't bend the brake line (Proc. 2 [9 and 10]). Be sure to reposition the shims carefully and not break the fragile brake line. Repeat this step on both axles.

Step 10: Replace the Brake Line Junction Block.

Find the 10 or 12mm bolt and washer or nut and washer and position the junction in or against the tab retainer, then put on the washer and bolt or nut. Keep the brake lines from bending and tighten the nut or bolt until snug.

Step 11: Reconnect Driveshaft to Differential.

See Ch. 11, Pt. 1, Proc. 5 (8) to reconnect the driveshaft.

Step 12: Fill Differential Case with Gear Oil and Bleed Rear Brakes (if necessary).

Do not drive without oil in the differential (Proc. 7 [3 and 4]). To bleed the rear brakes, see Ch. 5, Proc. 2.

Step 13: Replace the Wheels and Lower the Vehicle.

See Ch. 13, Pt. 1, Proc. 1.

PROCEDURE 5: REMOVE THE DIFFERENTIAL CARRIER ON INDEPENDENT REAR SUSPENSION CARS

Condition: You have determined after going through Proc. 1 that the rear end needs to be repaired or replaced.

Tools and Materials: Basic tool kit, chalk or fingernail polish, safety glasses, penetrating oil, an assistant.

Step 1: Jack, Chock, and Block.

Raise and block the rear of the car after chocking the front wheels. Block the rear end under the suspension carrier where the coil springs sit. Put the transmission in Neutral, emergency brake off.

Step 2: Remove the Axles.

You'll find this in Proc. 6 (2). Although it is possible to do this step by simply disconnecting the shafts at the inner flanges, the inner flange nuts are far easier to reach if the outer flanges are separated first. This is a good time to service the rear axle U-joints if necessary.

Step 3: Separate the Driveshaft from the Differential.

You're probably cursing the flanges by now, but have patience. The worst will soon be over. Follow the differential housing forward to where it connects to the driveshaft. You'll find further details in Ch. 11, Pt. 1, Proc. 5 (4).

Step 4: Remove Four Center Mounting Bolts from Differential Housing.

Just behind the flange that you disconnected from the driveshaft, the differential housing fits through and is supported by a large suspension member the width of the car. Four bolt heads are visible on the bottom side of the member, two to the front and two at the rear. These bolts slide vertically through the member and housing and are held in place by nuts atop the member.

Remove the bolts with a 17mm socket and open-end to keep the nuts above from turning. The bolts are tight and may require a breaker bar to loosen, turning counterclockwise. The front nuts are harder to reach. Keep the nuts, bolts, and washers together labeled "housing member."

Now look closely between the differential housing and the suspension member. There should be a 1/8in shim on which the housing rests at each bolt point. Account for these shims before removing the differential and keep track of them. They'll fall out when the housing comes away from the member.

Step 5: Remove the Rear Mounting Bracket.

On the backside of the differential, bolted to the housing and to the body, find a flat steel bar. This is the mounting bracket. Loosen and remove the two 17mm nuts on the backside of the brace with a socket and ratchet. Then remove the small 6in plate between the nuts and the member. Brace yourself with one foot against the rear cover of the differential and push the differential forward as far as it will go. Don't hurt yourself. Pick up the 17mm socket and remove the nuts holding either end of the mounting to the body. There are two flat washers, large and small, above each nut. **Caution:** Don't let the bracket fall on you once the nuts and washers are removed. Lower it off the studs. There are also washers on top that may or may not fall off the studs. Replace the washers and nuts on the studs for safekeeping. Set the bracket aside.

Step 6: Remove the Differential.

The differential is now free to come out of the suspension member. It isn't too heavy, but it's far easier and safer to remove if two people work on either side. Slide the differential rearward through the member. Start tipping it downward to clear the trunk which is directly above your head. The clearance is slight. Once the unit is out, account for the four shims that will either be still in the member (tunnel) or on the ground below it. Keep the shims with the rest of the nuts and bolts.

Step 7: Where to Get the Replacement Differential or Have Yours Repaired.

I have found an abundance of IRS differentials in the wrecking yards. Call around and tell them you want a third member from a 510 or 610 sedan (early not late 510). And tell them the year. If you choose to have yours rebuilt, get quotes beforehand. The wrecking yard price will probably be better. Look for one out of a vehicle with low mileage on it.

Step 8: Replace the Differential into the Car (independent rear suspension).

NOTE: Before you install the new assembly, check and/or drain the oil and clean the breather cap (Proc. 7 [1-3]).

This is done with two people. Determine which is the top and bottom of the unit. There are numbers and/or letters stamped on the bottom of the housing. Clean out any debris or dirt in the tunnel in the suspension member. Pick up the unit and slide the flange end into the tunnel while maneuvering the housing past the trunk bottom. Lift and slide it as far forward as possible, then stop.

Step 9: Replace the Rear Mounting Bracket.

Remove the nuts and washers from the vertical studs attached to the body. Locate the rubber insulated washers that fit on top of the mounting bracket. Install the washers with the rubber side down; then slip the bracket, bowed side rearward and offset side down, up onto the studs. Place the regular flat washers, large one then small one, under the member and thread on the nuts clockwise, rounded end down. Tighten the nuts enough to support the bracket so the holes drilled into it match the level of the studs in the rear of the housing.

Push the differential rearward while watching the holes in the suspension member and front section of the differential. Work the unit back until the studs at the rear fit through the holes in the mounting bracket.

Find the 6in brace plate and fit it over the two rear studs. Pick out the two 17mm nuts and thread them onto the studs clockwise, rounded ends facing the rear or end of studs, but don't tighten them yet.

Step 10: Install the Long Bolts Through Suspension Member and Differential.

Find the bolts and nuts and locate the four horseshoe shims. Align the holes in the differential with the holes in the suspension housing by moving the latter around. Squirt penetrating oil on the bolt threads. Slip the bolts through the member and differential until the threaded end is accessible on the top of the member. With dex-

terous fingers start the nuts, flat sides down, onto the bolt. After they're all started, pick up the four shims and a hammer. While lifting up on the differential, insert the shims between the bottom of the differential and the suspension member by tapping them in, open end first, around each of the bolts. The rear shims go in points forward with the front shims pointing rearward.

Once the shims are in place, tighten the nuts with a 17mm socket and open-end. Get these tight.

Now the nuts on the mounting bracket can be fully tightened, starting with the two on the rear of the housing, then the two on either end. All tight? Okay.

Step 11: Reconnect the Driveshaft.

You'll find this in Ch. 11, Pt. 1, Proc. 5.

Step 12: Replace the Axle Shafts.

Identify right from left and install the shafts connecting the inside flanges first. Be sure you have the shafts positioned properly (Proc. 6 [4]).

Step 13: Refill Differential with Gear Oil (if necessary)

See Proc. 7 (4).

Step 14: Lower the Car.

See Ch. 13, Pt. 1, Proc. 1.

PROCEDURE 6: REMOVE AND REPLACE AXLE SHAFTS ON INDEPENDENT REAR SUSPENSION DATSUNS AND REPLACE U-JOINT (510 and 610 sedans only)

Condition: You have a knocking or clicking sound in the rear end caused by a worn U-joint. You want to remove the differential assembly.

Tools and Materials: Basic tool kit, fingernail polish, an assistant.

Remarks: If the rubber boot on the shaft is ripped or deteriorated, you may want to replace the whole shaft with one from a wrecking yard.

Step 1: Jack, Chock, and Block the Rear of the Car.

See Ch. 13, Pt. 1, Proc. 1. Once the car is raised, place the gear shifter into Neutral with the emergency brake off.

Step 2: Mark and Disconnect the Outer Axle Flange and Hub Flange.

Focus on the axle that you want to remove. Close to the inside of the rear wheel and behind the coil spring, the outer half shaft of the axle is joined to the hub of the wheel by two mated flanges. Mark across both flanges with fingernail polish to rematch them later. These flanges are held together by four 14mm nuts and bolts with washers. Use two 14mm open-end wrenches or one 14mm and one 9/16in open-end or adjustable wrench. Loosen the nuts counterclockwise. Turn the axle round to reach the other three bolts.

Push the shaft inward and remove the bolts. Keep the bolts, washers, and nuts together labeled "axle nuts." If the flanges stick together, tap on the inside flange while keeping the shaft from crashing into your face. Once apart lift the shaft up and forward to place it on the flat suspension arm slightly behind and to the rear of the coil spring. NOTE: Do not let the sliding (rubber boot covered) halves of the shaft come apart.

Now look at the inside flange and U-joint. Four nuts hold the flanges together. You'll only need one wrench to loosen these nuts. **Caution:** While working on and moving the shaft around, pay attention to the outer end

of the axle which is lying on the suspension arm. It can fall and hurt you. Each time you turn the shaft, hold onto the free end.

Mark the inside flanges with nail polish. Turn and position the shaft at different angles to reach each of the nuts. The shaft will twist as you wrench on the nuts. To prevent this, wedge a hefty screwdriver, through the yokes of the U-joints to keep the shaft from turning as you loosen the nuts counterclockwise. Remove and stash the four nuts and washers. Hold onto the shaft once the nuts are removed. Wiggle or tap the flanges apart. Carefully lower the shaft.

If you remove both the axle shafts, use paint to indicate right and left. People removing the axle shafts to service the differential, repeat this step on the opposite axle.

Step 3: Remove the Faulty Universal Joint.

This procedure is much like that necessary to remove and replace driveline universal joints (Ch. 11, Pt. 1, Proc. 6). The differences are in design and size. As with the driveshaft joints, I don't tell you how to replace them. I suggest you have someone with U-joint experience and a vise do it for you, e.g., a machine shop, mechanic, or farmer. Take the shaft or old joint with you when buying the new part.

NOTE: It may be cheaper to replace the whole shaft with a used one from a wrecking yard.

Step 4: Replace Independent Rear Suspension Axle Shaft(s).

Carry the new shaft under the rear of the car as well as the 14mm wrenches, a medium screwdriver and assistant. While installing the shaft, be careful not to drop it on yourself. Have an assistant hold it steady as you secure either end, starting with the inside. The shaft is placed so the boot point's skinny (tapered) end is toward the wheel and away from the differential.

Slide the flange over the bolts, aligning the match marks, and place the opposite end of the shaft on the suspension arm next to the coil spring. Pick out four lockwashers and nuts and install them—washers first—over the bolts. Turn the nuts clockwise, tightening them in a crisscross pattern to draw the flanges together evenly. To reach all of the nuts, carefully turn the shaft while holding the loose end to avoid dropping it on your head. Get them as tight as you can or until the lockwashers flatten, keeping the shaft from turning with the medium screwdriver placed between the yokes of the U-joint. Now lift the opposite end of the shaft down from its perch and align the axle flange to the flange on the inside of the wheel by turning the rear wheel. The axle will slide in or out to fit between the flanges. Pick out the four bolts, washers, and nuts from the parts container. Slip the bolts through the holes from the inside of the axle flange. Install the lockwashers and nuts and start to tighten the nuts in a crisscross pattern. Keep the bolt head from turning with another wrench. If the opposite axle was removed, repeat the installation step with it.

Step 5: Lower the Car to the Ground.

These instructions are in Ch. 13, Pt. 1, Proc. 1.

PROCEDURE 7: CHECK AND CHANGE DIFFERENTIAL/REAR AXLE OIL, AND/OR FRONT DIFFERENTIAL OIL (4WD trucks)

Condition: You are here for the 30,000 mile maintenance check, or you just want to check the condition and/or level of the oil. You notice an oil leak.

Tools and Materials: ½in drive ratchet or breaker bar (and cheater pipe to fit over the handle if plug is tight). 80/90 wt. gear oil (2 quarts, or more exactly, 1.25 liter rigid rear axles or 1.0 liter IRS and 4WD front differential for a complete change), drain pan (for change), medium sized funnel, and 3ft of ½-5/8in garden or heater hose.

Remarks: Excessive oil loss means there's a leak (Proc. 1). IRS means early 510 and 610 sedan people. 4WD trucks have the same type housing for the **front** differential, but it's mounted in the opposite direction. On all these vehicles, the fill and drain plugs are on the rear (510, 610) or front (4WD) side of the housing.

Step 1: Check the Oil Level and Its Condition.

This can be done without raising the vehicle; however, on cars the differential may be too close to the ground. To jack up the rear end, see Ch. 13, Pt. 1, Proc. 1.

The differential is between the rear wheels. The front differential is between, well, you guess. Look at the center part of the housing to find a plug in the rear side (front side on 4WD front differentials). The square indentation in the plug fits a ½in socket drive. Use a screwdriver to clean out the indentation (on the top plug-IRS and 4WD front differential) and insert the breaker bar or ratchet with a cheater pipe. Turn the plug counterclockwise to remove it, using a cheater bar stuck on the end of the breaker bar or your foot against it, if the plug is stuck. Don't hurt yourself!

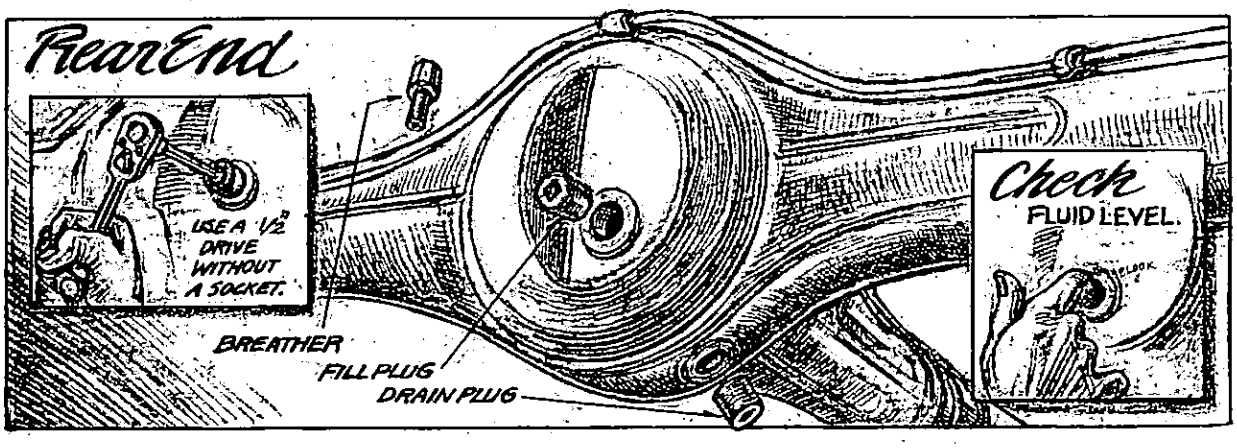
Stick your finger into the hole, then withdraw it to see if there is oil level with the bottom edge of the hole. The housing is full if there is. Stick your finger in farther to coat it with oil and look at it. If the oil is black, you should replace it. If the oil is clear brown and the level is low, you can top it off to the bottom of the hole and suspect a leak. If clear brown and up to level, replace the plug (Step 5). Some oil loss isn't dangerous as long as you keep the level up. But if the level is below your finger's reach, you should drain the housing, replace the oil, and find where the leak is (Proc. 1).

Step 2: Drain the Oil.

NOTE: **4WD People:** You'll have to drop the front skid pan (Ch. 11, Pt. 1, Proc. 16).

On the bottom center (or rear [510, 610 IRS] or front [4WD]) of the housing, you'll find another square indented plug. Clean out the square and use the ½in square socket drive to loosen the plug clockwise. Put a drain pan under the hole before removing the plug.

Let the oil drain completely out of the housing. Look at the opposite side of the drain plug. It should have a magnet screwed into it to attract iron particles that wear or chip off the differential gears. A few particles on it are normal but lots of chips mean trouble. Wipe off the plug and replace it into the threaded hole and tighten clockwise until it's snug.



Step 3: Clean Out the Breather Cap.

NOTE: **4WD Trucks** have a breather hose instead of a cap, so cleaning shouldn't be necessary.

Oil leaks are often caused by a clogged breather. On the top left side of the rear end housing, find a round cap threaded into a short pipe. Use pliers to unscrew the cap from the pipe. The underside of the cap is made to vent so pressure won't build up inside the housing.

Clean out the cap, then run a piece of stiff wire down the pipe to make sure it's clear. Replace the cap, turning clockwise until snug.

Step 4: Fill or Top Off the Rear End with Gear Oil.

Slip your funnel tightly into the garden or heater hose (both should be clean). Stand on the right rear side

of the vehicle and push the hose over the rear wheel, under the wheel well, and down to the filler hole. **4WD People** (front differential) come in from the front of your rigs. Go under the vehicle and insert the hose into the filler hole so that it stays put. Go back to the funnel and open the container of gear oil.

The oil is thick, so it will flow slowly, especially in cold weather. Avoid overfilling the housing by adding small amounts at a time.

Make sure the hose has fully drained before withdrawing it from the hole to avoid spilling this vile, viscous oil all over you and the floor.

Check the oil level by placing a clean, dry finger into the filler hole, keeping your finger level with the edge of the hole. The oil should come up to the edge when the housing is full.

Step 5: Replace the Filler Plug.

Once full, replace the filler plug and tighten it until snug with the ½in socket drive. Lower the vehicle if jacked and supported (Ch. 13, Pt. 1, Proc. 1). Record the mileage when you change the oil.

Discard the used oil at a recycling center or service station as you would engine oil.

PROCEDURE 8: REMOVE AND REPLACE DIFFERENTIAL/REAR AXLE HOUSING

Condition: You 4WD are here to remove the rear end as a whole assembly because unlike earlier trucks and 2WD, your differential can't be "unloaded" easily with the housing still in the truck.

Tools and Materials: A rolling floor jack (rentable), jackstands, basic tool kit, fingernail polish, 2 quarts 80-90 wt. gear oil, brake fluid, an assistant, and a replacement rear end.

Remarks: The 4WD housing differential/rear axle is mounted under the rear springs, while the 2WD housing is above the springs. The 4WD rear end is easier to remove and replace.

Step 1: Loosen the Rear Wheel Lug Nuts, Jack the Truck, and Remove the Wheels.

These instructions are in Ch. 13, Pt. 1, Proc. 1. Raise the rear of the truck and position the jack stands under the frame, not under the differential/axle housing. Get the wheels off the ground so the housing can hang. Remove the rear wheels.

Step 2: Remove the Lower Shock Absorber Mount

See Ch. 12, Proc. 6. Disconnect the lower shock mounting and push (collapse) the shock up out of the way. Keep the nuts and washers in a safe place labeled "lower shock."

Step 3: Disconnect the Breather Hose and Brake Lines.

Look at the housing from the right rear to find a vertical hose held on by a Phillips head clamp. Loosen the clamp and work the hose up off its tube.

To the left and down below the hose, find the brake junction block. Two steel brake lines connect to it. Soak the nuts holding these lines with penetrating oil and let them sit for a while. Use a 10mm open-end and try to loosen the nuts counterclockwise. Stop if you can't loosen them with your wrench and turn to Ch. 13, Pt. 1, Proc. 2, to get tips on how to use other tools for this job.

When the nuts are loose, carefully pull the lines away from the block. Now use a 12mm socket to loosen then remove the bolt holding the junction block to the housing. The block will hang on a flexible brake line that you should inspect and replace if deteriorated.

Step 4. Disconnect the Emergency Brake Cables.

You'll have to pull the brake drum and partially disassemble the rear brakes to disconnect the brake cable from the rear shoe (Proc. 2 [4]).

If you have problems with sticking emergency brake cables, consider getting the replacement cables along with the rear end from a wrecking yard or wherever. In this event, you can disconnect the cables at the balance lever, where the cable from the handle becomes two cables, one for each wheel.

Everyone: If you get a rear end complete with brake drums and brakes, you'll have to decide which assembly has better brake parts and use those (Ch. 5, Proc. 4 and 8).

Step 5. Place Jack, Remove Nuts from U-bolts, and Drop the Rear End.

Position your jack under the center, round part of the differential housing so it's just touching.

Find where the axle housing sits under the springs and the U-bolts are held by a plate and four nuts under each axle. Squirt the nuts with penetrating oil and wait. Use a 19mm socket and some muscle to remove all eight nuts and washers. Label these "spring mounts." Let the plates drop, which leaves the U-bolts hanging off the springs. Use paint to identify the left and right plates and add an arrow pointing forward. Store these parts in a safe place.

Now carefully lower the jack and rear end, then pull the assembly away from the truck. Have your assistant help you lift and carry the housing. If the wrecking yard doesn't want you to turn it in for the new (used) one, keep the old rear end for parts or a paperweight.

Step 6: Install the New Rear End.

NOTE: It's easier to do your brake work once the rear end is in the vehicle. Have your assistant help you install the housing.

Reposition the rear end on the jack so it's centered and balanced. Maneuver the housing perpendicular to the springs below the U-bolts. Raise the jack to align the top of the housing with bottom of the springs so it fits between the U-bolts.

Squirt some penetrating oil on the U-bolt threads and fit the base plate in its proper position (left or right) with the arrow pointing forward. Install a lockwasher and nut on each bolt end:

Tighten the nuts evenly so the plate fits up squarely against the housing and the bolt threads are equally exposed. Get the nuts tight with a 19mm socket so the lockwashers flatten. Do the same on the opposite side.

Step 7: Replace the Bottom Shock Absorber Mounting.

You'll find details on this in Ch. 12, Proc. 6.

Step 8: Reconnect the Breather Hose and Brake Lines.

Find the hose hanging off the truck bed and reconnect it to the pipe on the top right section of the housing. (Replace the hose if it's deteriorated.) Retighten the hose clamp.

The brake line junction block ought to be hanging nearby. Replace it on the bracket at the back side of the housing. Insert and tighten the 12mm headed bolt you removed from it.

With the block in place, carefully install the brake lines (if they're clean) in the side holes. Start tightening the flare nuts with a 10mm open-end only when you're sure they are not cross-threaded. Tighten until snug.

Step 9: Perform Necessary Brake Work, Reconnect Emergency Brake Cables, Replace Wheels, Adjust Brakes, and Bleed.

If you're swapping brake parts, now's the time to do it. At the same time, reconnect the emergency brake cables to their rear brake shoe levers if disconnected (Proc. 2 [10]).

If your emergency brake cables are already intact, reconnect them to the balance lever under the center of the truck (Ch. 5, Proc. 10).

When the brake drums are on, replace the wheels and lug nuts. Turn to Ch. 5, Proc. 2, to adjust, then bleed the rear brakes.

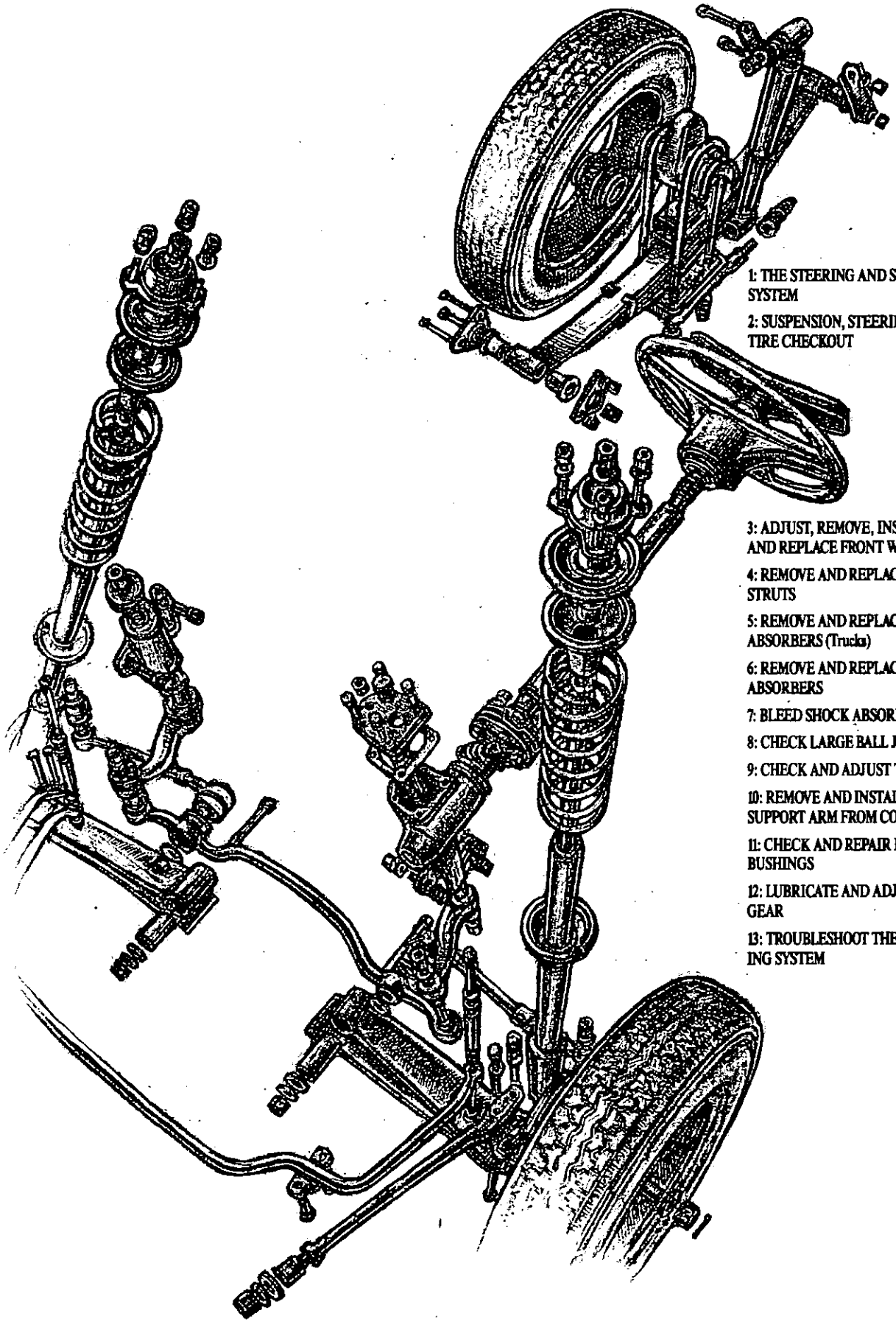
Step 10: Replace the Differential Gear Oil.

See Proc. 7.

Step 11: Lower the Truck and Tighten the Lug Nuts.

See Ch. 13, Pt. 1, Proc. 1, for this thrilling conclusion.

Steering and Suspension



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CHAPTER 12
STEERING AND SUSPENSION

Steering and suspension are lumped together because they share many of the same components in the front of your car or truck. In the rear, thank goodness, there is only suspension to consider. Either system, front or rear, if damaged or worn, can affect how your vehicle handles, sounds, rides and its tire wear. Proc. 1 and 2 are written to help you identify, understand, and diagnose such ailments.

They will guide you through these systems and lead you to other procedures that will help you fix many common problems and advise you on what to do about repairs requiring special tools and expertise. This is the realm of the front end specialist who uses special equipment to measure and adjust wheel alignment. But before you go running to the nearest wheelwright to get a miracle fix, take some time to check thoroughly the steering and suspension and eliminate worn or damaged parts that could be the source of the problem or make an alignment unnecessary or impossible. At least you'll understand the difference between a torsion bar and a baseball bat.

Something the front end specialist might not know and probably couldn't care less about is that the word "steering" comes from the Old Norse word "styra" or "stjorn," meaning a rudder. So keep your hands on the tiller and eyes on the road.

The term "suspension" is used because the car's body is suspended over the chassis and wheels by a series of springs and other devices. More accurately, as you will see, it is a system that cushions or absorbs road shock. You hope.

PROCEDURE 1: A TOUR OF THE STEERING AND SUSPENSION

Condition: You're curious or there's a problem and you suspect it's related to the steering and/or suspension.

Tools and Materials: A jack, jackstands, a light, and a sober assistant.

Remarks: Steering and suspension problems are most often noticed by uneven tire wear, or during cornering, driving at high speeds, or while traveling over rough roads. You can do many checks and repairs yourself but not alignment and some suspension work. These repairs should be left to a shop with the proper tools and know how. There are many terms for the steering parts used. I'll try to familiarize you with them all.

Above all don't ignore problems that make your vehicle unsafe to drive. Maintenance of the tires, wheel bearings, shock absorbers, and lubrication points, as well as driving cautiously on rough roads, will lengthen the life of your steering and suspension.

Step 1: Steering.

When you turn the steering wheel, you turn a rod that rotates a gear inside of the **steering box**. The easy way to understand front end action beyond the steering wheel is to watch it work. Follow the description and the illustrations.

•**510, 610, and 710 Models:** Jack up the front of the car (Ch. 13, Pt. 1, Proc. 1). The steering gear is tucked behind and under the engine which makes it hard to see. Therefore, it's best seen with the car up and you lying down. Lie on your back with a good light and look behind and under the **engine oil pan**, directly between the front wheels.

•**521, 620, and 720 Models:** Your steering system operates in front and below the engine, allowing you to eyeball its operation by simply lying on your side, head just under the front bumper.

•**Everyone:** You will need an assistant to turn the steering wheel if you want the full effect of the tour. On the driver's side, straight down the steering column from the steering wheel, there is a **steering box**. On 720 (trucks) with power steering, the box does more and has two pipes connected to it (Proc. 13). The rotation of the steering wheel and rod (inside the column) is transferred via gears in the steering box to a shaft. Connected at right angles to this shaft, sticking out of the steering box, is the **steering gear (Pitman) arm**. At the opposite end of the steering arm is a **small ball joint** (or **tie rod end**), which allows the two joined parts to move freely, much like your hip and leg move. Near the first small ball joint you'll see another one. At this juncture the steering action splits to control the two front wheels via a pair of rods.

The rod going across to the passenger side is called the **cross or tie rod**. It connects to the **idler arm** and the steering arm. One end of the idler arm swivels in the **idler arm bushing**, which is bolted to the frame of the vehicle. The idler arm and the steering arm connect to the right and left front wheels through small ball joints (or tie rod ends) and side rods (or drag links). Small ball joints on the outside end of each side rod connect the steering system to the steering levers that turn the wheels.

The points that wear are the **steering gears, large and small ball joints,** and the **idler arm bushings**. You'll find plugs or grease (zerk) **fittings** on the ball joints and maybe the idler arm housing. The plugs can be permanently replaced by greaseable zerk fittings, but come from the factory plugged. The dealer will usually install grease fittings during the first lube service.

The steering gears inside the steering box are filled with 80W-90 wt. gear lubricant. (On **Power Steering Trucks** this arrangment is different [Proc. 13].) These gears seldom wear out so I don't cover steering box replacement in this book. But the seals in the box can leak enough to merit refilling the box occasionally with oil. If proper lubrication and adjustment are carried out on schedule, the steering system should last the lifetime of the vehicle.

The idler arm bushings and king pins tend to wear out on trucks under rough service. The cross rod and side rods in the trucks are kind of naked and therefore more likely to be damaged or bent than in cars. It's better to replace these rods than try to straighten them. On late 620s and all 720s there's a problem with excessive play in the tie rod end and idler arm bushings. Keep reading.

•**1983½ on 4WD**: Many of you have a steering damper that connects the cross rod to the right side of the frame. It's there to absorb road shock. If the damper's worn out, the front might shimmy after driving over railroad tracks; if the front end vibrates at high speeds (and the wheels are balanced) or if the damper gets bent or leaks excessively, the damper should be replaced.

I don't cover this any further in this book. It's not difficult to replace the damper. When you have it off and stroke it, it should respond like a shock absorber as described in Proc. 7. The Nissan part is #48611-50W00.

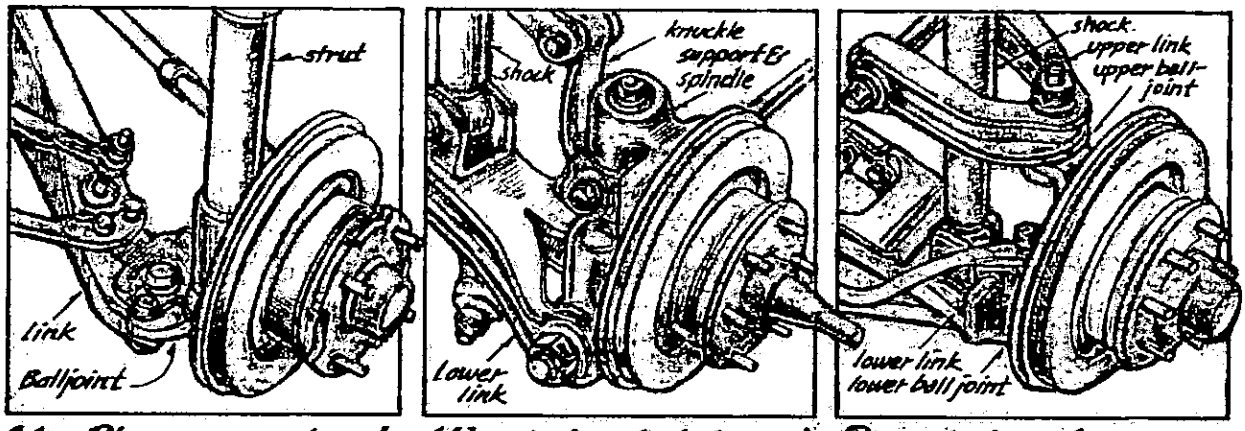
•**Everyone:** Now turn your attention to the insides of the wheels where the side rods connect to the **steering knuckle**. On cars this is to the rear of center on the wheel and on trucks it is forward of center.

Step 2: Suspension.

•**All 510, 610, and 710 Models:** These cars are equipped with MacPherson strut suspension (it's a bit like a Highland Fling that seldom touches the ground).

The **steering knuckle** bolts to the base of the strut, which is the tube you see on the inside of the wheel running vertically up into the wheel well. Below the strut base and the steering knuckle is the **control arm** and its large ball joint. The top of this ball joint is hidden, however, the bottom is visible at the outer end of the control arm. The ball joint allows the steering lever, strut, and wheel to turn side-to-side as well as move up and down over the bumps. The suspension of the right wheel is completely independent of that for the left.

You'll be able to see all this in action once the car is back on the ground. Have a friend bounce the front of the vehicle as you watch the ball joint. The ball joint is attached to the control arm as well as the steering knuckle. Only the ball joint shaft and the steering lever move when you turn; the control arm and ball joint base stay put. When the wheel moves up and down, the angle between the control arm and the strut changes and the ball moves within its joint, or socket. The opposite end of the control arm pivots on a "pin" attached to the



MacPherson strut • Kingpin (pickups) • Ball joint (pickups)

crossmember. A bushing is mounted in rubber and pressed into the arm to dampen road vibrations.

You'll see two steel bars connected to the control arm. The rod closest to the wheel is the **tension rod**, which attaches at the other end to the frame and is also mounted in rubber bushings. This rod keeps the control arm supported during braking and forward road impacts. The other round steel rod, the **stabilizer bar**, connects and keeps the control arms stable while turning. The rods and bar are occasionally damaged or the bushings wear out, causing undue strain on the control arm and therefore poor handling.

Go back to the base of the strut and follow the tube up to where the **coil spring** is mounted. A **shock absorber** is fitted within the spring and strut tube. The coil spring, shock absorber, strut, axle, and brake assembly can be removed from the vehicle as one unit. The top of the unit is bolted to the fender well (under the hood) and a bearing within it permits the entire strut assembly to turn with the wheels. Have a friend turn the steering wheel around as you watch the system and all of its components do their thing.

•520, 521, 620, (up to 1978) Models: Follow the steering lever rearward to where it bolts beneath the center of the wheel. Have someone turn the steering wheel as you watch the steering knuckle. You'll see that the wheel and the lever rotate on a **support piece**. The piece connected to the knuckle is the spindle (**axle**). The **king pin** connects the spindle and the support. As the spindle and knuckle turn from side to side, bushings in the spindle turn on the king pin. The king pins should have two grease fittings each.

•620 and 720 Models (1978 on): Follow the steering knuckle rearward to where it bolts to the inside of the wheels. It is actually bolted to the spindle on which the wheel turns. The knuckle/spindle is connected to the control arms by large ball joints. Follow the lever/spindle assembly inward to where it meets the control arms, one on top and one below. The ball joints fit between the control arms and the assembly and allow the wheel and knuckle/spindle assembly to turn from side to side, as well as up and down over bumps. The ball joints can be greased once fittings are inserted.

•All Trucks: The control arms link the **outer steering components** to the frame of the truck. On 2WD trucks **tension rods** connect to the front and bottom of the control arms one on either side. The front of this rod is rubber mounted and held stationary to the frame by a nut. This rod supports the control arm during braking and road shock. On 4WD vehicles there's a short **compression rod** connecting the back of each control arm to the frame. The frame end of this bar is insulated from the frame with rubber bushings. Another bar connects the control arms and is held to each one by a link. This is called the **stabilizer bar** because it helps maintain stability during cornering. The rods and bar should be uniform on both sides.

Midway along the lower control arm, between the wheel and the frame, a **shock absorber** is mounted. The top of the shock bolts to the frame. This is one of the components in the front suspension. The other component is the **torsion bar**. If you follow the lower control arm inward to where it connects to the frame, you'll see a nut and the end of a rod (the torsion bar) on the front side of the arm. Follow this torsion bar back through the control arm and back a few feet to a crossmember, part of the truck's frame. There is a torsion bar on either side of the vehicle. The bar acts as a spring; it twists. The front end of the bar moves with the control arm. The back

end is anchored to the frame. The torsion or twist in the bar forces the control arm back down after a bump or change in its regular posture. The front wheels are, therefore, independently suspended. These bars can and should be adjusted or at least checked before doing front end alignment (Proc. 9).

Truck steering systems wear in the king pins or large ball joints, the small ball joints, the idler arm bushings, and the control arm pivot points. In the suspension system, the shock absorbers get old and leak or rust out and the torsion bars sometime require adjustment, especially before alignment.

•**4WD People:** The front drive axles also affect your steering, for more on that read Ch. 11, Pt. 1, Proc. 15.

PROCEDURE 2: SUSPENSION, STEERING, WHEEL, AND TIRE CHECKOUT AND DIAGNOSIS

Condition: Your vehicle feels rough and ragged over the bumps, has been noisy in the front end, hard to steer, and it tends to wander around the road. The wheels wobble at certain speeds and/or the front tires wear out unevenly.

Tools and Materials: Jack, chocks, and blocks and an assistant. A droplight or flashlight. A smooth flat road, some corners, a rough road or railroad tracks.

Remarks: Before getting into this procedure, read this chapter's introductory comments. The most common and easiest handling problems to fix are those involving the front tires, especially in cars. Low quality cross-ply (non-radial) tires and/or mismatched or imbalanced tires make the Datsun/Nissan wobble or handle like a shopping cart. Inflate the tires to recommended pressures, check them when cold. You haven't driven on them for four hours. Have the front ones, if not all, spin balanced if they're worth it or buy radials if your pocketbook permits.

Before performing this step, inflate the tires to specification (28-34 psi) and park the vehicle on perfectly level pavement. No excess weight, i.e., truck bed is empty if possible. I refer to the tire and wheel as **the wheel**.

NOTE: The only sure fire way to troubleshoot shock absorbers is to remove each one and test it as described in Proc. 6.

Step 1: Check the Tire Condition.

Start with the front tires. The wear of the tread should be even all around the tire. If there are patches of wear, or chunks of tread missing, the tires should be replaced. If the center of the tread is worn more than the sides, the tire has been over-inflated. If the sides are worn more than the center, hard cornering or under-inflation is indicated. If one side of the tread is worn more than the other you have an alignment problem which only an equipped shop can correct. If there are bars worn across the tread, the tire is worn out.

On the side walls of every tire there should be some lettering molded into the tire. There are three basic types of tires available: bias ply, belted, and radial. For a car or truck to perform properly, tires of like tread design, amount of wear, and construction should be installed at least in sets of two for the front and rear. A customer of mine wondered why her 510 was so sloppy on the corners. I looked and found a snow tread on one front wheel and a bald tire on the other. Two good reasons. Radials are a different matter completely. One radial and three bias, or belted tires, or different sized tires can make driving a nightmare. Check the lettering on the side walls to compare the types and sizes, e.g., 165-13 or 185-14, as well as the tread condition and wear pattern. If you can afford it and the condition of your vehicle merits new tires, your handling problem may be as simple as that. But if there is a suspension or alignment problem, uneven wear will persist.

As you tour the tires, check their inflated pressures with a gauge. If you don't have a gauge, go to the service station and use theirs with a polite "May I?" Then doublecheck your reading. NOTE: Use the same gauge for all tires. Each gauge reads differently. The recommended pressure is stamped on the side of the tire. It's a good idea to verify this pressure with the tire dealer, especially if you carry heavy loads. Have them write it on the warranty. Adjust it if the tread wear pattern shows under- or over-inflation.

Step 2: Tighten the Lug Nuts.

If the lug nuts are loose, the wheel will wobble and fall off. If a lug nut or wheel bearing cover has fallen off, and your hub caps are on, you'll hear a rattling as the wheel turns. **Hub caps:** These must be removed to gain access to the lug nuts. Wedge a medium screwdriver between the hub cap and wheel then twist to pop the cap off. Examine each lug nut carefully to ensure that it is fully tightened against the rim (wheel). The wheel side of the nut is tapered to match the holes in the rim. You should have a lug nut wrench with your vehicle's jack. Check and tighten all of the lug nuts and replace the hub caps, if removed. NOTE: Some hub caps must be lined up and fitted over the valve stems on the tires.

•**4WD People:** Your hub (if manually operated) should be in the **Free** position. The hub cover twists over the hubs, locking behind the lug nuts.

Step 3: Take the Drive.

NOTE: It is a better idea to read this step before starting off. Then take a friend to read and take notes as you go along. Drive where there is light traffic and little wind. **Power Steering People:** Make sure your pump drivebelt tension and condition and fluid level are as they should be (Proc. 13). **4WD People:** Put your transfer into 2H. Hubs **Free**.

Find a straight flat dry road on which you can drive at 40 to 50 mph. When the car/truck is pointing straight ahead, the steering wheel should be steady and the front of the vehicle should not wander, pull or drift to one side or the other. If the vehicle wobbles the cause is tire imbalance, wheel bearings, or the suspension. The amount of steering wheel turn necessary before the wheels respond should be slight. If you swerve to miss an object in the road, the feel in the steering wheel should be even both ways and the front wheels should return to the straight ahead position without wobbling. Take notice: If the car body sways or rolls after the wheel is turned, the shock absorbers or springs are bad.

Try slowing down to a normal rate. If the vehicle pulls, it is probably a brake problem rather than a steering or suspension fault. If the steering wheel shakes, a wheel bearing, tire imbalance, worn shocks, or a damaged steering component is indicated. If the steering feels heavy or different from time to time, the steering box or a loose component might be the cause. On power steering trucks heavy steering is often accompanied by strange noises (Proc. 13).

Now find a section of road with curves in it. Maintain a steady speed around the bends. The feel of the steering should be the same whether turning right or left. If it isn't, bad tires, loose wheel bearings, poor suspension alignment, or steering box problems might be the cause. If the steering wheel doesn't return easily when straightened out, lack of lubrication, wear, or maladjustment in the steering box or ball joints, mismatched tires, bent or damaged steering and suspension parts could be at fault. Trucks with 4WD have front axles that move with the steering. Problems in those joints can make noises while turning (Ch. 11, Pt. 1, Proc. 15).

The next test requires a bumpy road or railroad tracks. Maintain a speed of about 30 mph and take some bumps. There should be little or no wobble or shimmy in the front tires or steering wheel during and after the bumps. If the wheels begin to wobble and the steering wheel commences to shimmy, tire imbalance is most likely the cause. Worn shocks or out of adjustment steering box, bent rim, or worn steering parts can all play their part in this condition, too. The shimmy will stop as you slow down. This is a common condition that should be corrected before you run into trouble—literally. The first step is to balance those front tires and check the wheel bearings and/or king pins. If the shocks and/or springs are worn out, you'll hear and feel heavy thunks when you hit the bumps. Don't let other noises like beer bottles on the floor, loose doors and windows, or other inside noises distract you. Suspension noise is distinct. Handling is affected considerably by worn shock absorbers, especially with the MacPherson strut front suspension. Loose suspension and steering component mountings cause abnormal thunks and rattles.

Step 4: Assess Your Information.

The most common problems in Datsun/Nissan steering systems and suspension are within your power to correct.

•**510, 610, and 710 Models:** Handling and wobble or shimmy are what you'll notice first. Tires are the first consideration. If they are worn, low on air or out of balance, the steering will seem shaky over bumps and around

curves. If the tires and balance are all right, yet the steering feels heavy, most likely you need shock absorbers, especially in the front where the weight is. A good set of radial tires and new shocks all around will make your car drive like a new one instead of a noodle with wheels.

•**521 and 620 through 1977:** Your truck is fitted with king pins which, if greased regularly, can last the lifetime of the truck. Because replacing the king pins is a miserable job, front end maintenance is a peach of an idea. There are lots of grease points in the front end (Ch. 3, Proc. 11). Out of adjustment wheel bearings, tire imbalance, and wear are also major contributors to handling difficulties. Shock absorbers are easy to replace because they are accessible. If you carry a lot of weight, the rear ones will wear out as fast as the front shocks.

•**620 (1978 on) and 720 Models:** Ball joint front ends are relatively problem free. However, loose cross rod ball joints and idler arms are a problem. Tire wear and a loose steering are often the result. See the following steps.

•**4WD People:** As I mentioned before, your steering is affected by the front driveaxles (Ch. 11, Pt. 1, Proc. 15).

•**Everyone:** Complete the following steps to pinpoint your problem and learn the systems.

Step 5: Check the Shock Absorbers for Leaks and Deterioration.

•**510, 610, and 710 Models:** You can only do a superficial check on your front shocks. Start at the right side of the vehicle. Look into the wheel well between the top of the tire and the edge of the fender. Find the coil spring on top of a tube. Within the coil spring there should be a rubber dust cover that protects the shock absorber inside. If the dust cover has fallen off, the chrome shock rod will be exposed. In that case, push the cover up and over the coil spring perch in the lip provided. Look at the other side and repeat this check. Your rear shocks are discussed below. There's more for you in Step 6. The rest of this step pertains to your rear shocks. **Everyone:** There's fluid inside the shock absorbers. When a shock gets worn or malfunctions, it can leak internally or externally, decreasing its efficiency. Extremely moist or dry climates will deteriorate the shock housing and its rubber mount bushings at either end.

Look at each shock. If there is a dark wet looking area on the lower half of the shock, you have a leak. Put your hand around this lower part of the tube and wiggle it. If it is leaking or is loose, replace it and the one on the other side, unless they have only a few thousand miles on them in which case they might still be warrantied.

Notice the mounting places at the top and bottom of the shocks. The mounting nuts and bolts should be fully connected to the control arm or axle housing and the frame or body.

NOTE: On some cars the top mount is inside the body. Grab the top of the shock and wiggle it. It should be solid. If not, go on to Proc. 6 for tightening info.

Step 6: Bounce Test.

NOTE: This check is not absolute but done in combination with the driving test (Step 3), it should give you a good idea of the shocks' condition.

You want to bounce the vehicle up and down so it's really rocking—like Grandpa when he's excited. Then let go and watch it settle. Hold onto the fender at the lip of the wheel well and without hurting your back lift up and pull down five or six times. When you let go, the motion should completely stop in one half to one stroke. (A stroke is one full movement up or down.) The rocking will be considerably harder with new, good shocks than with older or worn out ones. **510, 610, and 710 Models (front shocks only):** Open your hood and pry off the two black plastic covers on each fender, if there. Find the nut in the center of the strut mounting. Rock the car again and watch the nut. It shouldn't move. If loose, tighten it with a 17mm socket. The three nuts around it should also be tight. They are 14mm. Check both sides then replace the plastic covers if removed. **Everyone:** If you hear noises during the rocking, have an assistant rock while you watch the action of the shock absorber from below. Loose parts or broken shock mounts can cause rattles and thunks. New shocks look freshly painted and have supple new rubber bushings. Rusted shocks and cracked bushings mean old shocks.

If your vehicle is in good enough condition to merit a new set of tires, then it's probably worthy of a new set of shocks. Find them on sale or shop around and compare guarantees. Always replace the shocks in sets of two, front and/or rear. Lately gas shocks have become reasonably priced; I recommend these.

510, 610, and 710: MacPherson strut front suspension is a more expensive shock. You have to remove the

strut as a unit and take it to a garage for disassembly and cartridge replacement (Proc. 3). Compare the cost of replacing the strut inserts if you bring the strut assembly to a garage to have someone do the entire job for you. It may be cheaper, safer, and less strain on your back to have someone else remove the assembly.

Step 7: Check the Springs.

The vehicle has to be on a perfectly level piece of ground. Any load in the car or truck will affect the posture of the whole vehicle. The front wheels should be pointing straight ahead.

A well-sprung vehicle will look a little higher in the rear than the front. Look at it from the front and then the back. It should look level from side to side.

New shock absorbers, especially gas shocks, will raise the body slightly all around, especially gas shocks. One bad shock might lower it on that wheel. A broken or damaged spring or an out of adjustment torsion bar will make the vehicle sag considerably. **510, 610, and 710 Models Front:** If a coil spring is damaged, the strut assembly has to be removed and taken to a shop for disassembly. Do not attempt coil spring removal yourself as it is compressed under great tension. Once removed, the spring can be examined and replaced if necessary. **520, 521, 620, and 720 Models Front:** You have torsion bar suspension that can be adjusted. However, an adjustment of the torsion bar(s) won't help if the shocks are worn nor will it improve handling if other parts of the steering and suspension have given up the ghost. Continue checking, then read Proc. 9. **Everyone:** All cars and trucks have leaf spring rear suspension except for 510 and 610 sedans which have independent coil spring rear suspension. **510 and 610 sedans:** You are in a minority and your cars are very well built. If the vehicle sags or you suspect suspension problems, go to an expert. There is little else I can tell you to do. **Everyone Else:** The leaf springs should look alike and their mounts at the frame and differential should be tight. If you see shiny metal near the mounts, that mount is probably loose. (See Ch. 11, Pt. 2, Proc. 4, for alignment and retightening.)

Look for missing nuts, bolts, and washers at the mounts. Broken springs should be dealt with by a professional.

On the body, just above the differential housing, there should be a solid rubber cone or wedge attached to each side of the frame. This piece often falls off and is there to protect the frame and differential if you hit a severe bump while carrying a heavy load. Be careful or replace this piece(s) if you haul a lot of weight.

Step 8: Steering Checkout Starting at the Steering Wheel.

Sit in the driver's seat with your hands on the steering wheel. Turn the front wheels until they point straight ahead.

Now open the hood. Stand on the driver's side and look into the engine compartment. Find where the steering column comes through the **firewall** and into the engine compartment. Follow the column down to where it connects to the steering box. If your arms are long enough, put one hand on the steering wheel while craning your neck down into the engine compartment to look at the steering column and box; otherwise have a friend turn the steering wheel as you watch. Turn the steering wheel from side to side and watch the action of the steering shaft as it goes into the steering box. The reaction of the shaft should be exactly that of the steering wheel. If it is not, the steering wheel is loose or the shaft coupling or U-joint is damaged. Coupling and U-joint problems are rare thus not covered in this book.

•**Power Steering People:** Your system is different. Please read Proc. 13 to understand your system then read through the following steps.

Step 9: Check Play from the Steering Box to the Wheels.

NOTE: If your car is jacked up and on stands, find an assistant to hold the wheel and tire steady as you perform this step. If it's still on the ground, you can do it alone.

You want to determine how far the steering wheel has to turn before the tires move. There should be a fraction of an inch of steering wheel play before the tires move in either direction. If necessary, have your friend hold the driver's side tire steady at two points, 3 and 9 o'clock.

Move the steering wheel one way then the other. Watch the edge of the tire. If you have to turn the steer-

ing wheel more than 1in, there is wear somewhere between the steering shaft and the tires (wheels).

Now go to the right side of the vehicle and look through the wheelwell at the idler arm. Have your assistant move the steering wheel side-to-side while you watch for play between the arm and its mounts. If there is any, your idler arm bushings are worn.

Step 10: Check the Steering Box.

•**510, 610, 710 Models:** Car should be on the ground for this step.

•**Power Steering People:** Do this test with the engine running.

•**Everyone:** You'll need a helper for this one. Find the steering box and position yourself under the front (driver's) side of the vehicle. Put your friend in the driver's seat, hands on the steering wheel. Use a good light to identify the **sector shaft** that comes out at the base of the steering box. The shaft is attached to the steering or Pitman arm. Watch the shaft and the arm as your friend turns the steering wheel from side to side in short motions. You can judge if there's play inside the steering box by observing the movement of the steering shaft compared to that of the sector shaft and steering arm. (The steering shaft connects the steering wheel to the input shaft of the steering box.) If there is a lot of difference or play, (more than 1in of the steering wheel), read Proc. 12.

Take a look at the outside of the box. If it is covered with fresh looking oil and dirty, the bottom seal may be leaking. Proc. 12 tells how to lube it. **Power Steering People:** Pay careful attention to leaks (Proc. 13).

If the whole steering box moves when the steering wheel is turned fully from side to side, its mounting bolts are loose or the casting is cracked. This is both uncommon and dangerous. Have a pro look at it.

Step 11: Jack, Chock, and Block.

To further check out the steering and suspension you have to jack, chock, and block the vehicle so all wheels are off the ground. If it's not already up, see Ch. 13, Pt. 1, Proc. 1.

Step 12: Check the Front Wheels for Brake Drag.

Start on the driver's side and spin the left front wheel. On disc brake models, there should be a slight rubbing sound but the wheel should turn with little effort. On drum brake models, there may or may not be a slight dragging sound. If there is heavy drag and the car or truck has been pulling to one side or the other, an over-adjusted or inoperative brake may be the cause. These problems are diagnosed in Ch. 5, Proc. 1. Repeat this test on all four wheels (emergency brake off).

Step 13: The 6 and 12 Test (driver's side first).

•**4WD People:** Your bearings and suspension are more substantial than 2WD. As you do the next two steps use muscle and do the steps with the hubs in **free** and **lock** to see if there's a difference.

You have to know how to tell time the old-fashioned way for this test. You also need an assistant if this is your first shot at it. You should be on your knees or haunches facing the left front wheel.

Place one hand on the top of the tire at 12 o'clock and one on the bottom at 6 o'clock. The lug nuts must be tight. Push in the top while pulling out the bottom and vice versa to see if there is any play. A normal wheel will not move.

A truck with worn king pins will clunk a little and you'll feel play. Cars or 1978 on trucks will not move unless there is tremendous wear in the ball joints or wheel bearings or the lug nuts are loose. **520, 521, and 620 Through 1977 Models:** Have your assistant wiggle the wheel while you lie on your back facing the inside of that wheel. Look closely. If there is wear in the king pin assembly, the wheel will wiggle and movement between the spindle (the part connected to the wheel) and the support (the part connecting the control arms) will be evident. If the play is slight, keep the king pin well greased and it'll last quite a while (Ch. 3, Proc. 11). If the movement is to the clunking stage, plan to rebuild the king pin assembly. If there is movement in the wheel but not between the spindle and the support, go on to the next phase of this step and think of the wheel bearings. Worn king pins affect handling incredibly. The problem can only get worse and more dangerous. **1978 on 620 and 720 Models:** If you feel play in the wheel, there is definitely something wrong. Look carefully at the com-

ponents. Locate the ball joints and work your way down to the inside of the wheel from each one as your friend wiggles. Examine the top and bottom ends of the control arms where the ball joints are. The ball joint should not move. Follow the spindle down to where the steering lever bolts to it. If either of those bolts is loose, it must be tightened before driving another inch. (See Procedure 8 after reading Step 14.)

•**510, 610, and 710 Models:** If there is play, find its source before driving farther. Keep your friend wiggling as you look at the end of the control arm where the ball joint mounts. The ball joint shouldn't move at all. If it does, go to Proc. 8 and tighten the ball joint mounting bolts. You'll notice a badly worn ball joint or one missing its castellated nut if the control arm stays put and the steering lever moves. Other play might indicate loose wheel bearings (Step 14).

•**Everyone:** Repeat this step on the right wheel.

Step 14: The 3 and 9 Test (do the driver's side first).

•**4WD People:** Remember to try this with the hubs in **free** and **lock** if you have manual hubs. Make notes if there's a difference.

•**Everyone:** Have your assistant sit in the driver's seat and keep the steering wheel from turning while you face the left front wheel. Place your hands on the front and rear of the tire or at the 3 and 9 o'clock positions. Wiggle the tire and wheel in and out. There should be no play as long as the steering wheel can't move. If there's play, have the assistant take your place next to the wheel and tire as you crawl under the vehicle to look at the inner side of the wheel. Focus on the flat part (backplate) that covers the center of the wheel. This is the point of attachment of the steering and suspension. Have your helper wiggle the tire at 3 and 9 o'clock positions. If the wheel wiggles more than the backplate, the wheel bearings need to be adjusted, serviced, or replaced (Proc. 3). If the wheel and the backplate move together, continue on.

•**4WD People:** You have to see a pro for wheel bearing work (Ch. 11, Pt. 1, Proc. 15).

•**Everyone:** Now have your helper go back to the driver's seat and hold the steering wheel stationary while you face the wheel from the outside, hands at 3 and 9 o'clock. Try to wiggle the wheel. If it moves and the wheel bearings are in adjustment, there is wear in the steering system. Repeat these checks on the opposite wheel.

To check the steering system: Ask the assistant to bear with you. Have him or her face the left wheel and tire again, hands at 3 and 9 o'clock ready to wiggle. You lie on your back and find the end of the steering lever where the side rod attaches.

Tell the patient helper to wiggle the wheel while you watch the action between the lever and the small ball joint at the end of the side rod. If there is play between the two pieces, and the nut holding the small ball joint is in place, the ball joint (tie rod end) is worn. Examine the rubber boot that is sandwiched between the base of the ball joint and the piece to which it connects. If slightly ripped or dry looking, the joint may still be in good condition but out of grease and exposed to weather (Ch. 3, Proc. 11).

On the left side of the vehicle (assistant facing the left wheel): Have him or her wiggle the wheel as you follow the side rod inward, away from the lever. On cars and new trucks (1978 on), the inner end of the side rod attaches to the cross rod. On earlier pickups (1969-77), the side rod attaches to the steering gear arm. Check the ball joint here as well as the one next to it for play as the wheel is wiggled. There should be no play if the nuts are intact.

Look at the end of the steering gear arm that connects to the sector shaft coming out of the steering box. A large nut holds the arm on to this shaft. Examine the two pieces to make sure they are together and the nut and washer are in place as your friend wiggles the wheel and tire. If you hear great thunks coming from the steering box, there is too much play in the steering box (Proc. 12).

Now follow the cross rod over to the other wheel. Tell the assistant to stop wiggling and move to the opposite wheel. Move this wheel at 3 and 9 o'clock positions as you watch the small ball joint connected to that side's cross rod. On cars and new trucks the side rod and idler arm connect to the cross rod. On earlier trucks the cross rod and side rod connect to the idler arm. Examine the small ball joints as you did the others.

The idler arm connects the steering rods to the frame. Follow the arm up to its mount. Have the assistant go back to the driver's seat and turn the steering wheel one full turn in one direction and then another in the other direction as you watch the idler arm and its mount. The arm should turn in the mount without being loose. Take

your hand and push, then pull, back and forth on the arm. It should feel solid. If it's worn, read Proc. 11. If the bolts that hold the idler arm assembly to the frame are missing or loose, tighten them (Proc. 11).

Your arms have to be long enough to reach and pull together both front wheels while lying under the vehicle. It's especially important to perform this test on 620s and 720s (trucks) with ball joint front ends (1978 on).

Lie on your back with your shoulders between the front wheels. Stretch out your arms and grab the bottom of each tire and pull in. Do this a few times, looking at each movable point in the linkage. On the trucks mentioned idler arm and small ball joint play is common. I don't tell you how to replace the cross and side rods or their ends—the small ball joints. If you need to, take the job to a mechanic who can also align the front end after the work has been done.

The trucks mentioned came from the factory with excessive play in the steering. Nissan has never owned up to the problems of play in the rod ends and in the idler bushings.

The small ball joints (rod ends) are sold with the rod attached. They aren't cheap. On the other hand, Nissan does sell inexpensive plastic idler arm bushings that don't last long. I recommend using brass bushings, made for Datsun/Nissan trucks by a man in Oregon (Proc. 11).

Whatever your tests come up with, have your diagnosis confirmed by an expert, and ask to watch as he or she does the examination.

•**Car People:** Carefully examine the upper and lower sections of the idler arm mounting. There are rubber bushings here that should be checked for cracking or deterioration.

•**Everyone:** Once you have determined what, if anything, is worn, go back and recheck those parts or make only necessary adjustments. If the handling isn't improved by your corrections, don't hesitate, have an expert check out the front end and do an alignment if necessary.

Step 14: Lubricate the Front End and Check Large Ball Joints.

While the vehicle is jacked up, you may want to do a quick grease job, provided you have a grease gun (Ch. 3, Proc. 11).

Also you might as well check the large ball joints. This is not for pre-1978 trucks (Proc. 8).

Step 15: Lower the Vehicle.

See Ch. 13, Pt. 1, Proc. 1, to get the vehicle back on its paws.

Step 16: Tire Balancing and Rotation.

Balancing. There are two ways to balance tires: bubble (static balancing off the vehicle, spin (or dynamic) balancing on or off the vehicle) or spin balancing is the most accurate whichever way it's done.

Rotation. Rotating tires means to move their positions on the vehicle. Bias and belted tires are rotated differently than radial tires. Do not rotate tires that have been spin balanced on the vehicle. The owner's manual or your tire dealer can tell you how to rotate your set of tires. NOTE: Radials always should stay on the same side of the vehicle; they should always turn in the same direction.

PROCEDURE 3: ADJUST, REMOVE, INSPECT, PACK, AND REPLACE FRONT WHEEL BEARINGS

NOTE: **4WD People,** see Ch. 11, Pt. 1, Proc. 15.

Condition: You are here because of fate or maintenance. There is wobble or play in the front wheels. The brake drum or rotor and hub have been removed for brake work or wheelbearing packing and replacement.

Tools and Materials: Jack, jackstands, torque wrench if possible (not necessary), 22mm or 7/8in socket. **510, 610, and 710 People:** 26mm socket; **521, 620, and 720 People:** (channel lock pliers or adjustable wrench will work, 1 x 1/8in cotter pin. Channel locks or large jawed pliers, screwdriver, silicon (if necessary).

To replace wheel bearings: A 5 or 6in punch with a flat, round tip (in good condition—not mushroomed), hammer, short piece of 1 x 2in wood or something similar, new grease seals (one per wheel).

To pack wheel bearings: A can of non-fiber "high-temp" moly grease, new grease seals, and solvent.

Remarks: To adjust front wheel bearings, do Steps 1-6. To check, service, and replace front wheel bearings, do Steps 1-3 then what you need to of Steps 7-12.

Step 1: Jack, Chock, and Block Front of Vehicle.
Follow the instructions in Ch. 13, Pt. 1, Proc. 1.

Step 2: Remove the Hub Cover.
See illustration Ch. 5, Proc. 6 (4).

At the center of the wheel there's the hub with a domed cap covering it. Use a pair of large adjustable pliers to clamp on opposite sides of the cap and wiggle it out of the hub, or insert a screwdriver tip between the inside of the cap and hub and pry the cap off.

Look at the shoulder of the cap once it's removed to see if it has an O-ring around it. Don't lose it if there is one. Keep the dust and grime out of the cap and set it aside.

Step 3: Remove the Cotter Pin and Lock Nut (castellated or stamped retainer).
Wipe off enough grease to find the cotter pin and its bent up legs. Use your pliers to straighten the bent legs as much as possible. Find the opposite (head) end of the pin. Using pliers pull or pry the pin out of the axle from the head end (see illustration). Set it aside. If there is a stamped metal retainer covering the axle nut pull it straight off.

NOTE: If you are interested in greasing and/or looking at the condition of the outer or both wheel bearings or want to do a Lazi-Pac, which is packing only the outer wheel bearing and not removing the drum or rotor, you should now refer to Ch. 5, Proc. 6, **Disc Brake People** (Step 1), and **Drum Brake People** (Step 4). To simply adjust the bearings, go on to Step 4 (this procedure).

Step 4: Adjust the Wheel Bearings; Install the Wheel and Tire and Tighten the Lug Nuts so There's No Wobble.
The point of this is to tighten then loosen the spindle nut while spinning the wheel. The bearings are tapered and roll against a matching surface. The pressure between the bearings and the surface they ride on has to be just right to get the job done. By turning the nut in the axle you set the position of the bearing so there's no excess friction (too tight) or excess play (too loose). With experience you can do this important step by feel. NOTE: New bearings feel slightly different from old ones while being adjusted.

Use a torque wrench with the correct socket or a breaker bar. Sit facing the wheel with the socket on the spindle nut and the breaker bar pointing at 2 o'clock position. The nut should be turned until it's snug but not too tight, and the wheel should turn smoothly when spun by hand. Back off the nut a little and spin the wheel. Keep spinning and start turning the nut (clockwise) putting the weight of your hand and arm plus a little more on the wrench handle. If the bearing is new, put a little more umph on the wrench. The wheel should still spin freely.

Now notice that behind the nut there's a round washer. Watch this closely. It should move as the nut tightens. Continue tightening the nut clockwise until you feel resistance, then stop. Tighten the nut to the foot pound reading below.

•Torque Wrench People:
(1968-74 510, 610, 710—18-22 ft.lbs./45-90°)
(521 all—16-18 ft.lbs./45-90°)
(1974-77 610, 710, 620—22-25 ft.lbs./40-70°)
(1978 on 510—22-25 ft.lbs./90°)
(1978 on 620 and 720—25-29 ft.lbs./40-70°)

This reading should seat the bearings fully against their races. Once the torque is reached look at the end of your wrench handle and imagine it turning in a full circle making 360°. From the place your handle is now move it counterclockwise the number of degrees specified then stop and read through the non-torque wrench directions to doublecheck your adjustment.

•**Non-Torque Wrench People:** Without a torque wrench, you need to really watch the washer. It should move a little as the nut turns against it; you should feel resistance. Stop tightening and keep spinning. Turn the nut back just a little all the while watching the washer; it should move slightly with the nut. Stop. Put your tools down and stop spinning. Pick up a screwdriver and wipe off its tip. Slide the tip in between the outer edge of the washer and the inner edge of the hub. Pry the screwdriver against the washer. The washer should move with some resistance. If it is really stiff the nut is a little too tight. Moves and feels sloppy? It's too loose.

•**Everyone:** Repeat all of the above steps until you think you've got it; then wiggle the wheel from the edge of the tire with your hands placed at 9 and 3 o'clock. There should be no play between the hub, washer, and axle tip or nut. If there is, or the wheel drags when spun, do the step again or check the bearing condition. They may be worn, damaged or need to be greased. If okay, go on to Step 5.

Step 5: Install Cotter Pin and Retainer Washer.

Look at threaded end of the spindle axle and find the hole drilled through where the cotter pin fit.

•**Castellated Nut People:** If the hole is not visible, turn the nut just enough to align the hole with the closest gap in the nut.

•**Retainer People:** Clean and fit the retainer over the nut so one of the spaces in the retainer matches up with the hole in the axle spindle. They are offset so it may take a few tries.

•**Everyone:** When the holes and all are aligned, insert the new, straight cotter pin through the nut or retainer and hole with the flat side of the head against the nut (if one side is flat). Bend the cotter pin leg closest to you over the end of the axle and cut off any excess. Use wire cutters to cut off some of the other leg, just enough so it doesn't touch the washer when the leg is bent inward against the nut. Bend the legs of round headed pins over and around the nut/retainer and cut off the excess.

Step 6: Replace the Hub Cover (Cap) and Lower the Vehicle.

Look inside the cap to make sure there is no dirt or insects stuck in the grease. Slip the cap over the axle and inside the hub. Tap it lightly with a hammer to send it straight home, without denting the dome.

NOTE: If the cap is loose or turns by hand once in place, remove it and clean and coat the fitted edge with silicon. When the hubs are together lower your vehicle to the ground (Ch. 13, Pt. 1, Proc. 1). It should roll like a skate.

Step 7: Remove Grease Seal and Inner Wheel Bearing.

NOTE: You have to remove the hub before doing this step (Ch. 5, Proc. 6). This is a good opportunity to check and/or do brake work.

Lay the hub down so its inner side is facing you. Wipe off any grease around the inner lip of the drum or rotor hub. There's supposed to be a round **rubber grease seal** in the recess at the center of the hub. If all you see is a hole with a shiny ring inside of it, turn back to the spindle and look for the seal and/or the **inner wheel bearing** that may have pulled out of the hub as you removed it.

The seal has to be removed from the hub to get out the bearing. Use the large adjustable pliers, placing the curved jaw around behind the seal. Now work the handle of that jaw to pry the seal out. If this doesn't work for you, or if you have a truck where the seal lip is covered by the bearing race, use this screwdriver method: gently punch the seal's outer edge into the hub on one side with the screwdriver tip and hammer. The idea is to tip the seal, then get under it at the opposite side, and pop it out of the hub with the screwdriver. Be careful not to damage the lip of the hub with the screwdriver while pounding and prying.

Spread out some newspaper to lay the bearings on. Keep left and right parts separate. This is important.

If there is a **spacer** on top of the bearing, remove and set it aside with the bearing.

The inner wheel bearing will now pull out of the hub. Since wheel bearings are full of grease and will pick

up dirt easily, stash them (and all parts from each wheel) on newspaper or in a clean parts container. Keep the dusty parts separate from the greasy things, and pieces from one side of the vehicle apart from those of the other side.

If you plan to pack the bearings and/or the rotors (or drums) are going to the machine shop for work or inspection, mark on each the side of the vehicle from which it came. Use paint or punch marks. Write on the hub itself, not the shiny rotor surface.

•**Brake Work People:** The machinist will look for numbers cast into the hub which indicate the minimum thickness of the drum or rotor after it's been machined. Then he or she will use a micrometer or drum gauge to determine whether or not any metal can be machined off the surface. If you are told you'll have to find another drum or rotor, your alternatives are to buy a new one, visit the wrecking yard, or cannibalize a friend's parts car. Most yards have measuring instruments to check out such pieces. Make sure the drum or rotor you get matches yours and isn't in worse condition. Remember to keep the races with the bearings, don't mix them up with bearings from the wrecking yard. Before heading out to the machinist, read Step 8 to check your bearings to see if replacement or simple cleaning and packing are in order.

If, for one reason or another, you need to separate the rotor from the hub (disc brake models), turn back to Ch. 5, Proc. 6 (5). If your wheel bearings are reusable, it might be easier for you to match your good hub with the new/used rotor or drum.

Step 8: Check the Wheel Bearings.

NOTE: Keep the wheel bearings with the hub they came out of. Do not mix them up!

If properly maintained, wheel bearings will last the life of the vehicle. In the old days, bearings were routinely replaced more often, but because of the current value of chrome (much of it comes from South Africa), it's in everyone's interest to preserve these little bearings (rollers) with careful maintenance.

The inner wheel bearing is larger than the outer one. Both bearings work the same way. They are tapered (slight cone or bevel shape) to match the angle of a chrome ring or **race** that is pressed into the hub. The inside of the inner race remains stationary on the spindle (axle) while the outer race and bearing cage and bearings turn with the wheel. Proper lubrication and adjustment is all these bearings need to be reliable. Before you get tempted to do a Lazi-Pac and simply slap new grease into them, have a careful look at the bearing, cage, and race. If you are replacing the drum or rotor after brake work and you know the bearings are good or have been packed with grease recently, you can skip this and the next two steps and go to Step 11. If you have any question of their condition, do the bearings check and maintenance now while the drum or rotor is off. It's not recommended by anyone to mix grease types. The only time this is safe to do is if the bearings and grease condition are good and you have the same color and type of grease that's currently in the bearings.

Work over a solvent pan on one wheel's bearings at a time. Squirt and scrub the bearings with clean solvent. Stick your finger in the center hole to hold the bearing while you brush out the grease within the cage and rollers. The idea is to expose the bearing parts for a visual check.

Look closely at the bearings (rollers). Their surfaces should be uniform, without any scratches, chips, or discoloration. They should be all sitting squarely in the cage which holds them in place. The cage should be even all the way around. If it's at all distorted or damaged, that bearing assembly and its races must be replaced. Hold the cage with the fingers of one hand while pushing and pulling the inner race in and out. If any bearings come out of the cage, replace the bearing. Scratches on the bearing (roller) surfaces indicate dirt in the grease. Blue-black discoloration is a sign of heat if caused by lack of lubrication or too tight an adjustment. If yours have blue-black places, replace 'em.

The races are surfaces the rollers' bearings ride on. Both the inboard and outboard wheel bearings have inner and outer races. The inner race is assembled with the cage and rollers but the outer race is pressed into the hub. When you replace the bearing assembly, replace the outer race along with it. Many mechanics don't do this to save time, but it's not wise to run a new bearing on an old race. Take a look at the innermost part of the spindle (axle) where the inner race sat. Look for signs of grooving or wear, indicating the race has spun on the axle. If a bearing is in question, have a pro at the machine shop or garage look at it.

Now check the outer races. The outside bearing's outer race is on the small hole (nut) side of the hub. The inside bearing's outer race is visible when the race is turned over. The races are shiny. Check the surface for chips, scratches, or discoloration. These conditions necessitate replacement.

If only one out of the four front wheel bearings is bad, replace just that one. In any case, don't take short cuts with wheel bearings. If you intend to replace the bearing(s) and don't have the tools or knack to remove the races (after reading the next step), have the shop do it. Repeat this inspection on both bearing assemblies in each wheel. **Remember, don't mix up the bearings, the roller bearings match their races.**

Place the cleaned bearing assemblies on a piece of newspaper to absorb the solvent. If the bearings are to be repacked and reused, the solvent and old grease have to be removed. Go to a service station and do it with their compressed air or use aerosol carburetor cleaner. Don't let the bearing spin as you do this. Finally, let the bearing dry on lint-free cloth, then spin it slowly to be certain it's clean and dry.

Step 9: Remove and Replace Bearing Races (do this only if you are installing new wheel bearings).

•**Brake Job People:** If the drum and rotor are to be turned at the machine shop, leave the old races where they are until the machining is completed.

•**Everyone:** You should have a 6in punch or steel dowel for this step, but a long-straight-shafted screwdriver that you don't care too much about will also work. Safety glasses are a must here. Place the drum or rotor on a wooden surface, not concrete. Disc brake people should raise the hub at least 1in off the table using two 2in x 4in pieces of wood under the rotor.

Now place the drum or rotor outerside down and look into the hub. There should be a lot of grease in the center of the hub which is best removed with your finger and a grit-free rag; keep the grease away from the brake parts. Next turn the drum or rotor inboard side down to remove the inboard race. Find the inboard race. It sits on a ledge cut into the hub. Move your finger around the radius of the race and find two little cutouts in the hub that expose the bottom side of the race. At these points, you can insert the punch or screwdriver and, by alternating from side to side, pound the race out of the hub. Be careful not to scar the sides of the hub while doing this. Pick up the hammer and punch (or screwdriver). Position the tip of the punch against the bottom of the inboard race that is exposed by the cutout. Assure yourself that the punch is well placed and give it a good smack with the hammer. Two hits per cutout are enough to get the race moving out of the hub. Alternate from side to side until the race falls out.

Remove the outboard race the same way: turn the hub over so the outboard side is down. Both **Disc and Drum People** have to raise the hub off the bench at least an inch by supporting the hub's edges with sturdy blocks of wood.

Once the races are out, clean all the old grease out of the hub.

Clean the area where the new race will be seated, keeping grit out of the hub. You want to press the new race into the hub evenly. The initial entry is crucial for correct final result. Make sure the wall inside the hub is smooth before starting. Use emery cloth if necessary. You can use the old race to install the new one, at least to get it started. Set the new race even and square onto the edge of the hub. The wide part (bottom) of the race goes into the hub first, the tapered part (top) of the slant (bevel) faces out or toward you.

Gently tap the new race round and round to start it into the hub. Now place and align the old race on top of the race. Lay a clean piece of wood flat over the old race and tap it hard enough to start the race into the hub. When it goes flush with the hub's edge, remove the wood, rag, and old race and pick up your punch. Carefully place the tip of the punch against the top edge (not bearing surface) of the race to tap it in. Move the punch (or screwdriver) tip around to install the race evenly. Be patient. As you pound, keep checking the surface of the race to make sure you're not damaging it.

When the race is fully in place, there will be no gap between the bottom of the race and the ledge inside the hub. Clean off the shiny race surface with a rag. Install the other races.

Step 10: Pack the Wheel Bearings.

Keep a few rags handy for this step. Use only grease labeled "For wheel bearings." Disc brake people must use "high temp" grease, and should not mix types of grease. Use only new grease that is absolutely clean.

NOTE: Keep the bearings in order for left and right wheels.

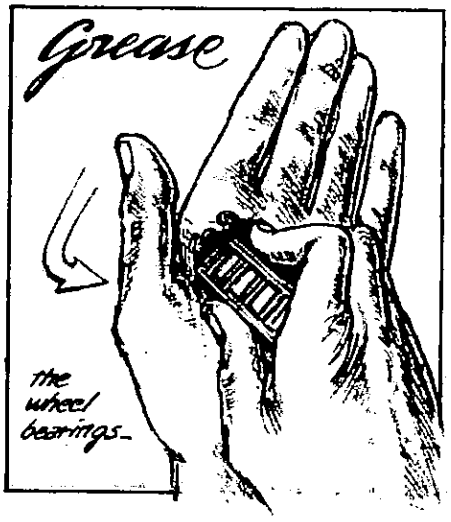
If you are reusing the old bearings, check again that the bearings (rollers) and cage are free of grit. Lay out a sheet of clean newspaper for each wheel (left and right); have the bearings nearby. Place an egg-sized dollop of the grease in the palm of your non-dexterous hand. Pick up the bearing with your working hand and slide it through the grease so grease is forced into the gap between the cage and the inner race, filling the space around the rollers. Repeat this squishing and packing on both sides until the cage is **completely** filled with grease. This is important. Set the packed bearing down on the newspaper and repeat the act with the next one. I prefer to do all four bearings, one right after the other, while my hands are covered in grease. When you're done, wipe the excess grease off your hands.

Step 11: Clean and Grease Inside of Hub.

Position the hubs so the outboard side is up, facing you. Lay out some newspaper. If you haven't already done so, use your fingers and a clean rag to wipe out **all** the old grease from the center of the hub. Put the old stuff on the newspaper and discard.

Pick up a two finger blob of new grease and smear it round the inside of the hub between the bearing races. Fill the space along the walls until the grease is smooth and even with the ledges on which the bearing races fit. Don't overfill the center so much that the axle (spindle) will force grease out when you reinstall the hub.

Do both hubs equally and wipe off your hands.



Step 12: Install Inner Bearing and Grease Seal.

Place the greased inner bearing (taped side down) into its race in the inboard side of the hub. On top of that, if you removed it, place the cleaned-up spacer.

Coat the lips of the new grease seal with a bit of grease and place it evenly into the hub with the flat, closed, or written-on side facing you. Or, if "bearing side" is printed on one side of the seal, put that side toward the bearing. (This is vital, so look carefully.) Press the seal in at least some of the way with your thumb. Lightly tap around the edge of the seal with the hammer, and a wooden dowel if you have one, constantly checking that the seal is going in evenly. On trucks there's a collar on the bearing that the seal fits over so you may need to use your punch on the seal. Stop when the face of the seal is flat, parallel with the edge of the hub. Make sure that it's in evenly all around. Be sure dirt stays out of that freshly greased hub. Repeat this step on the opposite wheel.

Go to Ch. 5, Proc. 6(6) to install the hubs.

PROCEDURE 4: REMOVE AND REPLACE THE MACPHERSON STRUT ASSEMBLY FOR FRONT SHOCK ABSORBER OR COIL SPRING REPAIR (Car People Only)

Condition: You have done diagnostic Proc. 1 and 2 and determined that the shock absorbers (or coil springs) are at fault, so perform this procedure. If the strut assembly is bent or damaged, you'll need a new or used one. While the struts are out is a good time to replace bad ball joints if necessary.

Tools and Materials: An assistant, a drip pan, a 2½—3ft pipe 1¼in in diameter, long crowbar or 3 ft 2x4, 6in piece of 2x4, 17mm socket, ratchet and 3in extension, 14mm socket, and paint or fingernail polish.

Remarks: Because removing the shock absorber from the strut assembly is dangerous and requires a special tool to compress the coil spring, this procedure tells only how to remove the assembly from the vehicle. You

can then take it to a Datsun/Nissan agency or qualified shop to have them do the dirty work. Call around before choosing the shop and the source for the parts. Since there are different sizes of shock absorbers, especially on old 510s, the strut will have to be measured for the correct replacement to be matched. Ask your parts person if you need to measure the strut or if the size is standard. Datsun used to sell all of the innards to rebuild strut type shock absorbers, now there are replacement cartridges which are infinitely more convenient. There are various brands and quality available. Buy replacements only as good as your car. Shop around for deals on parts and labor to renew the struts. By removing the assemblies yourself, you'll save on labor costs, though maybe not enough for you to take the assemblies out of the car.

If you intend to do a complete service on the brakes while you're here, turn to Ch. 5, Proc. 3, 5, and 6.

Step 1: Jack, Chock, and Block.

See Ch. 13, Pt. 1, Proc. 1.

Loosen the lug nuts and raise the car high enough to give you plenty of room to work underneath the control arm. The front bumper should be at least 2ft off the ground. When the car is safely supported, remove the lug nuts, tires, and wheels. Keep the wheels separated from one side to the other.

Step 2: Disconnect the Flexible Brake Line from the Chassis.

If you plan to pull the brake rotors, remove the calipers now (Ch. 5, Proc. 6 [3]), and tuck them out of the way without damaging the brake line.

If you aren't servicing the brakes now, caliper removal isn't necessary to perform this step. Find the flexible rubber hose that connects the steel brake line to the caliper or to another steel line mounted to a bracket on the strut.

•**Early 510, 610, and 710 People:** The hose goes directly to the caliper, so follow it up to the steel line and bracket that is mounted on the wheel well. You'll separate the line and hose here.

•**Late 510 People:** The hose goes down to a bracket mounted on the strut tube; you'll disconnect the lines there.

•**Everyone:** Squirt some penetrating oil around the threaded part of the fitting and let it soak. The flexible hose is on top with its hexagonal fitting set in a cutout in the bracket.

Place a drip pan below the bracket. Fit the 10mm open end onto the hexagonal fitting below. Pull the wrench toward you without slipping off the steel line fitting. You'll be turning the smaller fitting counterclockwise, out of the larger upper one. If the small fitting is stuck or the hexagonal part of it is rounded off, see information in Ch. 13, Pt. 1, Proc. 2.

NOTE: If the fitting comes loose but sticks and twists the steel line, back off, use the penetrating oil and wait. Keep trying until the fittings are loose and separated. Gently pull the steel line out of its mate and catch the released brake fluid in the pan. Carefully bend the steel line down an inch or so to get it out of the way. If either line is damaged, it must be replaced.

The flexible brake line is held in the bracket by a spring clip. The clip slides over a slot in the flexible line fitting on the underside of the bracket. One end of the clip is bent.

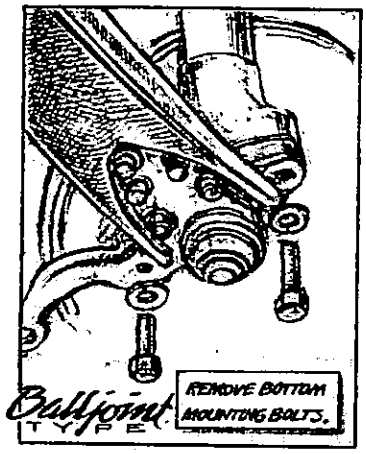
•**Early 510, 610, and 710 Models:** The bent end is to the rear.

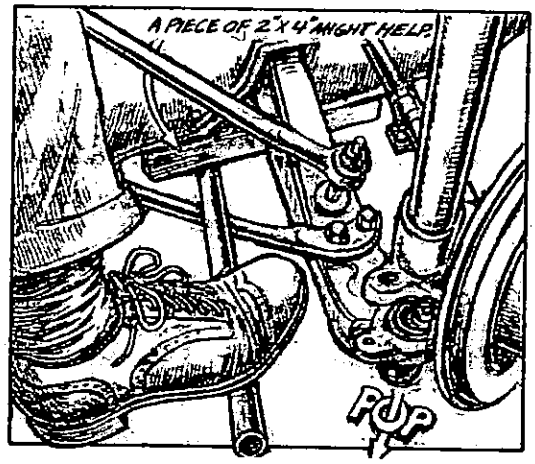
•**Late 510 Models:** The bent end is forward. Put the tip of your screwdriver or chisel against the inside of the bend in the clip. Alternating from side to side, tap the clip away from the brake line until it slips out. Put the clip into a parts container. The flexible line will now pull out of the bracket.

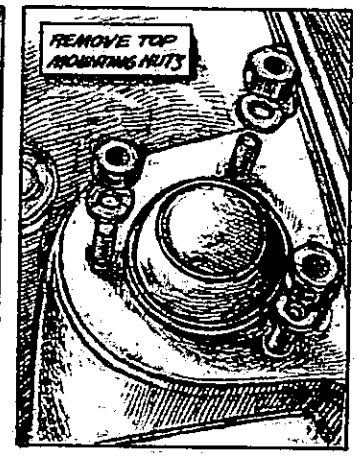
•**Late 510 People:** Mark the caliper end of the steel brake line with paint, then disconnect it from the caliper. Store it somewhere safe.

Step 3: Disconnect the Steering Knuckle (ball joint mount) from Strut Base.

Behind the strut base you'll find a small ball joint (or tie rod end). At this joint, the **steering knuckle** connects to the side rod which connects to the rest of the steering system. Follow the knuckle forward to where it bolts to the base of the strut assembly. The knuckle is held by two 17mm bolts screwed through it and into the base of the strut. Put together your 17mm socket, extension, and ratchet then lie on your back looking up at the







base of the strut. Identify the control arm which supports the strut. The steering knuckle is sandwiched between the control arm and the strut base. (The large ball joint holds the steering knuckle and the control arm together.)

Find the two 17mm bolts that are in the steering lever on either side of and above the large ball joint; they are the two closest to the plate behind the brake rotor. Squirt some penetrating oil on the bolt ends from above. Turn the wheels right or left to help you get at the socket on the bolt heads. The bolts are tight; therefore, get a good grip on the ratchet and unscrew, turning counterclockwise. Put the bolts and lockwashers in a baggie labeled "strut base."

Step 4: Prepare and Position the Lever for Strut Removal.

NOTE: Read through this step before beginning.

On the front side of the **control arm**, there are two rods connecting the arm to the car frame; these are the **stabilizer bar** and **tension rod**. The control arm, stabilizer bar, and tension rod have to be pried downward to allow the strut assembly to clear the ball joint. I use a 1in x 3ft long steel pipe placed against the frame and the tension rod to do this. Other tools work but the length and width of my pipe are ideal for leverage and fit. I also use a 6in piece of 2x4 as the fulcrum point between the frame and the end of the pipe. Before you jam your tool into something, look at the illustration and identify the parts. Take care not to damage the steel brake line or the rubber boot on the ball joint.

Call your friend for the next bit of work. Working from the front, slide the pry bar in between the stabilizer bar and tension rod. Push it back behind the stabilizer bar link (mount) and strut until the end is under the frame. Stand the 2x4 sideways between the flat bottom of the car's frame and your bar.

Position the end of the bar securely against the 2x4. The middle of the bar should sit as close to the bolted end of the tension rod as possible. With everything positioned just so, push down on the outer end of the lever with enough umph to start lowering the control arm downward. It may stick to the steering knuckle, so work hard to separate the two pieces. Two things to watch for are (1) that the bar is properly positioned and (2) that the car is well supported on jackstands.

Step 5: Remove the Strut Assembly.

Once you think that you can manage the prying routine, ask your friend to hold the lever and block in place while you pick up the 14mm socket, ratchet and fingernail polish. Open and support the hood. Follow the strut assembly up into the wheel well. There are three nuts on studs that hold the strut tower to the car body.

•**Early 510, 610, and 710 Models:** In the center of the studs and nuts find a plastic dome cap and pry it off.

•**Everyone:** Under that cap there is a 17mm nut that should be left untouched. Loosen all three 14mm nuts until they are nearly off their studs. Mark one of them and its position to the body with fingernail polish or paint. Read through the next paragraph before continuing.

Remove the three nuts with washers, put them in a baggie labeled "strut nuts." **Caution:** When you pry the

control arm down, the *heavy* strut assembly will also drop, so be careful. Also avoid damaging the sheet steel covering behind the rotor at the base of the strut. The strut weighs more than you might guess, so be prepared to handle it. Before your assistant starts to pry, put one of your hands on the hub (or axle) and one on the strut tube. When the bar is pushed down, pull the base of the strut outward while supporting its weight. Ease the assembly out of the wheel well, away from the car and lay it nearby. Release the weight from the lever, label the assembly you removed right or left, and move the tools to the other side of the vehicle to repeat the procedure. (NOTE: It's unlikely but there may be shims between the tower and the body. Take note as to the position of the shims as they were situated between the coil spring and the body. Look for the telltale traces where they may have been on top of the strut.)

Step 6: Front Shock Replacement (Macpherson strut cartridge).

Now you have to have the assembly disassembled by someone with the special tool or press. Don't try to do this yourself—it's very dangerous. NOTE: There is a bearing in the top of the strut which seldom wears out but should be checked and greased while disassembled. Ask the shop doing the work to check it for you. Also, be careful not to strain yourself or damage the strut assembly when moving it around.

If you disconnected the brake line, plug the end of the flexible or steel line with a tiny piece of rag.

•**Everyone:** Before paying for the job, make sure that the job was done (watch if possible) or look at the old innards and rotate the brake rotor from the hub to assure there was no damage done to the brake parts.

Step 7: Replace the Strut Assembly.

Read through first. Separate the struts left and right. The brake caliper side of the assembly goes to the rear. You will need your friend to do the prying routine while you lift the assembly up and into the wheel well. NOTE: Before you begin, find the stud you painted on top of the strut then match it with its position in the wheel well. You can turn the top piece with a long screwdriver slipped between two of the studs. The brake rotor should be parallel with the side of the car. It's tricky holding the assembly from the bottom while lining up the three studs and holes at the top.

Wipe off the top of the steering knuckle where the strut attaches. Do the same on the bottom of the strut. Position the ball joint so it's slanting outward toward you. Position the prying tool (see illustration, Step 5) and 2x4 block carefully. Put the three strut nuts and washers handy, close to the holes in the body. Replace the shims (if any) atop the spring perch. (Keep them in place with grease or sticky glue.) While struggling with the weight of the strut, guide the three studs into their holes in the fender wheel well. Once you have the studs through the holes, put one or two of the nuts onto the nearest stud(s) and relax. Now, push the base of the strut up against the steering knuckle and as much into place as you can. Ask your friend to let up on the pry bar until the assembly is supported by the control arm. Keep everything in place and install the three lock washer(s) and nuts onto the studs until they're snug.

Keep the pry bar in place for the moment and concentrate on the base of the strut. Find the two strut base bolts and washers that hold the steering knuckle up against the strut assembly. Squirt their threads with penetrating oil. It'll take some coaxing from a few angles to match the strut up to the holes in the knuckles. Use a punch or short screwdriver to align them. Pick up one of the bolts and start it by turning clockwise from below. You may need to lie on your back to get them going. When both are in place, tighten them evenly with the socket. The final torque setting is listed below. If you have a torque wrench use it; otherwise, tighten the bolts well. Make sure that the steering lever and the strut base are flush and there is no gap between them.

Steering Knuckle to Strut Base Torques:

510: 44-58 ft.lbs (6-8 mkg)
610 and 710 and new 510: 53-72 ft.lbs (7.3-9.9 mkg)

Now tighten the three upper nuts with a 14mm socket. The torque ratings are below, but make sure you tighten the nuts evenly while working around. Without a torque wrench, tighten the nuts until the lockwashers flatten and then some. Do not overtighten.

Strut Assembly to Wheel Well Torques:
510: 28-38 ft.lbs (3.9-5.2 mkg (37 ft.lbs)
610, 710 and new 510: 18-25 ft.lbs (2.5-3.5 mkg)

Step 8: Install the Brake Caliper and Reconnect the Brake Line.

If you removed the caliper replace it now (Ch. 5, Proc. 6 [7]). After the caliper is in place find the flexible brake line and while keeping an even, unkinked curve, position the line's hexagonal fitting down through the hole in the bracket that's attached to the car's body (old 510s, 610s and 710s) or strut tube (new 510s). The hexagonal edges of the fitting match cutouts in the bracket. Find the spring clip that holds the line to the bracket. It gets slipped into the groove in the end part of the fitting and holds the line in place. The bend in the clip faces downward and the legs go around the line fitting from the front (old 510, 610 and 710) or rear (new 510s). Position the legs on either side of the fitting and tap the clip into the fitting until it is flush with the bracket. Check that the clip is fully in the groove and the legs are straight. **New 510 People:** Find your steel brake line and, if the end is clean, install the painted end into the caliper hole (Ch. 5, Proc. 6 [8]).

Position the steel line and fitting close to the bracket. Clean out any grime in the line or on the fitting. The line will have to be bent carefully upward to fit. Move the end of the steel line into the flexible line fitting. The nut will thread easily into the upper fitting only if the steel line is perpendicular to it. Don't force anything. Keep the steel line pushed up into the flexible fitting and start turning the nut into it (clockwise) (Ch. 5, Proc. 6 [8]). Reconnect the spring, if there is one (used to hold the flexible line out of the way), to the line and the bottom coil spring perch. Repeat Steps 6-8 on the opposite wheel.

Step 9: Install the Brake Pads and Bleed the Front Brake.

Do this step only if you loosened a brake line and/or removed the caliper. (See Ch. 5, Proc. 5 and Proc. 2.)

Step 10: Replace the Wheel and Tire; Lower the Car.

Check that the rotor spins freely and doesn't rub against the steel backing plate. Install the wheels onto their appropriate hubs and lower the car (Ch. 13, Pt. 1, Proc. 1). NOTE: Check that the brakes are there with a few pumps before you road-test the car.

PROCEDURE 5: REMOVE AND REPLACE FRONT SHOCK ABSORBERS (Truck People Only)

Condition: You have done Proc. 1 and 2 and determined the shocks are worn. It might help to squirt all the nuts and bolts with penetrating oil a few hours or days before doing this.

Tools and Materials: 17mm box-end wrench, socket, and ratchet, pliers or vice grips, 14mm open-end, new pair of shocks, penetrating oil, anti-seize compound.

Remarks: This procedure describes the installation of hydraulic, not gas, shocks. Gas shocks, now dropping in price, are a good buy if available. They don't need to be bled and are self-expanding. Keep the shocks compressed until in position and follow the enclosed instructions carefully. After installing gas shocks you should certainly check Trim Height (Proc. 9).

Step 1: Raise the Truck off the Ground and Remove the Front Wheels.

See Ch. 13, Pt. 1, Proc. 1.

Step 2: Locate the Shock Absorber and Parts.

Look inside the wheel well directly behind and above the axle hub. The shock mounts at the top to the truck's frame and at the bottom to the lower control arm. The top of the shock has a stud that fits vertically into the frame

mount. There are washers and rubber insulating grommets on either side of the upper mount, shock, and nut(s). If there are two nuts, the top one locks the lower one in place. At the base of the shock there's a horizontal bolt passing through a mount welded to or part of the control arm, and rubber bushing is pressed into the bottom of the shock.

Step 3: Loosen and Remove the Upper Mounting Nuts.

NOTE: On many late model 720s there's a removable plastic plug in the left fender for access to the upper mount. Squirt penetrating oil on the top nuts. Clamp your Vise Grips securely onto the very top of the stud i.e., its squared sides. Hold the Vise Grips and use a 14mm box-end to loosen, counterclockwise, the top nut. Watch your knuckles. Thread the nut up to the end and stop. If there's another, loosen the lower nut and turn it to the top then remove the Vise Grips. Remove the nut(s) and put them aside. Pry off the top washer, rubber grommet, and lower washer. If they are stuck, use penetrating oil and wide jaw pliers to turn them off. If you want to test the shock action, see Proc. 6 (3).

Step 4: Remove the Lower Mount Bolt and the Shock.

Douse the nut and bolt with penetrating oil. Turn the wheels to the right to work on the left side and to the left to reach the right side. Connect the 17mm socket to a ratchet and extension. Place your 17mm box-end wrench on the bolt head on the front of the mount (2WD 720 People Only) and the socket on the nut at the rear.

•**4WD People:** The bolt head is to the rear; the nut is welded in place. Brace the open-end against the backplate.

•**Everyone:** If stuck, I use my foot to loosen the nut, turning counterclockwise, being careful not to slip off the nut and hurt my already scarred skin in the process. Remove the nut and push or tap the bolt out of the mount and shock. Use a punch if it sticks. Bag and save the nut and bolt together.

Pull the base of the shock toward you and out of the mount. Then push the bottom half up into the top part. When the shock is collapsed, it can be dropped out of the top mount and removed from the vehicle. Presto.

Step 5: Assemble and Install the New Shock.

Almost all new shocks come with instruction sheets that describe how the washers and grommets have to be installed in the correct positions. Make certain there are new washers, grommets, and nuts. There should be.

The top of the shock is the end with the stud on it. Fit one metal washer over the stud (cupped side up). Next slip a rubber grommet (flat side up) over the stud. If it sticks, use soapy water rather than oil to make it slide. Pick up the shock and bleed the air out of it according to the instructions or by reading Proc. 7.

Compress the shock and turn the lower half so it's aligned with the hole in the mount. Work the shock into the mount using penetrating oil and tapping to send it home. Coat the length of the bolt with anti-seize compound and install it from the front 2WD (rear 4WD).

•**2WD:** Start the nut onto the bolt with the flat side toward the mount. Tighten the nut slightly with a 17mm box-end.

•**4WD:** Your bolt threads into the mount. Don't fully tighten the bolt yet.

Extend the shock and fit the stud through the hole in the top mount. Find the new washer that has a little lip on one side. The lip fits over the stud and centers into the hole on top of the mount. The cupped side of the washer faces upward. Pick up the second rubber grommet. Fit it over the stud and down onto the washer. Put the last washer (cupped side down) over the stud and onto the grommet.

Turn the lower (or only) nut(s) clockwise down the stud until it touches the top washer, and stop. Start the second nut (if you have one) onto the stud until it is just above the first nut, then stop.

Use your 14mm open-end to tighten the lower nut. You may have to hold the squared top of the stud with the Vise Grips again. Compress the upper grommet until there's ½ to 3/8in between the washers on either side of the grommet. The lower grommet will also compress. If you have a deep socket and torque wrench, the rating is 14 ft.lbs. If you have it, turn the second nut down the stud onto the first nut. Hold the lower nut with another 9/16in or 14mm wrench, tighten the top nut until it locks tight against the bottom one.

Repeat Steps 2—5 on the opposite wheel.

Step 6: Install the Wheel and Lug Nuts, Lower the Truck; Tighten the Lug Nuts and Shock Fasteners.
Refer to Ch. 13, Pt. 1, Proc. 1. When the truck's on the ground tighten the lower shock bolts (and nuts). Grab and wiggle the shocks to make sure they're secure.

PROCEDURE 6: REMOVE AND REPLACE REAR SHOCK ABSORBERS

NOTE: Read **Remarks** in Proc. 5 for gas shock information.

Condition: You have run the checks in Proc. 1 and 2 and think the shocks are worn. It helps to squirt all the accessible nuts and bolts that hold the shocks with penetrating oil a few hours or days before doing this.

Tools and Materials: Penetrating oil, 12, 14, and 17mm wrenches and sockets.

Remarks: The accurate way to test a shock absorber is to disconnect one end (Steps 1 and 2), then move the shock absorber up and down to see if it's working smoothly. Do this if you're not convinced you need new shocks.

NOTE: The rear shocks on 1980 4WD trucks are the same as 2WD.

Step 1: Jack the Vehicle off the Ground.
You need only raise the rear of the vehicle (Ch. 13, Pt. 1, Proc. 1).

Step 2: Identify and Loosen the Lower Shock Mountings.
The shock absorbers connect the rear axle housing or supports and the vehicle body or frame. The function on all models is the same but the mounting locations are different. In all cases you must get on your knees or lie on your back to see the mounts.

•**510 and 610 Sedans with Independent Rear Suspension:** Look from the rear of the car at the inside of the rear wheel to see where the bottom of the shock absorber is mounted and held by a 12 or 14mm nut. Use a box-end wrench or socket to loosen and remove the nut. Also remove the washer(s) behind the nut.

•**510, 610, 710 Wagons, and 710 Sedans:** To the inside of the rear wheel under the axle housing find a bracket that secures the leaf spring and axle housing. The shock absorber is attached to the inside of this bracket and held in place by a 17mm bolt, or nut. Loosen and remove this nut with a box-end wrench or socket. Save the washers under the nut.

•**510 Sedan and Hatchback 1978 on:** The shock absorber is on the rear side of the axle housing directly behind the coil spring. The shock is attached to a bracket that is part of the housing. A 12 or 14mm nut and bolt secure the shock to the mounting. Hold the bolt head with an open-end wrench as you loosen and remove the nut followed by a lockwasher. Tap the threaded end of the bolt out of the bracket with a hammer.

•**510 Wagon 1978 on:** The shock absorber is attached to the bracket or seat that connects the leaf spring and the axle housing. The shock sits in the bracket and is held by two 12 or 14mm nuts from below the bracket. Remove the lower nut by holding the upper one with an open-end wrench or the stud with Vise Grips. Remove the upper nut and washer.

•**521, 620, and 720 (2WD):** The lower end of the shocks are mounted at the front of the rear axle to a steel pad. The shock is held by two 14mm nuts. At the top the shocks fit onto bolts welded onto the frame rail. Nuts (14mm) hold the shocks to the bolts. Remove the lower nut by first holding the end of the stud with a Vise Grips if necessary. After that, remove the second nut if there is one. You can now push the shock up out of the pad.

•**4WD:** The lower end of your left shock is mounted on the front of the axle and the right on the backside of the axle. They're held on by 17mm nuts. Remove these and slide the shocks inward, off of their mounting studs.

Step 3: Stroke the Shocks.
This does not apply to gas shocks. They will extend by themselves when unpacked.
With one end of the shock disconnected you can test its condition by stroking it. It's easier to tell if you know

how stiff and smooth a new shock feels. Once it has been "bled" the new shock will take some effort to collapse and extend without skipping during the strokes. If in doubt, replace your shocks with a new pair.

Step 4: Find and Remove Upper Shock Absorber Fasteners; Remove Shock.

•**510 Station Wagons:** Follow the shock tube up to where it is attached by a rectangular mount plate to the floor of the car. Use a 12mm socket to remove the four bolts and washers from the plate. Hold the tube to keep it from dropping on you. Tap the plate lightly to separate it from the body. The shock absorber and plate will then come free, once the base is pulled off the mounting bolt. Don't discard the old shocks. You *must* keep the rectangular plate.

•**510 and 610 Sedans:** Open the trunk of the car. Inside of the compartment toward the front, left or right of the cardboard partition, find the threaded tip and two 12mm nuts that secure the shock to the body. Loosen and remove the top nut with a wrench. Hold the lower nut or stud with a second wrench or Vise Grips, if necessary. When the nuts are off, go under the car and pull the shock absorber away from the lower mount and down out of its upper perch. Go into the trunk and collect the rubber and steel washers that went around the top of the shock.

•**510 Hatchbacks 1978 on:** Raise the hatchback and find the nuts on the inside of the wheel well. Otherwise your instructions are the same as **510 and 610 sedans**.

•**610 and 710 Station Wagons:** Lie under the rear of the car to look up at the top of the shock absorber. There is a bow-shaped mount held against the body by two 12mm bolts. Use a socket and extension to loosen and remove the two bolts. Keep one of the bolts in place until ready to handle the shock tube. Pull the lower end off the mounting and set the unit aside.

•**510, 620, and 720 Models:** Work from under the rear. Find the upper mounting by following the shock to the top where it mounts to the frame. Use a 17mm socket or open-end to loosen and remove the nut. Remove the washer under the nut, then pull the top of the shock off the mounting stud.

•**510 Station Wagons 1978 on:** The upper shock mounting is accessible over the top of the rear axle housing. A 17mm nut holds the top to the car body. Use a socket or open-end to remove the nut followed by a flat washer. Now both ends of the tube will pull off their mounting studs.

•**Everyone:** If the shocks are stuck to the mountings, use a large screwdriver to lever them off carefully.

Collect all of the various rubber grommets and washers that may have come off with the shock. Store the nuts and their washers back on the stud or bolt from whence they came. Don't discard any of the old parts until you have purchased and installed the new ones.

Step 5: Bleed the New Shock Absorber.

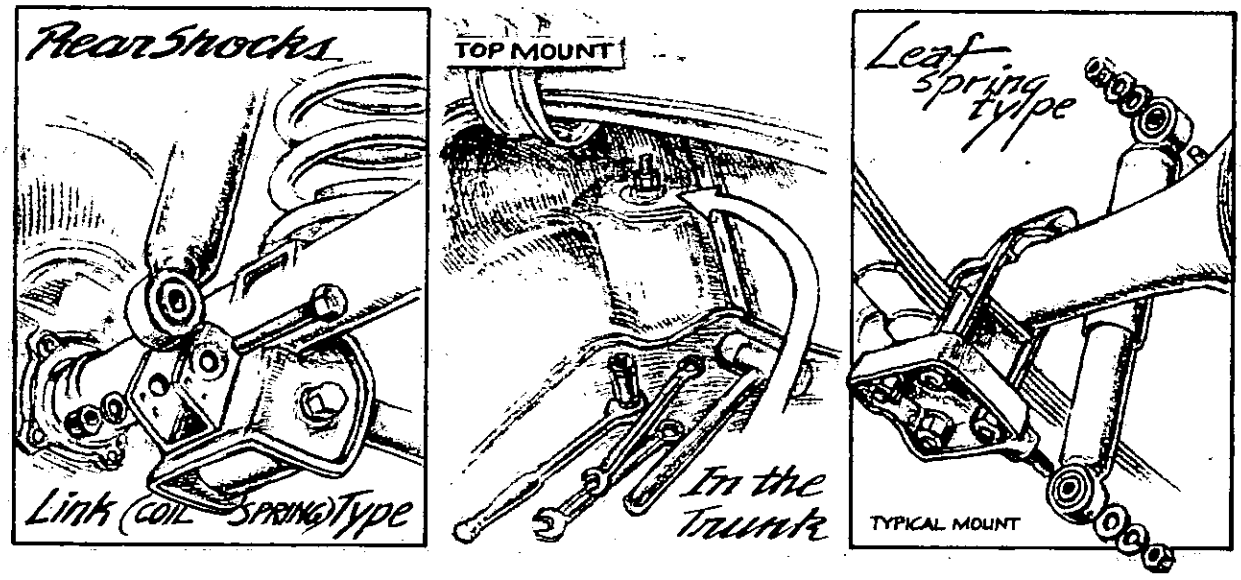
Hydraulic Shocks Only: Proc. 7 tells you how to bleed a shock; your new shocks may also contain an instruction sheet that covers bleeding and installation. Whichever path you follow, be sure to bleed each unit before installation.

Step 6: Install the New Shock Absorber.

NOTE: Read the instructions that come with the shocks for information.

•**510 pre-1978 Station Wagon Models:** Use a 12mm open-end to remove the nuts and washers holding the plate to the upper end of the shock absorber. Keep the washers and rubber grommets in their original position by slipping them back onto the mounting stud. Lay out the new shock, washers, rubber, and grommets. Scrape off any dirt or grime from the mounting plate. Slip a washer then a grommet over the stud. If the instructions show a different combination, follow that description. Slip the stud through the hole in the plate from the indented, hollow side, followed by the next washer rubber grommet, last washer, then the nuts. Tighten the first nut until the rubber just begins to squeeze, then stop and install the second nut until it locks against the first. Before finally tightening the nuts, look at the mounting points under the car and turn the shock so the hole in the base is aligned with its mount once the top plate is in place. Tighten the two top nuts.

Find the four top plate mounting bolts and washers and clean the threads. Lubricate the threads and the lower mounting stud, then position the lower end of the shock absorber onto its mount. Position the upper plate. Install



and tighten the four bolts evenly until the washers flatten. Locate the lower washer and nut, lube the mounting threads, and slip on the washer and thread on the nut. Don't fully tighten the nut until the wheels are back on the ground.

•**510 and 610 Sedans:** Lay out the new shock parts. Slip the new rubber grommet and washer over the top of the stud and fit it up into position in the mounting in the body. Lubricate the lower mounting stud and slip the bottom of the shock mount over it, then install the washer and nut. Don't fully tighten the nut until the car is on the ground. •**610 and 710 Station Wagons:** Put a light coat of lubricant over the lower mounting stud at the rear of the spring mount. Slip the lower part of the shock over the stud while lining the top bow-shaped mounting with the holes in the body. Lubricate their threads and install the two 12mm mounting bolts and washers. Tighten the bolts until snug and the lockwashers flattened. Install the flat washer and start the nut onto the lower mounting stud. Don't tighten this nut until the car is on the ground.

•**521, 620, and 720 2WD:** Your lower mount is like the upper one. •**4WD:** The right shock mounts to the rear of the axle housing, the left to the front.

•**Everyone:** Look at the top mounting stud and sand off any rust that has built up on it. Coat the studs with lubricant.

•**2WD:** Wipe away any debris from around the lower mounting pad. Assemble the lower first washer, then bushing.

•**Everyone:** Install the upper end of the shock over the stud, then the lower shock stud into the lower pad. Place the flat washer and nut on the top mount.

2WD: Gather and assemble the remaining washer, bushing and final washer onto the lower stud. Thread on the first larger nut and tighten it until the rubber bushings begin to squeeze slightly. Start the second nut on the stud.

4WD: Install the lower end as you did the upper mounting.

•**Everyone:** Don't tighten any of the nuts until the truck is on the ground. Repeat this step on the opposite side of the vehicle if you haven't already.

Step 7: Lower the Vehicle to the Ground and Tighten the Mounting Nuts and Bolts.

Follow the directions in Ch, 13, Pt. 1, Proc. 1. Once on the ground, make sure the vehicle won't roll before sliding underneath and tightening the mounting nuts and/or bolts until snug. Tighten nuts with lockwashers until the washers flatten and nuts with grommets under them until the rubber grommets just begin to squeeze. Tighten lock nuts securely against the hold nuts with two wrenches if necessary.

PROCEDURE 7: BLEED SHOCK ABSORBERS

NOTE: This procedure applies to all hydraulic type front and rear shocks. This does not apply to gas or air type shocks.

Condition: Before a new hydraulic shock absorber is installed, it should be checked for air within the unit and bled to ensure its proper function. Read the literature accompanying the new shock.

Tools and Materials: New shock absorbers.

Step 1: Determine Top from Bottom.

The top of the shock absorber has a larger diameter than the bottom, therefore it always fits over the lower, smaller end much like a sleeve.

Step 2: Feel the Action of the Shock and Bleed the Air Out.

Hold the shock absorber at either end. A new shock should be stiff in its action when thoroughly bled, so take a firm hold of it. The bleeding procedure is done by compressing and extending the shock as many times as necessary until its total travel feels uniform (smooth). When there's air in the unit, you'll feel skips or jerks as you push and pull on the ends.

Turn the shock absorber upside down and push the ends all the way together. Now turn the shock (top side up) and pull the ends away from one another until it's fully extended. Repeat these motions, inverting the shock (top down) to compress the ends together, then reverse (top side up) to pull the ends apart.

Continue the bleeding operation until the full travel of the shock absorber feels uniform without skips or jerks. When the action is stiff yet smooth, the air will be bled from the unit. Repeat this procedure with each new shock absorber to be installed.

PROCEDURE 8: CHECK LARGE BALL JOINT (510, 610, and 720 trucks); LOWER BALL JOINTS ONLY

Condition: You have run through the front end checks (Proc. 1 and 2) or have been told that your outer ball joint(s) is worn. Or, you are just plain curious about the condition of the ball joints.

Tools and Materials: A jack that will raise the bottom of the vehicle at least 2—2½ft above the ground, jack stands and chocks, the same or another jack that will fit under the outer end of the lower control arm to raise it once the vehicle is supported off the ground, a strong pry bar (2x4, or piece of pipe at least 3ft long), an assistant, a ruler, and grease gun.

Remarks: Ball joints on cars seldom wear out because of the lightness of the vehicle unless you drive on rough roads. Truck ball joints, on the other hand, often come from the factory a little loose. Nevertheless, alignment shops have been known to replace ball joints unnecessarily. The vehicle must be on solid ground, tires inflated. Before jacking up the vehicle, notice the angle between the lower control arm and the inside vertical plane of the front wheel. When jacking up the control arm (Step 2) raise it high enough to match this angle.

NOTE: Upper truck ball joints aren't covered in this Procedure. See an alignment specialist if you suspect that's the problem.

Step 1: Jack, Chock, Block, and Raise the Control Arm.

See Ch. 13, Pt. 1, Proc. 1 to jack and support your vehicle safely so the crossmember under the engine is 2—2½ft off the ground. Once supported, put the jack under the control arm close to the inside of the wheel you're going to test. Don't put the jack right under the ball joint but a little to the inside of it. Since the control

arm is now at an angle, the top of the jack will slip inward unless lodged in the hollowed part of the control arm or up against one of the bolt heads or ends sticking through the bottom of the control arm. Depending upon the type of jack you use and the amount of space between it and the bottom of the control arm, a piece of wood, placed between the jack and the arm, may help. NOTE: Do not damage the grease fitting at bottom of ball joint.

You want to jack the control arm up high enough so the suspension and wheel are in the position they would be with the vehicle on the ground. Jack the control arm up high enough so the vehicle just starts to come off the support stand on that side.

Step 2: Set Up to Test.

The idea is to see how much vertical motion there is in the ball joint. This test also reveals the amount of play between the lower control arm and the steering knuckle (and strut in cars or upper control arm in trucks). Turn the wheels straight. Have your assistant place the long pry bar in under the tire, positioned so when he or she lifts on the outer end of the bar, it will act as a lever against the bottom of the tire.

Look at the outer end of the control arm where the ball joint dust cover (rubber) is sandwiched between the control arm and the steering knuckle. You want to watch and measure the amount of play, if any, between the control arm and the steering knuckle when your assistant pries up on the lever.

Hold your ruler flat against the front of the knuckle. Position it far enough down to reach the front and top of the control arm. Line up one of the marks on the ruler with the top of the control arm and your eyeball level with the mark. Have your friend pry upward on the bar. The movement between the arm and the strut base will be slight, at worst, so watch carefully. It may take a number of tries before you see what's going on. There is a good chance that no play exists. If it is more than 1/16in or 1mm of play the ball joint is worn out. Repeat the test on the opposite wheel after moving the jack and pry bar.

If the play is slight and your problem is severe, look more closely at the rest of your front end components before condemning the ball joints.

•**Car People:** You should check the tightness of your MacPherson struts (Proc. 4).

•**Everyone:** If your ball joints are healthy, grease them (Ch. 3, Proc. 11). If the boots are ripped, check and grease them regularly.

Step 3: What to do Next?

I don't cover ball joint removal and replacement because it's not a frequent problem and it requires at least one special tool: a pickle fork or puller. The work should be done by a reputable front end specialist or qualified mechanic. Anyway, it's a good idea to get a second diagnostic opinion, and if possible, read Proc. 1 and 2 as well as have the mechanic show you what and where the problem lies. Have the alignment checked too. If you're a trucker, check your trim height (Proc. 9) before getting an alignment.

PROCEDURE 9: CHECK AND ADJUST RIDE (TRIM) HEIGHT (521, 620, and 720 Trucks)

Condition: A lovely feature of your Datsun/Nissan truck is that it has adjustable torsion bars for front suspension. If your truck sags or the truck has high mileage on it, you will want to do this procedure. Before beginning, fill the tank with fuel and most of all *inflate the tires when cool to the recommended average pressure.* The truck should be unloaded, crankcase full of oil, radiator full of water, with the spare tire and jack in the truck. The tread wear on the front tires should be even. Do this before you have the front end aligned, and after installing new shock absorbers, especially gas shocks.

Tools and Materials: Stiff tape measure or 1ft ruler, 17mm open-end and socket (521 people need a second wrench, an 11/16in or adjustable will work), fingernail polish, paper and pencil, and an assistant.

Remarks: These specifications for height are valid for standard height wheel and tire sizes only. This adjustment will affect alignment. For you rough guys, heavy duty torsion bars are available through the competition catalogue at your Datsun/Nissan dealer. I don't tell you how to install them though.

Step 1: Park on a Firm, Level Surface and Jounce the Truck to Measure the Height.

In order to obtain an accurate reading, the truck has to be on absolutely level ground with all of the conditions mentioned above fulfilled. Put the truck in gear and the emergency brake on before making the measurements.

Stand on the front bumper and bounce up and down to jounce or exercise the front end. Get it rocking then let it settle. Now roll the truck forward and back a few feet. Stop this rocking and rolling and block the wheels, brakes on and truck in gear. You're ready.

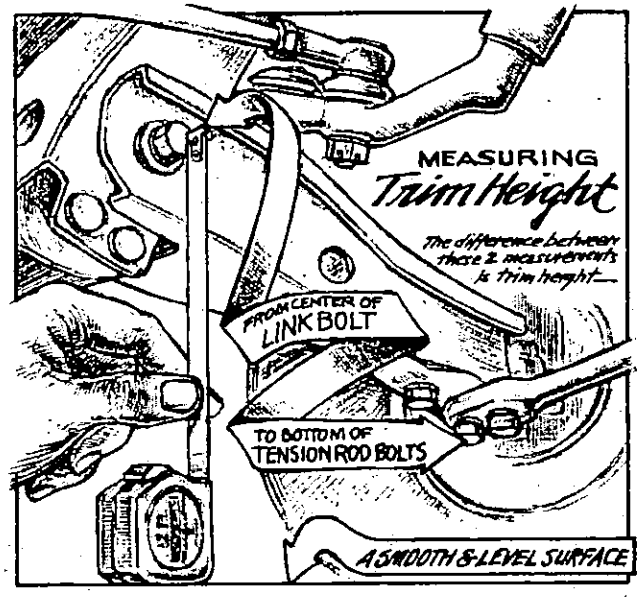
Step 2: Locate the Points of Measurement and Do It.

Lie on your stomach in front of the truck looking at one of the lower control arms, right or left. Follow the arm inward to find a bolt head. The center of this bolt head is one of your reference points.

•**521 and 620 Models Through 1977:** On the other end of the control arm there's another bolt at the base of the king pin support with a plug or maybe a grease fitting in it. The center of this bolt will be the other point of reference.

•**620 and 720 Models (1978 on):** On the bottom outer end of the control arm the tension rod (2WD) or compression rod (4WD) attaches by two bolts. The flat top (upside down) of the rearmost bolt will be your second point of reference.

•**Everyone:** Put chalk or paint marks on your reference points.



Step 3: Make your Measurements.

Calculate the distance between the bolt center of the inside reference point and the ground with your tape measure. The tape has to be perpendicular to the ground to get accurate measurements. Write the distance down. Move over to the outer end of the control arm and measure between the outer reference point and the ground. Record the distance, then subtract the larger measurement from the lesser measurement.

The correct trim height measurements given in the following table:

1969-76 521 and 620: 3-3/32—3¼in (78-82mm)
1977 620: 3-1/8—3-5/16in (79-100mm)
1978-83 (12/82) 620 and 720: 4-7/8—5-1/16in (124-129mm) 2WD
720: 5-9/32—5-15/32in (134-139mm) 4WD
1983½ (1/83)-1984 720:
2WD King Cab 4-7/16—4-19/32in (113-117mm)
2WD Regular Cab 4-5/8—4-13/16in (118-122mm)
4WD King Cab 1-17/32—1-11/16in (39-43mm)
4WD Regular Cab 1-¾—1-15/16in (44-48mm)
1985-86 720: 5-½2—5-3/16in (128-132mm) 2WD
2-3/32—2¼in (53-57mm) 4WD

Repeat the measurement on the opposite side, recording the measurements and figuring the differences. The torsion bar on the driver's side frequently sags more.

Step 4: What to Make of the Differences?

If the difference between the measurements is lower than the specified amount, the truck has sagged. If greater, someone has been tampering with the height adjustment. If one of the sides is a lot lower than the other and can't be adjusted up, or if it sags a lot when someone sits in the truck, there may be something more serious wrong. Consult an alignment or suspension expert. If the measurements are the same or close to the same and within the specified amount, you can go on your way feeling trim and riding high. For proper handling and safety, the differences should be close to specification. Gas shocks tend to raise the truck's posture.

Step 5: Make the Necessary Adjustments.

On 2WD it's easier to jack up the truck to reach the adjustment nuts, but it's not necessary. Do one side at a time. Put the jack under the frame behind the door so the back lifts before the front on the side you want to adjust first. Keep the jack in place and, of course, a jack stand (Ch. 13, Pt. 1, Proc. 1). You have to lower the truck each time to check your adjustment. Crawl under the truck near where the door is. Wear safety glasses to keep dirt out of your eyes. The anchor or adjustment bolts are on either side of the driveshaft. Find and follow the torsion bars back to where they attach. The bottom of the bolt attaches to the torsion bar anchor and the nuts on the threaded end of the bolt secure the bolt to the frame. (The torsion bar is on the outer side of the anchor piece and runs forward through the crossmember to the lower control arm.) If the nut on the top end of the anchor bolt is kept from turning and the bolt is turned clockwise, the torque on the torsion bar will be increased and that side of the truck will rise. If it is turned counterclockwise, the torque will be decreased and that side will be lowered. One full turn of the bolt should affect the height by 1/8-9/64in (3mm). Before beginning, figure out how many turns or fractions of a turn it will take to put the height within specification. Mark one side of the bolt to use for reference. (It is easier for me to figure it out in millimeters rather than inches.)

On the top side of the adjustment bolt, find two 17mm nuts. Squirt some penetrating oil on these. The top nut is a lock nut. You have to loosen this first. The bottom nut is the one you'll have to keep from turning. Loosen the top nut a few turns. Mark the bolt for reference. Now turn the anchor to raise or lower the side to within specification. When that's done, retighten the locking nut and repeat the process on the opposite side, if necessary, following your calculations.

Once the adjustment is made, lower the truck and recheck your measurements as in Step 2. Repeat the procedure until the trim height is correct. It may take a number of tries to get right. Each time you lower the truck, jounce the front end before making measurements.

If the driver's side is a hair higher than the passenger's, it's okay because it's more often occupied.

PROCEDURE 10: REMOVE AND INSTALL SPINDLE AND SUPPORT ARM FROM CONTROL ARMS; KING PIN REMOVAL AND REPLACEMENT (Trucks, 521, and 620 Through 1977)

Condition: This procedure tells you how to have your king pins renewed by the machine shop. While it's possible to remove the pins on the truck with few tools and little experience, it's easier to take the knuckle spindle and the knuckle arm off the upper and lower control arms and have a machine shop press the king pins out and install and ream the new bushings.

Tools and Materials: Jack, basic tool kit. New slotted pin 521 (#40023-30000), 620 (#40023-B5000) from Datsun/Nissan, your new upper link bushings (#54519-08700). 11/8in or 28mm socket, open-end or large adjustable wrench, a 2x4 1½ft in length, some mechanic's wire, fingernail polish.
NOTE: 521 and 620 king pin kits are very different from factory replacement kits are slightly different from after-market kits; the factory bushings come pre-drilled. You may want to order or make sure you can get the kit before starting this work.

Remarks: When raising the truck, be sure to lift it so the lower control arms are high enough to fit a jack under the control arm. Before performing this procedure take your truck to an alignment shop to have the front end completely checked out. They can tell you if the king pins are really worn and/or if the control arm inner and

outer bushings are worn; the outer control arm bushings can be repaired while you're doing the king pins. Brake work, shock or idler arm repair, grease fitting installation, front wheel bearing servicing, and other front end work can be conveniently done while the king pins are apart. (See the index to locate and check these parts before disassembling the king pins.)

Step 1: Jack, Chock, and Block the Front of Truck; Remove the Front Wheels and Drums.

Complete jacking safety information can be found in Ch. 13, Pt. 1, Proc. 1.

The steps to remove the hub cover, spindle nut, washer, outer wheel bearing, and brake drum can be found in Ch. 5, Proc. 6 (4). Once the hub and drum are removed, return here and perform Step 2. If you want to inspect the wheel bearings, read Proc. 3.

Step 2. Remove the Backplate from the Spindle.

Put on your safety glasses please.

With the brake drum removed the brake components are visible. The backplate is the round black steel plate behind the brake shoes and springs. It is bolted to the spindle casting. There are four bolts to be removed.

•**521 People:** The two bottom bolts have a locking retainer under them with the corners of it bent up around the heads of the bolts. Flatten these tabs against the backplate with a screwdriver tip tapped between the bolt and the corner of the retainer. Then, with a punch flatten the corner out enough to fit a 14mm socket over the bolt head. The bolts are tight, so be prepared. Put your body against the truck and pull up on the ratchet counterclockwise to loosen and remove the bolts. The upper bolts have nuts behind them with lock washers, thus no retainers. Put the box end of an open-end wrench over the nuts on the inner side of the backplate and the socket over the bolts on the brake side. Remove the two upper bolts. Put the nuts and washers back on the bolts once they've been removed. Bag these four bolts and the retainer labeled "backplate."

•**620 Models:** Find your 17mm socket, ratchet, and extension. Position yourself with your body against the truck, press the socket fully on the bolt head and pull the ratchet handle upward counterclockwise. When they are removed, bag and label them "backplate."

•**Everyone:** The backplate will now come off by wiggling the plate toward you and carefully over the spindle. The brake parts will stay attached to the backplate. Tie the backplate to the truck frame with a 12in piece of wire through a hole in the plate. Do not let it hang from the flexible brake line.

Step 3: Remove the Steering Knuckle from the Spindle Base.

Lie on your back to see the two 19mm bolts that hold the steering knuckle onto the spindle. The steering knuckle is the cast-iron piece that links the side rod and the spindle. Follow the knuckle back from the side rod end and under the spindle to find the two bolts. There's a retainer that keeps the bolt heads from coming loose; its corners are bent up against the sides of the bolt heads. Scrape off excess road dirt for a better look. Wedge a screwdriver tip in between the retainer and the bolt head. Use your screwdriver to bend flat the two corners over each bolt head. Put a 19mm socket over the bolt head and tap on the socket to flatten the corners flush with the knuckle.

Get on the left side of the truck. Fit the 2x4 1½ft block so its wide side is against the front of the control arm. You want to lock the steering by wedging the block between the inside of the steering knuckle (behind the side rod) and the outside of the tension rod mount. Position the 2x4 so you have access to the bolt heads and can keep the knuckle from turning as you work on the bolts.

Position yourself to remove the bolts counterclockwise. Working upside down can be confusing so think twice. Once the bolts on the left side are loose go to the right side and loosen those. Remove the bolts along with the locking plate. Bag and label them "knuckle to knuckle arm." The steering knuckle may need to be tapped a few times before dropping off. Turn the knuckle forward and out of the way. Remove the 2x4 if still in place.

Step 4: Place Jack and Raise the Lower Control Arm.

The spindle, which turns, and support, which connects the control arms, are connected by the king pin. You can disconnect the spindle and support together from the control arms. Because there is spring (torsion bar)

tension on the upper control arm, it's necessary to place a jack under the lower control arm and raise it slightly. Follow the support down to where it connects to the lower control arm. Follow the control arm inward to where the Y comes together. Position the jack just behind and under this joint. Once there, raise the jack just until the truck begins to lift, then stop. Make sure the jackstand supporting the truck stays put, and that the top of the jack is safely placed under the control arm.

Step 5: Remove the Upper Fulcrum Bolt.

Follow the support *up* to where it connects to the upper control arm. On the front side of the control arm there's a nut and, on the rear, a bolt head. Hold the bolt with a 19mm open-end wrench while turning the nut counterclockwise with a 17mm socket.

•**521 People:** There is a star washer under the nut.

•**Everyone:** Set the nut aside and try to push the bolt rearward out of the control arms. If necessary, use a punch and hammer to drive out the bolt. Place the nut back on the bolt bagged and labeled "upper control arm to support."

The spindle and support can now be pulled out from the top control arms and swiveled down to hang on the lower fulcrum pin. Remove the two rubber bushings from the support. These you'll probably want to replace.

Step 6: Remove the Slotted Lock Pin from Lower Fulcrum Pin.

Now look at the bottom inner side of the support, just above its rounded base (boss), find a 10mm nut on the end of a pin that goes all the way through the support. The pin is tapered to prevent the fulcrum pin from turning and has an unusual, smooth head barely visible from the outer side of the support. Loosen and remove the nut as well as the washer under it. Squirt the pin with some penetrating oil and wait. Thread the nut back onto the pin until it is just flush with the top of the threaded end of the pin then pick up the smallest hammer you have and begin tapping on the nut and pin. Keep tapping, harder if necessary, until the pin begins to move out of the support. Remove the nut and drive the pin the rest of the way out with a smaller bolt or punch. Put the washer and nut back on the pin and save them. If the pin is still straight, not bent in the slightest, it can be reused. Otherwise, it must be replaced with a fulcrum cotter pin.

Step 7: Remove the Pushing Caps, Fulcrum Pin and Dust Boots from the Lower Control Arm and Support.

At the base of the support where it attaches to the lower control arms, there's a fulcrum pin with a bushing threaded onto either end. The bushings thread into the control arm and the fulcrum pin. Their hexagonal heads are 11/8in or 28mm. Use an open-end wrench or socket or an large adjustable wrench. To loosen the bushings, starting with the *rear* one, turn counterclockwise enough to loosen the bushing, then stop. Now loosen the front bushing by also turning counterclockwise. Remove them by hand, both at the same time to test your coordination. Mark the front one with fingernail polish, then store both in a bag labeled "bushings."

The fulcrum pin is now visible at either end. Hold the support and spindle as you push or carefully tap out the fulcrum pin. Mark the front of the pin with fingernail polish. Keep left and right parts separate. The support and spindle are now free.

•**521 People:** Remove two rings (washers) from each end of the lower support.

•**620 People:** Remove two dust covers and their spring rings from each end of the lower support.

Step 8: Take the Assembly to Datsun/Nissan or an Automotive Machine Shop for King Pin Replacement.

NOTE: Use fingernail polish to mark the supports and spindles right and left. Call around to find the best deal, explaining that you want king pins and bushings removed and replaced, the bushings sized (reamed) and the lot reassembled.

•**620 People:** In your king pin kit there's a rubber-coated cap that fits in the lower king pin hole. Have the machinist leave this cap off for you to install. Take the fulcrum pin, bushings, upper fulcrum bolt, and rubber bushings with you to the machinist for him or her to inspect. Get new parts from Datsun/Nissan if necessary. Keep these parts separated, left and right. Have the machinist also install new grease fittings into the spindle.

Step 7: Install the Bottom Support Boss Into Lower Control Arm and the Lower Fulcrum Pin into Both.

Make sure you know on which side each of the two spindles goes. Start by differentiating top from bottom. The bottom of the spindle is the larger of the two ends (bosses) and the grease fittings or holes for the fittings face forward. Find the lower fulcrum pin. It has two threaded ends and a slot in the center of it. Also locate the slotted pin that's new or in good condition, as well as the washer and nut. Clean all the parts including the holes through the upper and lower control arms as well as the holes through the upper and lower support bosses. Spread a film of grease over the lower fulcrum pin and pick up the support and spindle.

•**620 People:** Install the dust boots over the bottom support holes. Keep the spring rings over the boots.

•**Everyone:** Align the lower support boss—the bottom part of the support piece—with the holes in the lower control arms. Install the fulcrum pin through the control arm and the support. Let the spindle pivot down and pick up the slotted locking pin. The pin fits through from the outside or spindle end of the support. The fulcrum pin has to be turned so the slot in it is lined up with the hole in the support. Look through the hole and turn the fulcrum pin until you can see through the hole. Insert the slotted pin with its flat side toward the fulcrum pin. Don't force the slotted pin in any way. When all is as it should be, the pins will fit nicely together and the threaded end of the *little* pin will be sticking through the support. Install the lockwasher and nut and tighten them until the lockwasher flattens.

•**521 People:** Put on the fulcrum pin rings (washers), one over each end of the fulcrum pin.

Step 8: Install Lower Fulcrum Pin Bushings.

The two screw bushings fit on the threaded ends of the fulcrum pin. Clean the bushings inside and out, then coat the threads inside and out with a dab of grease and begin screwing them onto the fulcrum pin, one at either end clockwise. Finish tightening them with a 11/8in or 28mm open-end or socket as tight as you can. When both of the bushings are tight, remove the plugs at their ends and install grease fittings if not already there. Lift the support and spindle up and down a few times to see that it moves freely.

Step 9: Install Upper Fulcrum Bolt Through Control Arm and Support Boss.

You stashed the nut, washer (521 Model only) and fulcrum bolt together. Install the rubber bushings tapered end into the upper support boss. Push the support and spindle up into the upper control arms. You can raise or lower the jack below the lower control arm to line up the hole in the support with the control arms. If the support's upper boss does not fit between the control arms, use a little soapy water on the inside of the rubber bushings.

Install the fulcrum bolt from the rear through the holes.

•**521 Model:** Place the washer over the threaded end of the bolt.

•**620 Model:** You have a self-locking nut. The flat, square end of the nut goes on first toward the control arm.

•**Everyone:** Start the nut onto the threaded end of the bolt. Tighten the nut with a 17mm socket while holding the bolt head with a 19mm open-end wrench. If you have a torque wrench, the rating is 35 ft.lbs. Without a torque wrench, tighten it securely. Repeat these steps on the other side of the truck, then go on to Step 10.

Step 10: Install the Steering Knuckle.

•**620 Model:** On the bottom end of spindle, over the bottom king pin hole fits a black rubber-coated grease dust cap. The machinist left these off and now it's time to install them. The caps are cupped on one side and flat on the other. Insert the caps with the flat side down, cupped side up toward the king pin. The flat side will be flush with the bottom of the spindle once installed.

•**Everyone:** Clean off the base of the spindle and pick up the steering knuckle. Scrape away any rust and scale on the upper side of it. Find the two 19mm headed bolts and the retainer plate with two holes in it. Clean and lube the bolts' threads and set the bolts close by. Turn the steering knuckle rearward fitting it into the base of the spindle. Put one of the bolts through the retainer and start it in through the knuckle and into the spindle, turning clockwise. Once it is started, line up the other side of the retainer and install the other bolt. Tighten the bolts as tight as you can, alternating one to the other. Do the same on the opposite wheel. Turn back to Step 3

and reposition the 2x4 between the knuckle and stabilizer bar on the **right** rather than the left side. Tighten the bolts. The torque rating for these hefty bolts is 80 ft.lbs. or as tight as possible without cheating. Tighten both sides then bend the edges of the retainers over the sides of the bolt heads with a punch and hammer, two tabs over each bolt head. Remove the 2x4.

Step 11: Install the Backplate onto the Spindle.

The brakes are still on the backplate unless you removed them for servicing. Do not contaminate brake surfaces with grease. The plate is tied aside to the frame.

Untie the backplate and fit it over the axle, with the wheel cylinder on top.

•**521 People:** Line up the holes and insert the two top bolts after separating them from their nuts and washers. Install the washers and nuts onto the opposite side of the spindle but not too tightly. Then install the two bottom bolts with retainers underneath and tighten until the bolts just touch the backplate Pick up a 14mm open-end and put it on the nut while you tighten the other side with a 14mm socket. Do not fully tighten the bolts yet. Now use the socket to tighten the lower bolts as tight as you can. Tighten the upper bolts until the lockwasher flattens. Put the tools down and pick up a screwdriver to pry the retainer's corners up and over the bolt heads, then tap the corners flat against the sides of the bolts.

•**620 People:** Find the four 17mm bolts with lockwashers. Line up the holes and thread the bolts through the backplate and into the spindle. Tighten the bolts with a socket in a crisscross pattern until the lockwashers flatten and then give them a good umph.

Step 12: Install Brake Drum and Adjust the Wheel Bearings.

This is an ideal time to inspect and repack your wheel bearings (Proc. 3 [7 on]). Once you are satisfied with the condition of the bearings and the brakes, make sure the inner grease seal is in place and install the drums (Ch. 5, Proc. 6 [6]), then return to this chapter (Proc. 3) to adjust wheel bearings.

Step 13: Grease the King pins and Check for Leaks.

Now is the time to start the maintenance of your new king pins. From here on in you will remember what it takes to replace the pins and keep them lubricated. While you are at it, locate all the other front end fittings and give them some grease, too (Ch. 3, Proc. 11). But first read through this step.

While you grease the king pins, notice the following things.

•**521 People:** Watch the top dust cap on top of the king pin hole to see if any grease squirts from around its edges. If it does, curse and go get a hammer and punch. Start tapping around the edges until you think the problem is solved and grease again. Keep trying until the cap is seated properly.

•**620 People:** Watch the grease relief valve on top of the upper dust cap. When full, grease should escape from this valve and not from around the edges of the cap.

•**Everyone:** Now grease the lower fitting and watch the grease ooze from between the lower spindle and the support. Lube the opposite side.

Step 14: Replace the Wheel and Adjust the Front Brakes.

Pick up the wheel and tire and place them over the six studs on the drum. Install and tighten the lug nuts until the wheel is centered, then tighten the nuts so the wheel doesn't wobble. Now turn to Ch. 5, Proc. 2, to adjust the front brakes before lowering the truck.

Step 15: Lower the Truck and Tighten the Lug Nuts.

Lower the truck and tighten the lug nuts when the vehicle is on the ground (Ch. 13, Pt. 1, Proc. 1).

PROCEDURE 11: CHECK AND REPAIR IDLER ARM AND IDLER ARM BUSHINGS

Condition: You have difficulty steering your car or truck and have determined that the idler arm is part or all of the problem (Proc. 1 and 2). When you move the idler arm up and down firmly, there is play between it and

its bracket. There may also be excessive side-to-side play in the arm and/or the small ball joints, which makes the steering feel mushy and causes premature tire wear.

NOTE: It takes some skill and/or special tools for non-mechanics to safely remove and replace the idler arm as a complete assembly. For these reasons I don't cover it in this book and recommend you take the job to a mechanic or front-end specialist. On certain models, however, it is possible to rebuild the assembly with new bushings while the bracket is bolted to the vehicle, and in this procedure, I'll tell you how.

Models with replaceable bushings (available from Datsun/Nissan or other sources):

Cars	Part #
510 (A-10) 1978 on	48544-H1000

Trucks	Part #
720 2WD	48544-H1000
4WD	48544-H1W00

*Truck bushings are also available in brass from an after-market source (see **Remarks** below).

Models on which you have to replace the **complete** idler arm assembly (available from Datsun/Nissan or other auto parts suppliers):

Cars	Part #
510, 610 and 710 (1969-1977)	48530-21400

Trucks	Part #
521 and 620 (drum brake 1970-7/1977)	48530-B2000
620 (disc brake from 7/1977)	48530-B9510

NOTE: For advice on replacing the whole assembly, see Step 1.

Remarks: Many 720 trucks 2WD and 4WD vehicles have mushy steering which causes handling and tire wear problems. Hank Schmidt from Eugene, Oregon, frustrated by his new 720 truck is wearing out tires, traced the problem to the plastic idler arm bushings. He decided to machine new ones out of brass and after testing the bushings now markets them. He has 150,000 miles on a set he's had in two trucks and tells me they hardly look worn. I have sold many sets to customers who are thrilled with the results. The bushings are only available for 720s; 2WD trucks take different bushings from 4WD. Some 2WD idler arm shafts are oversize so Hank sells two sizes; you may have problems getting the right set. Also some 4WD bushings have to be reamed to fit. It's uncanny how Nissan got so intolerant in making these idler assemblies.

Hank Schmidt
A/E Precision Tooling
1240 Taney Street
Eugene, OR 97402
(503) 689-4932

NOTE: These bushings may save you a set of front tires. Don't replace front end parts until you've tried this simple remedy. **Caution:** Do not overtighten the assembly nut; follow the enclosed instructions carefully.

Tools and Materials: Bushing People: Grease gun and grease, bushings, basic tool kit, and a torque wrench.

Step 1: To Replace the Complete Assembly.

Call around to get estimates on the job. **521 and 620 Drum Brake People:** Your idler arms take more labor to remove and replace than other models. **Everyone:** Datsun/Nissan dealers usually stock idler arm assemblies, however, most other parts stores have to order them. All truck idler arms are greaseable from the top or side, but many have grease fittings and, as a result, wear out (Ch. 3, Proc. 11). Get a 6mm or ¼in grease fitting and have the installer put it in and grease it for you. When you're sure the parts are available, call around to get price quotes and an appointment to have the new idler arm installed. You should have the alignment checked afterward.

Step 2: Replace Idler Arm Bushings.

See Condition above. Jack, chock, and block the front of the vehicle (Ch. 13, Pt. 1, Proc. 1).

•**510 People:** Follow the idler arm up through its housing to find the nut on top, which holds it all together. Remove the nut with 17mm wrench. Pull or pry down on the idler arm and shaft to slide it out of the bushings.

•**720 People:** If you're replacing the bushings with Hank Schmidt's brass ones, follow the instructions he includes. If you have a skid pan covering the front underbelly, remove it. There are four or six 10mm bolts to attach and save, labeled "skid pan." The nut holding the assembly to the housing is on the bottom side of the idler arm. Remove the nut by turning it counterclockwise, as well as the flat and rubber washers above it. The idler arm and housing can now be pulled or pried down and away from the shaft.

•**4WD:** The front differential may get in the way. If it does, you'll have to unbolt the idler assembly from the frame and raise it to drop the shaft and arm. Two 17 or 19mm bolts hold the housing. There are two nuts on the inside that may be easier to wrench from above. Remove the bolts with a ratchet. With some coaxing the shaft will drop out. Keep the washers with the bolts.

•**Everyone:** Inspect the shaft for wear. If its surface isn't smooth, you may have to replace the whole assembly and not just the bushings. In this case, reassemble the unit (Step 4) and read Step 1. Shaft wear is common on roughly used 4WD.

Step 3: Remove and Replace the Bushings.

The bushings should still be in the housing. Pry or push them out with a screwdriver or pliers. There may also be a washer/seal above the upper bushing and perhaps one on the bottom too. Don't discard these.

Clean out the housing and seal if you removed one. Press one of the new bushings into the housing. **Brass Bushing People:** Follow Hank's instructions.

•**510 People:** Smear a blob of grease into the housing between the bushing you installed and where the other one will fit.

•**Everyone:** Install the second bushing.

•**720 People:** Use grease to adhere the seals (if removed) onto the top and bottom of the bushings.

Step 4: Reassemble the Idler Assembly.

•**4WD People:** If you removed the assembly, do this step first, but don't tighten the nut until the housing is bolted to the frame (see end of this step). Get someone to turn the wheels while you line up the idler housing holes with the frame holes and insert the bolts.

•**Everyone:** Coat the shaft with grease and slip it up and into the housing (**510 People**) or the housing over the shaft (**720 People**). Hold the bushings in place as you fit the shaft. Install the steel bottom washer (**720 People**) and thread the nut onto the shaft and tighten it to 40-51 ft.lbs. (plastic bushings), and *only* 8ft.lbs. or 100in.lbs. (720 with brass bushings).

Try turning the steering wheel fully from side to side. **Power Steering People** will have to start the engine. The steering should feel smooth.

•**720 People:** If there isn't a grease fitting on the side of the housing, remove the plug and install one now (Ch. 3, Proc. 11).

Step 5: Lower the Vehicle, Recheck the Idler Nut and Alignment.

See Ch. 13, Pt. 1, Proc. 1. When it's on the ground, recheck the tightness of the idler nut and again after some driving. Have the alignment checked. Happy Motoring.

PROCEDURE 12: LUBRICATE AND ADJUST THE STEERING GEAR, SECTOR SHAFT TO WORM GEAR

This does not apply to power steering-fitted trucks (Proc. 13).

Condition: You have checked out the entire steering system and have found excessive play in the steering box. This means there is 1in or more steering wheel movement before the front wheels start to turn.

Tools and Materials: Some to ½ pint of 80W-90 gear oil, a small funnel, basic tool kit.

Remarks: If there is no further adjustment left in the screw or if the adjustment does not tighten the steering, a new box may have to be installed. Worn steering boxes are not a big problem in Datsun/Nissans, thus I do not cover their removal and replacement.

Remarks: Steering gears normally wear in the straight ahead position.

Step 1: Check the Steering Gear Oil Level.

The steering box is on the driver's side of the vehicle in the engine compartment. Stand on the driver's side looking down along the fender well. The steering column runs through the firewall from the steering wheel and connects through a linkage to the steering box. If the top of the box is covered with grease and dirt, clean and scrape it off. There are three or four bolts holding the top of the steering box in place, a nut and stud to adjust, and a removable filler plug in which you can add oil. Remove the plastic filler plug by turning it with a 14, 17, or 19mm wrench and carefully prying it upward. Look into the hole and see the level of the oil. If the level is more than ⅔in below the inside top of the housing, top it up with 80-90 gear oil by placing a funnel into the hole and pouring very slowly. Fill the box 1/8in from the top, then stop. Replace the filler plug so it's flush to the top of the box. If you have to add an inch of oil a year, there's a serious leak in the lower seal. Keep an eye on the level and have the steering box further checked and replaced by a pro.

Step 2: Adjust the Steering Box.

Jack up the front of the vehicle (Ch. 13, Pt. 1, Proc. 1), then return here.

Near the filler plug find a 14mm nut on a threaded stud with a slot in it. Turn the steering wheel fully each way and stop with the wheels in a straight ahead position. Loosen the 14mm nut with a box-end wrench, turning clockwise two full turns while preventing the slotted stud from moving with a screwdriver. Turn the steering wheel side-to-side, one turn each way then straight ahead. Now turn the slotted stud clockwise one full turn and retighten the nut slightly. Turn the steering wheel again from side-to-side and restraighten the wheels. Check the amount of play between the steering wheel and the movement of the front wheels. If there is still more than 1in of play, reloosen the nut and turn the stud in until it offers resistance, then stop and retighten the nut. Hold the nut from turning if it turns with the stud. When it's right, retighten the lock nut fully. Do not turn the stud in until it binds but only until you eliminate the play.

Step 3: Lower and Test Drive the Vehicle.

See Ch. 13, Pt. 1, Proc. 1, to lower the vehicle. Take a test drive and take the adjusting tools with you. If the steering is stiff and doesn't return smoothly after a turn, stop, raise the hood, loosen the lock nut, and back the screw out little by little, while making test drives, until it feels right. **Do not overtighten the screw.**

If there is excessive play in the steering between the box and the wheels no matter what you do, the box will have to be serviced by a pro. Make sure the lock nut is secure and the steering is safe before quitting work.

PROCEDURE 13: TROUBLESHOOT THE POWER STEERING SYSTEM; CHECK ITS FLUID LEVEL; LOOK FOR LEAKS; REMOVE AND REPLACE THE PUMP BELT; REMOVE AND INSTALL POWER STEERING PUMP AND IDLER PULLEY

Condition: You are here to remove the cylinder head or the whole engine. If your complaint is noise related, go through this procedure to try and isolate it. If it's a handling problem that persists after you have checked the fluid and drive belt condition, read through Proc. 1 and 2, then decide if you need to seek professional help.

Tools and Materials: Basic tool kit, automatic transmission fluid (Dexron Type D), new pump drivebelt (if necessary—take the old one to match).

Remarks: Don't drive with a broken belt or inoperative power steering system. I don't tell you how to fix the power steering pump or gear, because it takes special tools and lots of space to explain. If you have problems that this book can't help you with, take your truck to a pro.

To remove the pump and idler to reach the cylinder head or engine, see Steps 5-7. To check and/or add fluid, see Step 3. To check, adjust, remove, and replace the drive belt, go to Step 4.

Step 1: How Does Power Steering Work?

When the engine's running, a drive belt looped around the crankshaft pulley operates a pump that's mounted on the upper right corner of the engine. A reservoir, placed on top of the pump, supplies fluid to the system. Two hoses connect the pump to the steering gear (box). One hose provides high pressure, the other one low pressure.

When you turn the steering wheel, fluid pressure assists in moving the sector shaft and steering assembly, including the wheels. For all this to work effectively the fluid level and drive belt tension must be correct.

Step 2: So You Think Something's Wrong with the Power Steering System?

Leaks are usually the first visible sign of trouble, followed by noises. If the belt breaks or slips, the steering will feel heavy. Step 3 tells you about fluid leaks and leak checks. Step 4 describes belt checks and servicing.

The pump's hydraulic system works hardest when you turn the steering wheel. Don't keep the steering wheel turned hard right or left for longer than necessary. If you hear noises every time you turn, and adjusting the belt or adding fluid (if low) doesn't help, consult a pro.

If noises are heard all the time, you probably have bearing problems. The idler bearing is most likely the cause. To determine if the trouble is in the power steering or something else, loosen the belt so it doesn't turn when the engine runs (Step 4). If the noise disappears, the pump or idler is at fault. Spin the idler pulley by hand. If it sounds rough, the bearing's shot. You'll have to remove the idler assembly to replace it (Step 7). Make sure the idler and pump are securely mounted to the engine, and their pulleys are in line with the crankshaft pulley so the belt runs straight.

Step 3: How to Check and Add Fluid to the Power Steering System and Check for Leaks.

NOTE: The engine has to be cold to you to make this check.

To check fluid level: The reservoir is on top of the pump on the right front corner of the engine. Wipe around the black cap and turn it counterclockwise a ¼ turn and pull up. The dipstick's attached to the cap.

Look at the end of the stick for a double-ended arrow, indicating high and low fluid levels. Wipe off the dipstick, screw it back into the reservoir, then remove it again.

If it's below the arrow or there's no fluid at all on the stick, look into the reservoir. Any fluid? If it's really low or nonexistent, look for a leak as described below. Add fluid before driving.

To add power steering fluid: This system uses automatic transmission fluid (Dexron Type D). Add it to the reservoir where you removed the cap, a little at a time, rechecking the level often. Don't overfill. Reinstall the cap (clockwise) until it's secure.

To check for leaks in the power steering system: You'll need a light to look along the hoses and their connec-

tions, which are at the pump, at the pipes those hoses connect to, along the pipes themselves, at the other end of the pipes near the steering gear, and along those hoses and at their connections. Whew! It's a closed hydraulic system that has to be bled free of air if a leak occurs or the system is opened. Other leak points are at the seal behind the pump pulley and around the steering gear.

If you find a leak (a moist dirt covered area near any of the mentioned points), and if the fluid level continually drops, you have a leak. If this or other pump problems plague you, see your local Datsun/Nissan dealer.

Step 4: Check, Adjust and Replace the Power Steering Pump Drivebelt.

The drivebelt is the frontmost belt on the engine. Check its condition by looking closely for cracks or missing chunks especially on the part that contacts the pulley groove. There's more on drive belt examination in Ch. 3, Proc. 8.

To check drivebelt deflection and adjust it: The deflection is how much slack the belt has between the pump pulley on the right and the idler pulley on the left. Push down on the belt—half way between the two pulleys—with your thumb. If the belt's new, the deflection should be ½in. If the belt's old, the deflection should be no more than ¾in. If it's on the loose side, or if it feels really taut, i.e., too tight, adjust it (see below). If the belt's worn out or deteriorated, replace it as described below.

To adjust belt deflection: There's a movable idler pulley on the left side of the engine across from the pump pulley. Ch. 6, Pt. 2, Proc. 4 tells how to adjust such a pulley; it's not difficult. Use these techniques to adjust the belt to the specifications above. The locking nut is on the front of the pulley, and the adjusting bolt is on the left side of the idler.

To replace the power steering pump belt: Loosen the belt tension as described in the above section. When loose enough slide the belt off the pulleys (3) and over the fan blades.

Install the new belt so it fits, isn't twisted and lines up with all the pulleys. Adjust belt tension as described above. Recheck again soon if a new belt is used.

Step 5: Remove and Install the Power Steering Pump and Bracket.

First, slacken then remove the drivebelt as described in Step 4.

Second, unbolt the pump from the engine.

•**Z-22 People:** There's a horizontal bracket on the right side of the pump. Two 12mm bolts, one on the pump and the other on the head, hold the bracket in place. Remove these and the bracket and set them aside.

•**Z-24 People:** Find and remove the gold hued bracket that bolts to the back and side of the pump. A 12mm bolt holds it to the pump. On the bottom end the bracket bolts to the head, the same hole as the battery ground cable. Remove the bracket, let the cable hang, and put the bolt tightly back into the hole.

•**Z-22 and 24 People:** Put the bolt(s) and bracket aside. Follow the hoses down and back, unclipping and releasing the white plastic straps that hold them to other things. Resecure the straps around one of the pump hoses for safekeeping.

•**Z-24:** Find the nut on the back side of the pump where it bolts to the side of the head. Remove it and the washer and set them aside.

•**Z-22 and 24:** Loosen and remove the two bolts holding the front of the pump (black bracket) to the head mount (blue bracket). Undo the bottom one first. When the top one's been removed be prepared to take the pump's weight. Work the pump away from the head and lay it carefully back and up onto the right fender wall. Keep it upright so not to spill fluid. Secure the pump by tying it to something secure and not damaging the hoses.

Put the bracket and bolts (nut) in a bag labeled "pump."

To replace the pump: The head mount has to be bolted in place to do this.

•**Z-22:** It's easier with a helper.

•**Z-24:** Your rear pump mount fits over a stud on the right side of the head.

•**Z-22 and 24:** Move the pump up and position it so it will mount in place. The pulley groove must be parallel to the front of the engine and the most forward crankshaft pulley groove.

Install the front top bolt just until secure. Find the lower front bolt and install it. Don't tighten anything yet. Pick out the bracket. Match its shape to the pump, i.e., bent side down (Z-22) angled end below and behind

the pump (Z-24).

Install the bolt through the front end of the bracket into the pump and the rear or lower one into the head.

•Z-24: The battery ground wire connects at the same place except the ground eyelet fits between the head and the bracket. You also have a washer and nut to reinstall to secure the rear pump bracket.

•Z-22 and 24: When all the bolts (nut) are in place tighten them until secure. If the idler's in place, install and adjust the pump belt (Step 4). Reconnect the plastic straps along the hoses.

Step 6: Remove and Install the Power Steering Pump to Head Mount.

You need only remove this if the head is being stripped. The mount is held to the front and side of the head by two 12mm bolts and a nut. Make a sketch of how it's secured showing the bolt and nut layout. Use nail polish to indicate front. Save the fasteners and mount in a bag labeled "pump mount."

Install the pump mount to the head: Using your sketch, paint marks, and common sense, match the mount to the right front and side of the head. Install the fasteners, finally tightening them when they're all in position, and the mount's aligned.

Step 7: Remove the Power Steering Pump Idler Assembly and Bearing.

The pulley and bracket bolt to the front left of the head. Find the two 12mm bolts behind the pulley and remove them. The front engine slinger may mount in front of the bracket (top left).

Stash all these pieces in a bag labeled "steering pump idler." Replace the slinger and bolt if necessary.

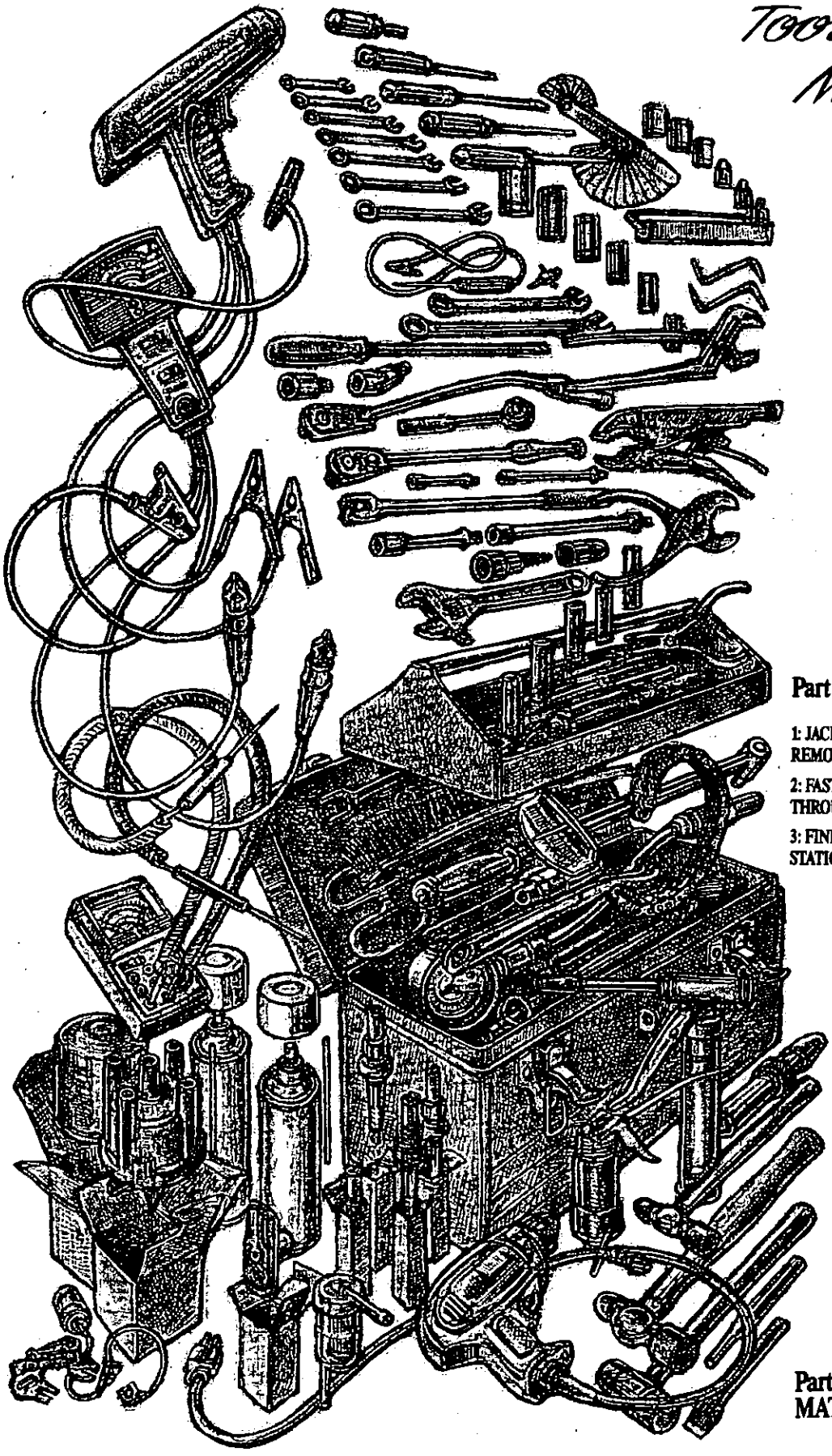
About the idler and bearing: The bearing is replaceable and far cheaper than a whole new idler assembly, which you need only replace it it's worn internally.

Take the pulley and mount to a garage or your Datsun/Nissan dealer to be disassembled and have the bearing replaced. It's easy, so I don't tell you how. The bearing is a common one, available from most automotive or bearing suppliers. The number is either 203FF or 204FF. This is a standard industry number not a Nissan number.

Install the idler assembly: When the assembly's ready to be remounted align it so its bracket fits against the left front of the head and the pulley is in line with the front groove on the crankshaft pulley.

Tighten the two 12mm bolts with the front engine slinger (if removed) in front of the upper bracket's bolt hole.

Know-how, Tools and Materials



Part One: KNOW-HOW

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3: FIND TOP DEAD CENTER (TDC); STATIC TIME ENGINE'S IGNITION 13-11

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CHAPTER 13
KNOW-HOW, TOOLS, AND MATERIALS

Part 1: KNOW-HOW

PROCEDURE 1: JACK, CHOCK AND BLOCK THE VEHICLE; REMOVE AND INSTALL THE WHEELS.

Condition: You are here to get your car or truck off the ground, to simply remove one or more wheels or do any number of other procedures that require the wheels to be off the ground and/or the bottom of the vehicle high enough for you to work underneath it. You have a jack, two chocks, a lug wrench, and if you plan to do more than just change a wheel (tire), adequate safety stands.

Tools and Materials: A jack—the one that comes with the vehicle will work for most jobs that don't require the vehicle to be raised higher than the jack can lift it, for example, transmission removal. Read the owner's manual (or the one that came with your jack) and this procedure for jacking instructions.

Chocks: Cars come from the factory with two yellow chocks, trucks have none. Try two pieces of wood or better yet something that's wedge-shaped to fit tightly between the ground and tire. Chocks are used to keep the wheels that are on the ground from rolling while you jack up and work on the vehicle.

Lug Wrench: One came with the vehicle from the factory but you might prefer buying and using a cross wrench instead. The lug nuts are 21mm (a 13/16in socket fits tightly). A socket and breaker bar work as well as a lug wrench.

Blocks (safety or jackstands): These are important. Don't use anything but the real things for this, definitely no bricks, concrete blocks, or stacks of 2x4s. Safety (jack) stands aren't expensive, so please use them.

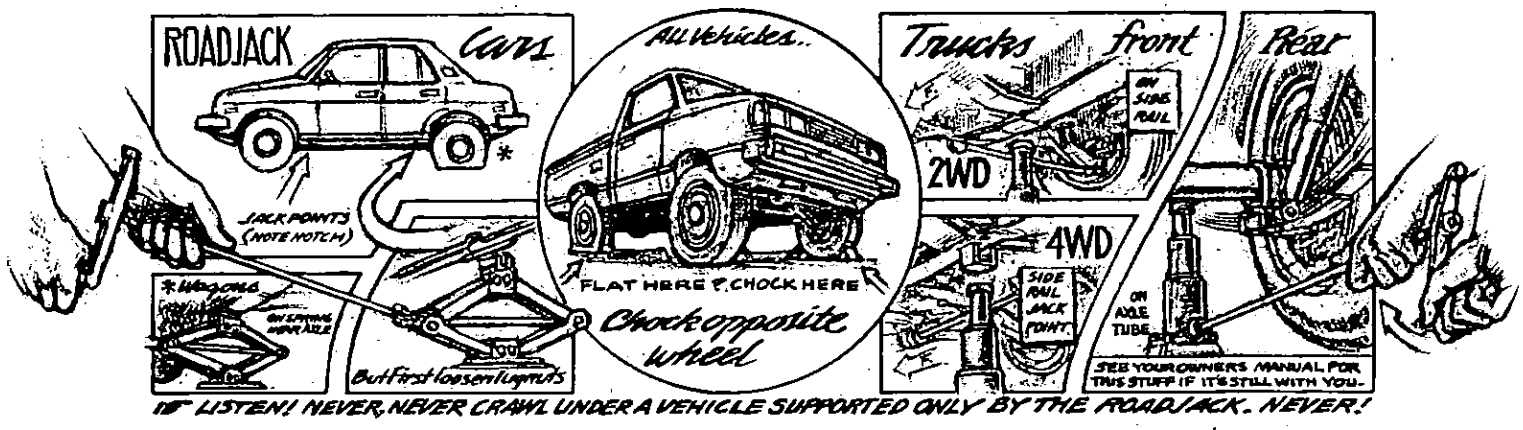
Remarks: This is a procedure where safety is God. Recklessness here can be fatal as you're dealing with one ton plus of thoughtless automobile. As soon as you take your car or truck's wheels off the ground there's a chance of its weight crushing you. Never put any part of your body under a vehicle unless it is safely blocked (Step 3). Always position the base of the stand or jack on the most level and firm ground possible. Asphalt and sand are horrible surfaces; concrete or hard packed, level ground is ideal. Keep in mind that the weight of the vehicle may cause the safety stand to sink into whatever it's resting on.

Step 1: Remove the Wheel Covers and Loosen the Lug Nuts.

This is only necessary if you plan to remove one or more of the wheels. If you just want to raise the vehicle, go on to Step 2.

If you have wheel covers (hub caps), they have to come off first. There are many designs of wheel covers, so use common sense and my directions to remove yours. Use the tipped end of the lug wrench or the largest regular tipped screwdriver you have as a prying tool, wedged between the cover and the wheel. You may need to pry (or twist) the tool at more than one place to get it off. Lay the cover aside.

Cars have four lug nuts and trucks have six. If you had your wheels balanced on the vehicle you should mark the wheel's position in relation to the hub. Otherwise it doesn't matter.



Fit the lug wrench over a nut and turn it counterclockwise. If someone overtightened these, you'll have to use a cheater pipe over the end of the wrench to increase your leverage. Just loosen the nut, no more than ½ turn. Next loosen the nut that's diagonally opposite the first one. Repeat this with the remaining nuts also in a crisscross fashion.

Loosen the nuts on whichever wheel you plan to remove.

Step 2: Chock the Wheels and Jack it Up.

Pull the emergency brake on.

Jacking methods are different for cars and trucks. Furthermore, the type of jack you use determines where you position the jack to raise the vehicle. The jack's position also depends upon which part you want to lift—front, side, rear or the whole beast.

To jack the car from the front or rear: The scissors (pantograph) type jack that came with the new car is designed to fit into little notches in the seam under the car's sides just below the doors. There are two notches on each side, one located in front of the front door to lift the **front** of the car, and the other in front of the rear wheel well to lift the **rear** of the car. On 1978 and later 510 wagons the rear lift point is under the leaf spring slightly behind the rear wheel; there's supposed to be an adapter to fit between the jack and spring. Position the top of the jack so it fits around the next to shortest spring leaf.

With the factory-equipped jack you can only lift one side (corner) of the car at a time. If you want to lift the front or rear ends, you'll have to lift one side, support it, then lower the jack and repeat the process on the opposite side.

The top part of the jack can be turned to fit into the notch, bridging either side of the seam in the body. There should be a crank along with the jack that fits into one end of the screw drive, and when turned clockwise raises the jack. If the screw threads are dry, lube them with penetrating oil and/or grease. If you have another type of jack it's probably a hydraulic type and should be placed under the car like the truck jack described below. Don't use a bumper style jack on your Datsun.

Trucks come with a screw type telescoping jack that's operated by inserting a cranking rod with a handle (or Vise Grips) into a drive piece, then turning it clockwise to extend the jack. NOTE: There's a yellow dot on the extension piece to indicate that the jack is fully extended.

To lift the truck from the front all at once or one side at a time, you have to lift it from the frame—not the body, engine or suspension parts. This is important.

•**2WD** (truck) **People:** Position the jack under the very front of the truck. Look underneath, behind the bumper and body trim to find the front part of the frame. It's solid, thick steel and has two diagonal **tension rods** with nuts on their ends attached to it. Position your jack in the center of this to lift the whole front end, but first read **Everyone** and the **4WD** sections below to identify the frame parts.

•**4WD People:** Look under the truck just behind the front wheel. Find the frame rails; there are two, one on either side that run the length of the vehicle. In addition there are crossmembers that run the width of the truck. Look for the crossmember that's just behind the front wheels. A little in front of this and on the side frame

rail find a steel box that's welded to the rail. Place the jack under the box.

Unfortunately you have to raise one side at a time, support that side, then move the jack and raise, then support, the opposite side to get the whole front end off the ground.

NOTE: **Car and Truck People:** If you're a car person using a non-factory jack, lift the front end from under the frame cross-member that's directly below the engine. Lift the rear end as described below in the rear end section.

To lift the rear end of the truck (or car with a non-factory equipped jack): To lift the whole rear end of the vehicle you can place the jack under the center part of the differential housing and raise it from there. To lift only one side put the jack under the far end of the housing or under the mount that connects the leaf spring and differential housing. If you plan to use safety stands, jack from the middle point.

In case you don't know, the differential housing is the large housing with a round center section that spans and connects the rear wheels.

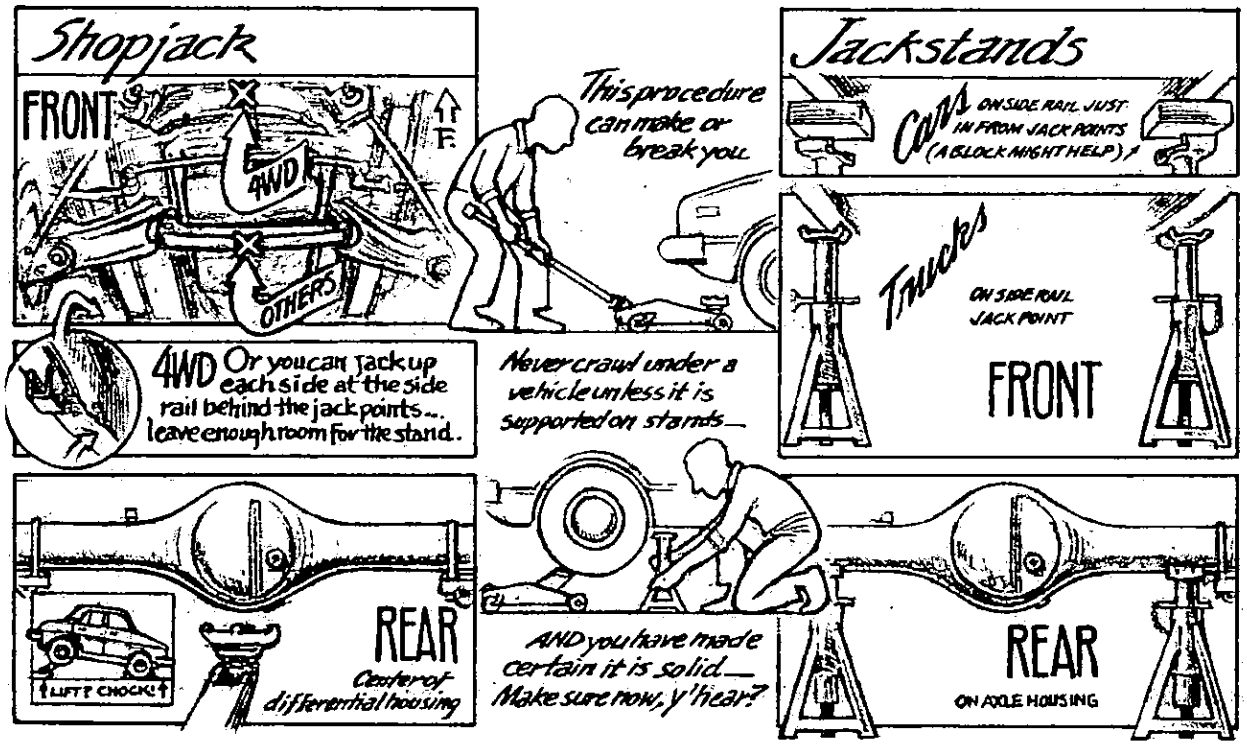
•**Everyone:** Before jacking it up place chocks in front of and behind the wheel opposite and diagonal to the wheel you're lifting off the ground. If you're lifting the whole front or rear end, place the chocks behind both rear wheels (lifting front) or front wheels (lifting rear).

OK, With your thinking cap on and jack in place, crank (or pump) it up until the jack touches the lift point then recheck its placement. If all is well, crank (or pump) away until you get the vehicle up as high as you want it.

If you're simply changing a tire (wheel) go on to Step 4 and remove the wheel. If you're supporting the vehicle for more involved work, go on to Step 3.

Step 3: Support the Vehicle with Safety (jack) Stands.

This is serious business so please do it right. I'll spare you the gruesome stories about people who didn't heed such warnings. The most important thing it to make sure your stands are in good, strong, reliable condition. You must know how they work (adjust) before trusting your life to them. Less expensive stands use pins to hold them in position; better ones have levers and pawls.



To position the safety stand(s) and support the front end:

•**Car People:** You have to find the main rails that run along the length of the car. Look behind the front wheels to find a rectangular channel that runs part way back under the car then stops. This is the main rail; there's one on each side. Position the stand(s) under this (these) just behind where the rail curves down to become straight—not too far back. But before you lower the jack, see **Everyone** below.

•**Truck People:** You found the frame rails earlier.

•**2WD** (truck) **People:** Read through the **4WD** directions in Step 2. You want to position your stand(s) just in front of where the **4WD People** (above) placed their jack. Your frame construction is similar to theirs except you don't have a box welded to the frame rail. Read **Everyone** below before lowering your jack.

•**4WD People:** Place your stand under the frame rail just in front of where you positioned the jack. Read **Everyone** below before lowering the jack.

To position the stands and support the rear end: These directions are the same for car and truck people. Place the stands under the far end of the differential housing next to where the spring-to-housing mount attaches, under the tubular/axle part of the housing.

•**Everyone:** Lower the jack slowly, watching how the frame or differential is going to rest on the stand. Reposition the stand, if necessary, to assure that the vehicle will come down and rest securely on it, and so the stand's base is flat on the ground, not tipped.

Repeat this process until the points you want raised are off the ground. When all that's done and the stands are safely under the frame points and level on the ground, completely remove the jack.

Now for the safety test. Before you remove the wheels and/or crawl underneath, firmly grab some part of the body and shake the vehicle with all your might. Do this at least four different places around the car or truck. If it falls, be glad it didn't do so on you. If it stays on the stands, you can safely go underneath after rechecking that the stands are still securely supporting the vehicle.

Step 4: Remove the Wheel (and tire).

Pick up your lug wrench and remove the four or six nuts. The wheel should stay on the studs until you lift and pull it off. Be careful not to hurt your back with the wheel's weight. Put the lug nuts in the wheel cover or some other container so they won't get lost. And keep the wheels in order by laying them close to the side they came from or marking each one.

Step 5: Install the Wheel (and tire), Replace Lug Studs (if necessary).

NOTE: If you marked the position of the wheel in relation to the hub for balance purposes, match the marks when you install the wheel. If you have some WD-40 or the like handy, squirt a little on each of the studs to make life easier.

Put the lug nuts close at hand. As you install the wheel aim the holes so they'll slip right over the studs. When the wheel's positioned over all the studs, grab a lug nut and spin it on a few turns to hold the wheel in place.

Install the remaining nuts. They should all go on easily with your fingers. If any of the threads are damaged and/or the nut is hard to get started, you'll have to replace the stud and/or the nut. Don't drive with missing or damaged lug nuts or studs.

NOTE: Steel and aluminum wheels use different shapes of lug nuts. Steel nuts are tapered and aluminum ones are shouldered.

To replace a damaged stud remove the bad stud, then get a replacement that's exactly the same length and diameter. On drum brake axles you'll have to remove the brake drum to remove the stud. The studs have little splines in them so they can't turn. The studs can easily be pounded inward and out of the flange. To replace the stud put some penetrating oil on its splines and insert it from the rear. When the splines are aligned with the grooves in the hole use the lug nut to pull the stud through the flange; you may need to put the (drum) wheel back on to draw the stud through fully.

Tighten the nuts with the lug wrench in a crisscross pattern, each a little at a time until the wheel is flush against the hub and all the nuts are tightened equally on the studs. The wheel shouldn't wobble as you wiggle

it from side to side. Fully tighten the nuts when the vehicle's on the ground. Put the rest of the wheels on (if necessary) the same way.

Step 6: Lower the Vehicle.

If the jack isn't already there, reposition it under the lifting point you want to lower. Step 2 tells where these points are. Make sure the chocks are in place if any wheels are touching the ground, and the emergency brake is on no matter what.

Watch the top of the jack as it touches the frame to see that it makes good contact. Keep raising it until the frame no longer touches the safety stand(s). At this time you can move the stand(s) out from under. But wait! **Don't put your body underneath the vehicle.** Reach under only with your arm and hand to quickly pull out the stand. Remove all the supports you can on the part that's been lifted, then slowly lower the jack until the wheels touch the ground.

Step 7: Tighten the Lug Nuts and Install the Wheel Cover(s).

Chock the wheels and put on the emergency brake or have someone push down on the brake pedal as you tighten the nuts. Do so in a crisscross pattern tightening them evenly. You want these tight but not tighter than your lug wrench can get them. The correct torque ratings given below are useful if you have a torque wrench and socket.

510, 610, 710, 521, 620, 720 (1980 2WD only):
steel wheels: 58-65 ft.lbs
aluminum wheels: 58-72 ft.lbs

720 (1980) 4WD and (1981-82) 2WD and 4WD:
steel wheels: 87-108 ft.lbs
aluminum wheels: 78-98 ft.lbs

720 (1983) on 2WD and 4WD:
steel wheels: 118-147 ft.lbs
aluminum wheels: 78-98 ft.lbs
dual rear wheels: 166-203 ft.lbs

Make sure all the nuts on all the wheels are tight and install the wheel covers.

There are many different wheel cover designs, but they all have to be put on or into the wheel by getting one part of the cover started then whacking the rest on with the heel of your hand, your foot, or a rubber mallet. The only good thing about putting on wheel covers is that it means the job is finished.

PROCEDURE 2: FASTENER LORE AND GETTING THROUGH TOUGH SPOTS

Condition: You came here from somewhere in the book looking for insight and help. Or you want to become familiar with fasteners—your car or truck's many nuts, bolts, washers, screws, etc.

FASTENERS

General Information: Your Datsun/Nissan is held together by countless nuts, bolts, washers, screws, clamps, pins, springs, and clips of many sizes and shapes. The majority of these fasteners have **metric** threads and are made to fit metric sized wrenches and sockets. So think metric. And while you're at it, think aluminum (a metal that's softer than steel). Take special care when screwing into aluminum. There's more on this below in Tightening.

Bolts are also called machine or cap screws if less than 10mm (3/8in) diameter. Most have hexagonal heads

with flat or recessed tops. Some smaller ones also have cross (Phillips) slots in them. A few aren't hexagonal but round and have a Phillips head.

A bolt's size is by diameter and length. The diameter is the measurement of the distance across the threaded part of the bolt (the **shank**). The length is the distance from the bottom of the bolt's head to the end of the shank.

Studs don't have heads, they're threaded from both ends, usually with an unthreaded section between the threaded ends. There may be studs holding the fuel pump and intake manifolds to your cylinder head. A stud's diameter and threads are measured like a bolt's. Length is measured from end to end. The shorter of the two threaded sections on the stud is the one that gets screwed into the engine or housing, while the longer section takes the nut. To remove and replace studs, carefully clamp your Vise Grips' jaws around the non-threaded section (if there is one) and turn; thread two nuts on the exposed end, tightening them against each other so when you wrench the nuts the stud turns.

Nuts on your vehicle are hexagonal (six sides/flats). They thread onto bolts or studs to hold parts together. Most nuts are the plain type, and use washers under them. There are high and low profile nuts (high is normal), called **plain nuts.** There are also **castellated** and **self-locking** nuts. Castellated nuts thread on flat end first; the slotted end has a cotter pin through it. Self-locking nuts have nylon inserts and don't use lockwashers. These get installed so the flat, wide end goes in first.

The threading and tightening rules are generally the same for nuts and bolts.

Washers are fitted under most nuts and bolts. Your vehicle has mostly **lock (spring) washers** or **flat (plain) washers.** Lockwashers are most common and are often the only washer found under the fastener. Sometimes a lockwasher and flat washer are used together. In this case the lockwasher fits next to the nut or bolt head, and the flat washer fits against whatever the fastener's securing.

Some nuts and bolts don't need washers for they have a shoulder that's part of the nut or bolt's head. On some bolts the washer(s) don't come off; they are crimped in place so they stay together with the bolt—a nice feature. Body screws and occasionally bolts may have a **starred** or **finished** washer under them.

Screws used on your car or truck are technically called **tapping screws**. These babies are pointed with wider spaced, sharper threads than bolts. Your vehicle uses screws in many body, dashboard, interior and thin metal parts. These screws typically have round Phillips (cross) slot heads. Don't confuse machine screws that have slotted heads with tapping screws. Their threads look very different.

Cotter pins fit through holes to hold castellated nuts, rods, retainer or clevis pins in place. You shouldn't reuse cotter pins or use nails or hair pins in their place. Cotter pins come in different diameters and lengths. The diameter is the distance from one leg to the other; the length is the measurement from the neck (bend) to end. Your Datsun/Nissan takes metric cotter pins but inch replacements are commonly and safely used if they fit as close as "damn" is to swearing. Install a cotter pin so its head fits through the castellated nut or retainer's slot and/or hole in the shaft. At least one of the cotter pin's legs should then be bent along the shaft and side of the nut or wrapped around the shaft. Any excess on the pin's leg(s) that interferes with nearby parts should be cut off but never completely flush with the nut or hole.

E-clips and spring clips also hold pins and rods in place as on your transmission and carburetor linkages. Remove E-clips with a straight screwdriver tip and the many varieties of spring clips with either a screwdriver or pliers. All clips are easily lost, so hold onto them during removal.

Woodruff (or half-moon) keys are used to attach pulleys and gears onto shafts.

Plugs are either threaded or non-threaded (blind). The threaded plugs you'll encounter are those for the engine

oil and coolant drain, transmission, differential fill, and drain. These have hexagonal or square heads.

Some blind plugs (covers) you may encounter are the engine's freeze plugs.

Grease zerks are put in the front end's steering and suspension parts. Threaded, removable plugs may be in their place.

Rubber grommets protect wires and cables where they travel through a panel or the body (like the firewall) between the engine and passenger compartments.

Clevis pins connect rods and linkages. You'll find these fasteners joining the clutch and brake pedals with their master cylinders. The pins are held in place by spring clips or cotter pins.

Fastener tightening and sizing: Common sense tells you that the smaller the bolt/nut the less tight it should be. This is true especially for those that thread into aluminum.

The three most common sizes used on Datsun/Nissans are 6mm, 8mm, and 10mm diameter (across the shank) and 10mm, 12mm, and 14mm wrench/socket size (width across the flats). The length of these bolts varies from 12mm to 140mm. The carburetor, distributor and alternator have some smaller nuts and bolts (4 or 5mm) that have hexagonal or slotted heads. Larger nuts and bolts (12 and 14mm) are used in the undercarriage and drivetrain.

In the text of this book I refer to nuts and bolts by their head width—flat to flat. This is the tool size that fits the fastener rather than the technically correct description, which is given as the diameter of the threaded part.

Special bolts have queer shapes or/and are made of harder metal for specific purposes. I'll tell you about these as we encounter them in the procedures.

Every nut, bolt, and screw on your vehicle has a designed torque rating (range) that indicates how tight it should be. This rating depends on the fastener's size—diameter and thread length—as well as what the fastener holds. A **torque wrench** measures this in **in.lbs** or **ft.lbs.** (and N.m. or Kg-m). In most cases you can use feel instead of a torque wrench, but in certain places the torque wrench is essential, e.g., cylinder head bolts, cam tower bolts, and bolts that go into aluminum (until you have the feel). These I mention as we go along.

It's a good idea to lube threads lightly before you reinstall them and also lubricate under the bolt's head or nut's contact side. This makes for more uniform feel when tightening.

Feel is difficult to describe. It's something that experience (including mistakes) teaches best. How tight is too tight or too loose? Inexperienced wrench benders are insecure that they're not tightening a nut or bolt enough, or they're afraid of "stripping" the threads and so leave it too loose. I use the expressions "wrist tight," "just until it's snug," and "just until the lockwasher flattens and then some" to describe tightness. "Wrist tight" is to tighten the fastener, using the twisting force or your hand choked up close to the drive end of a 3/8in drive ratchet, holding the wrench with one hand only. "Just until it's snug" feels like the fastener won't safely tighten any further—when you have felt real resistance and the nut or bolt is fully against what it's tightening. "Until the lockwasher flattens" is something you'll see when the split ends of the lockwasher squeeze flat. "and then some" is when you actually feel the bolt stretch slightly as you snug it to full tightness. Think of tightening a canning jar lid. In all cases the fastener should be tight enough to offer some resistance when loosened. Typical nut and bolt torque ratings are (by wrench size):

10mm: 7 ft.lbs
12mm: 15 ft.lbs
14mm: 30 ft.lbs
17mm: 55 ft.lbs.

Cross-threading happens when a nut, bolt or stud is installed crooked (not square to its mate), damaging it and/or the threads it goes into or onto. Another unforgivable error is to use a fastener whose threads don't match

its mate's, e.g., its threads aren't metric or are metric but a different size. Please don't let this happen or you'll regret it. Sometimes crossed threads can be straightened with a thread chaser or tap, or a die, see below.

Stripped threads are usually caused by overtightening, especially threads that have been weakened by some other abuse like cross-threading. The only cure is to drill and retap the hole oversize, or put in a thread insert (the better choice).

All fastener problems can be avoided by paying attention, installing the proper size, diameter, length and thread, and following the advice given in this procedure.

To install nuts, bolts, and studs: Always make sure the parts/fasteners you're threading together are the same diameter and thread pitch. Inspect the threads to make sure they're in good, undamaged condition and free of dirt and grime. Use penetrating oil on threads before removal and installation (see Tools and Materials in this chapter). Try screwing the fastener into its mate before mounting the part you're installing. Always **start** a threaded fastener with your fingers (spark plugs too). If there's resistance before it tightens, either when finger tightening or using a tool, remove the fastener and find out why before going on. **Never** force stubborn nuts, bolts, studs, or threaded plugs. For instance, if a bolt's too long, it will bottom out before really tightening when its head is fully contacting the part (washer). Use your eyes and common sense.

Sometimes it helps to turn the nut or bolt slightly in the opposite direction (counterclockwise) then clockwise until it "bites" the threads it's fitting into or onto. When starting a nut or bolt push it toward its mate. When more than one fastener holds something together, get all the fasteners well started before tightening any one, and then tighten them evenly around or across the part.

Springs are used to return things to their rest position. There are many shapes and sizes of springs. Typically a spring is slightly stretched when the part it's springing is at rest. If a spring's too stretched or completely relaxed when the part's at rest, it's either hooked in the wrong place or it's not the right spring.

Gaskets are placed between mating surfaces to contain fluids and gases. Your engine has many gaskets that will leak if improperly installed, or the mating surfaces they seal will become warped, and/or the gasket simply deteriorates. Investigate where leaks come from and why they're there. (Leaks can be internal or external.) Always use gaskets that fit exactly, clean the mating surfaces fastidiously, and tighten the nuts or bolts gradually to draw the mating surfaces together evenly.

Use a gasket scraping tool and emery cloth to remove thoroughly old gasket material. If you're careful, a single-edged razor blade will work wonders in removing tenacious bits of gasket. **Caution:** Don't scratch or otherwise mar the mating surfaces while scraping; aluminum is especially vulnerable (see **Seals** below).

Seals usually have two functions: to keep oil, water or grease in a housing and contamination out. The inner diameter of the seal normally fits round a shaft, e.g., an axle, a water pump shaft, or the engine's crankshaft. The outer diameter fits into a cavity in the housing. While some seepage past the inner diameter (lips) of a seal is acceptable, a lot can do damage.

When installing seals use the best quality available, press them squarely onto the sealing surface and housing, make sure the shaft surface isn't too worn, and don't distort the seal's shape by poking or pounding on it.

Hose clamps and hoses are used primarily in the fuel and cooling systems. (They're also used for the automatic transmission, air conditioning, and power steering systems.) Hoses should be inspected regularly. A broken or ruptured hose can be dangerous and/or cost you a lot of money. Always use a replacement with the same diameter when renewing hoses. Specific hoses are covered in their respective chapters.

Clamps come in different forms and should be tightened only enough to do the job. Overtightening the clamp will deform the hose. Tightening a leaking hose seldom stops the leak unless the clamp was too loose to begin with.

Before installing a hose, clean the surface of the pipe or fitting by scraping or sanding off any corrosion

on it. Coat an uneven, corroded pipe with non-hardening gasket sealer before installing the hose. Put the hose clamp on with its screw head positioned so you can easily reach it when everything's finally in place. Fit a hose on far enough to cover the pipe thoroughly and so the clamp fits securely. Don't position a clamp on the very end of the hose. Install it back a little way (¼ - ½in) from the hose's end and at least ¼ - ½in away (not right on top of) the covered end of the pipe. If the hose is deteriorated or can't be trimmed back and repositioned to fix a leak or crack, replace it. I suggest you replace the original wire type ones with strap style clamps, and use penetrating oil to lube clamp screw threads if stuck.

How to get through the rough spots: Tight, loose, cross-threaded, stripped or broken nuts, bolts, and studs. Tight nuts, bolts, studs, and screws can usually be removed by applying additional leverage, such as a "cheater" pipe fitted over the breaker bar or socket end, or by whacking a bolt on its head to "shake" it loose, or by using Vise Grips clamped around the stud or screw head you're trying to remove. Make sure your tool is properly fitted over the fastener, and that you're turning it in the right direction (counterclockwise to loosen—unless otherwise mentioned).

A propane (butane) heating torch is an excellent heat source if you need to expand and remove rusted fasteners and separate parts. But don't use flame on aluminum parts or brake drums for it will distort them. Don't use heat around seals or bearings. Be especially careful not to use flame around fuel or fuel lines, nor around hoses and electrical wires.

If all other remedies fail, stuck nuts or bolts can sometimes be removed with a **hammer and chisel** or **nut buster.** Wear safety glasses and position the chisel so it's angled in the direction you want to remove the fastener. You want its tip to cut into the outside edge of the fastener's head.

Whack the chisel with a ball peen hammer so it bites into the metal and forces the fastener to turn counterclockwise. A nut buster cracks a nut with applied screw force.

If a fastener repeatedly works loose and it has the proper washer(s) under it and it's tightened to the correct torque, put some Loctite (tm) or similar product on its threads. Use as directed.

Replace irreparable fasteners with new ones. You can restore threads in blind holes by straightening them using a **tap** or **thread chaser** that's the same diameter and thread size as the hole. Seriously damaged or completely stripped threads can be replaced by over-drilling the hole then installing a **thread insert.** The tools to prepare the hole for an insert are expensive; the inserts themselves aren't.

Stud and bolt threads can be restored with an **external tap** or **die** that's the same size or a metric thread bar.

Broken off bolts or studs can be removed by drilling a hole in the broken fastener, then using an Easy-Out (which isn't always so easy). Because there are different designs of Easy-Outs, I suggest you ask the loaner or salesperson how to use this tool.

A simple way to remove cotter pins is illustrated in Ch. 5, Proc. 6 (4). Straighten the pin's legs as much as possible, grab the pin's round end between the pliers' cutting edge and pry it out by twisting or levering the pliers against the shaft, pin, or nut through which the cotter pin fits.

When a cotter pin breaks and gets stuck in its hole, you can remove it with a pin punch (or possibly a nail) that's smaller in diameter than the pin hole.

Using Vise Grips to loosen stuck parts can do more harm than good if overdone. Practice adjusting and clamping Vise Grips on something solid. You'll soon get a feel for their operation and power. When using them on hollow items like tubes, brake fittings, screw heads, etc., be very careful only to apply enough pressure to hold and/or loosen the fitting and not damage it.

Keep track of fasteners and parts. Use **labels** to mark particular pieces or components and their fasteners. Store pieces in clean, reliable **parts containers** like coffee cans, small plastic tubs, egg cartons, or baggies. No matter how good your memory or the illustration given is, draw sketches and make careful notes if you're in doubt about putting something back together. In many cases simply reinstall nuts or bolts (and washers) on their studs or in their holes for safekeeping.

Miscellaneous tips: Have a detective's open mind while doing mechanics. As you screw in that monotonous nut or bolt look around for trouble, things that need attention like leaks, cracked hoses, missing fasteners, and

the like. If you find something that's easy to get at while you have something else apart, consider fixing that while it's accessible. This is really true for hard to reach hoses.

If you're working over rough ground (not a smooth floor), lay something down to catch parts that may fall and disappear. When something does fall into the abyss of gravitational "oh no" land, stop and try to find it right away. Remember what it sounded like as it fell. Did it hit the ground? Was it something tiny, hollow or solid?

Never pound or even tap on the threaded end of a bolt or stud without first putting the nut on a few threads to protect them.

Never pound or beat on something with a steel hammer that might damage the part's shape or surface or crack the casting; use a soft (brass, rubber, or plastic) hammers. If necessary, use a block of wood or a brass drift between the hammer and what you're pounding on.

Don't pry or lever against a thin walled casting (housing) unless you're sure it won't break or distort.

When removing a hose don't pull on it unless it is loose enough to move. It's better to twist the hose gently with wide jaw pliers or try to lever it if possible. Make sure the clamp is loose enough.

Always mark matching housing sections if they can go back together more than one way. Mark which direction and/or side identical parts face or fit.

Don't use gasoline to clean parts. Solvent or kerosene works best. Solvent is less oily than kerosene and designed for the job. Always wear solvent-proof rubber gloves when your hands are in such toxins.

Dispose of automotive fluids at petroleum recycling centers.

Recontain used coolant and take it to the dump. Don't pour it out on the ground or into the sewer.

To avoid doing damage when one car pushes another, use a rimless tire tied and strategically placed between the two vehicles.

When working in and around the engine be aware of any hoses or wires you may disconnect by accident. Be careful where you lean and even step in the engine compartment. If the engine's hot, avoid the exhaust system like the IRS.

Wrap a rag around the hood latch (especially on trucks) to protect your head while working.

Above all use your head for the brains it has. Work safely and use your tools properly. Never work under an unsupported vehicle.

When working with an assistant keep your directions clear—no unexpected moves—communicate and stay sober. Car work can be dangerous.

PROCEDURE 3: HOW TO FIND TOP DEAD CENTER (TDC); HOW TO STATIC TIME YOUR ENGINE'S IGNITION

Condition: You are here to find TDC as a reference point, or to static time your engine. The distributor has been removed and/or its position has been changed; or you can't move your distributor into the position necessary to time the engine. NOTE: There are illustrations of the TDC reference points in Ch. 3, Proc. 4; Ch. 3, Proc. 6; Ch. 9, Proc. 2; and Ch. 6, Proc. 1, 2 and 3.

Tools and Materials: Basic tool kit, fingernail polish.

Step 1: What is Top Dead Center (TDC)?

TDC is when a piston is at the top of its stroke. All four of the pistons in your engine reach TDC twice in the four strokes of their cycle—on the top end of the exhaust stroke and the top of the compression stroke. For now we're only concerned with #1 piston. So when I say TDC, I mean Top Dead Center, compression stroke of #1 piston. OK?

Step 2: How to Find TDC.

To find this position you need to rotate the crankshaft and align the timing marks on the front crankshaft pulley with the stationary marker on the timing cover. Ch. 3, Proc. 6 has a drawing of this. But wait! That pulley mark will come around twice during the full four cycles of each piston, so you have to get the right one. The

timing marks pass when #1 piston is at both TDC of its compression and exhaust strokes. Compression stroke is when both valves are closed and the spark plug fires. This is the one you want.

When the engine runs, the crankshaft rotates clockwise and the spark plug fires slightly before the piston reaches TDC of compression stroke. This happens in each cylinder exactly the same way but at different times; the firing order is 1-3-4-2. But remember, we are dealing with #1.

On all L-20B and Z-series and some L-18 engines, the TDC mark on the stationary pointer is the 0. On older L-16 and most L-18 engines, TDC is when the stationary pointer aligns with the deepest of the six grooves in the front pulley. Look closely.

How you rotate the crankshaft depends on what tools you have and the design of your front pulley. The easiest way is with a remote starter and a 27mm or 1-1/6in wrench. Connect the remote starter as described in Ch. 3, Proc. 4. Using the starter motor's power you can get the crankshaft position close to TDC. Then with the wrench you can turn the crankshaft pulley bolt to line up the pulley and stationary marks precisely.

Depending on how many or how few components are in the way, you can either reach the pulley bolt through the engine compartment or from underneath. In the latter case you may need to remove the skid pan first.

If your pulley is multi-sheaved (many grooved), the bolt may be recessed too far to reach with a wrench. **Manual Transmission People:** You can push the vehicle while it's in fourth or fifth gear on flat ground. This way the wheels will move the crankshaft via the drivetrain. **Automatic Transmission People:** You'll have to use the remove starter to get the crankshaft position close. Then, to nudge the crankshaft around to exactly TDC, grab two reachable stretches of the alternator/fan belt. While holding the belt tight, to get maximum friction on the pulley, turn it whichever way is necessary. Sounds easy, but it's not.

In any case, cranking the engine is easier if the spark plugs have been removed (Ch. 3, Proc. 3), the transmission's in Neutral, and the emergency brake's on.

Step 3: Other Reference Points to Find.

There are three ways to determine if you are in fact at the TDC #1 cylinder compression stroke: (1) noting the camshaft position; (2) noting the distributor rotor position; or (3) putting your thumb over #1 spark plug hole to feel for compression.

By using two of these methods, as well as aligning the stationary indicator and crankshaft pulley, you'll certainly find the TDC #1 compression stroke.

The crankshaft method: You'll have to remove the cam cover and watch the position of the two frontmost lobes on the shaft. At TDC (compression) the lobes on L-series engines are pointing up like rabbit ears, and on Z-series engines the lobes point downward like upside down rabbit ears—look closely. To remove the cam cover, see Ch. 3, Proc. 4.

The distributor rotor method: You'll have to remove the distributor cap. But first, identify where #1 spark plug is—the frontmost one. (On Z-series engines with 8 spark plugs, find the plug on the intake or right (passenger) side of the engine).

Follow this wire over the engine to the distributor cap. Mark the side of the cap with fingernail polish to indicate the position of #1 wire. Also make a corresponding mark on the side of the distributor housing. Now remove the distributor cap as described in Ch. 3, Proc. 5, then return here.

When the crankshaft's at #1 TDC compression stroke, the distributor rotor should point almost exactly toward the mark you made on the side of the housing—the position of the #1 spark plug wire. On all L and Z-series 4 spark plug engines, the rotor tip is obvious; it's the end with the metal tip. On Z-series 8 spark plug engines, there are two tips: one for the intake plugs and one for the exhausts. You want the intake tip. Look closely round the outer diameter of the rotor's plastic body to find a small metal tip that's barely sticking out of the plastic. This is the rotor tip.

If the crankshaft pulley and the stationary marker are aligned, but the rotor position is 180° opposite your mark on the housing, the engine's at TDC exhaust stroke and you'll have to rotate the engine 180° to reach TDC compression stroke. If it's not anywhere near the mark, the distributor driveshaft may be incorrectly installed.

The thumb over #1 spark plug hole method: You'll have to remove at least the #1 spark plug to do this and have a remote starter or an assistant to crank the engine with the starter motor. NOTE: If you crank the engine from the ignition key, you'll have to ground the coil wire(s) so the engine won't start, see Ch. 3, Proc. 6.

It also helps to have at least the distributor cap removed to observe at what position the rotor points when you feel compression. If the cam cover's off, you can also look at the #1 cylinder camshaft lobe's position as the cam turns.

Put your thumb over the vacant #1 spark plug hole and if all is clear, crank the engine. When #1 piston is on its compression stroke (upward) you'll feel a lot of air pressure against your thumb, the rotor will be nearing the #1 markpoint, and/or the camshaft lobes will be pointing where they should be—away from their rockers.

You'll also feel this pressure if you crank the engine manually, but not as much. In fact you can find the exact point at which the piston reaches TDC by putting a screwdriver tip into the spark plug hole and, without jamming the driver against the plug hole or piston top, slowly crank the engine manually, pulling the driver out as the piston rises until you feel the piston reach its topmost point of travel. Don't try this using the starter to crank the engine or you'll roast in mechanic's hell. If you do happen to get the screwdriver a little stuck, stop and free it by cranking the engine in the opposite direction.

Step 4: Now What?

If you can't get any one or some of these reference points to align, there may be an internal problem. However, if the engine ran before now and you have done nothing to alter its condition, reread and recheck the previous information to be sure you're doing the procedure right.

Internal problems that could throw you off are the following: (1) the camshaft lobes aren't positioned correctly, meaning the crankshaft to camshaft timing may be wrong (Ch. 9, Pt. 2, Proc. 3); (2) the distributor rotor doesn't point where and when it should, meaning its drivegear may not be in the correct position; or (3) the rotor isn't securely placed on the distributor shaft (Ch. 3, Proc. 5). You might even check that the distributor is correctly installed (Ch. 3, Proc. 5). Or if you don't feel compression with your thumb when the engine's cranked, make sure the valves are in adjustment (Ch. 3, Proc. 4) and there's compression (Ch. 3, Proc. 9).

So now you know about Top Dead Center. When you're satisfied, don't forget to install the parts you removed: the cam cover (Ch. 3, Proc. 4); the spark plugs (Ch. 3, Proc. 3); and/or the distributor cap (Ch. 3, Proc. 5). Good day!

Step 5: What about Static Timing?

In Chapter 3, I tell you how to dynamically set ignition timing, i.e., when the engine's running. Static timing is a way of setting timing when the engine's not running. The more precise method of timing is dynamic. The static method is a way of getting the timing close enough for the engine to run. And if necessary, a way of checking if there is spark at all. It's helpful to static time your engine if the timing cover and the distributor and distributor drivegear have been removed and reinstalled.

When static timing, position the distributor housing so that the ignition points (conventional ignition) begin to open, or (on electronic ignition) the reluctor passes the stator.

This is the point at which the coil "fires."

Step 6: Get Set to Static Time Your Engine

The first thing to do is find out what your engine's timing specification is, e.g., 3°, 8°, 12°, etc. **Before Top Dead Center (BTDC).**

Chapter 3, Proc. 6 has all this important timing information. When you know where the timing should be set, read through Steps 1-5 in this procedure and learn how to get the crankshaft positioned to the #1 TDC compression stroke, by aligning the crankshaft marks and using the rotor method described in Step 3. Instead of setting the crankshaft at TDC, set it BTDC on the designated timing mark.

When you have the timing marks aligned, the rotor should be pointing somewhere close to the #1 spark plug wire position. If it isn't, you may be on the exhaust stroke (180° off), or the distributor drive may be installed wrong (Ch. 9, Pt. 2, Proc. 4).

Step 7: Static Time the Engine.

Your distributor rotor turns counterclockwise. Remember, spark is created whenever the points open or the reluctor passes the stator when the ignition is **on**. You can simulate this by turning the distributor housing, thereby setting the position when the spark occurs.

So now you need to loosen the distributor setscrew(s) as described in Ch. 3, Proc. 6 and remove the rotor. While you're in that procedure, get familiar with the distributor parts then come back here.

If the timing is close, you should be able to turn the distributor housing one way or the other to open and close the points or make the reluctor and stator align.

Because the distributor shaft turns counterclockwise, rotating the housing clockwise will **advance** the timing—make the spark occur sooner. By rotating the housing counterclockwise you will **retard** the timing, i.e., make the spark occur later or closer to TDC. The spark should always occur before TDC (BTDC).

Turn the distributor housing fully clockwise. The points should close or the reluctor should be to the left (or counterclockwise) of the stator tip(s). Now turn the housing fully clockwise; the points should open or the reluctor should align (pass) the stator tip. NOTE: The point gap or the air gap should be checked before going on (Ch. 3, Proc. 5).

If you can't get the points or reluctor and stator to do as described above, try loosening the distributor fine timing screw (**4 Spark Plug People** only) (Ch. 7, Proc. 13), which will increase the housing's range of adjustment. If making a fine adjustment is fruitless, the distributor drivegear may be installed wrong. Perhaps one gear tooth is off. Recheck it by removing the distributor (Ch. 3, Proc. 5), checking the gear position (Ch. 9, Pt. 2, Proc. 4), changing it if necessary (Ch. 9, Pt. 2, Proc. 2 and 4), replacing the distributor (Ch. 3, Proc. 5), and then rereading this step. Whew!

Step 8: The Final Setting.

When the distributor and its drive gear are positioned so you can static time the engine as described in the previous steps, make the final setting.

Ideally you want to tighten the distributor housing setscrew when the housing is mid-point between the full clockwise or counterclockwise position and of course, when the distributor (engine) is in time (the crankshaft is on the correct timing mark, and the points are just beginning to open or the reluctor/stator are passing). Reread Step 7 if in doubt.

Is the housing position centered in the range adjustment slot? If it's close or right on, tighten the 10mm set screw(s) and go on about your business—job done. If the housing's too far to the right or left of center, change the fine timing adjustment setting as described in Ch. 7, Proc. 13. Then finally tighten the set screws when the housing is in the correct position.

To check for sparks: Read Ch. 7, Proc. 12 to get familiar with disconnecting the coil wire(s) and what spark is all about. You can make spark by turning the ignition on and turning the distributor housing as described in the previous steps, by opening the points or by making the reluctor/stator align. NOTE: The primary ignition circuit has to be connected to the distributor, the ignition turned ON, and fire precautions taken.

Part 2: TOOLS AND MATERIALS

Good workmen never quarrel with their tools.

—Lord George Byron
Don Juan, Canto 1, 201

Most mechanics agree that if up against the wall, the last possessions they would part with are their tools. Tools are like pets; if you cultivate a bond with and maintain them, they'll remain faithful friends.

Knowing how to fix cars is useless without the right tools to do the job. So if you plan to work on your car, you'll need a few basic hand tools. Most of the procedures can be done with the **Basic Tool Kit** that's listed below; for traveling in and out of town I suggest the **Travel Kit**; and for those major repairs there's the **Shop and Special Tool Kit.**

Along with tools I also list materials, those parts you'll need for roadside emergencies, and miscellaneous supplies you should keep handy in the shop.

How to Buy Tools: A few well-known and respected automotive specialty tool brands are Mac, Snap-On, Matco, Proto, New Britain, but most hand tool manufacturers sell the basic wrenches, ratchet, sockets, screwdrivers, etc., that you'll need. If you're going to use the tools for more than just emergencies, buy the best quality you can afford.

There's prestige (status) in tools. (I hear that next year Snap-On's coming out with a line of aerobics wear.) Furthermore collecting tools can be dangerously habit-forming, so be wary. This addiction's understandable. Quality tools are pieces of art; they handle well, clean off easily, are ergometrically designed, wear well, and have unbeatable warranties. But they aren't essential to get the job done. Similarly, you should avoid offshore "bargain" tools like those $5 complete socket or wrench sets. A single Snap-On or Mac wrench costs about $15; you get the idea.

My friend Bill, who seldom works on his truck, carries a set of foreign made (bargain) tools as his Travel Kit. I suppose they're useful in a pinch, but I have trouble looking at his tools leave alone using them. But don't get me wrong, I'm not a tool snob. My assortment of metric and American sized tools is a hodge-podge of varying quality. Although I do tend to choose the well-made ones more often.

Use cheap tools with prudence. Poorly cast and machined tools damage fasteners, break unpredictably, wear out fast, and fit sloppily. Worst of all they can hurt you. In fact **any** tool can hurt you if it's misused. Take the time to learn how to handle tools properly. The right tool can make an ugly job tolerable.

Another mistake beginners make is to buy a mechanic's "starter" set that includes tools they'll never use. It's usually cheaper to buy tools as you need them. **Used tools:** Before going to the flea market in search of bargains, get an idea of what new tools cost. Used tools aren't worth the high price they often fetch (especially if they're worn out). Examine them closely at the load points (where the wrench or socket fits over the fastener), where they swivel (at the slip or adjustment joint), or at their jaws or tips. Also examine the tool's finish, looking for tarnish, flaked-off chrome, or dents (signs of abuse). Make sure the tool fits what it's supposed to (over the fastener and/or the tool that drives it), e.g., the socket and ratchet. It's quite possible to buy a used, warranted tool then trade it back to the tool dealer for a replacement.

Mac, Snap-On, Matco, and a few others are only sold by dealers who travel around in marked vans. Ask your local mechanic on which days these salespeople will come by the shop. Brands like SK Wayne, Craftsman, Proto (Challenger), Blackhawk, New Britain, etc., are sold in department and auto parts stores. Ask the salesperson for a free tool catalogue and one of their racy calendars you can take home to peruse.

Stolen tools aren't a good alternative; using them is like (ab)using their rightful owner's heart and soul. Enough said.

THE BASIC TOOL KIT:

NOTE: Some American wrenches have metric equivalents: 9/16in—14mm, 11/16in—17mm, ¾—19mm, 13/16—21mm, 7/8in—22mm, 1-1/16in—27mm.

Combination Wrenches: A combination wrench is open on one end (spanner) and a box end on the other. You'll need these sizes: **6, 8, 10, 12, 14, 17,** and **19mm**, which is what makes up a typical set. Make sure you get them with a **12-point** (not 6-point) box-end. The points are the number of corners (flats) in the end of the socket that fits over the nut or bold head.

Adjustable (crescent) Wrench: An 8in adjustable is the most universal size you'll need. A few of these versatile wrenches in different sizes (4, 6, 10 or 12in) are useful additions to your collection. Don't use an adjustable wrench if you have another wrench that's the correct size.

Sockets: Start with a set of 3/8in drive 6- or 12-point metric ones. (The drive is the square part of the ratchet or extension that fits into the sockets.) Standard, shallow style sockets are all you'll need at first, then later you might expand your set with some deep sockets.

Ratchet and Breaker Bar: Get a 3/8in drive reversible (standard 8in long) ratchet to match your socket set. A well made ratchet can't be beat for feel and performance. A breaker bar isn't essential but useful. A ½in drive breaker bar with an adapter to fit your 3/8in drive sockets is more useful on big jobs than a 3/8in drive bar.

Extension(s): An extension fits between the ratchet and socket allowing you to get into otherwise unreachable places. If you can, buy three extensions: 1¾in, 3in, and 6in. When you get really brave buy a wobble extension.

Swivel or Universal Joint: This is like a short extension that swivels on two perpendicular axes. A swivel joint is great for working around corners. Get a 3/8in drive.

Screwdrivers: You'll need some that are straight (standard/slotted) and some Phillips (cross) tipped.

Straight (standard/slotted) tipped: A small one (3-4in blade x 5/16 or 3/16in wide tip), a medium one (4-6in blade x ¼ or 5/16in wide tip), a large one (8-10in blade x 3/8 or 7/16in wide tip), a stubby one (2in blade x ¼in wide tip).

Phillips (cross) tipped: A small one (3-4in blade x 3/16in or #1 wide tip), a medium (4-6in blade x ¼in or #2 wide tip), a stubby (½in blade x ¼in or #2 wide tip).

Offset (straight and Phillips): I love and often use a straight offset screwdriver that has four wide tips all at different angles made by Craftsman. A wide tipped offset is essential for Z-series carburetor work. Both a straight and a Phillips offset are very useful tools to have.

Screw Starters: These are nifty for holding hard-to-start screws, available in straight and Phillips.

Pliers: (1) As my mainstay, I use a pair of 6¼in long pliers, that have a tongue and groove type of swivel, alligator type jaws, which open to 1in and are made by Craftsman. A pair of slipjoint pliers between 6 and 8in long will do the same job. (2) A larger pair of tongue and groove pliers (say 9-12in long that open to 1½in) are almost essential and nearly as useful as Vise Grips. (3) Vise Grips are adjustable and the one tool that my friend Steve Rogers, the portly Bohemian, wants to have if he's ever marooned with only one tool in his possession. Vise Grips are your ace in the hole. They can clamp over endless shapes and sizes of stuck parts and fasteners with real muscle. If you can, get two sizes with straight jaws: one that's 7in long x 5/16in wide jaws, and another 10in long x 5/8in wide jaw.

Needlenose pliers are a must for working where your fingers can't reach.

Sidecutting or electrician's pliers aren't essential but good to cut wire, remove cotter pins, and to bend things.

Hammers: You'll need at least one ball peen hammer with a 10-20 oz head and an 11 to 14½in handle. If possible get a soft (plastic) tipped hammer and/or a brass headed one. Always wear safety glasses when hammering.

Punch, Drift, and Chisel: These aren't fancy boxing moves. A 3/16 or 5/16in round punch, a ½in line punch, a medium center punch (to punch mark metal parts) are ideal. Get a 5/16in round punch if one is all you can

afford. You can use a 5/8in brass drift or a 6in piece of 5/8in hardwood dowel to tap on and protect parts from the steel hammer head. A ½in cold chisel does countless brutal tasks. Use chisels carefully. Always wear safety glasses when using these tools.

Safety Glasses or Goggles: These are a must to protect your eyes. Forget designer frames here, get some with shatterproof lenses that fit. Wear them when hammering, handling automotive fluids, lying under a dirty vehicle, or doing anything where eye injury could result.

Pocketknife: Use one that's strong and won't suddenly break and cut you. I like the Swiss ones.

Jack: The one that comes with your vehicle or get a hydraulic 2 ton-jack. Never crawl under a vehicle that's only supported by a jack (Proc. 1).

Lug Wrench: If your wheel lug nuts are original they are 21mm (13/16in). There should be a wrench that came with and lives in your vehicle along with the jack. A 21mm socket and breaker bar will do.

Rags and Hand Cleaner: Lint-free cotton rags like the ones the pros use are the best. Towels or flannel are okay too. Keep plenty on hand. And speaking of hands, clean them with grit-free, non-toxic waterless hand cleaner.

Flashlight: Have one that works. I use a small (AA battery) flashlight, which I can hold in my mouth.

Emery Cloth: Get a few feet of the kind that comes on a roll; 100 grit is coarse and 220 grit is finer. I keep some of both around.

TUNE-UP AND MAINTENANCE:

Feeler Gauges: You L-series people should get the set of flat gauges, and Z-series people should get a set of bent ones (45°). A set with at least 0.008, 0.010, 0.012in blades will do. L-series people with point ignition also need 0.018 and 0.020in blades.

Spark Plug Wrench: Your plugs take a standard 13/16in (21mm) hexagonal socket. Get one that's 3/8in drive with a rubber insert inside to grip the plug.

Spark Plug Gapping Tool: I like the ones that have electrode benders on them. There are several styles, just make sure you get one that fits your size plug gap (Ch. 3, Proc. 3).

Compression Tester: If you don't use one a lot, an inexpensive push-in rubber tipped model will do.

Timing Light: Get one that's powered by your 12-volt car battery and has a clamp-on, inductive pick-up. Less expensive models will work but are hard to connect and see.

Tach/Dwell Meter: Hand-held combination meters are inexpensive and accurate. If you can get one with a Volt/Ohmmeter included, do so. (Electronic ignition people: You don't need a dwell meter, and if you have an in-dash tachometer you don't need one of these either.)

Oil Filter Wrench: They come in different sizes. You need one to fit around a 4in filter. Z-series People may want to get a ratchet operated filter wrench that you can operate in tight quarters.

Remote Starter: This is cheap and very useful for adjusting valves and other tasks that require cranking the

engine from the engine compartment. You can also buy remote starters ready-made. To make a remote starter: Go to an auto supply store and buy 7 feet of 10-gauge braided, insulated electrical wire; two alligator clips—one that opens to ½in and one that opens to 3/8in, a two pole push button switch, and if possible some insulating shrouds to slip over the clips. See Ch. 3, Proc. 4 for a drawing of the clips and their connections at the starter solenoid.

Cut the wire in half (two 3½ft lengths) and strip ¼in of insulation from all four ends. Connect a clip to one end of each wire. Attach the other ends of the wires to the two poles of the switch. The bared ends of the separated wires shouldn't touch.

To operate the remote starter, connect the clips as shown in Ch. 3, Proc. 4. (The remote starter in that drawing is a store bought version connected to a L-series solenoid.) Remote starter operating instructions are described in Ch. 3, Proc. 4.

Test/Jumper Wire(s): This is easy to make by connecting two alligator clips, the kind that open to 3/8in, to either end of a 1ft long, 12 or 14 gauge braided, insulated electrical wire.

12-Volt Test Light: Set a circuit tester (not a continuity tester) to check if wires and components have current to them.

Can Opener Half-Gallon Plastic Bottle or an Oil Filter Spout: You can cut the top section off a ½ gallon plastic bottle and use it as a funnel, putting the can upside down in the opened end. There are also opener/spouts designed for oil cans but they usually leak.

4 Feet of 5/8in Heater Hose and a Funnel to Fit the Hose: Use this combination to fill the manual transmission and differential. (Automatic transmission people: You'll need skinnier hose and funnel.)

Battery Terminal Cleaner: Buy the brush style, not the rigid cutter kind. The cleaner separates into male and female brushes that you can use to clean the battery clamps and posts.

Gasket Scraper and Razor Blades (single edged): These are helpful to scrape off old gasket material.

Magnet: I use a telescoping one with a 3/8in magnetic tip, and a small one with a screwdriver attached.

MATERIALS TO ACCOMPANY THE BASIC TOOL KIT:

Fingernail Polish: To mark matching parts and highlight timing marks. Get some in a light color to match your Ralph Lauren coveralls.

Electrical Tape: A roll of the vinyl kind.

Miscellaneous Hoses and Clamps: For vacuum and fuel purposes get two feet of each: 1/8in (4mm) hose, ¼in (6.3mm) hose, 5/16in (8mm) hose and clamps to fit them, also get some golf tees to plug vacuum hoses. For brake bleeding use 1½ft of 3/16in clear vinyl tubing.

Brake Fluid: DOT 3 or 4. One pint should be enough. Keep this toxic liquid somewhere safe and well sealed.

Penetrating Oil: WD 40 and other popular brands aren't technically penetrating oils but do a good job anyway. Keep a spray can of a petroleum (and/or silicon) penetrating oil around to loosen almost anything that's tight.

Anti-Seize Compound: I use the lead-based compound on fastener threads that tend to corrode.

Carb Cleaner: A spray can of this powerful chemical is a handy solvent you can use to blast out passageways and clean off grime. Carb cleaner evaporates fast without leaving any residue. Wear safety glasses when using it.

Wheel-bearing Grease: Get a small can. Non-fiber high-temp grease is the best and essential for front disc brake wheel bearings.

Cleaning Solvent: One gallon's enough for general use. You can get solvent at petroleum distributors. Kerosene also works but is more oily. Don't use gasoline to clean parts. Keep solvents off your skin, out of your eyes, and disposed of at oil recycling centers.

Solvent Brush: The ones made for cleaning parts have 8in handles and stiff bristles.

Solvent Proof Gloves: Keep solvent off your hands because it penetrates skin and is carcinogenic. Buy gloves made for the purpose, others will dissolve.

Pipe Cleaners: These are great for cleaning out passages and absorbing liquid within them. Be sure to pick out the lint they may leave.

Gasket Sealer: A tube of non-hardening sealer and a tube of blue silicon automotive sealer are all you're likely to need. Use sealer sparingly especially silicon, which is non-compressible and likely to clog passages inside the engine.

Mechanic's Wire: Although baling wire is slightly heavier, it works if you can't get a spool of steel mechanic's wire.

THE TRAVEL TOOLS AND MATERIALS KIT:

You may never need to use these tools on the road but they're great to have along just in case.

Tools: A jack and lug wrench, flashlight, 10, 12, 14, 17, and 19mm wrenches and sockets as well as a ratchet and extension, a pair of pliers (slip joint or Vise Grips and needlenose if possible), at least one straight tipped and one Phillips screwdriver, battery jumper cables (inexpensive ones are okay), pocketknife, test/jumper wire, this book, and some rags.

Materials: A spare fuel filter, points and condenser set (Non-electronic ignition people), drivebelt(s), at least one spark plug, spare fuses, tail and brake light bulbs, some motor oil, a tire pressure gauge.

For longer trips out of town: Take the Basic Tool Kit in full including the tools and materials in the Travel Kit. I suggest you do a thorough vehicle maintenance as outlined in Ch. 3 before taking any long jaunts. NOTE: If going to Mexico and points south where L and Z-series engines are rare, carry extra air, fuel and oil filters, new drivebelts, an extra fuel pump and insulator gasket, a spare water pump and gasket, a set of alternator brushes (maybe a diode/regulator pack) and/or voltage regulator, whatever coolant hoses are special sizes and shapes (Ch. 8), at least one set of tune-up parts (plugs, cam cover gasket, distributor cap and rotor, points and condenser, brake fluid, carb cleaner and penetrating oil). If applicable, carry a throttle cable and/or front brake pads.

BASIC GARAGE TOOLS:

Jack Stands, Wheel Chocks, and Wood Blocks: These are discussed in Procedure 1 of this chapter. Get ones designed for the job. You'll need at least two jack stands, four to get the vehicle fully off the ground. A few short pieces of 2 x 4 and 4 x 4 wood blocks come in handy to wedge, shim and pry.

Drop (trouble) Light and Extension Cord: Get a light with a metal cage (not plastic), or the more expensive florescent bulb type. The cord should be long enough to suit your work area. Get an extension cord with 12- or 14-gauge wire.

Fire Extinguisher: Get one that's classified ABC; it puts out all sorts of fire. Keep it charged and handy.

Grease Gun and Cartridge: Grease guns are inexpensive and necessary if you do your own maintenance. Get a cartridge insert of lithium chassis grease to go with it.

Floor Jack: Small 2-ton rolling floor jacks are inexpensive these days and add a convenient dimension to mechanics. In some procedures it's necessary. They can be rented.

Torque Wrench: This might even fit into the Basic Tool Kit. You'll definitely need one if you plan on doing major engine work. A beam type torque wrench (one that goes up to 100ft.lbs) works just fine.

10mm Socket Driven Hexagonal Wrench: L-series people have to get or make one of these to torque your cylinder head bolts. You can make one by cutting a 2in piece off an Allen/Hex wrench and inserting it into a 10mm socket (Ch. 9, Pt. 1, Proc. 2).

Pry Bar: A crow bar or truck tire iron is valuable to lever and move heavy, awkward objects.

Cheater Pipe: A 1½in x 3ft piece of steel pipe to use for that extra bit of mechanical advantage, after all else fails.

Hacksaw and Blade: There is only one operation in this book that calls for a hacksaw, but if you need one, you'll be glad it's there.

Other Sockets and Wrenches: These make a Datsun/Nissan mechanic's life a lot easier: a ½in drive ratchet, breaker bar, and extension with sockets in the same sizes as in Basic Tool Kit, a 1-1/16in or 27mm offset box-end wrench to turn your engine's front crankshaft pulley, a 22mm or 26mm socket depending on your model for 2WD front-wheel bearing nuts.

Volt/Ohmmeter: An inexpensive one of these gets you into the high tech world of electrical diagnosis.

Electric Drill, Wire Brush and Bits: A drill isn't necessary but useful if a wire brush is put in the chuck and used to clean parts, to run a cylinder hone, and of course to drill holes. A 3/8in reversible drill is a good buy. Wear safety glasses.

Tap and Die Tools: If you can, get some in standard metric automotive sizes: 6mm x 1.0, 8mm x 1.25 and 10mm x 1.5.

Propane/Butane Torch: Helpful to heat and free stuck fasteners (Proc. 2 this chapter).

Creeper: One of these makes crawling around under the vehicle a breeze. Buy one with metal wheels.

SPECIAL TOOLS—ONES SELDOM NEEDED AND PROBABLY RENTABLE

Timing Chain Blocking Tool: This you can make (Ch. 9, Pt. 1, Proc. 2 [5]). Ask your local Datsun/Nissan parts person about ordering one for you.

Engine Hoist: This is discussed further in Ch. 10. Get a cherry picker type and learn how to use it safely.

Cylinder Hone: You'll need this if you rebuild your engine and don't have a machine shop bore the cylinders. Get the ball "bottle brush" type.

Ridge Reamer: You probably won't need this unless there's ridge in the cylinders and the pistons can't be removed.

Bench Grinder: I use mine a lot, mostly to clean gasket surfaces and threads with its wire wheel. The other wheel is a medium, grit grinding stone. Wear safety glasses and read the manufacturer's safety instructions.

HOW TO BUY FASTENERS—NUTS, BOLTS, WASHERS, AND SCREWS

There's a general rap on what's what in Procedure 2. This section's about the thread and head sizes you'll find on your Datsun/Nissan. You already know that your vehicle's held together by metric fasteners so any replacements you buy have to have metric threads. The diameters of the nut, bolt or stud and thread number/pitch are most crucial; for example, 8mm (diameter) x 1.25 (threads per millimeter) x 55mm (length from bottom of bolt head to end of bolt). Typical nut and bolt sizes are as follows: 6mm x 1.0—10mm heads, 8mm x 1.25—12mm head, 10mm x 1.5—14mm head. There are other larger sizes and also different combinations of the above. A common problem happens when 8mm x 1.25 nuts are used with bolts that have 13mm heads. In fact, most replacements are like this—European and American standard. Try to get replacement 8mm nuts and bolts with 12mm heads, which are like the others in your car and easier to work with.

Try to get washers that fit well. Some American sizes are close to metric. Use tapping screws that look like the originals. Datsun/Nissan dealers usually have a good assortment of fasteners.

WRECKING YARDS

I know a couple who had an unusual junk yard experience. The male half of the pair is a diehard hippie who wears rectangular spectacles, a pony tail and tattered bell bottoms, while she's a feminist punk rocker with a purple orange mohawk hair-do and tattoos galore. They drive a 1970 Datsun 510 that looks a bit like each of them. Its multi-colored body parts, rock and political stickers (e.g., "Nobody for President," "U.S. Out of North America," "Rock Against Racism"), and dents reflect a long, hard life, extended by wrecking yard acquisitions.

On a fateful trip to Poor Boy's Auto Salvage the duo left their tired 510 parked in front of the office while they shopped for sundry knobs and switches. Unfortunately the car sat next to a line of recently delivered wrecks. One of the employees, thinking the 510 was for salvage, picked up their car with the forklift and hauled it to the back lot for slaughter. Before long the engine, rear axle and Mexican blanketed seats had been removed and the carcass sat perched atop a stack of retired 510s.

The couple left the office and quickly realized what had happened. Being non-flappable types with a sense of humor they contemplated leaving the car where it was and shrugging the experience off as Karma. But Poor Boy would have nothing to do with that idea, he insisted on making good their loss. In two hours Poor Boy's hard working "rats" had the car running again. The sturdy 510 was once again saved from automotive oblivion by recycled parts.

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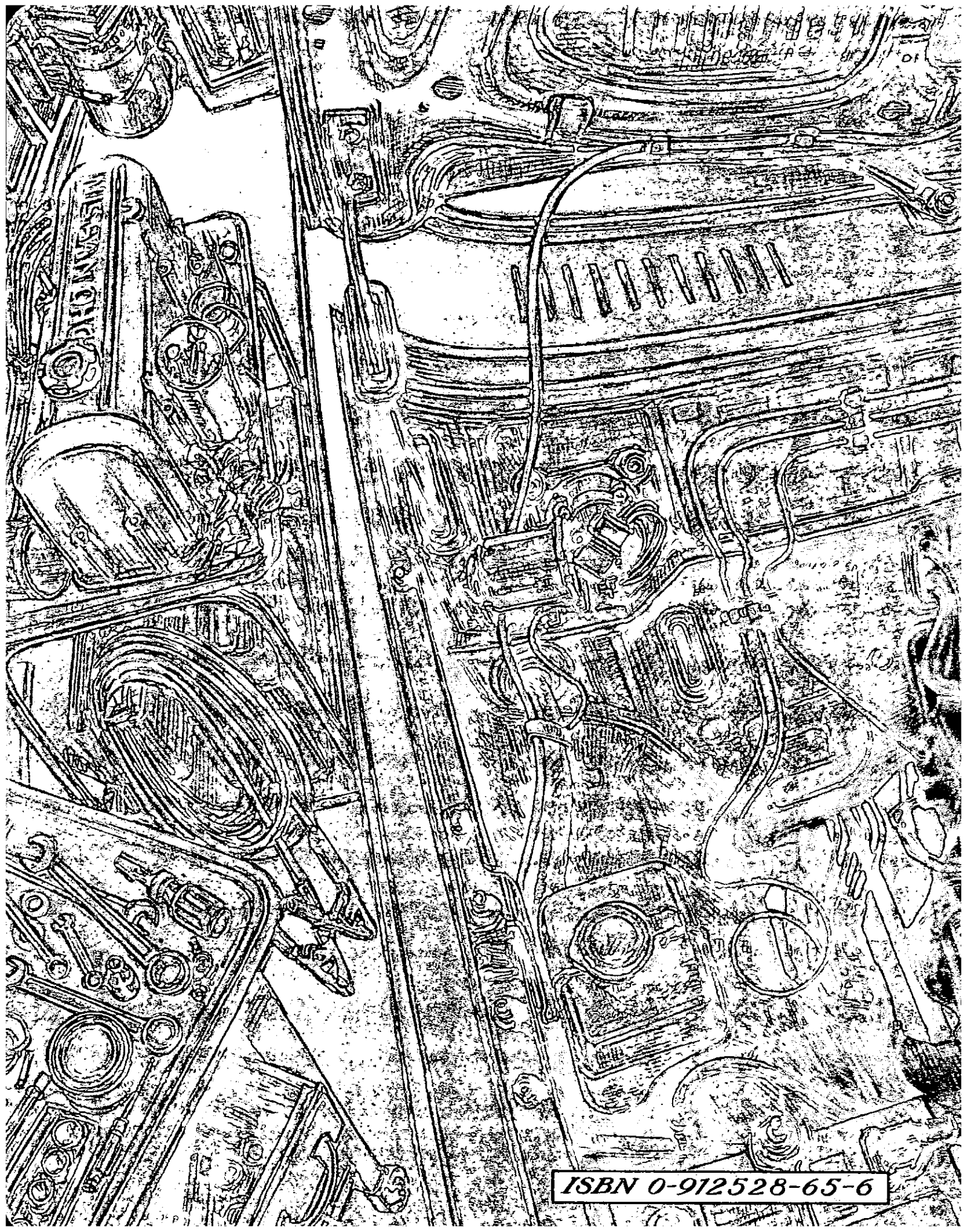

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