

BRAKES

CONTENTS

Brakes	Section 5
Master Cylinder	Section 5A
Front Disc Brakes	Section 5B1
Rear Disc Brakes	Section 5B2
Duo-Servo Drum Brakes	Section 5C2
Vacuum Booster System	Section 5D1
Antilock Brake System	Section 5E1
Antilock Brake System with Traction Control System	Section 5E2
Parking Brake	Section 5F

SECTION 5

BRAKES

CAUTION: Certain components in the Antilock Brake System are not intended to be serviced individually. Attempting to remove or disconnect certain system components may result in personal injury and/or improper system operation. Only those components with approved removal and installation procedures in Sections 5, 5E1 and 5E2 should be serviced.

CAUTION: When servicing brake parts, do not create dust by grinding, sanding brake linings, or by cleaning brake parts with a dry brush or compressed air. Many brake parts contain asbestos fibers which can become airborne if dust is created during servicing. Breathing dust containing asbestos fibers may cause serious bodily harm. A water dampened cloth or water based solution should be used to remove any dust on brake parts. Equipment is commercially available to perform this washing function. These wet methods will prevent asbestos fibers from becoming airborne.

CAUTION: Brake fluid may irritate eyes and skin. In case of contact, take the following actions:

- Eye contact - rinse thoroughly with water.
- Skin contact - wash with soap and water.

NOTICE: The use of rubber hoses or parts other than those specified for the Antilock Brake System may lead to functional problems requiring major overhaul. Replace all components included in repair kits used to service this system. Lubricate rubber parts with clean, fresh brake fluid to ease assembly. Do not use lubricated shop air on brake parts as damage to rubber components may result. If any hydraulic component is removed or brake pipe or hose assembly disconnected, it will be necessary to bleed the entire brake hydraulic system. The torque values specified are for dry, unlubricated fasteners.

NOTICE: When fasteners are removed, always reinstall them at the same location from which they were removed. If a fastener needs to be replaced, use the correct part number fastener for that application. If the correct part number fastener is not available, a fastener of equal size and strength (or stronger) may be used. Fasteners that are not reused, and those requiring thread locking compound will be called out. The correct torque value must be used when installing fasteners that require it. If the above conditions are not followed, parts or system damage could result.

NOTICE: Avoid spilling brake fluid on any of the vehicle's painted surfaces, wiring cables or electrical connectors. Brake fluid will damage paint and electrical connections. If any fluid is spilled on the vehicle, flush the area with water to lessen damage.

CONTENTS

General Description	5-2	Flushing Brake Hydraulic System	5-2
Brake Fluid and Fluid Handling	5-2	Combination Valve Assembly	5-2
Substandard or Contaminated Brake Fluid	5-2	Brake Pressure Differential Warning Switch ...	5-2

Brake Proportion Valve	5-2
Warning/Indicator Lamp Operation	5-4
Brake	5-4
Antilock	5-4
Diagnosis	5-4
Brake System Testing	5-4
External Conditions That Affect Brake Performance	5-4
Brake System	5-4
Brake Pedal Assembly Travel	5-4
Brake Fluid Leaks	5-5
Brake Hose and Pipe Assembly Inspection	5-5
Brake Fluid	5-5
Brake Indicator Diagnostic Charts	Refer to Section 8A-41
On-Vehicle Service	5-5
Filling Master Cylinder Reservoir	Refer to Section 5A

Brake Pedal Assembly with Bracket	5-5
Brake Pedal Assembly	5-8
Stoplamp and Cruise Control Switch Assemblies	5-9
Brake Pipe Assembly	5-11
Double Lap Flare	5-13
ISO Flare	5-19
Combination Valve Assembly	5-20
Brake Hose Assembly	5-21
Front Brake Hose Assembly	5-21
Rear Brake (Center) Hose Assembly	5-22
Rear Brake Hose Assembly	5-24
Bleeding Brake Hydraulic System	Refer to Section 5E1
Flushing Brake Hydraulic System	5-24
Specifications	5-25
General Specifications	5-25
Fastener Tightening Specifications	5-25
Special Tools	5-26

GENERAL DESCRIPTION

BRAKE FLUID AND FLUID HANDLING

CAUTION: Brake fluid may irritate eyes and skin. In case of contact, take the following actions:

- Eye contact - rinse thoroughly with water.
- Skin contact - wash with soap and water.

NOTICE: Avoid spilling brake fluid on any of the vehicle's painted surfaces, wiring, cables or electrical connectors. Brake fluid will damage paint and electrical connections. If any fluid is spilled on the vehicle, flush the area with water to lessen the damage.



Important

- Do not re-use fluid accumulated during brake hydraulic system bleeding.
- Always store brake fluid in a closed container. Reseal brake fluid containers immediately after use. Do not use fluid left in an open or improperly sealed container as it absorbs moisture or can become contaminated.

Substandard or Contaminated Brake Fluid

Use only hydraulic brake fluid GM P/N 1052535 or an equivalent DOT-3 fluid. **DO NOT** use power steering fluid, automatic transmission fluid or DOT-5 silicone hydraulic brake fluid.

Use of an improper fluid or one contaminated with mineral oil or water may cause the fluid to boil or the rubber components in the brake hydraulic system to deteriorate.

Flushing Brake Hydraulic System

The system must be flushed if there is any doubt about the condition of the fluid in the system or if fluid has been used which contains the slightest trace of petroleum

or mineral oil based fluids. Approximately 1.5 liters (1.5 quarts) of hydraulic brake fluid is required to flush the brake hydraulic system. Refer to "Flushing Brake Hydraulic System" under "On-Vehicle Service" in this section for more information.

COMBINATION VALVE ASSEMBLY

The non-serviceable brake combination valve assembly is located under the hood, mounted to the ABS modulator assembly on the left engine compartment side inner rail assembly. The brake combination valve assembly incorporates the following functions into a single component:

Brake Pressure Differential Warning Switch

The brake pressure differential warning switch monitors the front and rear brake systems to measure any difference in hydraulic pressure between the two systems. If a sufficient pressure differential exists between the systems, an electrical ground is made energizing the red "BRAKE" warning lamp if the ignition is on. The brake combination valve assembly and brake pressure differential warning switch are also designed so the warning switch will latch in the warning position once a malfunction has occurred. The "BRAKE" warning lamp will turn off only after the malfunction is repaired and a pedal force sufficient to develop approximately 3 100 kPa (450 psi) hydraulic brake pressure is applied.

Brake Proportion Valve

The brake proportion valve improves front-to-rear brake balance under severe brake application. Severe brake application transfers part of the vehicle's rear weight to the front wheels. The resulting decrease in weight at the rear wheels can cause reduced brake efficiency. The brake proportion valve limits the pressure to the rear brakes to reduce the tendency for reduced brake efficiency. The proportion valve also has a by-pass feature which assures full system pressure to the rear brakes in the event of a front system brake failure. Full front system pressure is retained in the event of rear brake system malfunction.

CAUSES	SYMPTOM	DIAGNOSTIC SECTION																			
		Improper Brake Pedal Travel	Brake Pedal Travel Gradually (Increases)	Excessive Brake Pedal Effort	Excessive Braking Action	Brakes Slow to Respond	Brakes Slow to Release	Brakes Drag	Uneven Braking Action (Side to Side)	Uneven Braking Action (Front to Rear)	Scraping Noise from Brakes	Brakes Squeak Without Application	Brakes Squeak During Stop	Brakes Chatter (Roughness)	Brakes Groan at End of Stop	"Brake" Warning Lamp "On"	Premature Lining Wearout	Parking Brake Won't Hold	Parking Brake Won't Release	Brake Pulsation	Brake Pulls
Leaking Brake Line or Conn.	X	XX							X						XX	X					5
Leaking Piston Seal	X	XX							X						X						5B
Leaking Master Cylinder (Internal)	X	XX							X						X						5A
Air in Brake System	XX				X				X						XX						5
Contaminated or Improper Brake Fluid	X				X	X	X	X	X						X						5
Leaking Vac. or Booster Sys.	XX		XX		X																5D1
Restricted Passage in Vacuum Booster			X	X		XX	X														5D1
Damaged Vacuum Booster	X	X	X	X	X	XX															5D1
Worn Out Brake Lining			X	X				X	X	X	X	X					X			X	5B,5C
Uneven Brake Lining Wear	X			X				X	X	X	X	XX					X			X	5B,5C
Glazed Brake Lining			XX		X			X	X		X	X									5B,5C
Incorrect Lining Material			X	X				X	XX		X	X		X		X	XX		X	X	5B,5C
Contaminated Brake Lining			X					XX	XX	X	X	X		X			X		X	X	5B,5C
Lining Damaged by Abusive Use	X		X	XX			X	X	X	X	X	X		X		X	X		X	X	5B,5C
Improper Rotor Surface Finish			XX	X				X	X								X			X	5B,5C
Scored Rotor				X				X	X		X	X	XX						X	X	5B
Improper Thickness Variation in Rotor	X												XX						XX		5B
Excessive Lateral Run-out in Rotor	X						X						X						X		5B
Brake Asm. Attachments Loose (Incl. Splash Shield)	X			X			X	X	X	X		X	X								5B
Restricted Brake Fluid Passage			X	X		X	X	X	X	X										X	5
Improperly Adj. Stoplamp Switch or Cruise Control Vacuum Dump	X						XX				X					XX					5
Brake Pedal Linkage Interference or Binding			X		X	XX	XX									X					5
Incorrect Vacuum Booster Pushrod Length	X						XX				X					X					5D1
Incorrect Front Wheel Align.								XX												XX	3A
Incorrect Tire Pressure								X												X	3A
Loose Front Suspension Parts							X	X		XX			X						X	X	3C
Out-of-balance Wheel Asm.													XX						X		3E
Operator Riding Brake Pedal			X				X									X					
Sticking Caliper or Caliper Pistons					X	X	XX	X	X		X					X	X	X		X	5B
Park. Brake Switch Ckt. Gnd.															XX						8A
Park. Brake Not Releasing					X	X	X								XX	X					5F
Low Brake Fluid	X								X						X						5
Caliper to Knuckle Clearance					X	X	X				X					X				X	5B
Improper Rear Brake Adj.	XX						X		X							X					5F
Low Engine Vacuum	XX		X		X																5
Excessive Vehicle Loading			X						XX			X				X					
Improperly Torqued Wheel Nuts													X						X		3E
Poor Drum Surface Finish				X									X						X		5C
Parking Brake Cables Seized							X									X	XX	XX			5F
Rotor Corroded			X					X		X			X						XX	X	5
Grease/Dirt on Rotor													X	XX							5
ABS Modulator RR Piston Seized			X						X							X					5E1

XX - INDICATES MORE PROBABLE CAUSE(S) X - INDICATES OTHER CAUSE(S)

RC0001-5-F-RP

Figure 1 - Brake System Diagnosis

WARNING/INDICATOR LAMP OPERATION

Brake

The brake system uses a single red "BRAKE" warning lamp located in the instrument cluster assembly. When the ignition switch is in the "START" position, the "BRAKE" warning lamp should come on. It should go off when the ignition switch returns to the "RUN" position.

The following conditions will activate the "BRAKE" warning lamp:

1. Parking brake applied. Lamp should be on when parking brake is applied and ignition switch is "ON."
2. Brake pressure differential warning switch detects failure. Refer to SECTION 8A for diagnosis.
3. During engine cranking "BRAKE" warning lamp should remain on. This notifies driver that warning circuit is operating properly.

Antilock

The antilock brake system (ABS) uses three indicator lamps: the red "BRAKE" warning lamp, an amber "ABS INOP" indicator lamp and an amber "LOW TRAC" indicator lamp, all located in the instrument cluster assembly. Under normal conditions, these lamps should operate as follows:

1. When ignition is turned to "RUN" position, prior to starting engine, amber "ABS INOP" indicator lamp should go on and red "BRAKE" warning lamp should flash.
2. As engine is cranked, both red "BRAKE" warning lamp and amber "ABS INOP" indicator lamp should come on and "LOW TRAC" indicator lamp may come on and off.
3. When engine is started, amber "ABS INOP" and red "BRAKE" lamps should go out and "LOW TRAC" indicator lamp may come on and off.

The operation of these three indicator lamps is an important part of the antilock brake system (ABS) diagnosis. If the warning/indicator lamps turn on while driving the vehicle, this indicates a malfunction. If the warning/indicator lamps don't turn on under normal conditions as described above, service the lamps as soon as possible. For further information regarding warning/indicator lamp operation for the antilock brake system (ABS), refer to SECTION 5E1.

DIAGNOSIS

BRAKE SYSTEM TESTING

Brakes should be tested on a dry, clean, reasonably smooth and level roadway. A true test of brake performance cannot be made if the roadway is wet, greasy or covered with loose dirt so that all tires do not grip the road equally. Testing will also be affected if the roadway is crowned, which would throw the weight of the vehicle toward the wheels on one side. If the roadway is too rough, the wheels will tend to bounce.

Test brakes at different vehicle speeds with both light and heavy brake pedal force.

External Conditions That Affect Brake Performance

Tires

Tires having unequal contact and grip on the road will cause unequal braking. Tires must be equally inflated, and the tread pattern of right and left tires must be approximately equal.

Vehicle Loading

A heavily loaded vehicle requires more braking effort. When a vehicle has unequal loading, the most heavily loaded wheels require more braking power than others.

Wheel Alignment

Misalignment of the wheels, particularly excessive camber and caster, will cause the brakes to pull to one side.

BRAKE SYSTEM

Figure 1

For diagnosis of the brake hydraulic system, refer to Figure 1.

BRAKE PEDAL ASSEMBLY TRAVEL

Most low brake pedal assembly problems are caused by air in the brake system or misadjusted rear drum brakes. Bleed the system until air is purged and check rear brake adjustment. Refer to SECTION 5E1. Other less frequent causes of excessive brake pedal assembly travel are incorrect pushrod assembly length, rear brake shoe adjusters not operating, linings excessively worn, and brake hydraulic system leakage.

High brake pedal assembly force problems are usually caused by low engine assembly vacuum, a vacuum leak, or an improperly functioning vacuum booster assembly. These conditions would also result in higher than normal brake pedal assembly efforts.



Measure

Tool Required:

J 28662 Brake Pedal Effort Gage

1. Install J 28662 onto pedal assembly.
2. Hook end of tape measure over top edge of pedal assembly and measure the distance to rim of steering wheel assembly.
3. With engine running at idle and the shift lever in "NEUTRAL" and the wheel and tire assemblies blocked, apply brake pedal assembly with 445 N (100 lb.) force and remeasure. The difference between both readings is actual brake pedal assembly travel and should be between 51 to 89 mm (2.0 to 3.5 inches).
4. If brake pedal assembly travel is more than specifications, refer to Figure 1.

BRAKE FLUID LEAKS

With engine running at idle and the shift lever in "NEUTRAL," depress the brake pedal assembly and hold constant foot pressure. If the pedal assembly gradually falls away with constant pressure, the brake hydraulic system may be leaking. Perform visual check to confirm any suspected leak.

Check the master cylinder assembly fluid levels. While a slight drop in master cylinder reservoir level does result from normal lining wear, an abnormally low level in either reservoir indicates a leak in the system. The brake hydraulic system may be leaking either internally or externally. Refer to SECTION 5A. Also, the system may appear to pass this test but still have slight leakage.

Check for possible brake fluid leaks at the brake pipe assembly and brake hose assembly connections. If any signs of leakage are found, replace the brake pipe or hose assembly. Also, inspect the connecting brake component to determine if it is damaged and should be rebuilt or replaced. Check the brake caliper boots and rear wheel cylinder boots for leaks. If any brake fluid appears to be leaking, rebuild or replace the assembly. Refer to SECTION 5B1, SECTION 5B2 or SECTION 5C2.

When checking the brake fluid levels, the master cylinder rear reservoir may be as low as 25.4 mm (1 inch) from the top if the linings are worn. This is not abnormal.

Brake Hose and Pipe Assembly Inspection

NOTICE: Do not allow brake components to hang from the flexible hose assemblies as damage to the hoses may occur. Some brake hose assemblies have protective rings or covers to prevent direct contact of the hose with other chassis parts. Besides causing possible structural damage to the hose, excessive tension could cause the hose rings to move out of their proper locations.



Inspect

1. Flexible hydraulic brake hose assemblies, which transmit hydraulic pressure from steel brake pipe assembly on body to steel brake pipe assemblies on rear axle assembly and to brake caliper assemblies, at least twice a year when vehicle is on lift for lubrication.
2. Brake hose assemblies for road hazard damage, cracks, and chafing of outer cover, and for leaks and blisters.
 - A light and mirror may be needed for adequate inspection.
 - If any of the above conditions are observed on brake hose assembly, it will be necessary to replace it.

BRAKE FLUID

NOTICE: Improper brake fluid, mineral oil or water in the brake fluid may cause rubber components in the brake hydraulic system to deteriorate. If brake master cylinder primary or secondary piston seals are swollen, the rubber parts have deteriorated. This

deterioration may also be seen by swollen brake master cylinder reservoir seals, rear wheel cylinder piston boots or brake caliper piston boots.

If rubber deterioration is evident, disassemble all hydraulic parts and wash with alcohol. Dry parts with compressed air before assembly to keep alcohol out of the system. Replace all rubber parts in the system, including brake hose assemblies, master cylinder assembly rubber parts, and brake caliper assembly and wheel cylinder assembly boots and seals. Also replace the combination valve assembly and brake pressure modulator valve assembly, since they have rubber components inside which are not serviceable. Check for brake fluid on the linings. If excessive brake fluid is found, replace the linings.

The system must be flushed if there is any doubt as to the condition of brake fluid in the system or if a fluid has been used which contains the slightest trace of petroleum or mineral oil based fluids. Refer to SECTION 5E1 for complete brake hydraulic system flush and bleed procedures.

ON-VEHICLE SERVICE

BRAKE PEDAL ASSEMBLY WITH BRACKET

Figures 2 through 4



Remove or Disconnect

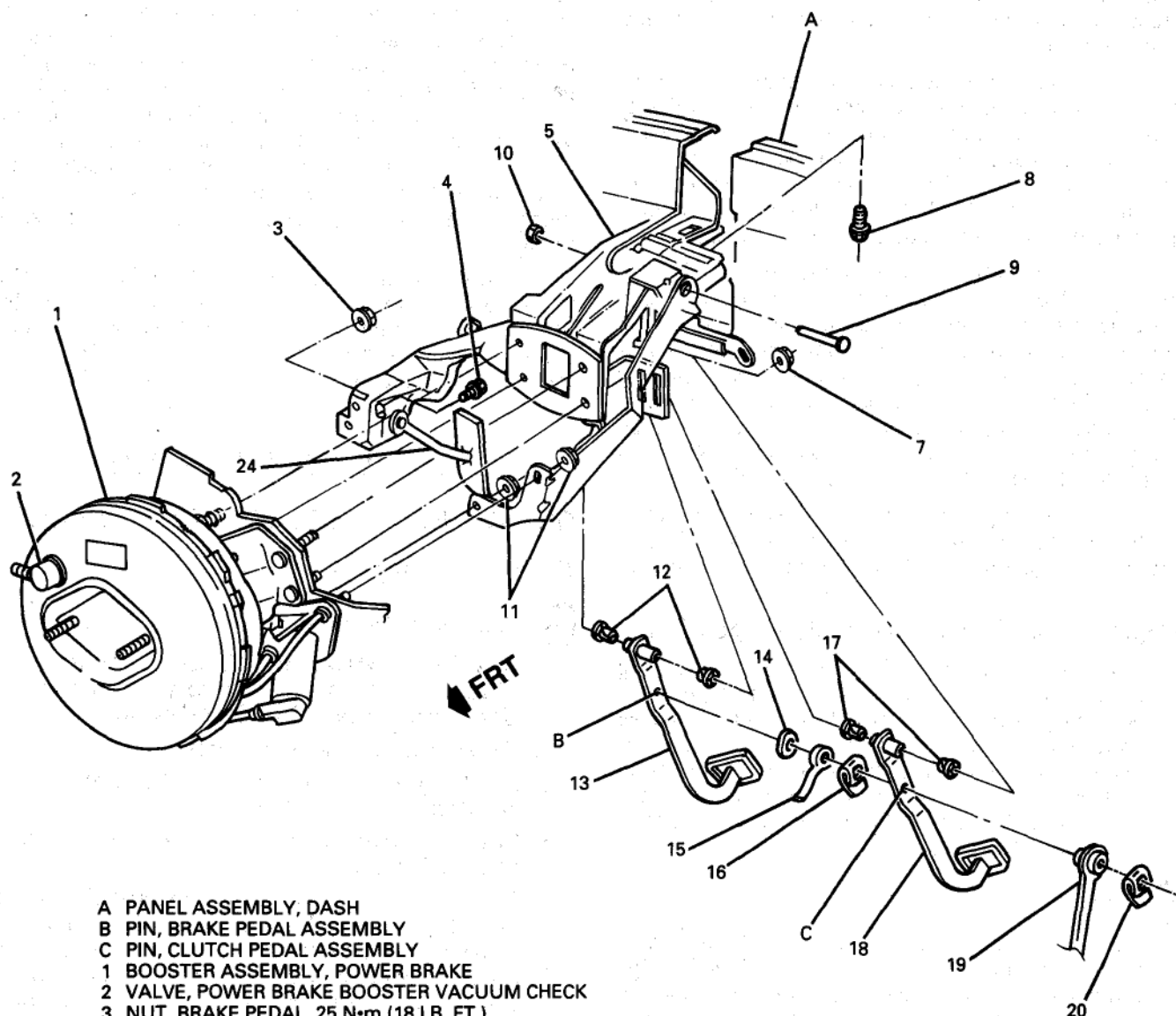
CAUTION: Refer to "Caution" under "Disconnecting the Battery Negative Cable Assembly" in SECTION 0A.

1. Battery negative cable assembly.
2. Left-hand instrument panel sound insulator assembly. Refer to SECTION 8C.
3. Electronic brake control module assembly. Refer to SECTION 5E1.
4. Release switch assembly, stoplamp and TCC switch assembly, and clutch switch assembly or clutch anticipate switch assembly if equipped, from pedal assembly with bracket. Refer to "Stoplamp and Cruise Control Switch Assemblies" in this section.
5. Clutch start switch assembly (29) from brake pedal assembly with bracket (5) on vehicle with manual transmission assembly.
6. Accelerator lever pedal assembly. Refer to SECTION 6C.
7. Retainer (16), brake pedal pushrod (15) and washer (14) from brake pedal assembly pin.
8. Retainer (20) and clutch pushrod (19) from clutch pedal assembly pin on vehicle with manual transmission assembly.
9. Nuts (3 and 7) and bolts/screws (4 and 8).
10. Nuts (11), on vehicle with manual transmission assembly.
11. Brake pedal assembly with bracket (5 or 6).



Install or Connect

NOTICE: See "Notice" on page 5-1 of this section.



- A PANEL ASSEMBLY, DASH
- B PIN, BRAKE PEDAL ASSEMBLY
- C PIN, CLUTCH PEDAL ASSEMBLY
- 1 BOOSTER ASSEMBLY, POWER BRAKE
- 2 VALVE, POWER BRAKE BOOSTER VACUUM CHECK
- 3 NUT, BRAKE PEDAL, 25 N·m (18 LB. FT.)
- 4 BOLT/SCREW, BRAKE PEDAL BRACKET, 25 N·m (18 LB. FT.)
- 5 PEDAL ASSEMBLY, BRAKE AND ACCELERATOR AND CLUTCH (WITH BRACKET)
- 7 NUT, BRAKE PEDAL BRACKET, 25 N·m (18 LB. FT.)
- 8 BOLT/SCREW, BRAKE PEDAL BRACKET, 25 N·m (18 LB. FT.)
- 9 BOLT/SCREW, BRAKE PEDAL PIVOT
- 10 NUT, BRAKE PEDAL PIVOT
- 11 NUT, CLUTCH MASTER CYLINDER, 27 N·m (20 LB. FT.)
- 12 BUSHING, BRAKE PEDAL PIVOT
- 13 PEDAL ASSEMBLY, BRAKE
- 14 WASHER, BRAKE PEDAL PUSHROD
- 15 PUSHROD, BRAKE PEDAL
- 16 RETAINER, BRAKE PEDAL PUSHROD PIN
- 17 BUSHING, CLUTCH PEDAL PIVOT
- 18 PEDAL ASSEMBLY, CLUTCH
- 19 PUSHROD, CLUTCH MASTER CYLINDER
- 20 RETAINER, CLUTCH PEDAL LEVER PIN
- 24 PEDAL ASSEMBLY, ACCELERATOR LEVER

PC0002-5-F-RP

Figure 2 – Manual Transmission Brake Pedal Assembly

**Important**

- When installing brake pedal assembly with bracket, make sure that dash panel insulator material does not get pinched between brake pedal assembly with bracket and dash panel.

1. Brake pedal assembly with bracket (5 or 6).
2. Nuts (11), on vehicle with manual transmission.
3. Nuts (3 and 7) and bolts/screws (4 and 8).

**Tighten**

- Nuts (7) to 25 N•m (18 lb. ft.) in sequence: inboard upper, outboard lower, outboard upper, inboard lower.
- Nuts (3) and bolts/screws (4 and 8) to 25 N•m (18 lb. ft.).
- Nuts (11) to 27 N•m (20 lb. ft.) on vehicle with manual transmission assembly.

4. Accelerator lever pedal assembly. Refer to SECTION 6C.
5. Retainer (20) and clutch pushrod (19) to clutch pedal assembly pin on vehicle with manual transmission assembly.
 - Lubricate clutch pedal assembly pin with chassis lubricant, GM P/N 1052497 or equivalent.
6. Retainer (16), brake pedal pushrod (15) and washer (14) to brake pedal assembly pin.
 - Lubricate brake pedal assembly pin with chassis lubricant, GM P/N 1052497 or equivalent.
7. Release switch assembly, stoplamp and TCC switch assembly, and clutch switch assembly or clutch anticipate switch assembly if equipped, to pedal assembly with bracket. Refer to "Stoplamp and Cruise Control Switch Assemblies" in this section.
8. Electronic brake control module assembly. Refer to SECTION 5E1.
9. Clutch start switch assembly (29) to brake pedal assembly with bracket (5), on vehicle with manual transmission assembly.
10. Battery negative cable assembly.

**Adjust**

- Release switch assembly, stoplamp and TCC switch assembly, and clutch switch assembly or clutch anticipate switch assembly on vehicle with manual transmission assembly. Refer to "Stoplamp and Cruise Control Switch Assemblies" in this section.

BRAKE PEDAL ASSEMBLY*Figures 2 and 3***Remove or Disconnect**

CAUTION: Refer to "Caution" under "Disconnecting the Battery Negative Cable Assembly" in SECTION 0A.

1. Battery negative cable assembly.

2. Electronic brake control module assembly. Refer to SECTION 5E1.
3. Retainer (16), brake pedal pushrod (15) and washer (14) from brake pedal assembly pin.
4. Nut (10) and bolt/screw (9) on vehicle with manual transmission assembly.
 - Slide out bolt/screw (9) part way, giving just enough clearance to remove brake pedal assembly (13).
5. Nut (22) and bolt/screw (21) on vehicle with automatic transmission assembly.
6. Brake pedal assembly (13).
7. Bushings (12) from brake pedal assembly (13), if necessary.
8. Spacer (23) from brake pedal assembly (13) on vehicle with automatic transmission assembly, if necessary.

**Clean**

- All parts with suitable solvent.

**Inspect**

- All parts for wear. Repair or replace as needed.

**Install or Connect**

1. Spacer (23) to brake pedal assembly (13), if removed.
2. Bushings (12) to brake pedal assembly (13), if removed.
3. Lubricate bolt/screw (9) with chassis lubricant, GM P/N 1052497 or equivalent on vehicle with manual transmission assembly.
4. Brake pedal assembly (13).
5. Bolt/screw (9) and nut (10) on vehicle with manual transmission assembly.
6. Bolt/screw (21) and nut (22) on vehicle with automatic transmission assembly.

**Tighten**

- Nut (10 or 22) to 54 N•m (40 lb. ft.).
7. Retainer (16), brake pedal pushrod (15) and washer (14) to brake pedal assembly pin.
 - Lubricate brake pedal assembly pin with chassis lubricant, GM P/N 1052497 or equivalent.
 8. Electronic brake control module assembly. Refer to SECTION 5E1.
 9. Battery negative cable assembly.

**Adjust**

- Release switch assembly, and stoplamp and TCC switch assembly, and clutch switch assembly or clutch anticipate switch assembly if equipped. Refer to "Stoplamp and Cruise Control Switch Assemblies" in the following procedure.

STOPLAMP AND CRUISE CONTROL SWITCH ASSEMBLIES

Figure 4

Adjustment

The release switch assembly (27) must be adjusted at the same time the stoplamp and torque converter clutch (TCC) switch is adjusted. The clutch switch assembly (25) or clutch anticipate switch assembly (28) cannot be adjusted until after the clutch pedal assembly is installed.

NOTICE: Proper stoplamp switch assembly adjustment is essential. Improper stoplamp switch assembly adjustment will cause brake drag and excessive brake lining wear.



Adjust

1. To adjust, depress brake pedal assembly or clutch pedal assembly and insert release switch assembly (27), stoplamp and TCC switch assembly (26) and clutch switch assembly (25) or clutch anticipate switch assembly (28) into pedal assembly with



Measure

- Release switch assembly and stoplamp and TCC switch assembly contacts should be open at 25.4 mm (1 inch) or less of pedal assembly travel, and occur at the same time or before the onset of braking. The

bracket (5 or 6) until retainer on release switch assembly (27), stoplamp and TCC switch assembly (26), or clutch switch assembly (25) or clutch anticipate switch assembly (28) is fully seated.

NOTICE: Make sure to apply the proper amount of force to the brake pedal assembly during adjustment. Too much force could damage the vacuum booster assembly. Too little could cause dragging brakes.

2. Slowly pull brake or clutch pedal assembly rearward with a force of 222 N (50 pounds) until "click" sounds can no longer be heard. At this point, release switch assembly (27), stoplamp and TCC switch assembly (26), and clutch switch assembly (25) or clutch anticipate switch assembly (28) will have moved retainers to their adjusted position.

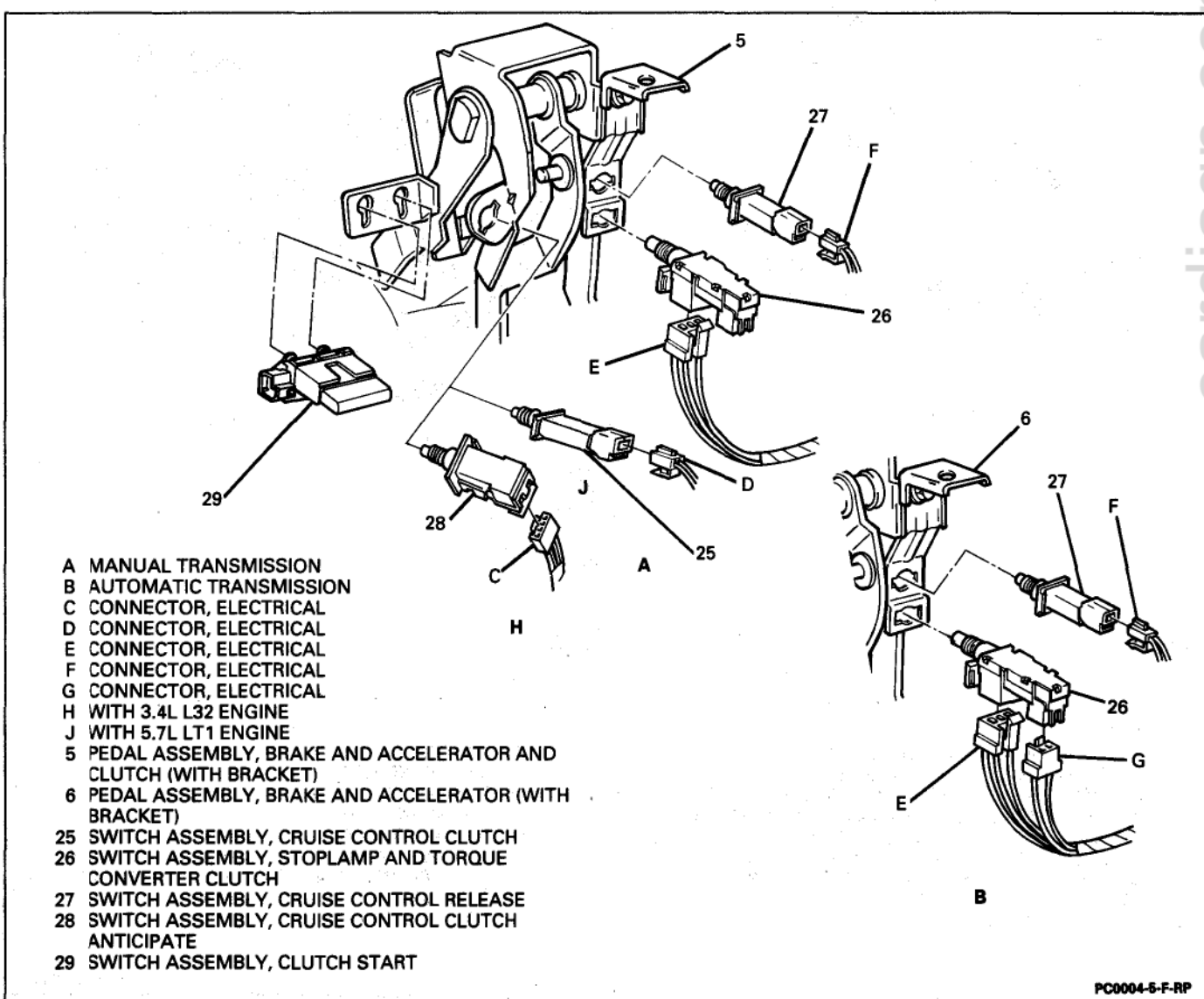
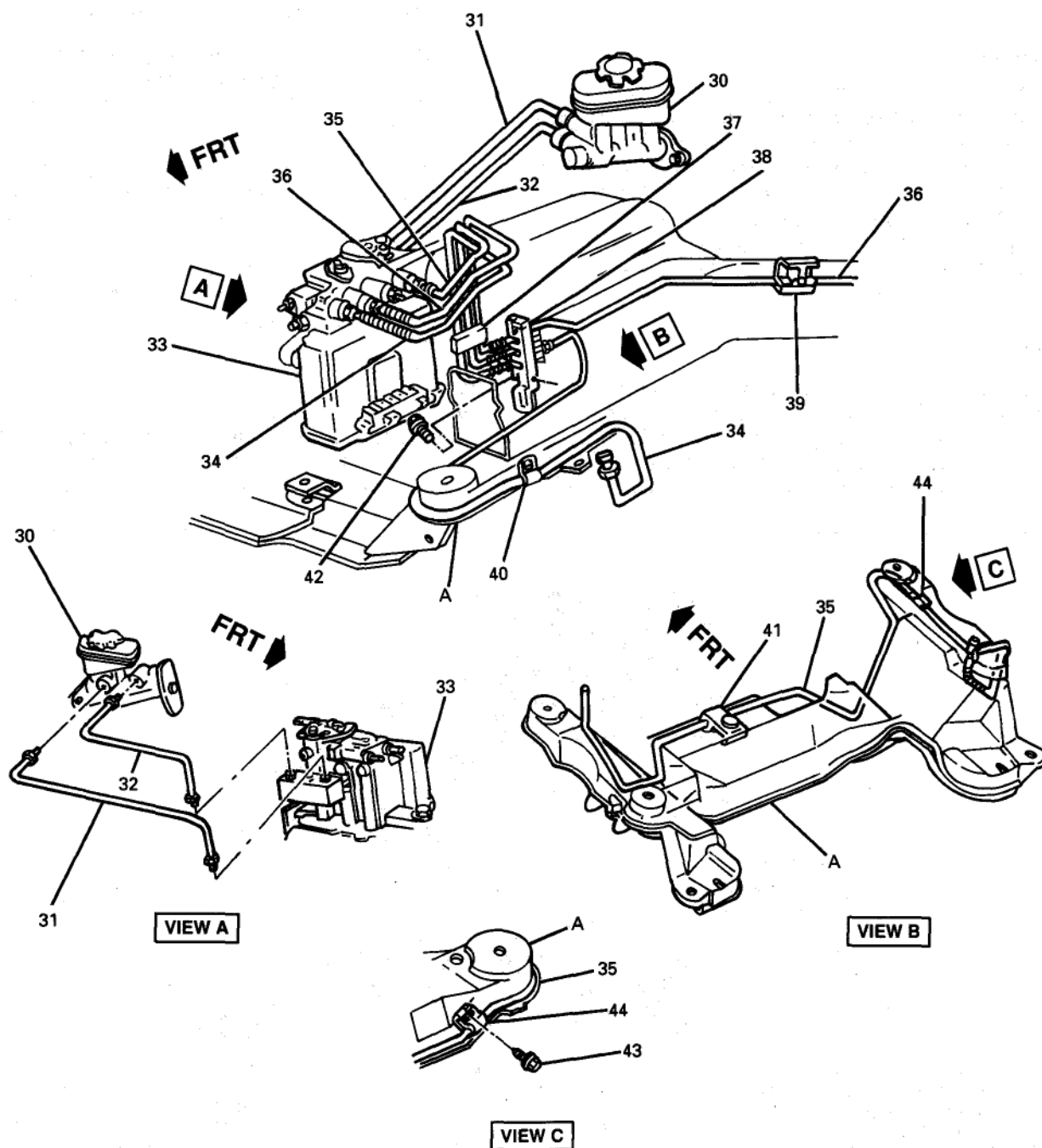


Figure 4 – Stoplamp and Cruise Control Switch Assemblies



- A CROSSMEMBER ASSEMBLY, FRONT
- 30 CYLINDER ASSEMBLY, BRAKE MASTER
- 31 PIPE ASSEMBLY, FRONT BRAKE COMBINATION VALVE
- 32 PIPE ASSEMBLY, REAR BRAKE COMBINATION VALVE
- 33 VALVE ASSEMBLY, BRAKE PRESSURE MODULATOR
- 34 PIPE ASSEMBLY, LEFT-HAND FRONT BRAKE
- 35 PIPE ASSEMBLY, RIGHT-HAND FRONT BRAKE
- 36 PIPE ASSEMBLY, REAR BRAKE FRONT,
15 N·m (11 LB. FT.)

- 37 CLIP, BRAKE PIPE
- 38 CLIP, BRAKE PIPE
- 39 CLIP, BRAKE PIPE
- 40 CLIP, BRAKE PIPE
- 41 CLIP, BRAKE PIPE
- 42 BOLT/SCREW, BRAKE PIPE CLIP, 6 N·m (53 LB. IN.)
- 43 BOLT/SCREW, FRONT BRAKE FRONT PIPE CLIP,
6 N·m (53 LB. IN.)
- 44 CLIP, BRAKE PIPE

Figure 5 – Routing Front Brake Pipe Assemblies (Without Traction Control System)

BRAKE PIPE ASSEMBLIES-TO-BRAKE MASTER CYLINDER ASSEMBLY					
CalloUT NUMBER	CIRCUIT	NUT SIZE	PIPE ASSEMBLY DIAMETER	APPROXIMATE BRAKE PIPE LINEAR LENGTH	NUT TIGHTENING SPECIFICATION
31	PRIMARY	M11 x 1.5	4.76 mm	411.0 mm (16.848")	32 N•m (24 LB. FT.)
32	SECONDARY	M11 x 1.5	4.76 mm	519.0 mm (20.895")	32 N•m (24 LB. FT.)

BRAKE PIPE ASSEMBLIES-TO-COMBINATION VALVE ASSEMBLY					
CalloUT NUMBER	CIRCUIT	NUT SIZE	PIPE ASSEMBLY DIAMETER	APPROXIMATE BRAKE PIPE LINEAR LENGTH	NUT TIGHTENING SPECIFICATION
31	PRIMARY	M10 x 1.0	4.76 mm	411.0 mm (16.848")	18 N•m (13 LB. FT.)
32	SECONDARY	M10 x 1.0	4.76 mm	519.0 mm (20.895")	18 N•m (13 LB. FT.)

BRAKE PIPE ASSEMBLIES-TO-BRAKE PRESSURE MODULATOR VALVE ASSEMBLY					
CalloUT NUMBER	CIRCUIT	NUT SIZE	PIPE ASSEMBLY DIAMETER	APPROXIMATE BRAKE PIPE LINEAR LENGTH	NUT TIGHTENING SPECIFICATION
34	LEFT-HAND FRONT	M10 x 1.0	4.76 mm	2321.50 mm (91.379")	32 N•m (24 LB. FT.)
35	RIGHT-HAND FRONT	M10 x 1.0	4.76 mm	1398.84 mm (55.072")	32 N•m (24 LB. FT.)
36	REAR	M12 x 1.5	6.00 mm	3736.0 mm (150.155")	32 N•m (24 LB. FT.)

BRAKE PIPE ASSEMBLIES-TO-BRAKE HOSE ASSEMBLIES					
CalloUT NUMBER	CIRCUIT	NUT SIZE	PIPE ASSEMBLY DIAMETER	APPROXIMATE BRAKE PIPE LINEAR LENGTH	NUT TIGHTENING SPECIFICATION
34	LEFT-HAND FRONT	M10 x 1.0	4.76 mm	2321.50 mm (91.379")	15 N•m (11 LB. FT.)
35	RIGHT-HAND FRONT	M10 x 1.0	4.76 mm	1398.84 mm (55.072")	15 N•m (11 LB. FT.)

NUT COLOR CODE	
SIZE	COLOR
M10 x 1.0	OLIVE
M11 x 1.5	ORANGE
M12 x 1.0	OLIVE
M12 x 1.5	OLIVE
3/8-24 UNF	VIOLET

RC0008-5-F-RP

Figure 6 – Front Brake Pipe Assemblies Specifications (Without Traction Control System)

brake pedal assembly travel can be up to 25.4 mm (1 inch) before the cruise control system disengages.

Replacement

Remove or Disconnect

1. Left-hand instrument panel sound insulator assembly. Refer to SECTION 8C.
2. Electrical connectors.
3. Release switch assembly (27), stoplamp and TCC switch assembly (26), and clutch switch assembly (25) or clutch anticipate switch assembly (28), if equipped, from pedal assembly with bracket (5 or 6).

Install or Connect

1. Release switch assembly (27), stoplamp and TCC switch assembly (26), and clutch switch assembly (25) or clutch anticipate switch assembly (28), if equipped, to pedal assembly with bracket (5 or 6).

2. Electrical connectors.
3. Left-hand instrument panel sound insulator assembly. Refer to SECTION 8C.



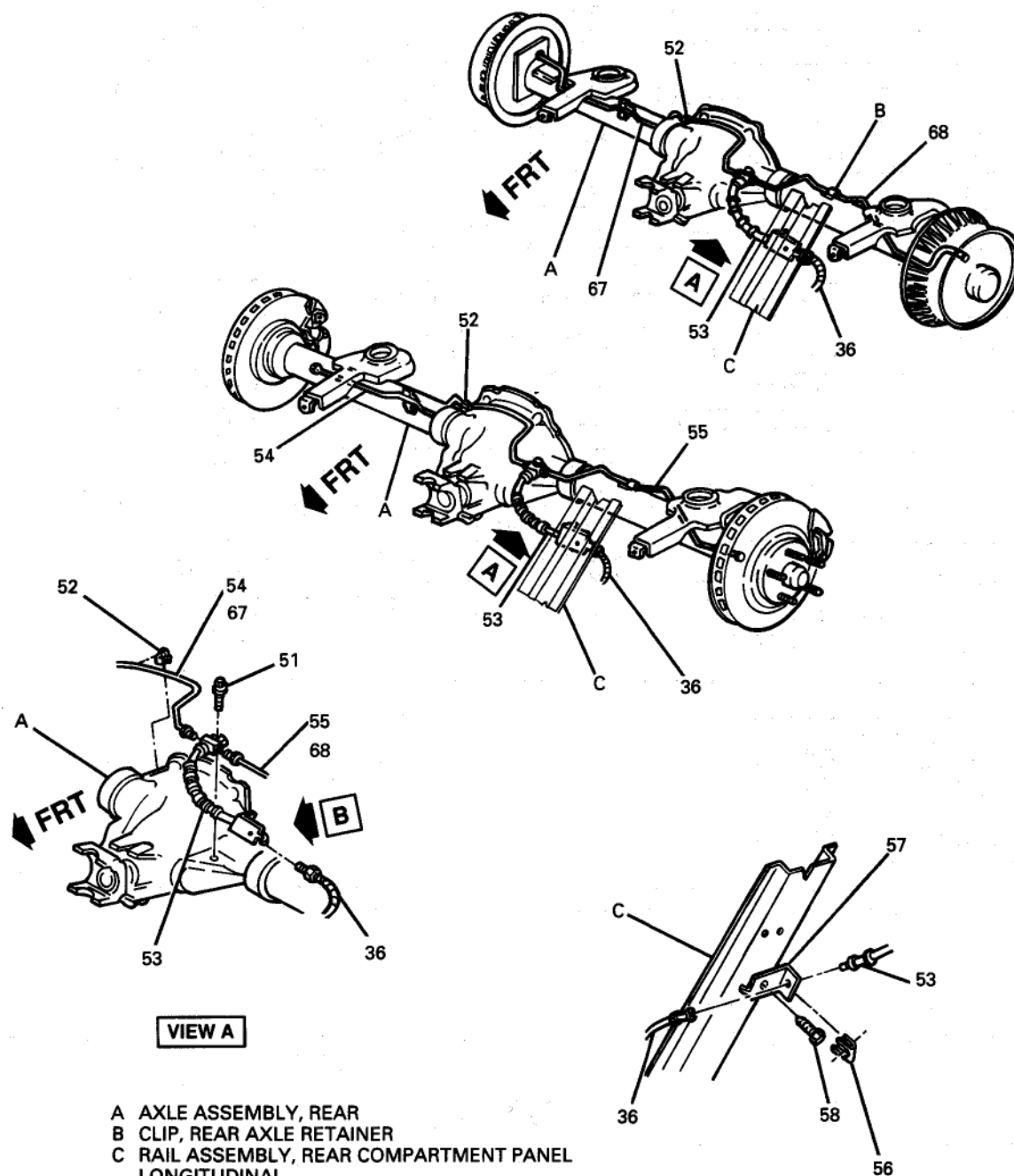
Adjust

- Release switch assembly (27), stoplamp and TCC switch assembly (26), and clutch switch assembly (25) or clutch anticipate switch assembly (28), as outlined above.

BRAKE PIPE ASSEMBLY

Figures 5 through 14

CAUTION: Always use double walled steel brake pipe when replacing brake pipe assemblies. The use of any other pipe is not recommended and may cause brake system failure. Carefully route and retain replacement brake



VIEW A

VIEW B

- A AXLE ASSEMBLY, REAR
- B CLIP, REAR AXLE RETAINER
- C RAIL ASSEMBLY, REAR COMPARTMENT PANEL LONGITUDINAL
- 36 PIPE ASSEMBLY, REAR BRAKE FRONT, 15 N·m (11 LB. FT.)
- 51 BOLT/SCREW, REAR BRAKE HOSE FITTING, 21 N·m (15 LB. FT.)
- 52 CLIP, REAR BRAKE PIPE
- 53 HOSE ASSEMBLY, REAR BRAKE
- 54 PIPE ASSEMBLY, RIGHT-HAND REAR BRAKE
- 55 PIPE ASSEMBLY, LEFT-HAND REAR BRAKE
- 56 RETAINER, REAR BRAKE HOSE
- 57 BRACKET, REAR BRAKE HOSE
- 58 BOLT/SCREW, REAR BRAKE HOSE RETAINER, 10 N·m (89 LB. IN.)
- 67 PIPE ASSEMBLY, RIGHT-HAND REAR BRAKE
- 68 PIPE ASSEMBLY, LEFT-HAND REAR BRAKE

PC0008-5-F-RP

Figure 7 – Routing Rear Brake Pipe and Hose Assemblies (Without Traction Control System)

REAR BRAKE PIPE ASSEMBLIES - TO - REAR BRAKE HOSE ASSEMBLIES							
CALLOUT NUMBER	CIRCUIT	NUT SIZE @ CENTER HOSE ASSEMBLY	NUT SIZE @ RIGHT AND LEFT HOSE ASSEMBLIES	PIPE ASSEMBLY DIAMETER	APPROXIMATE PIPE LINEAR LENGTH	NUT TIGHTENING SPECIFICATIONS	
						@ CENTER HOSE ASSEMBLY	@ RIGHT AND LEFT HOSE ASSEMBLIES
54	RIGHT-HAND REAR DISC	3/8-24 UNF	M10 x 1.0	4.76 mm	890.49 mm (35.058")	24 N•m (18 LB. FT.)	15 N•m (11 LB. FT.)
55	LEFT-HAND REAR DISC	3/8-24 UNF	M10 x 1.0	4.76 mm	541.91 mm (21.335")	24 N•m (18 LB. FT.)	15 N•m (11 LB. FT.)
36	REAR	M12 x 1.0	—	6.00 mm	3826 mm (150.629")	15 N•m (11 LB. FT.)	—

REAR BRAKE PIPE ASSEMBLIES - TO - REAR WHEEL CYLINDERS							
CALLOUT NUMBER	CIRCUIT	NUT SIZE @ CENTER HOSE ASSEMBLY	NUT SIZE @ WHEEL CYLINDER	PIPE ASSEMBLY DIAMETER	APPROXIMATE PIPE LINEAR LENGTH	NUT TIGHTENING SPECIFICATIONS	
						@ CENTER HOSE ASSEMBLY	@ RIGHT AND LEFT WHEEL CYLINDERS
67	RIGHT-HAND REAR DRUM	3/8-24 UNF	3/8-24 UNF	4.76 mm	1170.05 mm (46.064")	24 N•m (18 LB. FT.)	17 N•m (13 LB. FT.)
68	LEFT-HAND REAR DRUM	3/8-24 UNF	3/8-24 UNF	4.76 mm	864.30 mm (34.027")	24 N•m (18 LB. FT.)	17 N•m (13 LB. FT.)

NUT COLOR CODE	
SIZE	COLOR
M10 x 1.0	OLIVE
M11 x 1.5	ORANGE
M12 x 1.0	YELLOW
M12 x 1.5	BLACK
3/8-24 UNF	VIOLET

RC0002-5-F-RP

Figure 8 – Rear Brake Pipe and Hose Assemblies Specifications (Without Traction Control System)

pipe assemblies. Always use the correct fasteners and the original location for replacement brake pipe assemblies. Failure to properly route and retain brake pipe assemblies may cause damage to the brake pipe assemblies and cause brake system failure.

Refer to Figures 5 through 14 for brake pipe routing, tightening specifications and replacement. For information on the brake pressure modulator valve assembly, refer to SECTION 5E1. For information on the traction control brake pressure modulator valve assembly, refer to SECTION 5E2.

Important

- Rear brake front pipe assemblies (36, 117 or 118) should not be locally fabricated. These pipe assemblies should be ordered through your GM Parts Dealer.

Double Lap Flare

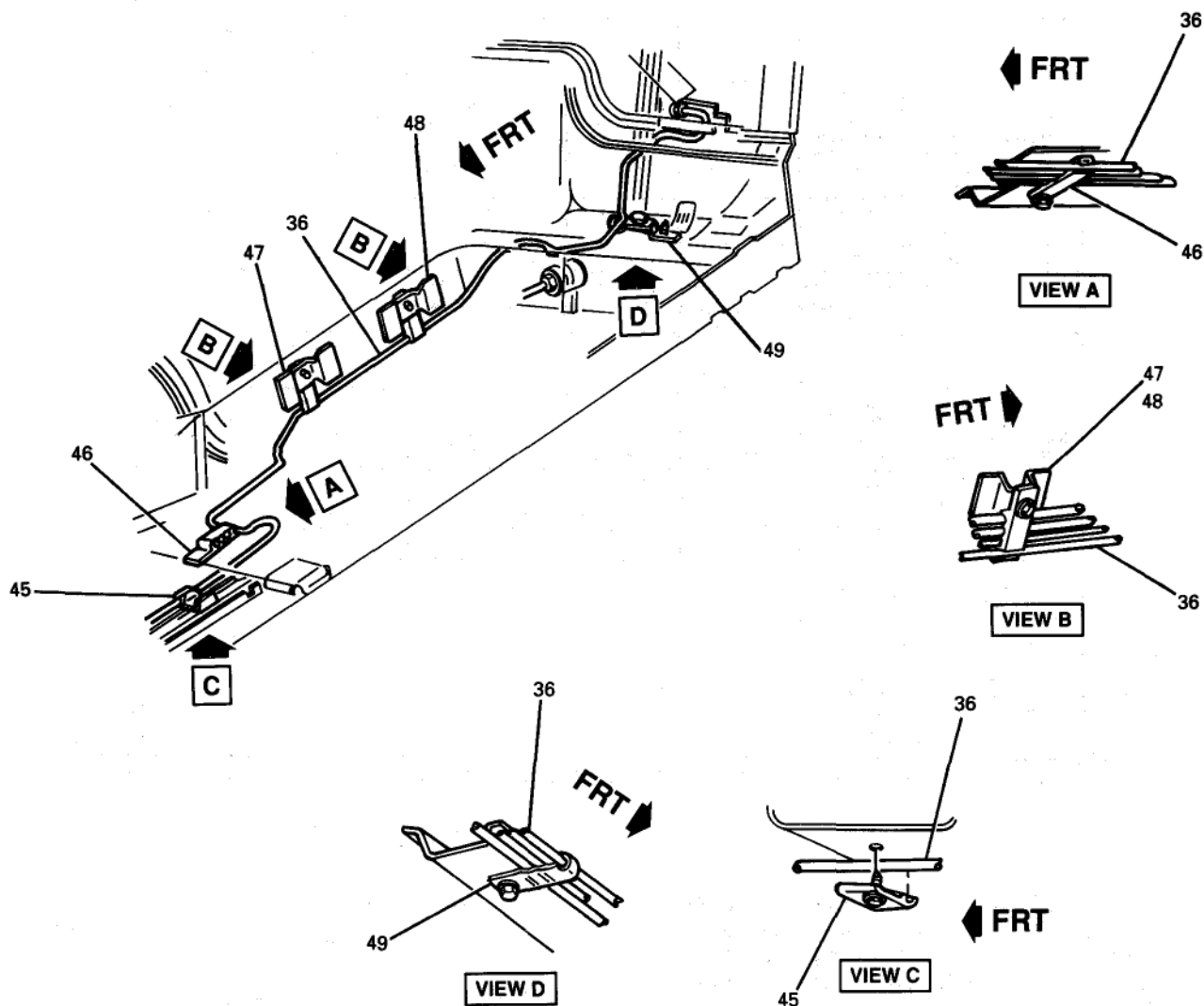
Figures 15 through 18

Double lap flares are to be used for rear brake rear pipe assemblies. All other brake pipe assemblies will use ISO flare.

Tool Required:

J 23530 Brake Line Flaring Tool (45 Degree Single and Double)

1. Obtain recommended tubing and steel fitting nuts of correct size.
 - Outside diameter of tubing is used to specify size.
 2. Cut tubing to length.
 - Correct length may be determined by measuring old brake pipe assembly using string and adding 3 mm (1/8 inch) for each double flare.
 3. Cut end square and chamfer inside and outside diameter of tubing with de-burring tool.
 - Remove all traces of lubricant from tubing.
- NOTICE:** Do not use single lap flaring tools. Double lap flaring tools must be used to produce a flare strong enough to hold system pressure. Using single lap flaring tools could cause system damage. A single lap flare will split tubing while a double lap flare produces a well-formed, unbroken, reinforced double walled flare.
4. Double lap flare tubing ends using J 23530.
 - A. Make sure fittings are installed before starting flare.
 - B. Unscrew compression screw until swivel cone is at its highest point.
 - Swing strap to one side.



BRAKE PIPE ASSEMBLY TO BRAKE PRESSURE MODULATOR VALVE ASSEMBLY

CALLOUT NUMBER	CIRCUIT	NUT SIZE	PIPE ASSEMBLY DIAMETER	APPROXIMATE PIPE LINEAR LENGTH	NUT TIGHTENING SPECIFICATION
36	REAR	M12 x 1.5	6.00 mm	3813.95 mm (150.155")	32 N•m (24 LB. FT.)

BRAKE PIPE ASSEMBLY TO REAR BRAKE (CENTER) HOSE ASSEMBLY

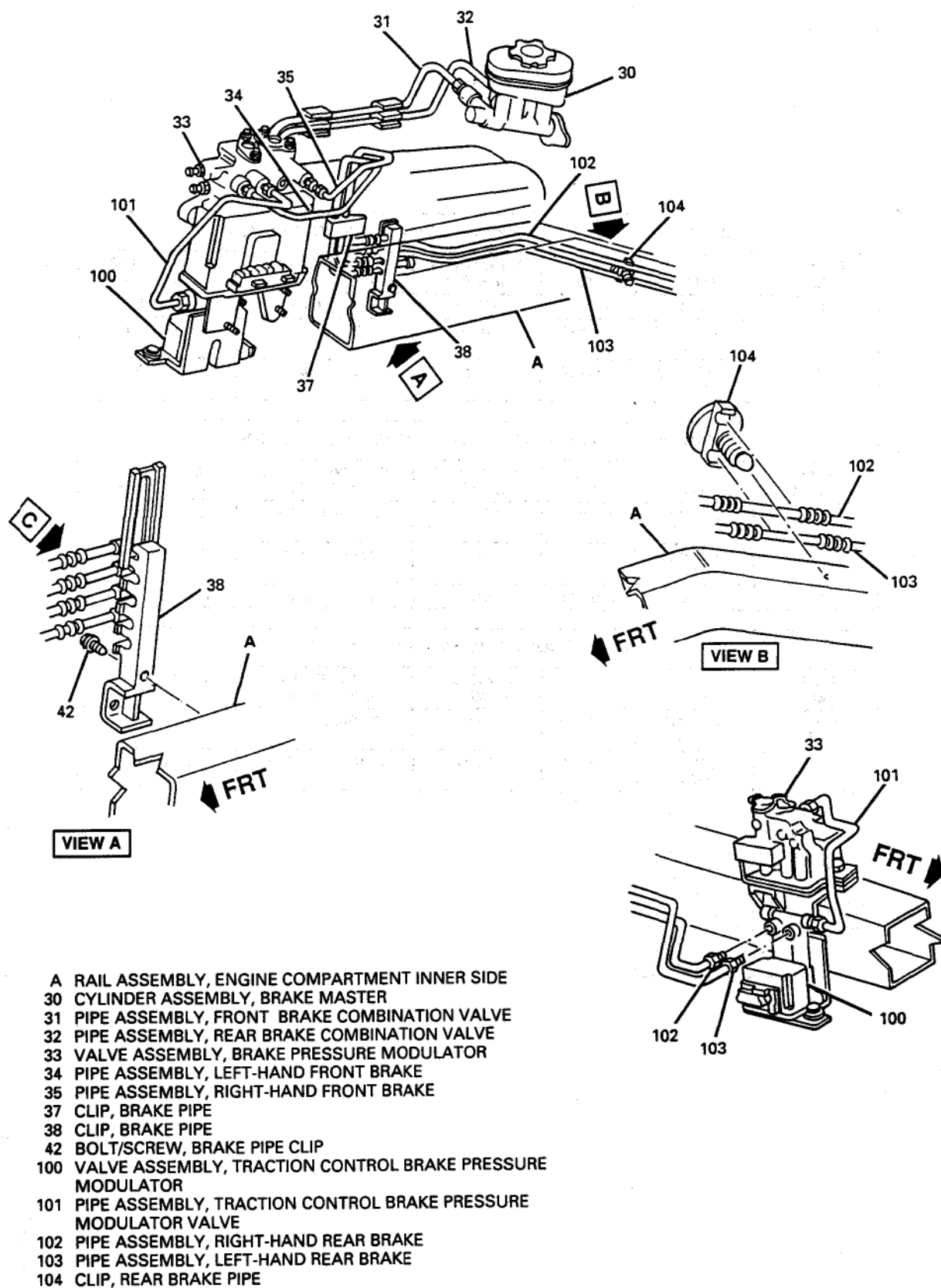
CALLOUT NUMBER	CIRCUIT	NUT SIZE	PIPE ASSEMBLY DIAMETER	APPROXIMATE PIPE LINEAR LENGTH	NUT TIGHTENING SPECIFICATION
36	REAR	M12 x 1.0	6.00 mm	3813.95 mm (150.155")	15 N•m (11 LB. FT.)

- 36 PIPE ASSEMBLY, REAR BRAKE FRONT,
15 N•m (11 LB. FT.)
45 CLIP, BRAKE PIPE
46 CLIP, FUEL LINE RETAINER
47 CLIP, FUEL LINE RETAINER
48 CLIP, FUEL LINE RETAINER
49 CLIP, FUEL LINE RETAINER

NUT COLOR	
SIZE	COLOR
M10 x 1.0	OLIVE
M11 x 1.5	ORANGE
M12 x 1.0	YELLOW
M12 x 1.5	BLACK
3/8-24 UNF	VIOLET

PC0007-5-F-RP

Figure 9 – Routing Underbody Rear Brake Front Pipe Assembly (Without Traction Control System)



RC0003-5-F-RP

Figure 10 – Routing Front Brake Pipe Assemblies (With Traction Control System)

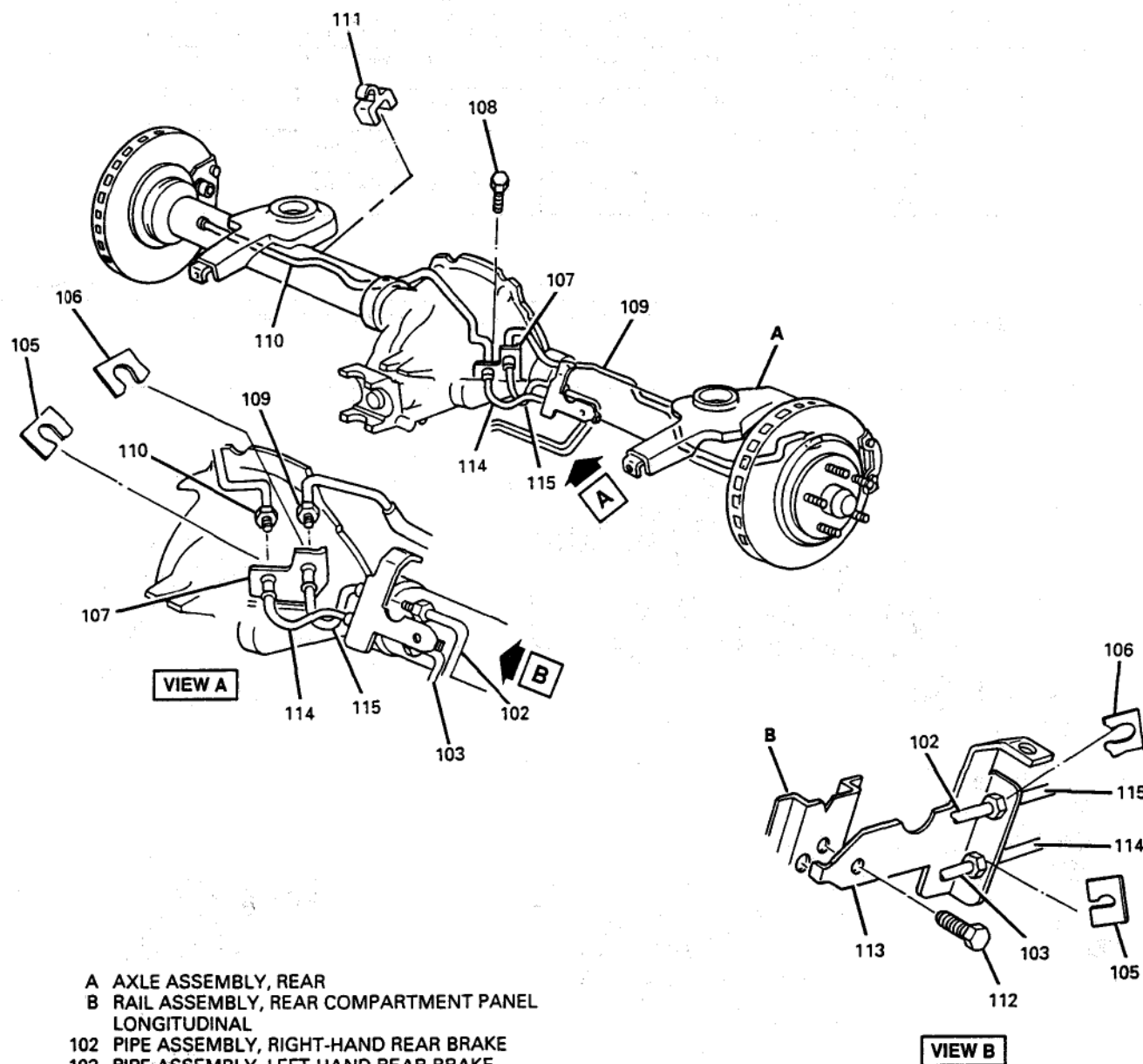
BRAKE PIPE ASSEMBLIES - TO - TRACTION CONTROL MODULATOR VALVE ASSEMBLY					
CalloUT NUMBER	CIRCUIT	NUT SIZE	PIPE ASSEMBLY DIAMETER	APPROXIMATE BRAKE LINEAR LENGTH	NUT TIGHTENING SPECIFICATION
101	REAR	M12 x 1.5	6.00 mm	403.0 mm (15.86")	32 N•m (24 LB. FT.)
102	RIGHT-HAND REAR	M11 x 1.5	4.76 mm	3615.0 mm (142.32")	32 N•m (24 LB. FT.)
103	LEFT-HAND REAR	M10 x 1.0	4.76 mm	3630.0 mm (142.91")	32 N•m (24 LB. FT.)

BRAKE PIPE ASSEMBLIES - TO - BRAKE PRESSURE MODULATOR VALVE ASSEMBLY					
CalloUT NUMBER	CIRCUIT	NUT SIZE	PIPE ASSEMBLY DIAMETER	APPROXIMATE BRAKE LINEAR LENGTH	NUT TIGHTENING SPECIFICATION
34	LEFT-HAND FRONT	M10 x 1.0	4.76 mm	2321.50 mm (91.379")	32 N•m (24 LB. FT.)
35	RIGHT-HAND FRONT	M10 x 1.0	4.76 mm	1398.84 mm (55.072")	32 N•m (24 LB. FT.)
101	REAR	M12 x 1.5	6.00 mm	403.0 mm (15.86")	32 N•m (24 LB. FT.)

BRAKE PIPE ASSEMBLIES - TO - BRAKE HOSE ASSEMBLIES					
CalloUT NUMBER	CIRCUIT	NUT SIZE	PIPE ASSEMBLY DIAMETER	APPROXIMATE BRAKE LINEAR LENGTH	NUT TIGHTENING SPECIFICATION
34	LEFT-HAND FRONT	M10 x 1.0	4.76 mm	2321.50 mm (91.379")	15 N•m (11 LB. FT.)
35	RIGHT-HAND FRONT	M10 x 1.0	4.76 mm	1398.84 mm (55.072")	15 N•m (11 LB. FT.)

NUT COLOR CODE	
SIZE	COLOR
M10 x 1.0	OLIVE
M10 x 1.5	ORANGE
M12 x 1.0	OLIVE
M12 x 1.5	OLIVE

Figure 11 – Front Brake Pipe Assemblies Specifications (With Traction Control System)



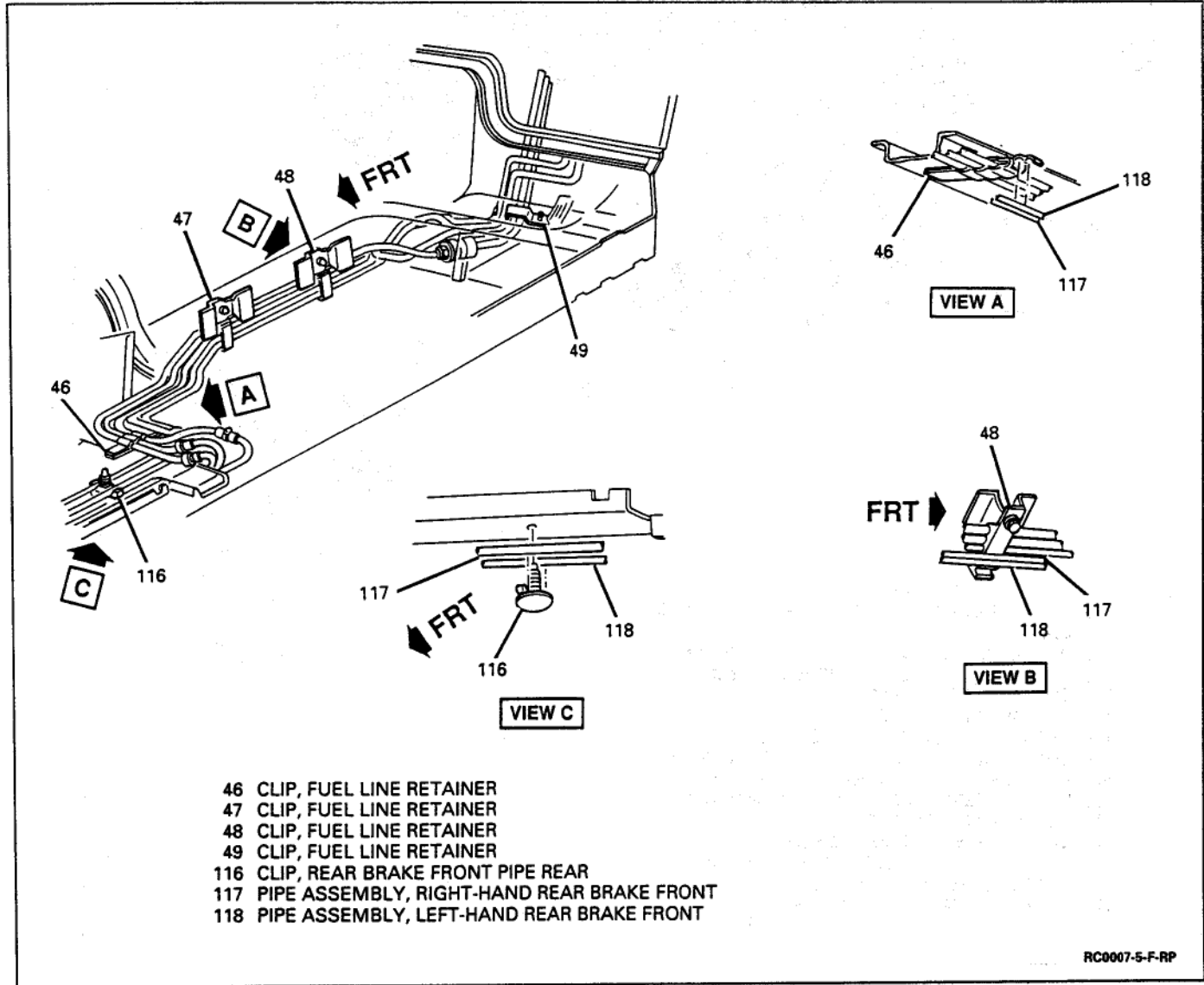
- A AXLE ASSEMBLY, REAR
 B RAIL ASSEMBLY, REAR COMPARTMENT PANEL LONGITUDINAL
- 102 PIPE ASSEMBLY, RIGHT-HAND REAR BRAKE
 103 PIPE ASSEMBLY, LEFT-HAND REAR BRAKE
 105 CLIP, REAR BRAKE PIPE
 106 CLIP, REAR BRAKE PIPE
 107 BRACKET ASSEMBLY, REAR BRAKE HOSE
 108 BOLT/SCREW, REAR BRACKET HOSE ASSEMBLY
 109 PIPE ASSEMBLY, LEFT-HAND REAR BRAKE
 110 PIPE ASSEMBLY, RIGHT-HAND REAR BRAKE
 111 CLIP, REAR BRAKE PIPE
 112 BOLT/SCREW, REAR BRAKE HOSE BRACKET
 113 BRACKET ASSEMBLY, REAR BRAKE HOSE
 114 HOSE ASSEMBLY, REAR BRAKE
 115 HOSE ASSEMBLY, REAR BRAKE

Figure 12 – Routing Rear Brake Pipe and Hose Assemblies (With Traction Control System)

REAR BRAKE PIPE ASSEMBLIES-TO-REAR BRAKE HOSE ASSEMBLIES							
CALLOUT NUMBER	CIRCUIT	NUT SIZE @ CENTER HOSE ASSEMBLY	NUT SIZE @ RIGHT AND LEFT HOSE ASSEMBLIES	PIPE ASSEMBLY DIAMETER	APPROXIMATE BRAKE PIPE LINEAR LENGTH	NUT TIGHTENING SPECIFICATIONS	
						@ CENTER HOSE ASSEMBLY	@ RIGHT AND LEFT HOSE ASSEMBLIES
54	RIGHT-HAND REAR DISC	M10 x 1.0	M10 x 1.0	4.76 mm	867.0 mm (34.13")	15.0 N•m (11 LB. FT.)	15.0 N•m (11 LB. FT.)
55	LEFT-HAND REAR DISC	M12 x 1.0	M10 x 1.0	4.76 mm	566.0 mm (22.28")	15.0 N•m (11 LB. FT.)	15.0 N•m (11 LB. FT.)
114	RIGHT-HAND REAR	M12 x 1.0	—	4.76 mm	3615.0 mm (142.32")	15.0 N•m (11 LB. FT.)	—
115	LEFT-HAND REAR	M10 x 1.0	—	4.76 mm	3630.0 mm (142.91")	15.0 N•m (11 LB. FT.)	—

RC0006-5-F-RP

Figure 13 – Rear Brake Pipe and Hose Assemblies Specifications (With Traction Control System)



RC0007-5-F-RP

Figure 14 – Routing Underbody Rear Brake Front Pipe Assemblies (With Traction Control System)

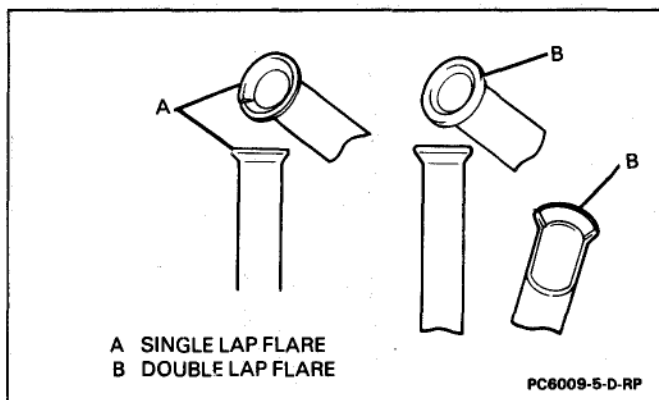


Figure 15 – Single Lap vs. Double Lap Flares

- C. Open lever handle so it is at right angle to rest of tool and revolve hexagonal tube lights to accommodate tubing (selection of six sizes).
- D. Be sure fitting nut is properly placed on tubing. Insert end of tube between two blocks until level with top of gage.

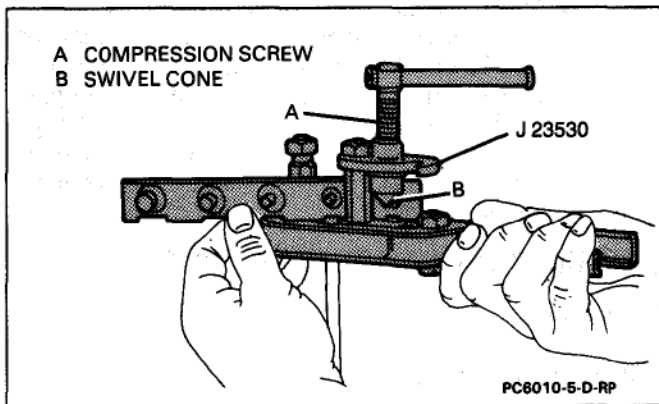


Figure 16 – Placing Tubing in Tool

- E. Insert proper pin of gage into tubing and swing strap back in closed position. Tighten compression screw until gage bottoms on tool, then unscrew compression screw and swing strap to one side. Remove gage.

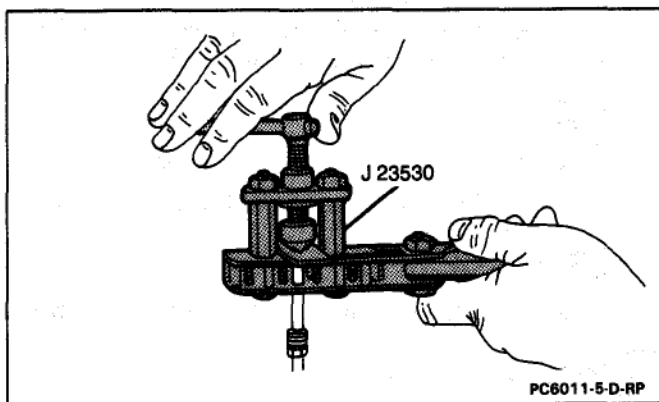


Figure 17 – Preparing for Double Lap Flare

- F. Swing strap back in closed position, then tighten compression screw to flare cone downward to complete double lap flare.

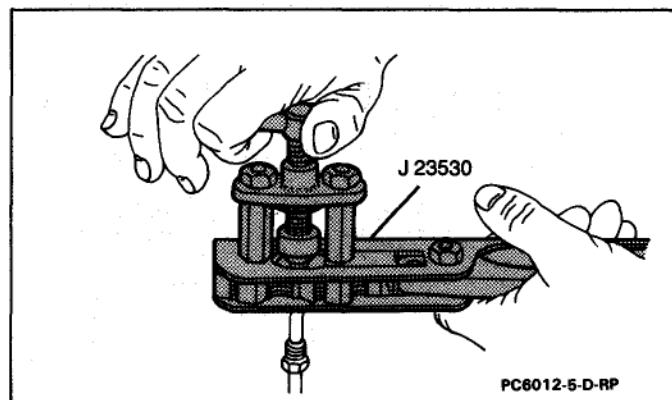


Figure 18 – Completing Double Lap Flare

- G. Unscrew compression screw and open smaller lever handle to remove brake pipe assembly.
 - H. Inspect flared ends for splits, cracks, pits or excessive out-of-round which may cause leaks.
 - I. Blow out brake pipe assembly with dry compressed air to remove any foreign objects.
5. Bend new brake pipe assembly to match old pipe assembly using a tubing bender.

Important

- Minimum clearance of 19 mm (3/4 inch) must be maintained from all moving components and 13 mm (1/2 inch) from all vibrating components, unless brake pipe assembly is clipped to the component. For armor wrapped pipe, contact is permissible if there is no relative movement between pipe assembly and contact surface.

ISO Flare

Figures 19 through 21

ISO flares are NOT to be used for rear brake rear pipes.

Tool Required:

J 29803-A ISO Flaring Kit

1. Obtain recommended tubing and steel fitting nuts of correct size.
 - Outside diameter of tubing is used to specify size.
2. Cut tubing to length.
 - Correct length may be determined by measuring old brake pipe assembly using string and adding 3 mm (1/8 inch) for each ISO flare.
3. Cut end square and chamfer inside and outside diameter of tubing with de-burring tool.
 - Remove all traces of lubricant from tubing.
4. ISO flare tubing ends using J 29803-A.
 - A. Make sure fittings are installed on tubing before starting flare.
 - B. Clamp flaring tool body in vise.
 - C. Select correct size collet and forming mandrel for tube size used.

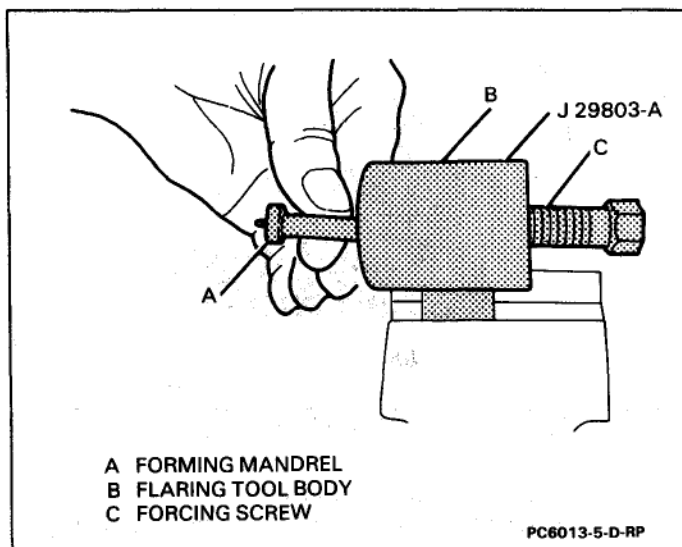


Figure 19 – Forming Mandrel and Forcing Screw

- D. Insert proper forming mandrel into tool body. While holding mandrel in place with your finger, thread in forcing screw until it makes contact and begins to move forming mandrel. When contact is made, turn forcing screw back one complete turn.
- E. Slide clamping nut over tubing into correct collet. Leave approximately 19 mm (3/4 inch) of tubing extending out collet. Insert assembly into tool body. Tube end must contact face of forming mandrel.
- F. Tighten clamping nut into tool body very tight or tube may push out.
- G. Wrench tighten forcing screw in until it bottoms. Do not tighten forcing screw further or flare may become over-sized.
- H. Back clamping nut out of tool body and disassemble clamping nut and collet assembly. Flare is now ready for use.

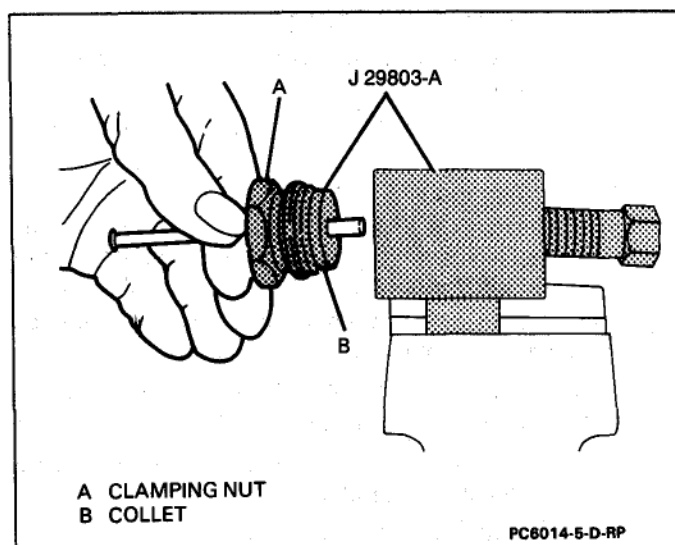


Figure 20 – Clamping Nut and Collet

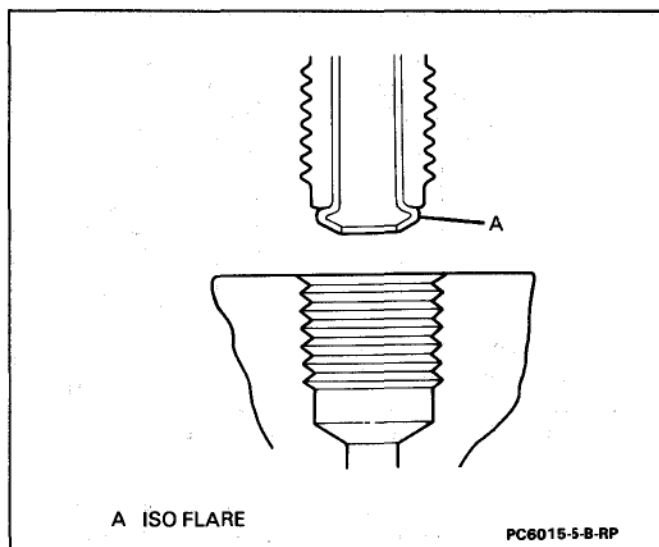


Figure 21 – ISO Flare

5. Bend new brake pipe assembly to match old pipe using a tube bender.

- Minimum clearance of 19 mm (3/4 inch) must be maintained from all moving components and 13 mm (1/2 inch) from all vibrating components, unless brake pipe assembly is clipped to the component. For armor wrapped pipe, contact is permissible if there is no relative movement between pipe assembly and contact surface.

COMBINATION VALVE ASSEMBLY

Figure 22

Remove or Disconnect

1. Brake motor assembly from brake pressure modulator assembly. Refer to SECTION 5E1.
2. Bolts/screws (59) and seals (60).
 - Discard seals (60).
3. Combination valve assembly (62).
4. Seals (61).
 - Discard seals (61).
5. Transfer tubes (64 and 65) and seals (63 and 66) from combination valve assembly (62).



Clean

- All parts in clean, denatured alcohol.
 - Dry with unlubricated, compressed air.



Inspect

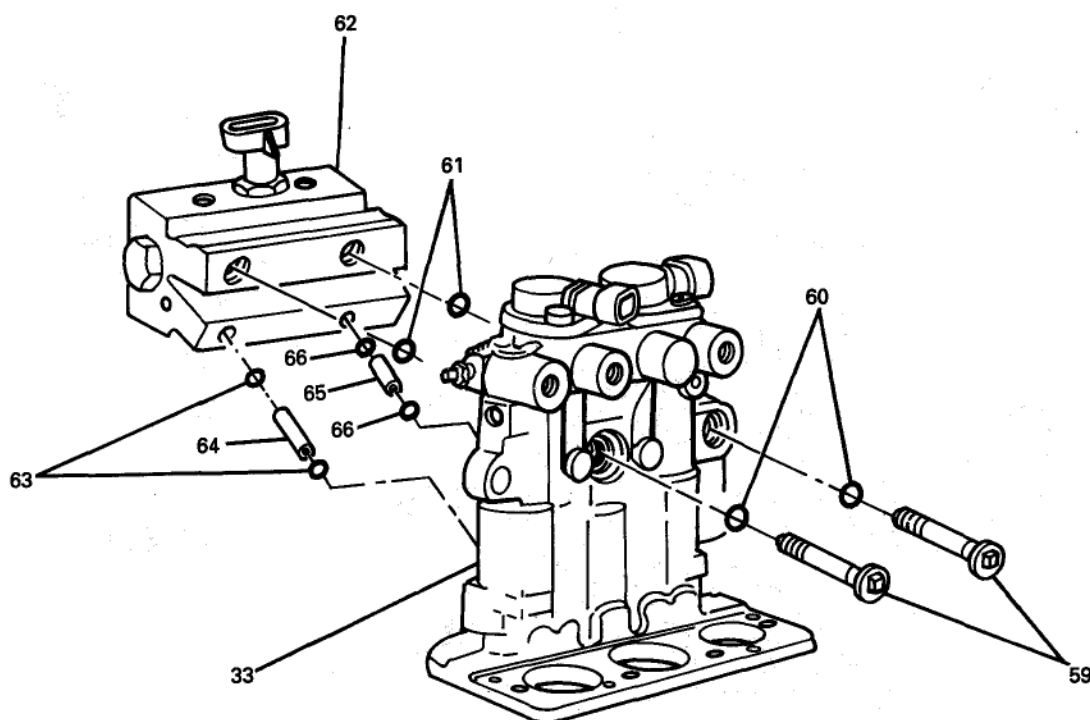
- All parts for wear. Repair or replace as needed.



Install or Connect

NOTICE: See "Notice" on page 5-1 of this section.

1. Transfer tubes (64 and 65) and seals (63 and 66) to combination valve assembly (62).
 - Lubricate seals (63 and 66) with clean brake fluid.



- 33 VALVE ASSEMBLY, BRAKE PRESSURE MODULATOR
 59 BOLT/SCREW, BRAKE COMBINATION VALVE,
 16 N•m (12 LB. FT.)
 60 SEAL, BRAKE COMBINATION VALVE
 61 SEAL, BRAKE COMBINATION VALVE
 62 VALVE ASSEMBLY, BRAKE COMBINATION
 63 SEAL, TRANSFER TUBE
 64 TUBE, TRANSFER
 65 TUBE, TRANSFER
 66 SEAL, TRANSFER TUBE

PC0010-5-F-RP

Figure 22 – Combination Valve Assembly

2. New seals (61).

- Lubricate seals (61) with clean brake fluid.

3. Combination valve assembly (62).

4. New seals (60) and bolts/screws (59).

- Lubricate seals (60) with clean brake fluid.



Tighten

- Bolts/screws (59) to 16 N•m (12 lb. ft.).

5. Brake motor assembly to brake pressure modulator valve assembly. Refer to SECTION 5E1.

BRAKE HOSE ASSEMBLY

Front Brake Hose Assembly

Figure 23



Remove or Disconnect

1. Tire and wheel assembly. Refer to SECTION 3E.



Clean

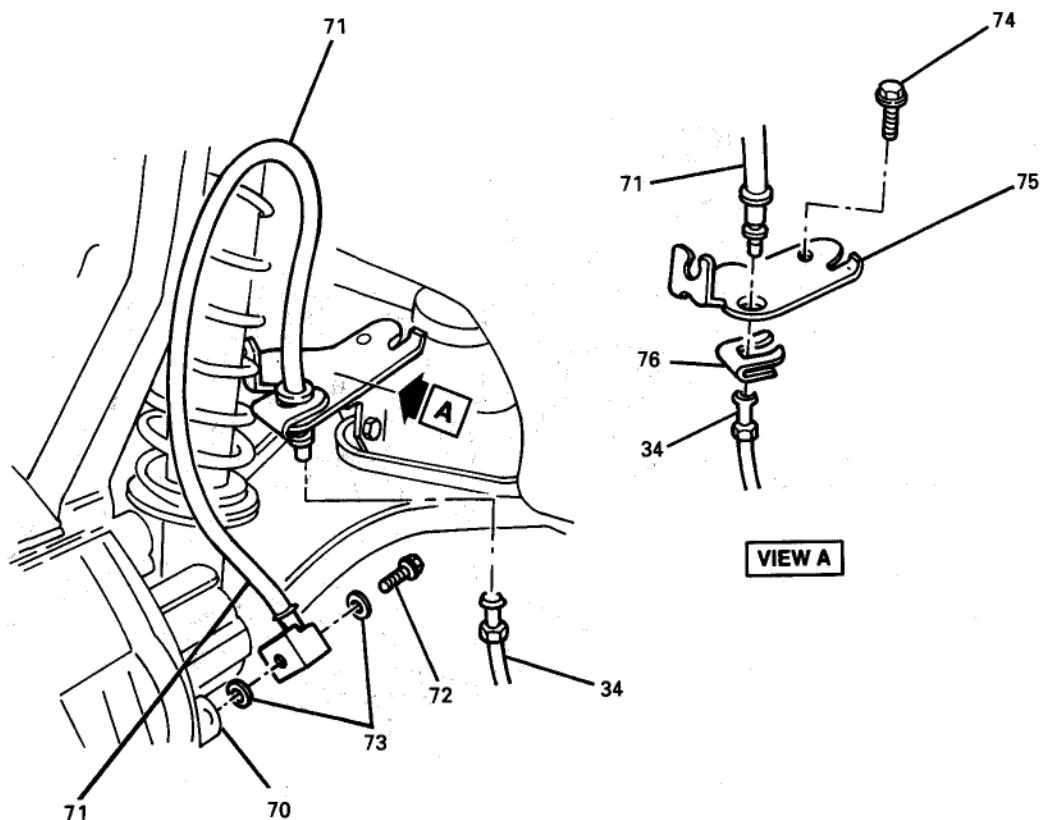
- Dirt and foreign material from front brake hose assembly (71) and front brake hose fitting (72).
- Pipe assembly (34) from hose assembly (71).
 - Use a backup wrench on hose assembly fitting.
 - Be careful not to bend bracket (75) or pipe assembly (34).
 - Retainer (76) from hose assembly fitting at bracket (75).
 - Hose assembly (71) from bracket (75).
 - Fitting (72), hose assembly (71), and two gaskets (73) from caliper assembly (70).
 - Discard two gaskets (73).



Install or Connect

NOTICE: See "Notice" on page 5-1 of this section.

- Fitting (72), hose assembly (71), and two new gaskets (73) to caliper assembly (70).



- 34 PIPE ASSEMBLY, LEFT-HAND FRONT BRAKE
 70 CALIPER ASSEMBLY, FRONT BRAKE
 71 HOSE ASSEMBLY, FRONT BRAKE
 72 FITTING, FRONT BRAKE HOSE, 44 N•m (32 LB. FT.)
 73 GASKET, FRONT BRAKE HOSE FITTING
 74 BOLT/SCREW, FRONT BRAKE HOSE CLIP
 75 BRACKET, FRONT BRAKE HOSE
 76 RETAINER, FRONT BRAKE HOSE

PC0011-5-F-RP

Figure 23 – Front Brake Hose Assembly (Left Side Shown, Right Side Similar)

- Lubricate hose assembly fitting threads with brake fluid.
- Hose assembly fitting flange must engage caliper assembly orientation ledge.

**Tighten**

- Fitting (72) to 44 N•m (32 lb. ft.).
- Hose assembly (71) into bracket (75).
 - There should be no kinks in hose assembly (71).
 - Retainer (76) at bracket (75).
 - Pipe assembly (34) to hose assembly (71).
 - Use backup wrench on hose assembly fitting.
 - Make sure that hose assembly (71) does not make contact with any part of suspension. Check in extreme right and extreme left turn conditions.

**Tighten**

- Pipe assembly (34) to hose assembly (71) to 15 N•m (11 lb. ft.).
- Bleed brake hydraulic system. Refer to SECTION 5E1.
 - Tire and wheel assembly. Refer to SECTION 3E.

Rear Brake (Center) Hose Assembly**Without Traction Control System****Figures 7, 8 and 9****Remove or Disconnect**

- Raise and suitably support vehicle. Refer to SECTION 0A.

**Clean**

- Dirt and foreign material from hose assembly and pipe assembly fittings.

2. Pipe assembly (36) from hose assembly (53).
 - Use backup wrench on hose assembly fitting.
 - Be careful not to bend bracket (57) or pipe assembly (36).
3. Retainer (56) from bracket (57) and hose assembly (53).
4. Hose assembly (53).
5. Left rear pipe assembly (55 or 68) and right rear pipe assembly (54 or 67) from hose assembly (53).
 - Be careful not to bend left rear pipe assembly (55 or 68) and right rear pipe assembly (54 or 67).
6. Bolt/screw (51) and hose assembly (53) from rear axle assembly.
 - Note position of hose assembly (53) for proper location during installation.

Install or Connect

NOTICE: See "Notice" on page 5-1 of this section.

1. Hose assembly (53) and bolt/screw (51) to rear axle assembly.

Tighten

- Bolt/screw (51) to 21 N•m (15 lb. ft.).
2. Left rear pipe assembly (55 or 68) and right rear pipe assembly (54 or 67) to hose assembly (53).

Tighten

- Left rear pipe assembly (55 or 68) and right rear pipe assembly (54 or 67) at hose assembly (53) to 24 N•m (18 lb. ft.).
3. Hose assembly (53) into bracket (57).
 - Be sure hose assembly (53) is seated properly and not twisted.
 4. Retainer (56) to bracket (57) and hose assembly (53).
 5. Pipe assembly (36) to hose assembly (53).
 - Use backup wrench on hose assembly (53).
 - Be careful not to bend bracket (57) or pipe assembly (36).

Tighten

- Pipe assembly (36) to hose assembly (53) to 15 N•m (11 lb. ft.).
6. Bleed brake hydraulic system. Refer to SECTION 5E1.
 7. Lower vehicle.

With Traction Control System

Figures 12, 13 and 14

Remove or Disconnect

1. Raise and suitably support vehicle. Refer to SECTION 0A.

Clean

- Dirt and foreign material from hose assembly and pipe assembly fittings.
2. Pipe assembly (102) from hose assembly (115).
 3. Pipe assembly (103) from hose assembly (114).
 - Use backup wrench on hose assembly fittings.
 - Be careful not to bend bracket assembly (113) or pipe assemblies (102 and 103).
 4. Clip (105) from bracket assembly (113) and hose assembly (114).
 5. Clip (106) from bracket assembly (113) and hose assembly (115).
 6. Pipe assembly (109) from hose assembly (115).
 7. Pipe assembly (110) from hose assembly (114).
 - Use backup wrench on hose assembly fittings.
 - Be careful not to bend bracket (107) or pipe assemblies (109 and 110).
 8. Clip (105) from bracket assembly (107) and hose assembly (114).
 9. Clip (106) from bracket assembly (107) and hose assembly (115).
 10. Hose assembly (114).
 11. Hose assembly (115).

Install or Connect

NOTICE: See "Notice" on page 5-1 of this section.

1. Hose assembly (115).
2. Hose assembly (114).
3. Clip (106) to bracket assembly (107) and hose assembly (115).
4. Clip (105) to bracket assembly (107) and hose assembly (114).
 - Be sure hose assemblies (114 and 115) are seated properly and not twisted.
5. Pipe assembly (110) to hose assembly (114).
6. Pipe assembly (109) to hose assembly (115).
 - Use backup wrench on hose assembly fittings.
 - Be careful not to bend bracket or pipe assemblies (109 and 110).

Tighten

- Pipe assembly (110) to hose assembly (114) to 15 N•m (11 lb. ft.).
 - Pipe assembly (109) to hose assembly (115) to 15 N•m (11 lb. ft.).
7. Clip (106) to bracket assembly (113) and hose assembly (115).
 8. Clip (105) to bracket assembly (113) and hose assembly (114).
 - Be sure hose assemblies (114 and 115) are seated properly and not twisted.
 9. Pipe assembly (103) to hose assembly (114).
 10. Pipe assembly (102) to hose assembly (115).
 - Use backup wrench on hose assembly fittings.

- Be careful not to bend bracket or pipe assemblies (102 and 103).

**Tighten**

- Pipe assembly (103) to hose assembly (114) to 15 N•m (11 lb. ft.).
- Pipe assembly (102) to hose assembly (115) to 15 N•m (11 lb. ft.).

11. Bleed brake hydraulic system. Refer to SECTION 5E1.
12. Lower vehicle.

Rear Brake Hose Assembly**Figure 24****Remove or Disconnect**

1. Wheel and tire assembly. Refer to SECTION 3E.

**Clean**

- Dirt and foreign material from hose assembly (81) and pipe assembly fitting.
2. Hose assembly (81) from pipe assembly (55).
 - Use backup wrench on hose assembly fitting.
 - Be careful not to bend bracket (85) and pipe assembly (55).
 3. Retainer (84) from bracket (85) and hose assembly (81).
 4. Fitting (83), two gaskets (82) and hose assembly (81) from caliper assembly (80).
 - Discard two gaskets (82).

**Install or Connect**

NOTICE: See "Notice" on page 5-1 of this section.

1. Fitting (83), two new gaskets (82) and hose assembly (81) to caliper assembly (80).
 - Lubricate hose assembly fitting threads with clean brake fluid.
 - Hose assembly fitting flange must engage caliper assembly orientation ledge.

**Tighten**

- Fitting (83) to 44 N•m (32 lb. ft.).
2. Retainer (84) to bracket (85) and hose assembly (81).
 3. Hose assembly (81) to pipe assembly (55).
 - Use backup wrench on hose assembly fitting.
 - Be careful not to bend bracket (85) and pipe assembly (55).

**Tighten**

- Pipe assembly (55) to hose assembly (81) to 15 N•m (11 lb. ft.).
4. Bleed hydraulic brake system. Refer to SECTION 5E1.

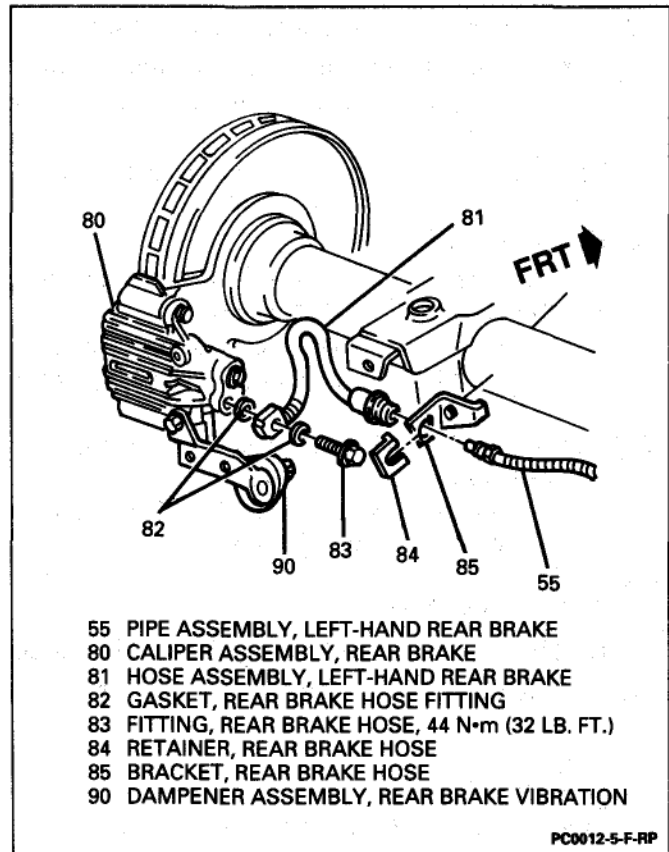


Figure 24 – Rear Disc Brake Hose Assembly (Typical)
(Left Side Shown, Right Side Similar)

5. Wheel and tire assembly. Refer to SECTION 3E.

FLUSHING BRAKE HYDRAULIC SYSTEM

NOTICE: Use only DOT 3 brake fluid from a clean, sealed container. Do not use any fluid from a container which is wet with water. Do not use DOT 5 silicone brake fluid. Improper brake fluid, mineral oil or water in the fluid may cause the brake fluid to boil or the rubber components to deteriorate. Keep all fluid containers capped to prevent contamination.

The system must be flushed if there is any doubt about the condition of fluid in the system or if fluid has been used which contains the slightest trace of petroleum or mineral oil based fluids. Approximately 1.5 liters (1.5 quarts) of brake fluid is required to flush the brake hydraulic system. All rubber parts, including brake hose assemblies, master cylinder assembly rubber parts, and brake caliper assembly and wheel cylinder assembly boots and seals that have been subjected to a contaminated fluid must be replaced. Also replace the combination valve assembly and brake pressure modulator assembly, since they have rubber components inside that are not serviceable. Refer to SECTION 5E1 for complete brake hydraulic system flush and bleed procedures.

SPECIFICATIONS

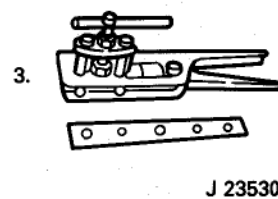
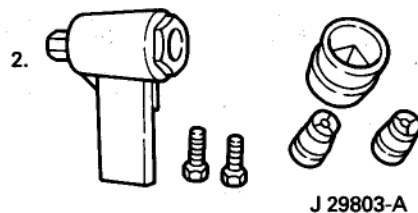
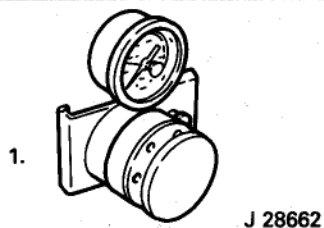
GENERAL SPECIFICATIONS

Brake Pedal Assembly Travel	51 to 89 mm (2.0 to 3.5")
Brake pedal assembly travel maximum with 445 N (100 lb.) force applied to pedal with engine running at idle.	
Hydraulic Brake (Glycol) Fluid	GM P/N 1052535 or equivalent DOT-3 fluid
Brake Pipe Assembly Clearance (Minimum)	
Moving Components	19 mm (3/4")
Vibrating Components	13 mm (1/2")
Armor-Wrapped Pipe Assemblies	Contact is permitted if there is no relative movement between pipe assembly and contact surface

FASTENER TIGHTENING SPECIFICATIONS

Brake Combination Valve Bolt/Screw	16 N•m (12 lb. ft.)
Brake Pedal Bracket Bolt/Screw	25 N•m (18 lb. ft.)
Brake Pedal Bracket Nut	25 N•m (18 lb. ft.)
Brake Pedal Nut	25 N•m (18 lb. ft.)
Brake Pedal Pivot Nut	54 N•m (40 lb. ft.)
Brake Pipe Clip Bolt/Screw	6 N•m (53 lb. in.)
Clutch Master Cylinder Nut	27 N•m (20 lb. ft.)
Front Brake Combination Valve Pipe Assembly-to-	
Brake Combination Valve Assembly	18 N•m (13 lb. ft.)
Front Brake Combination Valve Pipe Assembly-to-	
Brake Master Cylinder Assembly	32 N•m (24 lb. ft.)
Front Brake Hose Fitting	44 N•m (32 lb. ft.)
Front Brake Pipe Assembly-to-Brake Pressure Modulator Valve Assembly	32 N•m (24 lb. ft.)
Front Brake Pipe Assembly-to-Front Brake Hose Assembly	15 N•m (11 lb. ft.)
Front Brake Front Pipe Clip Bolt/Screw	6 N•m (53 lb. in.)
Rear Brake (Center) Hose Fitting Bolt/Screw	21 N•m (15 lb. ft.)
Rear Brake Combination Valve Pipe Assembly-to-	
Brake Combination Valve Assembly	18 N•m (13 lb. ft.)
Rear Brake Combination Valve Pipe Assembly-to-	
Brake Master Cylinder Assembly	32 N•m (24 lb. ft.)
Rear Brake Front Pipe Assembly-to-	
Brake Pressure Modulator Valve Assembly	32 N•m (24 lb. ft.)
Rear Brake Front Pipe Assembly-to-Rear Brake (Center) Hose Assembly	15 N•m (11 lb. ft.)
Rear Brake Hose Fitting	44 N•m (32 lb. ft.)
Rear Brake Hose Retainer Bolt/Screw	10 N•m (89 lb. in.)
Rear Brake Pipe Assembly-to-Rear Brake (Center) Hose Assembly	24 N•m (18 lb. ft.)
Rear Brake Pipe Assembly-to-Rear Brake Hose Assembly	15 N•m (11 lb. ft.)
Rear Brake Pipe Assembly-to-Rear Wheel Cylinder	17 N•m (13 lb. ft.)
Rear Brake Pipe Assembly-to-Traction Control Brake Pressure	
Modulator Valve Pipe Assembly	32 N•m (24 lb. ft.)
Traction Control Brake Pressure Modulator Valve Pipe Assembly	32 N•m (24 lb. ft.)

SPECIAL TOOLS



1. BRAKE PEDAL EFFORT GAGE
2. ISO FLARING KIT
3. BRAKE LINE FLARING TOOL (45° SINGLE AND DOUBLE)

PC0013-5-F-RP