

1.GENERAL

(1) Air cleaner

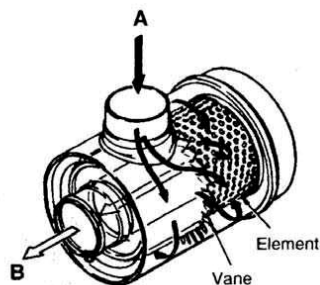
The element, which comes in two types; the single element types, is the filter paper type. Coated with plastics and given heat treatment, the element offers outstanding resistance to water and oils.

The air that has been drawn in is made to rotate by vane, and large particles of dust are centrifugally separated. Furthermore, small particles of dust are filtered out by the filter paper element, and the air thus made clean is drawn into the engine.

A : Outside Air

B : To engine

<Single element type>



(2) Dust Indicator

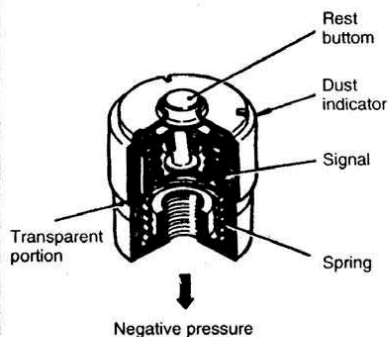
Mechanical type dust indicator is located near the intake air outlet of the air cleaner.

Operated by the negative pressure which is produced when the air is drawn into the engine, the dust indicator indicates that it is high time to clean or replace the element.

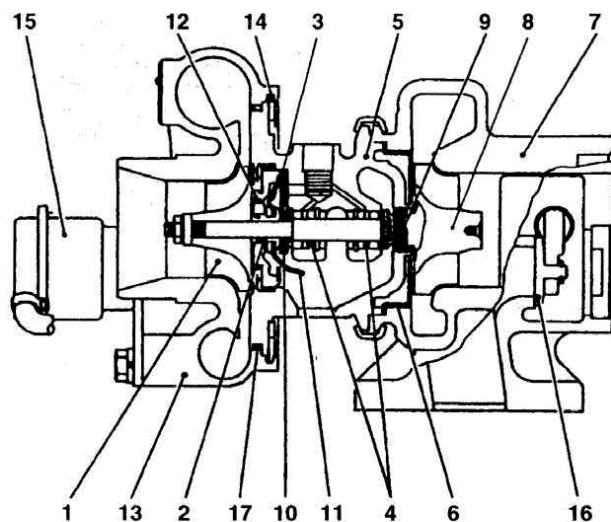
In other words, when the element is clogged with dust, the suction resistance increases.

When negative pressure A reaches 6.23 kpa[635 mmHg], signal(red) is pulled down against the spring pressure of spring. So the signal (red) appears in transparent portion of the body to indicate that it is high time to clean or replace the element.

After cleaning or replacing the element, press the reset button and the signal will return to its original position.



(3) turbo charger



- 1 Compressor wheel
- 2 Thrust sleeve
- 3 Thrust bearing
- 4 Bearing
- 5 Bearing housing
- 6 Turbine back plate
- 7 Turbine housing
- 8 Shaft & turbine wheel
- 9 Piston ring
- 10 Thrust ring
- 11 Oil deflector
- 12 Insert
- 13 Compressor cover
- 14 Snapping
- 15 Actuator
- 16 Waste gate valve
- 17 O-ring

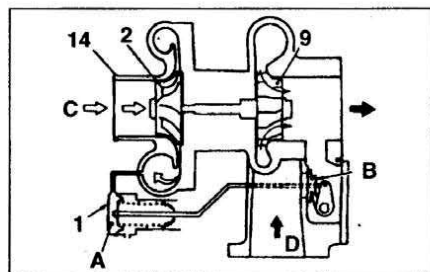
1 to 6, 8 to 12: Cartridge assemblies

(a) waste gate mechanism

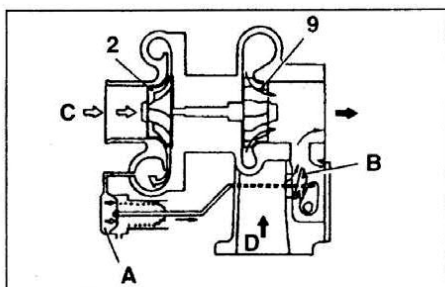
- 1) The waste gate mechanism has actuator assembly 1 to extra exhaust gas escape.

By so doing, the boost pressure is properly controlled to prevent the turbine wheel from overrunning and prevent an excessive pressure produced in the intake manifold.

- 2) The boost pressure is led from compressor housing 14 through a rubber hose to chamber A of actuator assembly 1. When the boost pressure that acts on chamber A is below the setting, the actuator assembly does not operate, and the waste gate valve remains closed, and exhaust gas D is blown against turbine wheel 9.

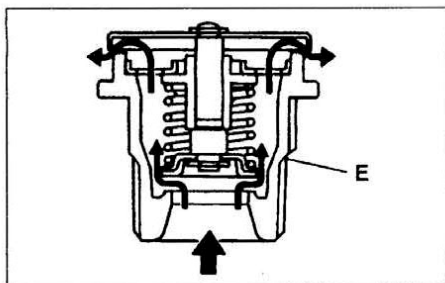


- 3) When the boost pressure that acts on chamber A exceeds the setting, the waste gate valve is opened. As a result, the amount of exhaust gas blown against turbine wheel 9 decreases, and the rotating speed of compressor wheel 2 also decreases, and the boost pressure falls.



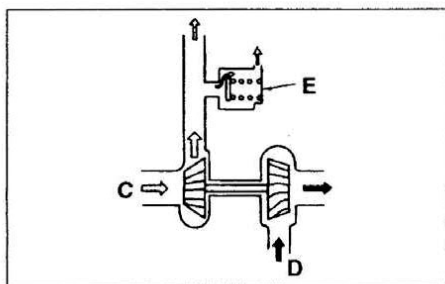
(b) Operation of overboost valve

- 1) Overboost valve E operates when the boost pressure becomes abnormally high due to the failure of the waste gate mechanism.



- 2) When the boost pressure of overboost valve E exceeds the setting, the valve releases the boost pressure into the atmosphere to make sure that a boost pressure more than necessary is not applied to the engine.

The valve whistles when it is in operation.



2. SPECIFICATIONS

Model	D4A	D4AK	D4DA
Element type	Paper filter type	←	←
Turbocharger type	-	TD04	TD05

3. SERVICE STANDARDS

3-1. Service standard table

Unit : mm

Description			Nominal value [Basic diameter]	Limit	Correction and remarks
Turbo-charger	I.D. of bearing inserting portion of bearing housing		[15.6]	15.686	Replace
	Turbine wheel shaft journal diameter		[9]	8.994	Replace
	Turbine wheel shaft bend			0.015	Replace
	Bearing	O.D.		15.574	Replace
		I.D.		9.04	
		Length	TD05	9.34	
	Piston ring open end clearance		0.05~0.15		Replace insert
	Clearance between turbine wheel and turbine housing		0.42~1.1		Check
	End play of turbine Wheel shaft	TD05	0.057~0.103		Check
	Clearance between turbine wheel and turbine back plate		0.37~0.85		Check
	Boost pressure (20℃, 760mmHg)		200mmHg, 3800rpm		Check

3-2. Tightening Torque Table

Maintenance item		Nominal value Basic diameter	Limit	Correction
Turbocharger (TD05)	Attaching Nut	M10 × 1.25	4.2	Apply MOLYKOTE (NLGI #2) to thred
	Compressor wheel attaching lock nut		0.8~0.9	
	Coupling		0.4~0.5	
Inlet manifold attaching bolt		M8 × 1.25	2.2	
Exhaust manifold attaching nut		M10 × 1.25	4.2	
Oil pipe lubrication eye bolt		M10 × 1.25	1.7	
Front pipe bolt		M10 × 1.25	4~5.0	

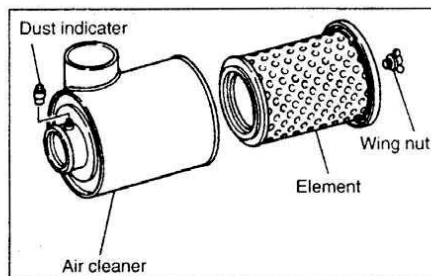
4 SPECIAL TOOLS

Tool name	Part number	Shape (Unit : mm)	Use
Boost pressure gauge	MH061366		

5. SERVICE PROCEDURES

5-1. Air cleaner

Disassembly and Assembly



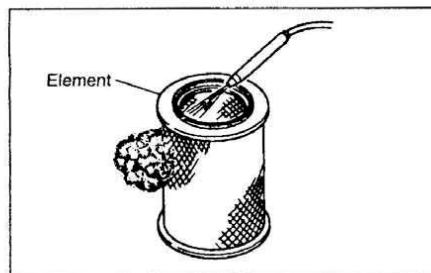
5-2. Element

a) Cleaning

- Blow compressed air 685 kPa {7 kgf/cm²} or less from inside element
- Blow the compressed air, working along the creases of filter paper of element up and down throughout the element.

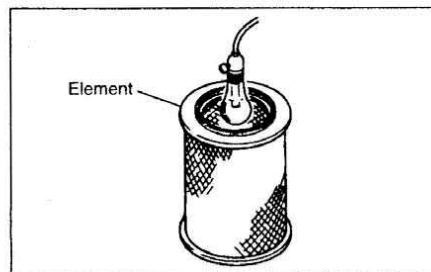
Note :

- Do not strike element to loosen dust.
- Do not blow the air from outside element.



b) Inspection

- Put a light inside element.
- If the filter paper is broken or partially thin, or if the packing on the top of element is broken, replace the element.
- If the dust deposited on element is wet with oil smoke or soot, replace the element irrespective of the replacement intervals.

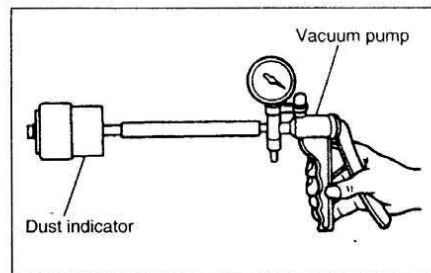


5-3. Inspection of dust indicator

Perform the following checks. If there is anything wrong, replace dust indicator.

<Mechanical type>

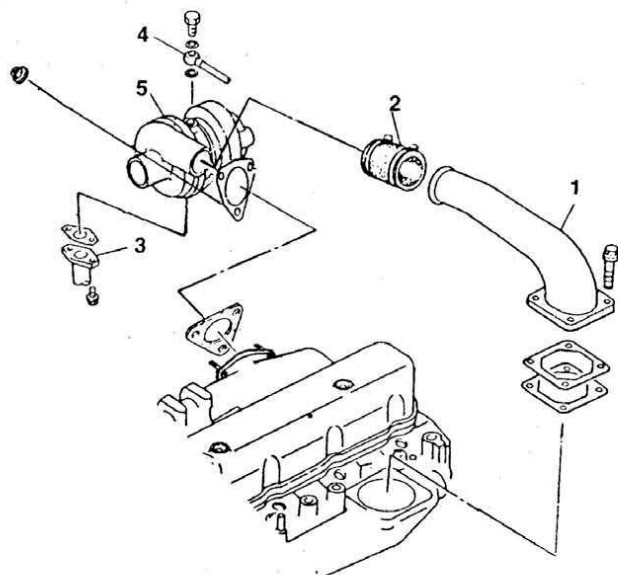
- Mount a hand vacuum pump on dust indicator and apply the standard operating negative pressure to check whether the red signal appears.



5-4. Turbocharger

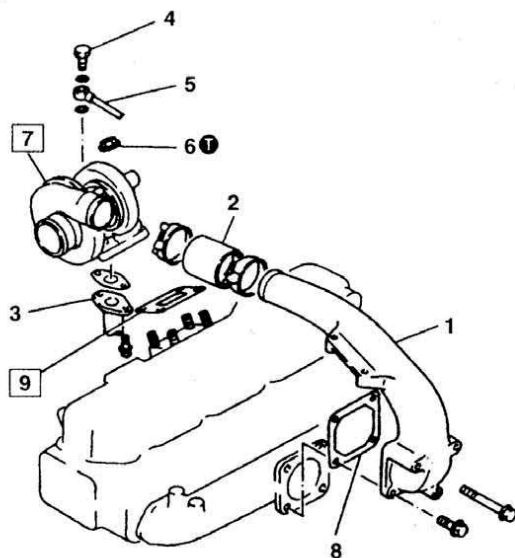
Disassembly and assembly

(D4AK)



- 1 Air inlet pipe
- 2 Rubber hose
- 3 Oil return pipe
- 4 Oil inlet pipe
- 5 Turbocharger

(D4DA)



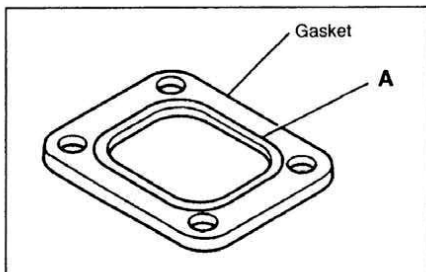
- 1 Air inlet pipe
- 2 Rubber hose
- 3 Oil return pipe
- 4 Eyebolt
- 5 Oil pipe
- 6 Nut
- 7 Turbocharger assembly
- 8 Gasket
- 9 Gasket
- 10 Overboost valve

● Installation sequence

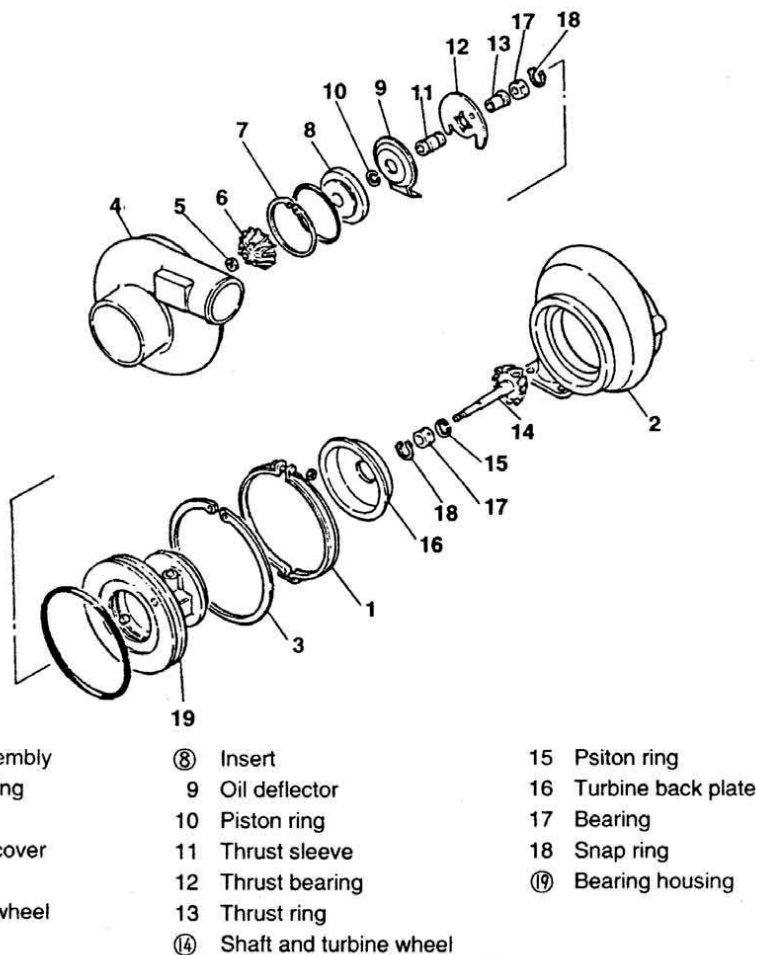
Follow the installation sequence in reverse.

Installation of gasket

Install gasket with grommet fold-back portion A toward the exhaust manifold.



5-4-1. Disassembly



- | | | |
|---------------------|---------------------------|-----------------------|
| 1 Coupling assembly | ⑧ Insert | 15 Piston ring |
| ② Turbine housing | 9 Oil deflector | 16 Turbine back plate |
| ③ Snap ring | 10 Piston ring | 17 Bearing |
| ④ Compressor cover | 11 Thrust sleeve | 18 Snap ring |
| 5 Lock nut | 12 Thrust bearing | ⑰ Bearing housing |
| ⑥ Compressor wheel | 13 Thrust ring | |
| ⑦ Snap ring | ⑭ Shaft and turbine wheel | |

For disassembly of parts with an encircled number, see following items.

- (1) Be sure to make alignment marks on the compressor cover, bearing housing, and turbine housing, as their positional relationship is extremely critical at reassembly.
- (2) Remove the coupling assembly to remove turbine housing.

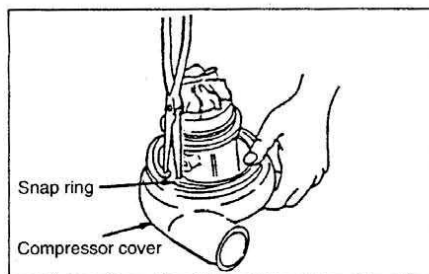
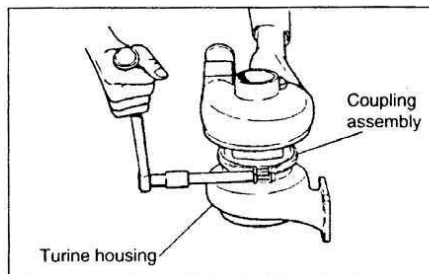
NOTE:

The compressor wheel and turbine wheel blades are easy to bend. Use care not to drop them or hit them against other objects.

- (3) Remove the snap ring.

NOTE:

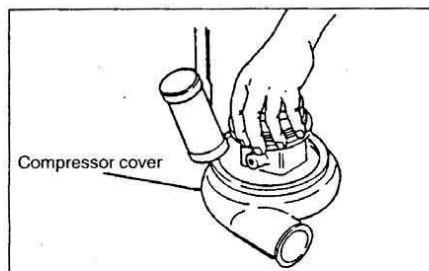
Retain the snap ring by hand to prevent it from springing out when slipping off the snap ring pliers.



- (4) Using a plastic hammer, tap the compressor cover on its periphery and remove.

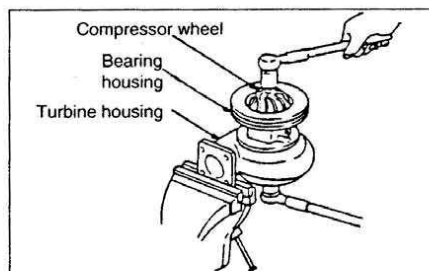
NOTE:

Be careful not to hit the compressor wheel against compressor cover as its blades are easy to bend.

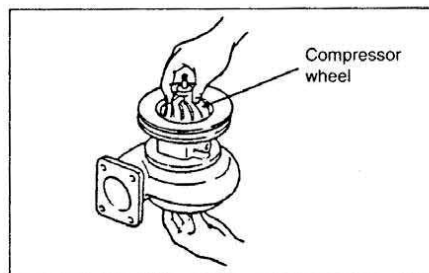


- (5) Removal of Compressor Wheel

- (a) Fit the bearing housing into the turbine housing which is clamped in a vise.
- Hold the bolt on shaft and turbine wheel and remove the lock nut that attaches the compressor wheel.



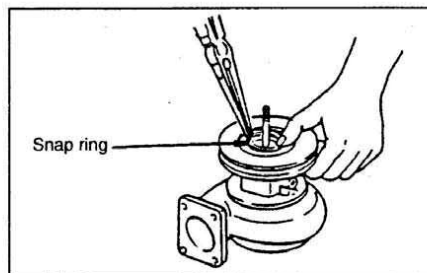
- (b) With the turbine wheel held by one hand, lightly turn the compressor wheel to remove it.



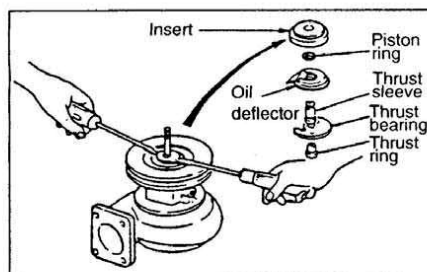
- (6) Remove the snap ring.

NOTE:

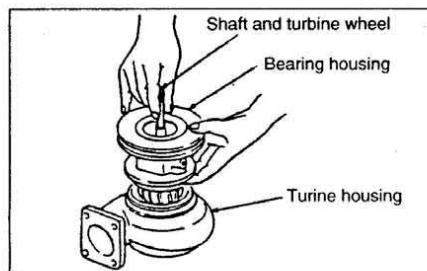
Retain the snap ring by hand to prevent it from springing out when slipping off the snap ring pliers.



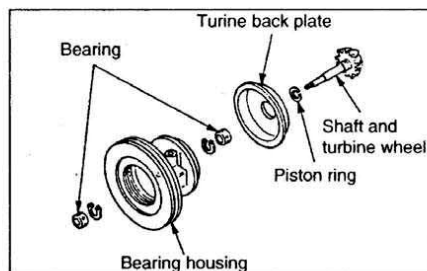
- (7) Removal of Insert, Oil Deflector, and Other parts
Using two screwdrivers, carefully remove the insert from the bearing housing.
Then, remove parts shown in illustration.



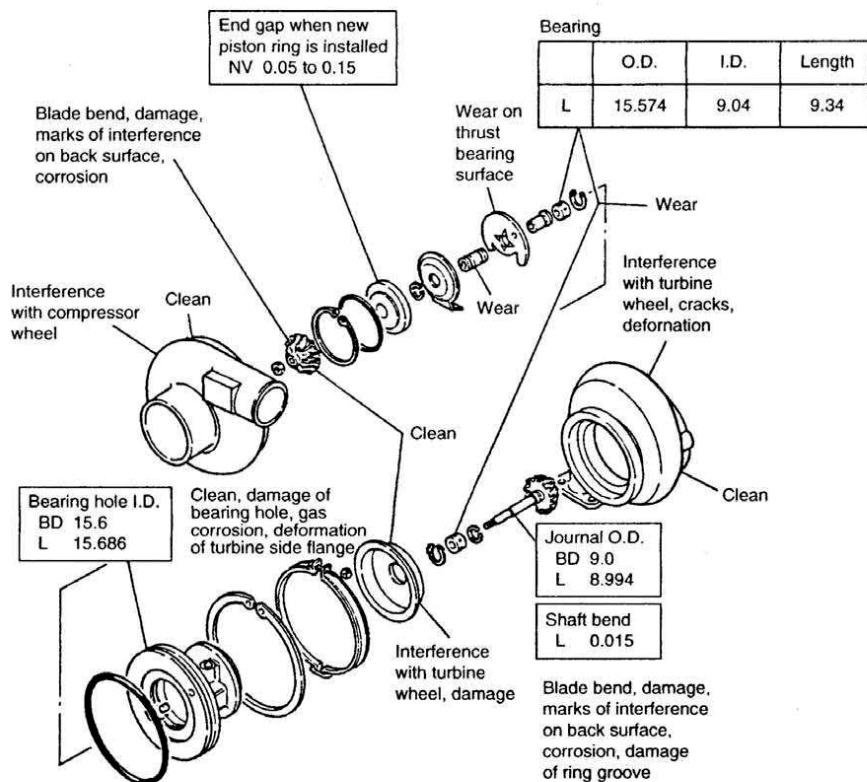
- (8) Removal of Shaft and Turbine Wheel, and Bearing
(a) Hold the shaft of turbine wheel and shaft by one hand and the bearing housing by the other hand, and carefully withdraw from the turbine housing.



- (b) Remove the parts shown in illustration from the bearing housing.



5-4-2. Cleaning and Inspection



BD ... Basic Diameter

NV ... Nominal Value

L ... Limit

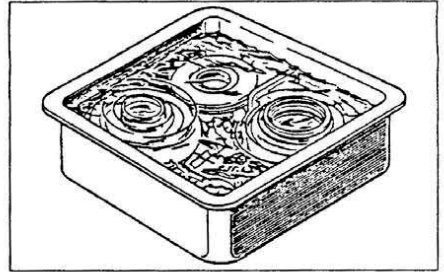
(1) Cleaning

Turbocharger manufacturers use a blasting equipment for cleaning parts at their workshop. As an alternative, effective method for overhaul at the dealer's workshop, use the following procedures.

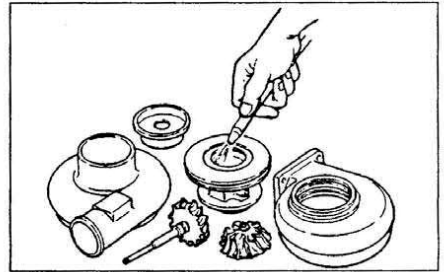
NOTE:

When a commercially-available neutral detergent is used for cleaning, make sure that it does not contain corrosive component.

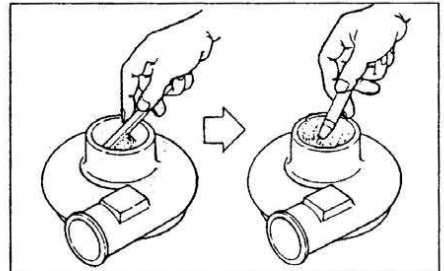
- (a) Before cleaning, visually check the condition of parts. Check for burns, wear, and other defects which could not be identified after washing.
- (b) Immerse disassembled parts in a nonflammable solvent to clean oily contamination.



- (c) Blow compressed air against the entire internal and external surfaces.



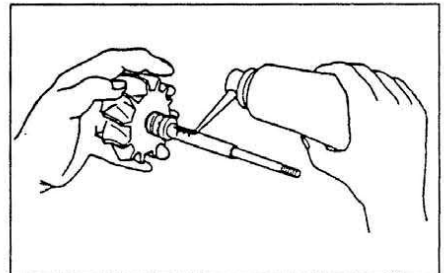
- (d) Using a plastic scraper or bristle brush, remove deposits from the surfaces. then, dip parts in the nonflammable solvent and blow compressed air to them again.



NOTE:

Use care to prevent damage to parts.

- (e) Apply clean engine oil to all sliding surfaces.

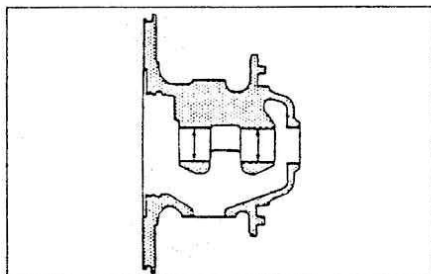


(2) Inspection

(a) Bearing housing

Measure the I.D. of bearing hole.

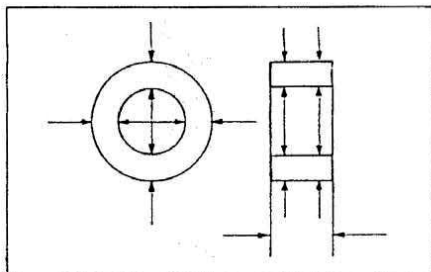
If the measurement exceeds the limit, replace the bearing housing.



(b) Bearing

Measure O.D., I.D., and length of the bearing.

If the measurement exceeds the limit, replace the bearing.

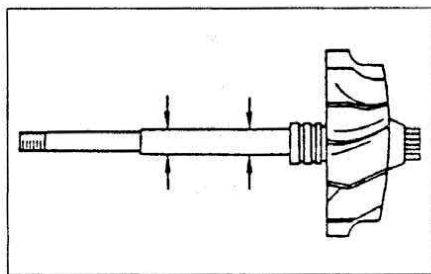


(c) shaft and turbine wheel

1) Measure O.D. of the shaft and turbine wheel journal.

If the measurement exceeds the limit, replace the shaft and turbine wheel.

Replace the piston ring with a new one.

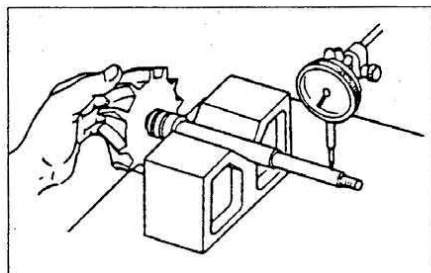


2) Measurement of shaft bend

Set a dial indicator just beside the threads on the shaft to measure bend.

If the deflection of dial indicator exceeds the limit, replace the turbine wheel and shaft.

If the shaft journal gets rough, hold the shaft between centers of a lathe, and polish the surface with a sand paper #400 and engine oil at a spindle speed of 300 to 600 rpm.



NOTE:

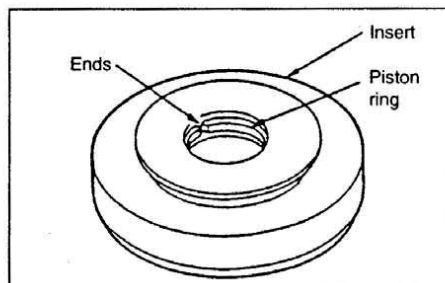
Do not attempt to correct, but replace, a bent shaft.

(d) Insert

Measure the piston ring gap.

Fit a new piston ring into the bore of the insert and measure the ring gap.

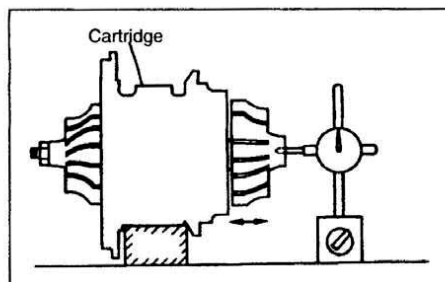
If the ring gap is out of the specification, replace the insert.



(e) Cartridge assembly

1) Axial play in shaft and turbine wheel assembly

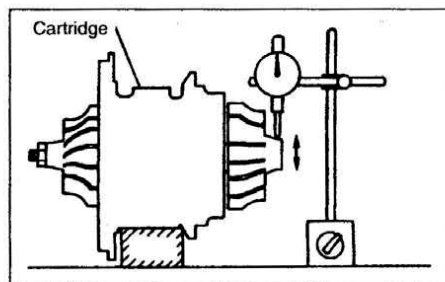
If the measurement exceeds the specified limit, replace cartridge assembly.



2) Play at right angle to shaft direction in shaft and turbine wheel assembly

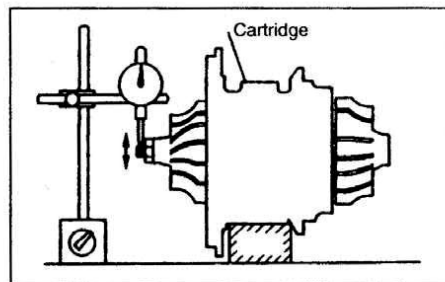
● Play on turbine wheel side

If the measurement exceeds the specified limit, replace cartridge assembly.

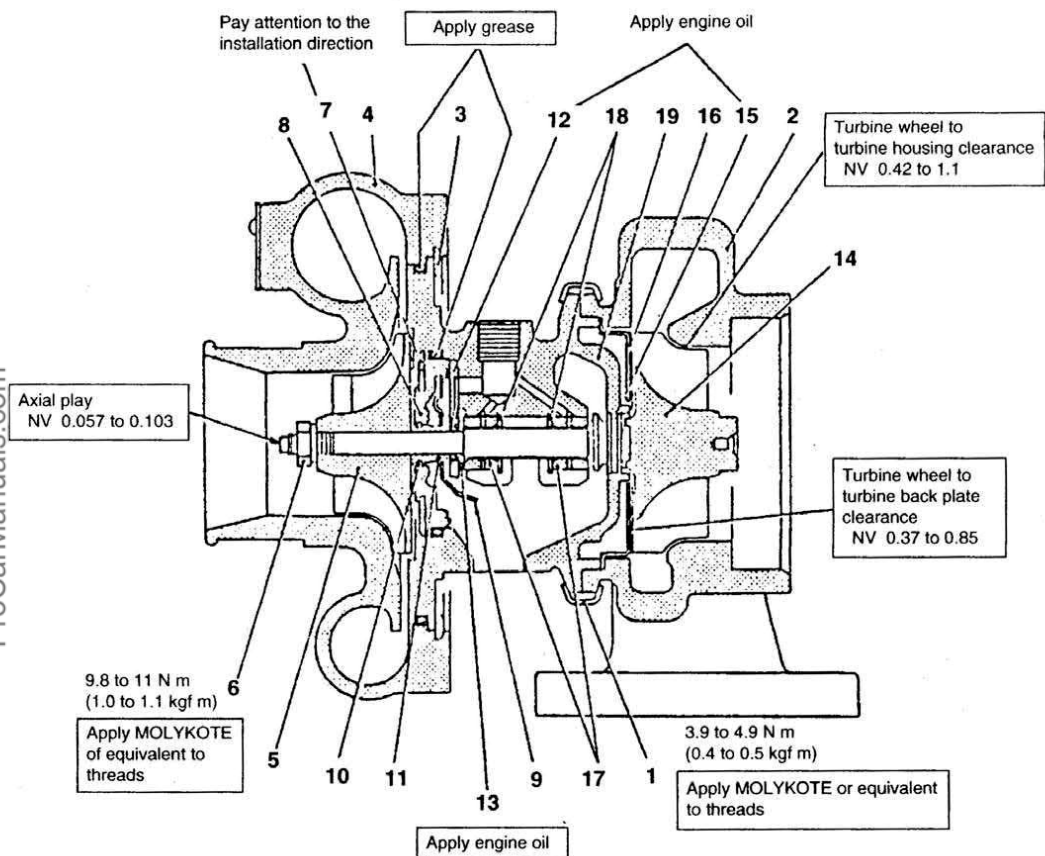


● Play on compressor wheel side

If the measurement exceeds the specified limit, replace cartridge assembly.

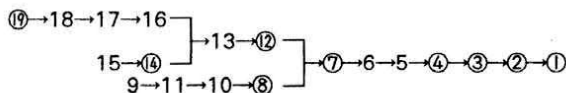


5-4-3. Reassembly



<Assembly sequence>

NV ... Nominal Value



For reassembly of parts with an encircled number, see following tiems.

NOTE:

With the overhauled turbocharger mounted on the engine, crank the engine with starter to allow the engine oil to circulate through the turbocharger.

(1) Installation of Shaft and Turbine Wheel, and Bearing

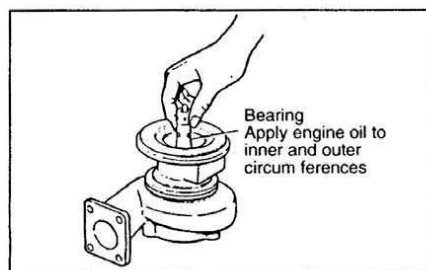
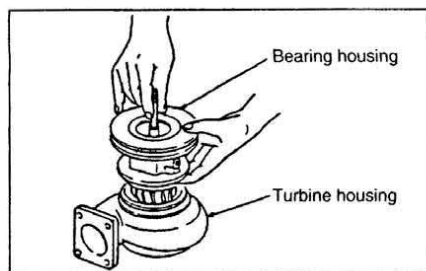
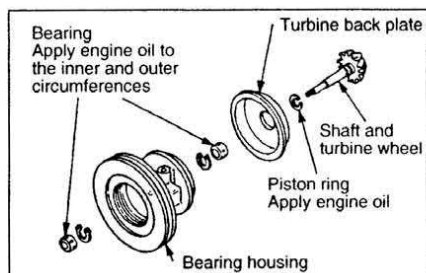
NOTE:

1. Apply engine oil to the piston ring and do not expand the ends when mounting it onto the turbine rotor.
2. Do not apply excessive force to the turbine rotor during installation.

After assembly, temporarily install the bearing housing to the turbine housing and temporarily secure with the coupling assembly.

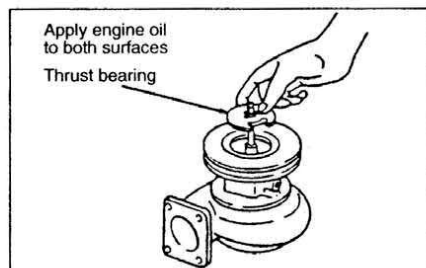
NOTE:

Place the bearing end face with six oil holes to the compressor wheel.



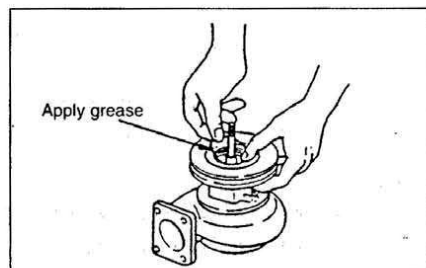
(2) Installation of Thrust Bearing

Before installation, apply engine oil to the surfaces of thrust ring and thrust bearing.



(3) Installation of O-ring

Install O-ring with grease applied to it.

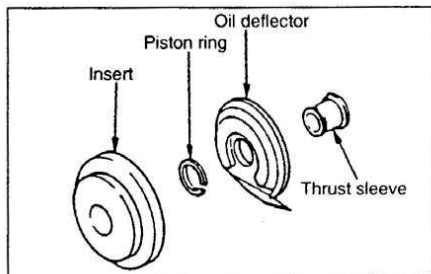


(4) Assembly of Insert Subassembly

NOTE:

1. When mounting piston ring to the thrust sleeve, ensure that the ring is not expanded and ring ends are not twisted.
2. Apply MOLYKOTE or equivalent to the piston ring that has been mounted to the thrust sleeve. Install the thrust sleeve to the insert with care to prevent damage to the piston ring.

Install the subassembly into the bearing housing.

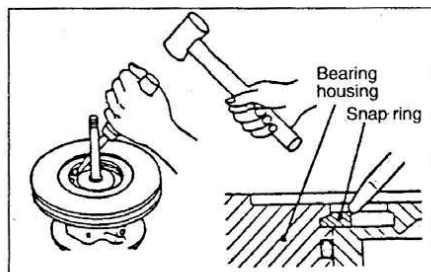
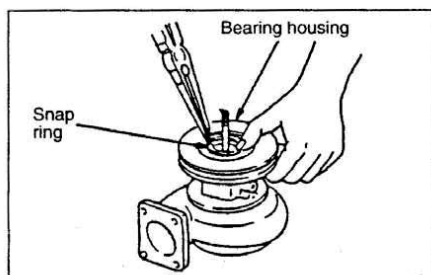


(5) Installation of Snap Ring

Install the snap ring to the bearing housing with its taper up.

NOTE:

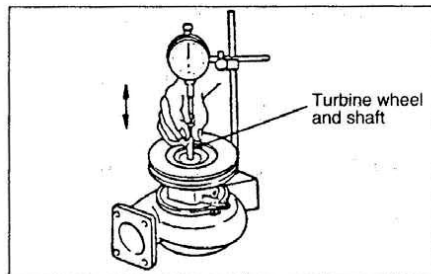
1. Ensure the correct installation direction.
2. To fit the snap ring into position, tap its ends with a screwdriver and hammer into the groove in bearing housing.
3. Special care must be exercised, when tapping the snap ring into position, to prevent damage to the bearing housing by the screwdriver.



(6) Measurement of Turbine Wheel to Turbine Housing Clearance

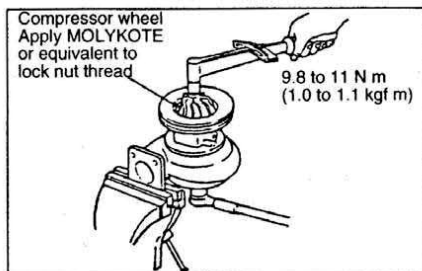
Set the dial gauge to the turbine wheel and shaft end. Move the turbine wheel and shaft and in the axial direction to measure the clearance.

If the measurement is not within specification, disassemble and locate the cause of trouble.



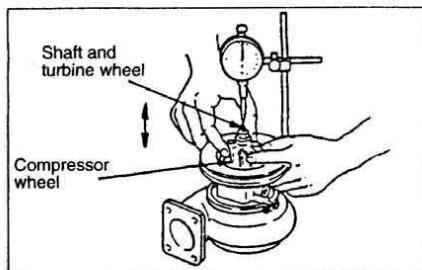
(7) Installation of Compressor Wheel

With the compressor wheel installed in position, apply MOLYKOTE to lock nut threads and tighten to specification.



(8) Measurement of play in Shaft and Turbine Wheel in Axial Direction

Set the dial indicator at the end of shaft and turbine wheel. Move the compressor wheel in the axial direction to measure the play. If the play is not within specification, disassemble and locate the cause of trouble.

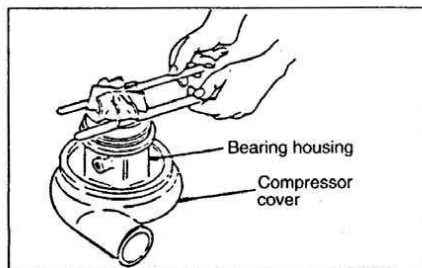


(9) Measurement of Turbine Back Plate to Turbine Wheel Back Surface

With the turbine housing removed from the bearing housing and compressor cover installed, make the following measurement.

Using thickness gauges, measure the clearance between the turbine back plate and turbine wheel back surface.

If the clearance is not within specification, disassemble and locate the cause of trouble.



NOTE:

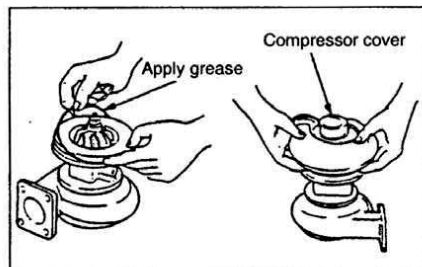
Use two thickness gauges.

Make the measurement at the end of the blade.

(10) Installation of Compressor Cover

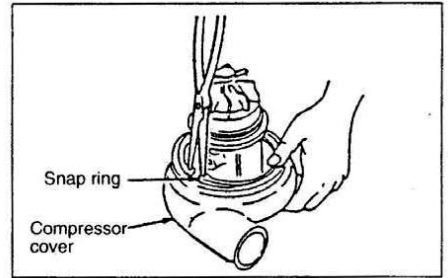
Install the compressor cover, ensuring the correct installation direction.

Apply grease to O-ring when mounting



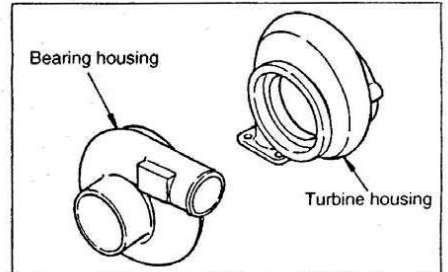
(11) Installation of Snap Ring

Install the snap ring to the compressor with its taper up.
Use the snap ring pliers for installation.



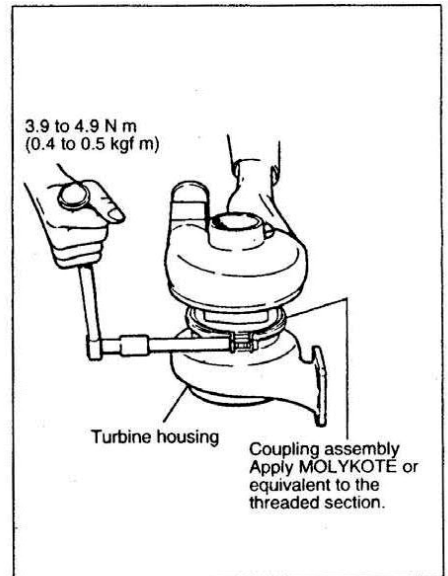
(12) Installation of turbine Housing

Install the turbine housing to the bearing housing, ensuring correct installation direction.



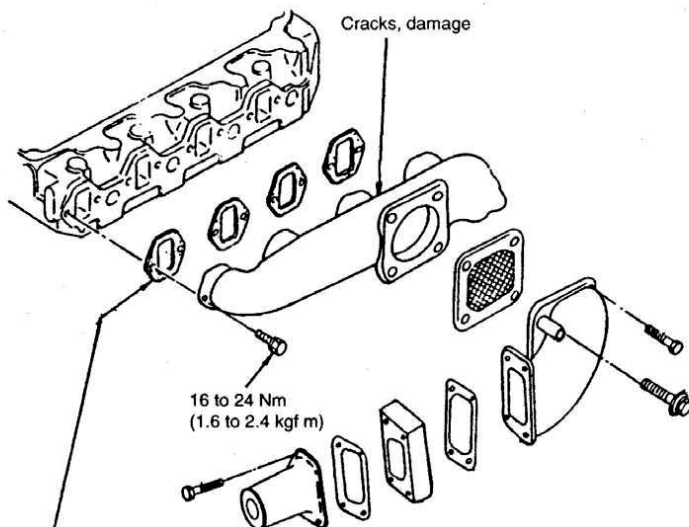
(13) Installation of Coupling Assembly

Apply MOLYKOTE or equivalent to threads in coupling assembly and tighten to specification



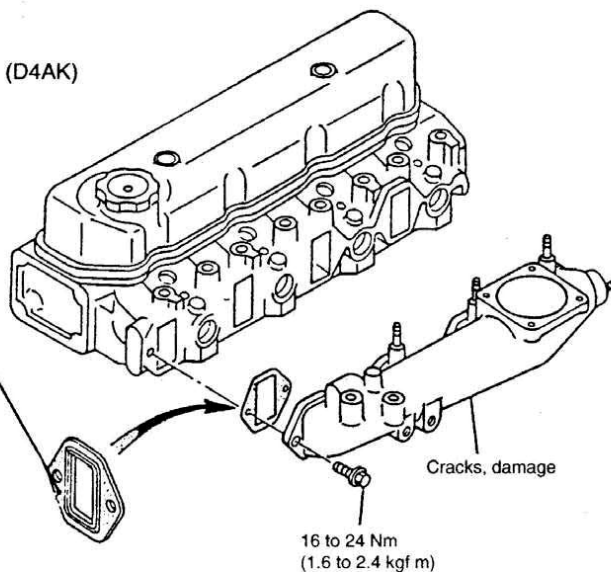
5-5. Inlet Manifold

(D4AN, D4DA, D4AF)

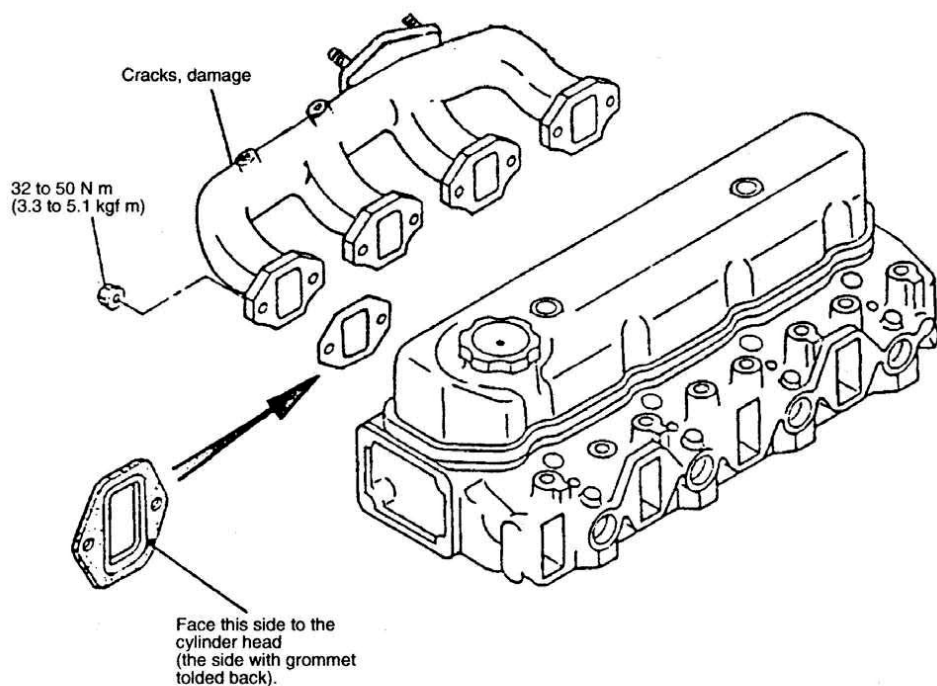


Face this side to the
cylinder head
(the side with grommet
folded back).

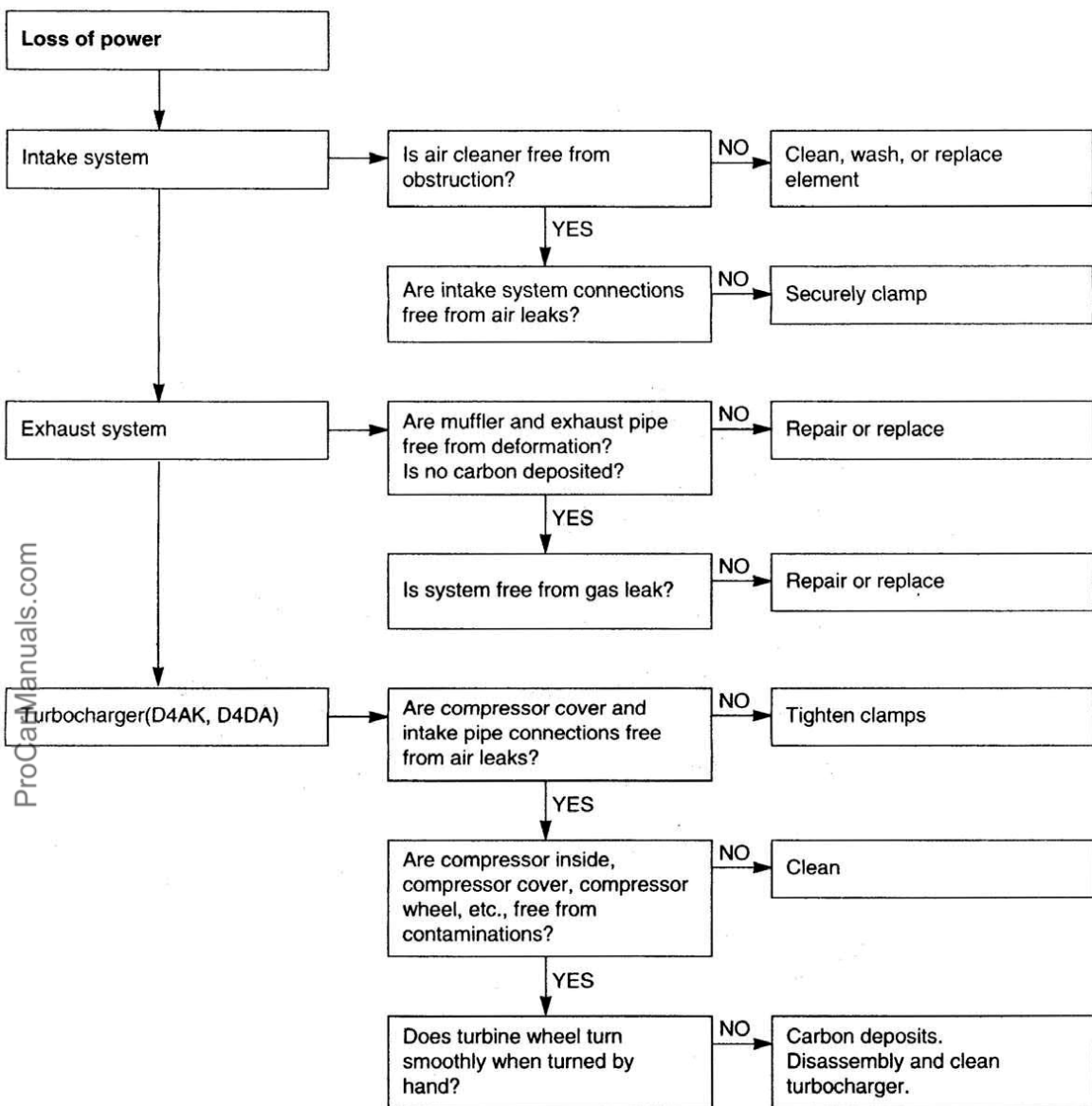
(D4AK)

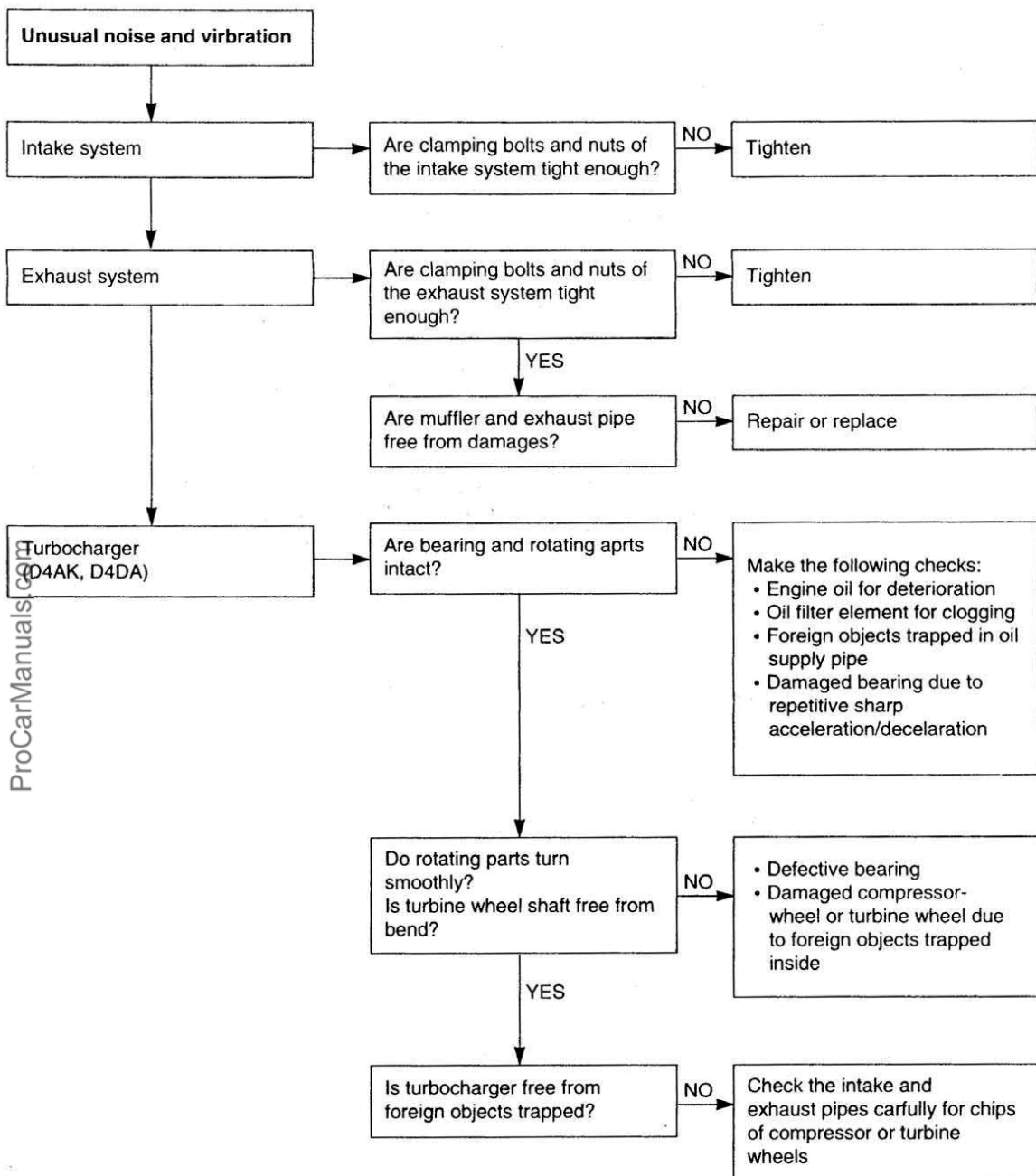


5-6. Exhaust Manifold



6. Troubleshooting





**Oil leak into intake and exhaust pipes;
white exhaust smoke**

**Turbocharger
(D4AK, D4DA)**

Is oil discharge pipe from turbocharger free from clogging?

NO

Disassembly and clean

YES

Are piston ring and ring groove free from excessive wear?

NO

Replace piston or piston ring

YES

Is air cleaner free from clogging resulting in oil leaking into intake pipe?

NO

Clean, wash, or replace element

YES

Air bearing and piston ring free from defects, resulting in oil leaking into intake and exhaust pipes?

NO

Replace