KOBELCO

SHOP MANUAL

MITSUBISHI DIESEL ENGINE

4D3.4DR

(For Industrial Use)

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Issued 09-1990

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4D3.4DR

ENGINE

Shop Manual

FOREWORD

This shop manual contains the specifications, construction, operation, adjustment and service procedures of the Model 4D31, 4D31-T, 4D32, 4DR5 diesel engine for service mechanics engaged in servicing of the Mitsubishi diesel engines.
Please make the most of this shop manual to perform correct servicing and wasteless operations.
Note that some of the contents of this shop manual are subject to change owing to improvements, etc. that may be introduced after publication of the shop manual.

SEP. 1990

Applicable Engine Models

4D31 4D31-T 4D32 4DR5	For industrial use

GROUP INDEX

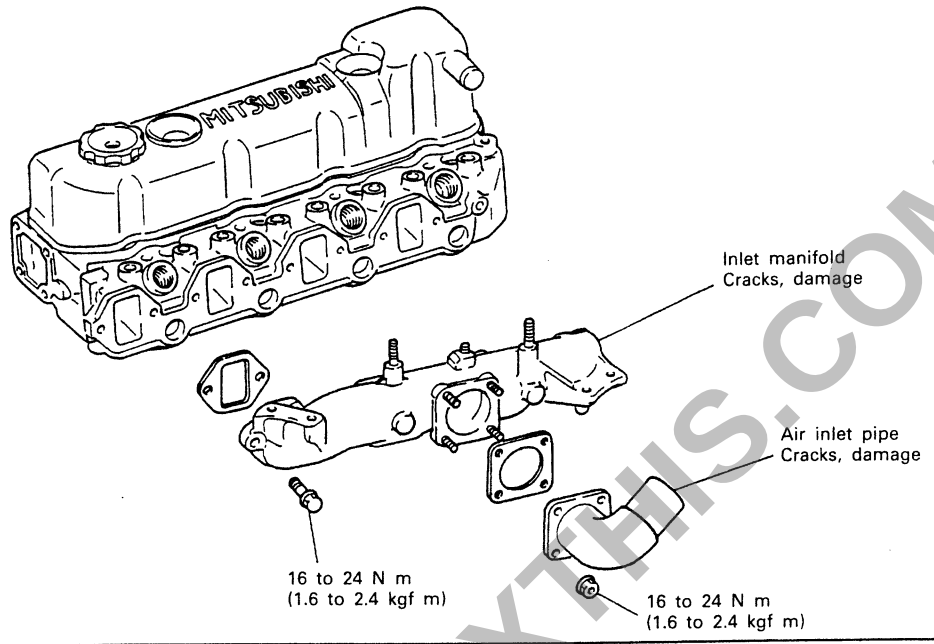
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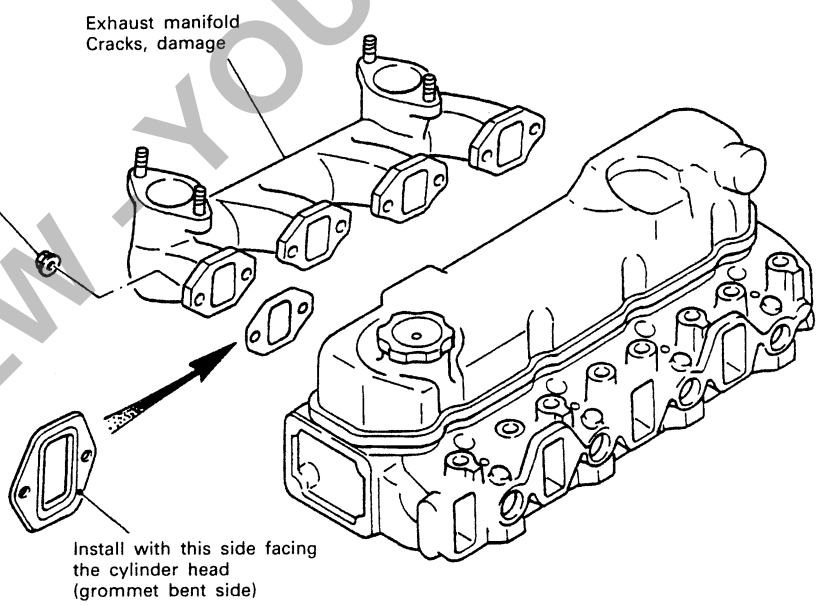
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<4DR5>



4.4 EXHAUST MANIFOLD

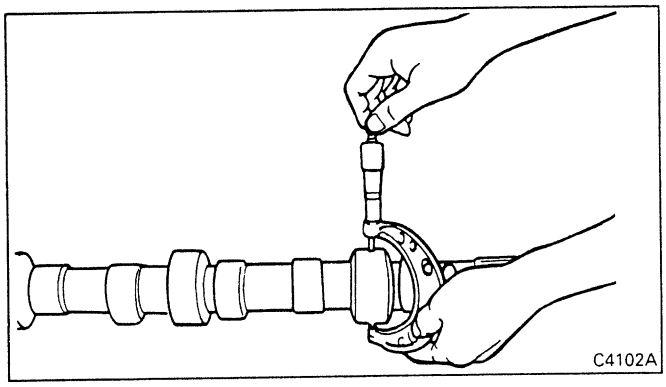
<4D31, 32>

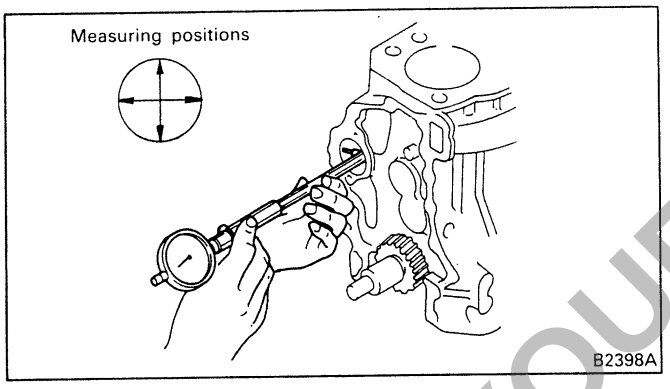


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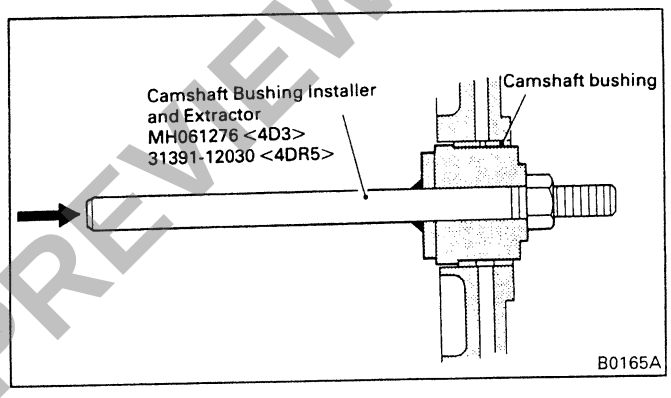
(d) Camshaft Journal to Crankcase Camshaft Bushing Clearance



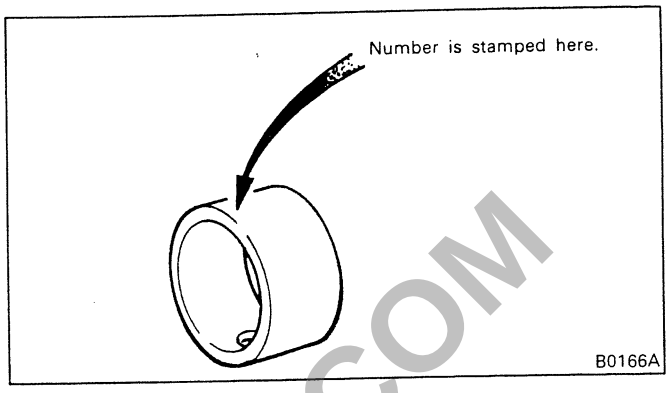


Measure the camshaft journal O.D. and crankcase I.D. If the limit is exceeded, replace the bushing in the crankcase.

(e) Replacement of Camshaft Bushing



To remove the bushing, first remove the sealing cap through the camshaft hole in the rear-end face of the crankcase. Then, using Camshaft Bushing Installer and Extractor (special tool), remove the camshaft bushing.



Bushing No. (Ascending from front of engine)	Stamped number	Applicable model
1	1	4D3
	31707-20700	4DR5
2	2	4D3, 4DR5
3	4	4D3
	3	4DR5

When installing the bushing, identify bushings with a unique number stamped on the external surface, indicating the installation position.
If the number is illegible, determine by measuring the I.D. and width.

<4D3>

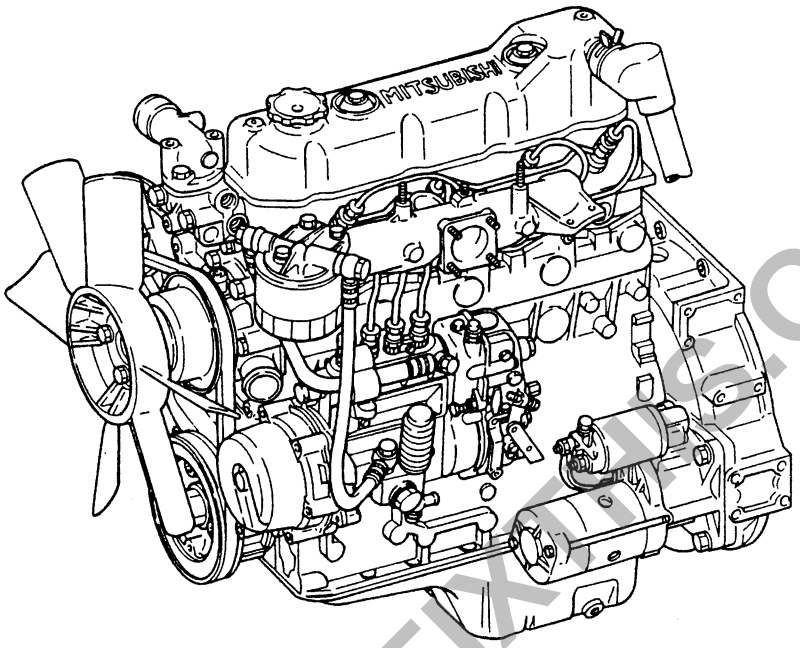
Bushing No. (Ascending from front of engine)	No. 1	No. 2	No. 3
I.D.	54.5	54.5	53
Width	41	21	21

<4DR5>

Bushing No. (Ascending from front of engine)	No. 1	No. 2	No. 3
I.D.	54.5	54.5	54
Width	36	26	26

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<4DR5>



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2. MAJOR SPECIFICATIONS

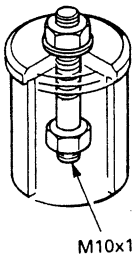
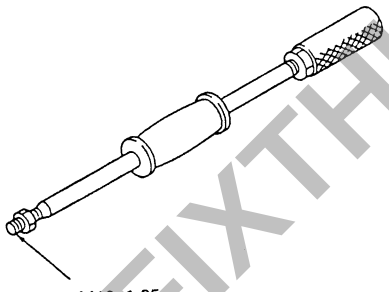
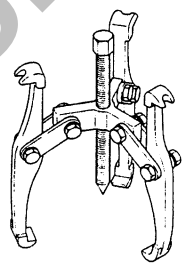
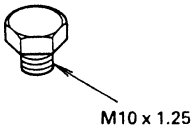
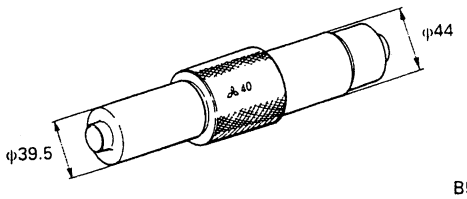
2.1 MAJOR SPECIFICATIONS

Item \ Engine model		4D31	4D31-T	4D32	4DR5
Type		Water cooled, 4-cycle diesel engine			
Combustion method		Direct injection			Swirl chamber
No. and arrangement of cylinder		Four in-line			
Bore x stroke	mm	100 x 105		104 x 105	92 x 100
Total displacement	cc	3 298		3 567	2 659
Engine dimension (without fan)					
Overall length	mm	857	857	857	778
Overall width	mm	647	657	647	750
Overall height	mm	745	871	745	752
Empty weight	kg*	340	350	340	290

* Empty weight as measured according to Mitsubishi Motors Corporation standard.

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Unit: mm

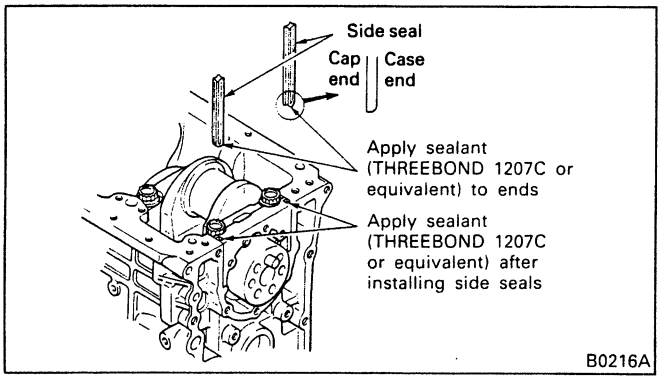
Tool Name	Part No.	Shape	Use
Idler shaft puller	MH062223 <4DR5>	 B0098A	Removal of idler shaft
Reverse gear shaft puller	03726-82000 <4D3>	 F0013A	Removal of idler shaft
Gear puller	MH061326	 Max. pulled out gear O.D. 150 B5072A	Removal of gears
Plug	MF665002	 B5401A	Blank plug used for removal of camshaft gear
Idler gear bushing puller	MH061228	 B5121A	Removal and installation of idler gear bushing

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Tighten the main bearing cap bolt to specified torque. Then, make sure that the crankshaft turns smoothly by hand.
Measure the crankshaft end play to determine if it is within the nominal value. (See 5.1.5 Disassembly.)

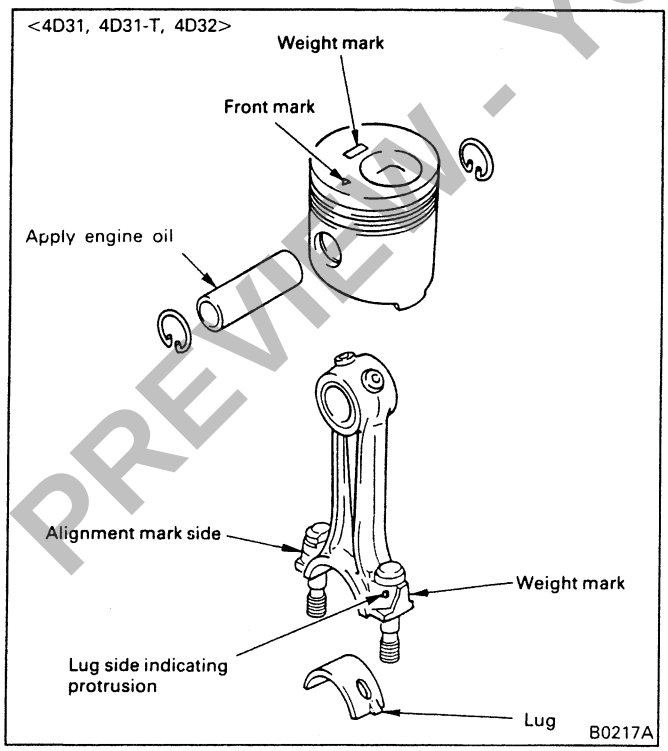
(d) Installation of Side Seal

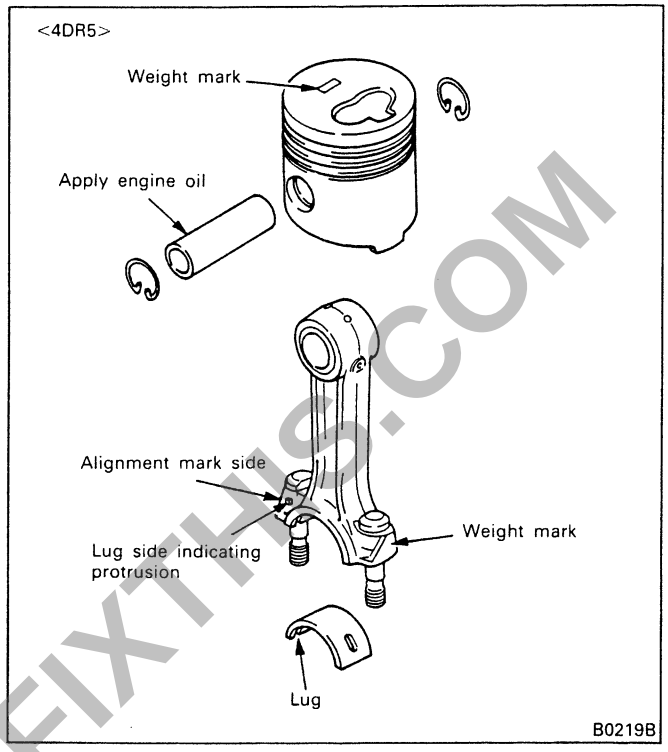


Install the side seal with sealant applied to its end. Then, apply sealant to the bearing cap.

NOTE:
When installing the side seal, ensure the correct installation direction.

(e) Reassembly of Piston and Connecting Rod





Assemble the piston and the connecting rod, ensuring correct direction as illustrated.
Insert the piston pin to couple the piston and connecting rod. Mount the snap ring to hold the piston pin in position.
The piston pin is a clearance fit in the piston. If the piston pin is hard to fit, heat the piston with a piston heater or hot water.

NOTE:
1. **The parts for an engine must be of the same weight mark.**
2. **Apply engine oil to all sliding surfaces.**

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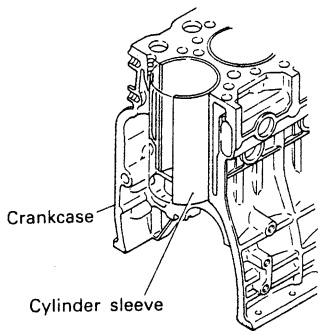
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(f) The tappet on the 4D3 is of cylindrical shape, while that on 4DR5 of mushroom-shape. Its mating surface with the camshaft is a large-diameter sphere to prevent local wear.

(g) The camshaft is provided with an oil pump drive gear, with its journals, cams, and gear induction-hardened.
The cam on 4D3 is a taper cam.

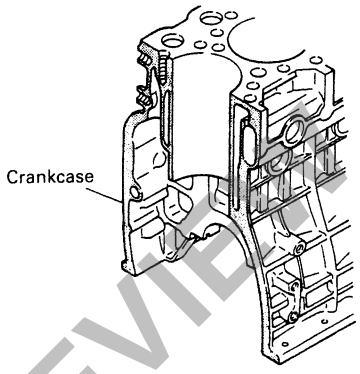
(3) Crankcase and Cylinder Sleeve

<4D31, 4D31-T, 4DR5>



B0075A

<4D32>



B0074A

(a) The crankcase is made of cast iron and built rigid with minimum stress concentration and deformation.

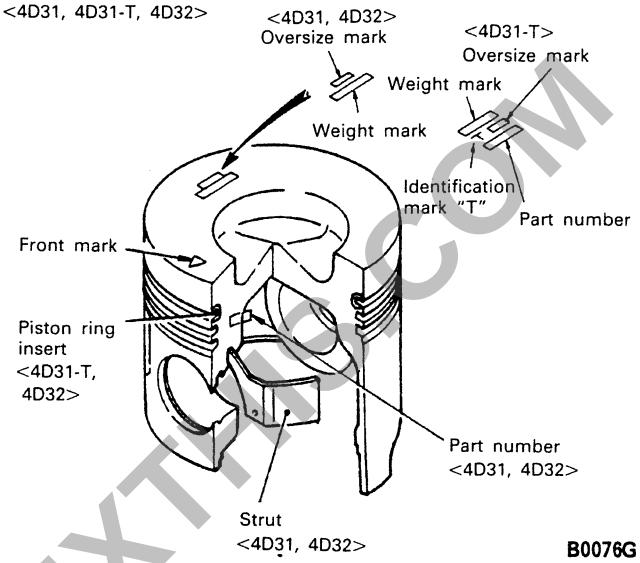
(b) Three camshaft bushings are installed in the camshaft bearings of the crankcase. To facilitate insertion and removal of the camshaft from the front end of the crankcase, the bushing I.D. is made smaller toward the rear.

(c) On 4D31, 4D31-T and 4DR5 engines, cylinder sleeves are press-fitted into the crankcase.

(4) Piston and Piston Ring

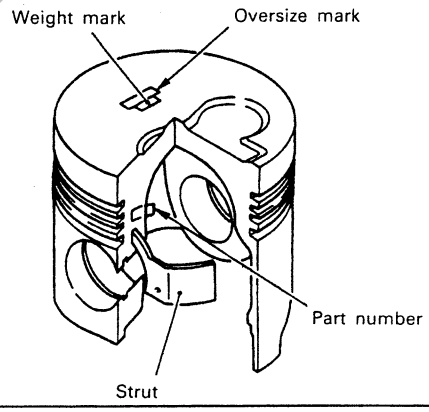
(a) Piston

<4D31, 4D31-T, 4D32>



B0076G

<4DR5>

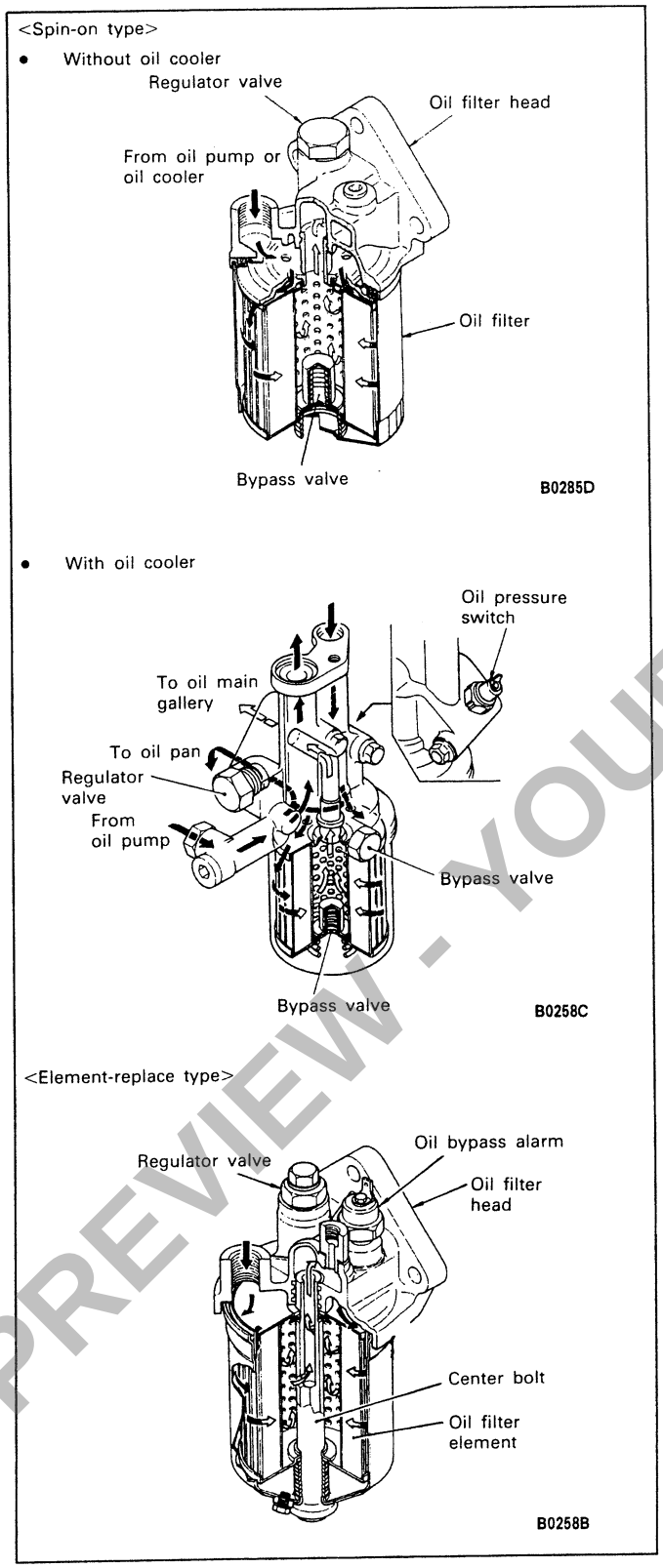


B0077D

The piston, made of aluminum alloy casting, has a strut inside (no strut installed on 4D31-T) that ensures an adequate clearance between the piston and cylinder sleeve.
The piston pin arrangement is full-floating. The piston pin is offset toward the thrust side, which, together with the effect of the strut, minimizes piston slap. Stamped on the top surface of the piston are the piston weight mark, part number, oversize mark (oversize piston only) and the front mark "◁". On 4D31-T and 4D32, a piston ring insert is cast in the top ring groove for increased durability.

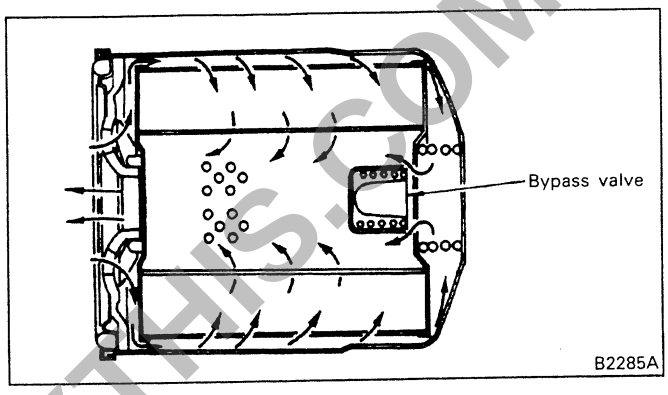
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<4DR5>



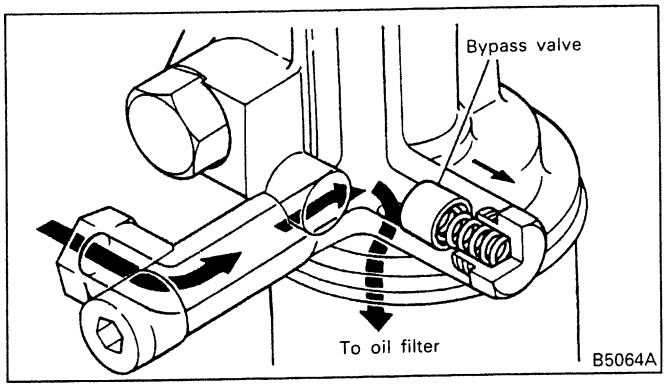
The oil filter is the filter paper full-flow type with a regulator valve, bypass valve and oil bypass alarm in its head. There are two types, the spin-on type that can be replaced easily and the element-replace type that can have its elements replaced individually.

(a) Bypass Valve (For Full-flow Filter)



When the difference between the engine oil pressures at both sides of the bypass filter rises to a specified level or higher due to a clogged element, the bypass valve installed in the lower section of the filter opens to allow unfiltered engine oil to flow to the engine. The oil bypass alarm operates similarly and when its built-in electric contacts cause the valve to open, the pilot lamp comes on to warn the driver about the clogged element.

(b) Bypass Valve <4DR5: Installed to Filter Head>



When the oil viscosity is high due to low temperature or when the flow is impeded by a clogged element, the bypass valve opens to allow engine oil to bypass the engine oil cooler and flow directly to the oil filter.

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6. TROUBLESHOOTING

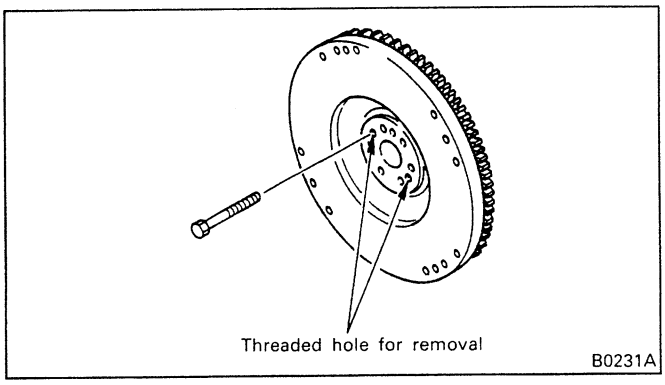
Symptom	Probable cause	Remedy	Ref. group
Engine will not start	Inadequate oil viscosity	Replace	Group 12
	Incorrect fuel in use		Group 13
	Low compression pressure • Incorrect valve clearance	Adjust	
	• Defective head gasket	Replace	
	• Worn valve and valve seat, carbon deposit		
	• Deteriorated valve spring		
	• Worn or damaged piston ring		
	• Worn or damaged piston ring groove		
	• Worn piston and cylinder sleeve or crankcase	Change to oversize	
	Defective preheater • Defective starter switch	Correct or replace	Group 16
	Incorrect injection timing	Adjust	
	Insufficient injection amount • Defective injection pump	Correct or replace	Group 13
	• Incorrect injection amount		
	Cooling system not functioning properly	Correct or replace	Group 14
Rough idle	Inadequate oil viscosity	Replace	Group 12
	Incorrect fuel in use		Group 13
	Defective cooling system	Correct or replace	Group 14
	Low compression pressure	See "Engine will not start".	
	Incorrect injection timing	Adjust	
	Defective fuel system • Defective injection pump	Correct or replace	Group 13
	• Defective injection nozzle		
	• Air trapped in fuel system	Bleed air after repair of defective part	
Abnormal exhaust gas color	Incorrect fuel in use	Replace	Group 13
	Cooling system not functioning properly	Correct or replace	Group 14
	Intake/exhaust system not functioning properly • Clogged air cleaner	Correct or replace	Group 15
	• Clogged muffler		
	• Oil leaks to intake/exhaust pipes		
	Low compression pressure	See "Engine will not start".	
	Defective fuel system • Defective injection pump	Correct or replace	Group 13
	• Defective injection nozzle		
	• Incorrect injection timing	Adjust	
	Excessive engine oil	Adjust	Group 12
	Binding of major moving parts	Correct or replace	

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Disassembly

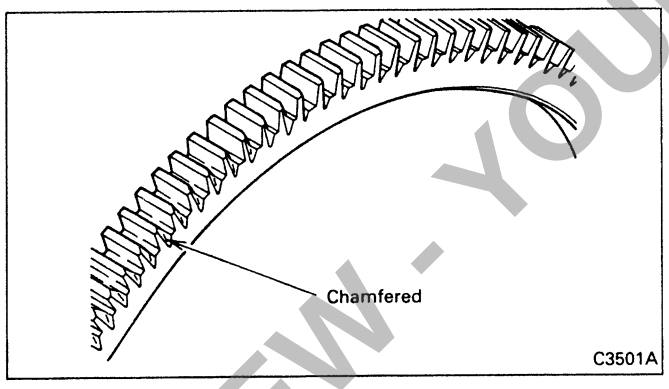
Removal of Flywheel



If the flywheel has threaded holes for removal, screw the flywheel mounting bolts into these holes evenly to remove the flywheel.
Remove the ring gear together with the flywheel.

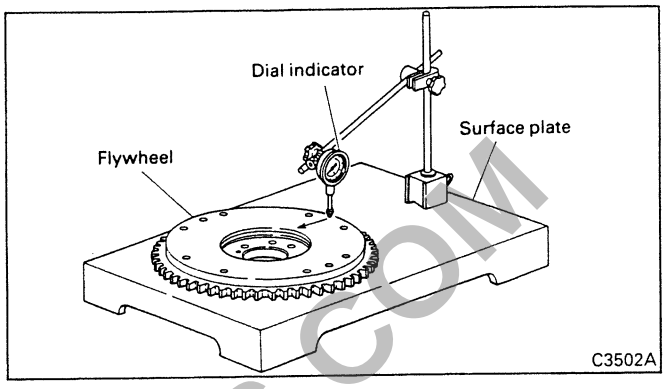
Inspection

(a) Replacement of Flywheel Ring Gear



To remove, use an acetyline torch or similar device and evenly heat the ring gear.
By applying a protective rod, hammer the entire periphery of the ring gear, forcing it off.
To install, heat the ring gear with piston heater (approx. 100°C) for three minutes.
Fit the ring gear onto the flywheel with the nonchamfered side of tooth crests toward the flywheel.

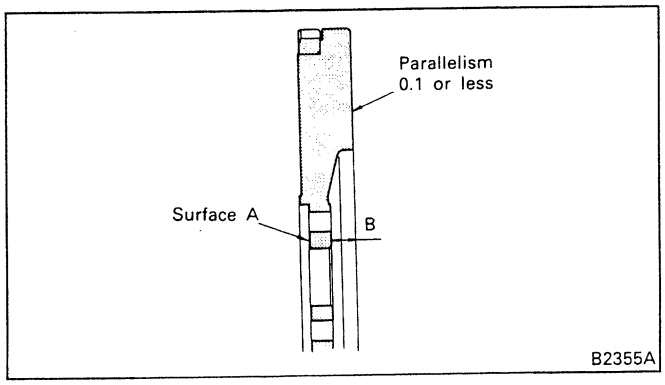
(b) Friction Surface Distortion



Place the flywheel on a surface plate and move a dial indicator over the flywheel friction surface to measure the distortion.
For more accurate measurement, use a portable jack.
If the distortion is beyond the limit, regrind the friction surface.

NOTE:
If the ring gear develops any unusual condition, replace it with a new one before taking a measurement.

(c) Correction of Friction Surface



Correct the friction surface with a surface grinder.
Make sure that the friction surface is parallel to surface A within 0.1 mm.

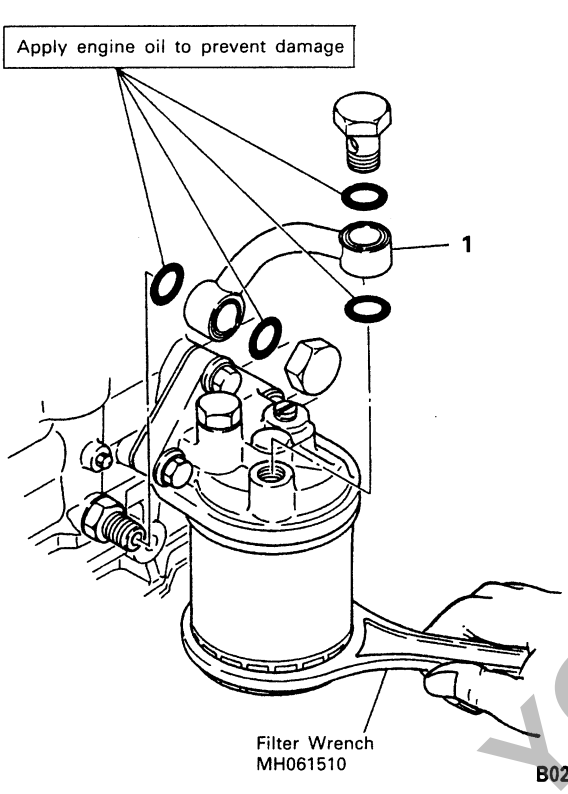
NOTE:
After correction, make sure that the height of the friction surface (dimension B) is within the limit.

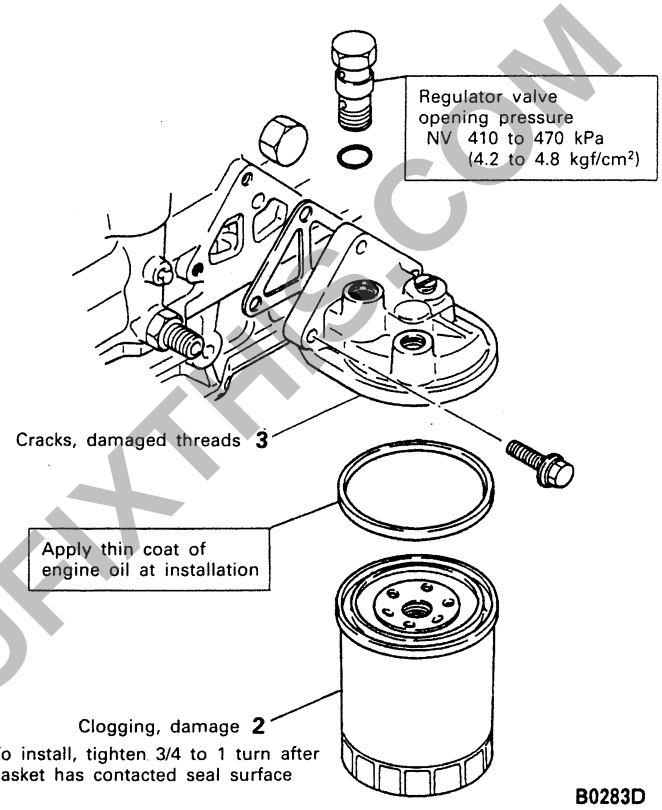
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(2) Oil Filter <4DR5: without oil cooler>

<Spin-on type>





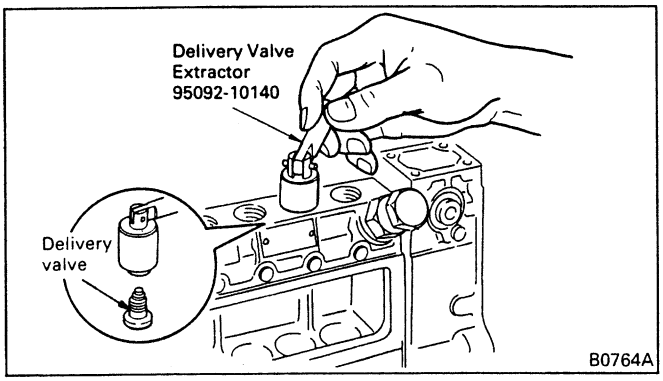
NV... Nominal Value

1. Oil pipe
2. Oil filter element
3. Oil filter head

NOTE:
1. Use special tool, Filter Wrench to remove the element.
2. After the element has been installed, start the engine and check connections for oil leaks.

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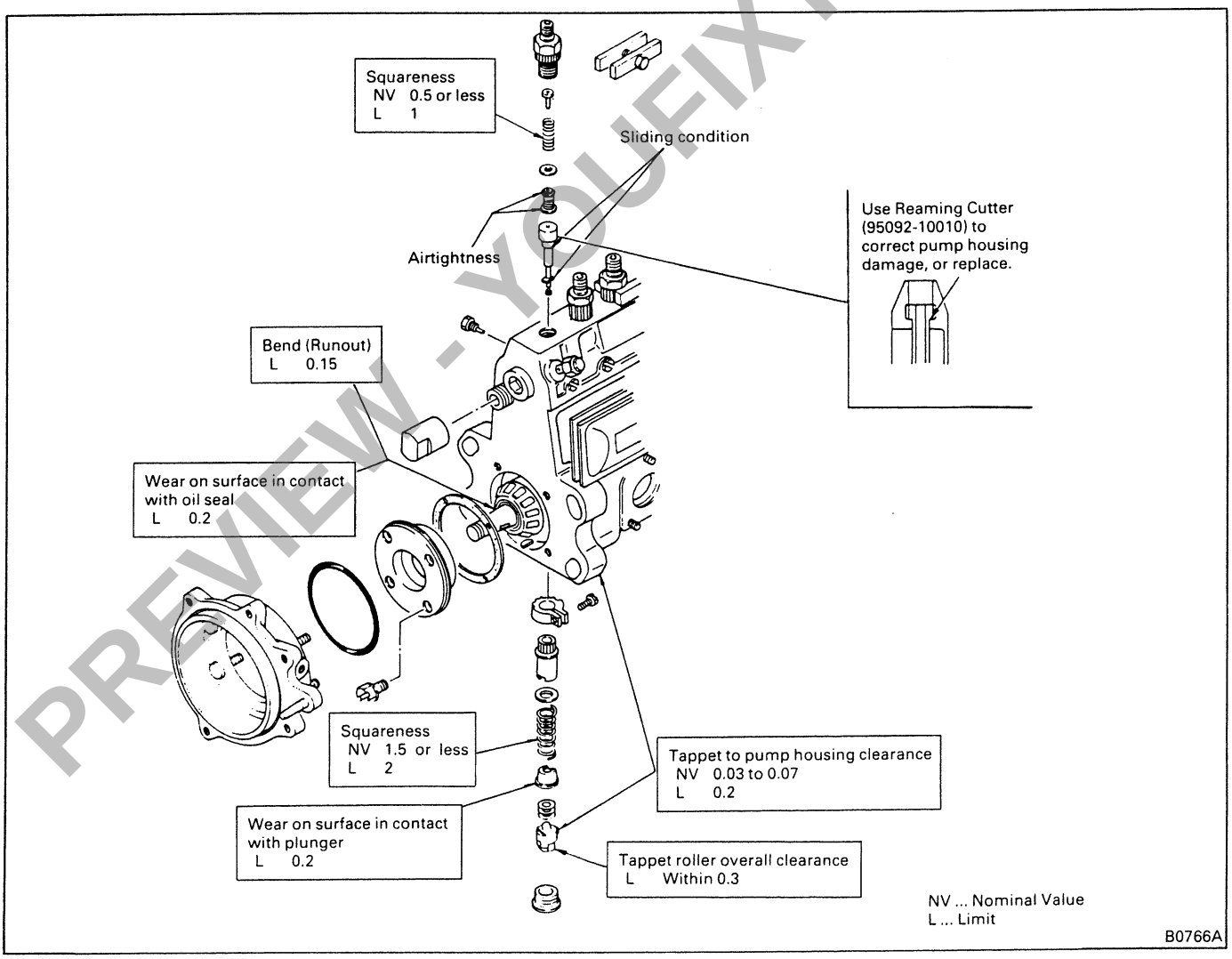
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NOTE:
Never change the combinations of the delivery valves and delivery valve seats.

(10)Using Delivery Valve Extractor (special tool), remove the delivery valve together with the delivery valve seat.

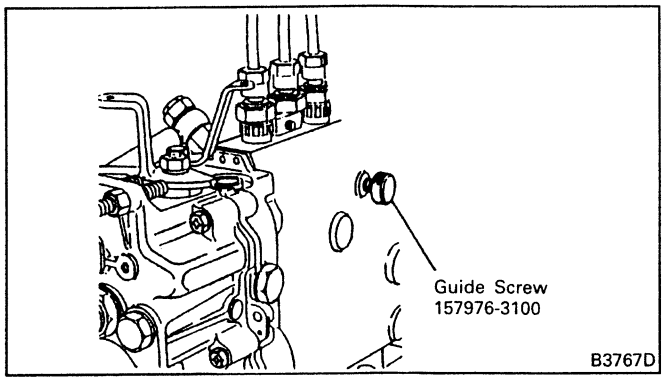
5.2.2 Inspection and Correction



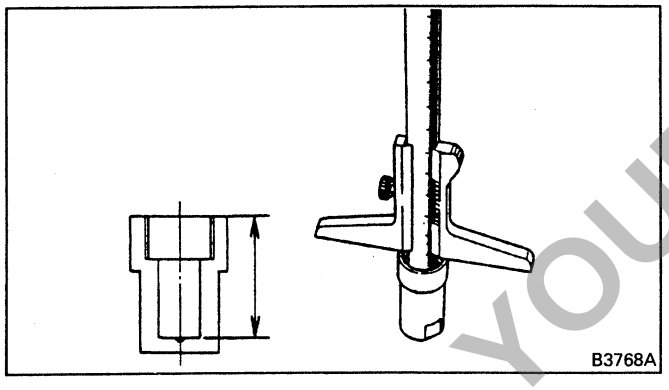
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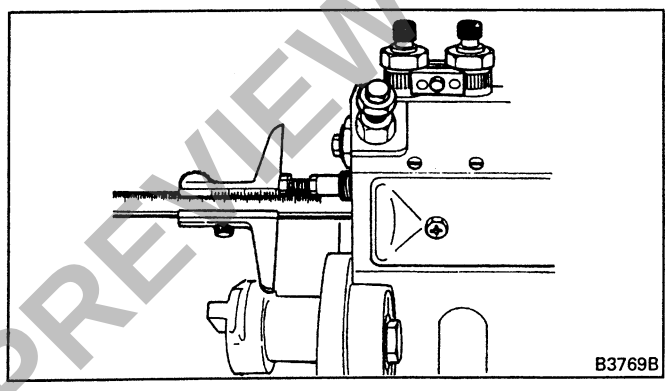
(12)Adjustment of Rack Limit



(a) Remove the rack guide screw from the back of the pump housing and install Guide Screw (special tool) in its place.

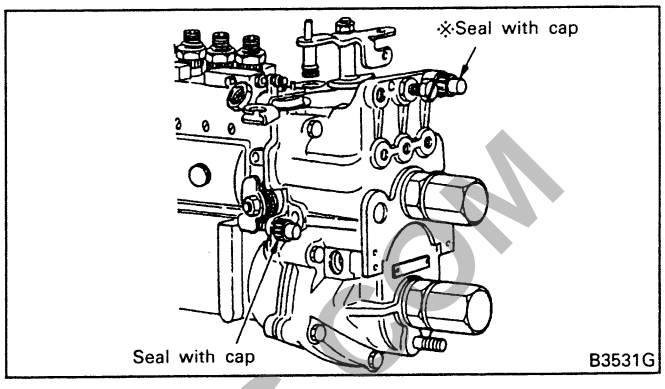


(b) Using a depth gauge, measure the rack cap depth.



(c) Adjust the nut fitted to the end of the rack to the same depth as the rack cap depth measured in (b) above. Fix in position with the lock nut.
After adjustment, fit the cap nut securely and check the injection quantity.

(13)Sealing



After adjustment, seal with cap.

NOTE:
Seal the point marked ※ after adjustment of the maximum speed under no load condition.

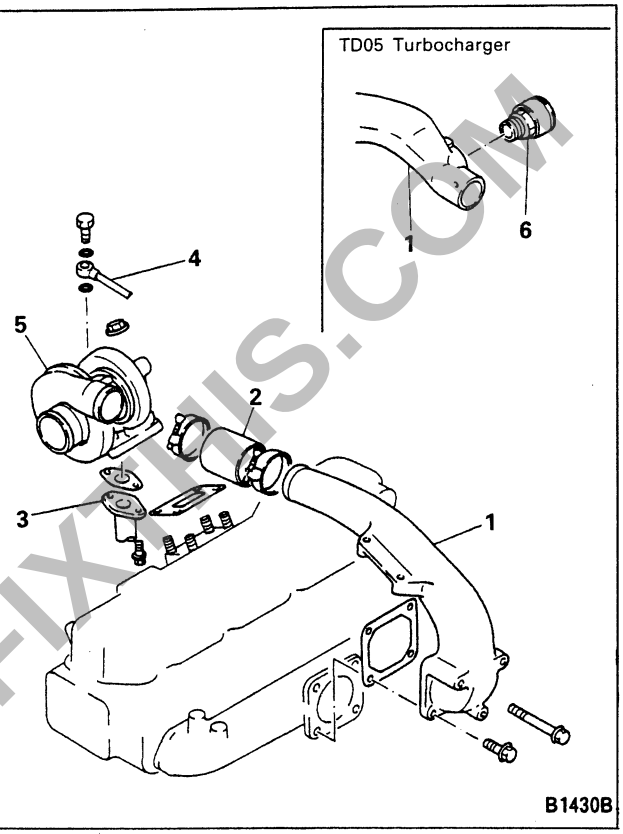
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4.2 TURBOCHARGER

4.2.1 Removal and Installation

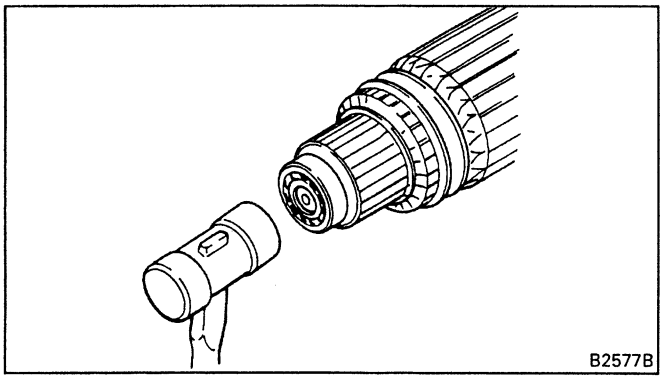
1 Air inlet pipe
2 Rubber hose
3 Oil return pipe
4 Oil pipe
5 Turbocharger
6 Overboost valve (TD05 Turbocharger)



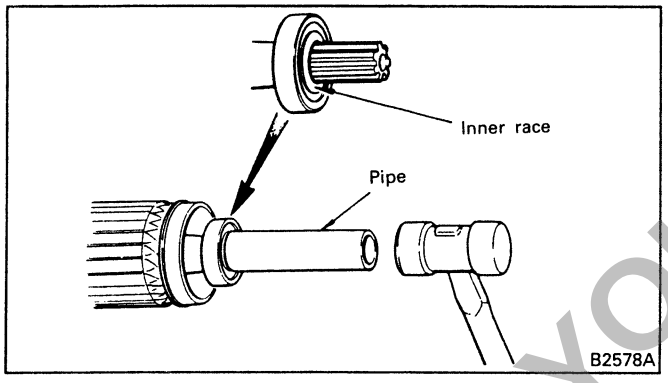
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<Installation>



Install the bearing by striking its inner race evenly with a soft hammer, etc.



To install the front bearing, use a pipe, etc. that matches exactly its inner race diameter and strike into position.

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Symptom	Probable cause	Remedy	Ref. group
Clutch slips	Mechanical failure of clutch proper (Disassemble and check clutch assembly)		
	• Diaphragm spring finger uneven in height	Adjust	
	• Deteriorated diaphragm spring	Replace	
	• Faulty clutch disc mechanism	Replace clutch disc assembly	
	• Worn facing		
	• Deformed clutch disc		
	• Hardened facing surface	Remove hardened surface, or replace clutch disc assembly	
	• Oil on facing	Remove oil or replace clutch disc assembly	
	• Distorted or damaged pressure plate	Correct by grinding or replace clutch cover assembly	Group 11
	Distorted or damaged flywheel	Correct by grinding or replace	
Clutch does not engage smoothly	Faulty operating mechanism		
	• Faulty clutch pedal operation	Lubricate or repair	
	• Deteriorated return spring of clutch pedal	Replace	
	• Faulty operation of clutch master cylinder		
	• Poor sliding of piston or piston cup	Replace faulty part	
	• Clogged brake fluid inlet/outlet	Disassemble and clean	
	• Faulty operation of clutch power cylinder		
	• Poor sliding of piston or piston cup	Replace faulty part	
	• Clogged brake fluid inlet/outlet	Disassemble and clean	
	Faulty mechanisms of clutch proper (Disassemble and check clutch assembly)		
	• Faulty clutch disc mechanism		
	• Distorted facing	Replace clutch disc assembly	
	• Hardened facing surface	Remove hardened surface, or replace clutch disc assembly	
	• Loose rivets	Replace clutch disc assembly	
	• Oil on facing	Remove oil, or replace clutch disc assembly	

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