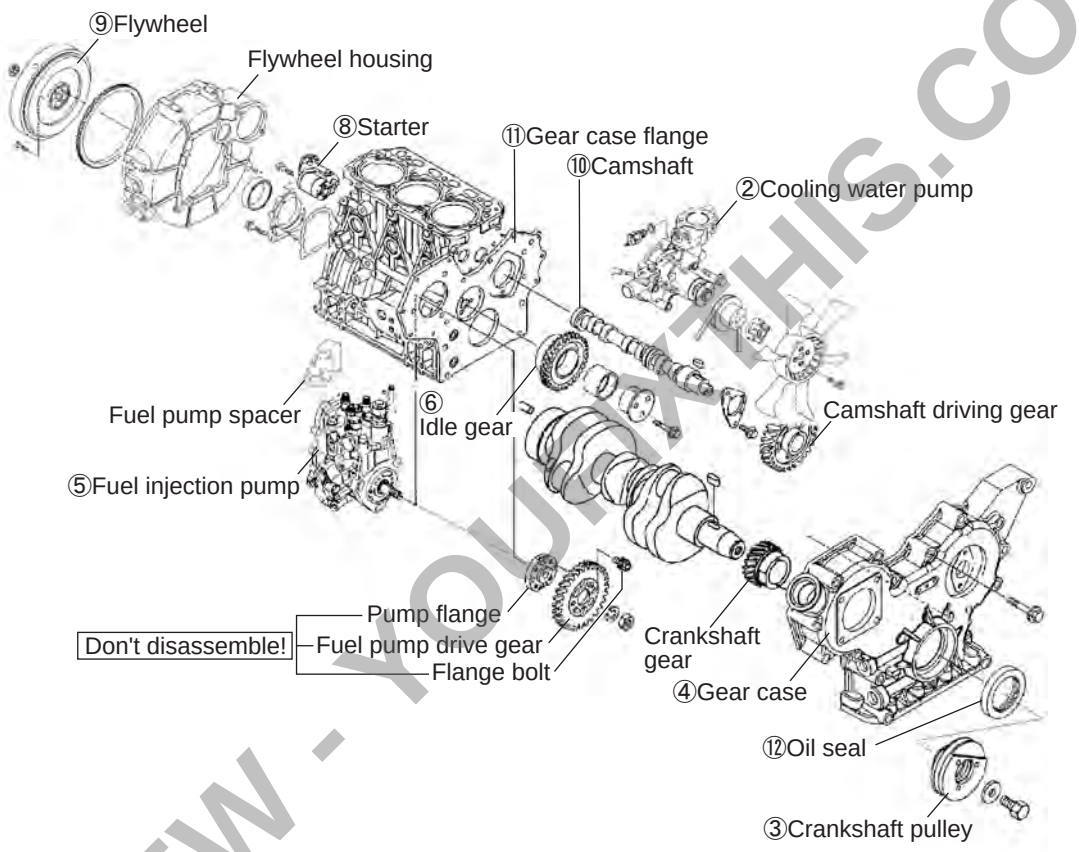
(2) How to Read the Explanations

- An exploded view, sectional views, a system diagram, etc. are shown at the beginning of each section as required for easy understanding of the mounted states of the components.
- For the removal/installation of each part, the procedure is shown with the procedural step No. in the illustration.
- Precautions and key points for disassembly and reassembly of parts are described as **points**. In the explanation for each point, detailed operation method, information, standard and precautions are described.

Description Example



Note) This figure shows the 3TNV84.

The job contents are described in the disassembly procedure for Nos. not shown in the illustration.

- Disassembly procedure

1)Follow steps (1) to (15) of the cylinder head disassembly procedure.
2)Remove the cooling water pump.
3)Remove the crankshaft pulley. (**Point 1**) ← Operation point to be explained on a later page.

- Operation points

Disassemble: Service point for removal
Reassemble: Service point for installation
Disassemble-Reassemble: Service point required in both removal and installation.

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9.3 For 3TNV82A to 3/4TNV88

9.3.1 Specifications

Manufacturer's code (Denso)	-	228000-0251
Yanmar code	-	12912-77010
Nominal voltage	V	12
Nominal output	kW	1.2
Rating	Sec	30
Revolution direction (as viewed from pinion)	-	Clockwise

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3.2 Quick reference table for troubleshooting

The following table summarizes the general trouble symptoms and their causes. If any trouble symptom occurs, take corrective action before it becomes a serious problem so as not to shorten the engine service life.

	Trouble symptom / Cause	Starting failure				Insufficient engine output	Poor exhaust color		High knocking sound during combustion	Abnormal engine sound	Uneven combustion sound	Hunting		Large engine vibration	Difficulty in returning to low speed	Excessive fuel consumption	Lubricating oil				Much blow-by gas	Cooling water		Air intake		Exhaust temperature rise	Corrective action
			Engine starts but stops soon.			Exhaust color	During work																					
			Exhaust smoke																									
		Engine does not start.	None	Little	Much	Ordinary	White	Black	White	Black				During idling	During work				Excessive consumption	Dilution by fuel oil	Mixture with water	Low L.O. pressure		Overheat	Low water temperature	Pressure drop	Pressure rise		
Engine system	Improper clearance of intake/exhaust valve	○	○			○						○														○		○	Adjust the valve clearance. (See 2.2.6 (4) in Chapter2.)
	Compression leakage from valve seat					○		○		○		○					○					○				○		○	Lap the valve seat. (See 4.2.6 in Chapter4.)
	Seizure of intake/exhaust valve	○			○	○		○		○		○		○	○				○			○				○			Correct or replace.
	Blowout from cylinder head gasket					○															○			○					Replace the gasket. (See 4.2.2-12) in Chapter4.)
	Seized or broken piston ring	○			○		○		○			○		○	○				○	○			○	○				○	Replace the piston ring. (See 4.4.2-5) & 10) in Chapter4.)
	Worn piston ring, piston or cylinder	○			○		○		○										○	○			○						Perform honing and use oversize parts. (See 4.4.5-1)4) and 4.4.6 in Chapter4.)
	Seized crankpin metal or bearing	○	○									○		○	○	○							○						Repair or replace.
	Improper arrangement of piston ring joints		○				○												○				○						Correct the ring joint positions. (See 4.4.4-point 6 in Chapter4.)
	Reverse assembly of piston rings						○		○										○				○						Reassemble correctly. (See 4.4.4-point 6 in Chapter4.)
	Worn crankpin and journal bearing					○						○		○	○	○						○							Measure and replace. (See 4.4.5-(2) in Chapter4.)
	Loosened connecting rod bolt											○				○						○							Tighten to the specified torque. (See 4.4.4-point 2 in Chapter4.)
	Foreign matter trapped in combustion chamber	○										○							○				○						Disassemble and repair.
	Excessive gear backlash											○																	Adjust gear meshing. (See 4.3.4-point 2 in Chapter4.)
	Worn intake/exhaust valve guide						○												○				○						Measure and replace. (See 4.2.5-(2) and 4.2.7 in Chapter4.)
	Defective governor		○											○	○	○	○												Make adjustment.
	Improper open/close timing of intake/exhaust valves	○					○	○	○	○		○																	Adjust the valve clearance. (See 2.2.6-(4) in Chapter2.)
Turbocharger	Fouled blower							○		○																			Wash the blower.
	Waste gate malfunction							○		○																			Disassemble and inspect.
	Worn floating bearing						○		○																				Disassemble and inspect.

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(1) 3TNV82A

Engine name	Unit	3TNV82A	
Engine specification class	-	CL	VM
Type	-	Vertical, in-line, 4-cycle, water-cooled diesel engine	
Combustion chamber	-	Direct injection	
Number of cylinders	-	3	
Cylinder bore × stroke	mm × mm	82 × 84	
Displacement	L	1.331	

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2. Inspection and adjustment

2.1 Periodic maintenance schedule

The engine periodic inspection timing is hard to determine as it varies with the application, load status, qualities of the fuel and lubricating oils used and handling status. General rules are described here.

○: User-maintenance ◎: Parts replacement ●: Shop-inspection

Classification	Item	Daily	Maintenance period				
			Every	Every 250	Every 500	Every 1000	Every 2000

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4.1.3 Complete disassembly

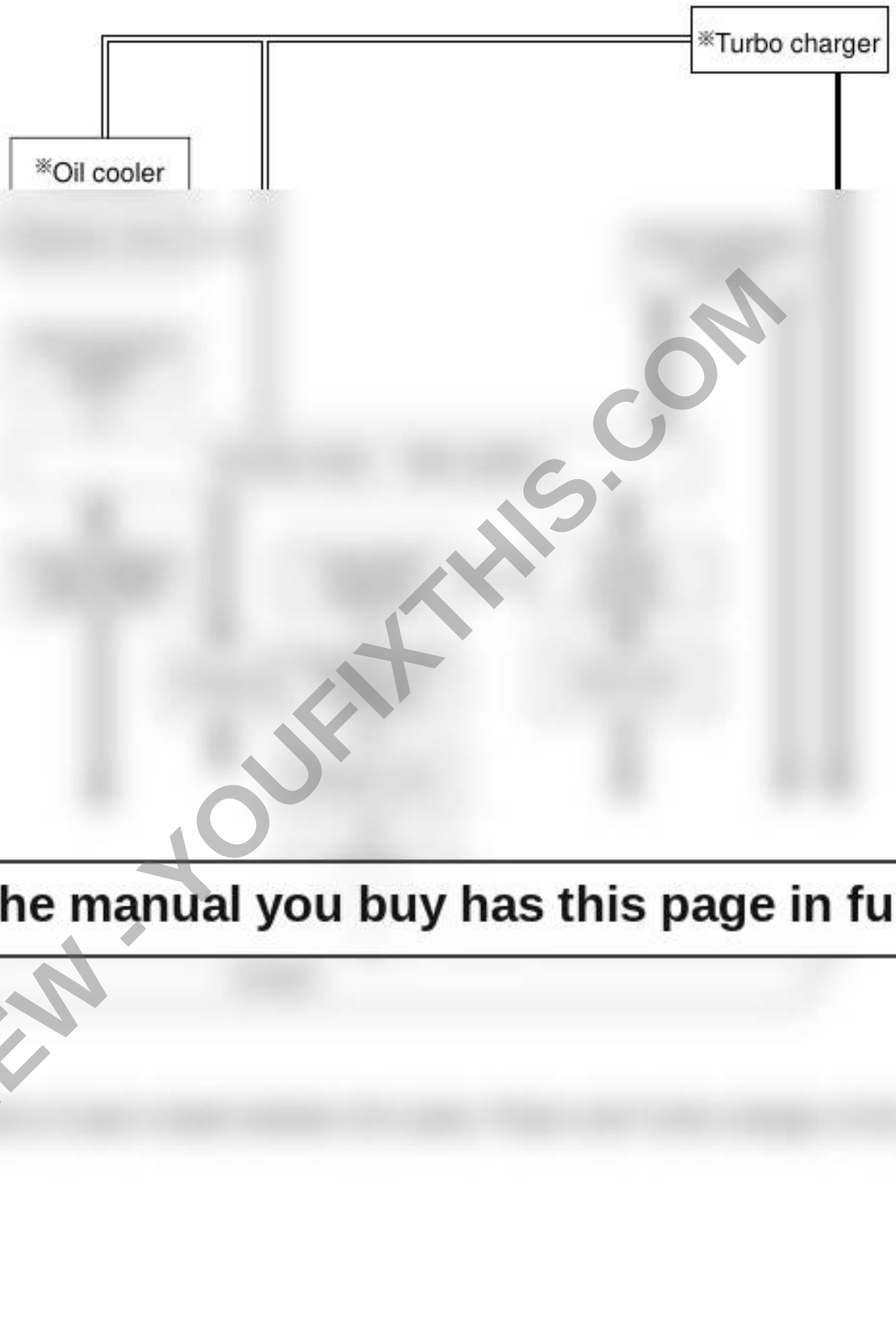
Peripheral parts such as air cleaner, muffler and radiator differ in installation and types for each application. Therefore, description in this Chapter is started with the steps to be taken just after the peripheral parts have been removed.

Step	Removal Parts	Remarks
1	1)Thoroughly remove sand, dust, dirt and soil from the surface of the engine. 2)Drain coolant water and lubricating oil from the engine.	
2	1)Remove turbocharger and exhaust manifold. 2)Remove intake manifold and surge tank.	
3	1)Close the fuel cock valve of the fuel tank. 2)Remove high-pressure fuel pipe. 3)Remove fuel return pipe. 4)Loosen the tightening nut on fuel injection nozzle retainer and extract the retainer and fuel injection nozzle. *) Fuel injection nozzle for Indirect injection system is screwed type.	1)If nozzle seat is left on the cylinder head, remove the cylinder head before extracting nozzle seat. 2)To prevent dust from entering fuel injection nozzle, fuel injection pump and high-pressure fuel pipe, seal their respective threads with a tape or the like. 3)Whenever extracting fuel injection nozzle, replace nozzle protector with a new one.
4	1)Remove rocker arm cover assembly.	
5	1)Remove valve rocker arm shaft assembly. 2)Remove push rod.	1)Attach a tag to push rod for each cylinder No. to put the push rod in order. 2)Remove valve cap from the intake/exhaust valve head. 3)Note that tappet of the indirect injection system can be removed at the same time when push rod is extracted. 4)Attach a tag to tappet for each cylinder No. to put the tappet in order.
6	1)Remove fan mounting bolt, and then remove fan. 2)Loosen adjusting bolt for the V-belt adjuster, and then remove V-belt. 3)Remove alternator. 4)Remove the spacer for cooling fan and V-pulley.	1)Never turn down alternator vigorously toward the cylinder block. Otherwise, your finger may be nipped and alternator broken.
7	1)Remove lubricating oil filter assembly. 2)Extract dipstick form the oil dip-stick hole.	
8	1)Disconnect fuel return pipes to. 2)Remove fuel filter.	

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5. Lubrication system

5.1 Lubrication system diagram



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3.3 Troubleshooting by measuring compression pressure

Compression pressure drop is one of major causes of increasing blowby gas (lubricating oil contamination or increased lubricating oil consumption as a resultant phenomenon) or starting failure. The compression pressure is affected by the following factors:

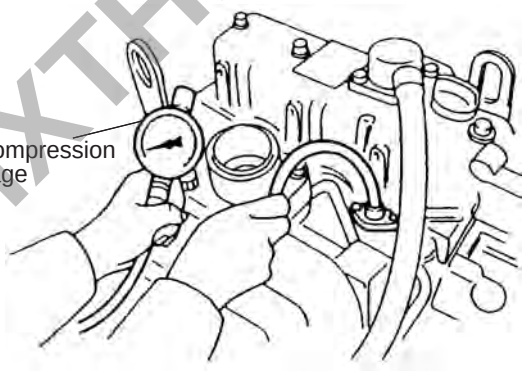
1)Degree of clearance between piston and cylinder
2)Degree of clearance at intake/exhaust valve seat
3)Gas leak from nozzle gasket or cylinder head gasket

In other words, the pressure drops due to increased parts wear and reduced durability resulting from long use of the engine.

A pressure drop may also be caused by scratched cylinder or piston by dust entrance from the dirty air cleaner element or worn or broken piston ring. Measure the compression pressure to diagnose presence of any abnormality in the engine.

(1) Compression pressure measurement method

1)After warming up the engine, remove the fuel injection pipe and valves from the cylinder to be measured.
2)Crank the engine before installing the compression gage adapter.
*1) Perform cranking with the stop handle at the stop position (no injection state).
*2) See 12.2-18 in Chapter 12 for the compression gage and compression gage adapter.
3)Install the compression gage and compression gage adapter at the cylinder to be measured.
*1) Never forget to install a gasket at the tip end of the adapter.
4)With the engine set to the same state as in 2)*1), crank the engine by the starter motor until the compression gage reading is stabilized.



Measurement of the compression pressure

(2) Standard compression pressure

Engine compression pressure list (reference value)

Engine mode	Compression pressure at 250 min^{-1} MPa (kgf/cm^2)		Deviation among cylinders MPa (kgf/cm^2)
	Standard	Limit	
3TNV82A	3.04 ± 0.1 (31 ± 1)	2.45 ± 0.1 (25 ± 1)	0.2 to 0.3 (2 to 3)
3/4TNV84	3.24 ± 0.1 (33 ± 1)	2.55 ± 0.1 (26 ± 1)	
3/4TNV84T	2.94 ± 0.1 (30 ± 1)	2.45 ± 0.1 (25 ± 1)	
TNV88 to 106 (T)	3.43 ± 0.1 (35 ± 1)	2.75 ± 0.1 (28 ± 1)	

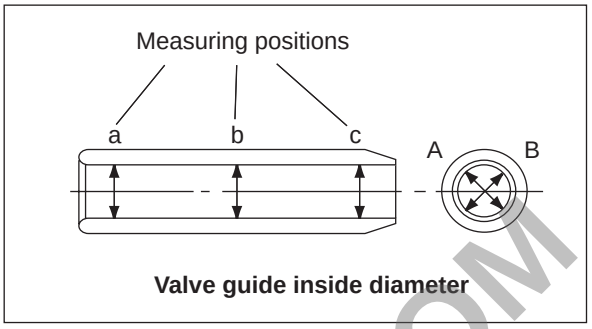
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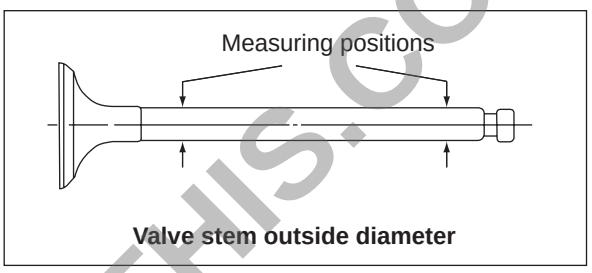
(2) Valve guide

Mainly check damage and wear on the inside wall.
Apply the service part code when replacing a part.

Model		Service part code
3TNV82A (2-valve)	Suction	124060-11800
	Exhaust	119802-11810
4TNV84 3TNV84(T) 3/4TNV88 (2-valve)	Suction	120130-11860
	Exhaust	129150-11810
4TNV84T (4-valve)	Suc./Exh.	119717-11800
4TNV94L 4TNV98(T) (4-valve)	Suc./Exh.	129907-11800
4TNV106(T) (4-valve)	Suction	123907-11800
	Exhaust	123907-11810



Valve guide inside diameter



Valve stem outside diameter

Valve stem clearance

Model	Part name	Place	Standard	Limit
3TNV82A (2-valve head)	Intake value	Guide I.D.	7.000 to 7.015	7.08
		Stem O.D.	6.945 to 6.960	6.90
		Clearance	0.040 to 0.070	0.18
	Exhaust value	Guide I.D.	7.000 to 7.015	7.08
		Stem O.D.	6.940 to 6.955	6.90
		Clearance	0.045 to 0.075	0.18
4TNV84 3TNV84 (T) 3/4TNV88 (2-valve head)	Intake value	Guide I.D.	8.010 to 8.025	8.10
		Stem O.D.	7.955 to 7.975	7.90
		Clearance	0.035 to 0.070	0.18
	Exhaust value	Guide I.D.	8.015 to 8.030	8.10
		Stem O.D.	7.955 to 7.970	7.90
		Clearance	0.045 to 0.075	0.18
4TNV84T (4-valve head)	Intake value	Guide I.D.	6.000 to 6.015	6.08
		Stem O.D.	5.960 to 5.975	5.90
		Clearance	0.025 to 0.055	0.15
	Exhaust value	Guide I.D.	6.000 to 6.015	6.08
		Stem O.D.	5.945 to 5.960	5.90
		Clearance	0.040 to 0.070	0.17
4TNV94L 4TNV98 (T) (4-valve head)	Intake value	Guide I.D.	7.000 to 7.015	7.08
		Stem O.D.	6.945 to 6.960	6.90
		Clearance	0.040 to 0.070	0.17
	Exhaust value	Guide I.D.	7.000 to 7.015	7.08
		Stem O.D.	6.940 to 6.955	6.90
		Clearance	0.045 to 0.075	0.17
4TNV106(T) (4-valve head)	Intake value	Guide I.D.	7.008 to 7.020	7.08
		Stem O.D.	6.960 to 6.975	6.92
		Clearance	0.033 to 0.060	0.16
	Exhaust value	Guide I.D.	7.008 to 7.020	7.08
		Stem O.D.	6.945 to 6.960	6.90
		Clearance	0.048 to 0.075	0.18

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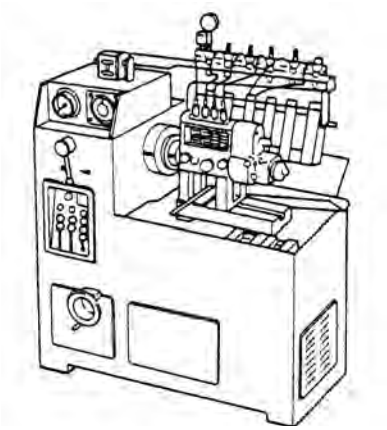
4. Adjustment of Fuel Injection Pump and Governor

Adjust the fuel injection pump after you have completed reassembly. The pump itself must be readjusted with a special pump tester when you have replaced major parts such as the plunger assembly, roller guide assembly, fuel camshaft, etc. Procure a pump tester like the one illustrated below.

4.1. Preparations

Prepare for adjustment of the fuel injection pump as follows:

(1) Adjusting nozzle assembly and inspection of injection starting pressure.



Mpa (kgf/cm$^{2)}$

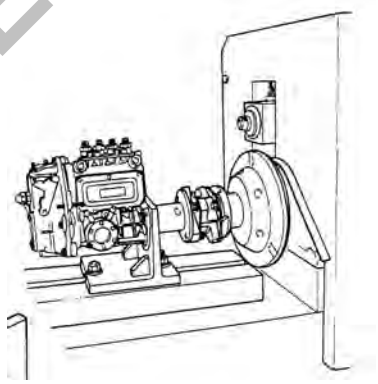
Adjusting nozzle type	YDN-12SD12
Injection starting pressure	16.2 – 17.2(165 – 175)

(2) Adjusting injection pipe.

mm

Inner dia./outer dia. × length	Φ2.0/Φ6.0 × 600
Minimum bending radius	25

(3) Mount the fuel injection pump on the pump tester platform.



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SAFETY LABELS

- Most accidents are caused by negligence of basic safety rules and precautions. For accident prevention, it is important to avoid such causes before development to accidents.
  Please read this manual carefully before starting repair or maintenance to fully understand safety precautions and appropriate inspection and maintenance procedures.
  Attempting at a repair or maintenance job without sufficient knowledge may cause an unexpected accident.

- It is impossible to cover every possible danger in repair or maintenance in the manual. Sufficient consider-

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