RCD Drilling Machine Instruction Manual

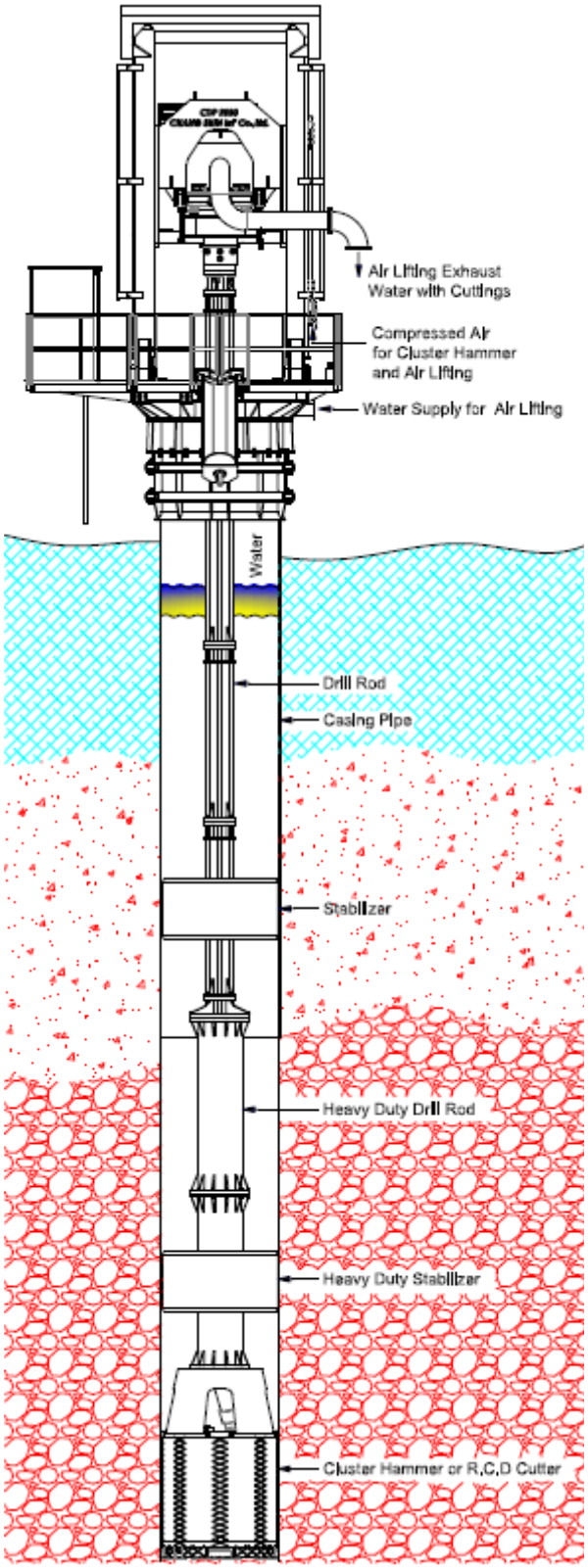
(Model : CPD 2000)

Serial No. : 2012-004 / 005

Chang Shin International Co.,Ltd.

Contents

1. R.C.D Drilling Method.



The Reverse Circulation Drilling (RCD) method is the largest diameter among the drilling methods.

The air lifting is the basic of the reverse circulation.

Before drilling, the casing pipe should be installed.
This casing pipe prevents any collapse of the drilling hole and inflow of mud.

The drilling machine is installed on the casing pipe.

The cluster hammer & RCD Cutter is used for drilling as drilling tool.

During drilling, air is supplied and blows into the drill rod.
By this air, the water in the rod is lifted up.
And at the bottom of the drilling tool, cuttings are swept into the rod by water flow.
For this continues circulation, water should be poured into the casing.

2. Machine Specification.

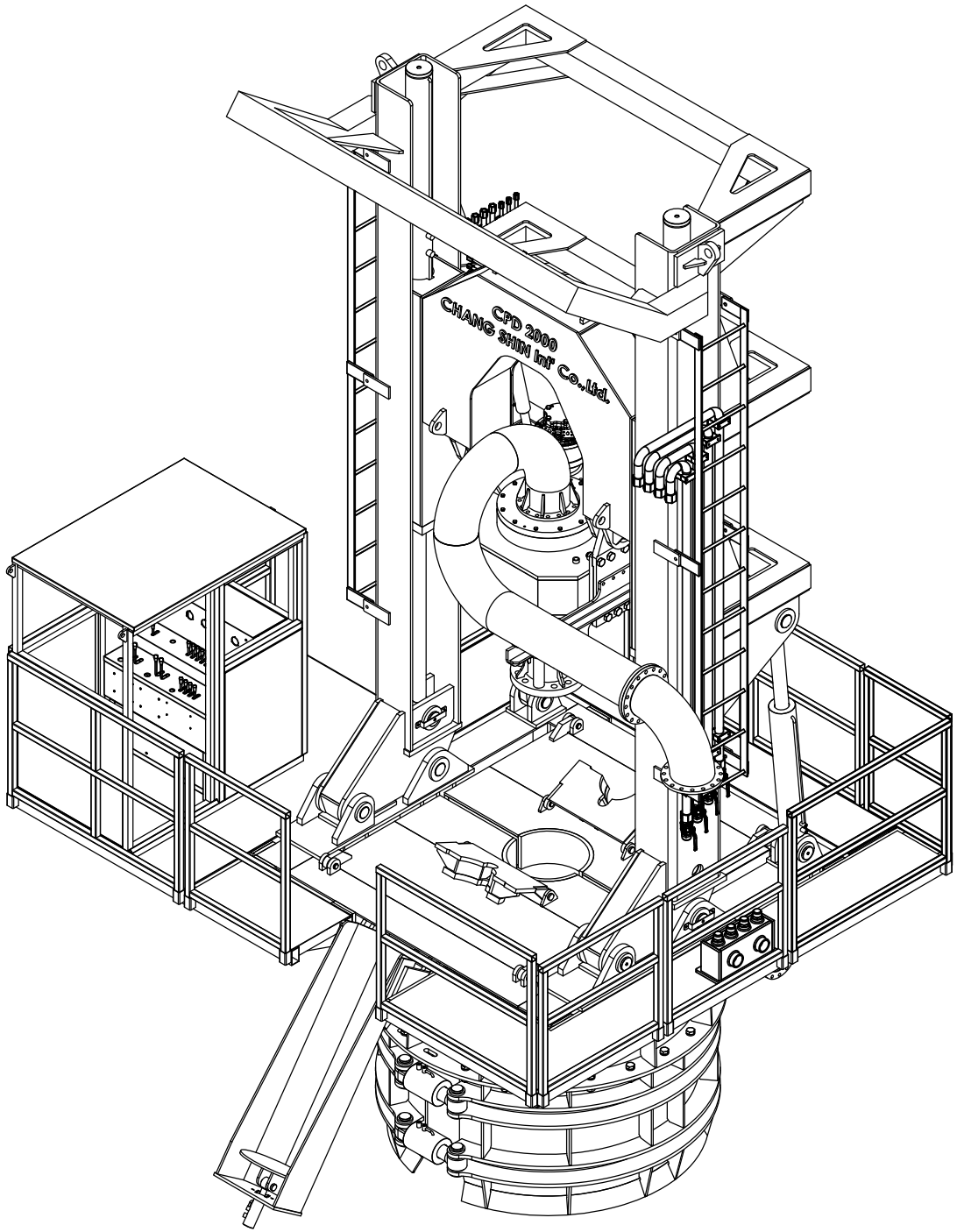
2.1 Model : CPD-2000 Drilling Machine
2.2 Dimension : 4,200 × 5,350 × 8,700
2.3 Weight : 28,000kg
2.4 Rotation
Speed : 0 ~ 10rpm (Max.22rpm)
Torque : 149.4kN*m (250bar)
2.5.Thrust Force
Pull Down : 61.2Ton
Pull Up : 100.5Ton
2.6 Feed Stroke : 3.65m
2.7 Power pack
Power : 230kW/1400rpm
Engine : Doosan PU126Ti
Hyd' Pump : 140 × 2 / 63 × 1
Max.Pressure : 350bar(Operating 250bar)

2.8 System
- Hold Back System
- Drilling Speed Control System

2.9 Lay Out Drawing

DWG NO. CS-CPD20-000

REV.	DESCRIPTION	DATE	DWG	CH'D	CH'D	APP'D
1	First Issued	'11.07.30	CH.R.KIM	T.Y.JANG	C.K.LEE	C.K.LEE



Specification

1. ***Model : CPD2000 Drilling Machine***
2. ***Weight : 28,000kg***
3. ***Drill Rod : NW300 / 3,000mm***
4. ***Free Passage : Max 2,030mm***
5. ***Rotation : 0 ~ 10(Max.22)rpm***
6. ***Torque : Max 149.4kN*m(250bar)***
7. ***Pull Down / Pull Up : 61.2ton / 100.5ton***
8. ***Feed Stroke : 3,650mm***
9. ***Hold Back System***
10. ***Multi Air port for Cluster Hammer***

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APP'D		TITLE	CPD 2000 Drilling Machine
CH'D		MATERIAL	MODEL
CH'D		–	–
DRAW		Proj' 3각법	DWG NO. CS-CDP20-000
DATE	SIGN.	Weight 28,000 kg	

DWG NO. CS-CPD20-000

REV.	DESCRIPTION	DATE	DWG	CH'D	CH'D	APP'D
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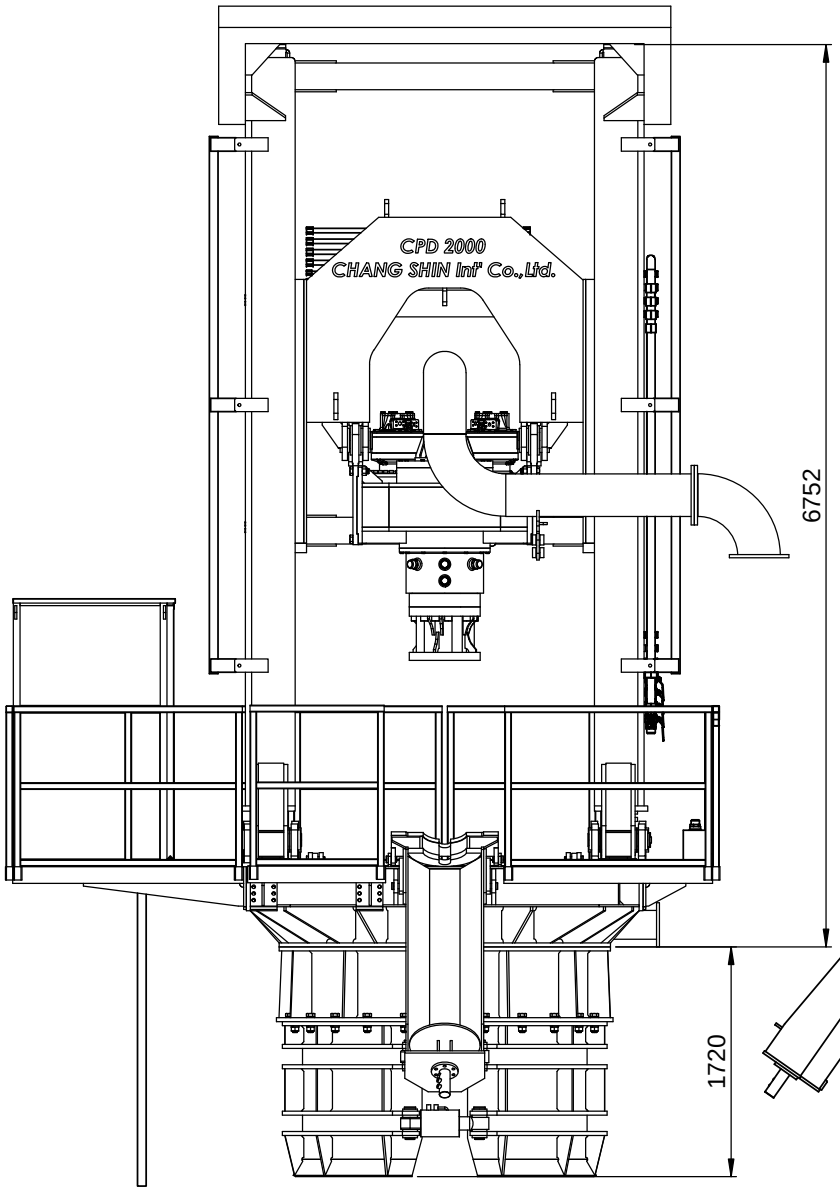

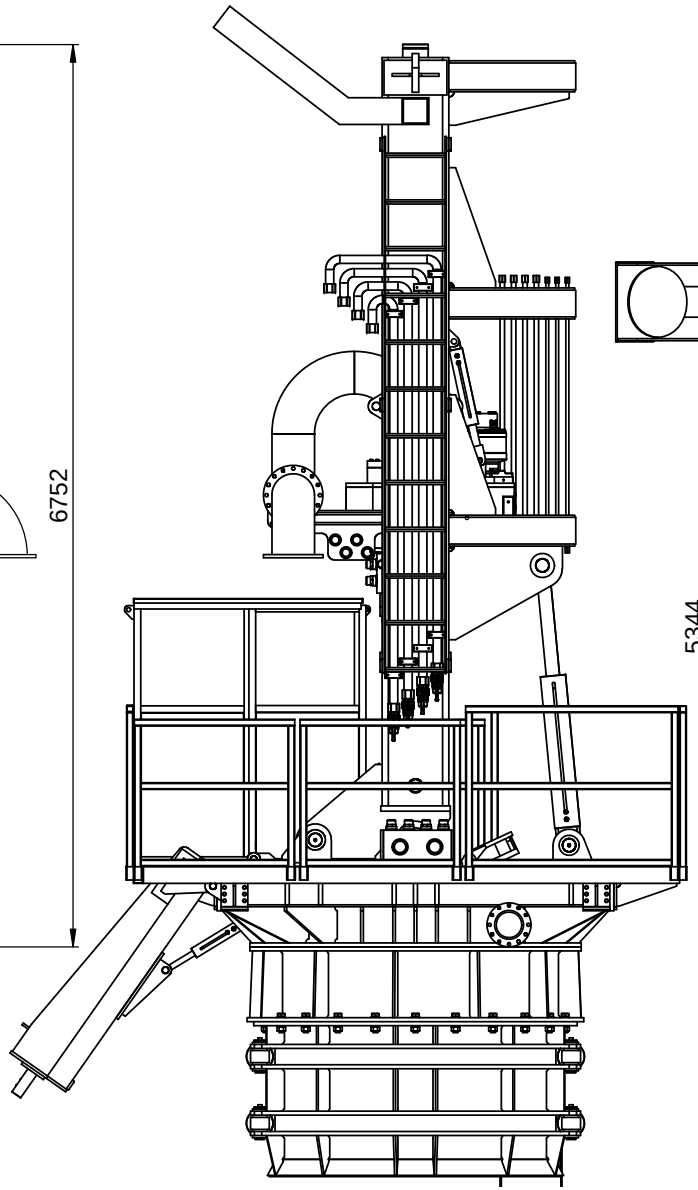

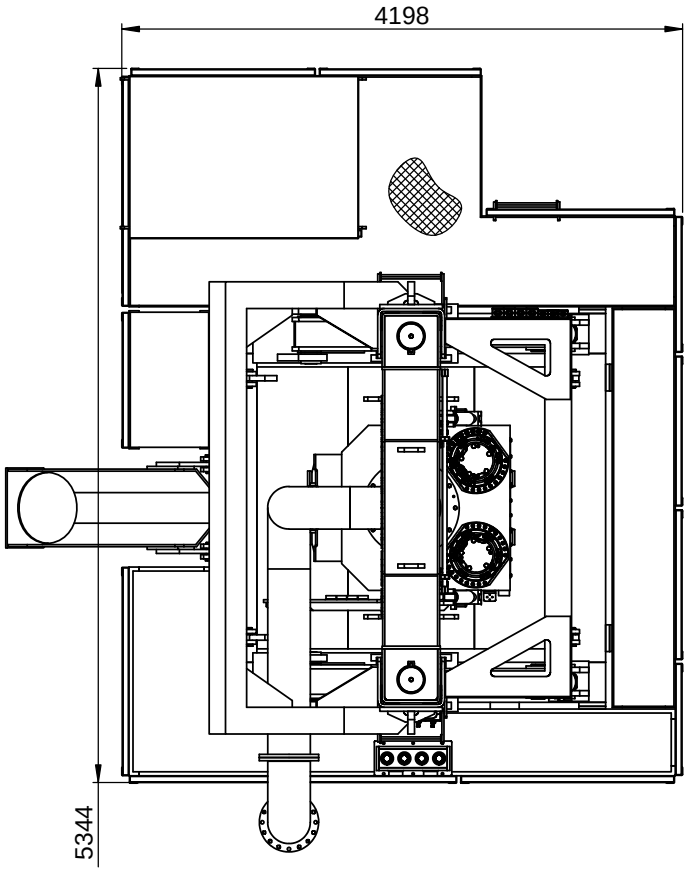

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APP'D		TITLE	CPD 2000 Drilling Machine
CH'D		MATERIAL	MODEL
CH'D		–	–
DRAW		Proj' 3각법	DWG NO. CS-CPD20-000
	DATE SIGN.	Weight 28,000 kg	

3. Operating Manual.

3-1. Pre-checking

Before engine start, system checking is needed.

1) Checking the circuit

Check that the current pipeline meets the hydraulic circuit.

Note : Hydraulic hose coupling should be very cleaned when connecting.

2) Checking the oil(fuel & hydraulic oil) level

① Check the leakage of oil in the power pack and hose connections and in the machine.

② Check the oil level and If not enough, fill the oil.

3) Oil-feeding

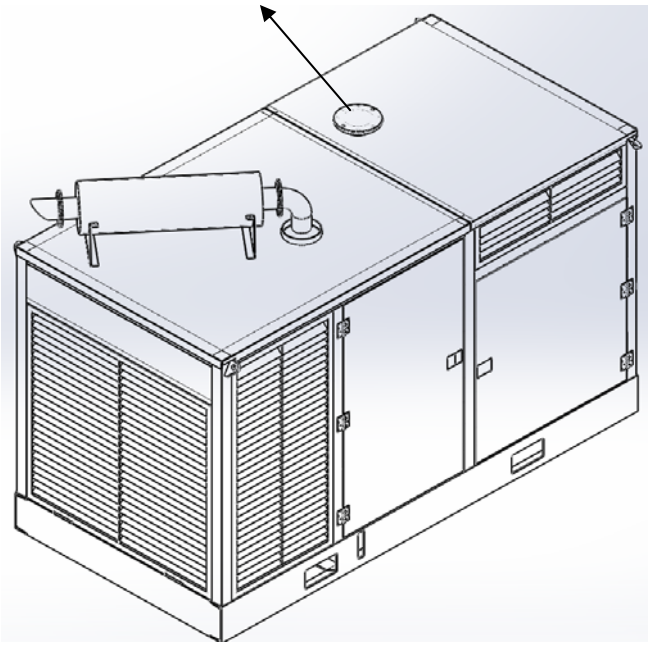
① Fuel Oil

Fuel oil tank is located in center bottom of the power pack.

② Hydraulic Oil

Hydraulic oil tank is located in the power pack.

The tank cap is reached on the roof of the power pack.



3-2. Preliminary operation

Note : Before engine start, check the control valve in neutral position.

① **Start the engine and check it for abnormal sound and vibration.**

② **In general, if the oil temperature of the oil tank is 20℃ or lower, any non-load or shot-term operation should be prohibited.**

③ **After a non-load operation, the set pressure of the relief valves of the hydraulic pump and other pressure control valves should be gradually elevated to the designated pressure.**

④ **Repeat the aeration of the hydraulic circuit with a repeated operation of the actuators.**

3-3.Test-operation

① **Confirm the designated output during operation of the machine with caution in terms of operation pressure, actuator speed, oil tank level change, operation sound, and oil leakage. If the situation of operation is recorded during test operation, such record may be used as the standard in relation to the changes in the performances of hydraulic devices; therefore, it is recommended to record the situation of operation in the operation diary.**

② **Although disassembling and checking is smoothly performed during piping work, oil-feeding, and adjustment operation, foreign substances may be frequently circulated and flow in resulting in troubles. Therefore, if any trouble is generated during test operation due to foreign substances, it is recommended to replace the oil or clean the oil tank again.**

3-4. Guide for normal operation

① **Checking the oil level of the fuel and hydraulic oil tanks.**
Check that the oil level of the oil tank is adequate. During stoppage of an operation, the oil may leak out of pipe joints lowing the oil level of the oil tank. If the oil level falls below normal oil levels during the stoppage of an operation, it may result in an oil leak, in which case a prompt check and repair is required.

② **Checking the changeover positions and the opening/closing of hydraulic devices**
Check or perform the below-stated matters before starting the motor.
- Check that the switch valves are at the designated switchover positions.

③ **Oil tank temperature**
Check that the temperature of the oil tank is in an adequate range. In general,

if the temperature of the oil tank is 20℃ or lower, a gentle operation is recommended with no load or light load.

④ Operate the machine with caution in terms of operation pressure, actuator speed, change in oil temperature, change in oil level, operation sound, and oil leak, etc.
If any abnormal sound is heard during the operation, stop the operating & actuator.

3-5. Stoppage

① Check the control valves position in neutral position before stop the engine.

② Turn off the main power switch.

3-6. Check Point

① Daily checking

Order	Items for Daily Checking	Standard
1	- Is the oil level of the oil tank adequate?	Check the indicator of the oil level meter.
2	- Are the temperature and viscosity of the operation oil adequate?	Check the temperature and viscosity of the operation oil.
3	- Contamination and turbidity state of operation oil.	
4	- Does the pressure gauge indicate an adequate level during stoppage of the hydraulic pump?	0 Kg/cm^2
5	- Discharge pressure of the hydraulic pump . Is the operation pressure adequate? . The indicator of the pressure gauge should not be shaken due to an abnormality.	
6	- Does the hydraulic systems have any abnormal sound inside?	
7	- The casings of the hydraulic pump and motor should not have an abnormally high temperature.	
8	- If the oil temperature of the oil tank is in an adequate range and the indicated pressures of the gauges are not higher than the adequate levels, there may be blockage in the suction filter; take the suction filter out of the unit and wash it with clean oil or remove contaminants using a soft brush, etc.	
9	- If the blocking of a filter element is identified using an indicator, remove the element and wash it. If sintered metal is attached to the element, wash the element.	Check the indicator.
10	- The pipeline joints of the devices should not show an oil leakage.	Visual observation
11	- Operation of actuator - Is the designated speed achieved? - Is the actuator smoothly operated?	Operation record during test operation

② Repair and Checking Standard

Material	Item	Method	Frequency	Maintenance Standard	Standard
Hydraulic oil	Flow volume	Check the level gauge	Occasionally	Within the designated level	Refill
	Cleanness	Request to the oil maker	6 months		
Hydraulic pump	Abnormal sound	Listen with ears (measuring with a phone meter)	4 months	≤80 dB, in general	
	Temperature	Install a thermometer in the main body of the pump	1 year	≤ 80℃	
	Pressure	Measure with a pressure gauge	2 months	Maintenance of designated pressure without change	
	Oil leakage	Visual check and touching with hands	2 months		Replace packing
Filter	Attachment of foreign substances	Check with an indicator	Occasionally	No foreign substance or damage on the surface	
Pressure gauge	Measure pressure	Measure pressure with a gauge	1 month	Error should be not larger than 1/2 of the minimum scale	Large error or damage
Pressure control valve	Pressure control	Control in the range from minimum pressure to maximum pressure	2 months	Possible pressure control	
Flow control valve	Flow control	Adjust cylinder speed	1 year	Possible flow control	If the operation is wrong, check the inside. If any abnormality is found, replace the component.

Hydraulic cylinder	Operation state	Smooth operation	1 month	Specification	If the operation is wrong, replace the component
	Oil leakage	Visual check and touching with hands	Occasion ally	No external leakage	Replace the packing for the leakage part
Oil tank	Oil leakage (Welded part)	Visual check and touching with hands	Occasion ally	No oil leakage	
	Oil leakage (packing part)	Visual check and touching with hands	Occasion ally	No oil leakage	Replace the packing for the leakage part
Pipeline	Vibration	Visual check and touching with hands	Occasion ally	No shaking of pipes due to vibration	
	Pipe and clamp	Visual check and touching with hands	Occasion ally	No loosening or separation	Fasten the connection

③ Pressure Control Valve

Cause	Daily Check Items	Standard
Excessively high/low pressure	Weak spring	The needle valve spring may be problematic; if it is weak, the designated pressure cannot be achieved.
		If the balance piston spring is weak, it may result in an incorrect operation; in this case, the spring should be replaced.
	- The pressure is not adequately adjusted with the adjustment handle	- The pressure should be adjusted with the handle looking at the pressure gauge.
	Needle valve does not accurately match	Take out the needle valve and reassemble the unit. (If foreign substances are found, wash the component and reassemble the unit.)
		Replace the needle valve.
	Wrong operation of balance piston valve	Check the balance piston valve for the existence of foreign substances.
		Check that the main body and balance piston are adequately assembled and are operating smoothly.
	Pressure gauge is wrong	Check the pressure gauge.
Vibration	Wrong operation of balance piston valve	Check the operation oil for cleanness. Replace it if required.
	Vent port has air	Remove the air from the operation oil completely.
		- Operation oil that has been used for a long time may contain air, moisture, and dust in large quantities; check it and replace it if required.

④ Flow Control Valve

Cause	Daily Check Items	Standard
The control shaft valve is heavily rotated.	- Dust is attached on the outside of the control shaft valve.	- Disassemble and wash it.
	- High primary pressure	- Adjust the relief valve in order to reduce the circuit pressure and adjust the shaft valve control handle.
	- Large change in adjusted flow	- Check that the machine is used in the maximum flow range of the valve, and if needed, replace the valve with an adequate one.
Pressure compensation piston does not work.	- Operation failure due to dust attached on the compensation piston.	- Disassemble the unit, wash the unit in order to remove dust completely, and reassemble the unit.
	- Dust is attached in the small hole of the sleeve.	- Take out the drainpipe, check it, wash it, and reassemble it.
The splitting device goes upward.	- Drainpipe has dust.	- Take out the drainpipe, check it, wash it, and reassemble it.
	- The drain port of the valve has backpressure.	- Separate the drain port and reduce the backpressure to the possible lowest level.

3-7 Cautions in disassembling

When changing, adding, repairing, or checking the circuit or assembling it due to efficiency, the below-stated items are important.

① **Understand the circuit diagrams, cross-section diagrams of components, operation of the circuits, and the operation and structure of elements in full.**

② **Before loosening bolts or pipe fittings, check them for a possible ejection of oil due to residual pressure or differential pressure.**

③ **If the components are kept after disassembling, they may get rusty. Keep them coated with anticorrosive oil using soft cloths.**

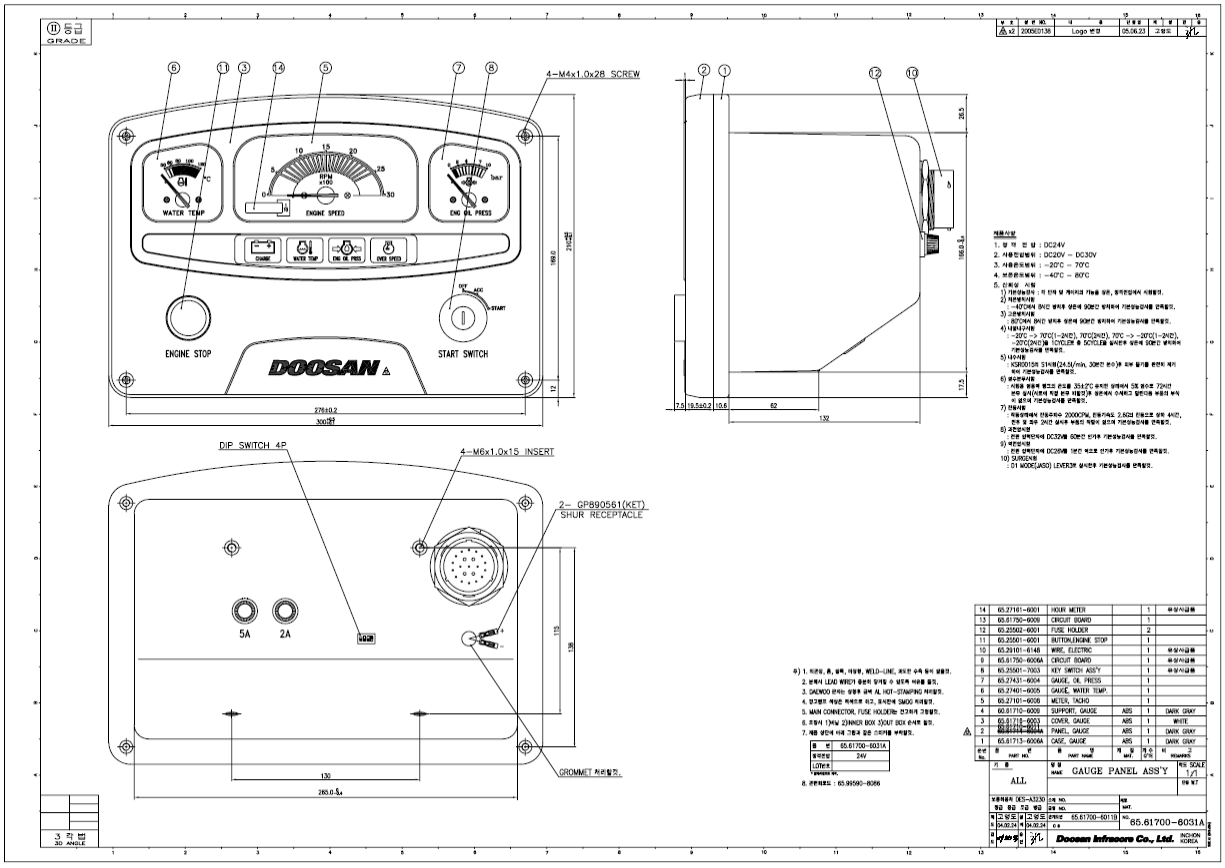
④ **Wash the disassembled element components with petroleum, and after drying them, apply operation oil and reassemble them.**

⑤ **When reassembling the defective or repaired parts, replace O-rings and packing with new ones.**

⑥ **When re-operating the machine, check that the bolts, plugs, and pipe fittings are fastened well.**

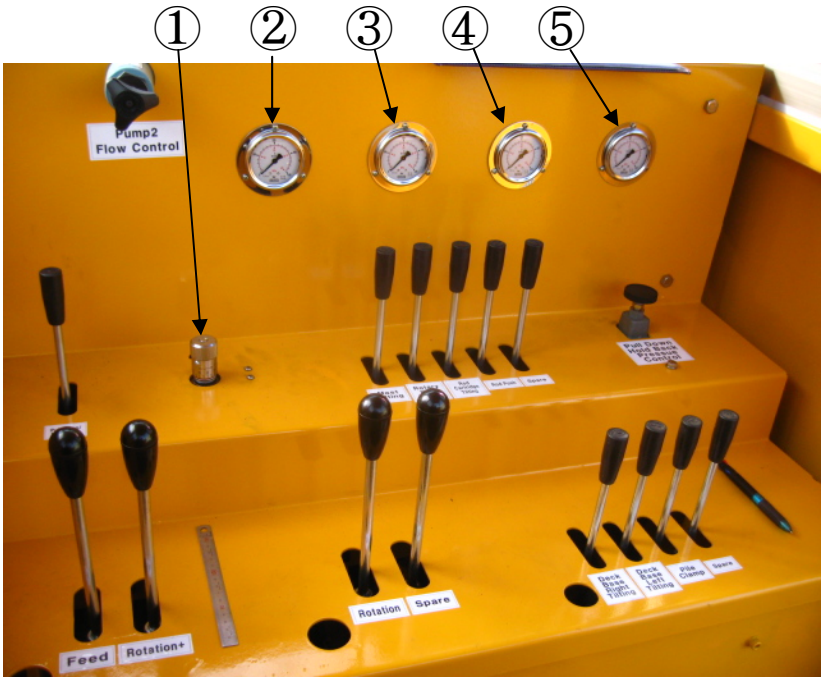
4. Drilling operating.

4-1 Engine Panel

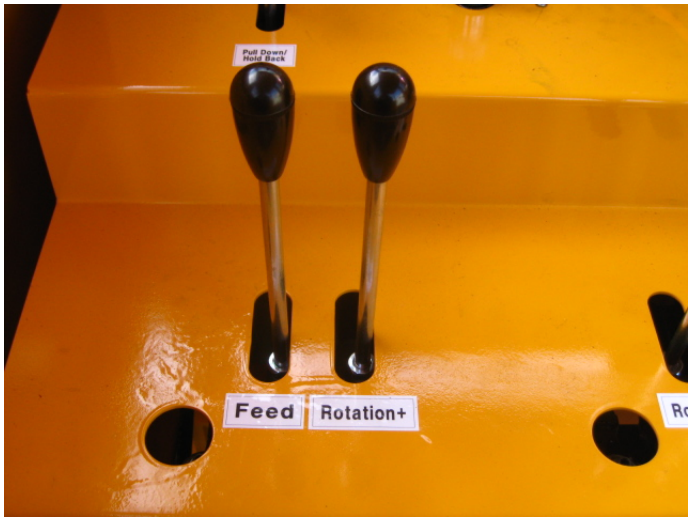


Note : After engine warming up, set the rpm at 1,200 ~ 1,400rpm for general operation.

4-2 Control Panel



① : Drilling Speed Control
② : Pull Down & Hold Back Pressure Gauge
③ : Pump 1 Pressure Gauge
④ : Pump 2 Pressure Gauge
⑤ : Pump 3 Pressure Gauge

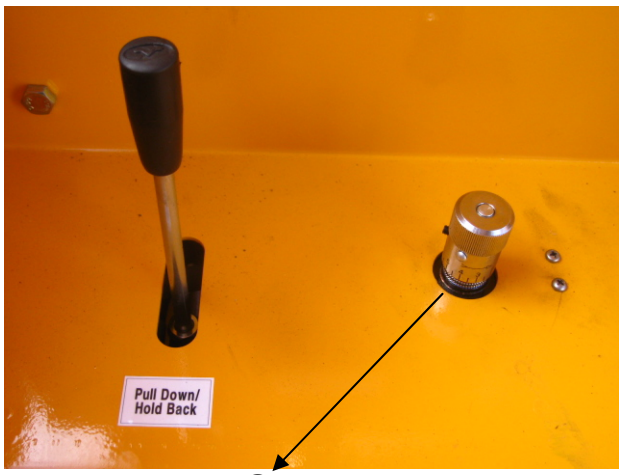


Feed : Fast up / down of the rotary head for rod changing.
Rotation + : Rotary head rotation speed up.

Rotation : Rotary head rotation.
Spare : Spare port.

Deck Base Tilting : Right and left deck is opened and closed for drilling tool installation.
Pile clamp : Clamping / Unclamping of the pile clamp for the machine installation.
Spare : Spare port.

Mast tilting : Mast tilting for the drilling tool installation.
Rotary head tilting : rotary head tilting for the drill rod changing.
Rod cartridge tilting : The rod cartridge should be adjusted for the rod changing.
Rod push : For the rod connection, Rod can be push up a little.
Spare : Spare port.



① : Drilling speed control

During drilling these three(3) controller should be controlled for drilling effiency

Pull Down / Hold Back :

The operator should consider the drilling condition (drilling depth, drilling speed, drilling tool and etc.) and decide “pull down” or “Hold back”.

Pull down / Hold back pressure control.

During drilling pull down or Hold back force should be controlled for efficiency drilling.

The drilling feed is carried by two(2) hydraulic cylinder, the diameter Inner diameter is 160mm, and cylinder rod outer diameter is 100mm.

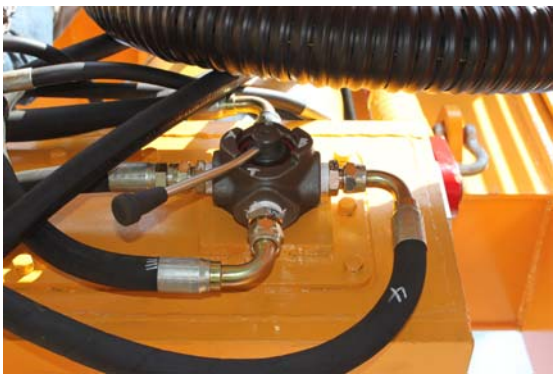
The pull down force is ((16×16)×3.14 / 4) × 2 × Gauge Pressure(bar).

The Hold Back force is (16×16 - 10×10) × 3.14 / 4) × 2 × Gauge Pressure(bar).

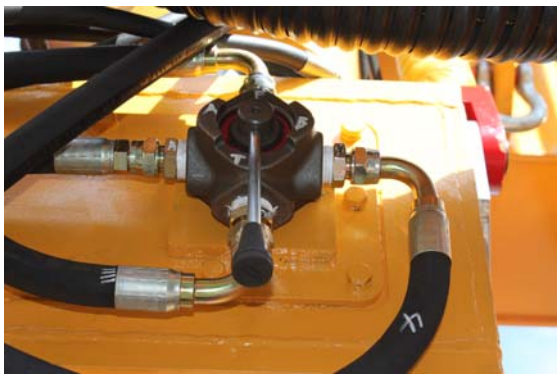
Drilling speed :

During drilling in the soil, mud and very soft rock formation, drilling speed should be controlled for preventing the drilling tool to be floundering in that.

Pump 2 flow control for the rotation speed control.



<Low Rotation speed>



<High Rotation Speed>

Note : At the “High” be care at abnormal sound(chattering).

4-3. Drilling Condition

For the Cluster hammer

“Rotation” , “Low Rotation speed” makes Max 5rpm.

CD1500 need 10 ~ 20Ton W.O.B

CD2000 need 13 ~ 26Ton W.O.B

NW300 Drill Rod : 750kg / D1500 Stabilizer : 1,500kg / D2000 Stabilizer : 1,800kg

CD1500 : 9,000kg / CD2000 : 19,000kg

W.O.B should be calculated and the pull down / hold back pressure should be adjusted.

For the RCD Cutter

“Rotation” , ” Rotation +” , “Low Rotation speed” makes Max 10rpm.(Recommended)

The pull down / hold back pressure should be adjusted by drilling speed.

4-4. Air supply

1ST PORT : Air Lifting

2nd ~ 4th PORT : Cluster Hammer

To operating cluster hammer

1. Lift up the cluster more than 0.5m from the bottom of the hole.
2. Just open the 1st port slowly to make air lifting(flushing water flow).
   When the flushing water came out from the pipe, Open 2nd port slowly.
   That is for cleaning the air supply hole and hammer.
3. And rotate the rotary head.
4. Slowly feed down the cluster.
5. Open the other air ports valve slowly.
6. When the drill bits of the cluster are touched on the rock, the hammer would start drilling.
7. During drilling, the driller should control the cluster.
8. During drilling, the driller should check the drilling condition.
9. If the flushing waster flow is too much, a little close the 1st port to reduce the air supply.
10. If rotation stop, check the pull down force and rock jamming.
    A little lift up & down the cluster for rotation.
11. If flushing water stop, check collapse of hole wall, flushing hole plugging or too much flow in mud.
12. After drilling the cluster should be lifted up from the bottom of the hole.

5. Reference Drawings and Documents.

DWG NO. CDP-20-HY-0

REV.	DESCRIPTION	DATE	DWG	CH'D	CH'D	APP'D
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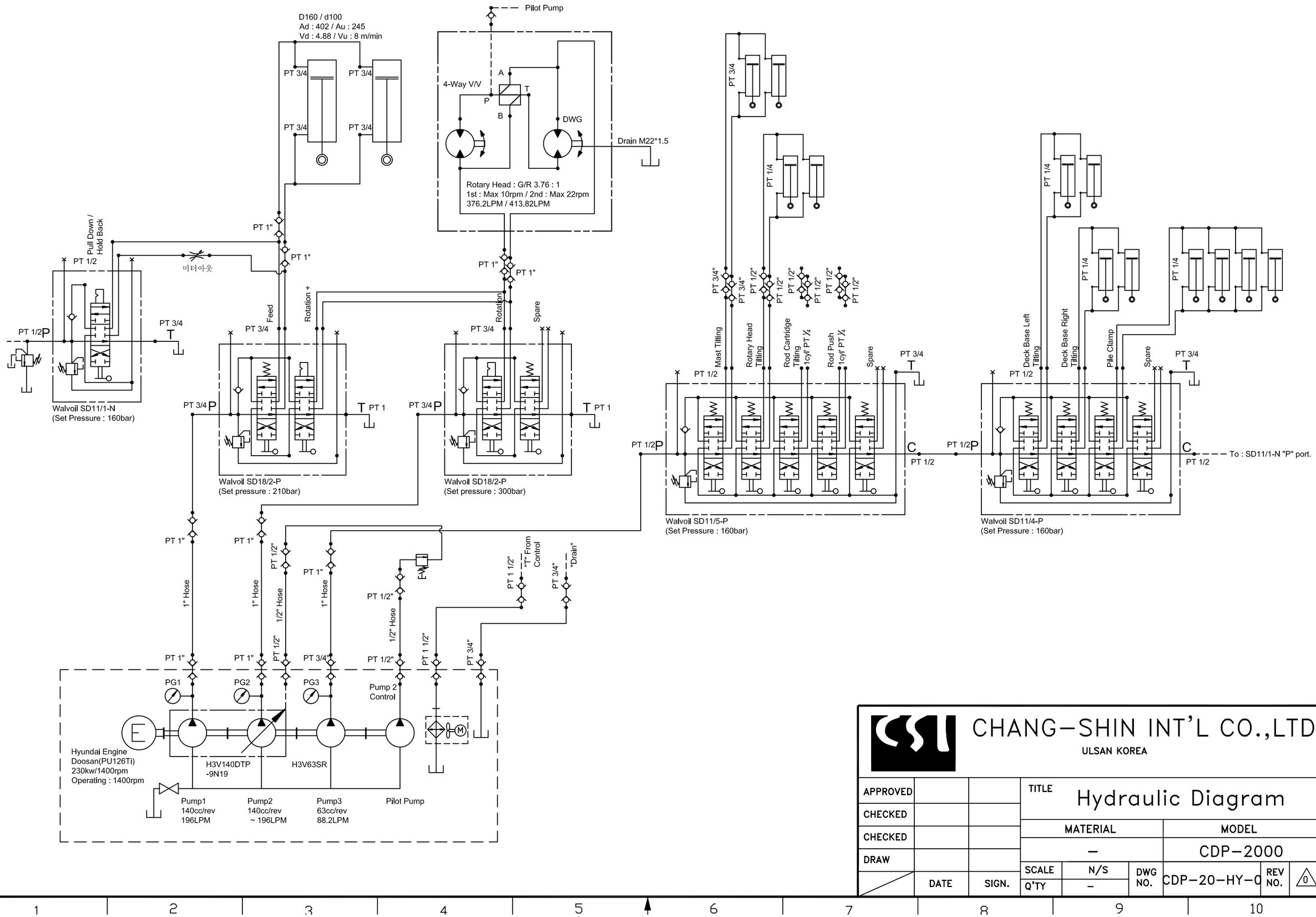

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ULSAN KOREA

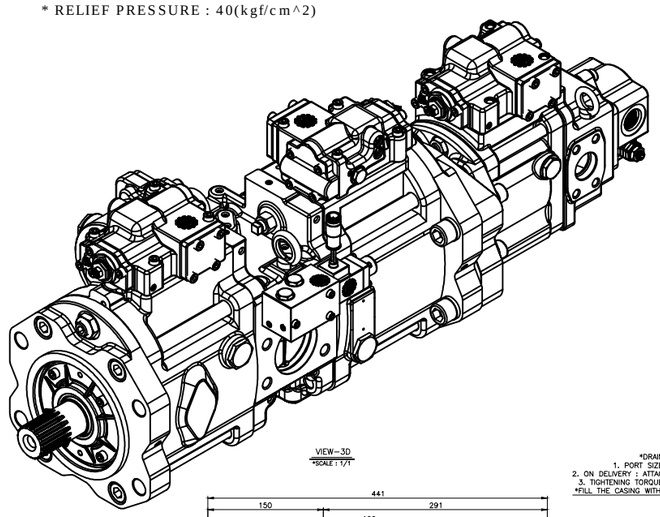
APPROVED			TITLE	Hydraulic Diagram		
CHECKED			MATERIAL		MODEL	
CHECKED			–		CDP-2000	
DRAW			SCALE	N/S	DWG NO.	CDP-20-HY-0
	DATE	SIGN.	Q'TY	–	REV NO.	0

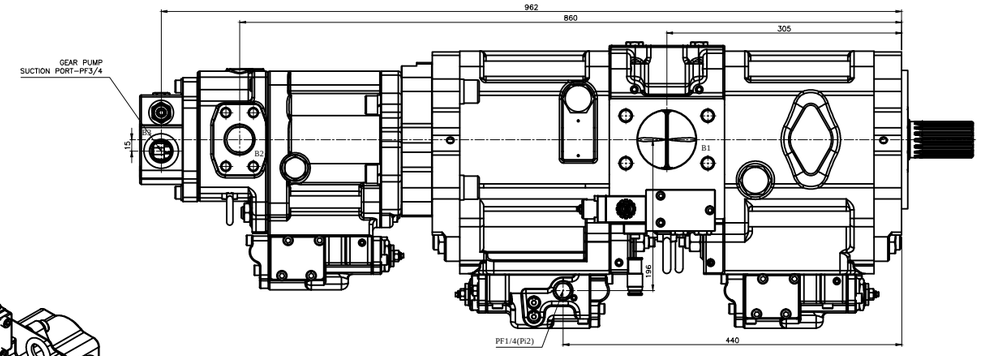
번호 NO.	승인일자 DATE	수정 내용 DESCRIPTION	수정 DWG BY	검도 REV. BY	검도 REV. BY	승인 APP. BY	도면변경회차 번호 REVISION NO.
2	12.08.30	APPROVAL					
1							

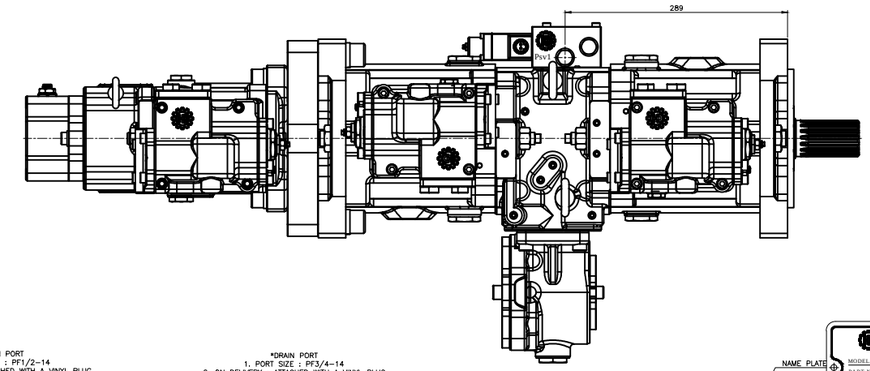
H3V140DTP - OPERATING SPECIFICATIONS
* DISPLACEMENT : 140cc/rev
* RATED SPEED : 2,150rpm
* MAX WORKING PRESSURE : 35(356)MPa(kgf/cm^2)

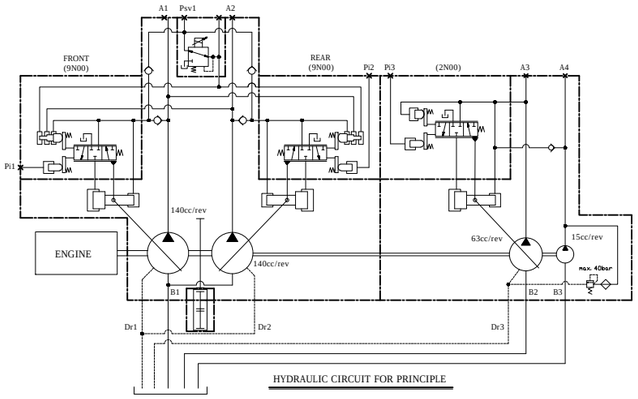
H3V63RS - OPERATING SPECIFICATIONS
* MAX. DISPLACEMENT : Max 63cc/rev
* MAX WORKING PRESSURE : 35(356)MPa(kgf/cm^2)

GEAR PUMP - OPERATING SPECIFICATIONS
* MAX. DISPLACEMENT : Max 15cc/rev
* RELIEF PRESSURE : 40(kgf/cm^2)

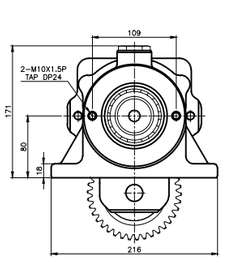


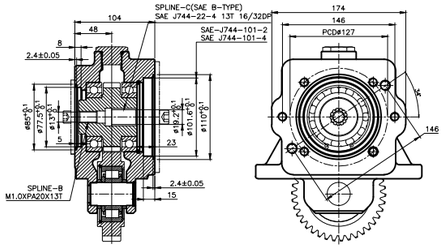




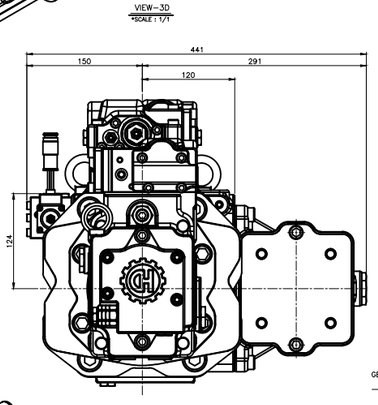


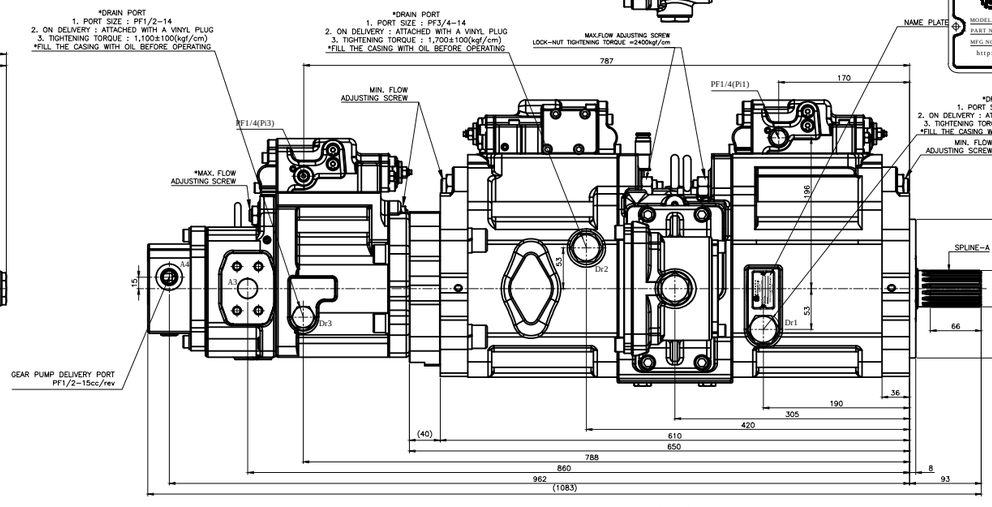
HYDRAULIC CIRCUIT FOR PRINCIPLE



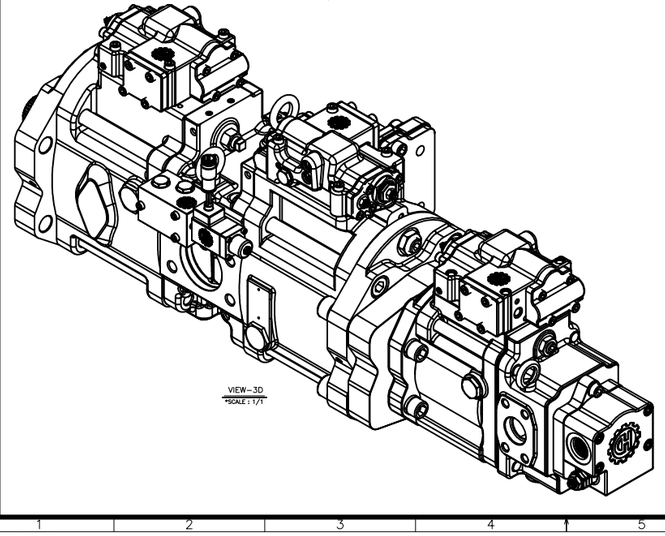


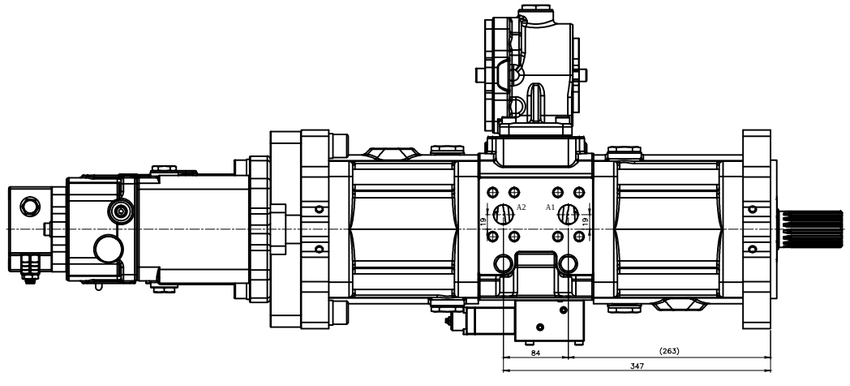
PTO ASS'Y SPECIFICATION

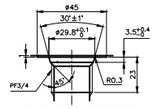


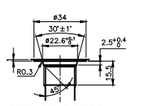


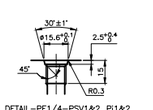
HANDOK HYDRAULIC EQUIPMENT
MODEL. H3V140DTP+H3V63RS
PART NO.
MFG NO.
http://www.hydraulic.co.kr
MADE IN KOREA

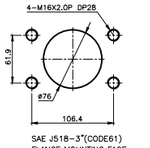


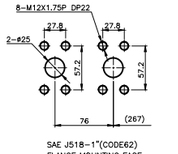


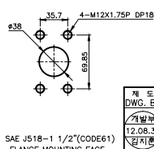












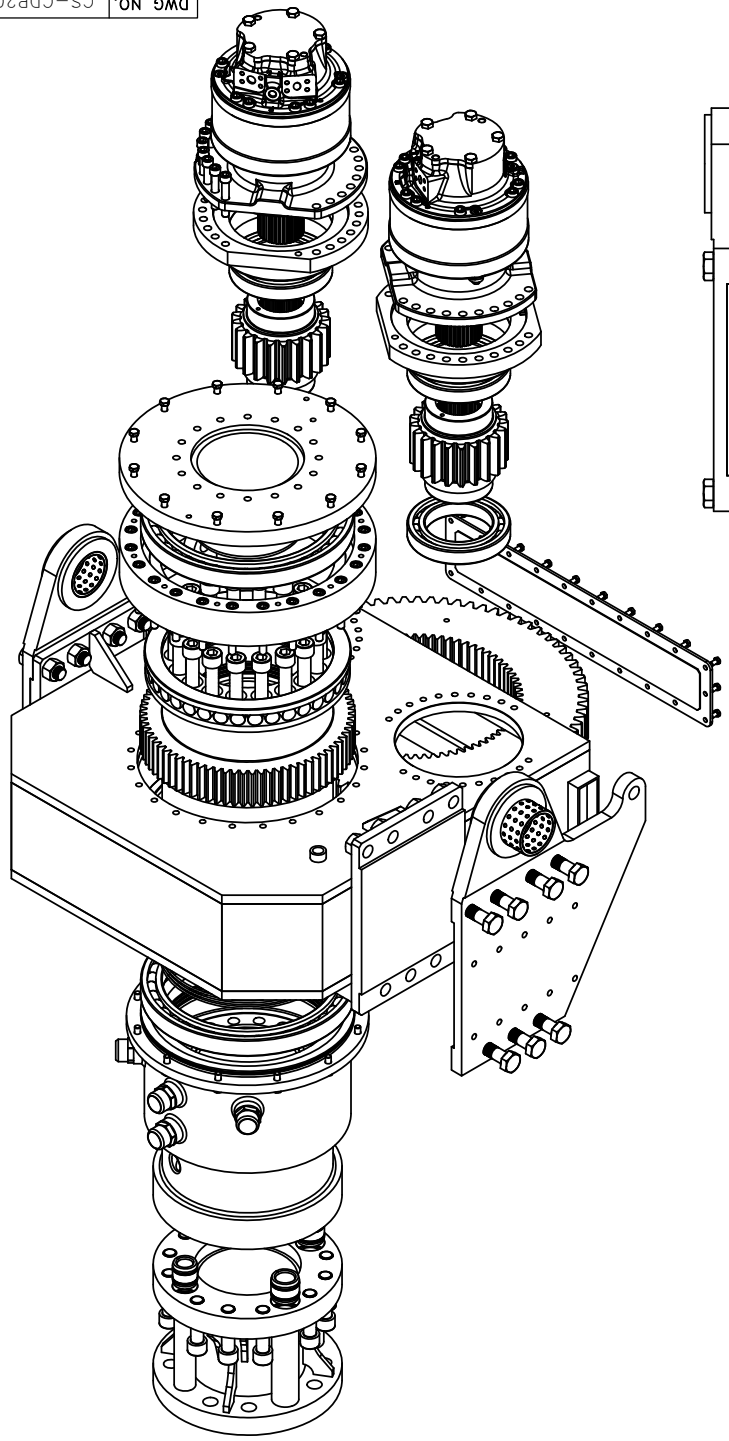
INVOLUTE SPLINE 요목표-A

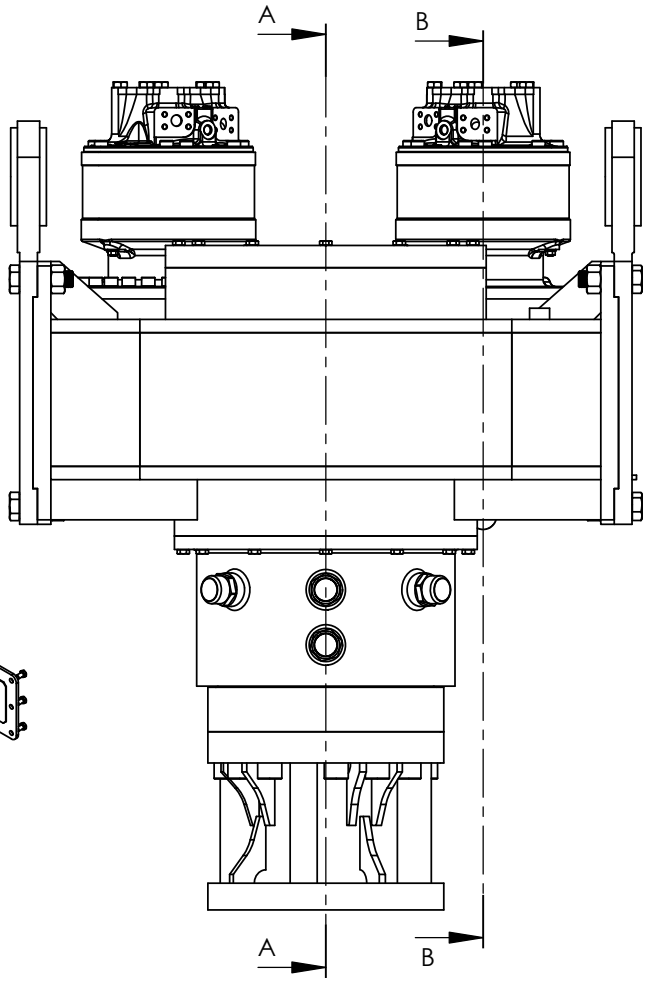
치 수 Nunber Of Teeth	17
기준피치원지름 Pitch Diameter	42.5
모 듈 Moudle	2.5
압력각 Pressure Angle	20°
전위계수 Profile Shift Coefficient	0.8
Measuring Pin Dia Measurement Over Pins	ø4.5 51.621
규 격 Standard	JIS

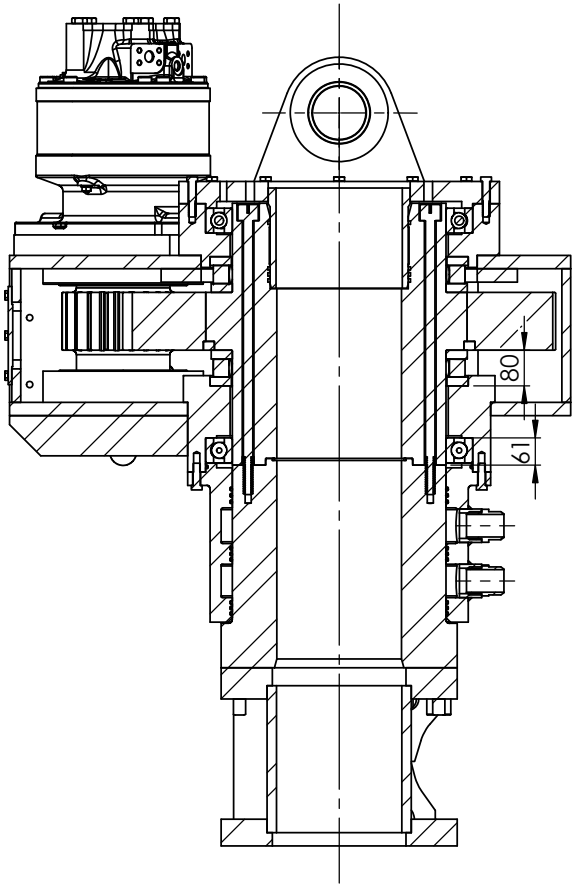
제도 DWG. BY	검도 REV. BY	검도 REV. BY	승인 APP. BY	척도 SCALE	규 격-MODEL
개발부 12.08.30 김지훈				1/1	H3V140DTP +H3V63RS
일 자-DATE : 2012.008.30			단위-UNIT : mm		품 명-PART NAME MAIN PUMP
HAN DOK HYDRAULIC				도면크기 DWG SIZE A1	도 번 DWG NO. H3V140DTP-H3V63RS-KSY-01-A

DWG NO. CS-CDP20-400

REV.	DESCRIPTION	DATE	DWG	CH'D	CH'D	APP'D
1	First Issued	'11.07.30	CH.R.KIM	T.Y.JANG	C.K.LEE	C.K.LEE





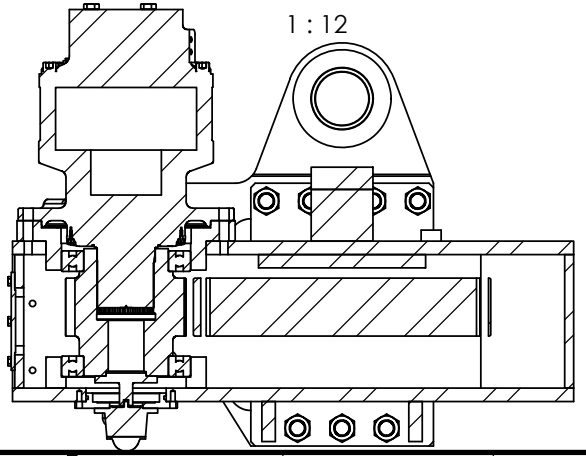


A-A

1 : 12

B-B

1 : 12



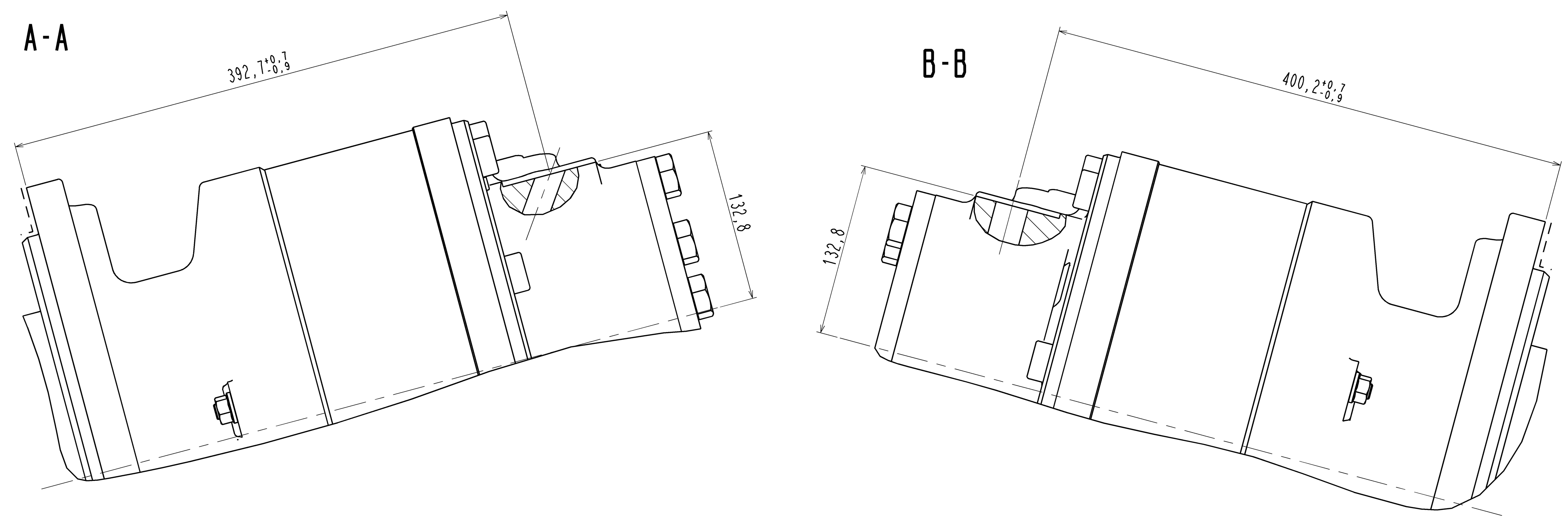
CHANG-SHIN INT'L CO.,LTD

ULSAN KOREA

APP'D			TITLE	Rotary Head Assy for CDP2000	
CH'D					
CH'D			MATERIAL		MODEL
DRAW			–		–
	DATE	SIGN.	Proj'	3	DWG NO. CS-CDP20-400
			Weight	4,500 kg	

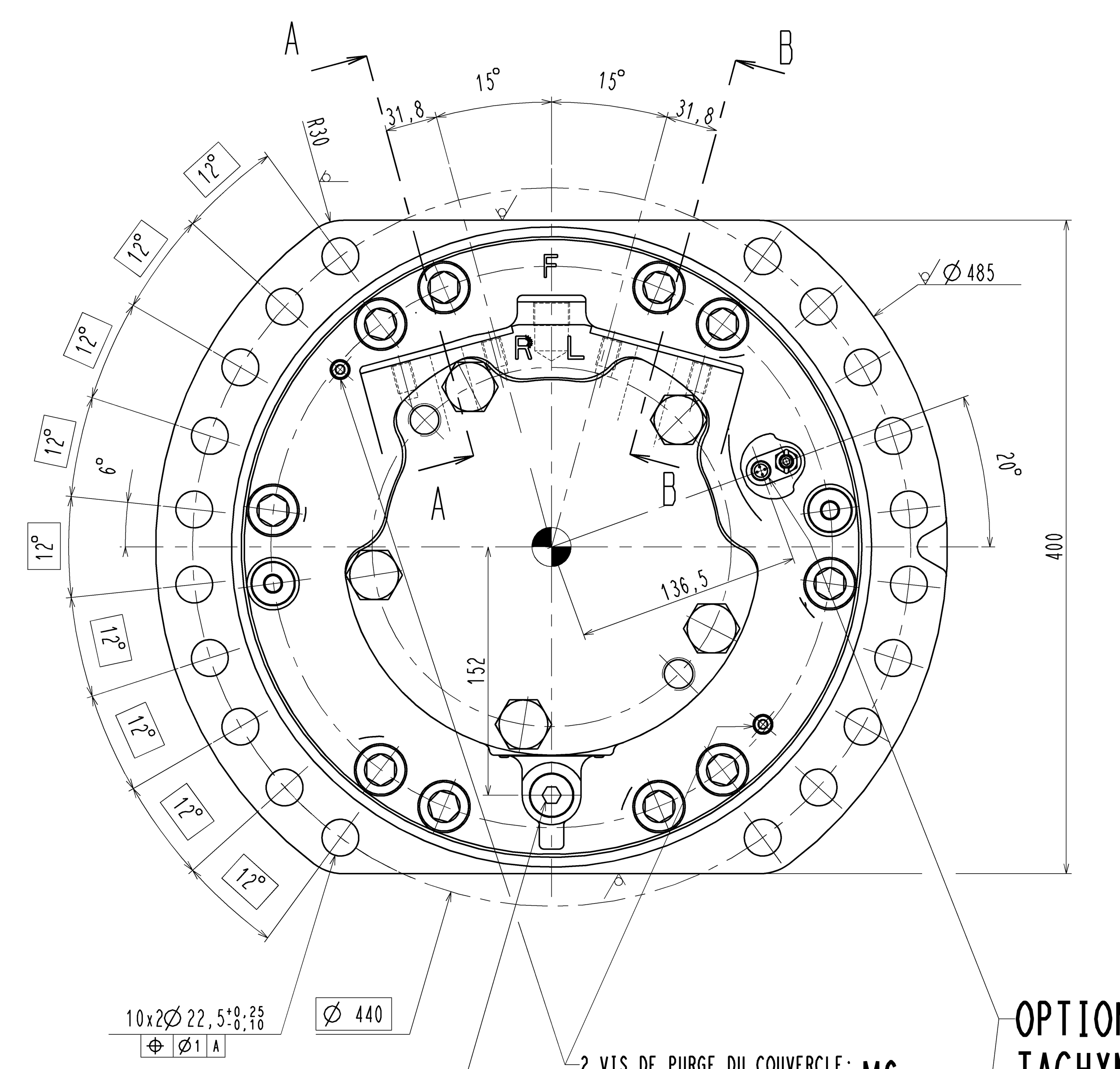
AUTRES SPECIFICATIONS / *OTHERS SPECIFICATIONS*

PH RECOMMANDE UNE DISTANCE D'AU MOINS 6mm ENTRE LES SURFACES REPERES ✓ ET LES STRUCTURES ADJACENTES.	*PH RECOMMENDS AT LEAST 6mm GAP BETWEEN MARKED SURFACES ✓ AND NEARBY STRUCTURES.*
TOUS LES ORIFICES HYDRAULIQUES, TOUS LES TARAUDAGES ET LA PLAQUE-ID SONT PROTEGES CONTRE LA PEINTURE.	*ALL HYDRAULIC ORIFICES, ALL THREADED ITEMS AND ID-PLATE ARE PROTECTED AGAINST PAINT.*
– – ABSENCE DE PEINTURE	*– – NO PAINT*
CENTRE DE GRAVITE	*GRAVITY CENTRE*



CANNELURES	*SPLINES*	Ø B
NORME DE REFERENCE	*REFER STANDARD*	NF E22141
ANGLE DE PRESSION	*ANGLE OF PRESSURE*	20°
DIAMETRE NOMINAL	*NOMINAL DIAMETER*	Ø 130
NOMBRE DE DENTS	*TEETH QUANTITY*	33
MODULE	*MODULUS*	3,75
TYPE DE MONTAGE	*FIT TYPE*	GLISSANT/SLIDING
CENTRAGE	*CENTERING*	SUR FLANCS/ON FLANKS
Ø PIGES DE CONTROLE	*Ø CONTROL PINS*	Ø 6,75
COTE SUR 2 PIGES	*DIMENSION OVER 2 PINS*	137,376 -0,028 -0,155
NOMBRE DE DENTS DE CONTROLE	*CONTROL TEETH QUANTITY*	K=5
COTE DE CONTROLE SUR K DENTS	*CONTROL DIMENSION ON K TEETH*	53,174 -0,013 -0,071

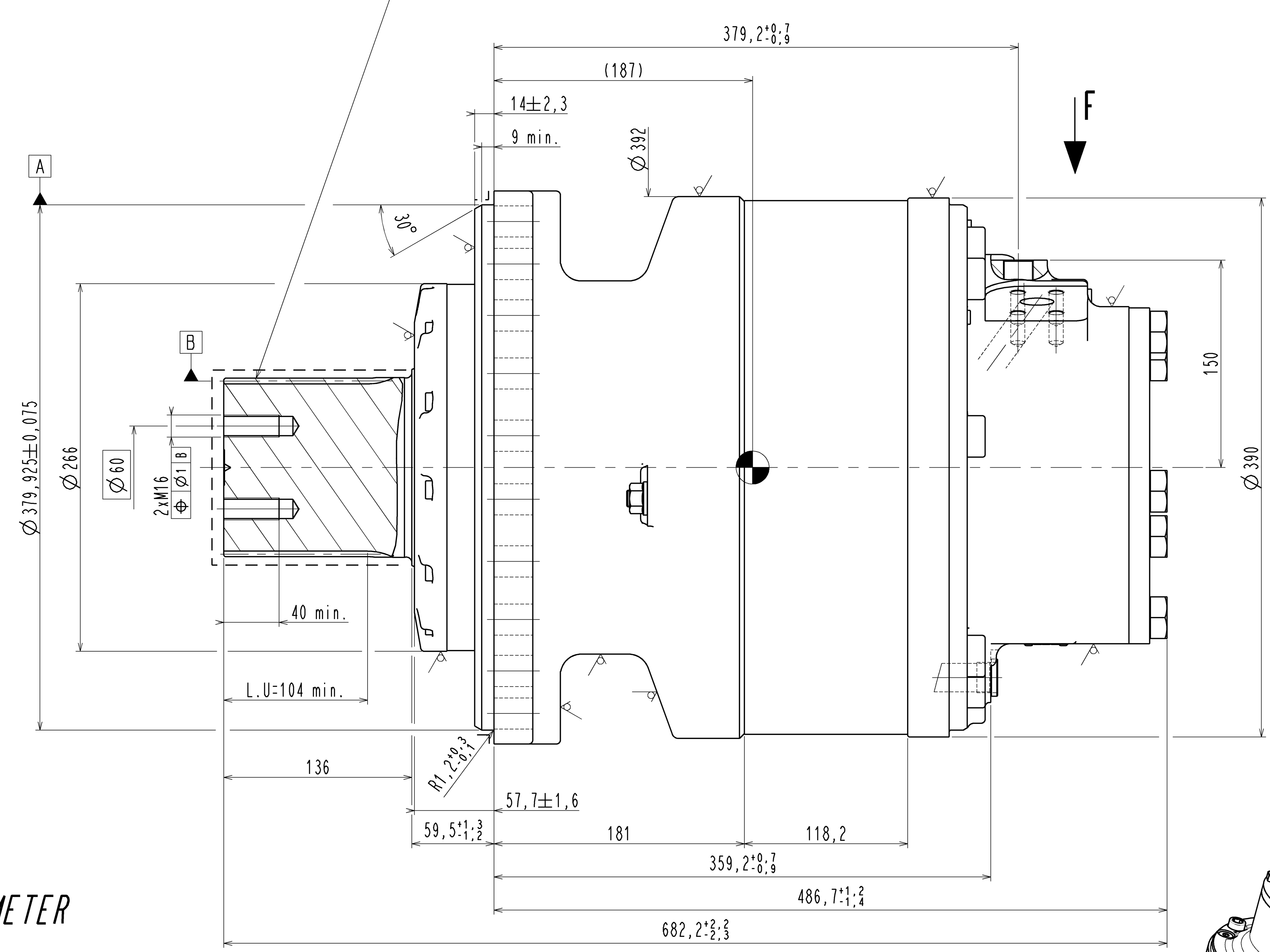
CAD_Symbol:B

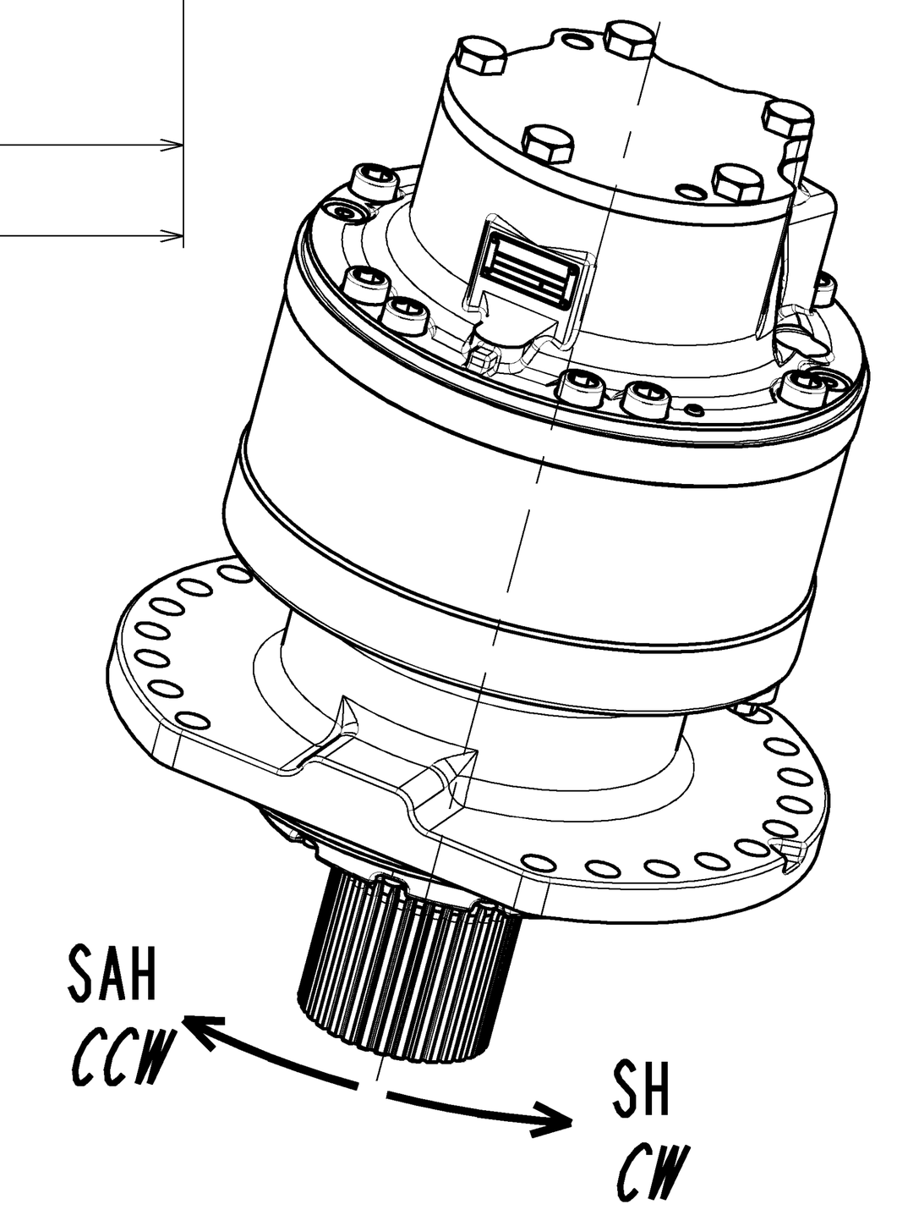


2 VIS DE PURGE DU COUVERCLE: M6
2 COVER BLEED SCREWS:

OPTION 5
ORIFICE/ *PORT 2*
SANS OPTION = PAS D'USINAGE
WITHOUT OPTION = NO MACHINING

OPTION
TACHYMETRIQUE/ *TACHOMETER*
SANS OPTION = PAS D'USINAGE
WITHOUT OPTION = NO MACHINING

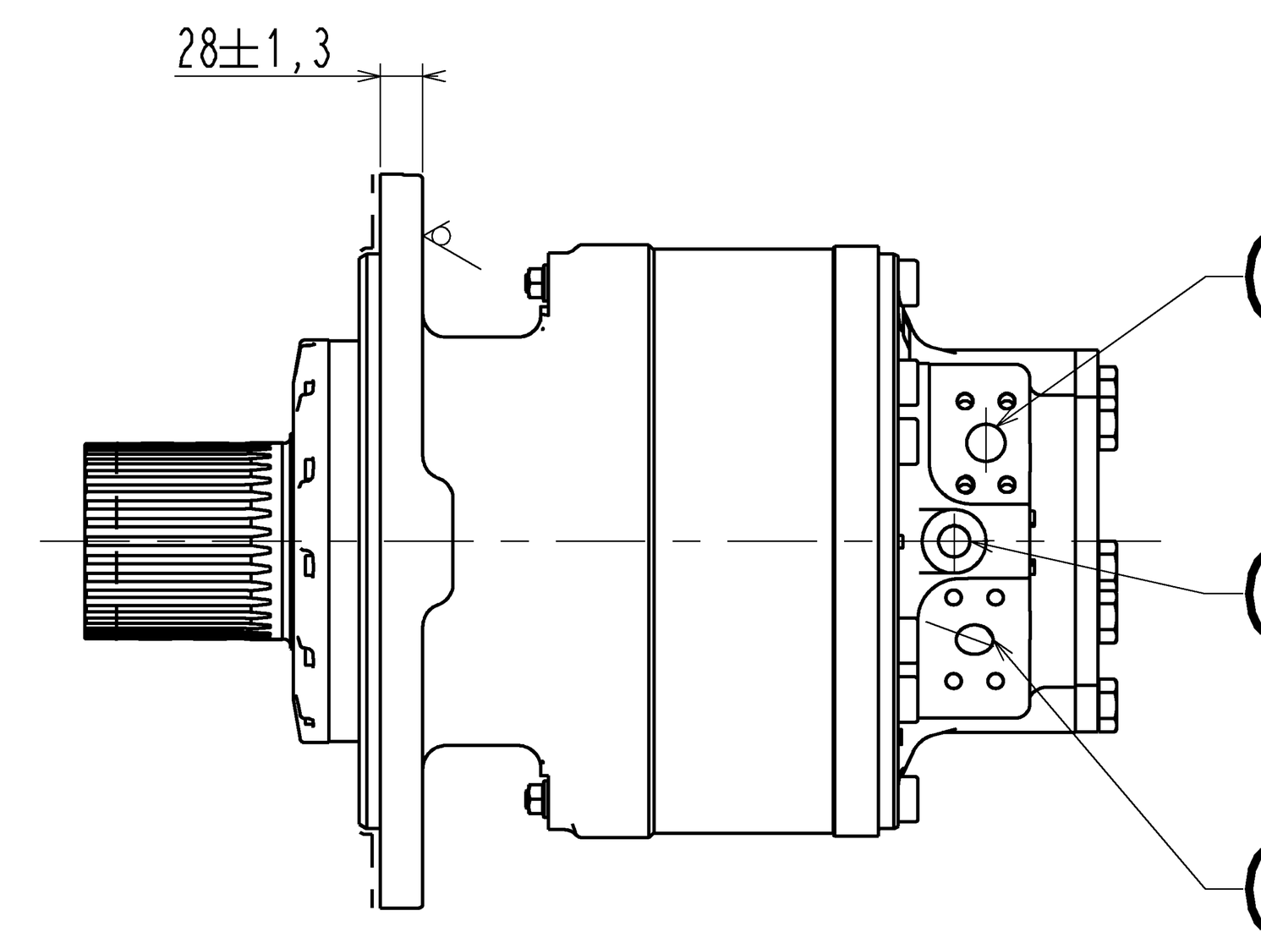




MOTEUR	*MOTOR*		MS50							
SPECIFICATION CAME	*CAM SPECIFICATION*	X	0	1	2	7	8	9	K	A
CYLINDREE	*DISPLACEMENT*	cm^3/tr cm^3/rev	4997	5504	6011	3500	4008	4498	4252	5010
PRESSION MAXI	*PRESSURE MAXI*	bar	450							
VITESSES MAXI	*SPEED MAXI*	tr/min *RPM*	111	-	92	148	138	-	72	92
COUPLE THEORIQUE A 100 BAR	*THEORETICAL OUTPUT TORQUE AT 100 BAR*	N.m	7945	8751	9557	5565	6373	7152	6761	7966
CAPACITE D HUILE TOTALE	*TOTAL OIL CAPACITY*	l	6							
PRESSION CARTER CONTINUE / EN PICS	*DRAIN PRESSURE CONTINUOUS/PICS*	bar	1 / 3 (OPTION E 2,5 / 15)							

	ORIFICES	*PORTS*	
R & L	ALIMENTATION	*FEEDING*	PN400 DN25-X-NF ISO 6162-2, 4xM12
1 & 2	DRAINAGE	*DRAIN*	M22x1,5-ISO 9974-1

F
1/5

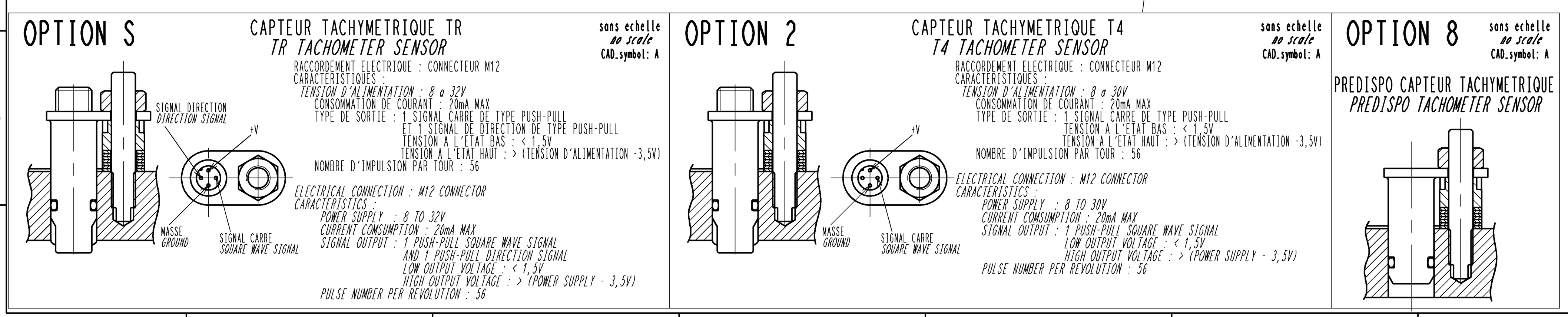


ORIFICE/ *PORT L*
ORIFICE/ *PORT 1*
ORIFICE/ *PORT R*

OPTION S
CAPTEUR TACHYMETRIQUE TR
TR TACHOMETER SENSOR
sans echelle *no scale*
CAD.symbol: A

OPTION 2
CAPTEUR TACHYMETRIQUE T4
T4 TACHOMETER SENSOR
sans echelle *no scale*
CAD.symbol: A

OPTION 8
PREDISPO CAPTEUR TACHYMETRIQUE
PREDISPO TACHOMETER SENSOR
sans echelle *no scale*
CAD.symbol: A



CAD_symbol: -

PAGE	LOCATION	VERSION	ETAIT AVANT MODIFICATION / *WAS BEFORE REVISION*
DATE:		NOM / NAME:	OMT / ECO:

TOLERANCES GENERALES / *GENERAL TOLERANCES*
DISTANCE / *LENGTH* : ±0,5
ANGLE / *ANGLE* : ±3°

MATIERE ET SPECIFICATIONS:
MATERIAL AND SPECIFICATIONS:

PRINCIPE FONDAMENTAL DE TOLERANCEMENT / *FUNDAMENTAL TOLERANCING PRINCIPLE* : ISO 8015
TOLERANCEMENT GEOMETRIQUE : ISO 1101 — *SHAPE AND POSITION TOLERANCE : ISO 1101*
ETAT DE SURFACE :ISO 1302 (1992) — *SURFACE FINISH :ISO 1302 (1992)*

MASSE / *MASS* 272 Kg
ECHELLE/*SCALE* : 1 / 2

INT-MS50-X-111-R50-2A10-X

CREE / *CREATED* le/*on*:23-Feb-2011 par/*by*: MIKSA OMT/*ECO*: 0012008

POCLAIN HYDRAULICS INDUSTRIE
B.P. N 106
F-60411 VERBERIE
Tel:+33 3 44 40 77 77

VERIFIE / *CHECKED* par/*by*:RICHTARECH
FORMAT / *FORMAT* A0
CAO / *CAD* : PRO/E
PLANCHE / *PAGE* : 1 / 1

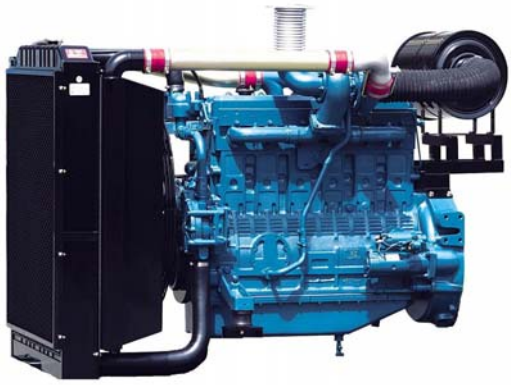
A42130T
VERSION -

PU126TI P-DRIVE

◎ POWER RATING

Intermittent rating kW(PS) / rpm	Max. torque N.m(kg.m) / rpm	Fuel consumption g/kW.h(g/PS.h) / rpm
294 (400) / 2,100	1521 (155) / 1,400	220 (162) / 2,100

Note : 1. The engine performance corresponds to ISO 3046, DIN 6270B.
2. Continuous duty at charge and constant speed consider on engine choice, a power derating of about 14%.
3. Max. rpm of Continuous duty is 1,800rpm.



◎ MECHANICAL SYSTEM

○ Engine Model	PU126TI
○ Engine Type	In-line 4 cycle, water cooled Turbo charged & intercooled
○ Combustion type	Direct injection
○ Cylinder Type	Replaceable dry liner
○ Number of cylinders	6
○ Bore x stroke	123(4.84) x 155(6.1) mm(in.)
○ Displacement	11.051(674.5) lit.(in3)
○ Compression ratio	17 : 1
○ Firing order	1-5-3-6-2-4
○ Injection timing	14° BTDC
○ Compression pressure	Above 28 kg/cm^2(398 psi) at 200rpm
○ Dry weight	Approx. 910 kg (2006 lb)
○ Dimension (LxWxH)	1,383 x 870 x 1,207 mm (54.4 x 34.3 x 47.5 in.)
○ Rotation	Counter clockwise viewed from Flywheel

◎ FUEL SYSTEM

○ Injection pump	Zexel in-line “P” type
○ Governor	RSV type(all speed control)
○ Feed pump	Mechanical type
○ Injection nozzle	Multi hole type
○ Opening pressure	220 kg/cm2 (3,129 psi)
○ Fuel filter	Full flow, cartridge type
○ Used fuel	Diesel fuel oil

◎ LUBRICATION SYSTEM

○ Lub. Method	Fully forced pressure feed type
○ Oil pump	Gear type driven by crankshaft
○ Oil filter	Full flow, cartridge type
○ Oil pan capacity	High level 23 liters (6.1 gal.) Low level 20 liters (5.3 gal.)
○ Angularity limit	Front down 25 deg. Front up 25 deg. Side to side 15 deg.
○ Lub. Oil	Refer to Operation Manual

◎ MECHANISM

○ Type	Over head valve
○ Number of valve	Intake 1, exhaust 1 per cylinder
○ Valve lashes at cold	Intake 0.30 mm(0.0118 in) Exhaust 0.30 mm(0.0118 in.)

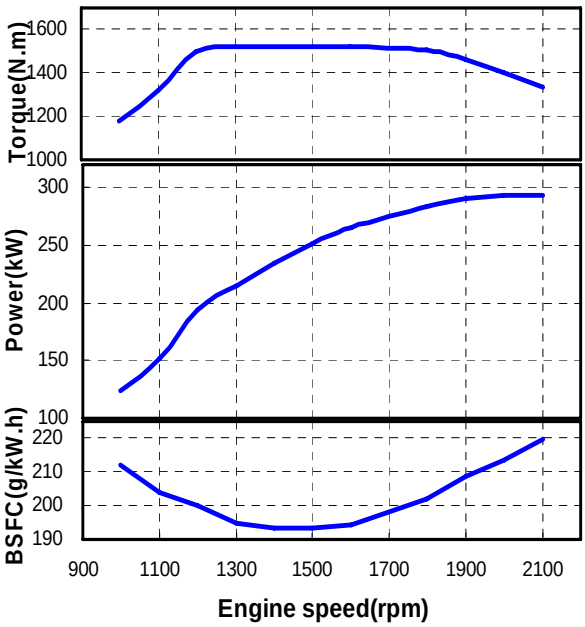
◎ VALVE TIMING

	Opening	Close
○ Intake valve	18 deg. BTDC	34 deg. ABDC
○ Exhaust valve	46 deg. BBDC	14 deg. ATDC

◎ OPTION & ACCESSORY PARTS

○ Engine parts	Fly wheel & housing Intake & exhaust manifold
○ Accessory parts	Raditor, silencer & air cleaner
○ Electrical parts	Gauge panel & stop solenoid

◎ PERFORMANCE CURVE



Printed in September 2006 PS-SBP0505-E1C

PU126TI P-DRIVE

◎ COOLING SYSTEM

○ Cooling method	Fresh water forced circulation
○ Water capacity (engine only)	19 liters (5.02 gal.)
○ Pressure system	Max. 0.9 kg/cm^2 (12.8 psi)
○ Water pump	Centrifugal type driven by gear
○ Water pump Capacity	320 liters (84.5 gal.)/min at 2,100 rpm (engine)
○ Thermostat	Wax – pellet type Opening temp. 83°C Full open temp. 95°C
○ Cooling fan	Blower type, plastic 755 mm diameter, 7 blade

◎ ENGINEERING DATA

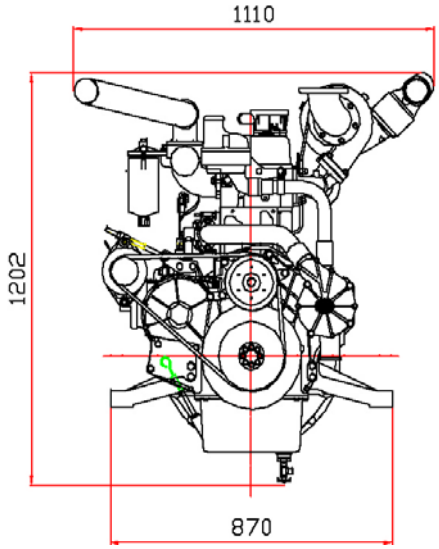
○ Water flow	320 liters/min @2,100 rpm
○ Heat rejection to coolant	30 kcal/sec @2,100 rpm
○ Air flow	26 m^3/min @2,100 rpm
○ Exhaust gas flow	65 m^3/min @2,100 rpm
○ Exhaust gas temp.	505 °C @2,100 rpm
○ Max. permissible restrictions	
-.Intake system	220 mmH_2O initial 635 mmH_2O final
-.Exhaust system	1,000 mmH_2O max.

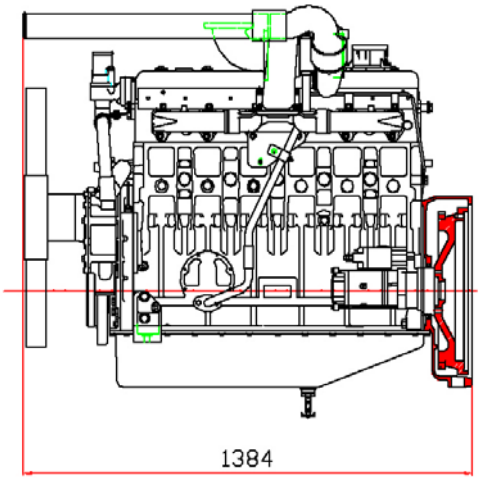
◎ ELECTRICAL SYSTEM

○ Charging generator	24V x 45A alternator
○ Voltage regulator	Built-in type IC regulator
○ Starting motor	24V x 6.0kW
○ Battery Voltage	24V
○ Battery Capacity	150 AH (recommended)
○ Starting aid (Option)	Block heater

◆ CONVERSION TABLE

in. = mm x 0.0394	lb/ft = N.m x 0.737
PS = kW x 1.3596	U.S. gal = lit. x 0.264
psi = kg/cm2 x 14.2233	kW = 0.2388 kcal/s
in3 = lit. x 61.02	lb/PS.h = g/kW.h x 0.00162
hp = PS x 0.98635	cfm = m^3/min x 35.336
lb = kg x 2.20462	





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Seoul Office
Doosan Infracore Co. Ltd.,
22nd Floor, Doosan Tower, 18-12, Euljiro 6-ga, Jung-gu,
Seoul, Korea.
TEL : 82-2-3398-8521~8535 FAX : 82-2-3398-8509
Web site : www.doosaninfracore.com

※ Speccifications are subject to change without prior notice

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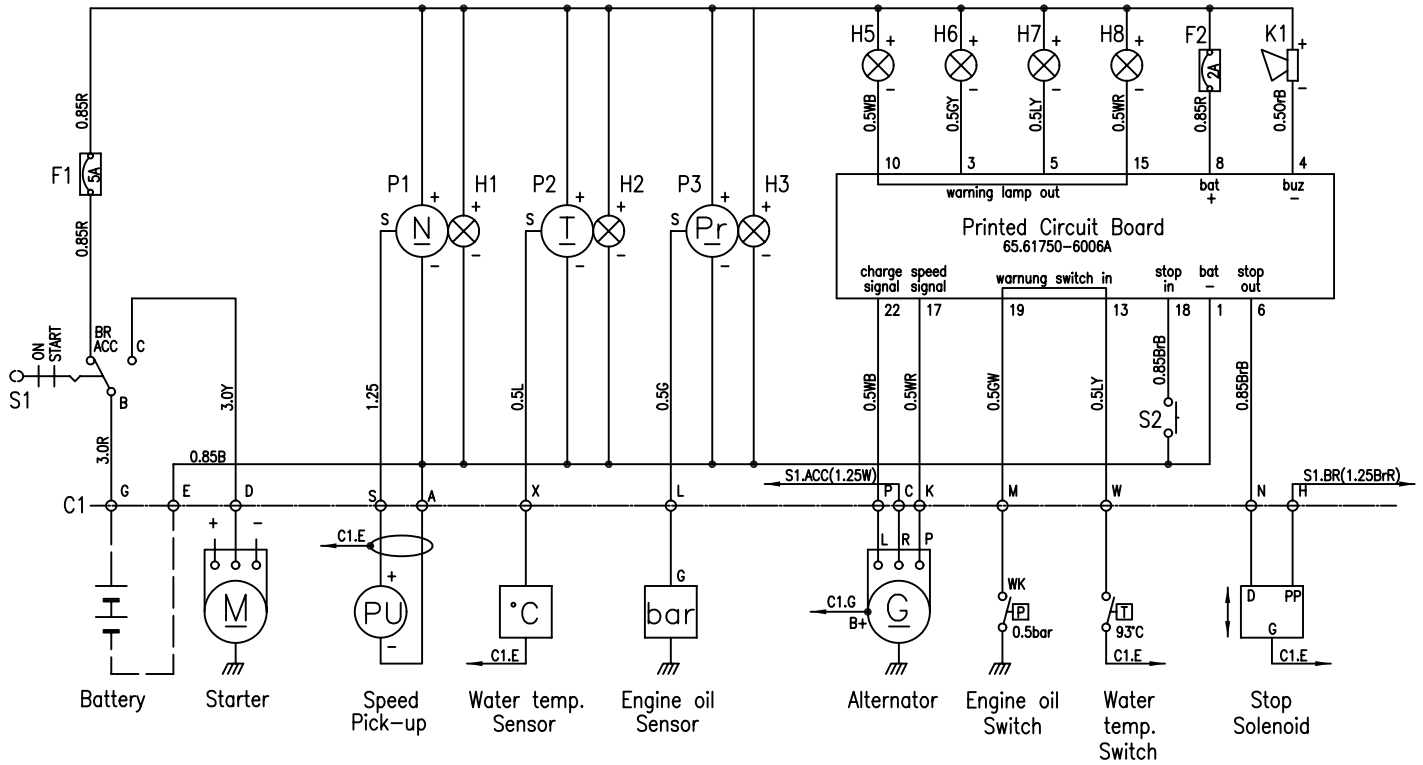
Ⅱ 등급
GRADE

부 호	설 변 NO.	내 용	년 월 일	제	설	검	승



Parts list

C1	1	Main Connector	21-pole	65.26810-0008
F1	1	Fuse (for Gauge)	5A	65.25502-6001
F2	1	Fuse (for P.C.B)	2A	65.25502-6001
H1-H3	3	Light lamp	LED	
H5	1	Cahrge indicator lamp	LED	
H6	1	Low oil pressure warning lamp	LED	
H7	1	High coolant temp. warning lamp	LED	
H8	1	Over speed warning lamp	LED	
P1	1	Tacho meter	0-3000rpm	65.27101-6008
P2	1	Coolant temperature gauge	40-120°C	65.27401-6004
P3	1	Engine oil pressure gauge	0-10bar	65.27431-6002
K1	1	Buzzer	DC24V	60.25301-6003
S1	1	Engine start key switch	Rotary	65.25501-7001
S2	1	Engine stop switch	Push button	65.25501-6001

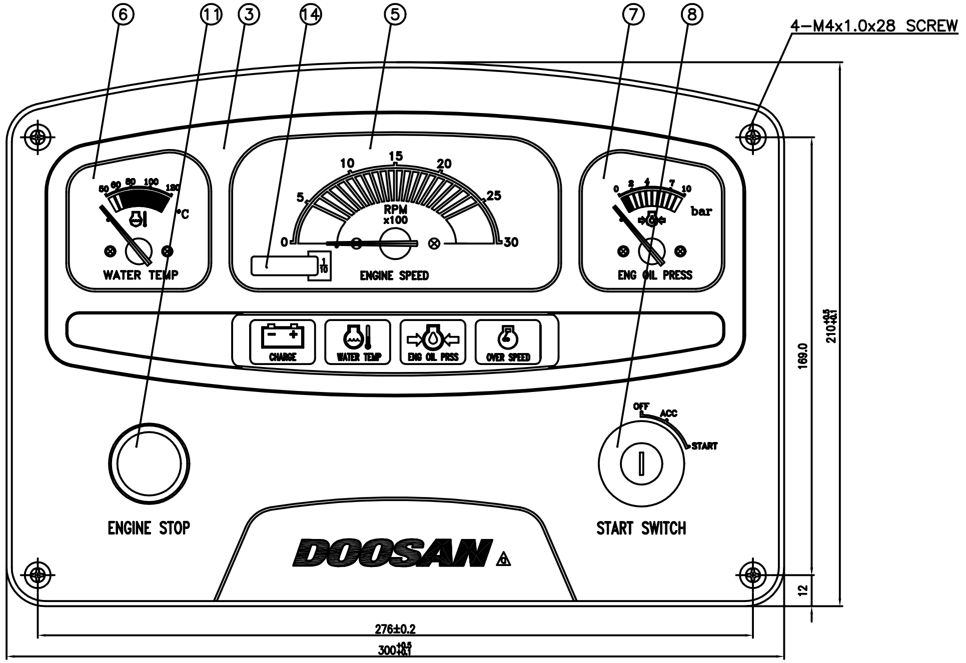
품 번 PART NO.	품 명 PART NAME	재 질 MAT.	개 수 Q'TE	비 고 REMARKS
기 종 L126TIH	명 칭 NAME CIRCUIT DIAGRAM for 65.61700-6031			척도 SCALE N/S 단중 W.T
보통허용차 DES-A3230 정급 중급 조급 병급	소재 NO. 금형 NO.			재료 MAT.
제도 고영도 04.03.12	설계 고영도 04.03.12	관계도번 65.99590-8020A	0 #	NO. 65.99590-8086
검도	승인	Doosan Infracore Co., Ltd. INCHON KOREA		

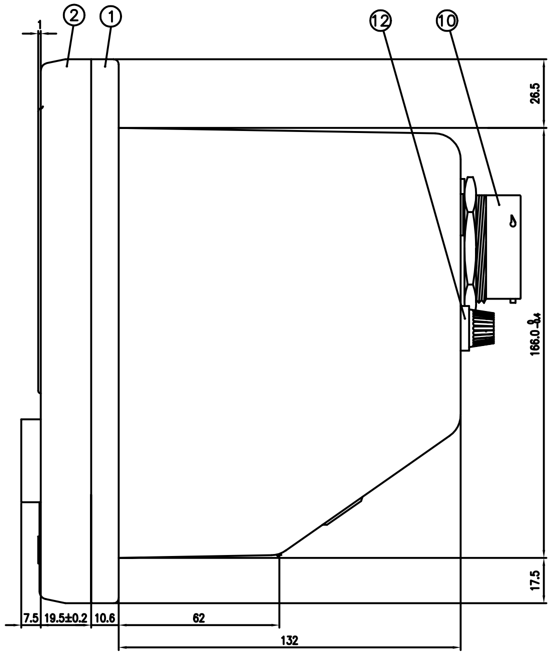
3각법
3D ANGLE

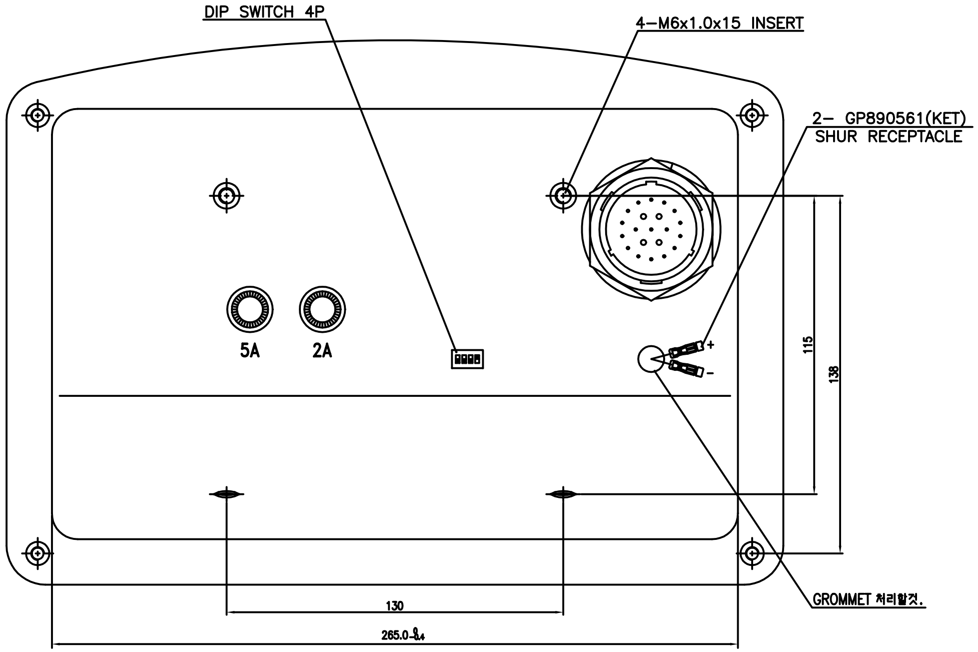
SIZE A3 (420x297)

Ⅱ 등급 GRADE

부호	설변 NO.	내용	년월일	제	설	검	승
△x2	2005E0138	Logo 변경	05.06.23	고영도			







제품사양

1. 정 격 전 압 : DC24V
2. 사용전압범위 : DC20V – DC30V
3. 사용온도범위 : –20°C – 70°C
4. 보존온도범위 : –40°C – 80°C
5. 신뢰성 시험
   1) 기본성능검사 : 각 단자 및 게이지의 기능을 상온, 정격전압에서 시험할것.
   2) 저온방치시험
      : –40°C에서 8시간 방치후 상온에 90분간 방치하여 기본성능검사를 만족할것.
   3) 고온방치시험
      : 80°C에서 8시간 방치후 상온에 90분간 방치하여 기본성능검사를 만족할것.
   4) 내열내구시험
      : –20°C –> 70°C(1–2시간), 70°C(2시간), 70°C –> –20°C(1–2시간), –20°C(2시간)을 1CYCLE로 총 5CYCLE을 실시한후 상온에 90분간 방치하여 기본성능검사를 만족할것.
   5) 내수시험
      : KSR0015의 S1시험(24.5l/min, 30분간 분수)후 외부 물기를 완전히 제거하여 기본성능검사를 만족할것.
   6) 염수분무시험
      : 시험용 염용액 탱크의 온도를 35±2°C 유지한 상태에서 5% 염수로 72시간 분무 실시(시료에 직접 분무 피할것)후 상온에서 수세하고 말린다음 부품의 부식이 없으며 기본성능검사를 만족할것.
   7) 진동시험
      : 작동상태에서 진동주파수 2000CPM, 진동가속도 2.6G의 진동으로 상하 4시간, 전후 및 좌우 2시간 실시후 부품의 탈락이 없으며 기본성능검사를 만족할것.
   8) 과전압시험
      : 전원 입력단자에 DC32V를 60분간 인가후 기본성능검사를 만족할것.
   9) 역전압시험
      : 전원 입력단자에 DC26V를 1분간 역으로 인가후 기본성능검사를 만족할것.
   10) SURGE시험
      : D1 MODE(JASO) LEVER3로 실시한후 기본성능검사를 만족할것.

주) 1. 외관상, 흠, 얼룩, 미성형, WELD-LINE, 과도한 수축 등이 없을것.
2. 분해시 LEAD WIRE가 충분히 당겨질 수 있도록 여유를 둘것.
3. DAEWOO 문자는 성형후 금박 AL HOT-STAMPING 처리할것.
4. 경고램프 색상은 적색으로 하고, 표시판에 SMOG 처리할것.
5. MAIN CONNECTOR, FUSE HOLDER는 견고하게 고정할것.
6. 포장시 1)비닐 2)INNER BOX 3)OUT BOX 순서로 할것.
7. 제품 상단에 아래 그림과 같은 스티커를 부착할것.

품 번	65.61700-6031A
정격전압	24V
LOT번호	

* 업체사양으로 제작.

8. 관련회로도 : 65.99590-8086

순번 No.	품 번 PART NO.	품 명 PART NAME	재 질 MAT.	개수 Q'TE	비 고 REMARKS
14	65.27161-6001	HOUR METER		1	유상사급품
13	65.61750-6009	CIRCUIT BOARD		1	
12	65.25502-6001	FUSE HOLDER		2	
11	65.25501-6001	BUTTON,ENGINE STOP		1	
10	65.29101-6148	WIRE, ELECTRIC		1	유상사급품
9	65.61750-6006A	CIRCUIT BOARD		1	유상사급품
8	65.25501-7003	KEY SWITCH ASS'Y		1	유상사급품
7	65.27431-6004	GAUGE, OIL PRESS		1	
6	65.27401-6005	GAUGE, WATER TEMP.		1	
5	65.27101-6008	METER, TACHO		1	
4	60.61710-6009	SUPPORT, GAUGE	ABS	1	DARK GRAY
3	65.61716-6003	COVER, GAUGE	ABS	1	WHITE
△ 2	65.61710-6011 ~~65.61714-6004A~~	PANEL, GAUGE	ABS	1	DARK GRAY
1	65.61713-6006A	CASE, GAUGE	ABS	1	DARK GRAY

기종	명칭 NAME	척도 SCALE
ALL	GAUGE PANEL ASS'Y	1/1
		단중 W.T

보통허용차 DES-A3230 정급 중급 조급 병급

소재 NO.

금형 NO.

재료 MAT.

제도 고영도 04.02.24 | 설계 고영도 04.02.24 | 검도 | 승인

관계도번 65.61700-6011B

0 #

NO. 65.61700-6031A

Doosan Infracore Co., Ltd. INCHON KOREA

3 각 법 3D ANGLE

6. Operations and Maintenance Guide of the Engine.

DOOSAN Infracore

65.99897-8078A

Operation & Maintenance Manual

GENERATOR DIESEL ENGINE

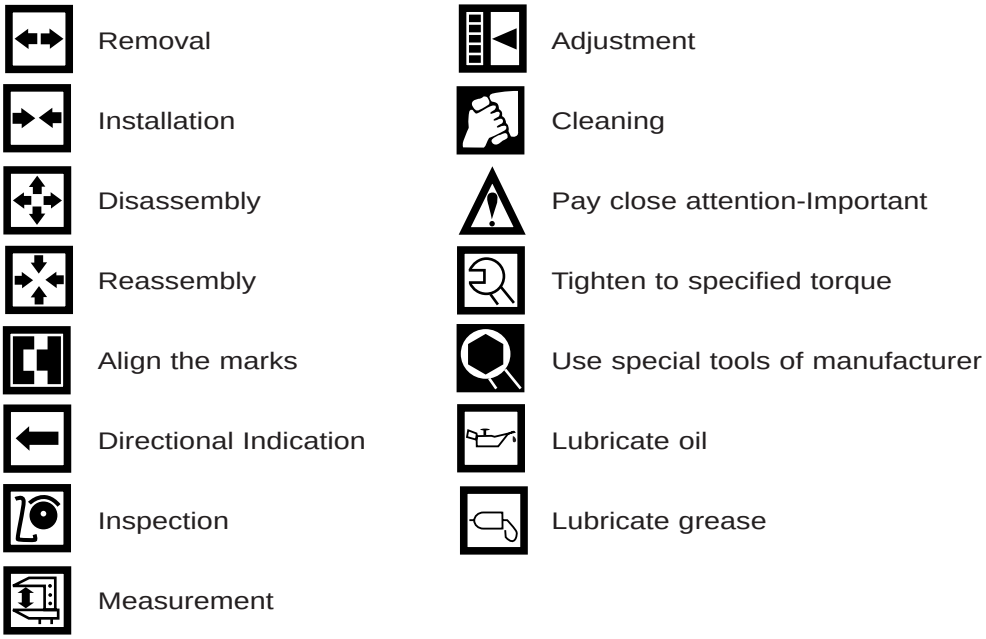
DE12T

POULS

P126TI-1
P126TI
P126TI-II

FOREWORD

This manual is designed to serve as an instruction for the Operation & Maintenance of generating-set engines of Doosan POLUS series: P126TI-Ⅱ/P126TI /P126TI-1/DE12T. The POLUS means 'Power Plus' that is represented more powerful Doosan generating-set engines and it is marked on engine name as an initial P. On the other hand, intial D stands for standard engine prior to POLUS version.
The first half is for operation and the latter half is for maintenance like disassembling, inspecting and re-assembling etc in order to help an understanding for the maintenance procedure more easily.
To keep the best performance and the durability of engine for a long time, CORRECT OPERATION and PROPER MAINTENANCE are essential.
In this manual, the following symbols are used to indicate the type of service operations to be performed.



If you have any question or recommendation in connection with this manual, please do not hesitate to contact our head office, dealers or authorized service shops near by your location for any services.
Also some figures in this manual may be different from the actual appearance of the engine because of explaining them with the representative figure among these models
For the last, the contents of this instruction manual may be changed without prior notice for some quality improvement. Thank you.

Nov. 2003

DOOSAN Infracore Co., Ltd.

CONTENTS

<Operation>

<Maintenance>

1. Safety Regulations

1.1. General Notes

Handling diesel engines and the necessary resources is no problem when the personnel commissioned with operation and maintenance are trained accordingly and use their common sense.

This summary is a compilation of the most important regulations. These are broken down into main sections which contain the information necessary for preventing injury to persons, damage to property and pollution. In addition to these regulations those dictated by the type of engine and its site are to be observed also.

Important :
If, despite all precautions, an accident occurs, in particular through contact with caustic acids, fuel penetrating the skin, scalding from oil, antifreeze being splashed in the eyes etc., consult a doctor immediately.

1.2. Regulations Designed to Prevent Accidents

1.2.1. During commissioning, starting and operation

Before putting the engine into operation for the first time, read the operating instructions carefully and familiarize yourself with the “critical” points, If you are unsure, ask your DAEWOO representative.

- For reasons of safety we recommend you attach a notice to the door of the engine room prohibiting the access of unauthorized persons and that you draw the attention of the operating personal to the fact that they are responsible for the safety of persons who enter the engine room.
- The engine must be started and operated only by authorized personnel. Ensure that the engine cannot be started by unauthorized persons.
- When the engine is running, do not get too close to the rotating parts. Wear close-fitting clothing.
- Do not touch the engine with bare hands when it is warm from operation risk of burns.
- Exhaust gases are toxic. Comply with the installation instructions for the installation of DAEWOO generator diesel engines which are to be operated in enclosed spaces. Ensure that there is adequate ventilation and air extraction.
- Keep vicinity of engine, ladders and stairways free of oil and grease.
  Accidents caused by slipping can have serious consequences.

1.2.2. During maintenance and care

- Always carry out maintenance work when the engine is switched off. If the engine has to be maintained while it is running, e.g. changing the elements of change-over filters, remember that there is a risk of scalding. Do not get too close to rotating parts.
- Change the oil when the engine is warm from operation.

Caution :
There is a risk of burns and scalding. Do not touch oil drain valve or oil filters with bare hands.

- Take into account the amount of oil in the sump. Use a vessel of sufficient size to ensure that the oil will not overflow.
- Open the coolant circuit only when the engine has cooled down. If opening while the engine is still warm is unavoidable, comply with the instructions In the chapter entitled “Cooling”.
- Neither tighten up nor open pipes and hoses (lube oil circuit, coolant circuit and any additional hydraulic oil circuit) during the operation. The fluid which flow out can cause injury.
- Fuel is inflammable. Do not smoke or use naked lights in its vicinity. The tank must be filled only when the engine is switched off.
- Keep service products (anti-freeze) only in containers which can not be confused with drinks containers.
- Comply with the manufacturer’s instructions when handling batteries.

Caution :
Accumulator acid is toxic and caustic. Battery gases are explosive.

1.2.3. When carrying out checking, setting and repair work

- Checking, setting and repair work must be carried out by authorized personnel only.
- Use only tools which are in satisfactory condition. Slip caused by the worn open-end wrench could lead to Injury.
- When the engine is hanging on a crane, no-one must be allowed to stand or pass under it. Keep lifting gear in good condition.
- When checking injectors, do not put your hands under the jet of fuel.
  Do not inhale at atomized fuel.
- When working on the electrical system disconnect the battery earth cable first. Connect it up again last in prevent short circuits.

1.3. Regulations Designed to Prevent Damage to Engine and Premature Wear

1) Never demand more of the engine than it was designed to yield for its intended purpose.
   Detailed information on this can be found in the sales literature. The injection pump must not be adjusted without prior written permission of DAEWOO.

2) If faults occur, find the cause immediately and have it eliminate in order to prevent more serious of damage.
3) Use only genuine DAEWOO spare parts. DAEWOO will accept no responsibility for damage resulting from the installation of other parts which are supposedly “just as good”.
4) In addition to the above, note the following points.
   - Never let the engine run when dry, i.e. without lube oil or coolant. Use only DAEWOO-approved service products (engine oil, anti-freeze and anticorrosion agent).
   - Pay attention to cleanliness, The Diesel fuel must be free of water. See “Maintenance and care”.
   - Have the engine maintained at the specified intervals.
   - Do not switch off the engine immediately when it is warm, but let it run without load for about 5 minutes so that temperature equalization can take place.
   - Never put cold coolant into an overheated engine. See “Maintenance and care”.
   - Do not add so much engine oil that the oil level rises above the max. marking on the dipstick. Do not exceed the maximum permissible tilt of the engine. Serious damage to the engine may result if these instructions are not adhered to.
   - Always ensure that the testing and monitoring equipment (for battery charge, oil pressure, and coolant temperature) function satisfactorily.
   - Comply with instructions for operation of the alternator. See “Commissioning and operation”.
   - Do not let the water pump run dry. If there is a risk of frost, drain the water when the engine switched off.

1.4. Regulations Designed to Prevent Pollution

1.4.1. Engine oil, filter element, fuel filter

- Take old oil only to an oil collection point. Take strict precautions to ensure that oil does not get into the drains or into the ground.
- The drinking water supply may be contaminated.
- Oil and fuel filter elements are classed as dangerous waste and must be treated as such.

1.4.2. Coolant

- Treat undiluted anti-corrosion agent and / or antifreeze as dangerous waste.
- When disposing of spent coolant comply with the regulations of the relevant local authorities.

1.5. Notes on Safety in Handling Used Engine Oil

Prolonged or repeated contact between the skin and any kind of engine oil decreases the skin. Drying, irritation or inflammation of the skin may therefore occur. Used engine oil also contains dangerous substances which have caused skin cancer in animal experiments. If the basic rules of hygiene and health and safety at work are observed, health risks are not to the expected as a result of handling used engine oil.

Health precautions

- Avoid prolonged or repeated skin contact with used engine oil.
- Protect your skin by means of suitable agents (creams etc.) or wear protective gloves.
- Clean skin which has been in contact with engine oil.
  - Wash thoroughly with soap and water, A nailbrush is an effective aid.
  - Certain products make it easier to clean your hands.
  - Do not use petrol, Diesel fuel, gas oil, thinners or solvents as washing agents.
- After washing apply a fatty skin cream to the skin.
- Change oil-soaked clothing and shoes.
- Do not put oily rags into your pockets.

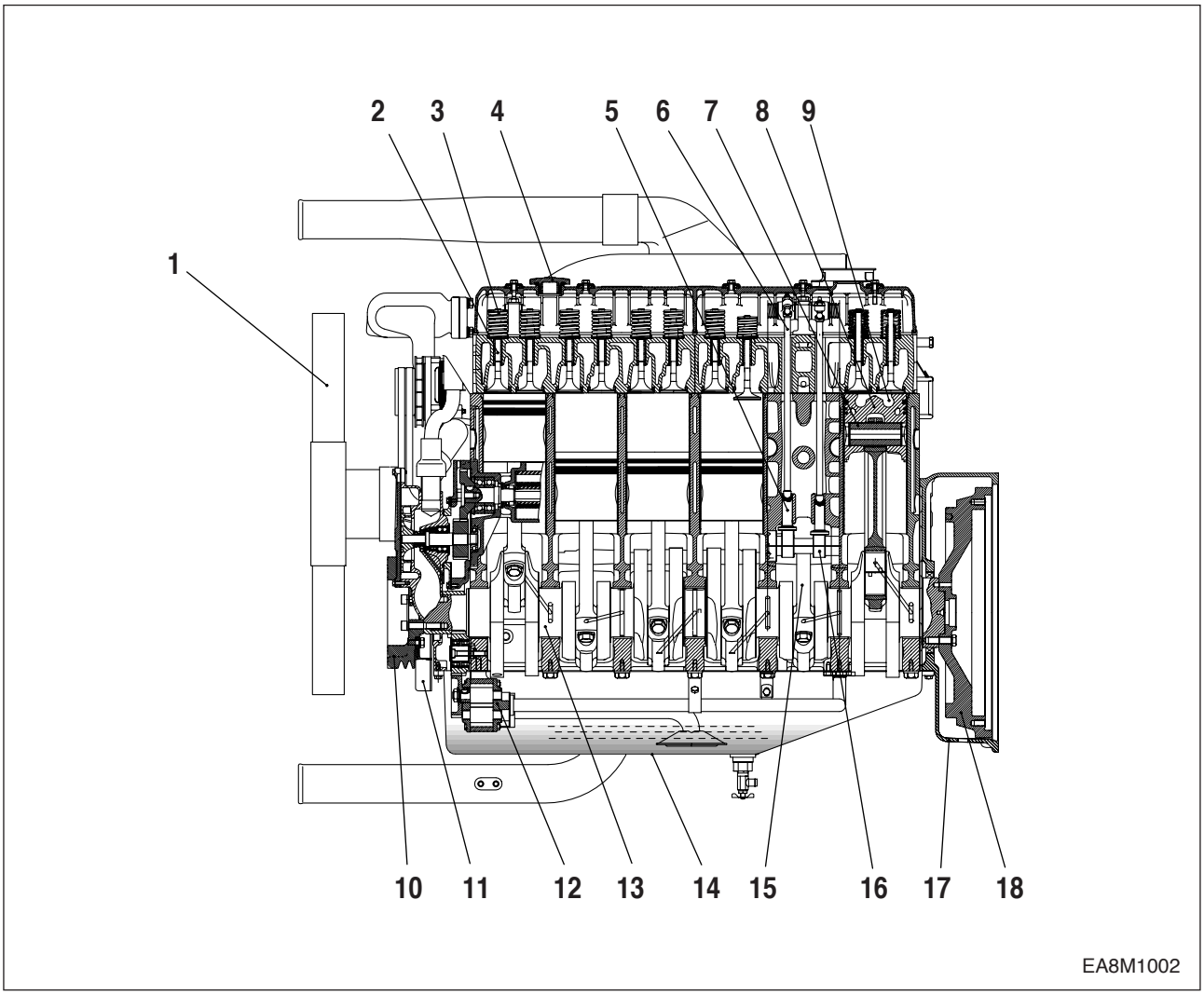
Ensure that used engine oil is disposed of properly.
- Engine oil can endanger the water supply -

For this reason do not let engine oil get into the ground, waterways, the drains or the sewers. Violations are punishable. Collect and dispose of used engine oil carefully.
For information on collection points please contact the seller, the supplier or the local authorities.

2. General Information

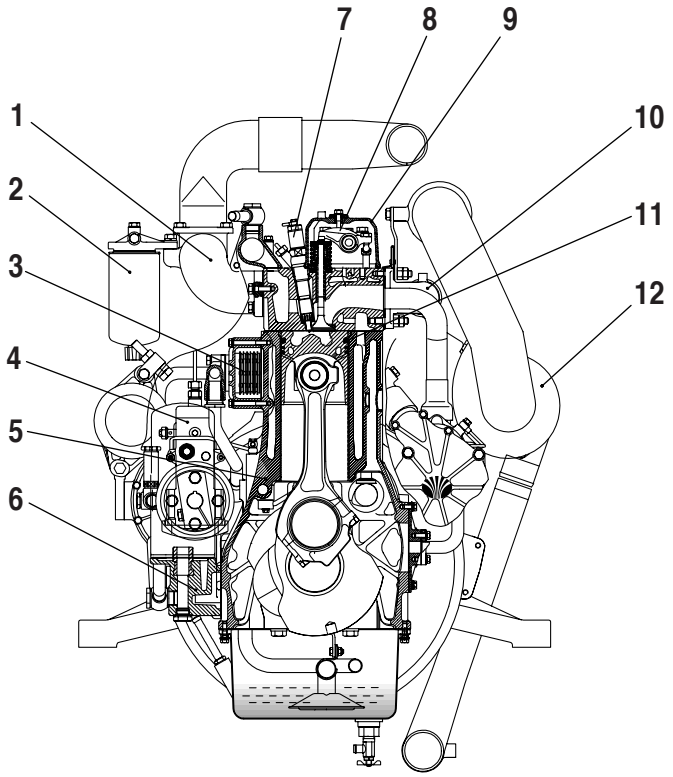
2.1. Engine Assembly

2.1.1. Engine sectional view (Longitudinal)



1. Cooling fan
2. Exhaust valve
3. Valve spring
4. Oil filter
5. Tappet
6. Push rod
7. Piston pin
8. Piston
9. Combustion chamber
10. Crankshaft pulley
11. Vibration damper
12. Oil pump
13. Crankshaft
14. Oil pan
15. Connecting rod
16. Camshaft
17. Flywheel housing
18. Flywheel

2.1.2. Engine sectional view (Cross)

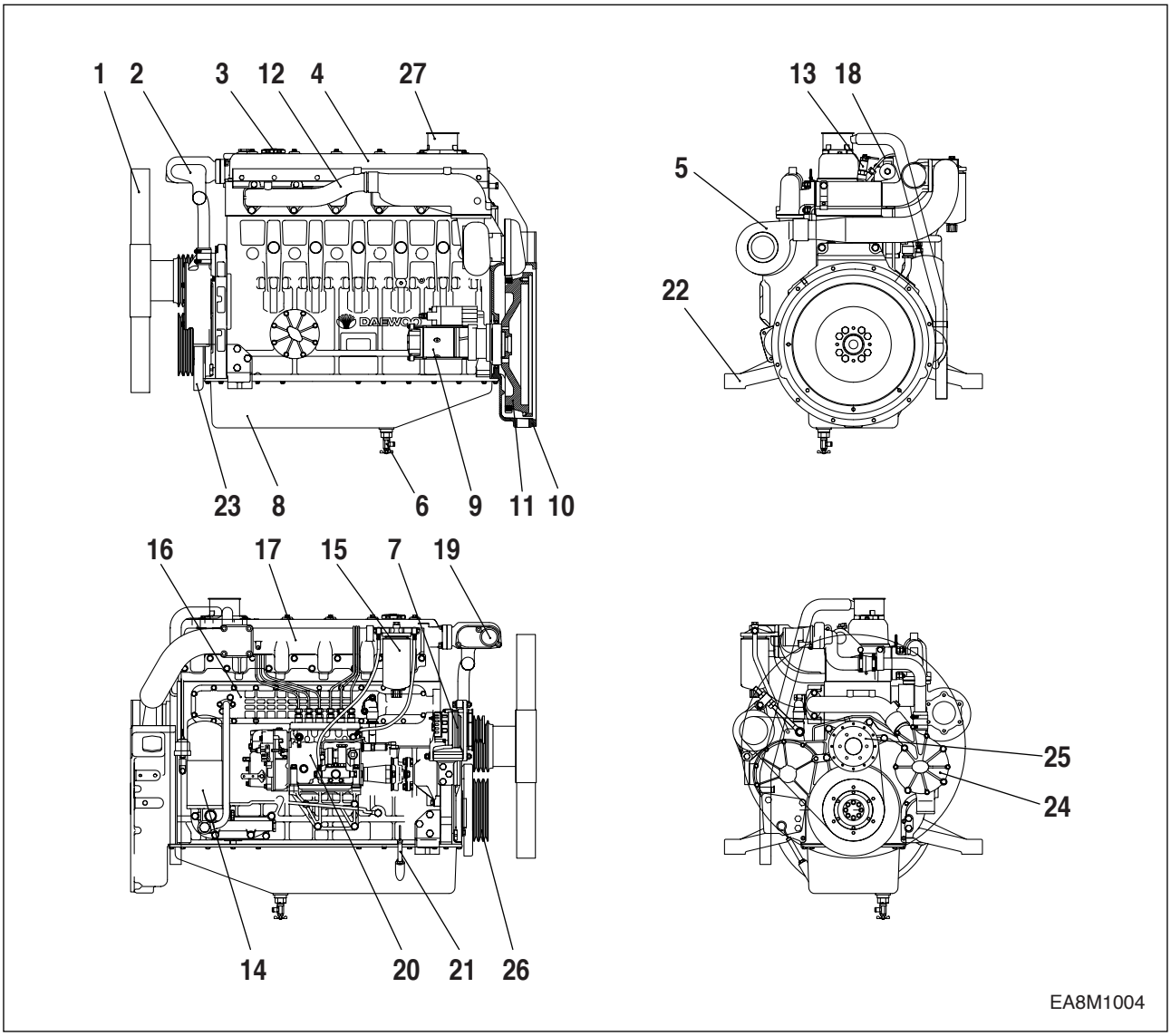


EA8M1003

1. Intake manifold
2. Fuel filter
3. Oil cooler
4. Injection pump
5. Cylinder block
6. Oil filter
7. Injection nozzle assembly
8. Rocker arm
9. Cylinder head cover
10. Exhaust manifold
11. Piston ring
12. Turbocharger

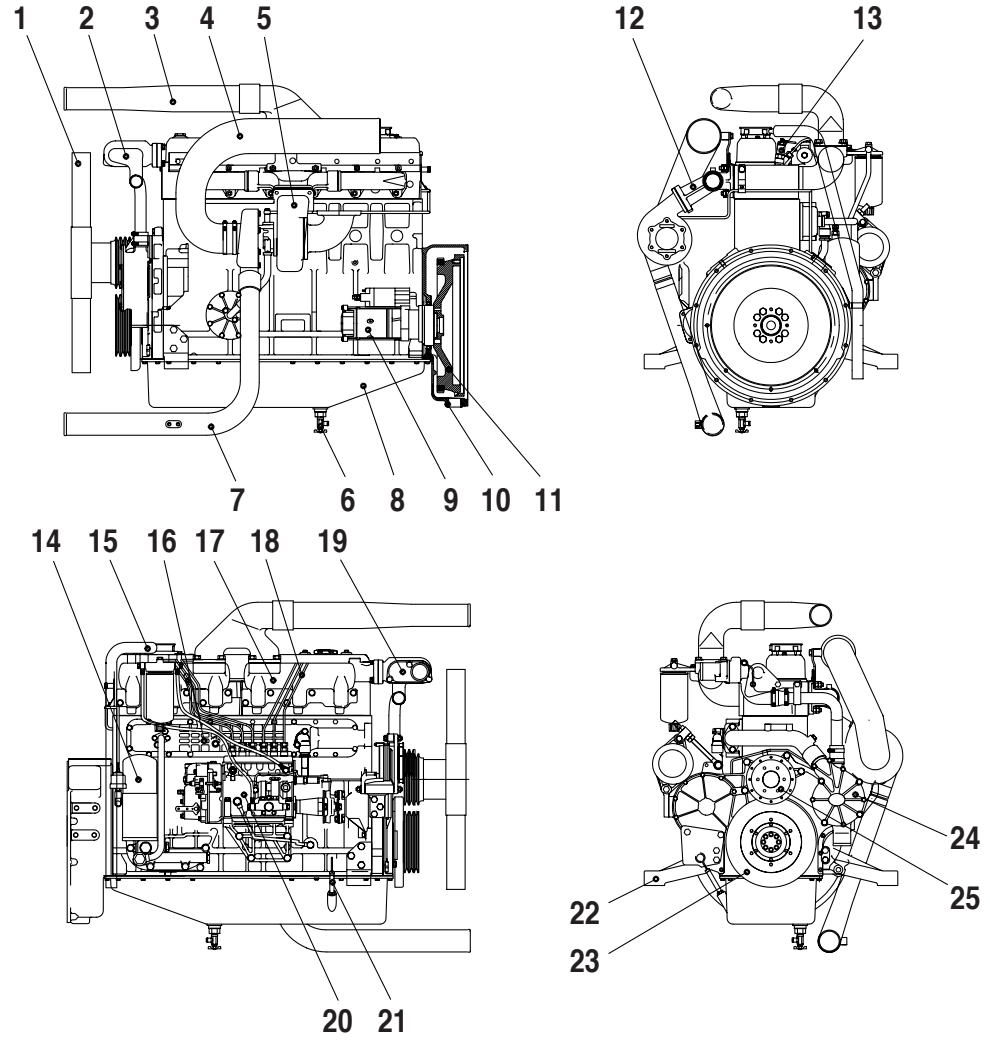
2.1.3. Engine assembly views

1) DE12T



1. Cooling fan
2. Cooling water pipe
3. Oil filler cap
4. Cylinder head cover
5. Turbocharger
6. Oil drain valve
7. Alternator
8. Oil pan
9. Starter
10. Flywheel housing
11. Flywheel
12. Exhaust manifold
13. Injection nozzle assembly
14. Oil filter
15. Fuel filter
16. Oil cooler
17. Intake manifold
18. Injection pipe
19. Thermostat
20. Injection pump
21. Oil level gauge
22. Mounting bracket
23. Vibration damper
24. Water pump
25. Fan drive
26. Crankshaft pulley
27. Breather

2) P126TI / P126TI-Ⅱ



1. Cooling fan
2. Cooling water pipe
3. Air pipe
   (Intercooler ⟶ Intake manifold)
4. Air pipe
   (Air cleaner ⟶ Turbocharger)
5. Turbocharger
6. Oil drain valve
7. Air pipe
   (Intercooler ⟶ Intake manifold)
8. Oil pan
9. Starter
10. Flywheel housing
11. Flywheel
12. Exhaust manifold
13. Injection nozzle assembly
14. Oil filter
15. Breather hose
16. Oil cooler
17. Intake manifold
18. Injection pipe
19. Thermostat
20. Injection pump
21. Oil level gauge
22. Mounting bracket
23. Vibration damper
24. Water pump
25. Fan drive

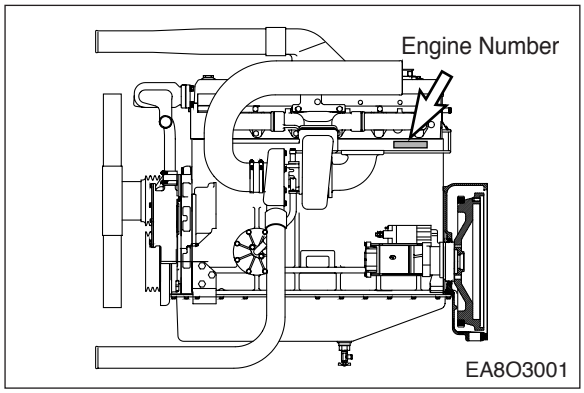
2.2. Engine Specification

Items \ Engine Model		DE12T		P126TI		P126TI-1	P126TI-Ⅱ
Engine type		Water-cooled, 4 cycle in-line type Turbo charged		Water-cooled, 4 cycle in-line type Turbo charged & intercooled			
Combustion chamber type		Direct injection type					
Cylinder liner type		Replaceable dry liner					
Timing gear system		Gear driven type					
No. of piston ring		Compression ring 2, oil ring 1					
No. of cylinder-bore x stroke (mm)		4 - 123 x 155					
Total piston displacement (cc)		11,051					
Compression ratio		17.1 : 1					
Engine dimension (length x width x height) (mm)		1,365.5 x 870 x 1,046		1,383 x 870 x 1,207			
Engine weight (kg)		930		910			
Rotating direction (from flywheel)		Counter clockwise					
Fuel injection order		1 - 5 - 3 - 6 - 2 - 4					
Fuel injection timing (B.T.D.C static)		12°		16°		16°	16°
Injection pump type		Zexel in-line “P” type					
Governor type		Mechanical governor type(RSV)		Electric governor type(Ghana Control)			
Injection nozzle type		Multi-hole type (5 hole)		Multi-hole type (5 hole)			
Fuel injection pressure (kg/cm^2)		220		1st : 160, 2nd : 220			
Compression pressure (kg/cm^2)		28 (at 200 rpm)					
Power (ISO 3046)	Condition	50Hz (1,500rpm)	60Hz (1,800rpm)	50Hz (1,500rpm)	60Hz (1,800rpm)	60Hz (1,800rpm)	60Hz (1,800rpm)
	Continuous	-	-	280PS (206kW)	336PS (247kW)	-	-
	Prime	205PS (151kW)	245PS (180kW)	328PS (241kW)	378PS (278kW)	356PS (262kW)	-
	Stand by	226PS (166kW)	270PS (199kW)	370PS (272kW)	405PS (298kW)	392PS (288kW)	465PS (342kW)
Intake and exhaust valve clearance (at cold) (mm)		0.3					
Intake valve	Open at	18° (B.T.D.C)					
	Close at	34° (A.B.D.C)					
Exhaust valve	Open at	46° (B.B.D.C)					
	Close at	14° (A.T.D.C)					
Lubrication method		Full forced pressure feed type					
Oil pump type		Gear type driven by crankshaft					
Oil filter type		Full-flow, Cartridge type					
Lubricating oil capacity (max./min.) (lit)		23/20					
Oil cooler type		Water cooled					
Water pump		Gear driven impeller type					
Cooling Method		Pressurized circulation					
Cooling water capacity (engine only) (lit)		19					
Thermostat type		Wax pallet type (71 ~ 85 °C)					
Alternator voltage - capacity (V - A)		24 - 45					
Starting Motor voltage - output (V - kW)		24 - 6.0					

3. Technical Information

3.1. Engine Model and Serial Number

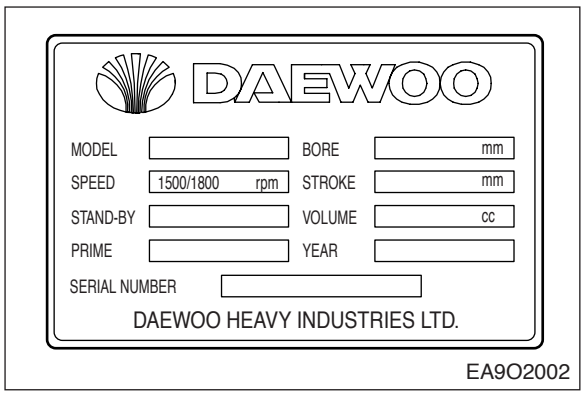
The engine model and serial number is located on the engine as illustrated. These numbers are required when requesting warranty and ordering parts. They are also referred to as engine model and serial number because of their location.



- **Engine serial No. (example 1 : DE12T)**

EBHOA300001

Serial No.
ProductionYear(2003)
Engine Model Suffix

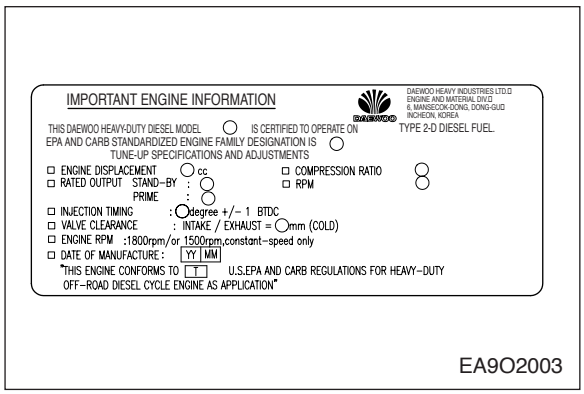


< Name Plate : General >

- **Engine serial No. (example 2 : P126TI)**

EDIOA300001

Serial No.
ProductionYear(2003)
Engine Model Suffix



< Name Plate : EPA & CARB >

- **Engine serial No. (example 3: P126TI-Ⅱ)**

EDIOC300001

Serial No.
ProductionYear(2003)
Engine Model Suffix

3.2. Engine Type

The Engines DE12T/ P126TI / P126TI-Ⅱ are in-line vertical water-cooled 6-cylinder four-stroke diesel engines with direct injection. DE12T is turbo-charged engine, and P126TI / P126TI-Ⅱ models are turbo-charged and inter-cooled engine.

3.2.1. Cylinder block

The cylinder block is a single piece of alloy cast iron. To increase its stiffness, it is extended to a level below the crankshaft center line. The engine has replaceable dry cylinder liners and individual cylinder heads with struck-in valve seat rings and replaceable valve guides,

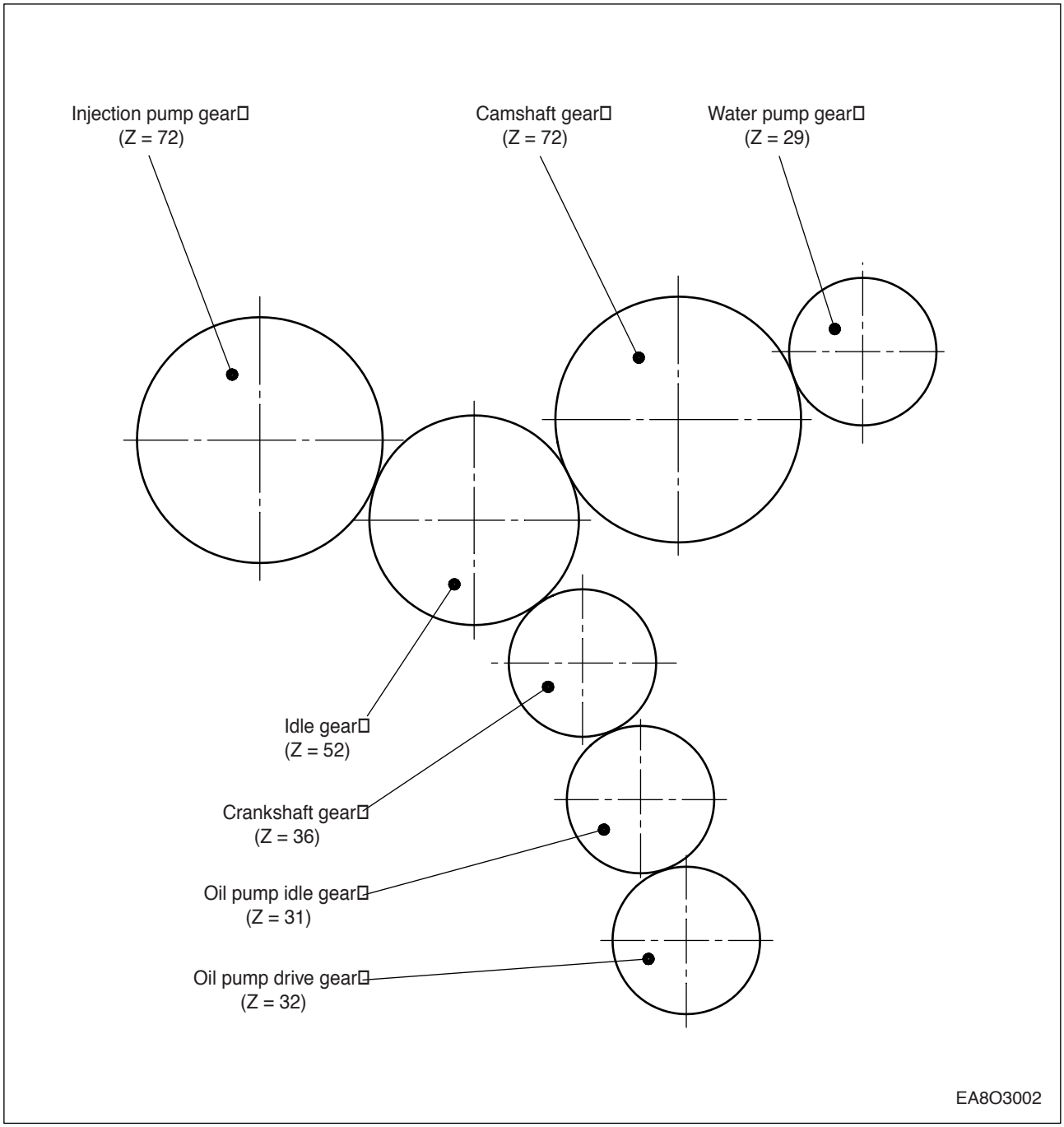
3.2.2. Piston con-rod / crankshaft

The forged crankshaft is a ingrate type (Counterweight is integrated with crank shaft body). Radial oil seal on crankshaft and flywheel are provided to seal the flywheel housing inside penetrations.

The con-rods (connecting rods) are die-forged, diagonally split and can be removed through the top of the cylinders together with the pistons. Crankshaft and connecting rods run in steel-backed lead bronze ready-to fit type bearings.

3.3. Engine Timing

Camshaft, oil pump and injection pump are driven by a gear train arranged at the front end.



3.4. Valves

The overhead valves are actuated via chilled cast iron tappets, push rods and rocker arms from the camshaft.

3.5. Lubrication System

The engine is equipped with force-feed lubrication.

The pressure is produced by a gear pump whose drive gear is in direct mesh with the crankshaft gear at the front end of cylinder block.

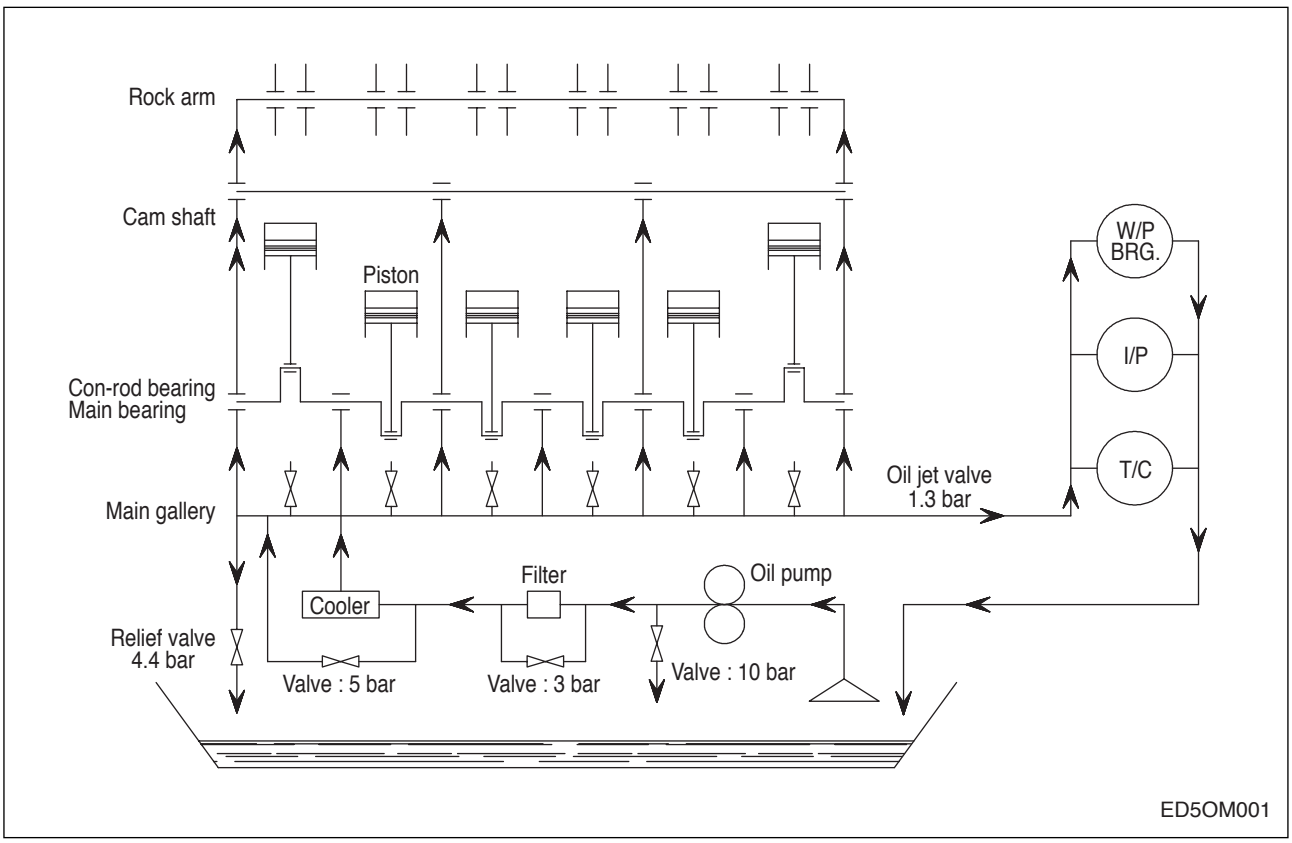
The oil pump draws the oil from the oil sump and delivers it through the oil cooler and oil filter to the main distributor gallery and from there to the main bearings, big-end bearings and camshaft bearings as well as to the small-end bearings and the rocker arms.

The injection pump and the turbocharger are also connected to the engine lubricating system.

The cylinder walls and timing gears are splash lubricated.

Each cylinder has an oil jet provided for cooling the underside of the pistons.

The lube oil is cleaned in a full-flow oil filter.

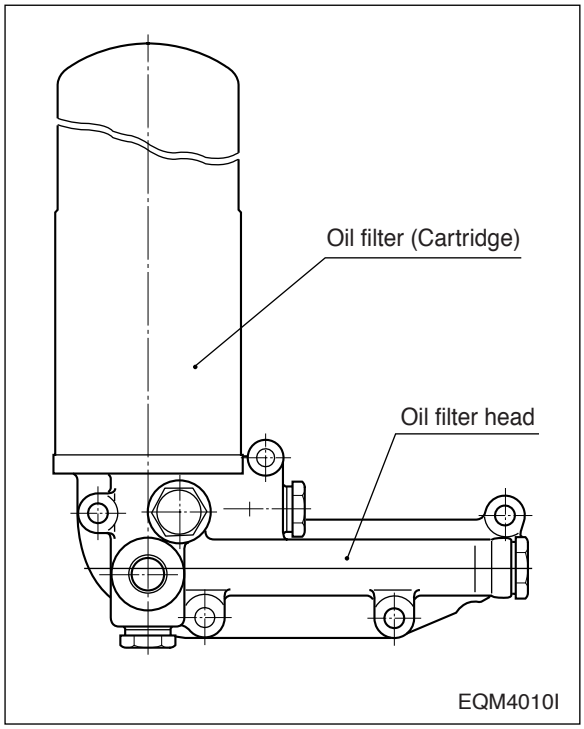


3.5.1. Oil cooler

An oil cooler is provided between the oil filter and the cylinder block. This cooler is a flat tube type with turbulence inserts and operated by the coolant.

3.5.2. Oil filter

Check for oil pressure and oil leaks, and repair or replace the oil filter if necessary. Change the oil filter cartridge simultaneously at every replacement of engine oil.



3.6. Air Cleaner

In case that elements are deformed, damaged or if the air cleaner has a crack, replace it.
By the definite interval, the elements must be cleaned and replaced.

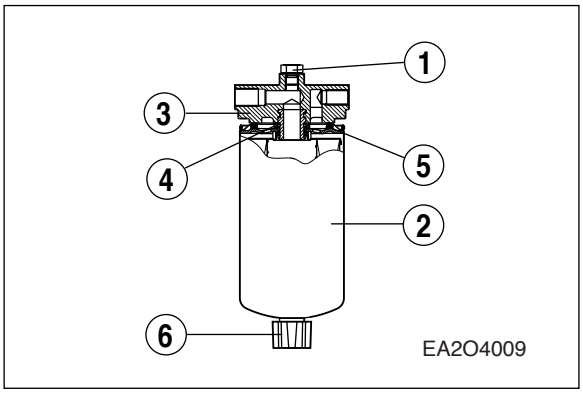
- Cleaning of air cleaner element: Every 200 hours.
- Changing of air cleaner element: Every 400 hours.

3.7. Fuel System

The fuel is delivered by the fuel feed pump via the fuel filter to the injection pump and from there to the injection nozzles.
The fuel is sprayed into the cylinders through nozzles fitted in screw-fit injection nozzle holders in the cylinder heads.
Excessively delivered fuel and leak fuel from the nozzle flow through the return pipe back to the tank.
A strainer is arranged ahead of the fuel feed pump.

3.7.1. Fuel filter

This fuel filter has two functions not only oil filtering but also water separating.
Before entering the suction chamber of the injection pump, the fuel is cleaned in a strainer of fuel feed pump and a fuel filter.
Drain water in cartridge with loosening the cock under filter manually (6) from time to time.
The fuel filter should be replaced at every 400 hours.



3.7.2. Fuel requirements

DAEWOO marine diesel engines was designed to use Number 2-D diesel fuel or equivalent that meets specification DIN 51601-DK. For maximum fuel economy, Number 2-D fuel whenever possible. When temperatures are below -7˚C(20˚F), use Number 1-D fuel. If Number 1-D fuel is not available, the mixture of one kerosene to two gallons of Number 2-D fuel can be used. Once kerosene has been added, the engine should be run for several minutes to mix the fuel.

3.7.3. How to select fuel oil

Fuel quality is an important factor in obtaining satisfactory engine performance, long engine life, and acceptable exhaust emission levels. DAEWOO engines are designed to operate on most diesel fuels marketed today. In general, fuels meeting the properties of ASTM Designation D975 (grades 1-D and 2-D) have provided satisfactory performance.
The ASTM 975 specification, however, does not in itself adequately define the fuel characteristics needed for assurance of fuel quality.
The properties listed in the fuel oil selection chart below have provided optimum engine performance. Grade 2-D fuel is normally available for generator service. Grade 1-D fuel should not be used in pleasure craft engines, except in an emergency.

Fuel oil selection chart

General Fuel Classification	ASTM Test	No. 1 ASTM 1-D	No. 2 ASTM 2-D	DIN 51601
Gravity,˚API #)	D 287	40 ~ 44	33 ~ 37	0.815 ~ 0.855
Flash Point Min. ˚F (˚C)	D 93	100 (38)	125 (52)	131 (55)
Viscosity, Kinematic CST 100 ˚F (40 ˚C)	D 445	1.3 ~ 2.4	1.9 ~ 4.1	1.8 ~ 10
Cloud Point ˚F #)	D 2500	See Note 1)	See Note 1)	See Note 1)
Sulfur Content wt%, Max.	D 129	0.5	0.5	0.15
Carbon Residue on 10%, wt%, Max.	D 524	0.15	0.35	0.1
Accelerated Stability Total Insolubles mg/100 ml, Max. #)	D 2274	1.5	1.5	
Ash, wt%, Max.	D 482	0.01	0.01	
Cetane Number, Min. +)	D 613	45	45	> 45
Distillation Temperature, ˚F(˚C)	D 86			
IMP, Typican #)		350(177)	375(191)	
10% Typical #)		385(196)	430(221)	
50% Typical #)		45(218)	510(256)	680(360)
90% +)		500 (260) Max.	625(329) Max.	
End Point #)		550(288) Max.	675(357) Max.	
Water & Sediment %, Max.	D 1796	0.05	0.05	0.05

#) Not specified In ASTM D 975

+) Differs from ASTM D 975

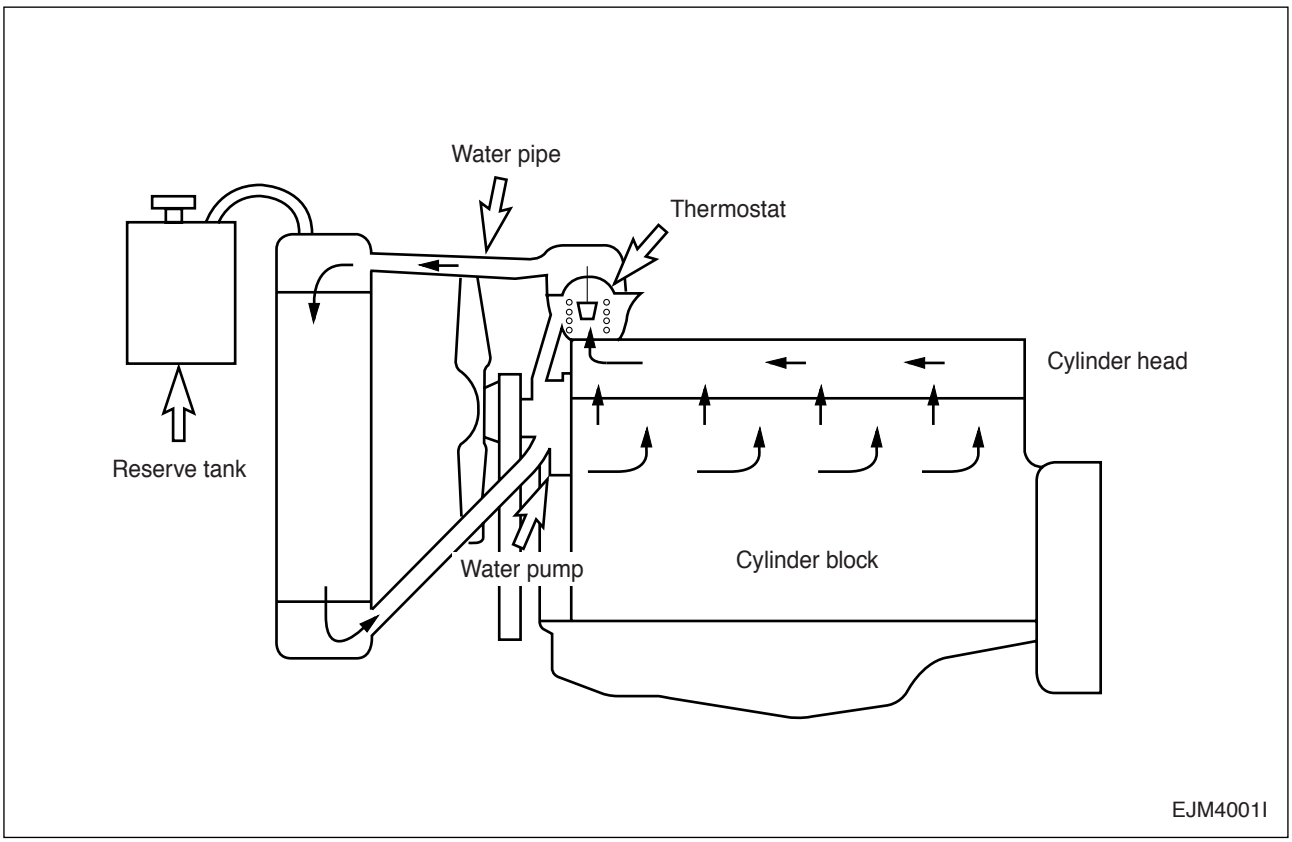
Note : 1.The cloud point should be 6˚C(10˚F) below the lowest expected fuel temperature to prevent clogging of fuel fitters by crystals.

3.8. Cooling System

The engine has a liquid-cooling system. The fresh water pump is a maintenance-free by gear from the crankshaft.

Depending on the agreed extent of delivery and the design of the engine, the coolant circuit can be equipped with temperature monitors which, in the event of loss of coolant, shut the engine down.

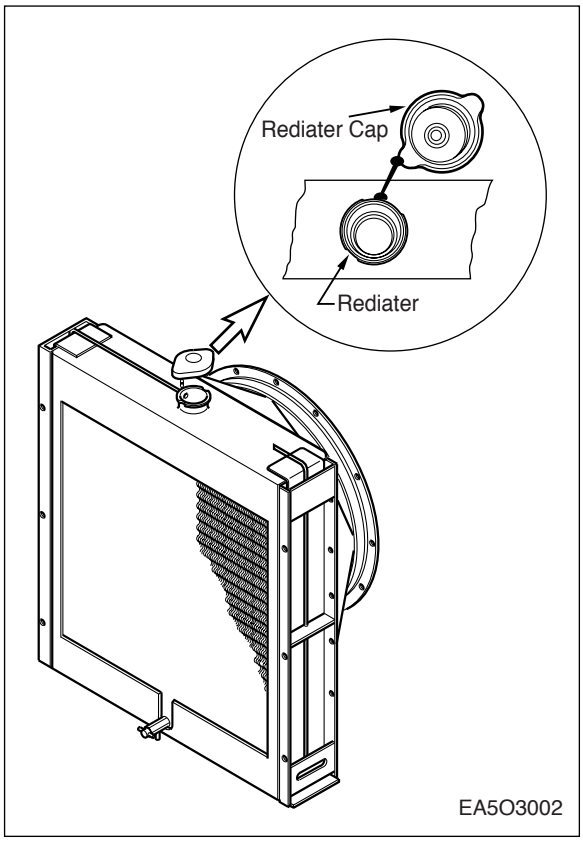
- Check the coolant level of the expansion tank by removing the expansion tank filler cap, and add coolant if necessary.
- When injecting antifreeze solution, first drain out the old coolant from the cylinder block and radiator, and then clean them with cleaning solution.
- Be sure to mix soft water with antifreeze solution.



3.8.1. Coolant pressure cap

Check the pressure valve opening pressure using a expansion tank cap tester. Replace the filler cap assembly if the measured valve does not reach the specified limit. (pressure valve opening pressure : 0.9 kg/cm^2)

Note : Because it is dangerous to open the pressure cap quickly when coolant is hot, after lowering the inside pressure of the tank by slow-opening at first open it fully.



3.8.2. Cooling water

- Regarding the cooling water that is to be used for engine, the soft water not the hard water must be used.
- The engine cooling water can be used diluting it with antifreezing solution 40% and the additive for rust prevention (DCA4) 3 ~ 5 %.
- The density of above solution and additive must be inspected every 500 hours to maintain it properly.

Note : The proper density control of antifreezing solution and rust preventing additive will be able to prevent the rusting effectively and maintain the stable quality of engine. For the improper control might give the fatal damage to the cooling water pump and cylinder liners, detail care is needed.

- Since DE12T , P126TI and P126TI-Ⅱ cylinder liner is dry type, particularly the cooling water control should be applied thoroughly.
- The density of antifreezing solution and additive for rust prevention is able to be confirmed by the cooling water test kit. (Fleetguard CC2602M)
- How to use the cooling water test kit

  1) When the cooling water temp. of engine is in the range of 10 ~ 55 °C, loosen the plug for cooling water discharge and fill the plastic cup about a half.

Note : In taking the cooling water sample, if the water in auxiliary tank were taken, it is hard to measure the accurate density. Take the cooling water sample necessarily loosening the cooling water discharge plug.

2) At the state of a test paper soaked in the sampled water, after taking the paper out through water agitation, shake off the water.
3) Wait for about 45 sec. till the color change of test paper.

Note : However, it should not elapse longer than 75 sec, and if it did, the hue would change.

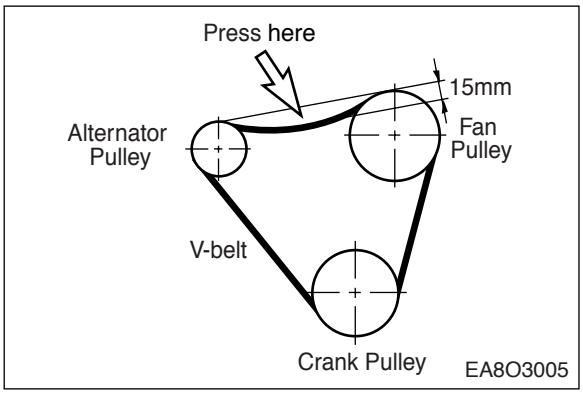
4) Make the numerical value by comparing the test paper which hue has changed with the color list of label on storage bottle.
5) By comparing the hue changed into yellowish green or so with the green color indication of test paper storage bottle, confirm the density. (Then, the density indication must be in the hue range of 33% to 50%).
6) The brown at the middle of test paper and the lower pink color indication represent the additive state for rust prevention, and the proper range is that the meeting numerical value of brown (vertical) and pink color (horizontal) locates in the range of 0.3 to 0.8 at the color list of label on the test paper storage bottle.
7) In case of less than 0.3, replenish the additive for rust prevention (DCA4), and in case of more than 0.8, pour out the cooling water about 50% and then readjust the density after refilling with clean fresh water.

- **Amount of Anti-freeze in winter**

Ambient Temperature (˚C)	Cooling water (%)	Anti-freeze (%)
Over -10	85	15
-10	80	20
-15	73	27
-20	67	33
-25	60	40
-30	56	44
-40	50	50

3.9. V-belt Tension Check and Adjust

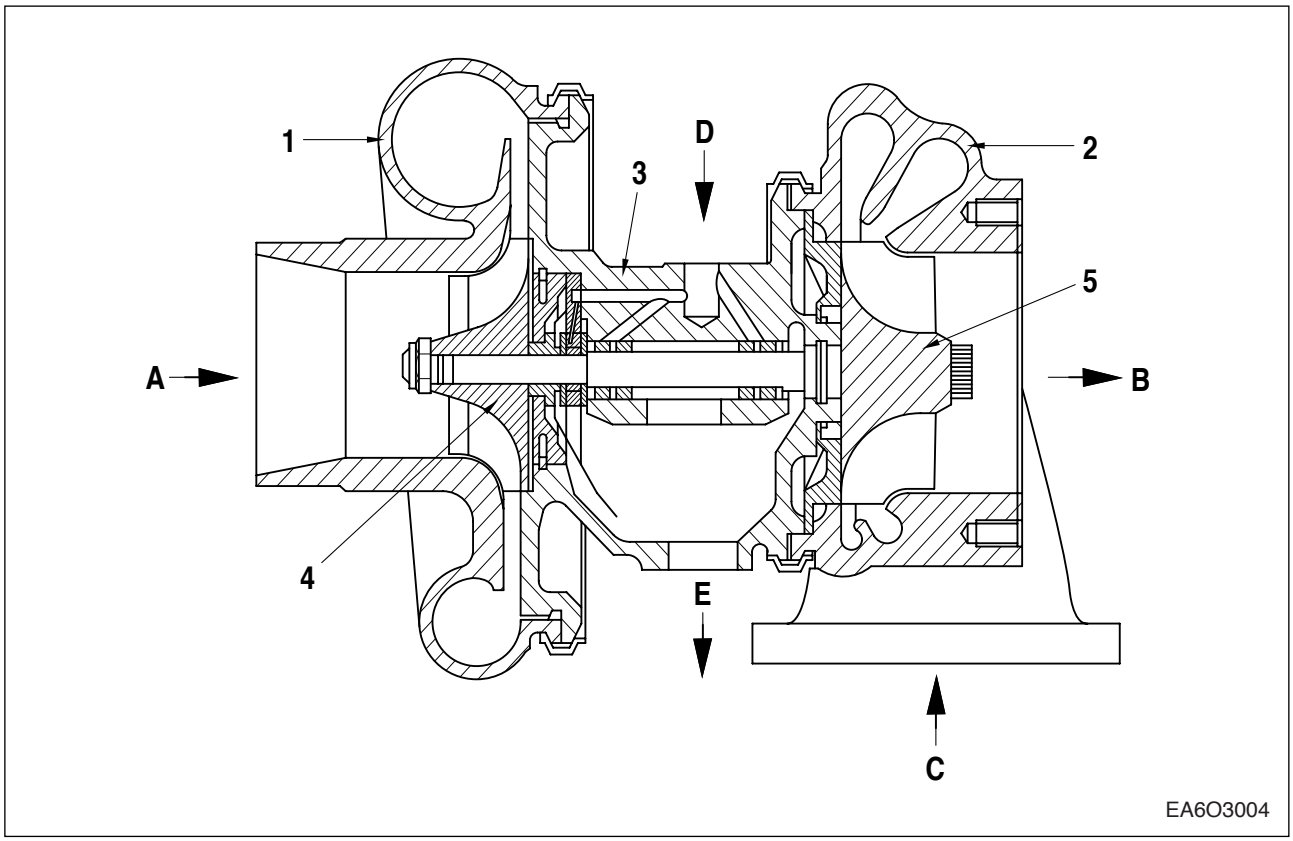
By the finger-pressure the belt is pressed by 10mm ~ 15mm between the fan pulley and the alternator pulley in normal condition. For the adjustment of the tension, loosen the adjusting bolts which support the alternator, adjust the tension and tighten the bolts again.



3.10. Turbocharger

The exhaust gases of the engine are passed through the turbine rotor of the turbocharger. Air compressor impeller mounted on the same shaft draws in fresh air and delivers it at a higher pressure to the cylinders.

The turbocharger is naturally air-cooled. Lubrication of the main bearing is by oil under pressure from the engine lubricating system.



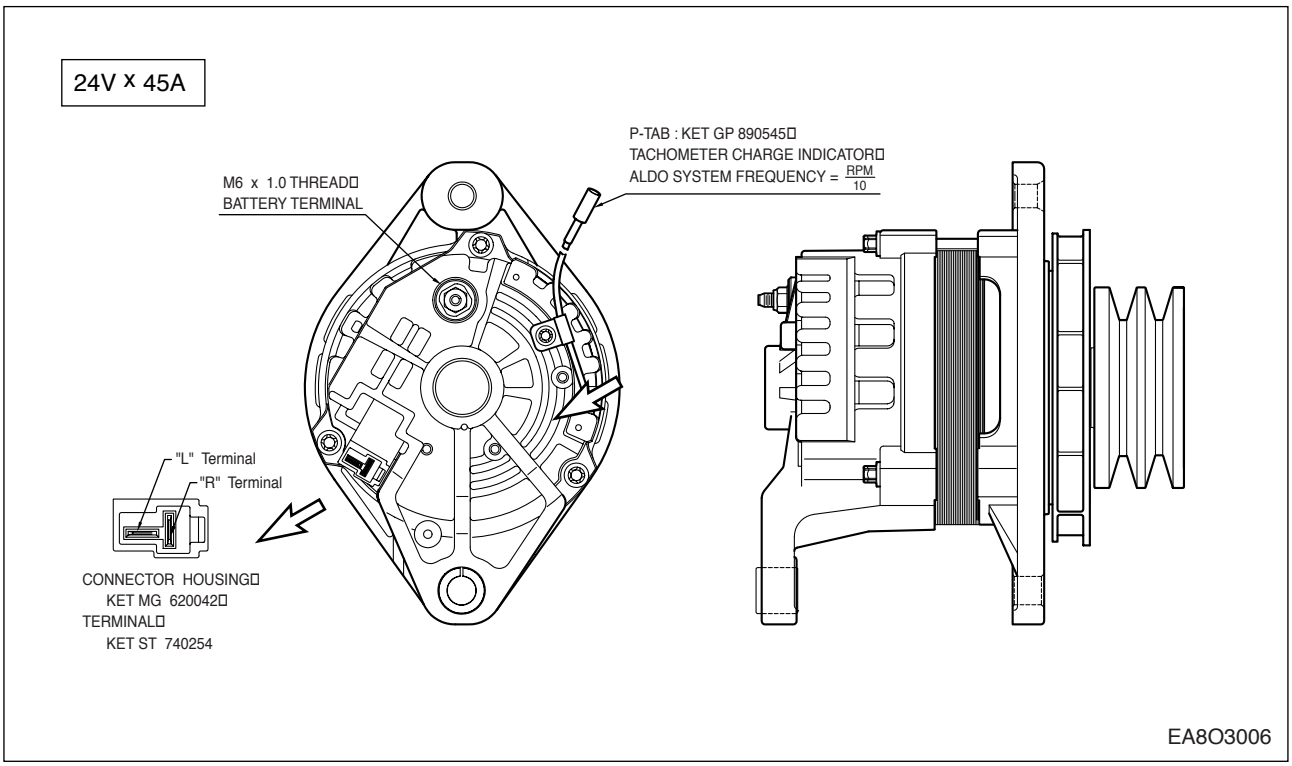
1. Compressor casing
2. Turbine casing
3. Compressor wheel
4. Impeller
5. Turbine

A. Air inlet
B. Gas outlet
C. Gas inlet
D. Oil supply
E. Oil return

3.11. Electrical Equipment

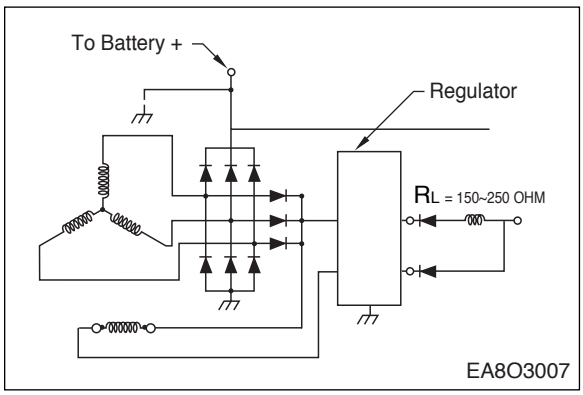
3.11.1. Alternator

The alternator is fitted with integral silicon rectifiers. A transistorized regulator mounted on the alternator body interior limits the alternator voltage. The alternator should not be operated except with the regulator and battery connected in circuit to avoid damage to the rectifier and regulator.



The alternator is maintenance-free, nevertheless, it must be protected against dust and, above all, against moisture and water.

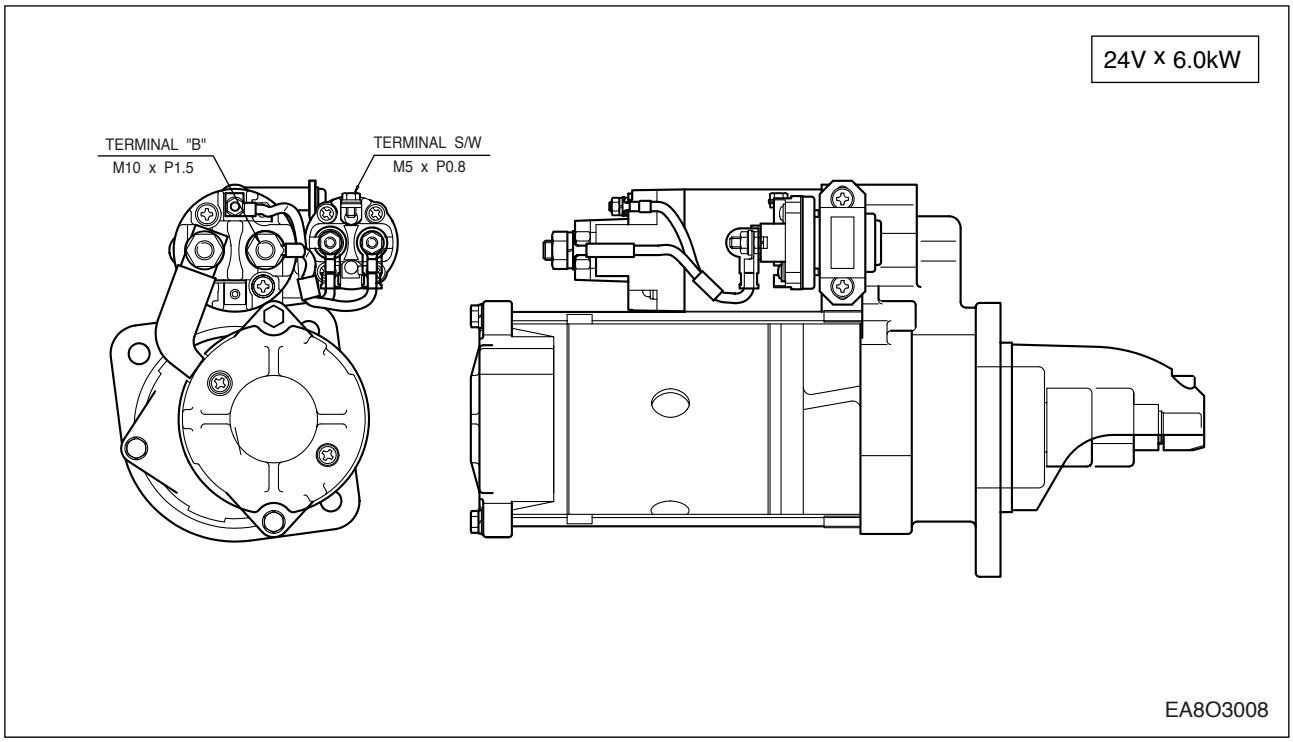
Operate the alternator according to the instructions given in the chapter.



3.11.2. Starter motor

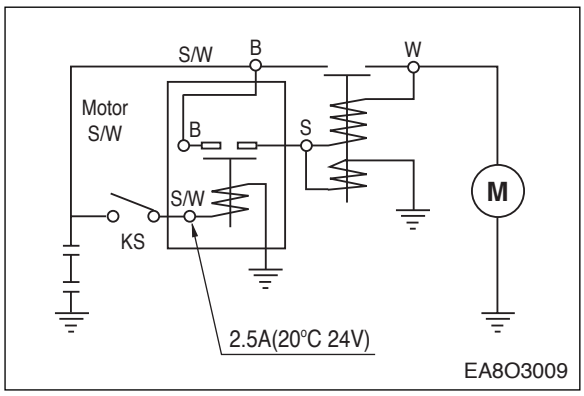
The sliding-gear starter motor is flanged to the rear of the flywheel housing on the left-hand side. When the starting key switch is turned on, the starter motor pinion flies out and engages the ring gear of the flywheel. Then the main contact is closed, current flows, and the engine is started. After the engine starts, the pinion automatically returns to its initial position when the starting key switch is released. Once the engine starts, the starting key switch should be released immediately. Otherwise, the starter motor may be damaged or burned out.

In case of repairing the engine dip the pinion of the starter and ring gear into the fuel and remove the corrosion with brush. After that apply the grease on them to protect the corrosion. Whenever you clean the starter, always pay attention not to occur the electric short due to entering the water.



Always protect starter motor against moisture.

Warning : Always disconnect the battery earth cable before starting work on the electrical system. Connect up the earth cable last, as there is otherwise a risk of short-circuits.



4. Commissioning and Operation

4.1. Preparation

At the time of initial commissioning of a new or overhauled engine make sure to have observed the “Technical Information for the installation DAEWOO generator engines”.

- Oil filler neck on cylinder head cover
  Before daily starting of the engine, check the fuel, coolant and oil level, replenish if necessary.
  The notches in the dipstick indicate the highest and lowest permissible oil levels
  The oil required in the sump is specified in the “Engine Specification”.

Note : The oil required to fill the oil fillers and pipes depends upon the engine and use and must be determined individually at the time of initial commissioning. (Make the Max and Min. marks of the determined quantity on the oil level gauge.)

- Cleanliness
  Ensure outmost cleanliness when handling fuels, lubricants and coolants.

4.2. Breaking-in

4.2.1. Operation of a new engine (Break-In)

Because the sliding surfaces of a new engine are not lapped enough, the oil film can be destroyed easily by overload or overspeed and the engine life-time may be shortened.
Therefore the following things must be obeyed by all means.

Up to the first 50 hours

- Engine should be run at fast idling until the temperature of the engine becomes normal operating condition.
- Overload or continuous high speed operation should be avoided.
- High speed operation with no load should be prevented.
- Abrupt start and stop of the engine should be avoided.
- Engine speed must be under 70% of its maximum speed.
- Maintenance and inspection must be accomplished thoroughly.

4.2.2. Check points for break-in

During the break-in (the initial running of the engine) period, be particularly observant as follows:

a) Check engine oil level frequently. Maintain oil level in the safe range, between the “min.” and “max.” marks on dipstick.

Note : If you have a problem getting a good oil level reading on dipstick, rotate dipstick 180˚ and re-insert for check.

b) Watch the oil pressure warning lamp. If the lamp blinks, it may be the oil pick-up screen is not covered with oil. Check oil dipstick. Add oil to the oil pan, if required. Do not overfill. If level is correct and the status still exists, see your DEALER for possible switch or oil pump and line malfunction.

Note : Oil pressure will rise as RPM increases, and fall as RPM decreases. In addition, cold oil will generally show higher oil pressure for any specific RPM than hot oil. Both of these conditions reflect normal engine operation.

c) Watch the engine water temperature gauge and be sure there is proper water circulation. The water temperature gauge needle will fluctuate if water level in expansion tank is too low. At the end of the break-in period, remove break-in oil and replace the oil filter. Fill oil pan with recommended engine oil. Refer to following table.

<Engine Oil capacity>

	Oil pan (only)
DE12T	23 liter
P126TI/P126TI-Ⅱ	23 liter

4.2.3. Operating after break-in

When starting a cold engine, always allow the engine to warm up gradually. Never run the engine at full throttle until the engine is thoroughly warmed up. Be sure to check the oil level frequently during the first 50 hours of operation, since the oil consumption will be high until the piston rings are properly seated.

4.3. Inspections after Starting

During operation the oil pressure in the engine lubrication system must be monitored. If the monitoring devices register a drop in the lube oil pressure, switch off the engine immediately.
And the charge warning lamp of the alternator should go out when the engine is running.

- Do not disconnect the battery or pole terminals or the cables!
- If, during operation, the battery charge lamp suddenly lights up, stop the engine immediately and remedy the fault in the electrical system!
- Engine should be stopped if the color, the noise or the odor of exhaust gas is not normal.
- Confirm the following things through warning lamps and gauge panel.

4.3.1. Pressure of lubricating oil

The normal pressure comes up to 1 kg/cm^2 (1.0 bar) at idling and 3 ~ 5 kg/cm^2 (3.0 ~ 4.9 bar) at maximum speed. If the pressure fluctuates at idling or does not reach up to the expected level at high speed, shut down the engine immediately and check the oil level and the oil line leakage.

4.3.2. Temperature of cooling water

The cooling water temperature should be 71 ~ 85˚C in normal operating conditions. Abnormally high cooling water temperature could cause the overheating of engine and the sticking of cylinder components. And excessively low cooling water temperature increases the fuel consumption, accelerates the wears of cylinder liners and shortens the engine life-time.

4.4. Operation in Winter Time

Pay special attention to the freezing of cooling water and the viscosity of lubricating oil.

4.4.1. Prevention against the freeze of cooling water

When not using anti-freeze, completely discharge the whole cooling water after engine running. The freeze of cooling water causes the fatal damages of the engine. Because the anti-freeze is used to prevent cooling water from freeze, consult “The amount of anti-freeze”.

4.4.2. Prevention against excessive cooling

Drop of thermal efficiency caused by excessive cooling increases fuel consumption, therefore prevent the engine from excessive cooling. If the temperature of coolant does not reach to normal condition (71 ~ 85˚C) after continuous operation, examine the thermostat or the other cooling lines.

4.4.3. Lubricating oil

As cold weather leads to the rise of oil viscosity, engine speed becomes unstable after starting. Therefore the lubricating oil for winter should be used to prevent this unstability. Refer to “Lubricating System section”.

4.5. Tuning the Engine

The purpose of an engine tune-up is to restore power and performance that's been lost through wear, corrosion or deterioration of one or more parts or components. In the normal operation of an engine, these changes can take place gradually at a number of points, so that it's seldom advisable to attempt an improvement in performance by correction of one or two items only. Time will be saved and more lasting results will be obtained by following a definite and thorough procedure of analysis and correction of all items affecting power and performance.

Economical, trouble-free operation can better be ensured if a complete tune-up is performed once every years, preferably in the spring. Components that affect power and performance to be checked are:

- Components affecting fuel injection ;
  Nozzle, delivery valve, fuel filter, water separator, etc.
- Components affecting Intake & exhaust ;
  Air filter, inter-cooler, turbo, silencer, etc.
- Components affecting lubrication & cooling ;
  Air & oil filter, anti- freeze, etc.

5. Maintenance and Care

5.1. Periodical Inspection and Maintenance

In order to insure maximum, trouble-free engine performance at all times, regular inspection, adjustment and maintenance are vital.

- Daily inspections in below figure should be checked every day.
- The maintenance should be executed thoroughly at regular intervals.
  (Refer to " 7.1. Periodic Inspection Cycle")

5.2. Lubrication System

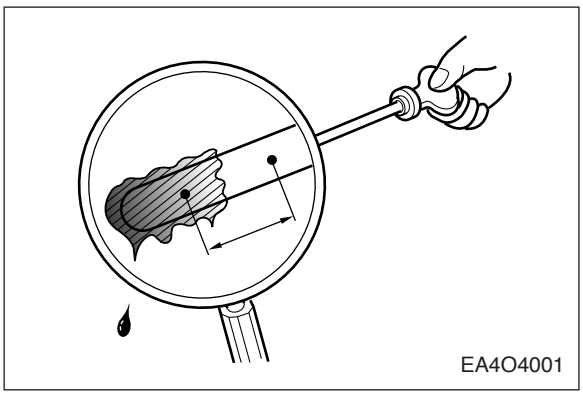
5.2.1. Exchanging of lubrication oil

Engine oil and the oil filter are important factors affecting engine life. They affect ease of starting, fuel economy, combustion chamber deposits and engine wear. Refill and drain oil pan every 50 hours of operation or 6 months whichever occurs first. At the end of the break-in period (50 hours), change the oil sump oil and replace the oil filter.

5.2.2. Oil level

Check the oil level in the engine sump daily with a dipstick.

- The notches in dipstick must indicate the oil level between the max. and the min. permissible.
- The oil level should be checked with the engine horizontal and only after it has been shut down for about 5 minutes.
- Examining the viscosity and the contamination of the oil smeared at the dipstick replace the engine oil if necessary.

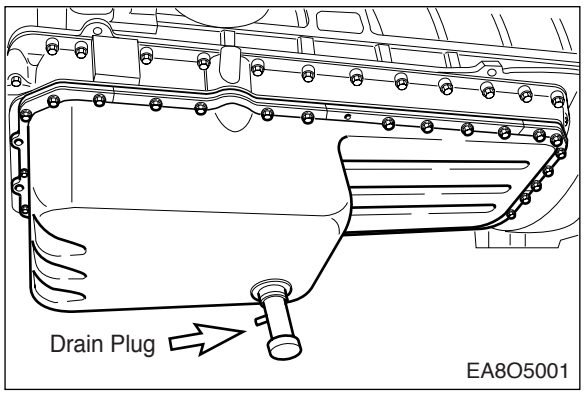


Caution : Do not add so much engine oil that the oil level rises above the max. marking on the dipstick. Over lifting will result in damage to the engine.

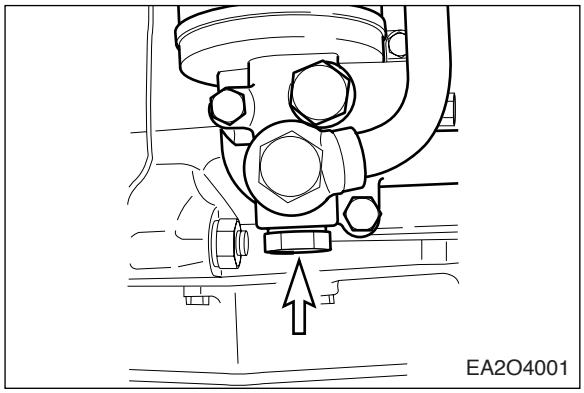
5.2.3. Oil exchange procedure

While the oil is still hot, exchange oil as follows:

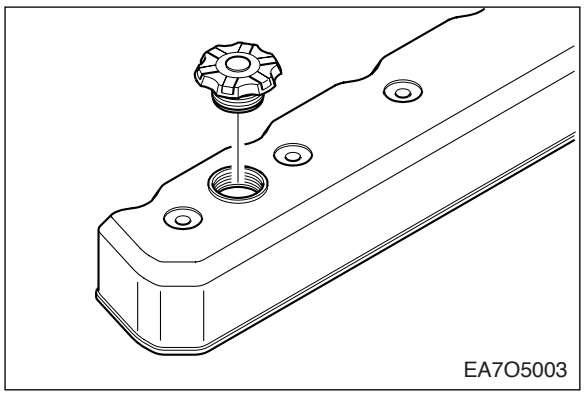
- Take out the oil dip dipstick.
- Remove the drain valve from oil pan and the drain plug form oil filter head, then drain out the engine oil into a container.



- Reassemble the drain valve with the oil pan and the drain plug with oil filter head after draining out the engine oil.



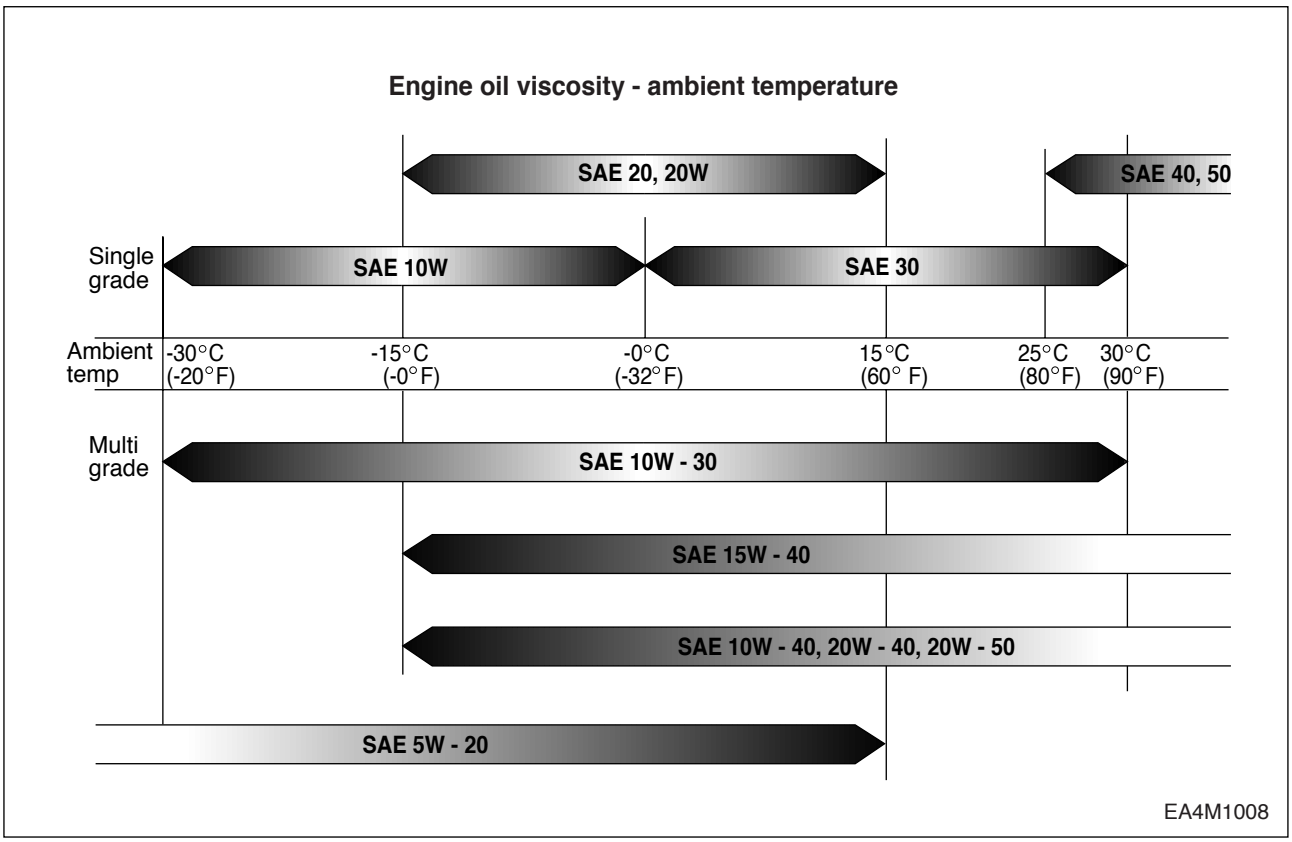
- Refill with new engine oil at the oil filler neck on the head cover and the lubricating oil in accordance with the oil capacity of the engine through oil filler. Be careful about the mixing of dust or contaminator during the supplement of oil. Then confirm that oil level gauge indicates the vicinity of its maximum level.
- For a few minutes, operate the engine at idling in order to circulate oil through lubrication system.



- Thereafter shut down the engine. After waiting for about 10 minutes measure the quantity of oil and refill the additional oil if necessary.

- **Recommend of lubricating oil**

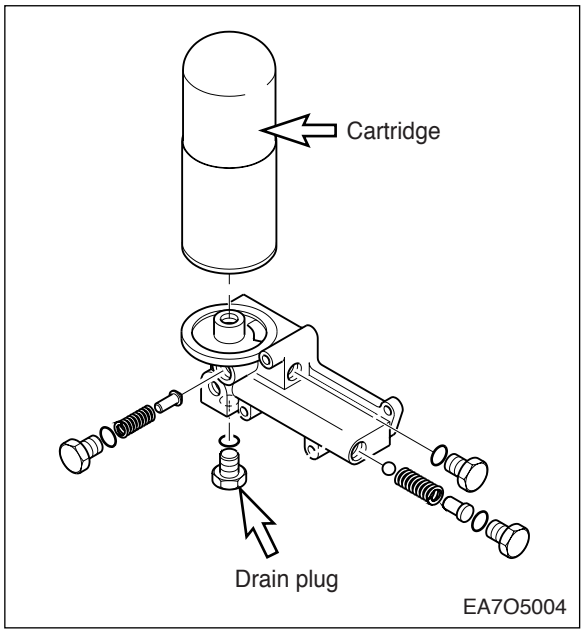
Initial factory filling is high quality break-in oil (API Service CH-4 grade). During the break-in period (50 hours), check the oil level frequently. Somewhat higher oil consumption is normal until piston rings are seated. The oil level should be maintained in the safe range between Min. and Max. mark on the dipstick. To obtain the best engine performance and engine life, Engine oil is specified by API Service, lettered designations and SAE viscosity numbers. If the specified engine oil is not available, use a reputable brand of engine oil labeled for API Service CH-4 and SAE viscosity 15W40 or 10W40. Refer to oil identification symbol on the container.



5.2.4. Replacement of oil filter cartridge

At the same times of oil exchanges, replace the oil filter cartridge.

- Drain engine oil by loosening the drain plug on the filter head.



Caution : Don't forget tightening the drain plug after having drained engine oil.

- Loosen the oil filter by turning it counter-clockwise with a filter wrench.
- With a rag wipe clean the fitting face of the filter body and the oil filter body so that new oil filter cartridge can be seated properly.
- Lightly oil the O-ring and turn the oil filter until sealing face is fitted against the O-ring. Turn 1-1/4 turns further with the filter wrench.

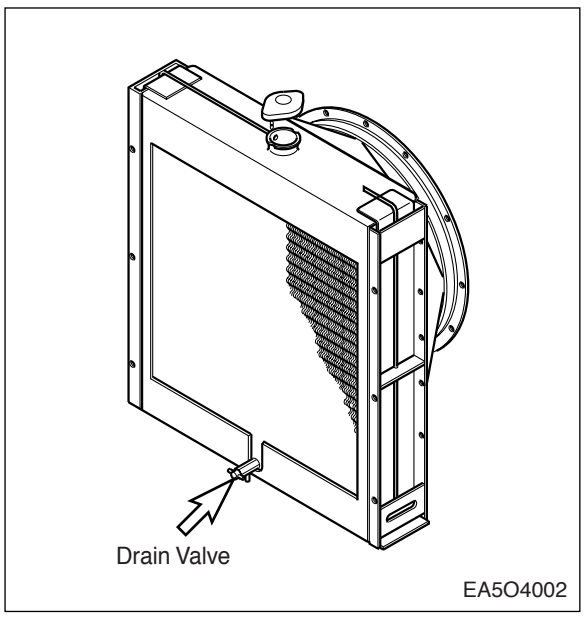
Note : It is strongly advisable to use DAEWOO genuine oil filter cartridge for replacement.

5.3. Cooling System

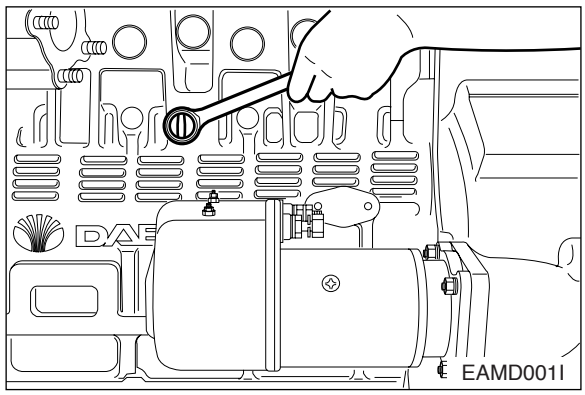
The coolant must be changed at intervals of 1,200 hours operation or six months whichever comes first. If the coolant is being fouled greatly, it will lead an engine overheat or coolant blow off from the expansion tank.

5.3.1. Coolant draining

a) Remove the pressure cap.
b) Open the drain valve at the radiator lower part to drain the coolant as the right figure.



c) Loosen the coolant drain plug.
Loosen the coolant drain plug of the cylinder block.



Caution : When removing the pressure filler cap while the engine is still hot, cover the cap with a rag, then turn it slowly to release the internal steam pressure This will prevent a person from scalding with hot steam spouted out from the filler port.

5.3.2. Cleaning of the cooling system inside circuit (by authorized specialist personnel)

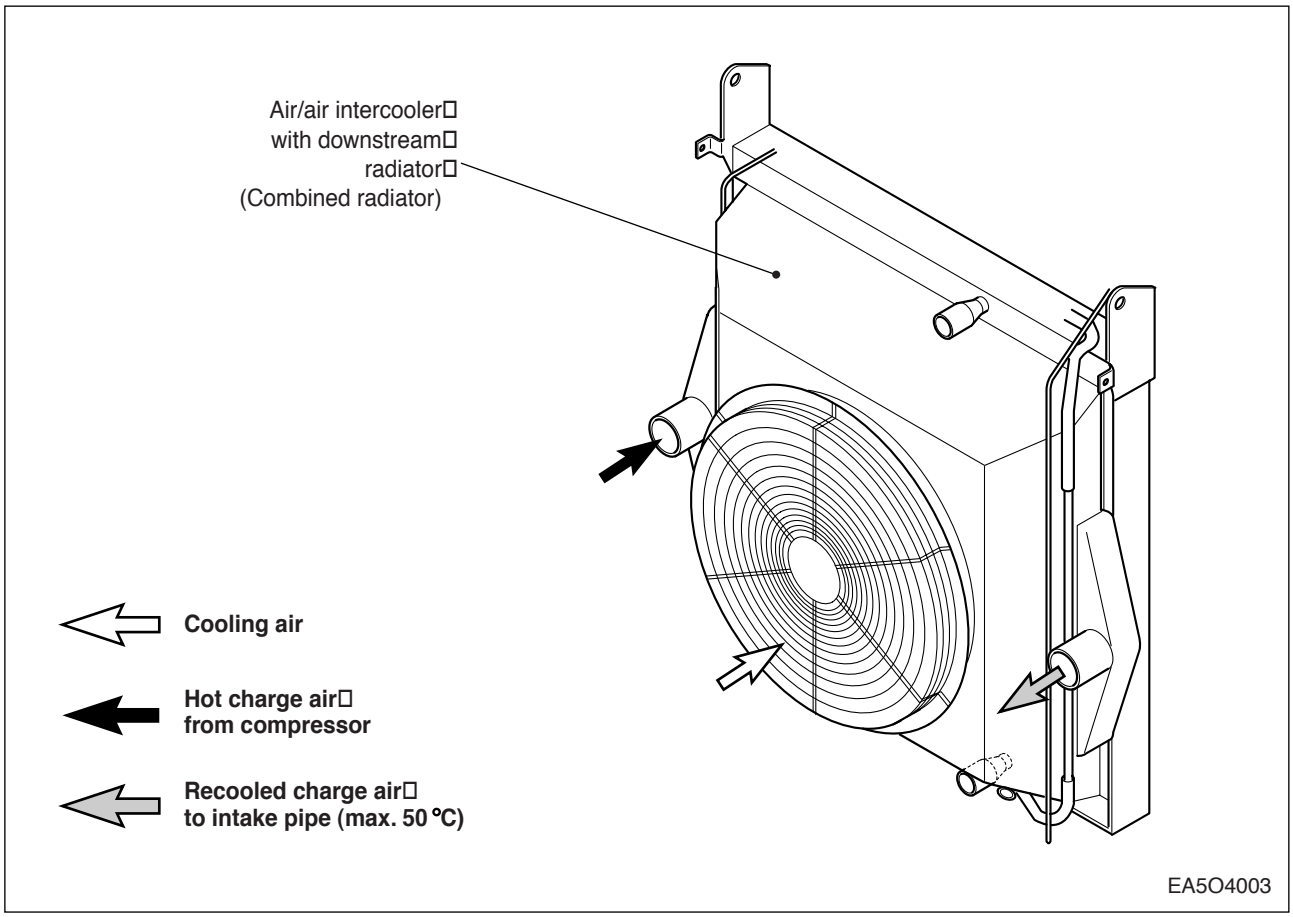
When the cooling system circuits are fouled with water scales or sludge particles, the cooling efficiency will be lowered.
Investigations have shown that in many cases the poor condition of the coolant and /or the cooling system accounts for damage to the water pump mechanical seal, The poor condition of the cooling system is normally due to use of unsuitable or no anti-freezing agents and corrosion inhibitor or defect, not early enough replaced covers for filler neck and working valves.
If twice in a short time the water pump of an engine develops leases or the coolant is heavily contaminated (dull, brown, mechanically contaminated, gray or black signs of a leakage on the water pump casing) clean the cooling system prior to removing that water pump as follows.

a) Drain coolant.
b) Remove thermostats, so that the whole cooling system is immediately flown through when cleaned.
c) Fill the cooling system with a mixture of potable water and 1.5% by volume of cleaner. (Henkel P3T5175)
d) Warm up engine under load. After a temperature of 60˚C is reached, run engine for a further 15 minutes.
e) Drain cleaning fluid.
f) Repeat steps c) and d).
g) Flush cooling system.
h) Replace drain plug by drain plug with a bore of 8mm diameter.
i) Fill cooling system with hot water.
j) Run engine at idle for 30 minutes. At the same time continuously replenish the water leaking from the bore in drain plug by adding fresh water.

Periodically clean the circuit interior with a cleaner.
- Cooling system cleaning interval: Every 1,200 hours.

5.3.3. Intercooler

The intercooler is air to air type and has a large cooling fan capacity. The intercooler life and performance depends on the intake air condition greatly. Fouled air pollutes and clogs the air fins of intercooler. As a result of this, the engine output is decreased and engine malfunction is occurred. So you always check whether the intake air systems like air filter element are worn or polluted.



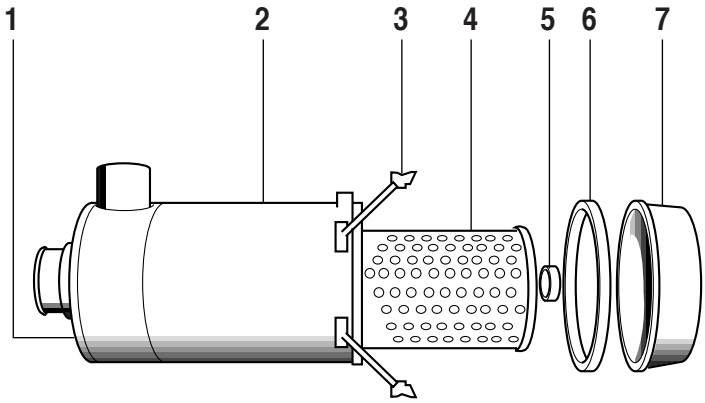
- **Cleaning**

  In order to maintain the heat transfer efficiency of the intercooler, it is necessary to clean it at regular intervals.

Cleaning of intercooler fins : Every 600 hours.

5.4. Air Intake System

1. Connection port, fouling indicator
2. Cleaner housing
3. Clamp
4. Element
5. Hexagon nut
6. Cover
7. Dust bowl



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5.4.1. Maintenance (only when engine is switched off)

Empty the dust bowl (7) regularly. The bowl should never be filled more than halfway with dust. On slipping off the two clamps (3), the dust bowl can be removed. Take off the cover (6) of the dust bowl and empty.

Be careful to assemble cover and bowl correctly.

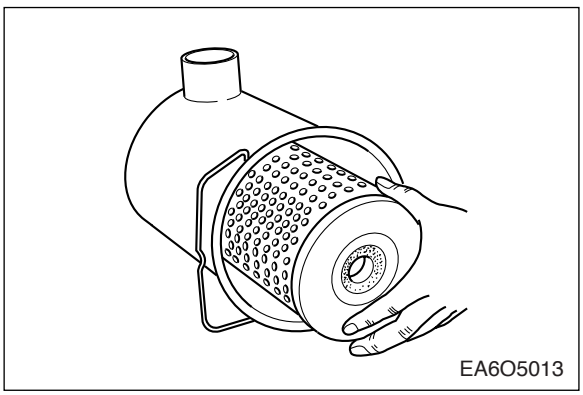
There is a recess in the cover rim and a lug on the collector which should register. Where the filter is installed horizontally, watch for “top” mark on cleaner bowl.

5.4.2. Changing filter element

Caution : Do not allow dirt to get into the clean air end.

On removing the hexagon nut, take out the dirty cartridge and renew or clean.

Wipe the cleaner housing with a damp cloth, in particular the sealing surface for the element.



EA6O5013

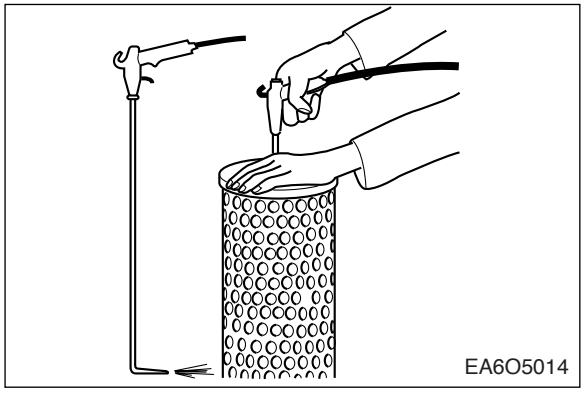
Notice : Unless the maximum number of cleanings (up to 5 x) have been done, the filter cartridge should be renewed every two years or 4,000 hours operation.

5.4.3. Cleaning filter elements

- **By compressed air (Wear goggles)**

For the purpose, the air gun should be fitted with a nozzle extension which is bent 90˚ at the discharge end and which is long enough to reach down inside to the bottom of the element.

Moving the air gun up and down, blow out the element from the inside (maximum 500kPa - 5 bar) until no more dust comes out of the filter pleats.



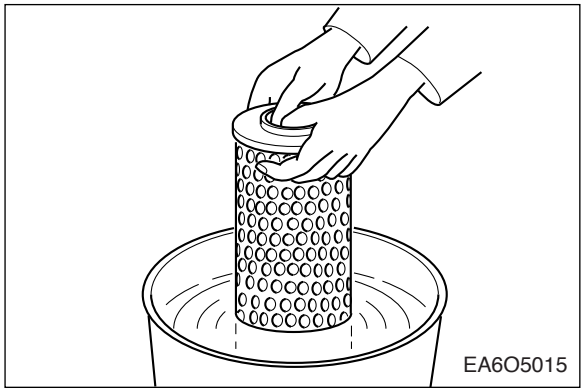
- **By washing**

Before washing, the element should be precleaned by means of compressed air, as described above.

Then allow the element to soak in lukewarm washing solvent for 10 minutes, and then move it to and for in the solvent for about 5 minutes.

Rinse thoroughly in clean water, shake out and allow drying at room temperature. The cartridge must be dry before it is reinstalled.

Never use steam sprayers, petrol (gasoline), alkalis or hot liquids etc. to clean the filter elements.



- **Knocking out dirt by hand**

In emergencies, when no compressed air or cleaning agent is available, it is possible to clean the filter cartridge provisionally by hitting the end disk of the cartridge with the ball of one's thumb.

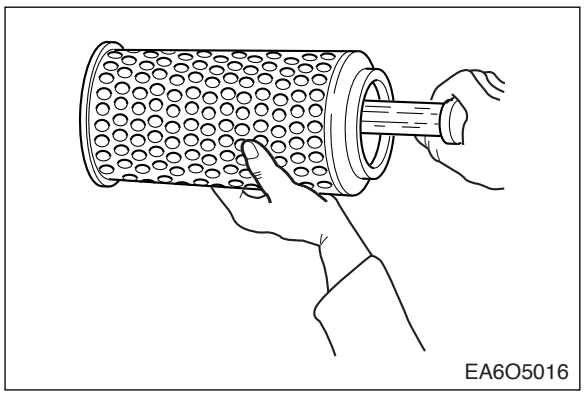
Under no circumstances should the element be hit with a hard object or knocked against a hard surface to loosen dirt deposits.

- **Checking the filter cartridge**

Before reinstalling the cartridge, it must be checked for damage e.g. to the paper pleats and rubber gaskets, or for bulges and dents etc. in the metal jacket.

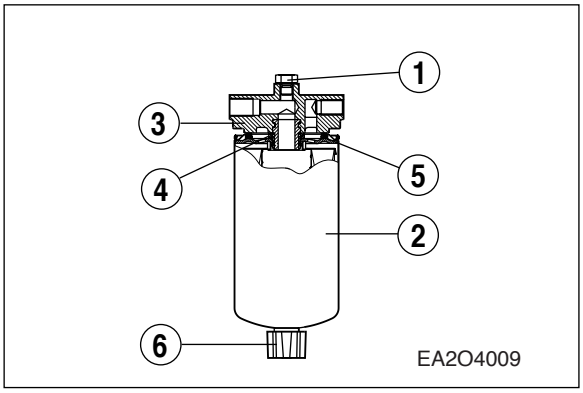
Cracks and holes in the paper pleating can be established by inspecting the cartridge with a flashlight.

Damaged cartridges should not be reused under any circumstances. In cases of doubt, discard the cartridge and install a new one.



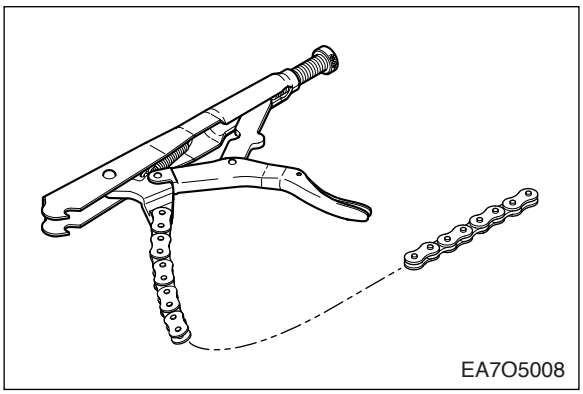
5.5. Fuel System

5.5.1. Fuel filter



- After every 200 hour of operation, drain the water and sediment from the fuel-water separator.
- Shut off the engine. Use your hand to open the drain valve ⑥ .
- Turn the valve counter clockwise approximately 2 ~ 3 turns until draining occurs. Drain the filter sump of water until close fuel is visible.
- Turn the valve clockwise to close the drain valve. Do not over tighten the valve, over-tightening can damage the threads.

5.5.2. Replacement of fuel filter



- Clean the area around the fuel filter head ③ .
- Remove the fuel filter ② by turning it counter-clockwise with filter wrench. (Discard the used filter.)
- Remove the fuel filter thread adapter seal ring ④ .
- Use a clean lint free cloth to clean the gasket surface of the fuel filter head ③ .
- Install the new thread adapter seal ring ④ supplied with the new filter.
- Use clean oil to lubricate the filter seal ⑤ , and fill the new filter with clean fuel.
- Install the filter on the filter head ③ .
- Tighten the filter until the gasket contacts the filter head surface.
- Tighten the filter on additional one-half to three-fourths of a turn with the filter wrench, on as specified by the filter manufacturer.

Notice : Mechanical over tightening of the filter can distort the thread or damage the filter element seal.

5.5.3. Fuel system checks

Fill the tank with the recommended fuel. Keeping tanks full reduces water condensation and helps keep fuel cool, which is important to engine performance.
Make sure fuel supply valves (if used) are open.
To insure prompt starting and even running, the fuel system must be primed with the fuel feed pump manually before starting the engine the first time, or after a fuel filter change.
Refill at the end of each day's operation to prevent condensation from contaminating the fuel. Condensation formed in a partially filled tank promotes the growth of microbial organisms that can clog fuel filters and restrict fuel flow.

If the engine is equipped with a fuel water separator, drain off any water that has accumulated. Water in fuel can seriously affect engine performance and may cause engine damage. **DAEWOO recommends installation of a fuel water separator on generator units.**

- **Air removal of fuel system**
  The suction room of fuel injection pump has the function of air removal continuously during the operation through a relief valve.
  In case that the suction room lacks fuel at all, for instance, in case of new installation of injection pump, after loosening the air removing screws of cartridge filter respectively, remove the air by operating the manual pump of fuel supply pump until bubble will disappear.

- **Fuel supply pump**
  Every time of engine oil replacement, the fuel strainer installed at the fuel supply pump should be removed and cleaned.

5.5.4. Fuel Contamination and water trap

In the generator environment, the most likely fuel contaminants are water and microbial growth (black "slime"). Generally, this type of contamination is the result of poor fuel handling practices.
Black "slime" requires water in the fuel to form and grow, so the best prevention is to keep water content to a minimum in storage tanks.
If diesel fuel which contains moisture is used the injection system and the cylinder liners / pistons will be damaged. This can be prevented to same extent by filling the tank as soon as the engine is switched off while the fuel tank is still warm (formation of condensation is prevented).
Drain moisture from storage tanks regularly. Installation of a water trap upstream of the fuel filter is also advisable.

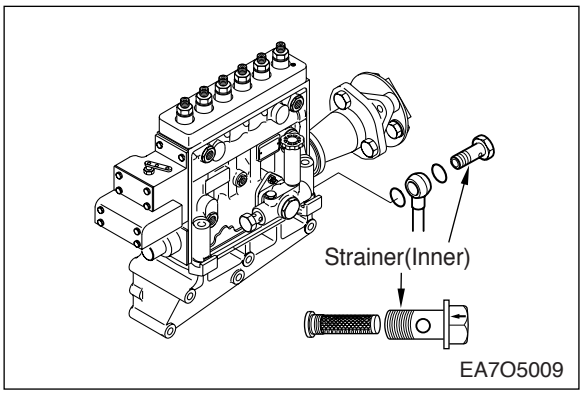
Notice : A galvanized steel tank should never be used for fuel storage, because the fuel oil reacts chemically with the zinc coating to form powdery flakes which can quickly clog the fuel filters and damage the fuel pump and injection nozzles.

5.5.5. Priming pump strainer cleaning

Clean the priming pump strainer every 200 operation hours.

The strainer is incorporated in the priming pump inlet side joint bolt.

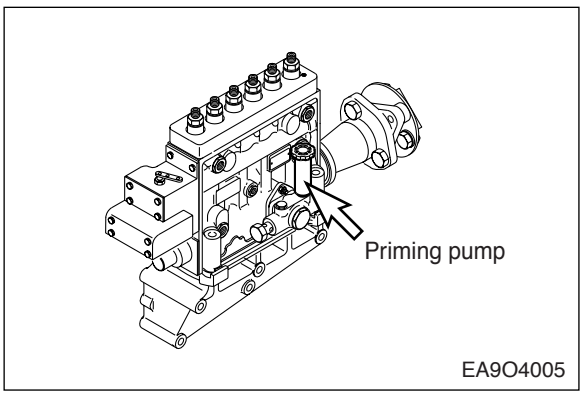
Clean the strainer with the compressed air and rinse it in the fuel oil.



5.5.6. Bleeding the fuel system

Whenever fuel filter is changed or the engine is stopped by cause of the fuel lack, the air of fuel line must be removed as follows.

Bleed the fuel by manually operating the priming pump with fuel filter outlet joint bolt and injection pump bleeder screw loosened.



- Press the feed pump cap repetitively until the fuel without bubbles overflows from the bleeding plug screw.
- After the whole air is pulled out, close the plug screws of the filter and the pump.
- Confirm the resistance of fuel delivery by repetition pressing of the feed pump cap, Pressure and turn the priming pump cap simultaneously to close it.

5.5.7. Injection pump

- Check the fuel injection pump housing for cracks or breaks, and replace if damaged.
- Check and see if the lead seal for idling control and speed control levers have not been removed.
- No alterations must be made to the injection pump. If the lead seal is damaged the warranty on the engine will become null and void.
- We strongly recommended that any faults developing in the injection pump should be taken care of by authorized specialist personnel.

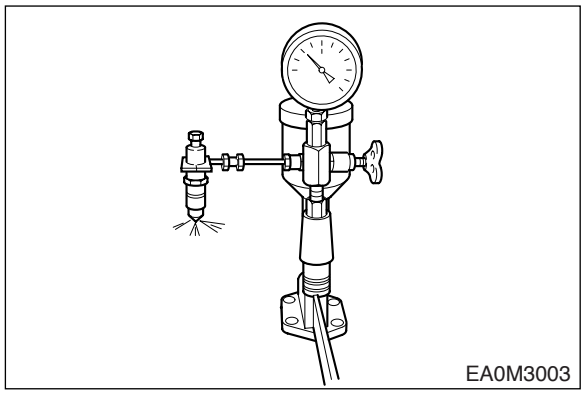
5.6. Injection Nozzle Maintenance (by authorized specialist personnel)

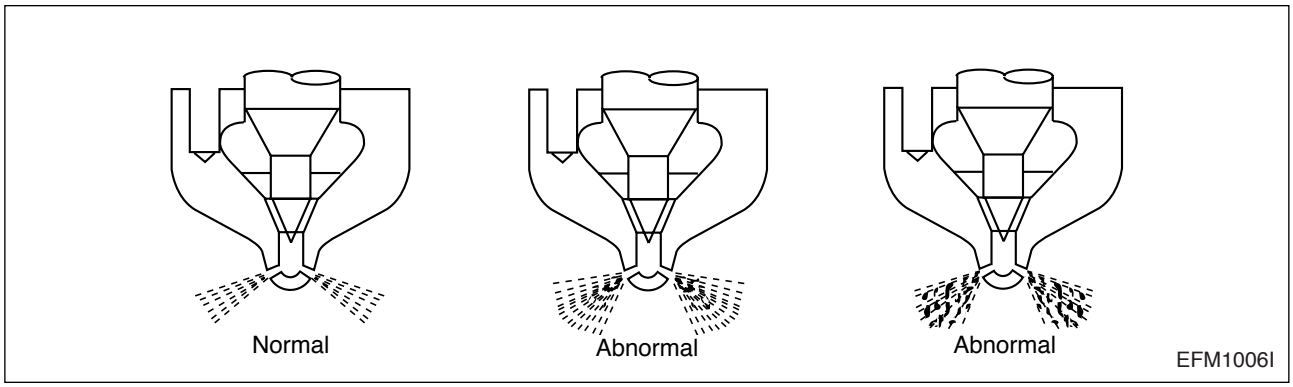
The injectors are designed to spray the fuel delivered by the injection pump directly into the spherical combustion chamber in the piston crown.

The injector consists of the nozzle and the nozzle holder.

A copper seal fitted to the injector ensures gas-tight seating and good heat dissipation.

The opening pressure of the nozzle is adjusted by means of shims at the compression spring.





- Install a nozzle to a nozzle tester.
- Check injection pressure, and adjust the nozzle using the adjusting shim if the pressure does not meet the specified limit.
- Check nozzle spray patterns and replace if damaged.

	DE12T	P126TI / P126TI-Ⅱ
Opening pressure	220kg/cm^2	1st : 160kg/cm^2 2nd : 220kg/cm^2

Caution : The injection lines are designed for high operating pressures and should thus be handled with particular care.

- When mounting the pipes to the engine take care of good fitness.
- Do not bend pipes to permanent deformation (not for replacing the nozzles either).
- Do not mount any heavily bent pipes.
- Avoid bending the pipes at the ends by more than 2 to 3 degrees.

In case of faults in the injection system which might have resulted in excessive operating pressures, not only the failed part but also the injection line has to be replaced.

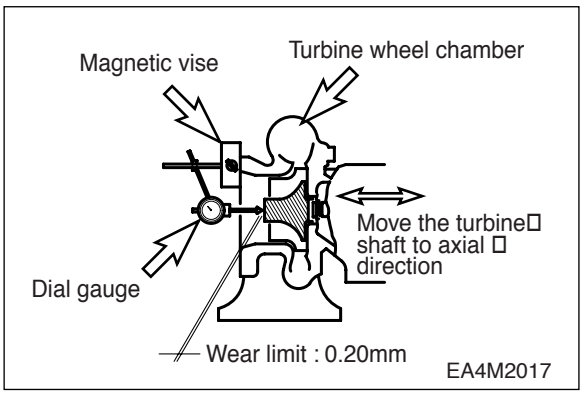
5.7. Turbocharger

5.7.1. Maintenance (by authorized specialist personnel)

The turbochargers do not call for any specific maintenance.
The only points to be observed are the oil pipes which should be checked at every oil change for leakage and restrictions.
The air cleaners should be carefully serviced.
Furthermore, a regular check should be kept on charge air exhaust gas pipes. Any leakages should be attended to at once because they are liable to cause overheating of the engine.
When operating in highly dust or oil-laden atmospheres, cleaning of the air impeller may be necessary from time to time. To this end, remove compressor casing (**Caution : Do not skew it!**) and clean in a non-acid solvent, if necessary using a plastic scraper.
If the air compressor should be badly fouled, it is recommended that the wheel be allowed to soak in a vessel with solvent and to clean it then with a stiff brush. In doing so, take care to see that only the compressor wheel is immersed and that the turbocharger is supported on the bearing casing and not on the wheel.

5.7.2. Special hints

It is recommended that the radial and axial clearances of the rotor be checked after every 3,000 hours operation.
This precaution will enable any wear of the Measuring of axial clearance bearings to be detected in good time before serious damage is caused to the rotor and bearings.

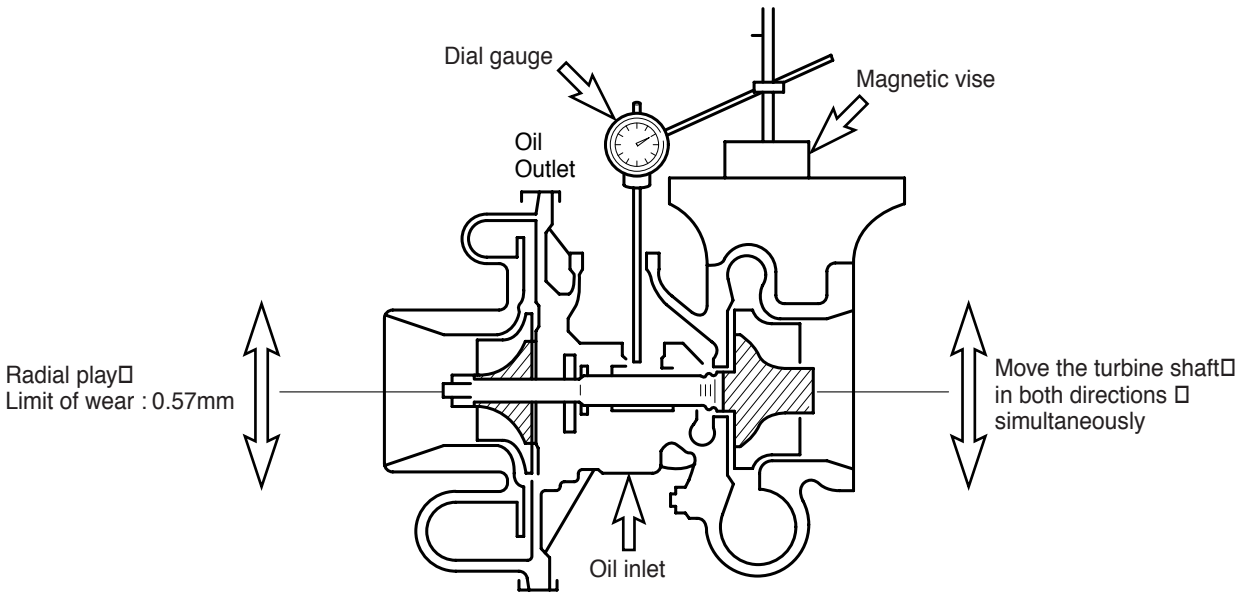


• Measuring rotor axial clearance

Axial clearance	0.2 mm

• Measuring radial clearance

Radial clearance	0.65 mm


Dial gauge
Magnetic vise
Oil
Outlet
Radial play
Limit of wear : 0.57mm
Move the turbine shaft
in both directions
simultaneously
Oil inlet

EA4M2018

6. Checking and Setting

6.1. Adjustment of Valve Clearance

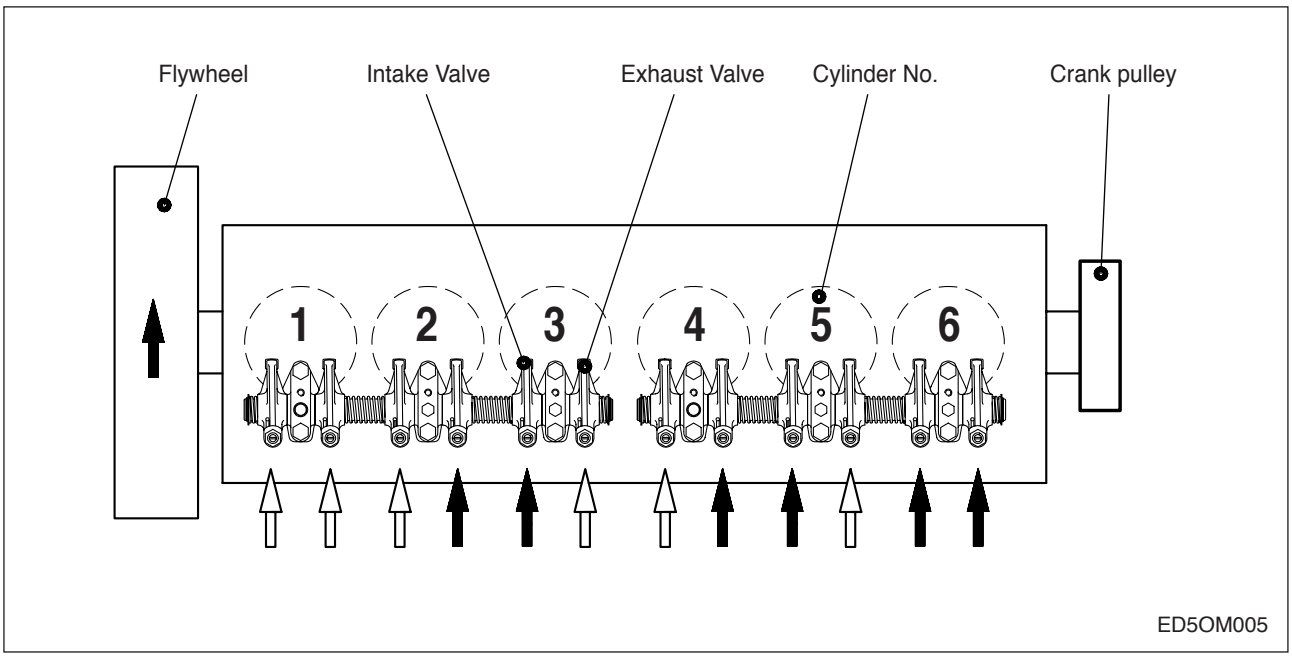
6.1.1. General information

The valve clearances are to be adjusted at the times of the following situations.

- After initial 50 hour's operation.
- When the engine is overhauled and the cylinder heads are disassembled.
- When severe noise comes from valve train.
- When the engine is not normally operated, even though there is no trouble in the fuel system.

6.1.2. Adjusting order of the valve clearance

- Cylinder No. 1 begins from the rear side where the flywheel is mounted but cylinder No. 6 begins from the front side of the engine on the contrary.



Step 1:

- After letting the cylinder No.6 in the overlap TDC position by turning the crankshaft, adjust the valves corresponding to " ⇧ " of following figure. At this time cylinder No. 1 should be at the ignition TDC position(O.T).

Step 2:

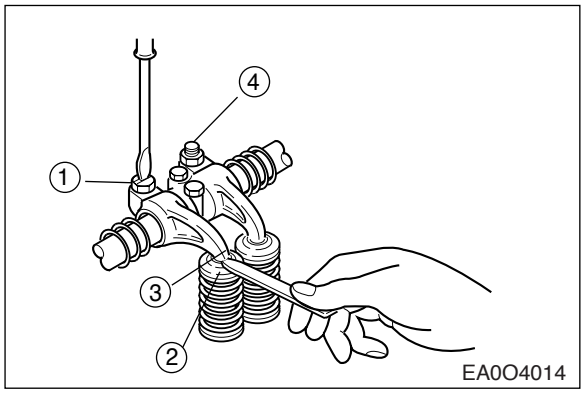
- After adjusting upper valves turn the crank pulley 360˚ to adjust the other valve clearance until the cylinder No. 1 comes to overlap TDC position.
  At this time cylinder No. 6 should be at the ignition TDC position(O.T).
- Adjust the valves corresponding to " ⇧ " in upper figure.
  After reconfirming the valve clearances, retighten it if necessary.

• Loosen the lock nuts of the rocker arm adjusting screws and push the specified feeler gauge and adjust the valve clearance with adjusting screw respectively.

Model	Intake Valve	Exhaust Valve
DE12T P126TI / P126TI-Ⅱ	0.3 mm	0.3 mm

6.1.3 Method of adjusting the valve clearance

1) Loosen the lock-nuts ① using a ring spanner.
2) Insert a thickness gauge of 0.3mm between valve stem ② and rocker arm ③.
3) Turn the adjusting bolts ④ using a screw driver until the gauge can be pulled out with some restriction.
4) After the adjustment fix the adjusting bolt not to rotate and tighten the lock-nut at the same time.
5) Measure the clearance one more time and if necessary adjust again.

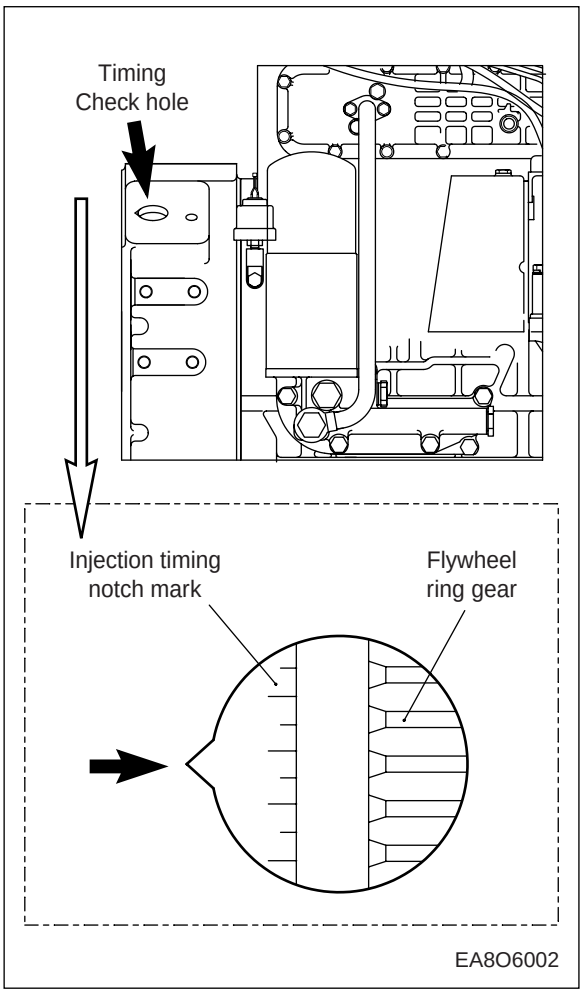


6.2. Adjustment of Injection Timing

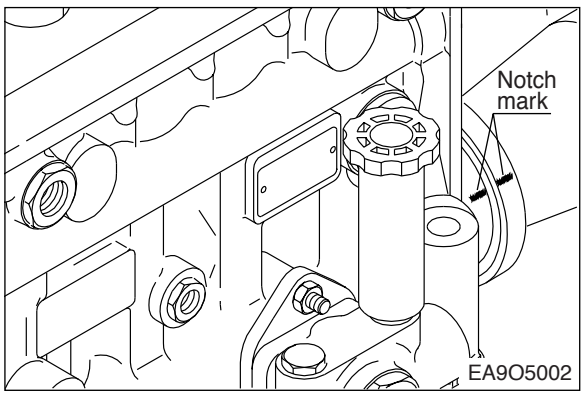
6.2.1. Method of adjusting injection timing

- Turn the flywheel until No. 1 piston is placed in the “OT” position of notch marks on the flywheel, and then turn again the flywheel clockwise until showing the notch mark of the right figure corresponding to the injection timing is aligned with the pointer (↓) on the flywheel housing.

	DE12T	P126TI/P126TI-Ⅱ
Fuel injection timing (B.T.D.C static)	12°	16°

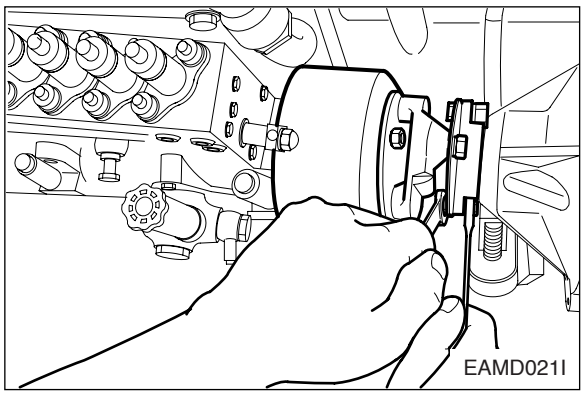


- Turn the timer until the notch mark of the indicator plate attached to the fuel injection pump is aligned with the notch mark of the timer.



• Tighten the coupling fixing bolts and nuts to specified torque.

Torque	6.0 kg·m



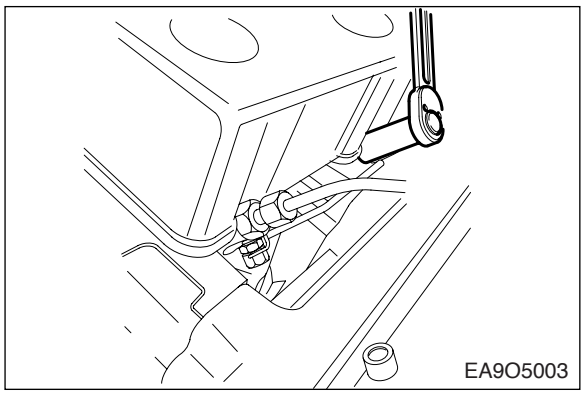
• Tighten the drive shaft connecting flange fixing bolts to specified torque.

Torque	7.5 ~ 8.5 kg·m

• Install the oil delivery pipe and return pipe.

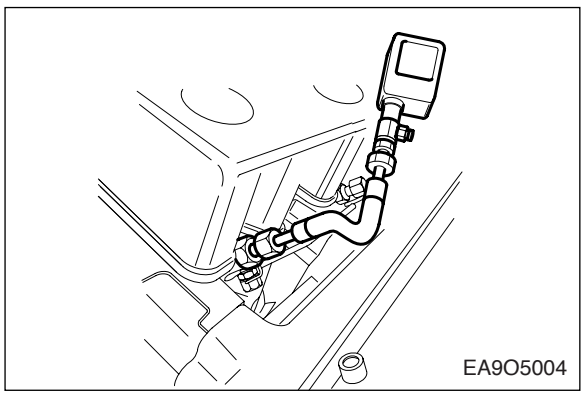
6.3. Cylinder Compression Pressure

1) Stop the engine after warming it up, then remove the nozzle assemblies.



2) Install a special tool (gauge adapter) in nozzle holder hole and connect the compression pressure gauge to the adapter.

3) Cut off fuel circulation, rotate the starter, then measure compression pressure of each cylinder.



Standard value	25~28 kg/cm²
Limit	24 kg/cm² or less
Difference between each cylinder	Within ± 10%

- Testing conditions : at water temperature of 20 °C and speed of 200 rpm (10 turns)

6.4. V-belts

The tension of the V-belts should be checked after every 2,000 hours of operation.

(1) Change the V-belts if necessary

If in the case of a multiple belt drive, wear or differing tensions are found, always replace the complete set of belts.

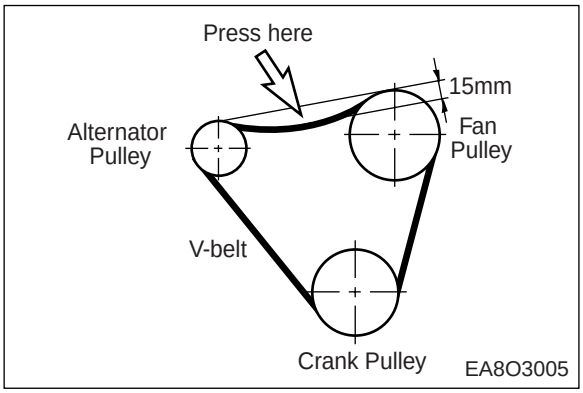
(2) Checking condition

Check V-belts for cracks, oil, overheating and wear.

(3) Testing by hand

The tension is correct if the V-belts can be pressed in by about the thickness of the V-belt. (no more midway between the belt pulleys)

A more precise check of the V-belt tension is possible only by using a V-belt tension tester.

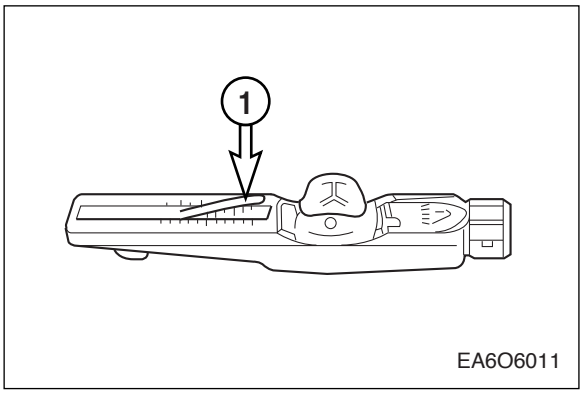


(4) Measuring tension

① Lower indicator arm (1) into the scale.

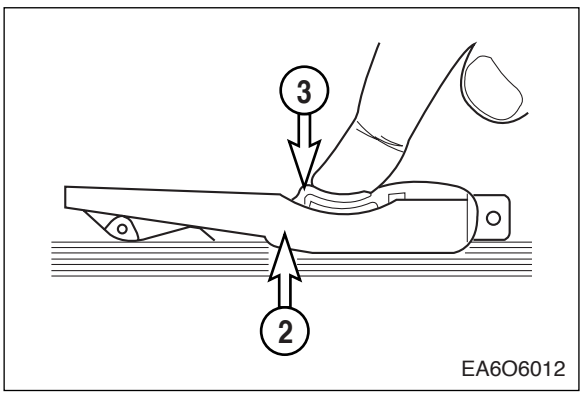
- Apply tester to belt at a point midway between two pulleys so that edge of contact surface (2) is flush with the V-belt.
- Slowly depress pad (3) until the spring can be heard to disengage. This will cause the indicator to move upwards.

If pressure is maintained after the spring has disengaged a false reading will be obtained!



② Reading of tension

- Read of the tensioning force of the belt at the point where the top surface of the indicator arm (1) intersects with the scale.
- Before taking readings make ensure that the indicator arm remains in its position.



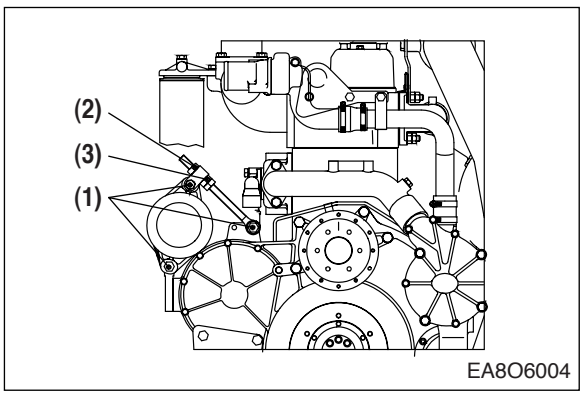
Type	Drive belt width	Tensioning forces on the tester		
		new installation		When servicing after long running time
		Installation	After 10 min. running time	
M	9.5 mm	50 kg	45 kg	40 kg
A *	**11.8 mm**	**55 kg**	**50 kg**	**45 kg**
B	15.5 mm	75 kg	70 kg	60 kg
C	20.2 mm	75 kg	70 kg	60 kg

*** : Adopted in DE12T and P126TI / P126TI-Ⅱ**

(5) Tensioning and changing V-belt

- Remove fixing bolts. (1)
- Remove lock nut. (2)
- Adjust nut (3) until V-belts have correct tensions.
- Retighten lock nut and fixing bolts.

To change the V-belts loosen mounting bolts (1) and lock nut (2) and push tension pulley inwards by turning adjusting nut (3).



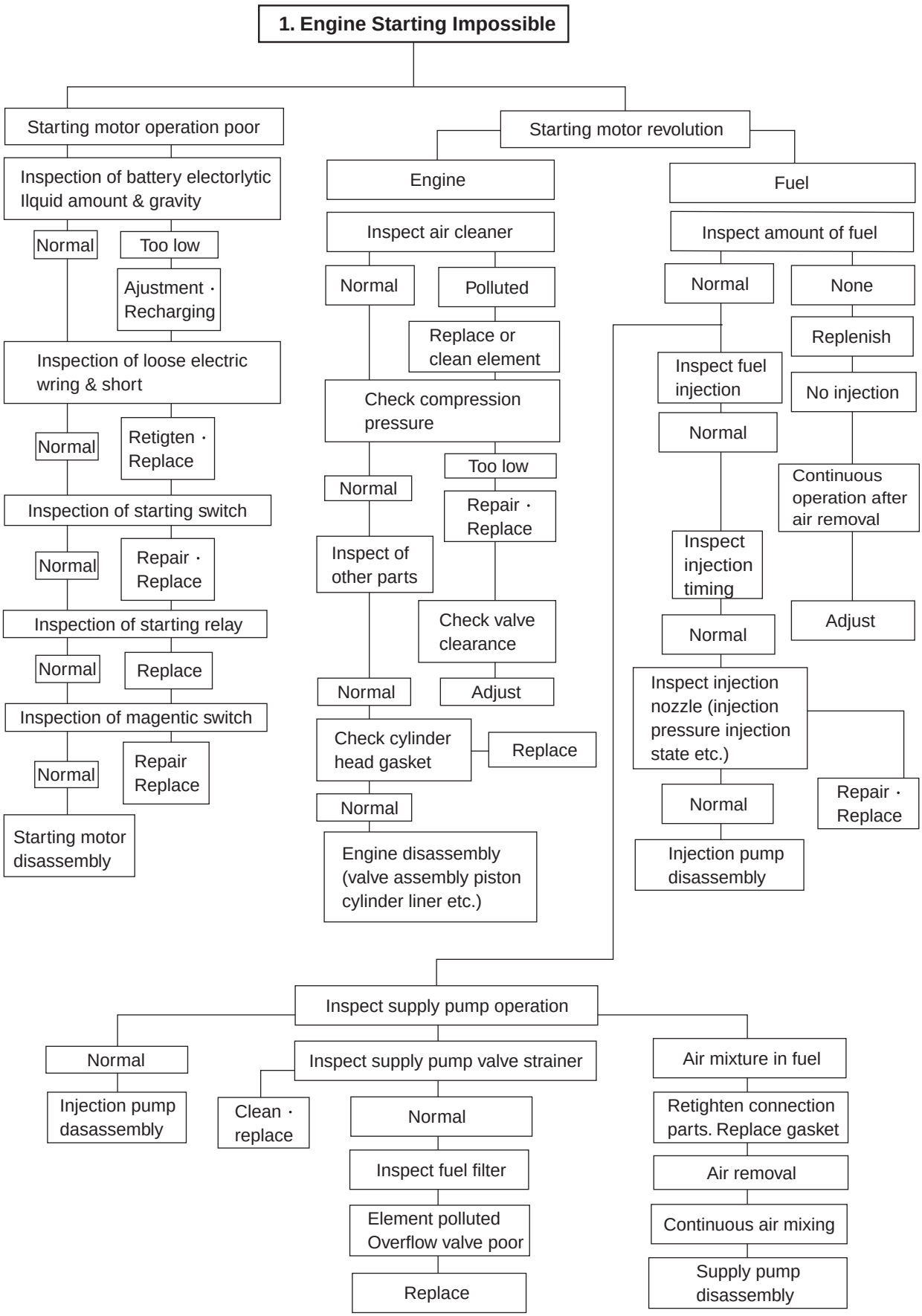
7. Operation Tip

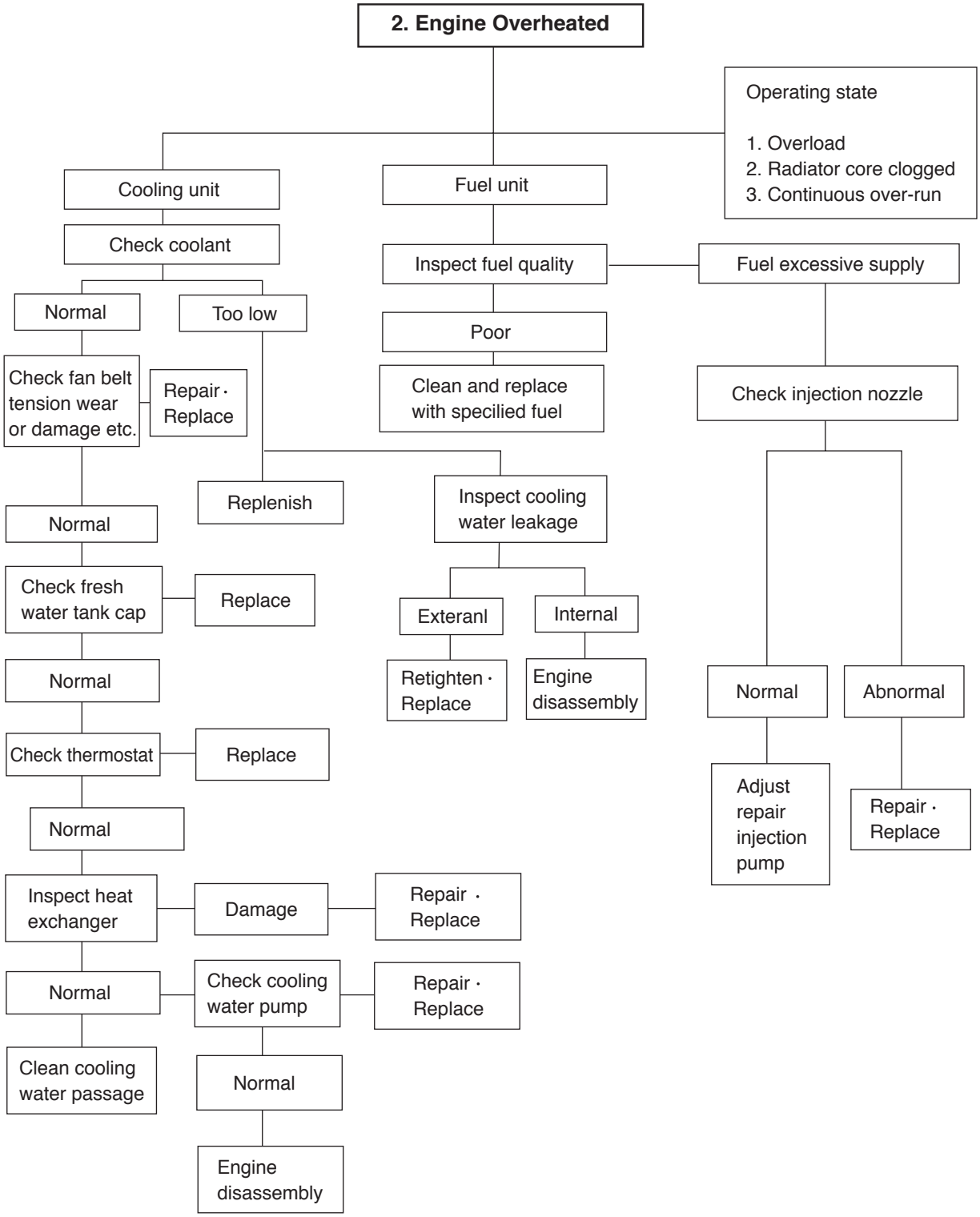
7.1. Periodic Inspection Cycle

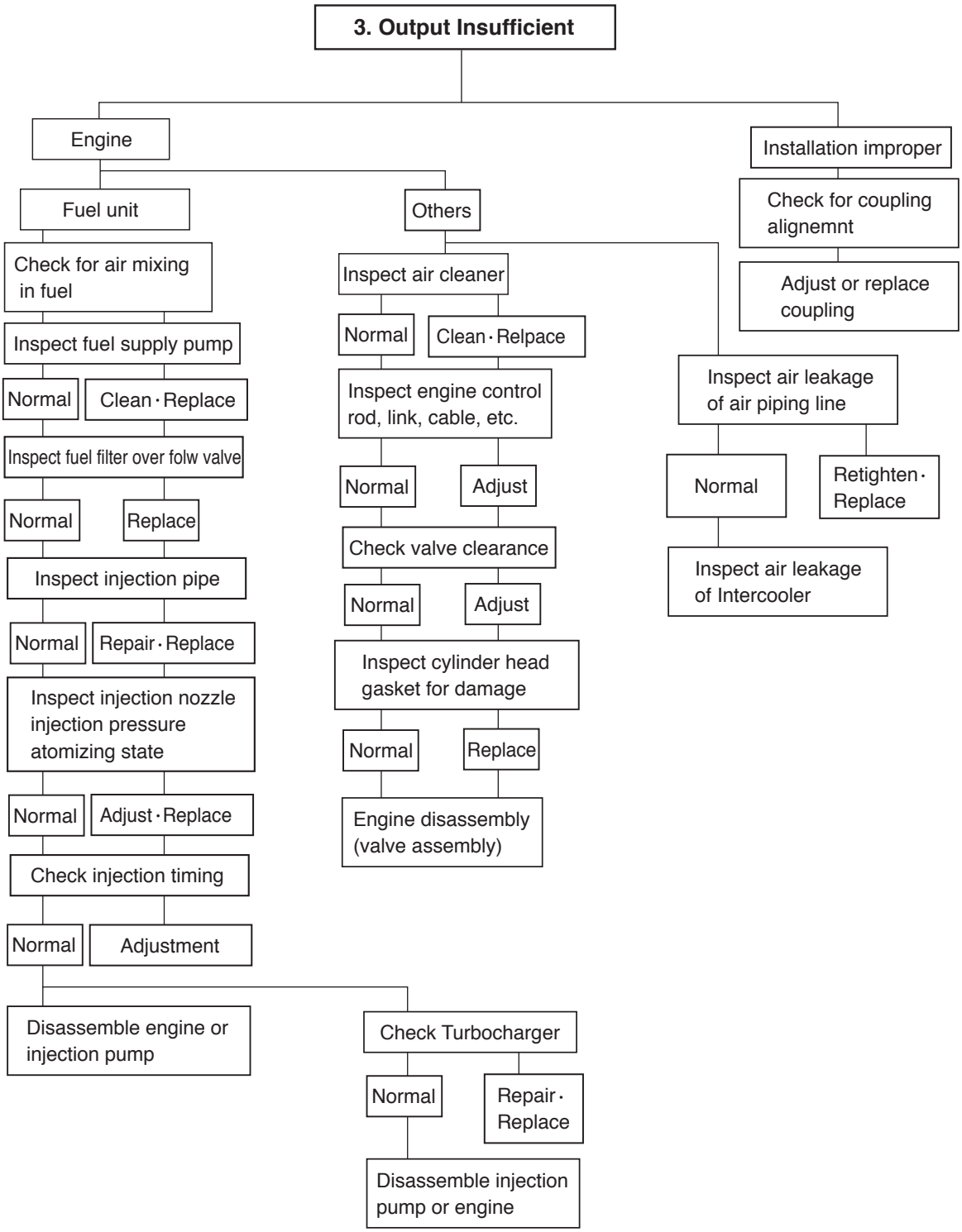
○ : Check & adjust ● : Replace

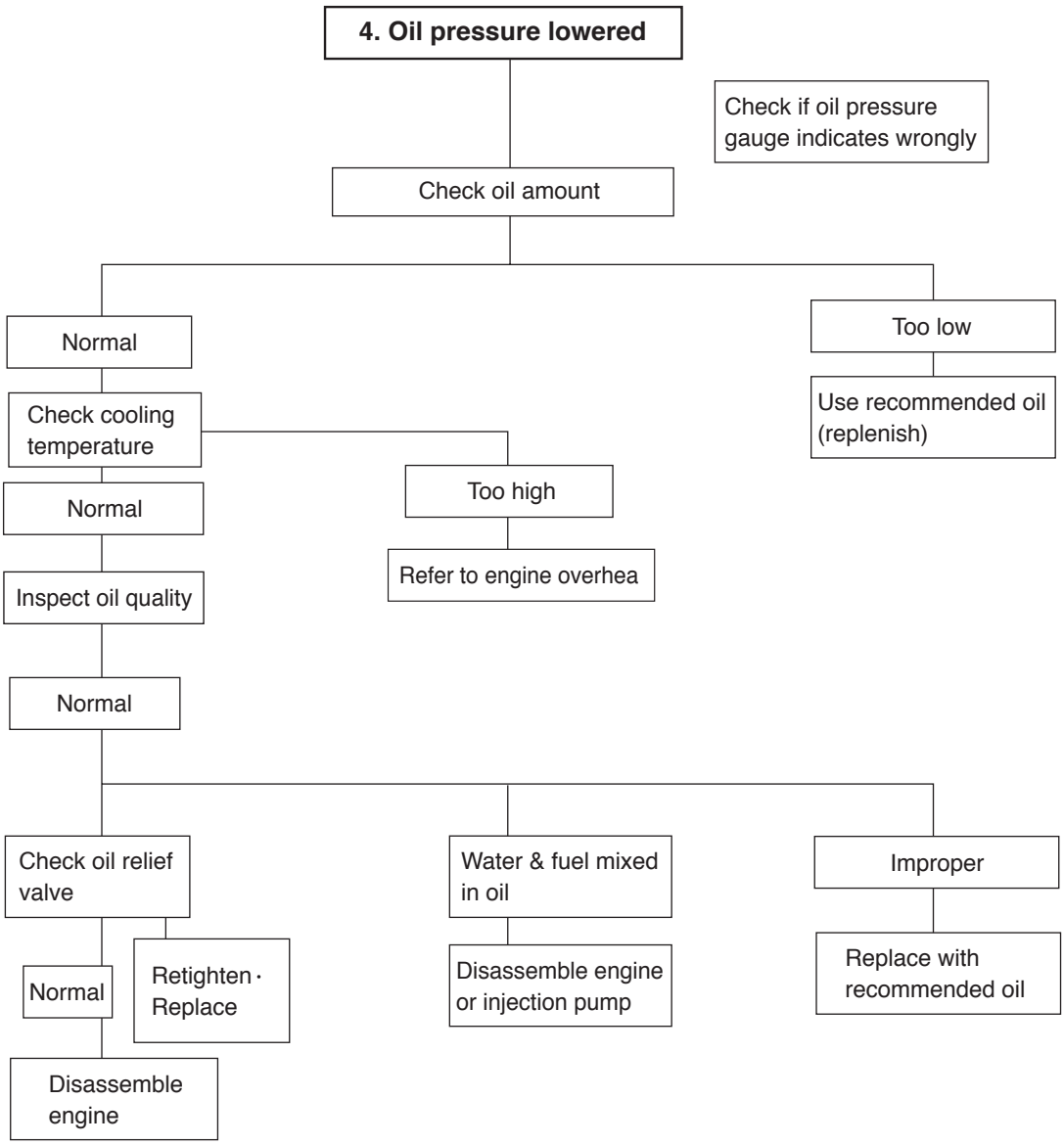
Inspection		Daily	Every 50hrs	Every 200hrs	Every 400hrs	Every 800hrs	Every 1200hrs	Remark
Cooling System	Check for leakage(hoses, clamp)	○						
	Check the water level	○						
	Change the coolant water						●	
	Adjust the V-belt tension	○						Every 2,000hrs
	Clean the radiator						○	
Lubrication System	Check for leakage	○						
	Check the oil level gauge	○						
	Change the lubricating oil		● 1st	●				
	Replace the oil filter cartridge		● 1st	●				
Intake & Exhaust System	Check the leakage for intercooler (hoses, clamp)	○						
	Clean and change the air cleaner element			○ clean	●			
	Clean the inter-cooler air fins				○			
	Clean the turbo-charger							Every 2,000hrs
Fuel System	Check the leakage fuel line	○						
	Clean the fuel strainer of fuel feed pump						○	
	Remove sediment from fuel tank						○	
	Drain the water in separator			○				
	Replace the fuel filter element				●			
	Check fuel Injection timing			○				When necessary
	Check the injection nozzles			○				When necessary
Engine Adjust	Check the state of exhaust gas	○						
	Check the battery charging	○						
	Check the compression pressure						○	When necessary
	Adjust Intake/Exhaust valve clearance		○ 1st					When necessary

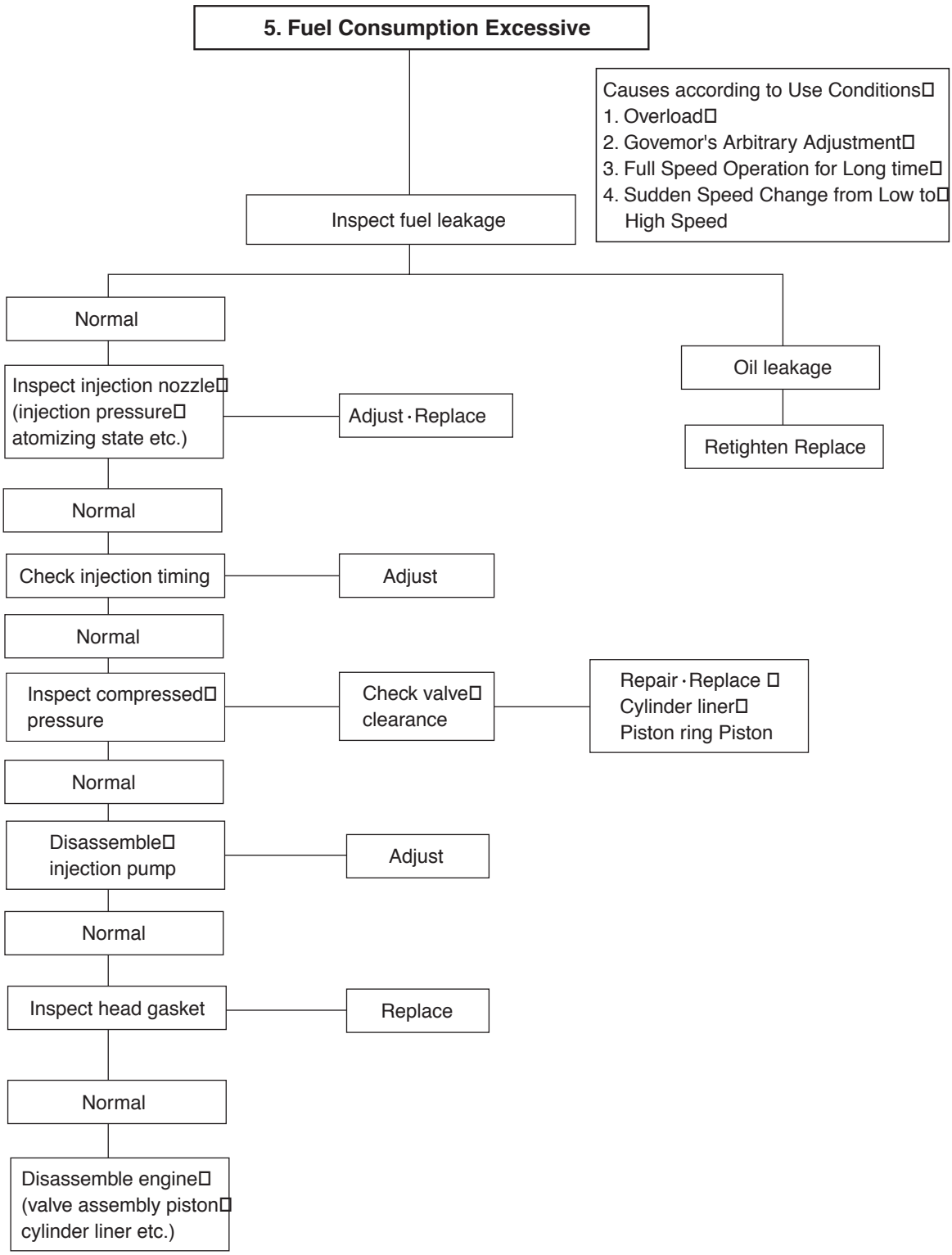
7.2. Trouble Shooting

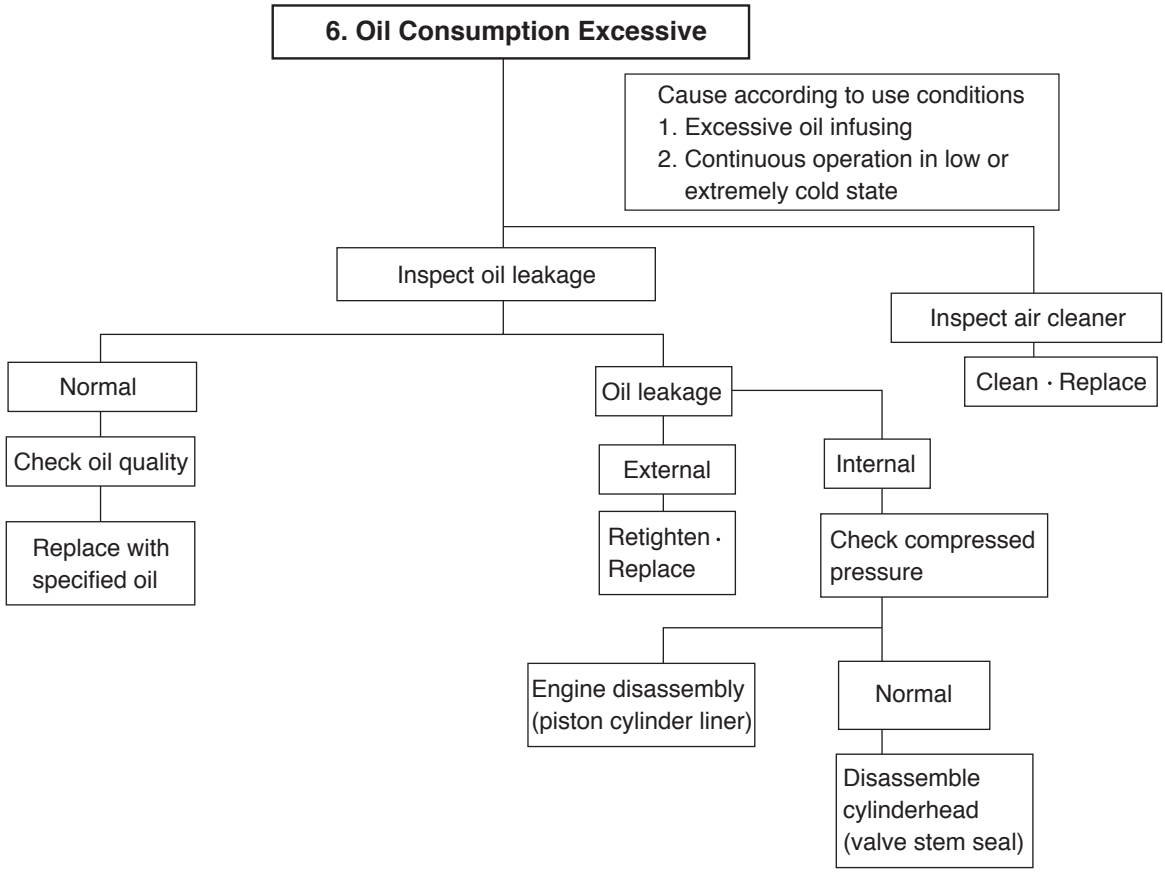


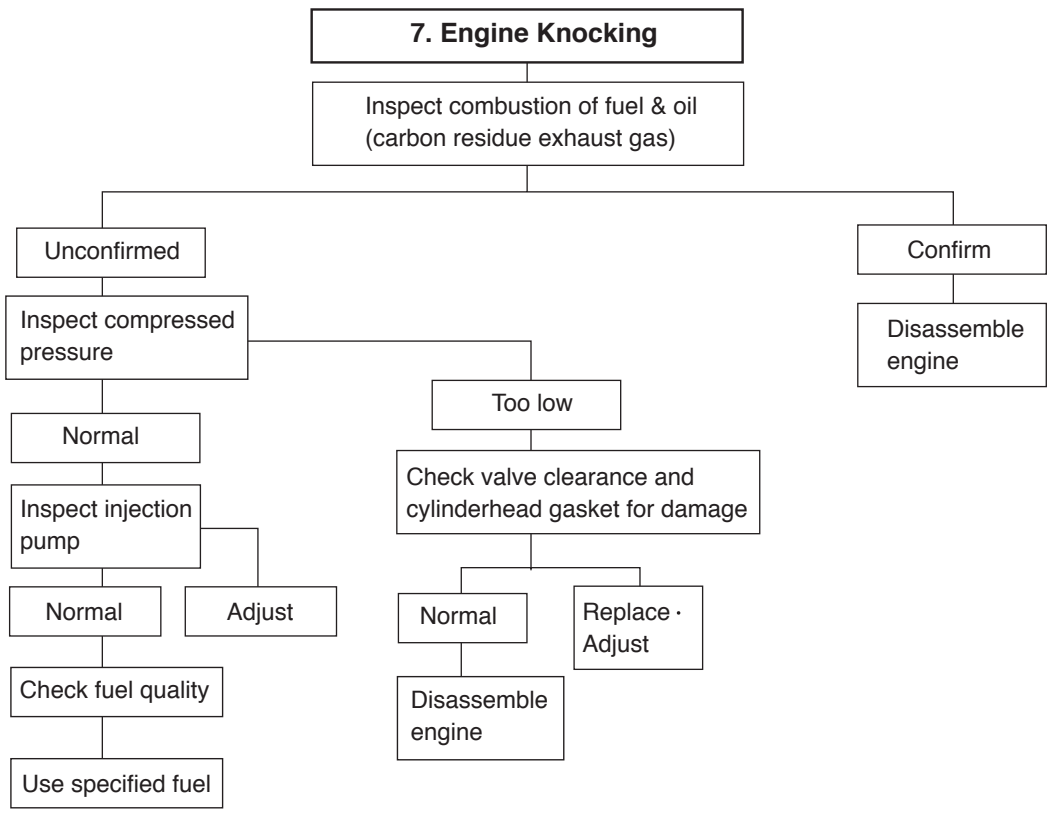

2. Engine Overheated
Operating state
1. Overload
2. Radiator core clogged
3. Continuous over-run
Cooling unit
Fuel unit
Check coolant
Inspect fuel quality
Fuel excessive supply
Normal
Too low
Poor
Check fan belt tension wear or damage etc.
Repair · Replace
Clean and replace with specilied fuel
Check injection nozzle
Replenish
Inspect cooling water leakage
Normal
Check fresh water tank cap
Replace
Exteranl
Internal
Normal
Abnormal
Retighten · Replace
Engine disassembly
Normal
Check thermostat
Replace
Adjust repair injection pump
Repair · Replace
Normal
Inspect heat exchanger
Damage
Repair · Replace
Normal
Check cooling water pump
Repair · Replace
Clean cooling water passage
Normal
Engine disassembly

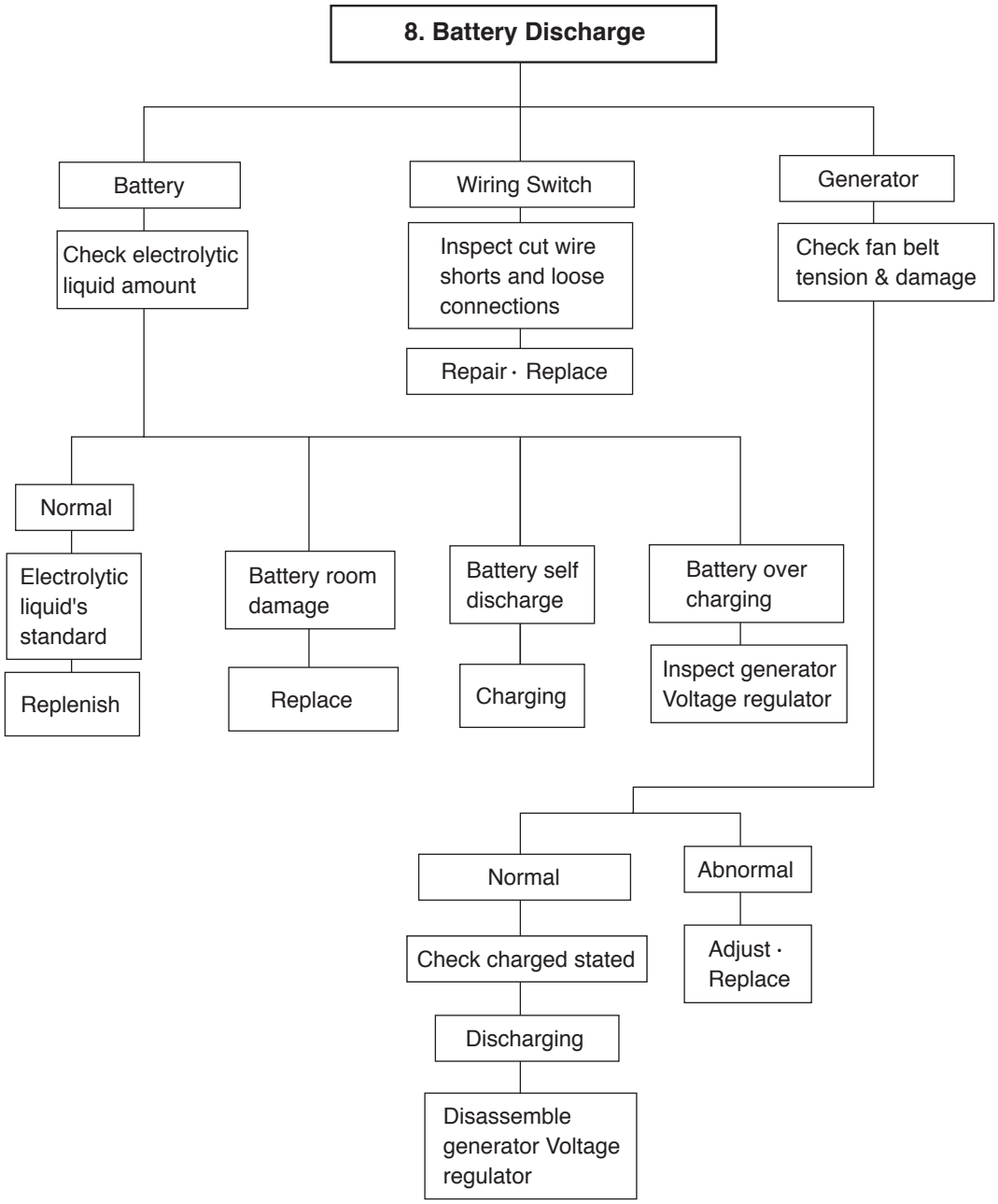

3. Output Insufficient
Engine
Fuel unit
Check for air mixing in fuel
Inspect fuel supply pump
Normal
Clean · Replace
Inspect fuel filter over folw valve
Normal
Replace
Inspect injection pipe
Normal
Repair · Replace
Inspect injection nozzle injection pressure atomizing state
Normal
Adjust · Replace
Check injection timing
Normal
Adjustment
Disassemble engine or injection pump
Others
Inspect air cleaner
Normal
Clean · Relpace
Inspect engine control rod, link, cable, etc.
Normal
Adjust
Check valve clearance
Normal
Adjust
Inspect cylinder head gasket for damage
Normal
Replace
Engine disassembly (valve assembly)
Check Turbocharger
Normal
Repair · Replace
Disassemble injection pump or engine
Installation improper
Check for coupling alignemnt
Adjust or replace coupling
Inspect air leakage of air piping line
Normal
Retighten · Replace
Inspect air leakage of Intercooler


4. Oil pressure lowered
Check if oil pressure gauge indicates wrongly
Check oil amount
Normal
Too low
Use recommended oil (replenish)
Check cooling temperature
Too high
Refer to engine overhea
Normal
Inspect oil quality
Normal
Check oil relief valve
Water & fuel mixed in oil
Improper
Normal
Retighten · Replace
Disassemble engine or injection pump
Replace with recommended oil
Disassemble engine


5. Fuel Consumption Excessive
Causes according to Use Conditions
1. Overload
2. Govemor's Arbitrary Adjustment
3. Full Speed Operation for Long time
4. Sudden Speed Change from Low to High Speed
Inspect fuel leakage
Normal
Oil leakage
Inspect injection nozzle (injection pressure atomizing state etc.)
Adjust · Replace
Retighten Replace
Normal
Check injection timing
Adjust
Normal
Inspect compressed pressure
Check valve clearance
Repair · Replace Cylinder liner Piston ring Piston
Normal
Disassemble injection pump
Adjust
Normal
Inspect head gasket
Replace
Normal
Disassemble engine (valve assembly piston cylinder liner etc.)


6. Oil Consumption Excessive
Cause according to use conditions
1. Excessive oil infusing
2. Continuous operation in low or extremely cold state
Inspect oil leakage
Inspect air cleaner
Clean · Replace
Normal
Check oil quality
Replace with specified oil
Oil leakage
External
Retighten · Replace
Internal
Check compressed pressure
Engine disassembly (piston cylinder liner)
Normal
Disassemble cylinderhead (valve stem seal)


7. Engine Knocking
Inspect combustion of fuel & oil (carbon residue exhaust gas)
Unconfirmed
Confirm
Disassemble engine
Inspect compressed pressure
Too low
Normal
Check valve clearance and cylinderhead gasket for damage
Inspect injection pump
Normal
Adjust
Normal
Replace · Adjust
Check fuel quality
Disassemble engine
Use specified fuel


8. Battery Discharge
Battery
Wiring Switch
Generator
Check electrolytic liquid amount
Inspect cut wire shorts and loose connections
Check fan belt tension & damage
Repair · Replace
Normal
Electrolytic liquid's standard
Replenish
Battery room damage
Replace
Battery self discharge
Charging
Battery over charging
Inspect generator Voltage regulator
Normal
Abnormal
Check charged stated
Adjust · Replace
Discharging
Disassemble generator Voltage regulator

7.3. Causes and Remedies

Condition	Causes	Remedies
1) Starting difficult (1) Compression pressure	• Valve's poor shut, stem distortion • Valve spring damage • Cylinder head gasket's leak • Wear of piston, piston ring or liner	Repair or replace Replace valve spring Replace gasket Adjust
2) Idle operation abnormal	• Injection timing incorrect • Air mixing at injection pump	Adjust Remove air
3) Engine output insufficient (1) Continuous output insufficient	• Valve clearance incorrect • Valve tightness poor • Cylinder head gasket's leak • Wear, stick, damage of piston ring • Injection timing incorrect • Fuel injection amount insufficient • Nozzle injection pressure improper or stuck • Supply pump's function lowered • Fuel pipe system clogged • Air suction amount insufficient • Supercharger poor	Adjust Repair Replace gasket Replace piston ring Adjust Adjust injection pump Adjust or replace Repair or replace Repair Clean or replace air cleaner Repair or replace
(2) Output insufficient when in acceleration	• Compression pressure insufficient • Injection timing incorrect • Fuel injection amount insufficient • Injection pump timer's function insufficient • Nozzle infection pressure, infection angle improper • Supply pump's function lowered • Air intake amount insufficient cleaner	Disassemble engine Adjust Adjust injection pump Repair or replace Repair, replace Repair or replace Clean or replace air
4) Overheating	• Engine oil insufficient or poor • Cooling water insufficient • Fan belt loosened, worn, damaged • Cooling water pump's function lowered • Water temp. regulator's operation poor • Valve clearance incorrect • Exhaust system's resistance increased	Replenish or replace Replenish or replace Adjust or replace Repair or replace Replace Adjust Clean or replace

Condition	Cause	Remedies
5) Engine noisy	For noises arise compositely such asrota ting parts, lapping parts etc., there is nec essity to search the cause of noises accu rately.	
(1) Crankshaft	• As the wear of bearing or crankshaft progress, the oil clearances increase. • Lopsided wear of crankshaft • Oil supply insufficient due to oil passage clogging • Stuck bearing	Replace bearing & grind crankshaft Grind or replace Clean oil passage Replace bearing & Grind
(2) Con rod and Con rod bearing	• Lopsided wear of con rod bearing • Lopsided wear of crank pin • Connecting rod distortion • Stuck bearing • Oil supply insufficiency as clogging at oil passage progresses	Replace bearing Grind crankshaft Repair or replace Replace & grind crankshaft Clean oil passage
(3) Piston, piston pin & piston ring	• Piston clearance increase as the wear of piston and piston ring progresses • Wear of piston or piston pin • Piston stuck • Piston insertion poor • Piston ring damaged	Replace piston & piston ring Replace Replace piston Replace piston Replace piston
(4) Others	• Wear of crankshaft, thrust bearing bearing • Camshaft end play increased • Idle gear end play increased • Timing gear backlash excessive • Valve clearance excessive • Abnormal wear of tappet, cam • Supercharger inner part damaged	Replace thrust Replace thrust plate Replace thrust washer Repair or replace Adjust valve clearance Replace tappet, cam Repair or replace
6) Fuel Consumption Exttive	• Injection timing incorrect • Fuel injection amount excessive	Adjust Adjust injection pump

Condition	Cause	Remedies
7) Oil Consumption Excessive		
(1) Oil level elevated	• Clearance between cylinder iner & piston	Replace
	• Wear of piston ring, ring groove	Replace piston, piston ring
	• Piston ring's damage, stick, wear	Replace piston ring
	• Piston ring opening's disposition improper	Correct position
	• Piston skirt part damaged or abnormal wear	Replace piston
	• Oil ring's oil return hole clogged	Replace piston ring
	• Oil ring's contact poor	Replace piston ring
(2) Oil level lowered	• Looseness of valve stem & guide	Replace in set
	• Wear of valve stem seal	Replace seal
	• Cylinder head gasket's leak	Replace gasket
(3) Oil leak	• Looseness of connection parts	Replace gasket, repair
	• Various parts' packing poor	Replace packing
	• Oil seal poor	Replace oil seal

8. General Information

8.1. General Repair Instructions

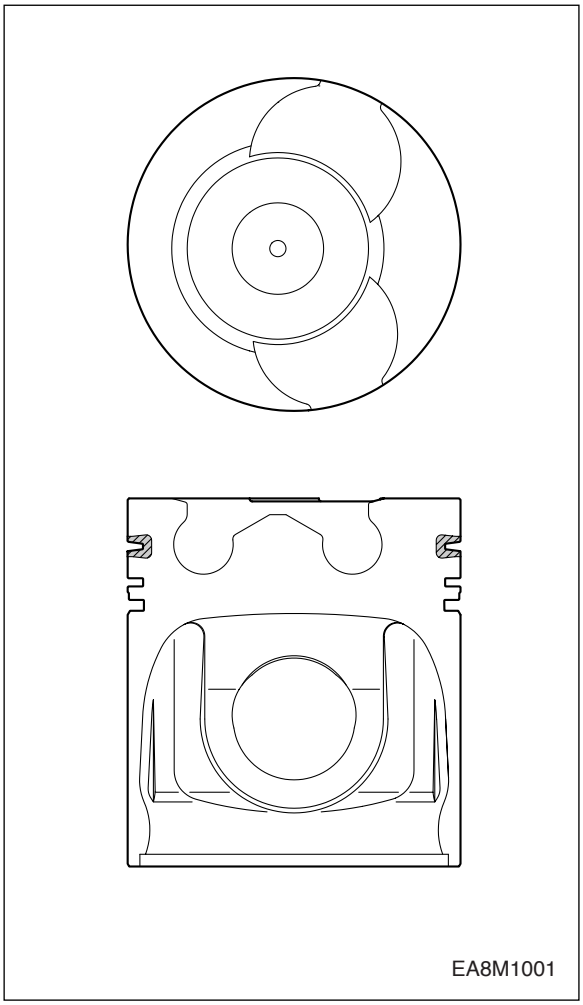
1. Before Performing service operation, disconnect the grounding cable from the battery for reducing the chance of cable damage and burning due to short-circuiting.
2. Use covers for preventing the components from damage or pollution.
3. Engine oil and anti-freeze solution must be handled with reasonable care as they cause paint damage.
4. The use of proper tools and special tools where specified is important to efficient and reliable service operation.
5. Use genuine DAEWOO parts necessarily.
6. Used cotter pins, gaskets, O-rings, oil seals, lock washer and self-lock nuts should be discarded and new ones should be prepared for installation as normal function of the parts can not be maintained if these parts are reused.
7. To facilitate proper and smooth reassemble operation, keep disassembled parts neatly in groups. Keeping fixing bolts and nut separate is very important as they vary in hardness design depending on position of Installation.
8. Clean the parts before inspection or reassembly. Also clean oil ports, etc. using compressed air to make certain they are free from restrictions.
9. Lubricate rotating and sliding faces of parts with oil or grease before installation.
10. When necessary, use a sealer on gaskets to prevent leakage.
11. Carefully observe all specifications for bolts and nuts torques.
12. When service operation is completed, make a final check to be sure service has been done property.

8.2. Engine Characteristics

8.2.1. OMEGA combustion bowl

The OMEGA combustion bowl is a unit designed to perform high efficiency, low emission combustion. As the rim around the combustion bowl port of the upper of the piston has been machined in a smaller size than the interior of the combustion bowl, strong swirl is produced in the combustion bowl and strong squish flow makes the fuel be mixed more sufficiently with air.

Due to the application of OMEGA combustion system and optimal utilization of intake and exhaust port configuration within the cylinder head, the POLUS P126TI, P126TI-Ⅱ and DE12T (DE12 series) generator diesel engines discharge very low level of hazardous exhaust gases such as smoke, nitrogen oxide, hydrocarbon, or carbon monoxide and thus ensure high performance and low fuel consumption.



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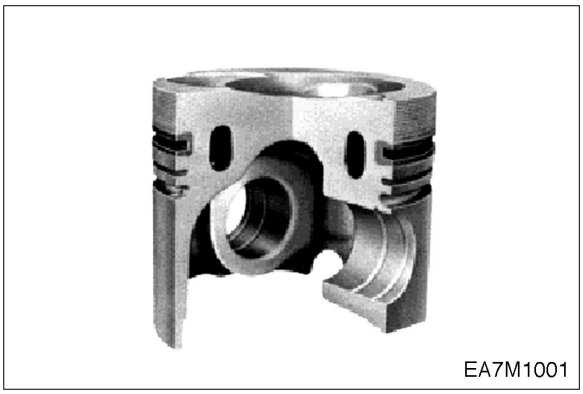
8.2.2. Oil Gallery Cooling Type Piston (P126TI / P126TI-Ⅱ)

Oil gallery cooling is used for the piston of P126TI and P126TI-Ⅱ generator engine.

When thermal loading is high, piston cooling by means of an oil gallery in the crown is normally necessary to prevent crown cracking and ring sticking. The design of the gallery, the design and location of the oil spray nozzle and the quantity of oil flowing in the gallery are critical in order to achieve the desired temperature reduction.

The cross section shape of the gallery should be designed to achieve sufficient oil movement to maximize cooling efficiency.



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9. Disassembly and Reassembly of Major Components

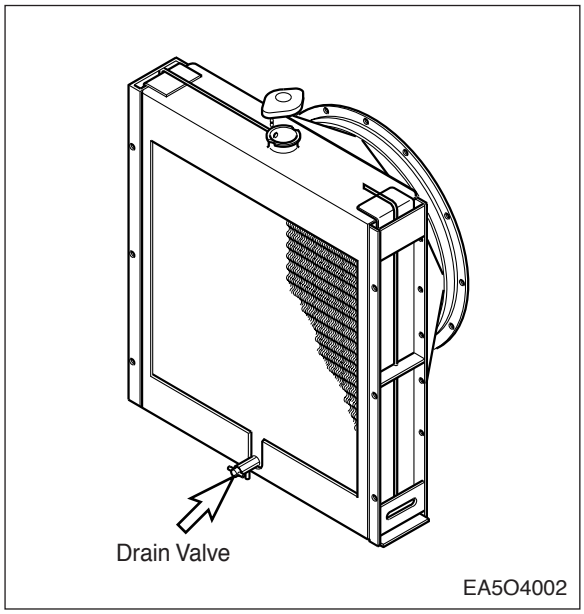
9.1. Disassembly

9.1.1. General precautions

- Maintenance operation should be carried out in a bright and clean place.
- Before disassembly, provide parts racks for storage of various tools and disassembled parts.
- Arrange the disassembled parts in the disassembly sequence and use care to prevent any damage to them.

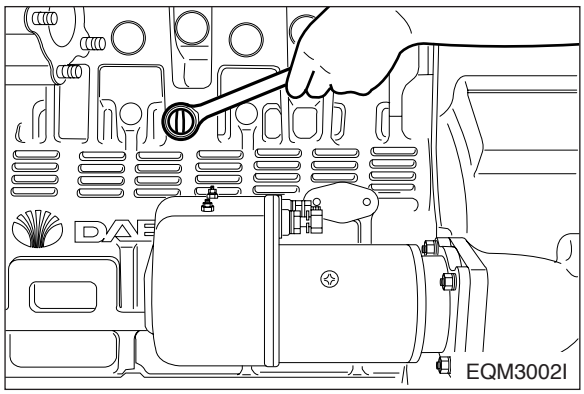
9.1.2. Cooling water

- Remove the radiator cap. Open the drain plug at the radiator lower part to drain the coolant as the right figure.



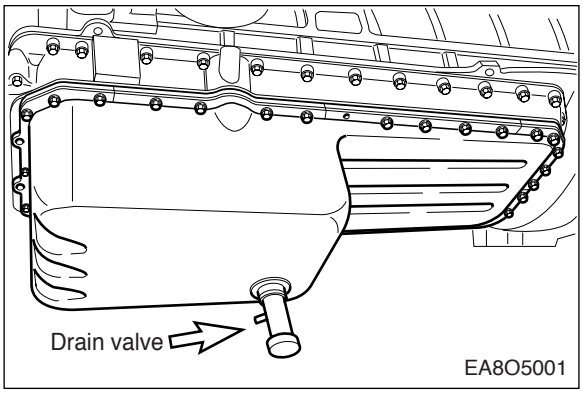
CAUTION : When removing radiator filler cap while the engine is still hot, cover the cap with a rag, then turn it slowly to release the internal steam pressure This will prevent a person from scalding with hot steam spouted out from the filler port.

- Remove the drain plug from the cylinder block and drain out the cooling water into a container.



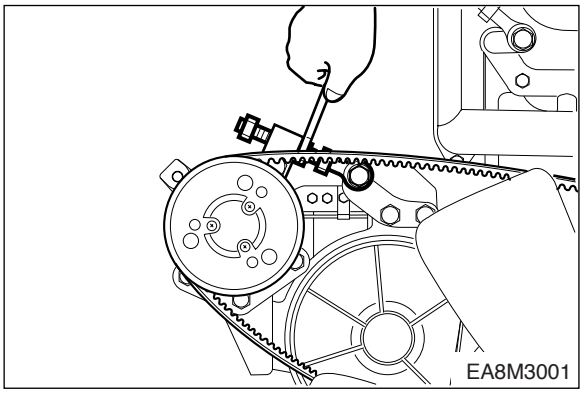
9.1.3. Engine oil

- Take out the oil dipstick.
- Remove the oil drain valve of oil pan and drain out the engine oil into a prepared container.



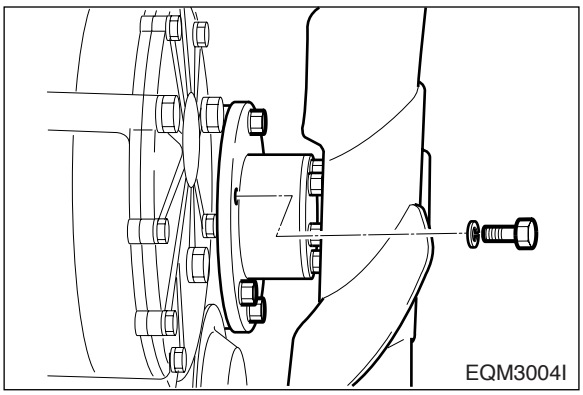
9.1.4. Alternator belt

- Loosen the tension adjusting nut installed on the alternator bracket, and take off the alternator belt.



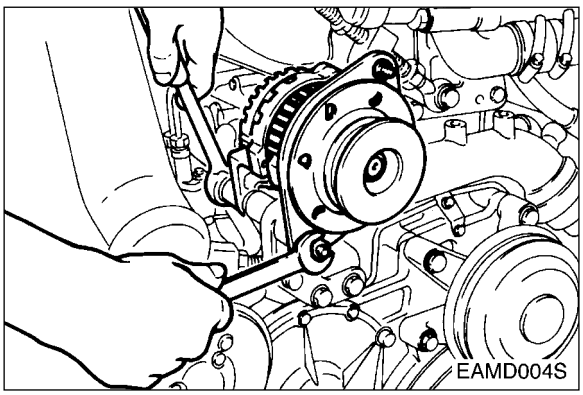
9.1.5. Cooling fan

- Remove the flange fixing bolts, then take off the flange and cooling fan.



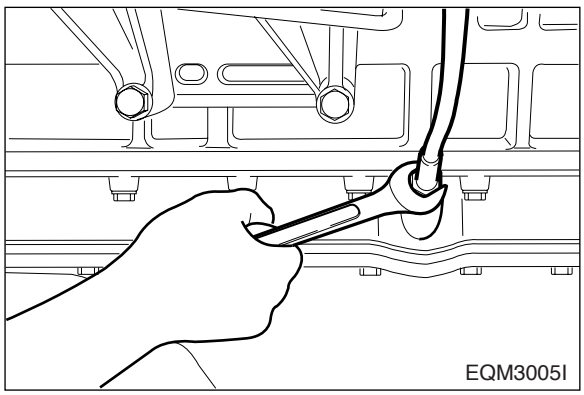
9.1.6. Alternator

- Remove the alternator fixing bolt and disassemble the alternator.
- Remove the tension adjusting bolt and bracket.



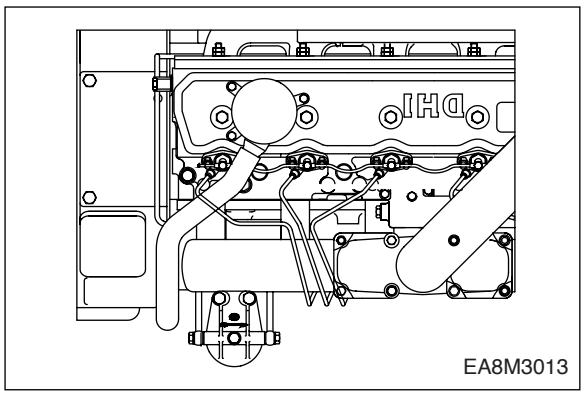
9.1.7. Guide tube of oil level gauge

- Loosen the flange nut installed on the oil pan to remove the guide tube.



9.1.8. Fuel filter

- Remove fuel hoses connected to the fuel injection pump, take off the bracket fixing bolts, then disassemble the fuel filter.

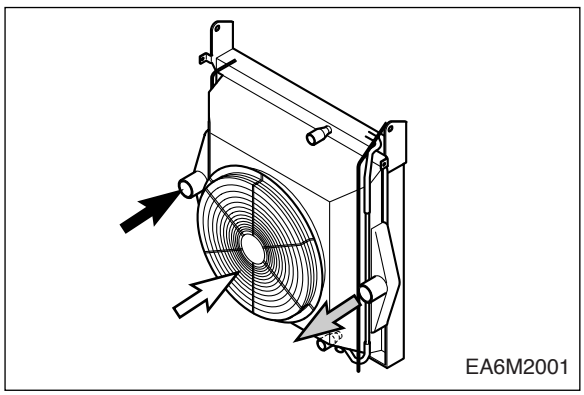


9.1.9. Breather

- Loosen the clamp screw to remove the rubber hose.

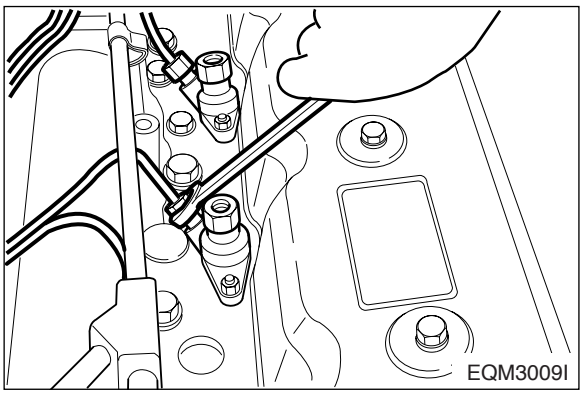
9.1.10. Intercooler

- Tear down the various hoses and air pipes from the inter cooler.
- Remove the intercooler fixing bolts and tear it down.



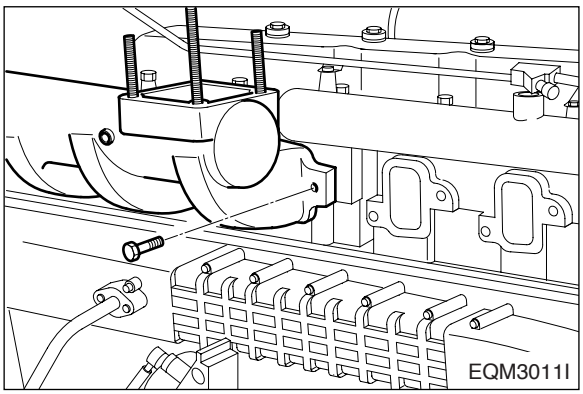
9.1.11. Injection pipe

- Unscrew the hollow screws to disassemble the fuel return pipe.
- Remove the nuts installed on the fuel injection pump and nozzles, then disassemble the injection pipe.



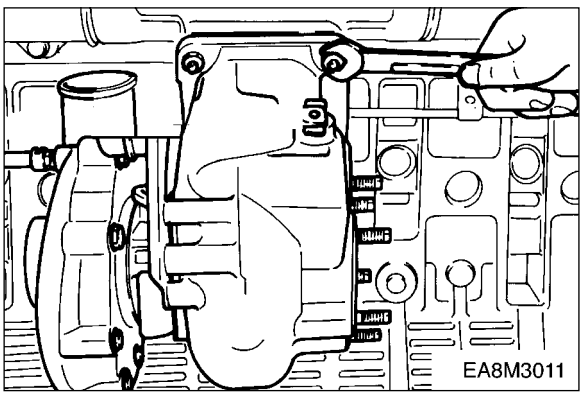
9.1.12. Intake manifold

- Remove the air hose connected to the fuel injection pump.
- Loosen the intake manifold fixing bolts, then disassemble the intake manifold.



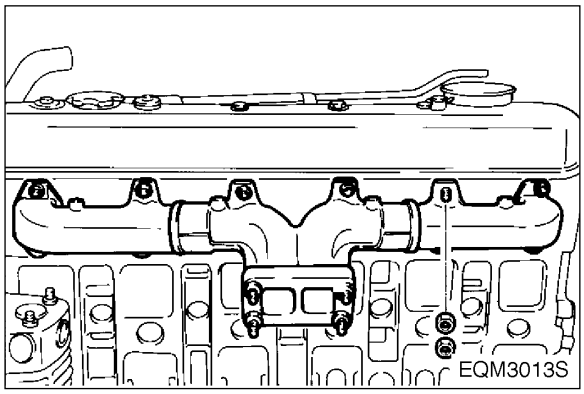
9.1.13. Turbo charger

- Release the clamp screw of the rubber hose connected to the intake manifold, and take off the intake pipes both simultaneously.
- Unscrew the exhaust pipe bracket fixing bolts, release the nuts installed on the turbocharger, then disassemble the exhaust pipe.
- Remove the turbocharger after removing the oil supply pipe and return pipe and releasing the fixing nuts.



9.1.14. Exhaust manifold

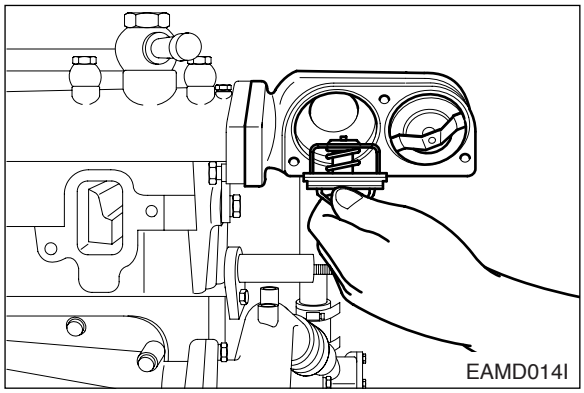
- Release the exhaust manifold fixing bolts, disassemble the exhaust manifold, then remove the heat shield and gasket.



NOTE : Make sure to release the nuts one after another because the exhaust manifold will be removed if you unscrew two nuts simultaneously.

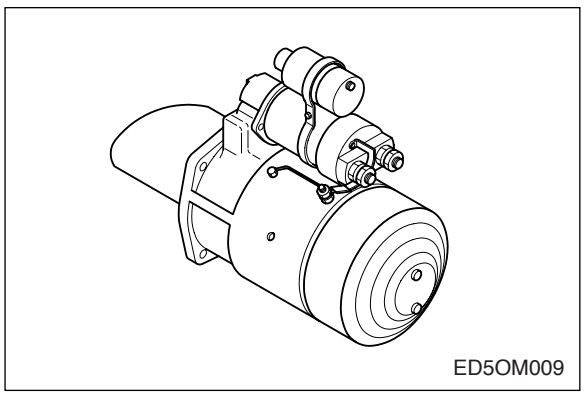
9.1.15. Thermostat

- Remove the by-pass pipe connected to the water pump, unscrew the thermostat fixing bolts, then disassemble the thermostat housing.
- Disassemble the thermostat housing and remove the thermostat.
- Disassemble the water pipe by unscrewing the bolts and nuts installed on the cylinder head.



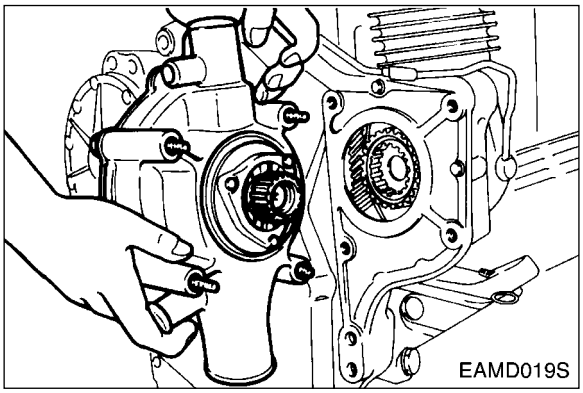
9.1.16. Starter

- Unscrew the starter fixing bolts, then disassemble the starter.



9.1.17. Water pump

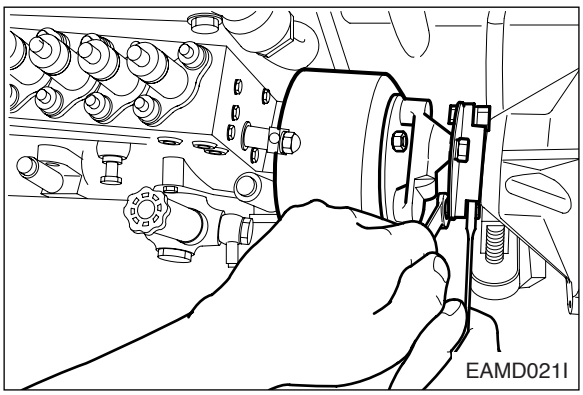
- Remove the water pipe connected to the expansion tank.
- Remove the water pipe and hoses connected to the water pump.
- Unscrew the water pump fixing bolts and remove the water pump.



9.1.18. Injection pump

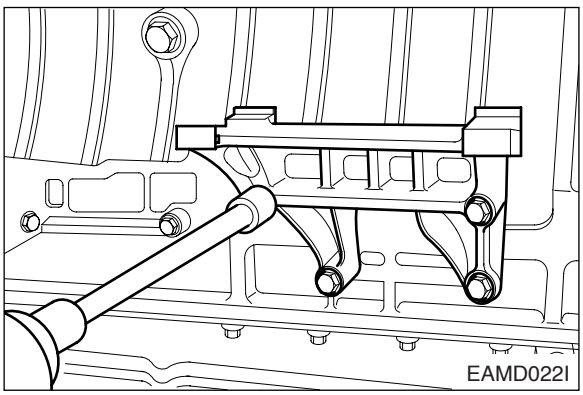
- Remove the oil supply pipe and return pipe connected to the fuel injection pump.
- Unscrew the bolts connecting the coupling and drive shaft, disassemble the injection pump mounting bolts, then detach the injection pump.

NOTE : After letting No.1 cylinder to the 'OT' position by turning the crankshaft, disassemble the injection pump.



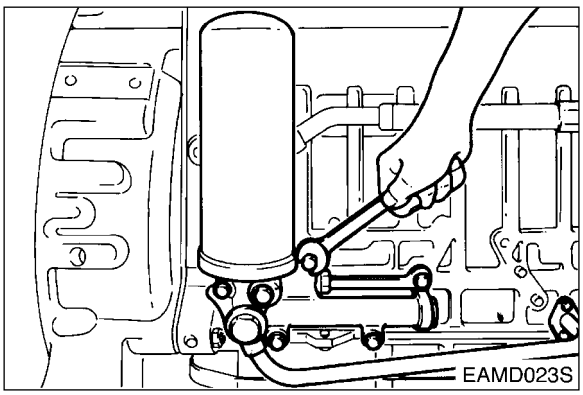
- Release the pump fixing bracket bolts to disassemble the bracket from the cylinder block.

NOTE : Do not mix the disassembled shims. These should be reassembled to the original position.



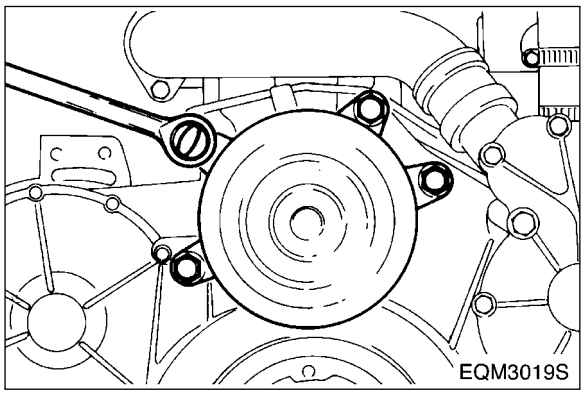
9.1.19. Oil filter

- Using a filter remover wrench, remove the oil filter cartridge.
- Remove the pipe connected to the oil cooler.
- Loosen the oil filter fixing bolts and disassemble the oil filter head from the cylinder block.



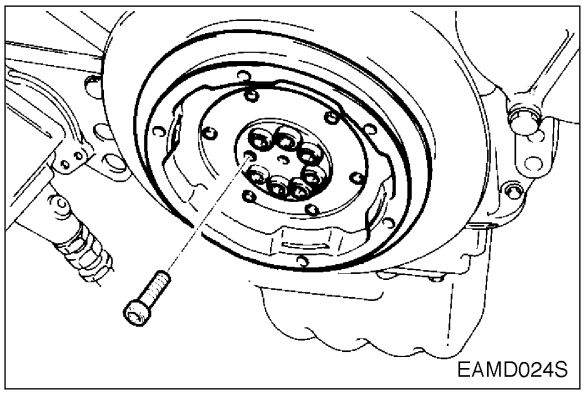
9.1.20. Fan drive pulley

- Remove the bolts and disassemble the fan drive pulley.



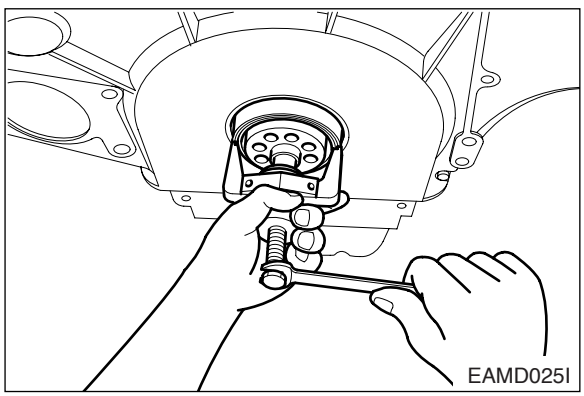
9.1.21. Vibration damper

- Unscrew the pulley fixing bolts and disassemble the pulley-vibration damper assembly.
- Unscrew the vibration damper fixing bolts and disassemble the damper from the pulley.



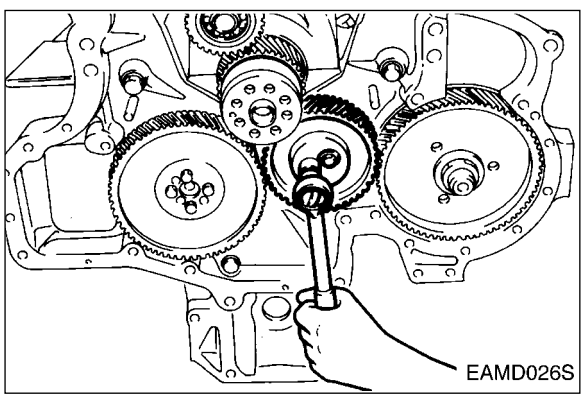
9.1.22. Timing gear case cover

- Disassemble the oil seal using an oil seal removing jig.
- Remove the cover fixing bolts and disassemble the cover from the timing gear case.



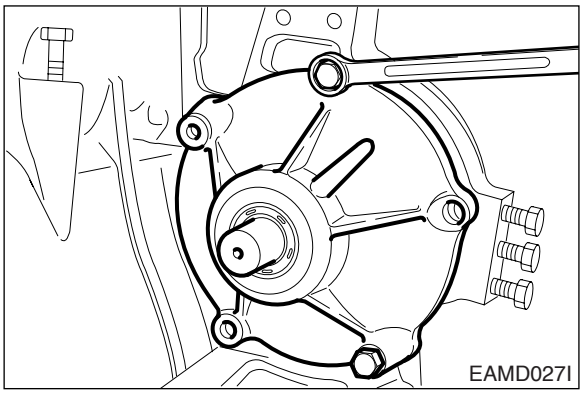
9.1.23. Idle gear

- Unscrew the idle gear fixing bolts and disassemble the thrust washer and idle gear.
- Disassemble the idle gear pin using a rubber hammer to prevent damage to them.



9.1.24. Fuel injection pump drive assembly

- Unscrew the injection pump drive shaft bearing housing fixing bolts and remove the injection pump drive assembly which the shaft, gear, bearings, and housing are put together.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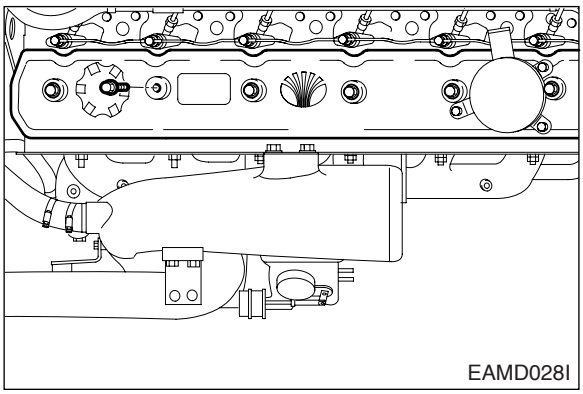
9.1.25. Cylinder head cover

- Unscrew the cover fixing bolts and disassemble the cover.
- Keep the bolts in an assembly state so that the packings and washers may not be lost, and keep the cover packing as assembled with the cover.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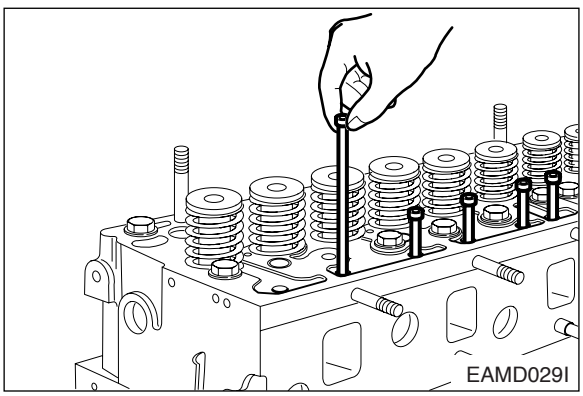
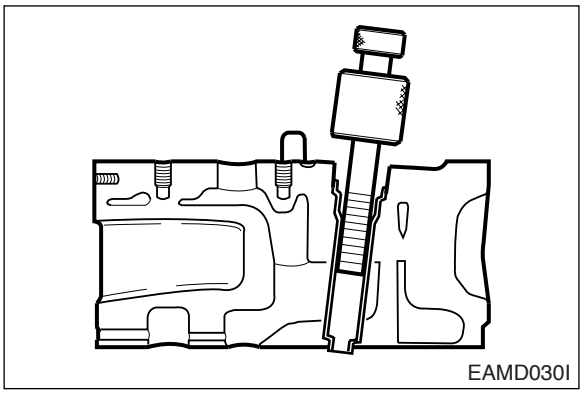
9.1.26. Rocker arm assembly

- Unscrew the rocker arm bracket bolts and remove the rocker arm assembly.
- Take off the snap rings to remove the washers and rocker arm, then unscrew the bracket fixing bolts to take off the bracket and springs.
- Take out the push rods.


EAMD029I

9.1.27. Injection nozzle

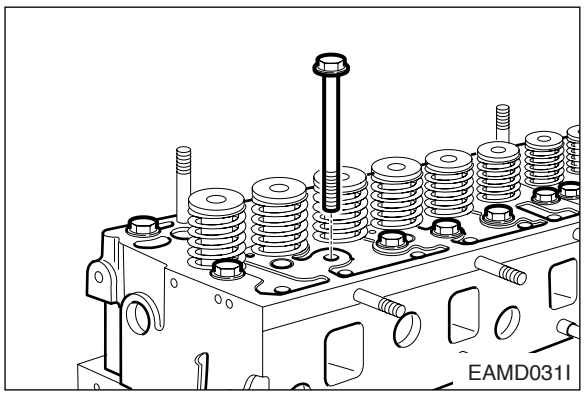
- Take off the injection pipes between the injection pump and injection nozzles.
- Remove the nozzle tube using nozzle tube removing jig.


EAMD030I

Do not disassemble injection nozzle unless coolant or gas come out.

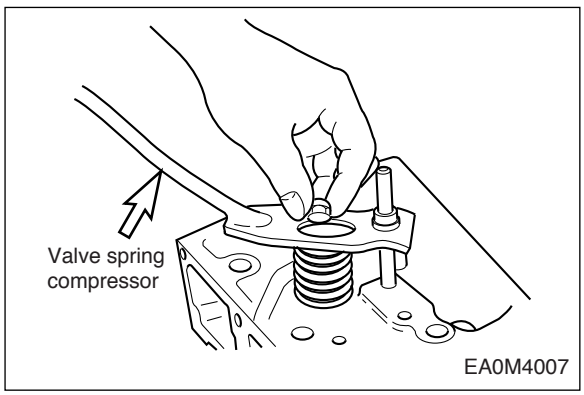
9.1.28. Cylinder head

- Unscrew the cylinder head fixing bolts and take off the cylinder head.
- Remove the cylinder head gasket.



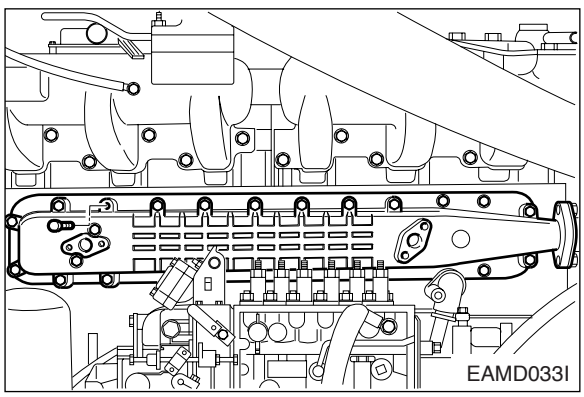
9.1.29. Valve and valve stem seal

- Compress the valve spring retainer using a jig and take off the valve cotter pins.
- Disassemble the valve springs and retainers.
- Take off the valves.
- Remove using a general tool and discard the valve stem seals in order not to be re-used.



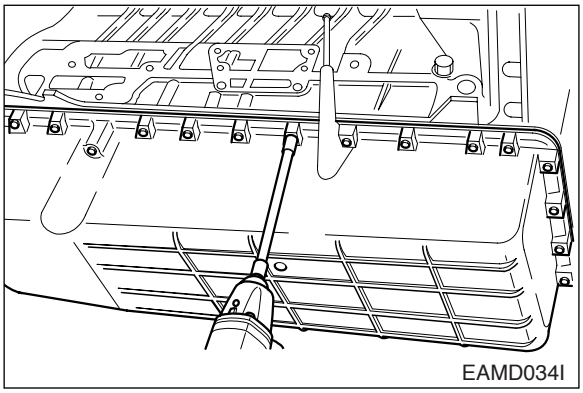
9.1.30. Oil cooler

- Remove the water pipe connected to the water pump.
- Remove the oil pipe connected to the cylinder block.
- Unscrew the oil cooler cover fixing bolts and disassemble the oil cooler assembly from the cylinder block.
- Unscrew the oil cooler fixing bolts and remove the oil cooler from the oil cooler cover.



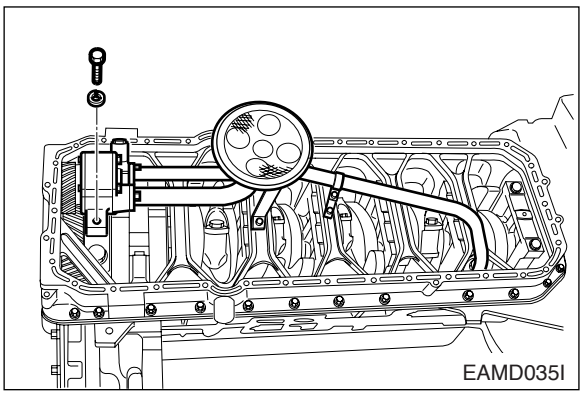
9.1.31. Oil pan

- Stand the engine with the flywheel housing facing the bottom.
- Release the oil pan fixing bolts, remove the stiffeners then disassemble the oil pan.


EAMD034I

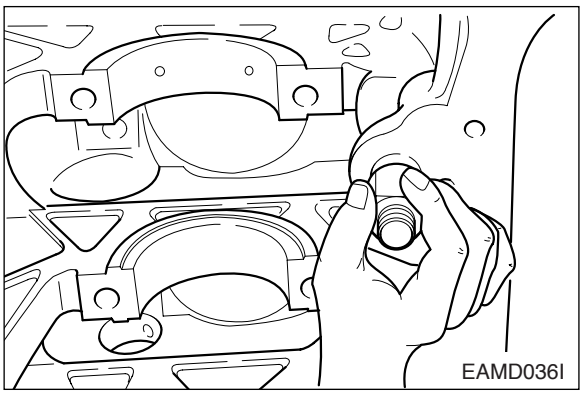
9.1.32. Oil pump and oil pipe

- Unscrew the oil suction pipe bracket bolts, releasing the pipe fixing bolts, then disassemble the oil suction pipe assembly.
- Disassemble the oil pipe feeding oil from the oil pump to the cylinder block.
- Unscrew the oil pump fixing bolts and disassemble the oil pump.


EAMD035I

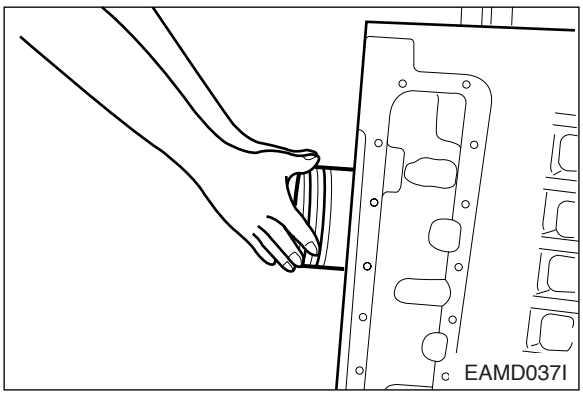
9.1.33. Relief valve

- Disassemble the relief valve.

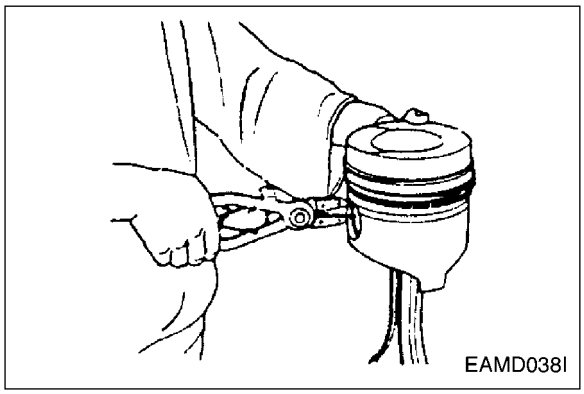

EAMD036I

9.1.34. Piston and connection rod

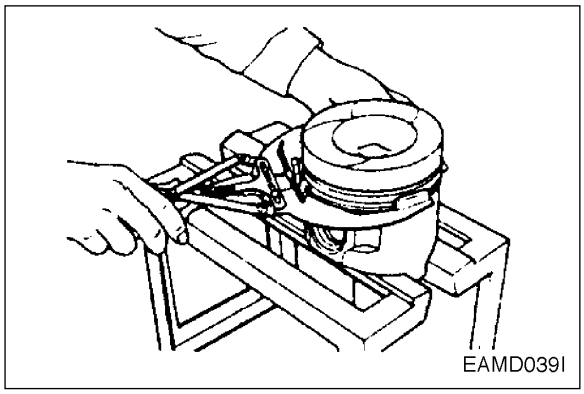
- Disassemble the pistons by two cylinders while turning the crankshaft.
- Unscrew the connecting rod fixing bolts and take off the pistons and connecting rods in the direction of piston.


EAMD037I

- Remove the piston pin snap rings, take off the piston pin, then disconnect the connecting rod from the piston.

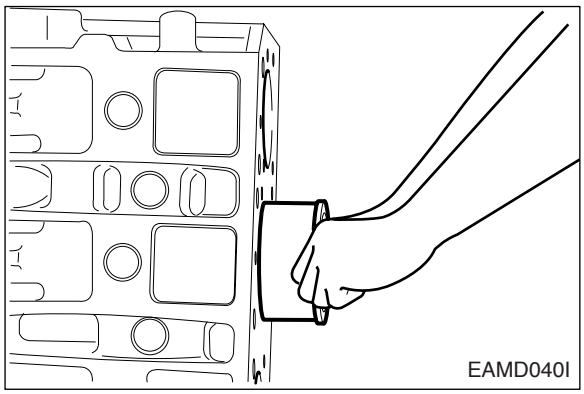


- Disassemble the piston rings using ring pliers.
- Use care not to interchange the disassembled parts and keep them in the sequence of cylinder No.



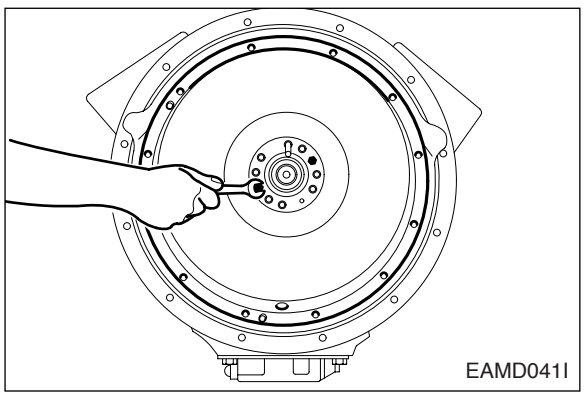
9.1.35. Cylinder liner

- Disassemble the cylinder liner using a liner puller.



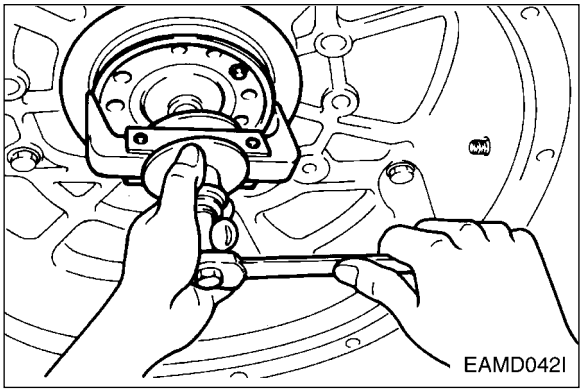
9.1.36. Flywheel

- Position the engine so that the head installing surface of the cylinder block faces down.
- Unscrew the flywheel fixing bolts and fit a dowel pin.
- Install flywheel disassembling bolts in the bolt holes machined on the flywheel, and disassemble the flywheel.



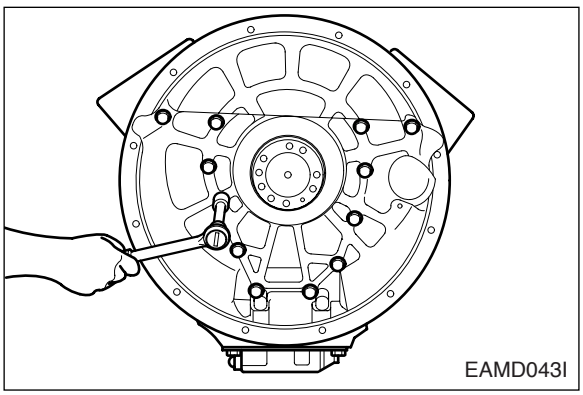
9.1.37. Oil seal

- Take off the rear oil seal using an oil seal disassembling jig.
- If only the inside guide ring is removed, use a special tool to take off the outside seal.



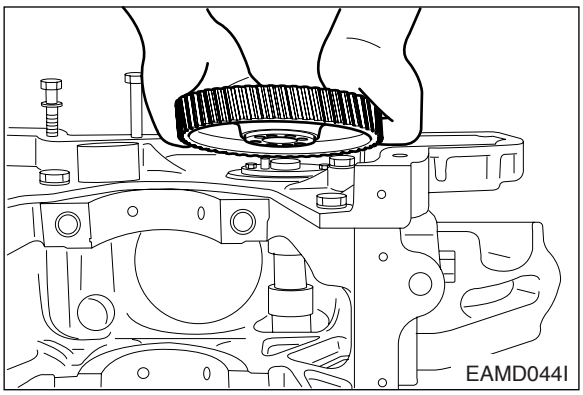
9.1.38. Flywheel housing

- Loosen the housing fixing bolts disassemble the flywheel housing.



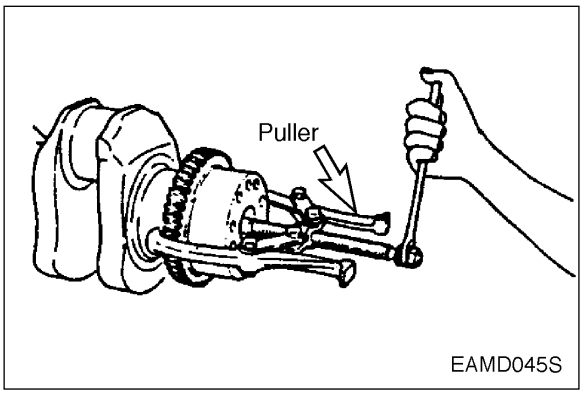
9.1.39. Cam shaft and tappet

- Remove the cam shaft gear.
- Take off the cam shaft gear thrust washer.
- Take out the cam shaft using care not to damage the cam shaft.
- Slide out the tappets by hand.



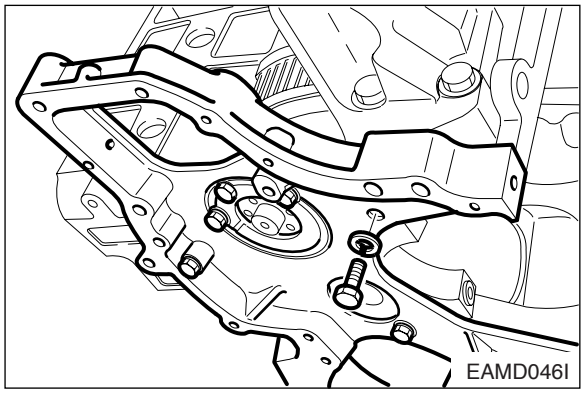
9.1.40. Crankshaft gear and oil pump idle gear

- Loosen the socket head bolts and take out the oil pump idle gear.
- Use a puller to remove the crankshaft gear.



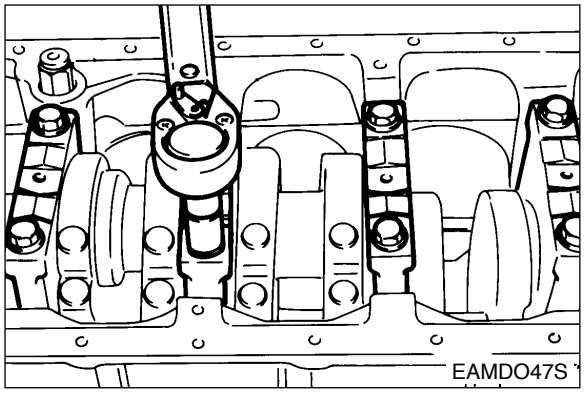
9.1.41. Timing gear case

- Unscrew the case fixing bolts and disassemble the timing gear case.



9.1.42. Crankshaft

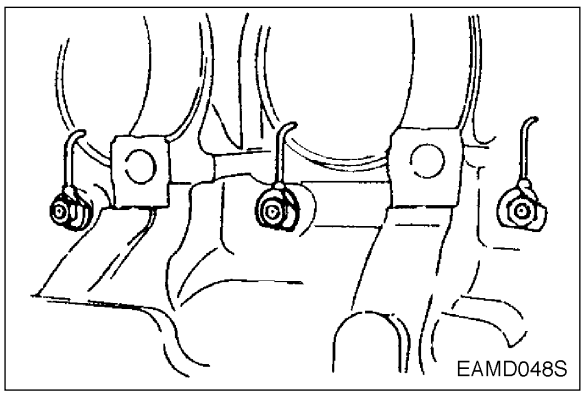
- Remove the bolts from bearing caps.
- Remove the main bearing cap fixing bolts in the order of assembling.
- (Remove them in the same way of the cylinder head bolts.)
- Maintain the removed bearing caps in the order of cylinders.
- Temporarily install the bolts at the both side of crankshaft, and lift the shaft with a rope.



NOTE : Do not mingle with the metal bearings and bearing caps randomly. To prevent mixing, temporarily assemble the metal bearings to the corresponding bearing caps in turn.

9.1.43. Oil spray nozzle

- Unscrew the fixing bolt and remove the oil spray nozzles.



9.2. Inspection

9.2.1. Cylinder block

1) Clean the cylinder block thoroughly and make a visual inspection for cracks or damage.
2) Replace if cracked or severely damaged, and correct if slightly damaged.
3) Check oil and water flow lines for restriction or corrosion.
4) Make a hydraulic test to check for any cracks or air leaks.(Hydraulic test) :
   Stop up each outlet port of water/oil passages in the cylinder block, apply air pressure of about 4kg/cm^2 against the inlet ports, then immerse the cylinder block in water for about 1 minute to check any leaks. (Water temperature: 70 ˚C)

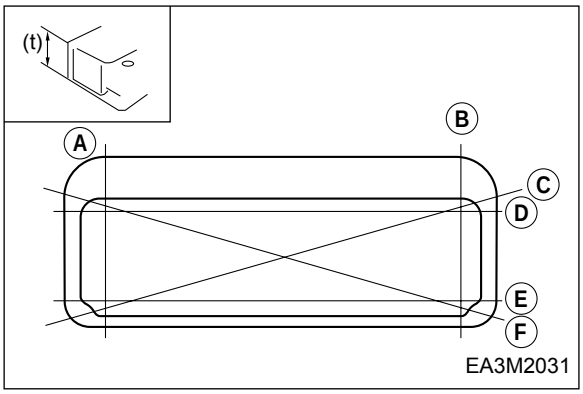
9.2.2. Cylinder head

1) Inspection

- Carefully remove carbon from the lower face of the cylinder head using nonmetallic material to prevent scratching of the valve seat faces.
- Check the entire cylinder head for very fine cracks or damage invisible to ordinary sight using a hydraulic tester or a magnetic flaw detector.

2) Distortion at the lower face

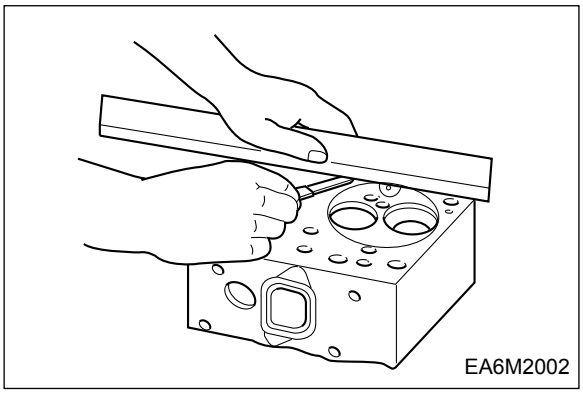
- Measure the amount of distortion using a straight edge and a feeler gauge at six positions (A ~ F) as shown in the right figure.
- If the measured value exceeds the standard value, retrace the head with grinding paper of fine grain size to correct such defect.
- If the measured value exceeds the maximum allowable limit, replace the cylinder head.



EA3M2031

Lower face warpage and height

	Standard	Limit
Warpage	0.2 mm or less	0.3 mm
Thickness : t (reference)	114.95 ~ 115.0 mm	113.9 mm


EA6M2002

3) flatness

Measure flatness of the intake/exhaust manifolds fitting surfaces on the cylinder head using a straight edge and a feeler gauge.

Standard	Limit
0.05 mm	0.2 mm

4) Hydraulic test

Hydraulic test method for the cylinder head is same as that for cylinder block.

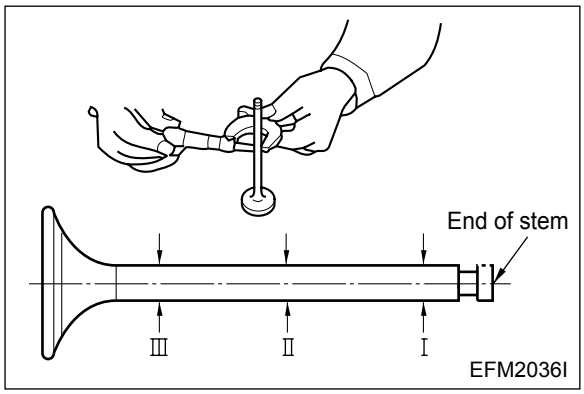
9.2.3. Valve and valve guide

1) Valve

Clean the valves with clean diesel oil, then inspect them as follows:

- **Valve stem outer diameter**

Measure the valve stem outer diameter at 3 positions. (top, middle, and bottom) If the amount of wear is beyond the limit, replace the valve.



Dimension / Description	Standard	Limit
Intake valve stem	ø 8.950~ ø 8.970 mm	ø 0.02 mm
Exhaust valve stem	ø 8.935~ ø 8.955 mm	ø 0.02 mm

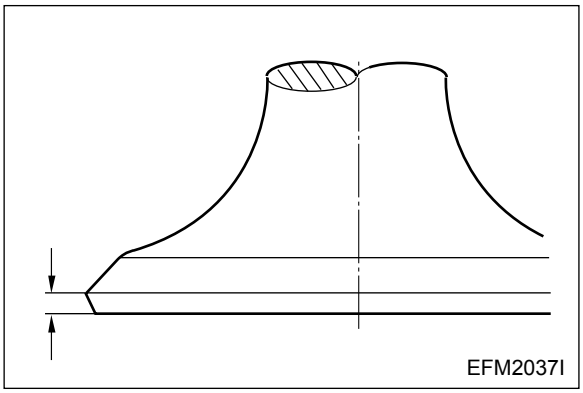
- **Valve seat contacting faces**

Check the valve seat contacting faces for scratches or wear, and correct the faces with grinding paper as necessary. Replace if severely damaged.

● **Valve head thickness**

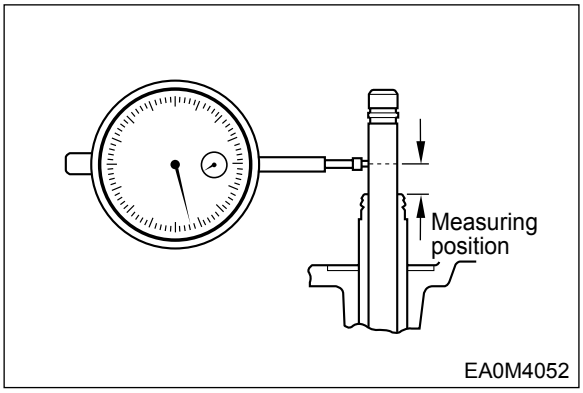
Measure the valve head thickness, and replace the valve if the measured value is beyond the limit.

Dimension / Description	Standard	Limit
Intake valve	1.5 mm	1 mm or less
Exhaust valve	1.5 mm	0.9 mm or less



2) Valve guide

● Install the valve into the valve guide and measure the clearance between them by valve movement. If the clearance is excessive, measure the valve and replace either the valve or the valve guide, whichever worn more.



Valve stem end play

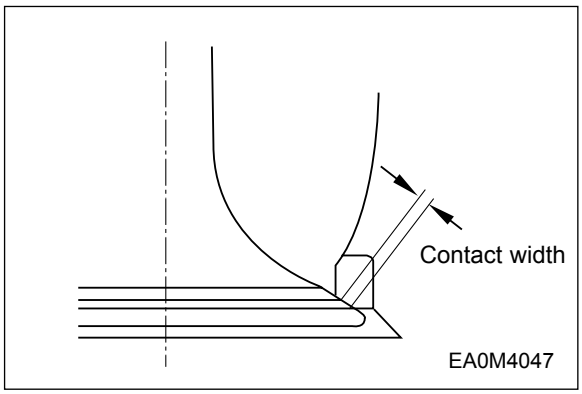
	Standard	Limit
Intake valve	0.04 ~ 0.07 mm	0.2 mm
Exhaust valve	0.06 ~ 0.09 mm	0.25 mm

● Install the valve into the cylinder head valve guide, then check and see if it is centered with the valve seat using a special tool.

3) Valve seat

- **Contacting face amount**

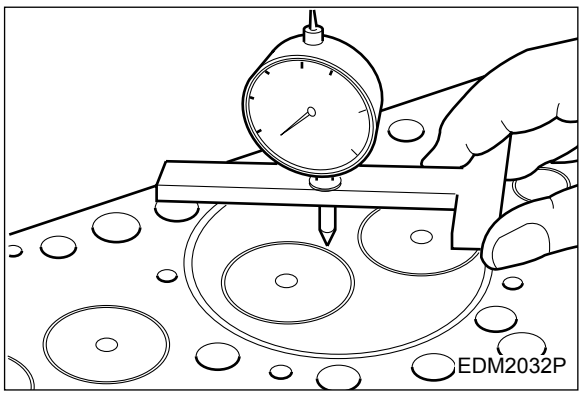
Measure the contacting face between intake valve and exhaust valve seat for valve seat wear, and replace if the measured value exceeds the specified limit.



Valve contact width

Standard	Limit
1.5 mm	2.0 mm

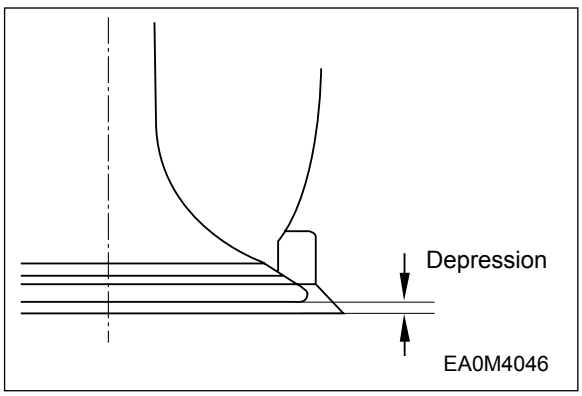
- Install the valve into the valve seat on the cylinder head, and check the amount of depression of the valve from the lower portion of the cylinder head using a dial gauge.



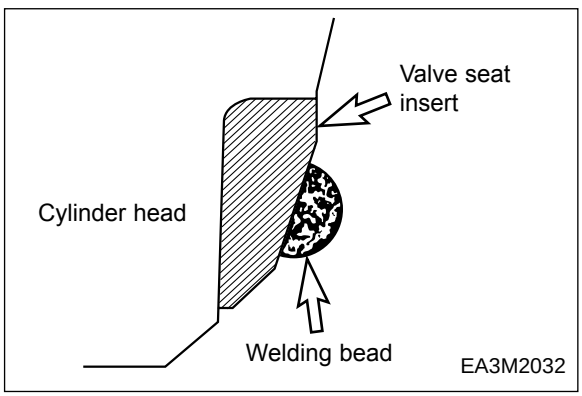
Valve Depression

	Standard	Limit
Intake & Exhaust	0 ~ 0.3 mm	0.55 mm

If the amount of depression is beyond the specified limit, replace the valve seat.



- For removal of the valve seat, apply arc welding work to two points of valve seat insert, and pull out the valve seat insert with inner extractor.



- For assembling of a new valve seat, by putting it among the dry ices of an ice box previously for about 2 hours for the cold shrinkage, and press it in the cylinder head by a special tool. (bench press)
- Apply the valve lapping compound on the valve head seating face and lap the valve seat by turning it until it is seated in its position, then wipe out the lapping compound.

Note : Clean the valve and cylinder head with light oil or equivalent after the valve seat finishing is completed, and make sure that there are no grinding materials remained.

4) Valve spring

- **Visual check**

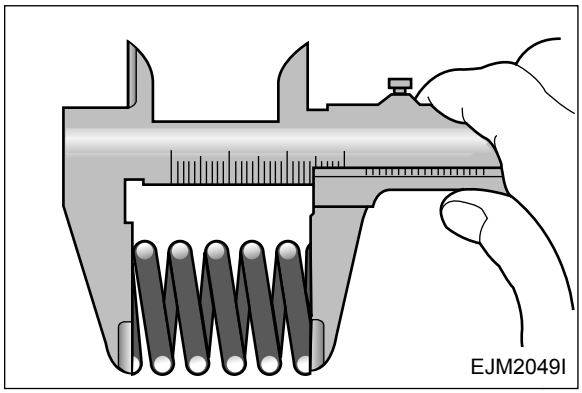
Visually check the exterior of the valve springs for damage, and replace if necessary.

- **Valve spring free length**

Use a vernier caliper to measure the valve spring free length.

If the measured value is less than the specified limit, the valve spring must be replaced.

Spring free Length		Standard
Intake valve		75.5 mm
Exhaust valve	Inner	65 mm
	Outer	75.5 mm

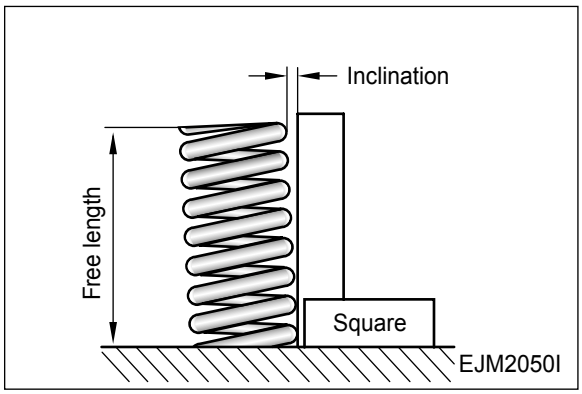


- **Valve spring inclination**

Use a surface plate and a square to measure the valve spring inclination.

If the measured value exceeds the specified limit, the valve spring must be replaced.

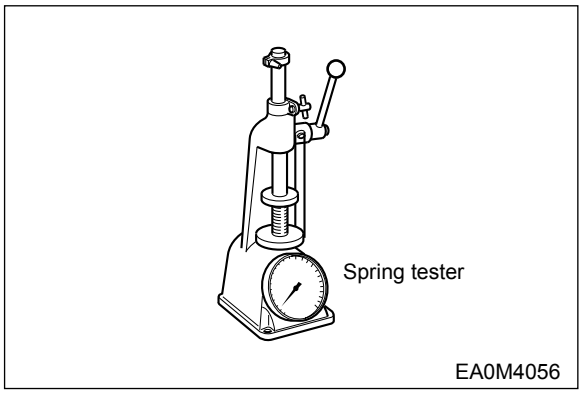
	Standard	Limit
Valve spring Inclination	1.0 mm	2.0 mm



● **Valve spring tension**

Use a spring tester to measure the valve spring tension if the measured value is less than the specified limit, the valve spring must be replaced.

	Set Length		Spring force	Limit
Intake valve	Valve Spring Tension at 37mm Set Length		61.8 ~ 68.3 kg	61.8 kg
Exhaust valve	Inner	34 mm	36.1 ~ 39.9 kg	36.1 kg



9.2.4. Rocker arm shaft assembly

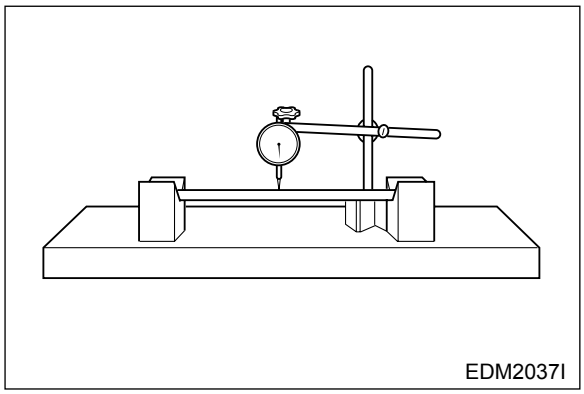
1) Rocker arm shaft

● **Rocker arm shaft run-out**

Place the rocker arm shaft on two V blocks and inspect the shaft for bend using a dial gauge.

If the amount of this run-out is small, press the shaft with a bench press to correct the run-out Replace the shaft if the measured value exceeds the limit.

Limit	0.2 mm

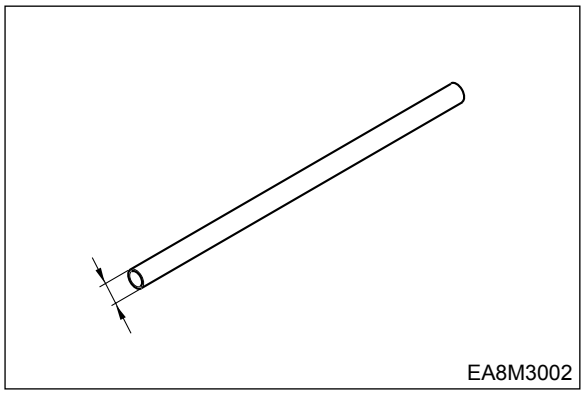


● **Rocker arm shaft diameter**

With an outside micrometer, measure the rocker arm shaft diameter at the point where the rocker arms have been installed.

Replace the rocker arm if the amount of wear is beyond the specified limit.

Standard	Limit
∅23.978 ~ ∅23.959 mm	∅23.75 mm



2) Rocker arm

- **Visual check**

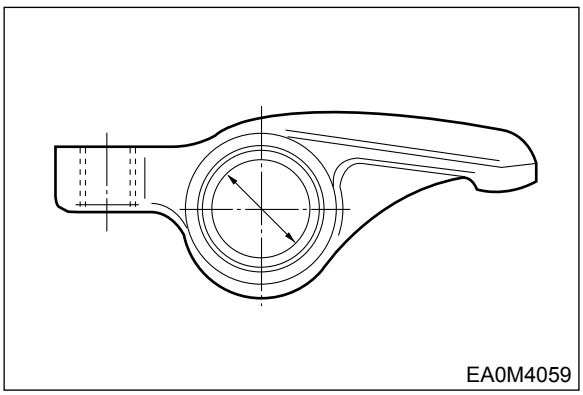
  Visually check the face of the rocker arm in contact with the valve stem end for scores and step wear. If the wear is small, correct it with an oil stone or grinding paper of fine grain size. Rocker arm with a considerable amount of step wear should be replaced.

- **Diameter of the rocker arm bushing**

  Measure the inside diameter of the rocker arm bushing with an inside micrometer or vernier calipers, and compare the measured values with the rocker arm shaft diameter. If the clearance exceeds the limit, replace either bushing or shaft, whichever worn more.

  <Clearance>

Standard	Limit
0.020 ~ 0.093 mm	0.25 mm


EA0M4059

3) Tappet and push rod

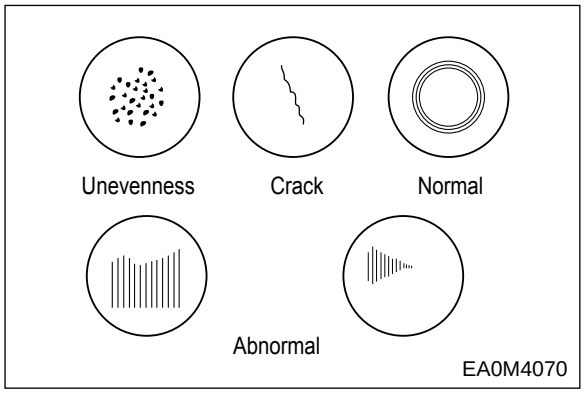
- **Clearance**

  Measure the clearance of the tappet and tappet holes of the cylinder block. If the value is beyond the specified limit, replace tappets.

Standard	Limit
0.035 ~ 0.077 mm	0.1 mm

● **Visual check of tappet**

Visually check the face of the tappets in contact with the cam for pitting, scores or cracks, and replace if severely damaged. If the amount of cracks or pitting is small, correct with an oil stone or grinding paper.

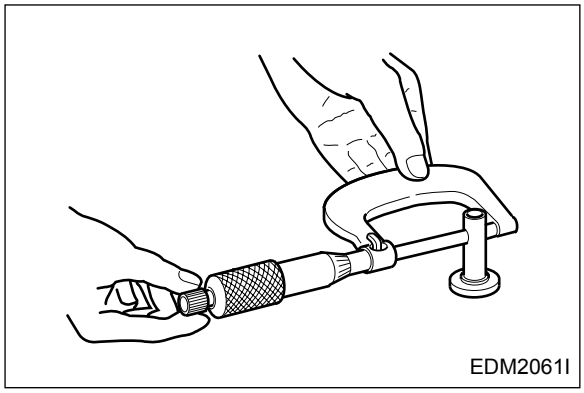


● **Outside diameter**

With an outside micrometer, measure the tappet outside diameter If the measured value is beyond the limit, replace tappets.

Tappet Dia	ø19.944 ~ ø19.965 mm

	Standard	**Limit**
Tappet Clearance	0.035~0.077mm	0.1mm

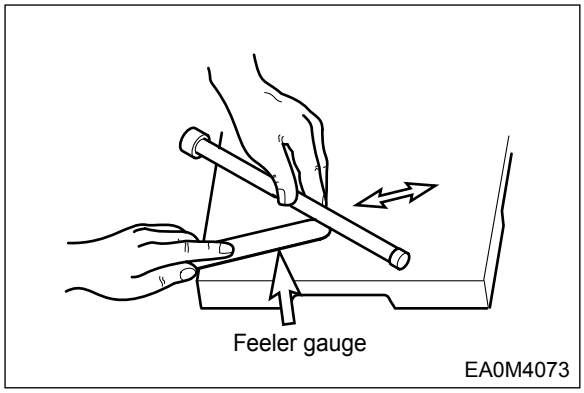


● **Push rod run-out**

Limit	0.3 mm or less

Use a feeler gauge to measure the push rod run-out.

Roll the push rod along a smooth flat surface as shown in the figure.



9.2.5. Cam shaft

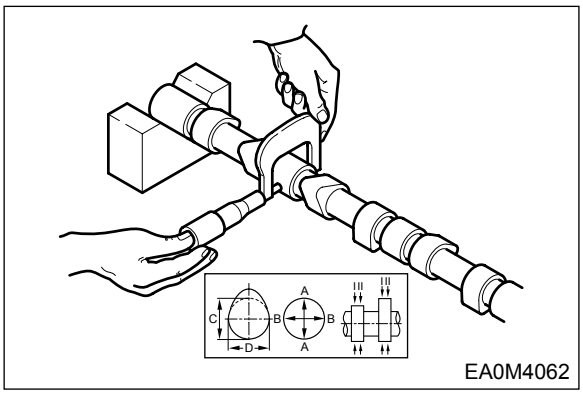
1) Cam

● **Cam lobe height**

	Standard	Limit
Cam journal diameter(A,B)	∅ 59.86 ~ ∅ 59.88 mm	∅ 59.52 mm

Use a micrometer to measure the cam journal diameter.

If the measured number is less than the specified limit, the camshaft must replaced.



● **Cam surface**

Inspect the cam face for scratch or damage.

Slight step wear or damage on the cam face may be corrected with oil stone or oiled grinding paper. But, replace if severely damaged.

2) Cam shaft

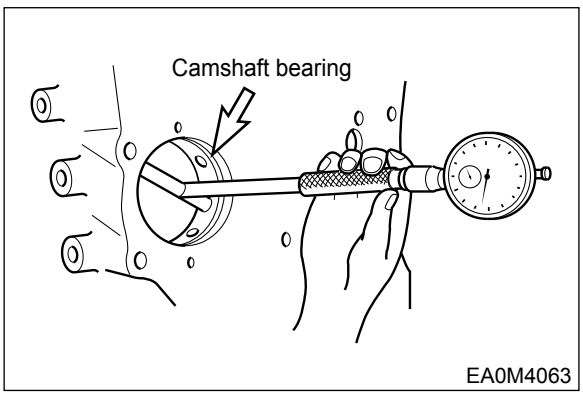
● **Clearance between camshaft journal and camshaft bush**

- With an outside micrometer, measure the camshaft journal diameter.
- Measure the inside diameter of the camshaft bushing on the cylinder block using a cylinder bore indicator, and compare the measured value with the camshaft outside diameter to determine the clearance.

<Clearance>

Standard	Limit
0.050 ~ 0.128 mm	0.2 mm

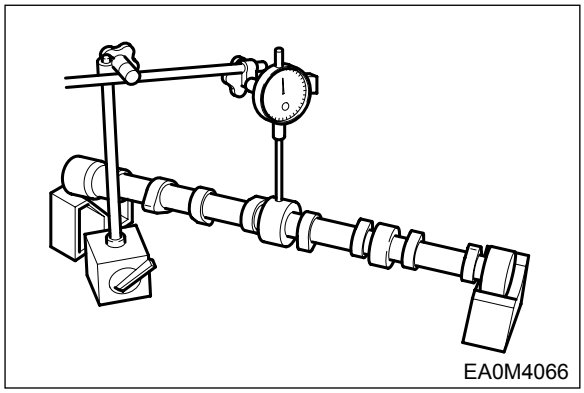
Replace the bushing if the measured value is beyond the specified limit.



● **Run-out**

Support the camshaft on two V blocks and check for run-out using a dial indicator. Correct or replace the cam shaft if the amount of run-out is beyond the value indicating need for servicing.

Standard	Limit
0.05 mm	0.2 mm


EA0M4066

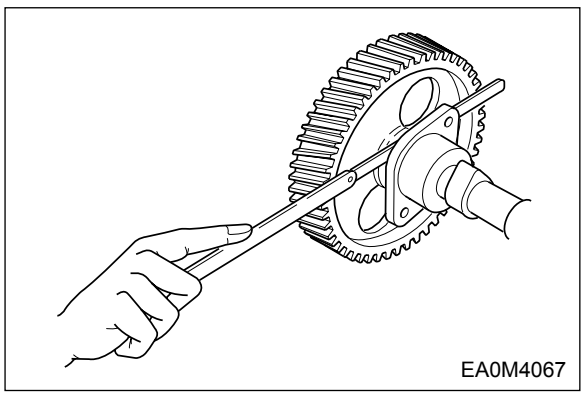
3) Cam shaft end play

● Push the thrust plate toward the cam gear.

● With a feeler gauge, measure the clearance between the thrust plate and camshaft journal.

● If the end play is excessive, replace the thrust plate.

Standard	Limit
0.13 ~ 0.27 mm	0.3 mm


EA0M4067

9.2.6. Crank shaft

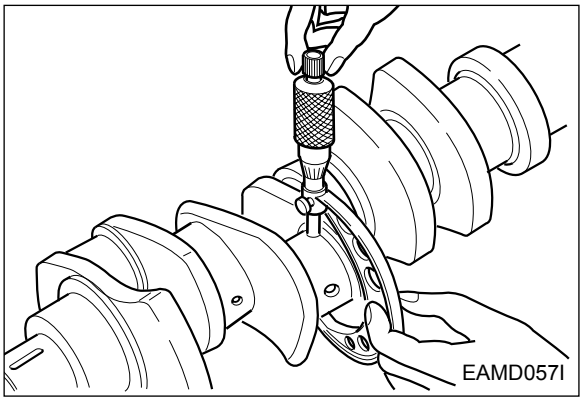
1) Defect check

● Visually check the crankshaft journal and crank pins for scores or cracks.

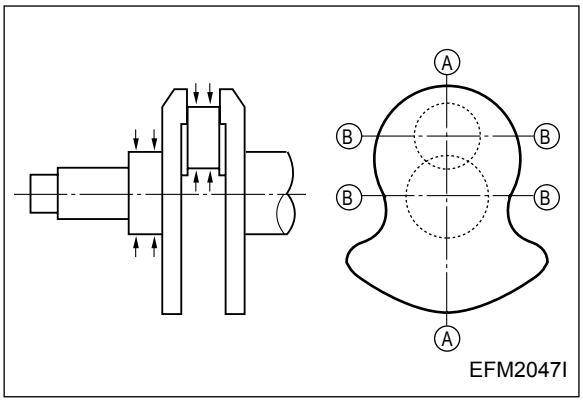
● Using a magnetic particle test and color check, inspect the crankshaft for cracks, and replace the crankshaft which has cracks.

2) Wear

- With an outside micrometer measure the diameter of the crankshaft journals and pins in the directions as shown, and compare the measured values to determine the amount of wear.
- If the amount of wear is beyond the limit, have the crankshaft ground and install undersize bearings. However, if the amount of wear is within the limit, you can correct the wear using an oil stone or oiled grinding paper of fine grain size. (Be sure to use grinding paper which has been immersed in oil.)



	Standard	Limit
Journal diameter	ø95.966 ~ ø95.988 mm	ø95 mm
Pin diameter	ø82.966 ~ ø82.988 mm	ø82 mm

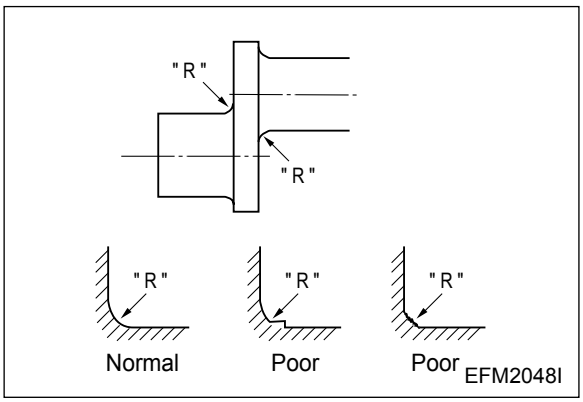


*** Undersize bearings available**

- Standard
- 0.25 (Inside diameter is 0.25 mm lesser than the standard size.)
- 0.50 (Inside diameter is 0.50 mm lesser than the standard size.)
- 0.75 (Inside diameter is 0.75 mm lesser than the standard size.)
- 1.00 (Inside diameter is 1.00 mm lesser than the standard size.)

Undersize bearings are available in 4 different sizes as indicated above, and the crankshaft can be reground to the above sizes.

Note : When regrinding the crankshaft as described below, the fillet section 'R' should be finished correctly. Avoid sharp corners or insufficient fillet.



*** Standard values of 'R'**

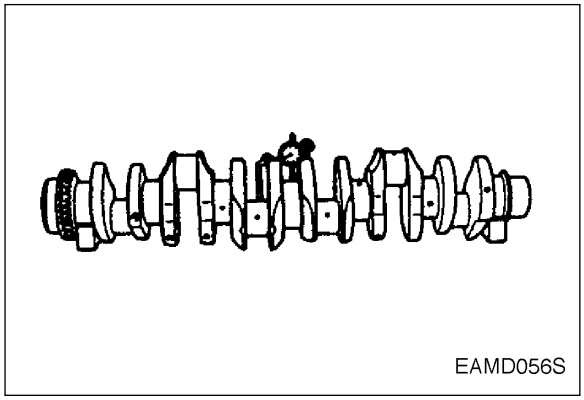
① Crankshaft Pin 'R': 4.5 $^{0}_{-0.2}$

② Crankshaft journal 'R': 4 $^{0}_{-0.2}$

3) Crankshaft run-out

- Support the crankshaft on V blocks.
- Turn the crankshaft with a dial indicator placed on the surface plate and take the amount of crankshaft run-out.

Standard	Limit
0.05 mm	0.1 mm


EAMD056S

9.2.7. Crank shaft bearing and connection rod bearing

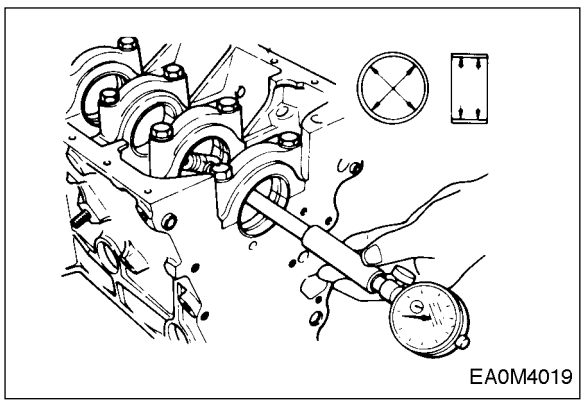
1) Visual check

Visually check the crankshaft bearing and connecting rod bearing for scores, uneven wear or damage.

2) Oil clearance between crankshaft and bearing.

- Main bearing clearance (Method 1)

Install the main bearing in the cylinder block, tighten the bearing cap to specified torque, then measure the inside diameter.


EA0M4019

Torque	30 kg•m

Standard Dia.	ø96.06 ~ ø96.108 mm

Compare the two values obtained through measurement of main bearing inside diameter with the outside diameters of crankshaft journals to determine the oil clearance.

<Main bearing oil clearance>

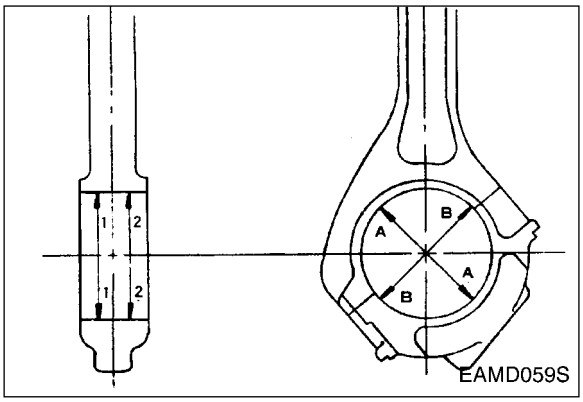
Standard	Limit
0.072 ~ 0.142 mm	0.25 mm

● **Connecting rod bearing clearance**

Install the connecting rod bearing in the connecting rod bearing cap, tighten the connecting rod cap bolts to the specified torque, then measure the inside diameter.

Torque	28 kg•m

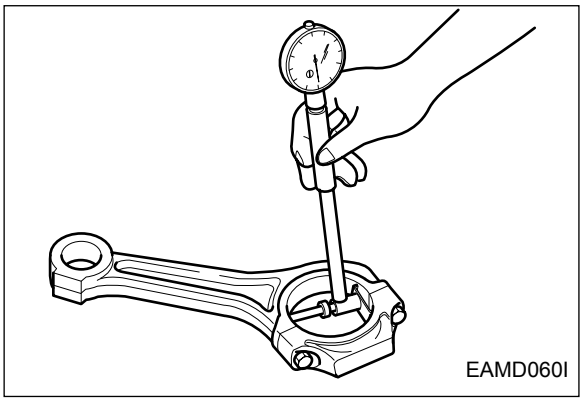
Standard Dia.	∅83.02 ~ ∅83.092 mm



EAMD059S

Compare the two values obtained through measurement of connecting rod bearing inside diameter with the outside diameters of crankshaft pins to determine the oil clearance.

Standard	**Limit**
0.032 ~ 0.102 mm	0.20 mm


EAMD060I

● If the clearance deviates from the specified range, have the crankshaft journals and pins ground and install undersize bearings.

● **Connecting rod bearing clearance**

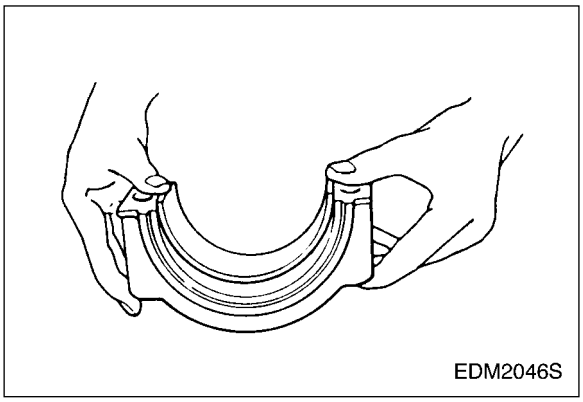
(Method 2 : with plastic gauge)

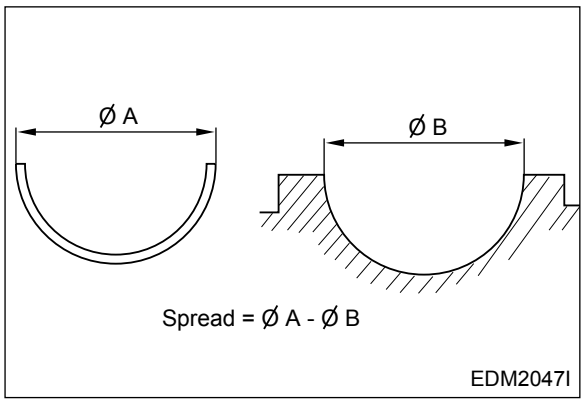
Assemble the crankshaft on the cylinder block and put the plastic gauge on journal and pin of crankshaft and then after assembling bearing cap, tighten the bolts at the specific torque. Again after disassembling the bearing cap by removing the bolts, take out the flatted plastic gauge and measure the width of plastic gauge by means of plastic gauge measuring scale. This is the oil clearance.

3) Bearing spread and crush

● **Inspection**

Check to see that the bearing requires a considerable amount of finger pressure at reassembly operation.

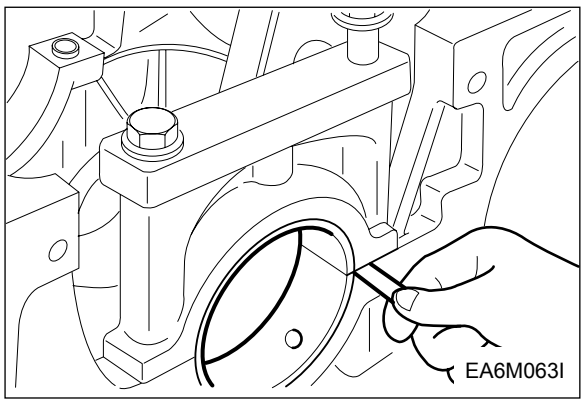

EDM2046S



● **Crankshaft bearing crush**

Install the bearing and cap in the cylinder block, retighten the bolts to specified torque, unscrew out one bolt completely, then measure the clearance between the bearing cap and cylinder block using a feeler gauge.

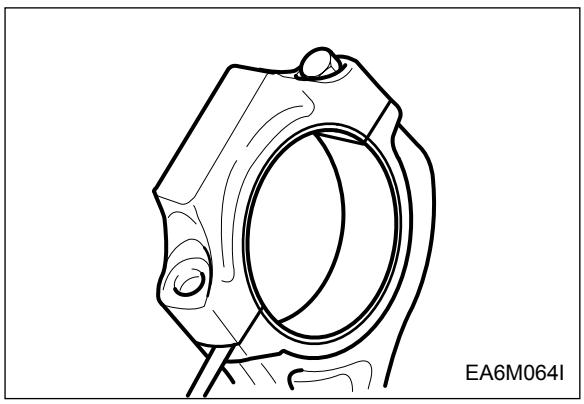
Standard Dia.	0.15 ~ 0.25 mm



● **Connecting rod bearing crush**

Install the bearing and cap in the connecting rod big end, retighten the bolts to specified torque, unscrew out one bolt completely, then measure the clearance between the bearing cap and connecting rod big end using a feeler gauge.

Standard	0.086 ~ 0.116 mm

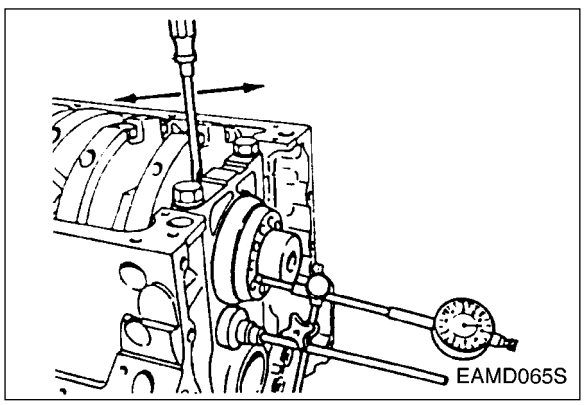


4) crank shaft end play

● Assemble the crankshaft to the cylinder block.

● With a dial gauge, measure crankshaft end play.

Standard	**Limit**
0.15 ~ 0.325 mm	0.5 mm



9.2.8. Piston

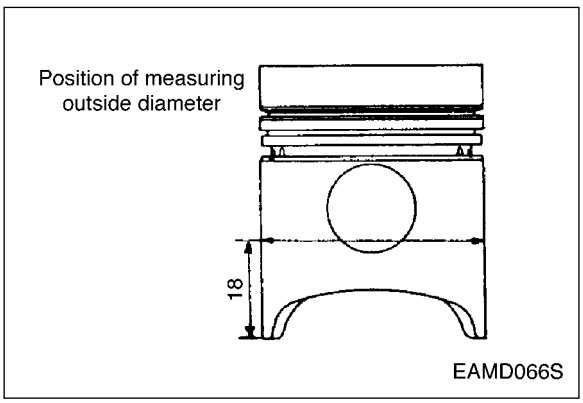
1) Visual check

Visually check the pistons for cracks, scuff or wear, paying particular attention to the ring groove.

2) Clearance between the piston and cylinder liner

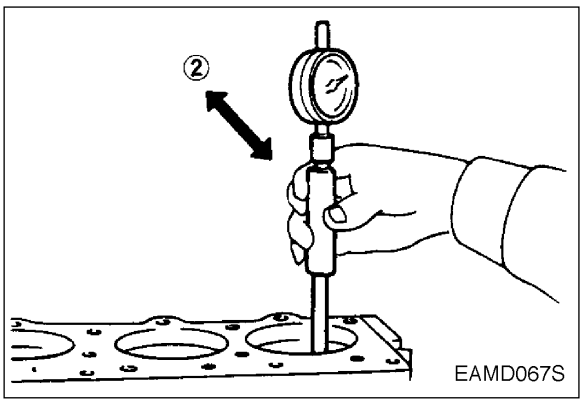
- With an outside micrometer, measure the piston outside diameter at a point 18mm away from the lower end of piston skirt in a direction at a right angle to the piston pin hole.

Standard	∅122.433 ~ ∅127.863 mm



- Using a cylinder bore gauge, measure cylinder liner inside diameter at 3 points (cylinder top ring contacting face, middle, and oil ring contacting face on BDC) in a direction at an angle of 45 . Take the mean value with the largest and smallest values excepted.

Standard	Limit
∅123 ~ ∅123.023 mm	∅123.223 mm



- The clearance is computed by subtracting the piston outside diameter from the cylinder liner inside diameter. Replace either piston or cylinder liner, whichever damaged more, if the clearance is beyond the specified limit.

Clearance between piston and liner

Standard	0.109 ~ 0.166 mm

9.2.9. Piston rings

1) Visual check

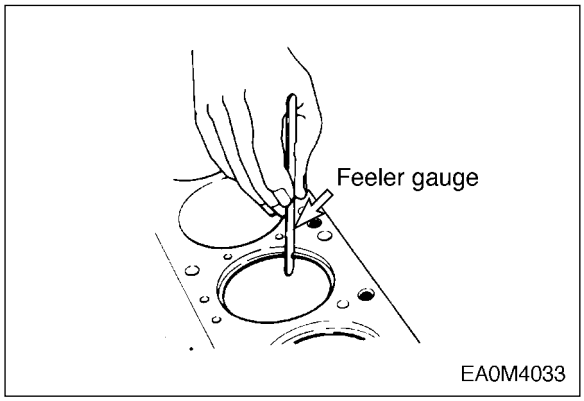
Replace the piston rings with new ones if detected worn or broken when the engine is overhauled.

2) Piston ring gap

- Insert the piston ring into the upper portion of the cylinder liner bore so that it is held at a right angle to the cylinder liner wall.
- Measure the piston ring gap with a feeler gauge.

	Standard	Limit
Top ring	0.30 ~ 0.45 mm	1.5 mm
2nd ring	0.35 ~ 0.50 mm	1.5 mm
Oil ring	0.30 ~ 0.50 mm	1.5 mm

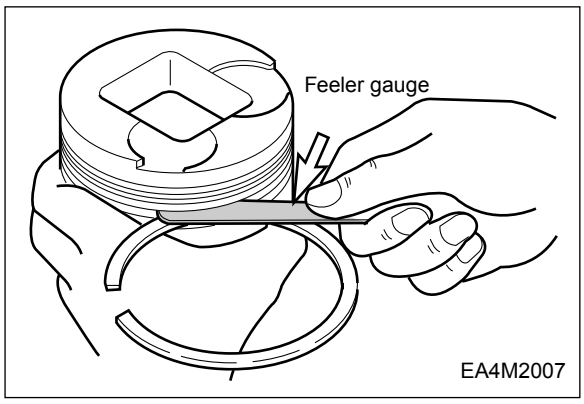
Replace piston rings with new ones if the gap is beyond the limit



3) Piston ring side clearance

- Fit the compression ring and oil ring in the piston ring groove.
- With a feeler gauge, measure side clearance of each ring, and replace either the ring or piston if the measured value is beyond the specified limit.

	Standard	Limit
Top ring	0.105 ~ 0.155 mm	
2nd ring	0.07 ~ 0.102 mm	0.15 mm
Oil ring	0.05 ~ 0.085 mm	0.15 mm



4) Piston ring tension

With a tension tester, measure piston ring tension. Replace the piston ring if the measured value is beyond the limit.

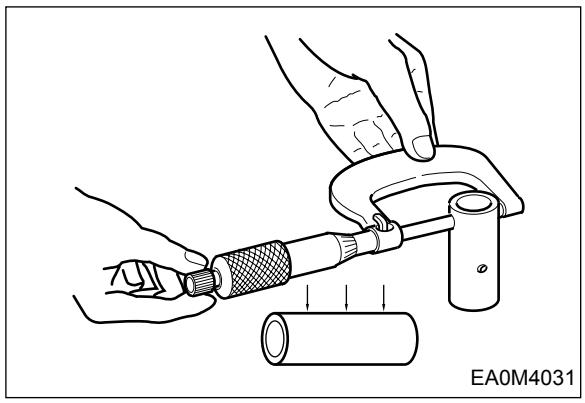
	Standard
Top ring	2.27 ~ 3.41 kg
2nd ring	2.0 ~ 3.0 kg
Oil ring	4.03 ~ 5.57 kg

9.2.10. Piston pin

1) Wear

Measure the amount of wear on the piston pin at the points as shown. The measured values are beyond the limit (0.005 mm or greater), replace the pin

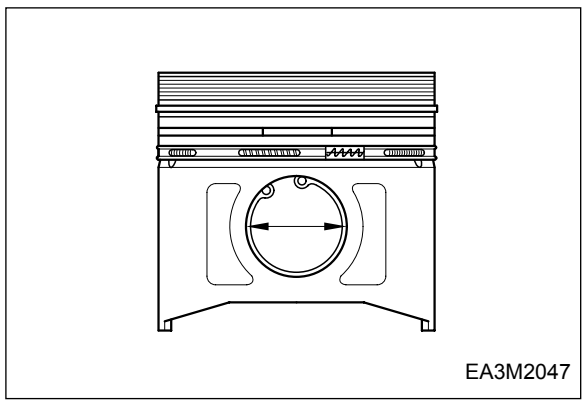
Standard	Limit
∅44.995 ~ ∅45 mm	∅44.990 mm or less


EA0M4031

2) Clearance

Measure the clearance between the piston pin and connecting rod bushing, and replace either of them, whichever damaged more, if the measured value is beyond the limit.

Standard	Limit
0.003 ~ 0.009 mm	0.011 mm


EA3M2047

3) Condition check

Check the engaged condition of the piston and piston pin. If it is possible to force the pin into the piston heated with piston heater, the piston is normal. When replacing the piston, be sure to replace the piston pin together.

9.2.11. Connecting rod

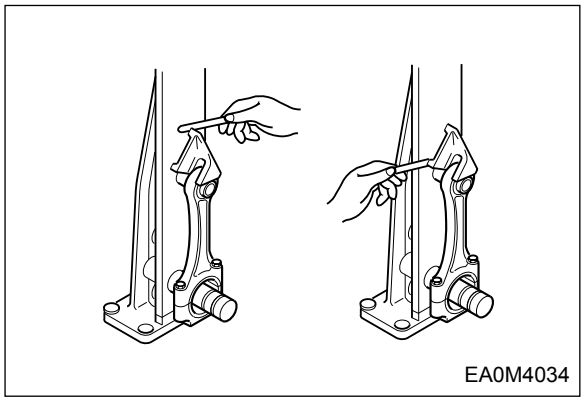
1) Distorsion

Check the connecting rod for distortion. As shown in the figure below, install the connecting rod to the connecting rod tester, and check for distortion using a feeler gauge. If the connecting rod is found distorted, never re-use it but replace with a new one.

2) Holes alignment (parallelism)

Measure the alignment of the connecting rod piston pin bushing holes with connecting rod big end holes. At this time also, use both connecting rod tester and feeler gauge.

Standard	Limit
0.05 mm	0.1 mm or less



3) Wear

- Assemble the connecting rod to the crankshaft and measure connecting rod big end side clearance using a feeler gauge.
- Assemble the connecting rod to the piston and measure connecting rod small end side clearance.
- If the measured values are beyond the limit, replace the connecting rod.

Limit	0.5 mm

9.3. Reassembly

9.3.1. General precautions

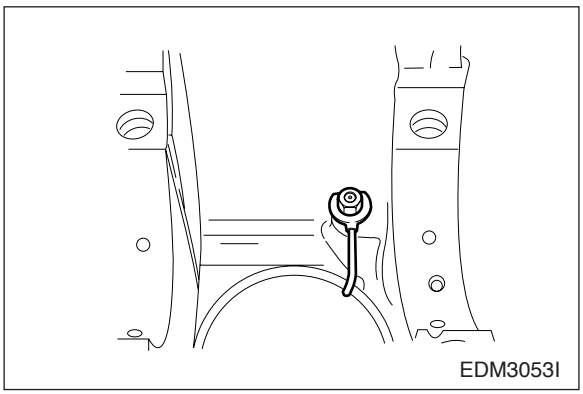
- Wash clean all the disassembled parts, particularly oil and water ports, using compressed air, then check that they are free from restrictions.
- Arrange the general and special tools in order for engine assembly operation.
- To wet each sliding part, prepare the clean engine oil.
- Prepare service materials such as sealant, gaskets, etc.
- Discard used gaskets, seal rings, and consumable parts, and replace with new ones.
- Apply only the specified torque for bolts in the specified tightening order and avoid over-tightening.
- Be sure to check that all the engine parts operate smoothly after being reassembled.
- Check the bolts for looseness after preliminary reassembly.
- After completing the engine reassembly operation, check if there is missing parts or shortage of parts.
- Keep your hands clean during the working.

9.3.2. Cylinder block

Cover the floor of the workshop with wood plate or thick paper to prevent damage to the cylinder head and place the cylinder block with the head fitting surface facing downward.

9.3.3. Oil spray nozzle

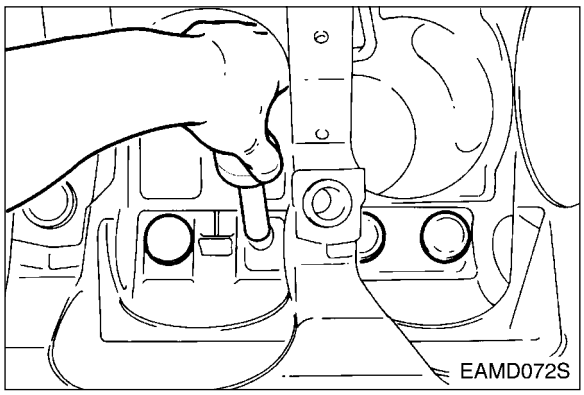
Tighten and assemble the oil spray nozzle flange with fixing bolts using the spray nozzle jig.


EDM3053I

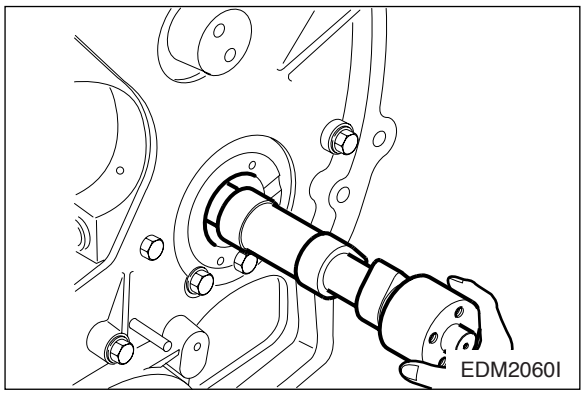
9.3.4. Tappet and cam shaft

- Undercool a new bush with dry ice for about 2 hours and press it into position in the cylinder block using a bench press. After the pressing operation, measure the inside diameter of the cam bush to check if it is not deformed.

- Apply engine oil to the entire face of the tappets and slide them into the tappet holes on the cylinder block.

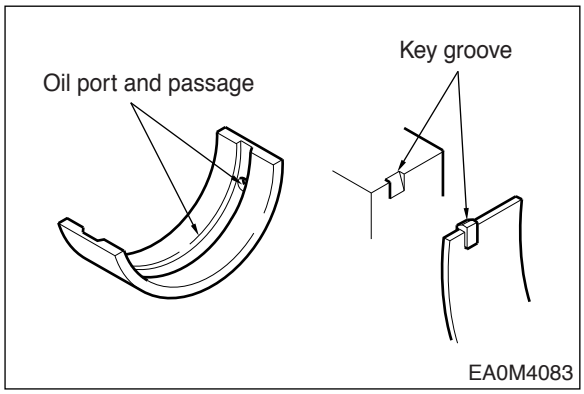


- Wet the cam bush inside diameter and camshaft with oil, and carefully assemble them while turning the camshaft.
- Check to see that the camshaft rotates smoothly.

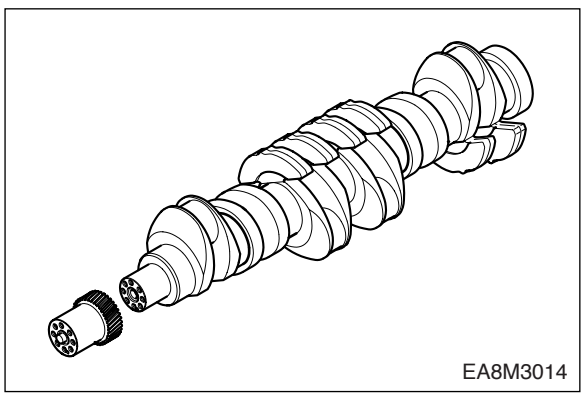


9.3.5. Crankshaft

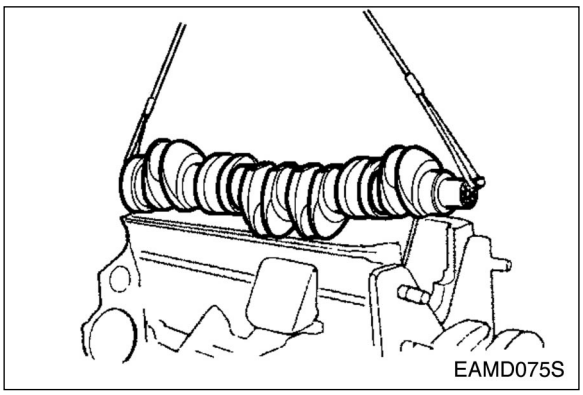
- Install the main bearing machined with two holes in the cylinder block so that the key is aligned with the key groove, then apply oil to the bearing surface.



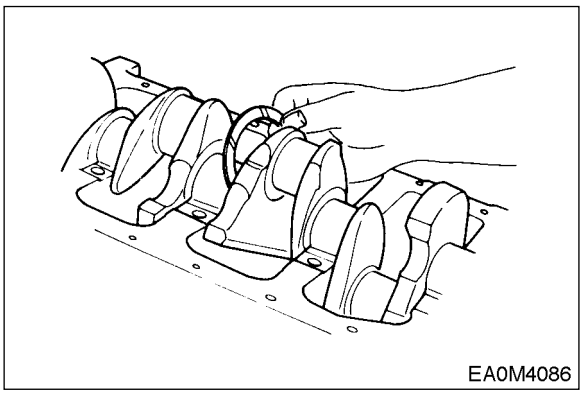
- Heat the crankshaft gear for at least 10 minutes to 120˚C, then apply sealant (Loctite # 641) to the inside wall of the heated crankshaft gear evenly before inserting it to the end of crankshaft.



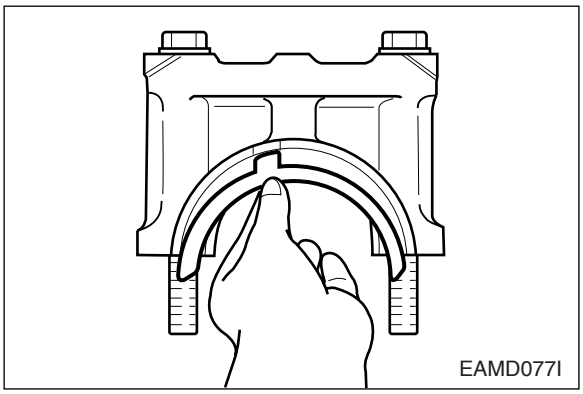
- Semi-tighten a bolt at both sides of the crankshaft, apply engine oil to journals and pins, then assemble the crankshaft with the cylinder block by tightening the fixing bolts.


EAMD075S

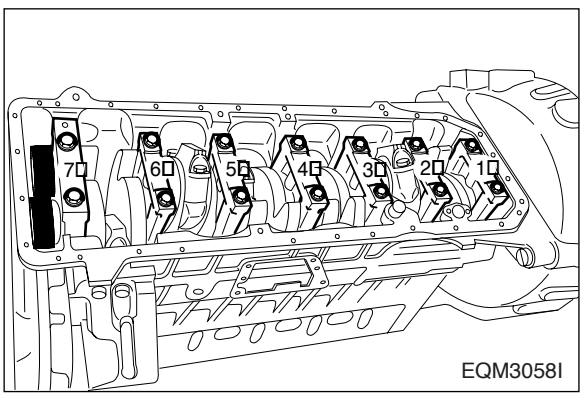
- Install the oiled thrust washers with the oil groove facing outward.


EA0M4086

- Install the bearing and thrust washers to the bearing cap and apply oil to the bearing and thrust washers.


EAMD077I

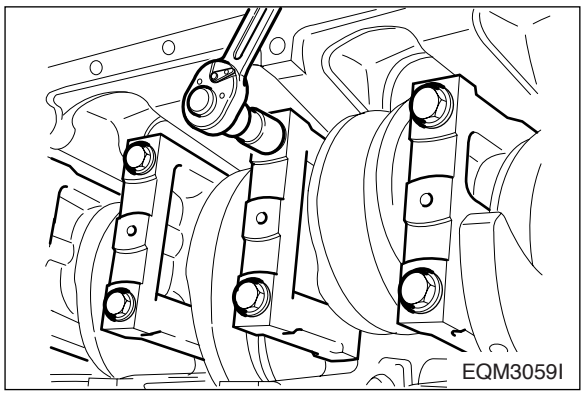
- Install the bearing cap by matching the cylinder block No. with the bearing cap No.



EQM3058I

- Apply oil to the entire part of the bearing cap bolts, then tighten in tightening sequence to specified torque.

Torque	30 kg•m

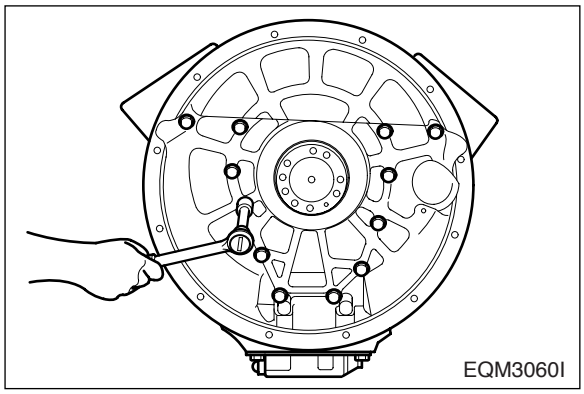

EQM3059I

- After semi-tightening both bolts evenly, tighten them diagonally specified torque using a torque wrench as follows.
  <Tightening order>
  (1) First stage : Coat engine oil over the bolts.
  (2) Second stage : Temporary assemble the bolts about 1 ~ 2 threads
  (3) Third stage : With impact wrench, tighten up to about 15 kg.m
  (4) Fourth stage : With torque wrench, tighten up to about 25 kg.m
  (5) Fifth stage : By means of torque wrench, tighten finally in the specified torque. (30 kg.m).
- Tighten the bearing cap in the sequence of 4-3-5-2-6-1-7.
- Check to see that the assembled crankshaft turns smoothly.

9.3.6. Flywheel housing

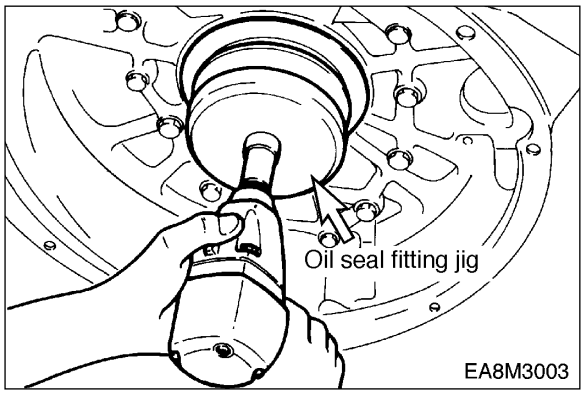
- Temporarily install the guide bar on the cylinder block.
- Apply gasket to the cylinder block.
- Using the dowel pin and guide bar, install the flywheel housing and tighten the fixing bolts in a diagonal sequence to specified torque.

Torque	12 kg•m


EQM3060I

9.3.7. Rear oil seal

- Apply lubricating oil to the outside of theoil seal and flywheel housing inside diameter and fit them over the crank shaft, then assemble the oil seal using an oil seal fitting jig.

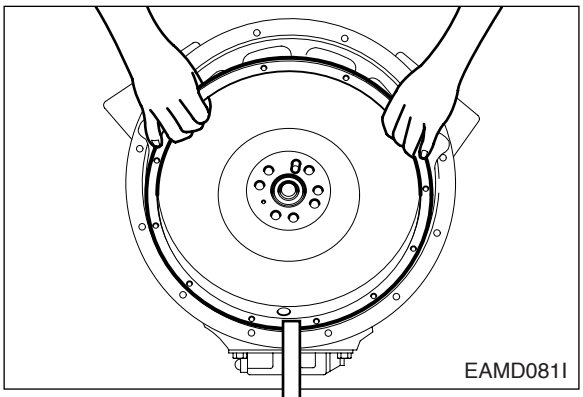


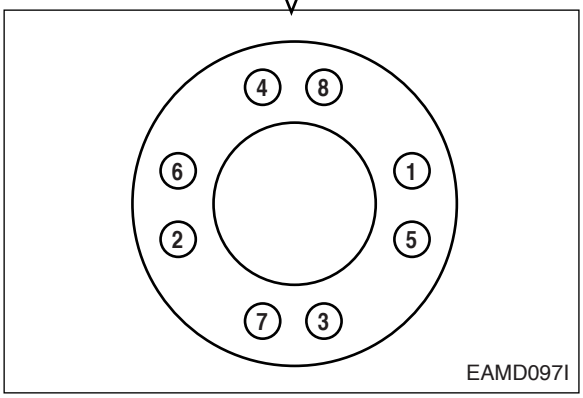
EA8M3003

9.3.8. Flywheel

- Install a guide bar into a bolt hole on the crank shaft, and lift the flywheel to align the dowel pin with the pin hole on the flywheel for temporary assembly operation.
- Install bolts in the remaining holes, take out the guide bar, then install a bolt in the hole where the guide bar had been inserted.
- Tighten the fixing bolts using a torque wrench in a diagonal sequence to specified torque.

Torque	18 kg•m

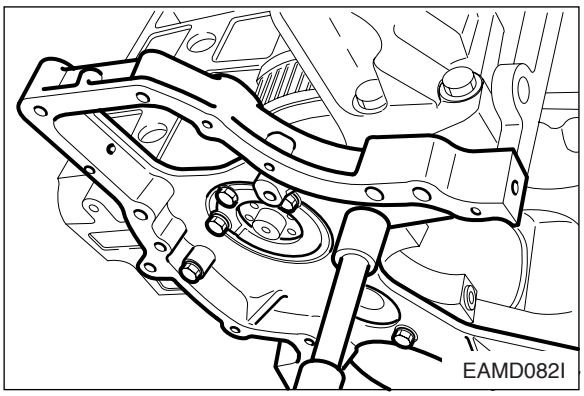

EAMD081I



EAMD097I

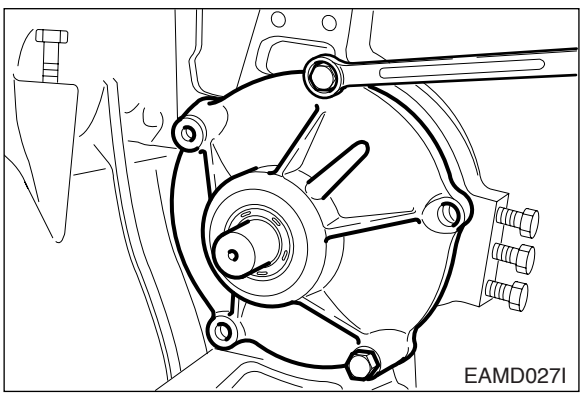
9.3.9. Timing gear case

- Mount gasket using dowel pin on the cylinder block.
- Install the timing gear case by aligning the dowel pin with the dowel pin hole on the timing gear case.


EAMD082I

9.3.10. Fuel injection pump drive gear assembly

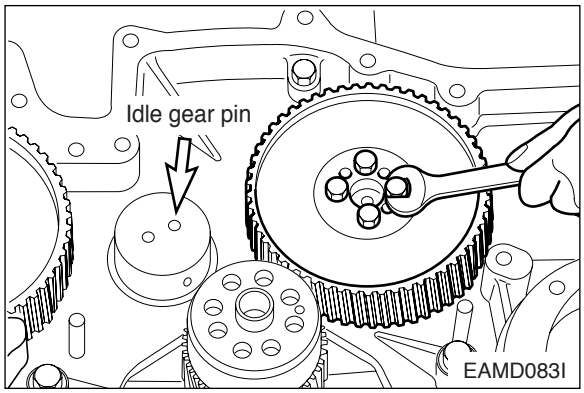
- Mount gasket by aligning the bolt holes with the pin holes on the bearing housing.
- Tighten up the fixing bolts in the direction of fuel injection pump.


EAMD027I

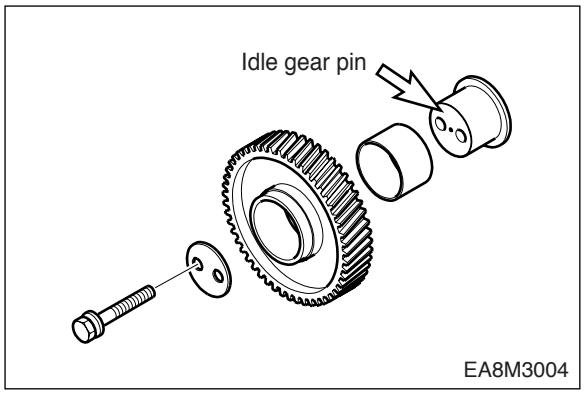
9.3.11. Timing gear

- Install the oil pump idle gear onto the No.7 bearing cap.
- Install a thrust washer over the camshaft and assemble the cam gear by aligning it with camshaft key groove.

Torque	3.1 kg•m

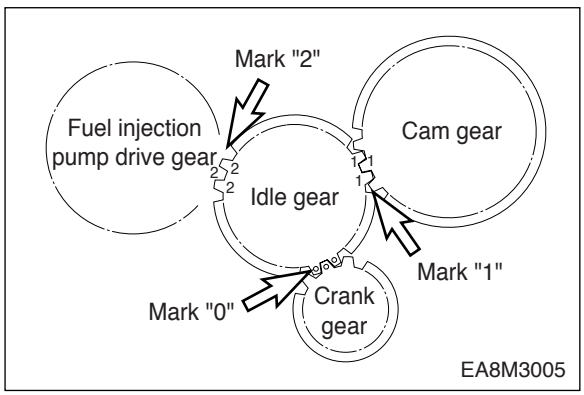


- With the oil port on the idle gear pin facing the cylinder block, install the idle gear pin.



- Install the idle gear by coinciding the marks impressed on the crank gear, cam gear, fuel injection pump drive gear, and idle gear.
- Install a thrust washer on the idle gear and tighten to specified torque.

Torque	7.4 kg•m

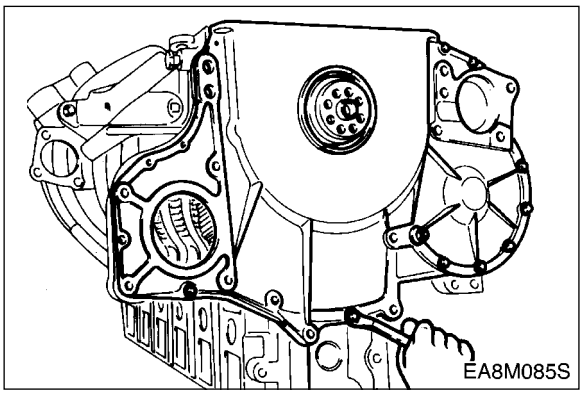


- Check and adjust the amount of backlash between gears using a feeler gauge.

Measuring position (between)	Backlash	Limit
Cam gear & idle gear	0.16 ~ 0.28 mm	0.35 mm
Crank gear & idle gear	0.16 ~ 0.28 mm	0.35 mm
Injection pump & idle gear	0.16 ~ 0.28 mm	0.35 mm

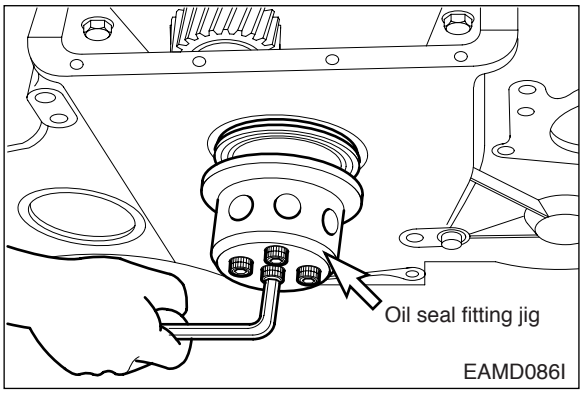
9.3.12. Timing gear case cover

- Install dowel pin on the timing gear case.
- Mount a gasket by aligning the fixing bolt holes with those on the gasket.
- Align the dowel pin with the cover pin hole, then install the cover with light tap.
- Tighten the fixing bolts beginning with the oil pan fitting face.



9.3.13. Front oil seal

- Apply lubricating oil to the outside of the oil seal and timing gear case inside diameter and fit them over the crankshaft, then assemble the oil seal using an oil seal fitting jig.

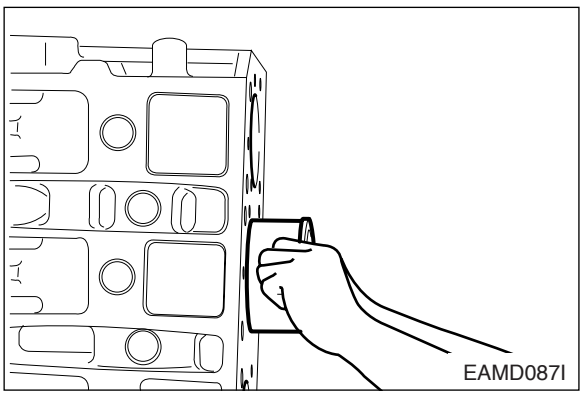


9.3.14. Cylinder liner

- Stand the cylinder block so that the flywheel faces downward.

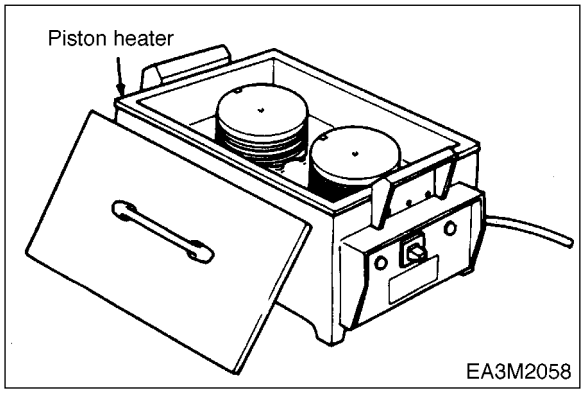
- Thoroughly clean the liner flange fitting surface and bore inside with compressed air to prevent the entry of foreign substances.
- After the cleaning operation, make the cylinder liner dried up and push it into the cylinder block by hand.

- Wet the liner inside diameter with engine oil.

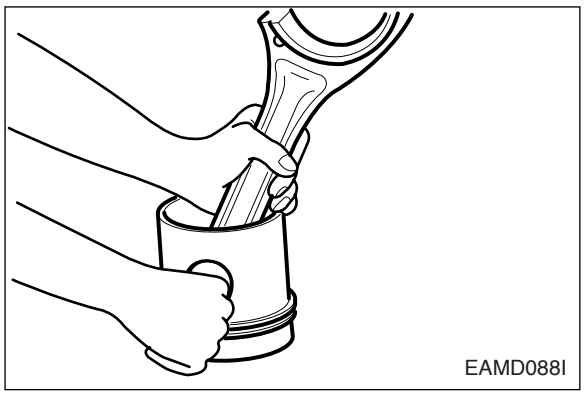


9.3.15. Piston and connecting rod

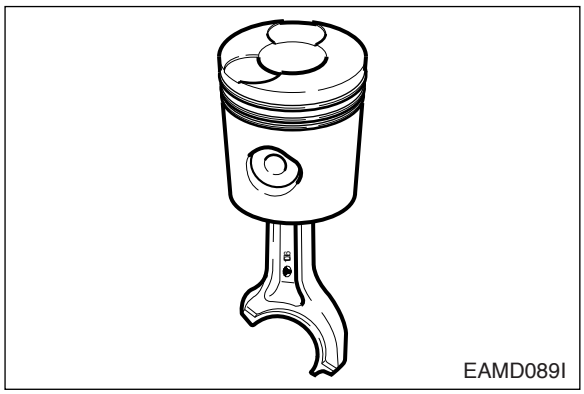
- Use a piston heater to heat the piston approximately 100 ˚C (212 ˚F) for 5 minutes.



- Align the piston pin hole with the oiled connecting rod small end and press the piston pin (by lightly tapping with a rubber hammer) to assemble the connecting rod with the piston.



- Noting the direction of the piston, make the longer side (machined with key groove on the bearing) of the connecting rod big end and the mark of ‘ ’ impressed on the inside of the piston face each other in opposite directions. On the piston head surface, the longer side of connecting rod big end is in opposite direction from the valve seating surface as well as in the same direction with the narrow margin of combustion chamber.

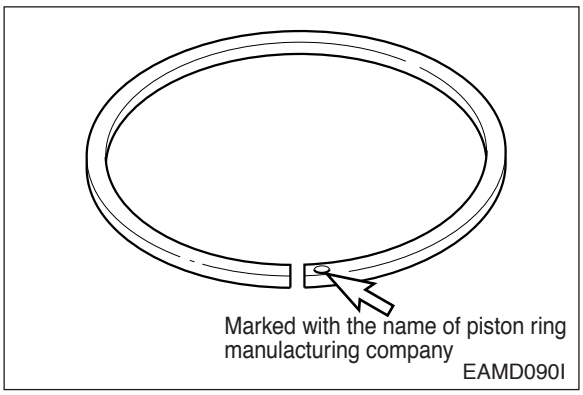


- Install the snap rings and check to see that it is securely assembled.

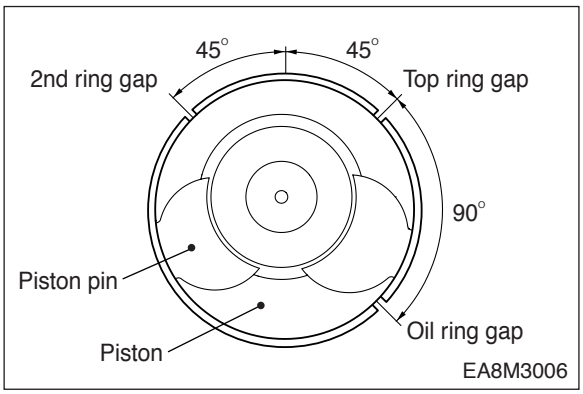
- Install the piston ring in the piston using piston ring pliers.

- Identify the mark "Y" or "TOP" on the ring end to prevent the top and bottom of the piston ring is interchanged each other and make the marked top face upward.

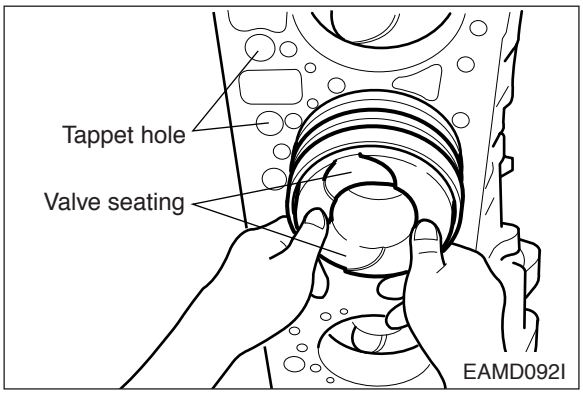
Note : Be sure to make the piston ring end marked face("Y" or "TOP") upward.

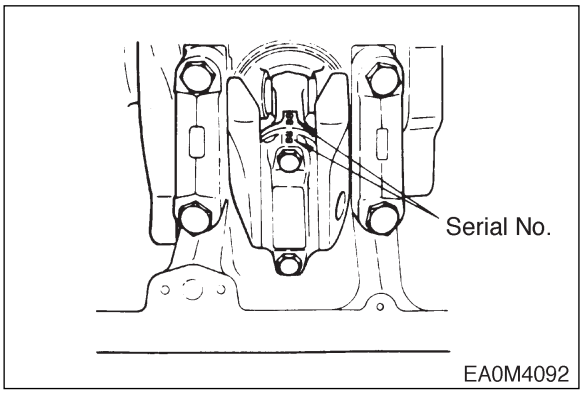


- Adjust the angle among individual piston ring gaps to 90˚ and fit a piston assembling jig onto the piston, Use care not to match the ring gaps with the pin direction.
- Install the bearing by aligning it with the connecting rod key groove and apply oil to the bearing and piston.



- Position the valve seating surface toward the tappet hole and insert the piston with hand.
  Use care not to damage the cylinder liner and piston, and slightly lift and insert the piston into the cylinder so that the ring may not be damaged by the fillet of the liner.
- Install the bearing in the connecting rod cap and apply oil.
- Make sure that the manufacture serial numbers impressed on the connecting rod cap and connecting rod big end are identical, and install the connecting rod cap by aligning it with dowel pin.





- Wet the fixing bolts with oil, semi-tighten them with hand, tighten them to specified torque using a torque wrench as follows.

  <Tightening order>

  (1) First stage : Coat engine oil over bolts

  (2) Second stage : Temporary screw the bolt about 1 ~ 2 threads

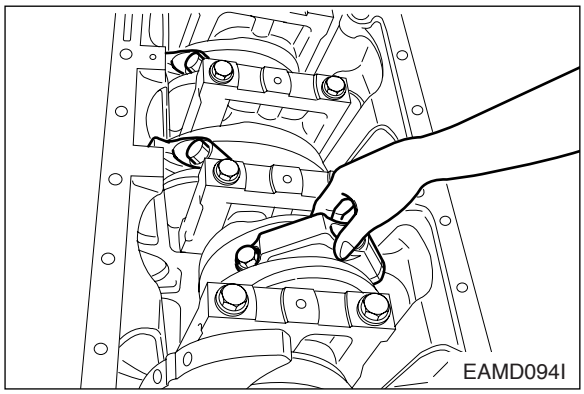
  (3) Third stage : With torque wrench, tighten at about 15 kg.m

  (4) Fourth stage : With torque wrench, tighten up to about 22 kg.m

  (5) Fifth stage : Finally, tighten in the specified torque 28kg.m with torque wrench .

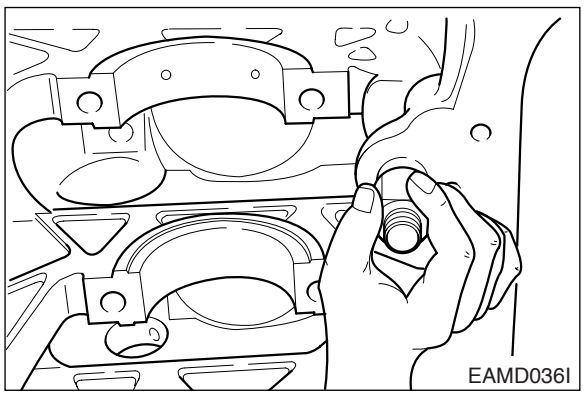
Torque	28 kg•m

- Move the bearing cap with hand, and release and reassemble it if no movement is detected.


EAMD094I

9.3.16. Relief valve

- Assemble the relief valve.

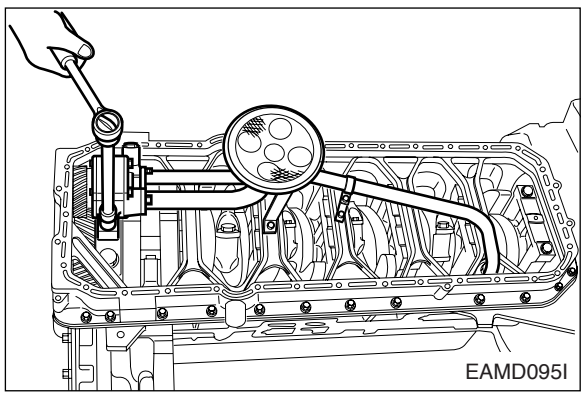

EAMD036I

9.3.17. Oil pump and oil pipe

- Install a dowel pin in the No.7 bearing cap, then assemble the oil pump with specified torque.

Torque	4.4 kg•m

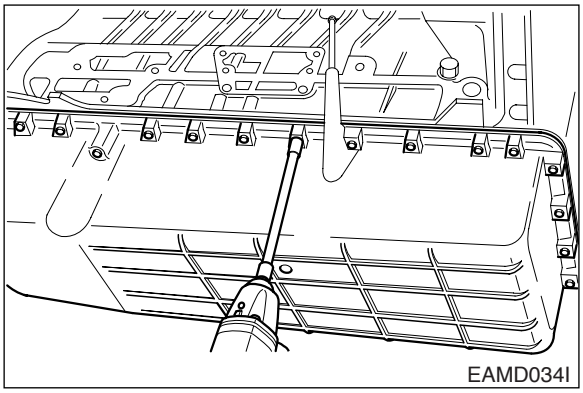
- Assemble the oil suction pipe with the delivery pipe, then install the bracket on the bearing cap.


EAMD095I

9.3.18. Oil pan

- Mount gasket and put the oil pan thereon.
- Place stiffeners and tighten bolts.
- Align the bolt holes with gasket holes to prevent damage to the gasket and tighten to specified torque.

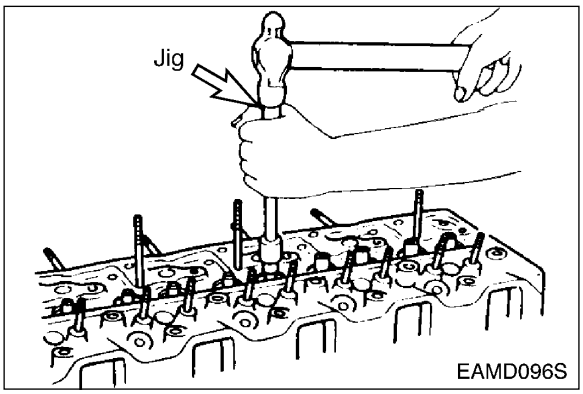
Torque	2.2 kg•m


EAMD034I

9.3.19. Intake and exhaust valves

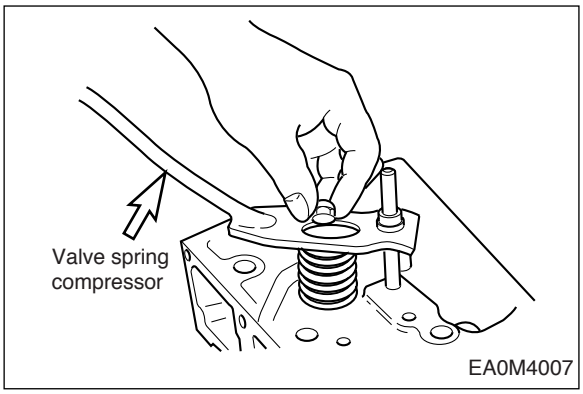
- Identify the marks of “IN” and “EX” impressed on the valve head before assembling the valve with the valve head.

- With a valve stem seal fitting jig, assemble the valve stem seal with the valve guide.



EAMD096S

- After installing valve springs and spring retainer, press the retainer with a jig, then install cotter pin.
- Tap the valve stem lightly with a rubber hammer to check that the valve is assembled correctly.

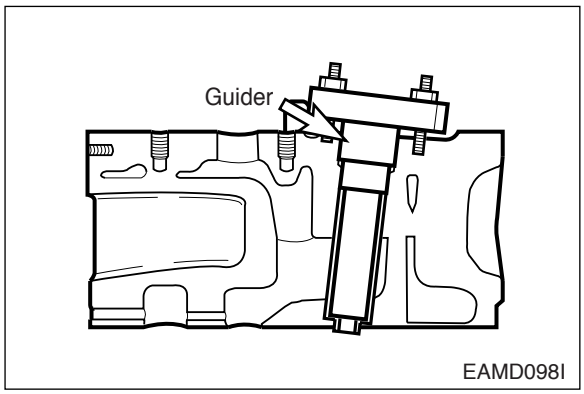


EA0M4007

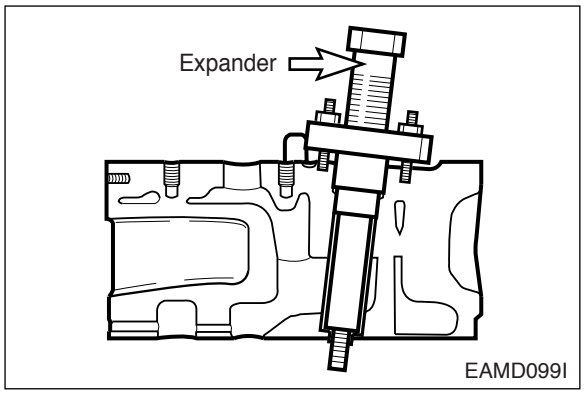
9.3.20. Nozzle tube

- Apply sealant (LOCTITE # 620) to the nozzle tube and place the O-ring over the cylinder head fitting face on the nozzle tube, then install the nozzle tube in the cylinder head.

- Install a guider of the nozzle tube insert ass'y (Guider + Expander) the cylinder head, then tighten the nozzle fixing nuts.



- Apply engine oil to an expander and install it onto the special tool (guider).
- Tighten the bolts until the expander is forced out of the cylinder head bottom.

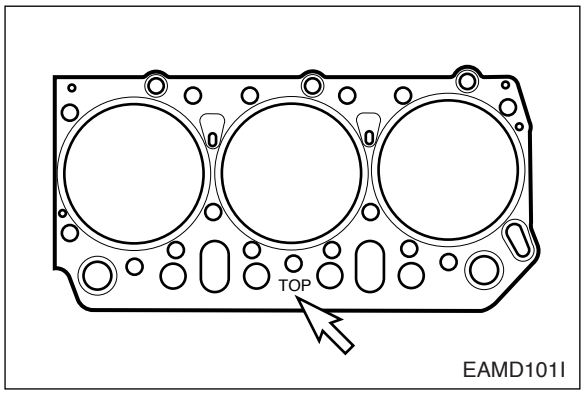


- After mounting the nozzle tube, make a hydraulic test to check for water leaks.

Test pressure	2 kg/cm²

9.3.21. Cylinder head

- Install the injection nozzle fixing stud bolts and water pipe fixing stud bolts.
- Clean the head bolt holes on the cylinder block with compressed air to remove foreign substances and thoroughly clean the gasket fitting face of the cylinder block.
- Install head gasket, with 'TOP' mark facing upward, on the cylinder block by aligning the holes with dowels.



Cylinder Head gasket	Asbestos core type		Semi steel type
	Rubber color : Black		Rubber color : Red
Use bolt	TY 12.9T	TY 10.9T	

- Check the inside of combustion chamber for foreign substances, and carefully mount the cylinder head assembly in the block by aligning the dowel pin with the dowel pin hole. Be careful not to damage the head gasket. If the dowel pin is not in alignment, lift the cylinder head again and then remount it.
- Coat the head bolts with engine oil, then tighten them in proper sequence to the specified torque.

<Cylinder Head Bolts>

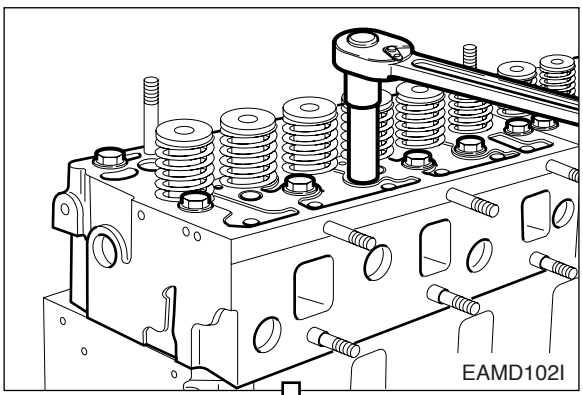
	Type 1	Type 2	Type 3(12.9T)	Type 4(12.9T)	Type 5(10.9T)
Type	TY 12.9T M14x1.5x153	TY 10.9T M14x1.5x150	 M14x1.5x153	 M14x1.5x150	 M14x1.5x150
Tighten torque	24.5 kg.m	1st : 6kg.m 2nd : 180° Finished : 150°	1st : 6kg.m 2nd : 90° + 90° Finished : 30°	1st : 7kg.m 2nd : 90° + 90°	1st : 6kg.m 2nd : 90° + 90° Finished : 90°

However, before tightening bolts, align the side face of 2 cylinder heads with parallel. They should be adjusted in a straight line exactly.

<Tightening order of bolts by steps>

(1) First stage: Coat the bolts with engine oil.
(2) Second stage : Tighten 1 ~ 2 threads with hands.
(3) Third stage : Tighten at about 6 kg.m with a wrench.
(4) Fourth stage : Tighten at rotating angle method 90˚ with a wrench.
(5) Fifth stage : Tighten at rotating angle method 90˚ with a wrench.
(6) Sixth stage : Finally, tighten at rotating angle method 90˚ with a torque wrench .

Especially, all bolts are tightened simultaneously in each step according to above process as possible.



Note : Cylinder head bolts should be replaced by new one after using two or three times because of being loosed as a result of its length too extended. (Limit length 150mm)

- Coat the push rod with engine oil and insert it into the push rod hole.
- Adjust the valve clearance as following guide.

<Guide for valve clearance adjustment>

◆ After letting the #1 cylinder's piston come at the compression top dead center by turning the crankshaft, adjust the valve clearances.

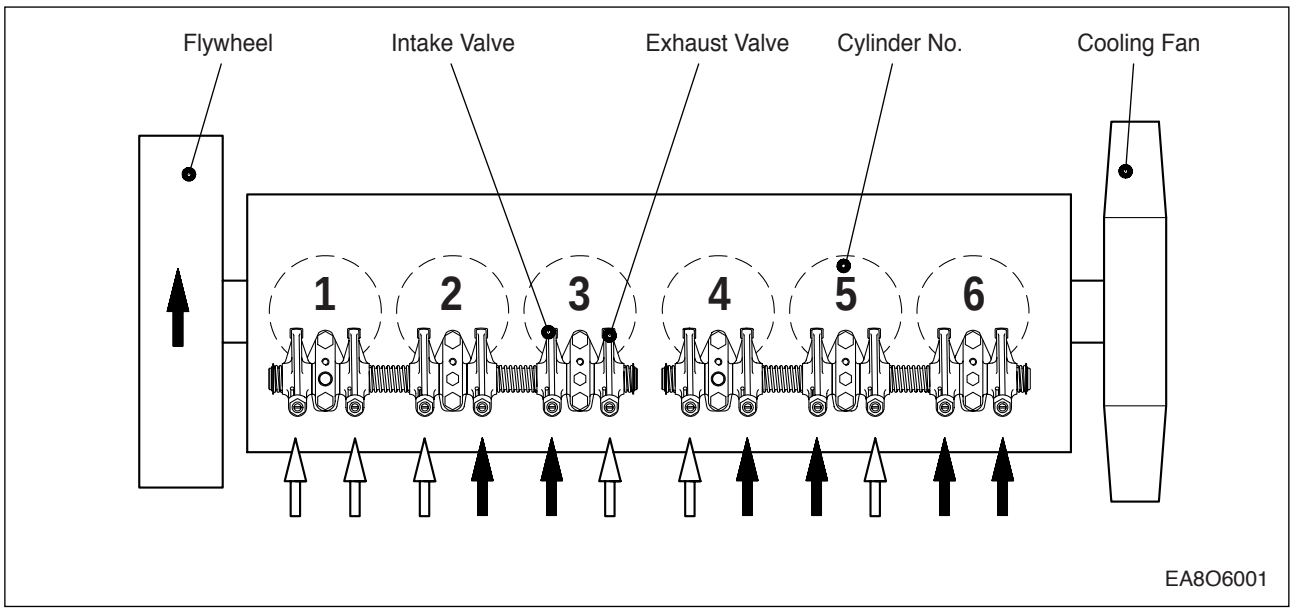
◆ Loosen the lock nuts of rocker arm adjusting screws and push the feeler gauge of specified value between a rocker arm and a valve stem and adjust the clearance with adjusting screw respectively and then tighten with the lock nut.

◆ As for the valve clearance, adjust it when in cold, as follow.

Model	Intake Valve	Exhaust Valve
DE12T P126TI / P126TI-Ⅱ	0.3 mm	0.3 mm

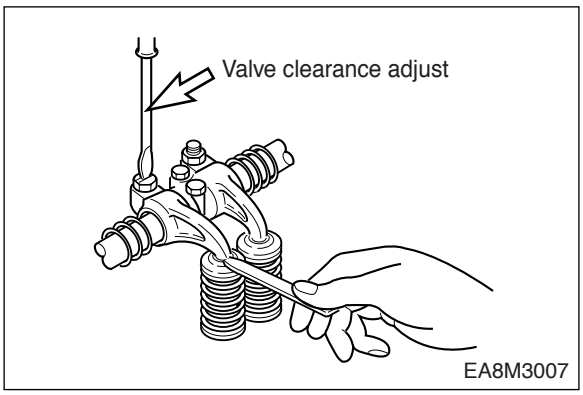
- By cranking the engine, let #6 cylinder's valves overlap.
- In time, adjust the valve clearance corresponding to " ⇨ " of lower lists.
- Adjust the valve clearance corresponding to " ➔ " of lower lists.
- After reinsuring the valve clearances, retighten if necessary.

◆ No. 1 Cylinder is located at the side where flywheel was installed.



- Adjust valve clearance with a feeler gauge and tighten the fixing nuts to specified torque.

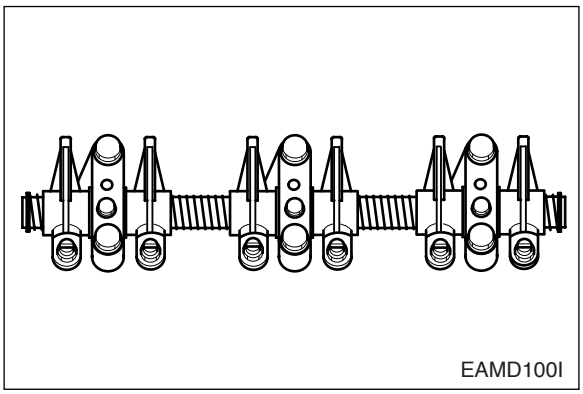
Torque	4.4 kg·m



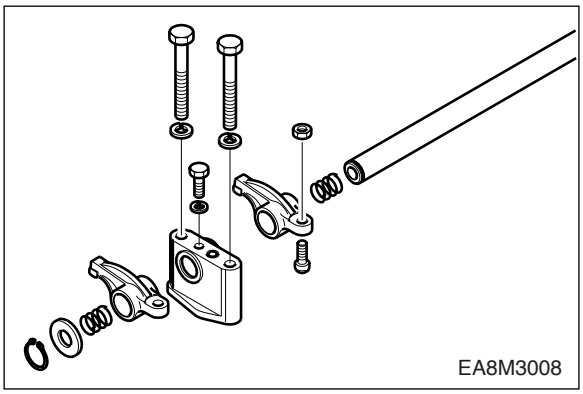
9.3.22. Rocker arm assembly

- Apply lubricating oil to the rocker arm bush and shaft, and assemble the intermediate bracket with the rocker arm using fixing bolts.

Torque	M10(x2) : 4.4 kg·m M8 : 2.2 kg·m



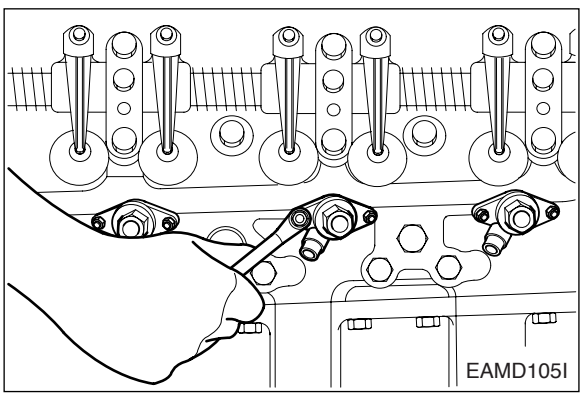
- Semi-install valve clearance adjusting bolts onto the rocker arm.
- Install the spring, rocker arm, bracket, rocker arm, spring, washer, and snap ring in the described sequence.
- Install the rocker arm and bracket in the same direction.



9.3.23. Injection nozzle

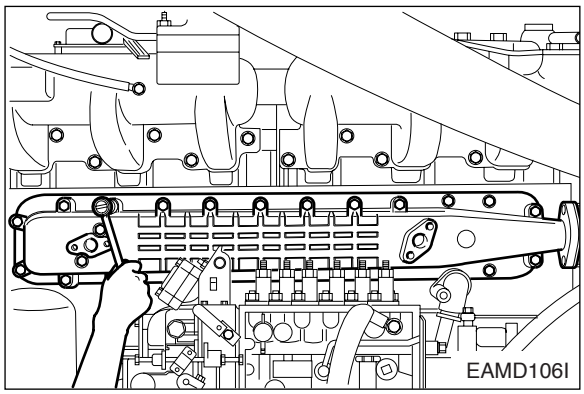
- Install the dust seal with its round portion facing downward.
- Mount a seal ring (0.5 mm) on the seal ring seating surface of the nozzle tube and assemble nozzle holder assembly with the stud bolt with the nozzle pipe installing direction facing outward.
- Be sure to follow the specified torque.

Torque	1.0 kg·m



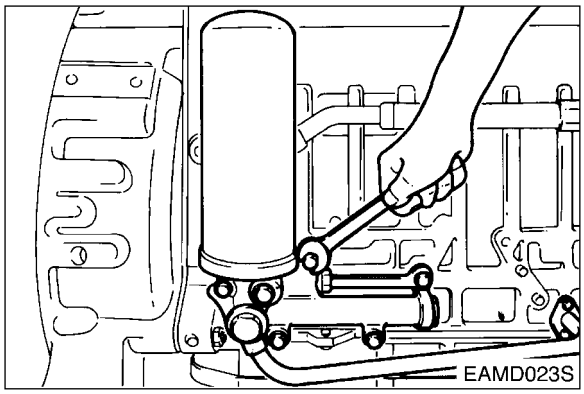
9.3.24. Oil cooler

- Install the oil cooler onto the oil cooler cover.
- Carefully apply the gasket to prevent oil leakage.
- Do not damage the gasket and install the cover onto the cylinder block.
- Connect a connection pipe between the water pump and oil cooler.



9.3.25. Oil filter

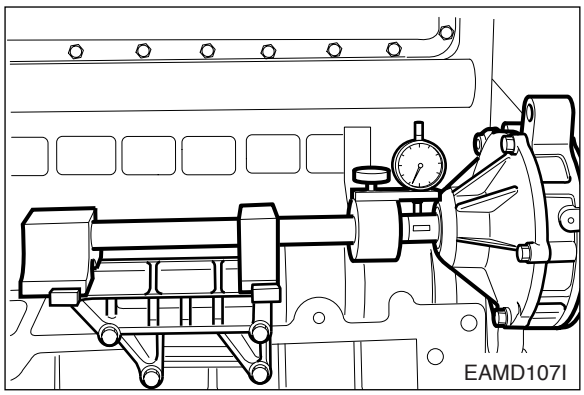
- Install the oil filter onto the cylinder block, and tighten the fixing bolts.
- With the hollow screw, assemble the oil pipe connected between the oil cooler and cylinder block.
- Install a connection pipe between the oil cooler and oil filter.
- Install the oil cooler connecting pipe.
- Install packing and assemble the cartridge using a filter wrench.



9.3.26. Injection pump

- Install the injection pump bracket in the cylinder block.
- After measuring the amount of run-out with an alignment setting jig, disassemble the bracket, adjust the shims, then reassemble it.

Run out	0.2 mm or less

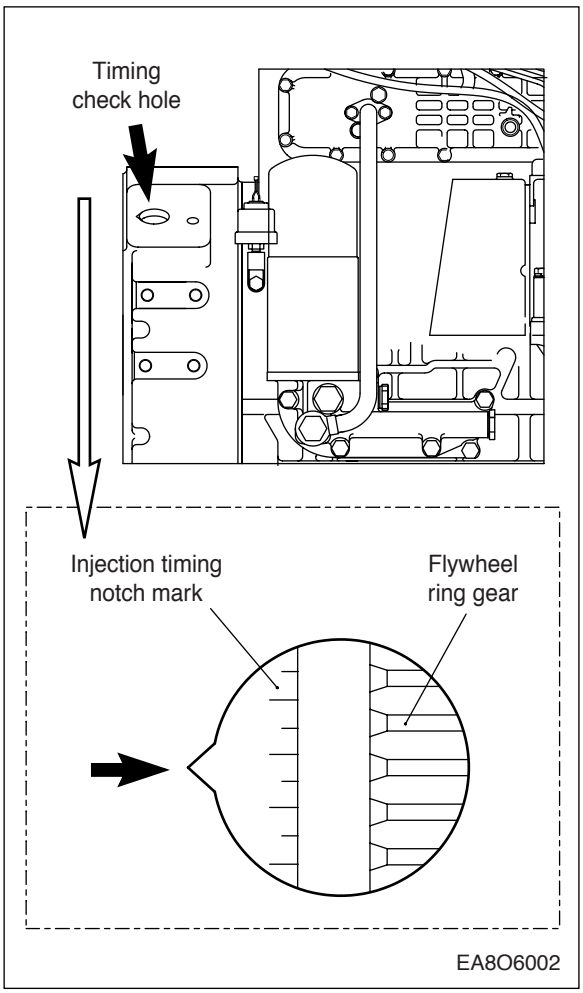


- Mount the top/bottom adjusting shims in the bracket and then mount the fuel injection pump.
- Tighten the fixing bolts in a diagonal sequence to specified torque.

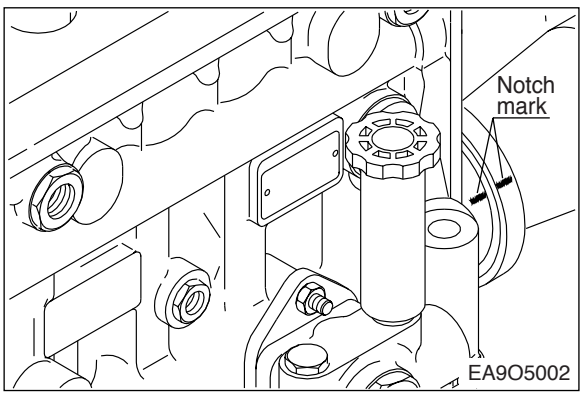
Torque	4.4 kg·m

- Turn the flywheel until No. 1 piston is placed in the “OT” position of notch marks on the flywheel, and then turn again the flywheel clockwise until showing the notch mark of the right figure corresponding to the injection timing is aligned with the pointer (↓) on the flywheel housing.

	DE12T	P126TI/P126TI-Ⅱ
Fuel injection timing (B.T.D.C static)	12°	16°

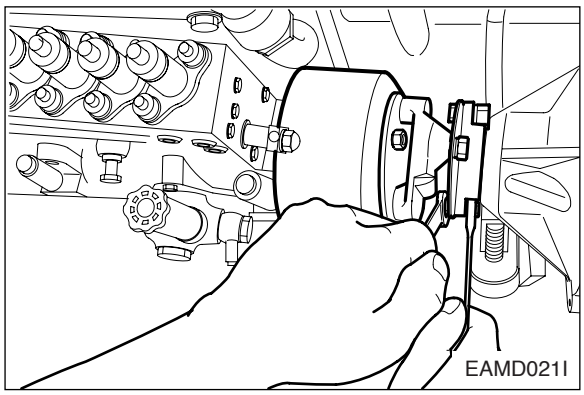


- Turn the timer until the notch mark of the indicator plate attached to the fuel injection pump is aligned with the notch mark of the timer.



- Tighten the Coupling fixing bolts and nuts to specified torque.

Torque	6.0 kg·m



- Tighten the drive shaft connecting flange fixing bolts to specified torque

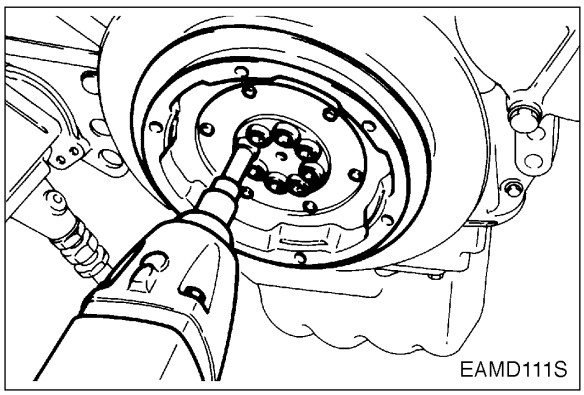
Torque	7.5 ~ 8.5 kg·m

- Install the oil delivery pipe and return pipe.

9.3.27. Vibration damper end pulley

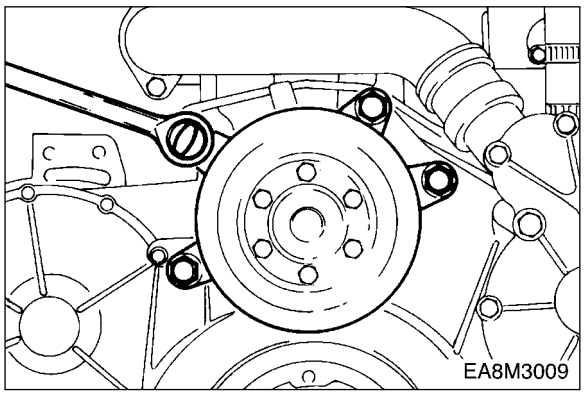
- Install the vibration damper on the crankshaft pulley.
- Install the crankshaft pulley assembly on the crankshaft, then tighten the bolts and thrust washers.

Torque	13.4 kg·m



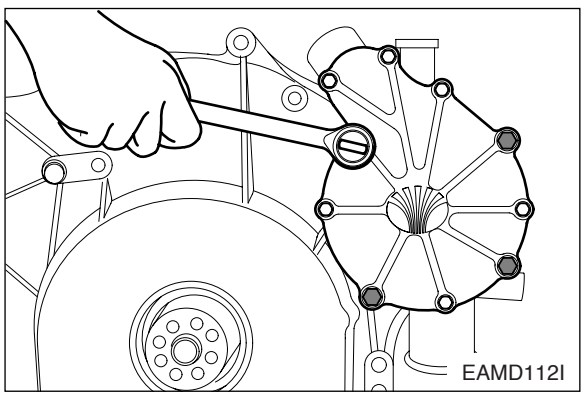
9.3.28. Fan drive pulley

- Install the fan drive pulley onto the timing gear case cover.



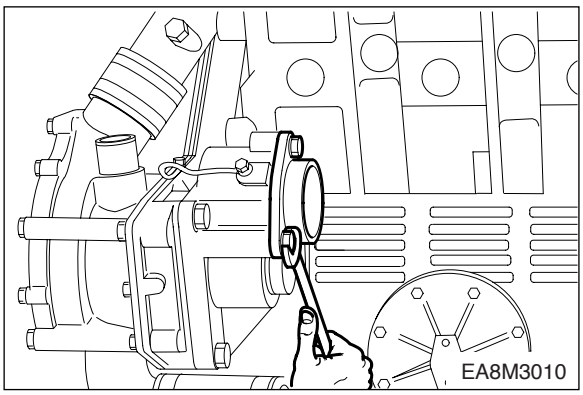
9.3.29. Water pump

- Mount a new O-ring.
- Install the water pump drive pinion over the PTO (power take-off) spline.
- Connect water pipes and by-pass pipe to the water pump.
- Connect a water pipe to the expansion tank.



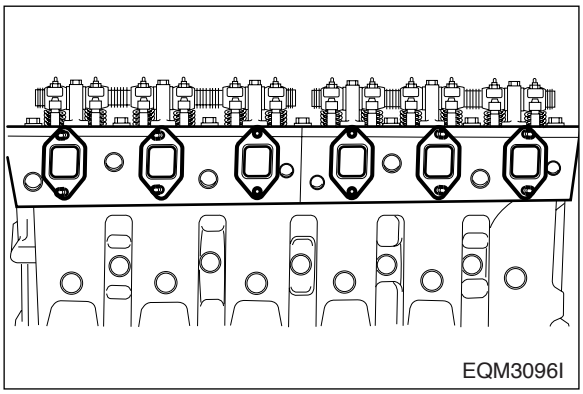
9.3.30. Power take-off

- Assemble the power take-off sub assembly.



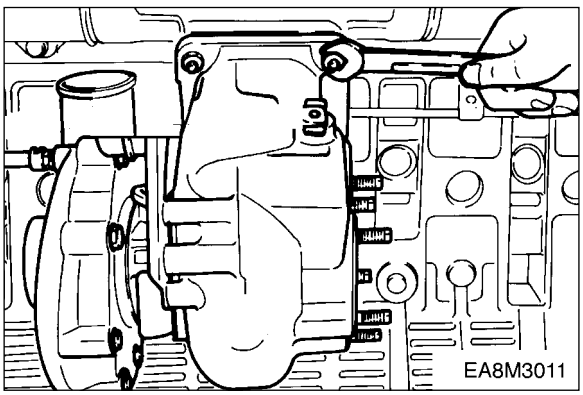
9.3.31. Exhaust manifold

- Install the exhaust manifold gasket over the stud bolts by aligning the gasket with the exhaust port on the cylinder head so that the face and back of the gasket can be positioned correctly.
- Semi-assemble the exhaust manifold and install the heat resisting plate.
- First, install the nuts and then place an additional nut on each of them to prevent looseness.

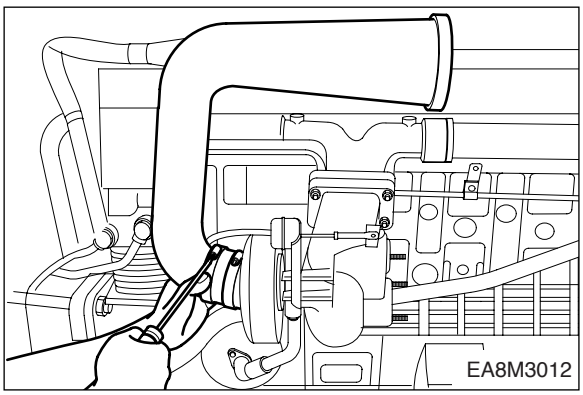


9.3.32. Turbocharger

- Fit a new gasket over the stud bolts of the exhaust manifold before tightening those turbocharger fixing bolts.
- Install the oil supply pipe and return pipe.

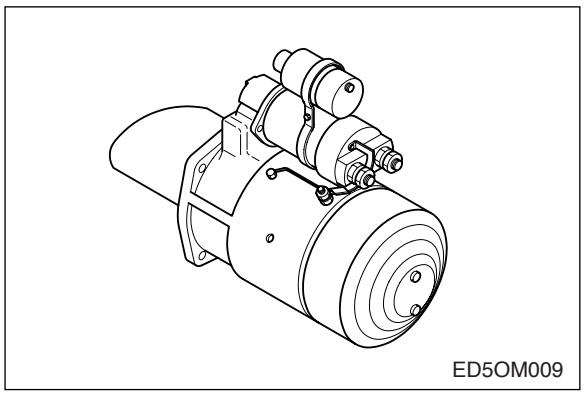


- Semi-assemble the bracket to the intake pipe, connect a rubber hose between the turbocharger and intake pipe using rubber hose, then assemble the bracket completely.



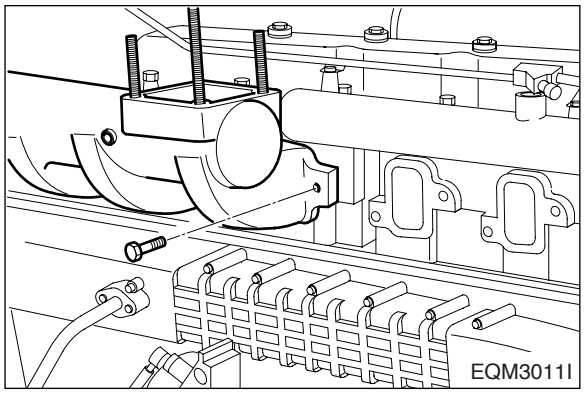
9.3.33. Starter

- Assemble the starter in position on the flywheel housing.



9.3.34. Intake manifold

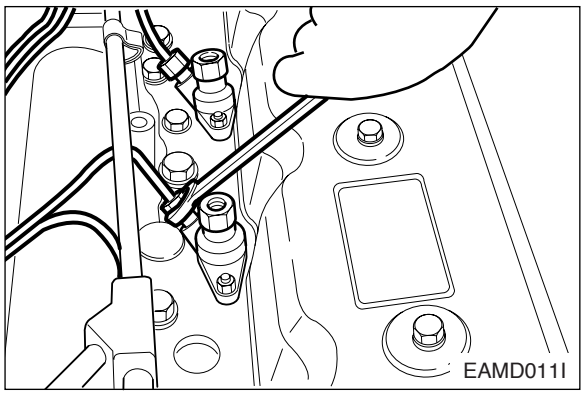
- Fit a gasket on the intake manifold before assembling the intake manifold.



9.3.35. Injection pipe & fuel return pipe

- Assemble the injection pipe according to specified torque as blow

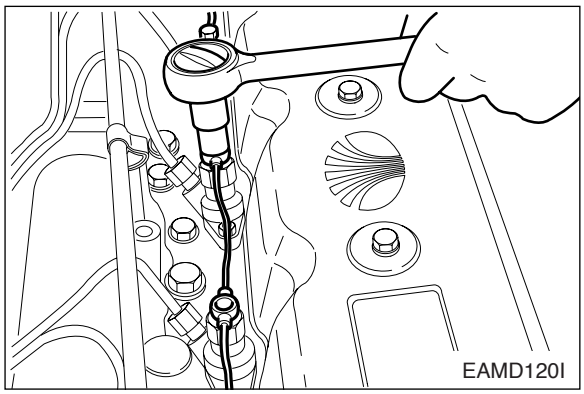
Nut size	Torque
Spanner Dia. 17mm	3.0Kg·m
Spanner Dia. 19mm	4.0Kg·m



- Semi-assemble the nuts at both end of the fuel injection pipe and tighten them up one by one to specified torque.

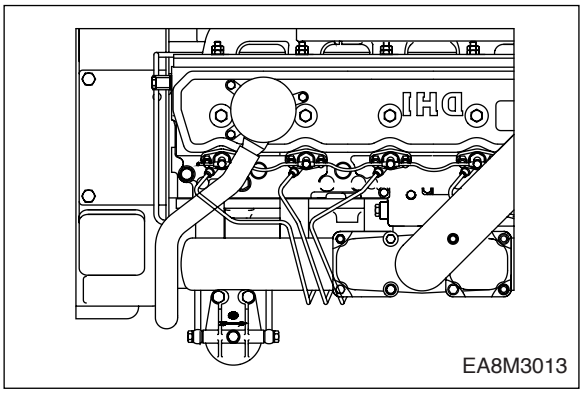
Torque	1 ~ 1.5 Kg·m

- Tighten the hollow screws to assemble the fuel return pipe.
- Assemble the fuel return hose on the fuel injection pump.



9.3.36. Fuel filter

- Assemble the fuel filter with the intake manifold.
- Assemble the fuel feed hose according to the direction of an arrow impressed on the fuel filter head so that fuel can be fed in the sequence of **FUEL FEED PUMP → FUEL FILTER → FUEL INJECTION PUMP.**

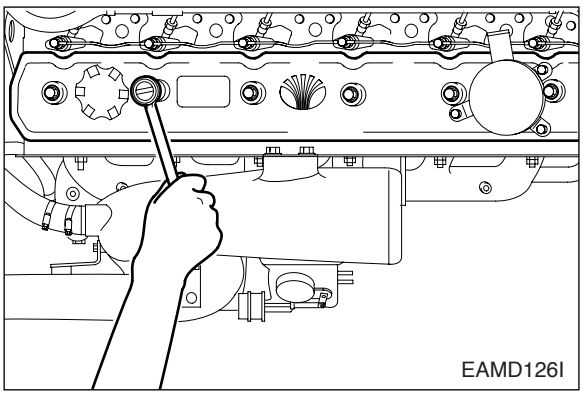


9.3.37. Cylinder head cover

- Assemble the cover packing with the cover, install the cover on the head, then tighten the fixing bolts in sequence to specified torque.

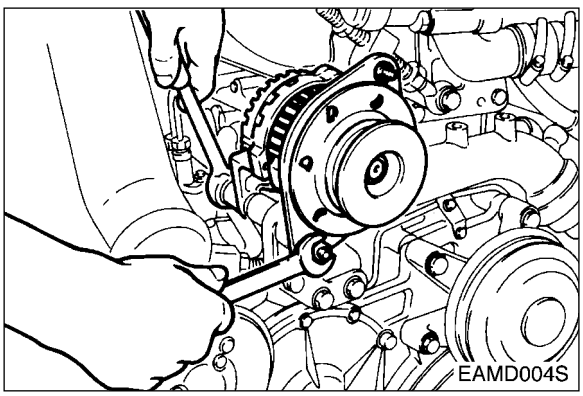
Torque	2.5 kg·m

- Assemble the breather hose with PCV valve.



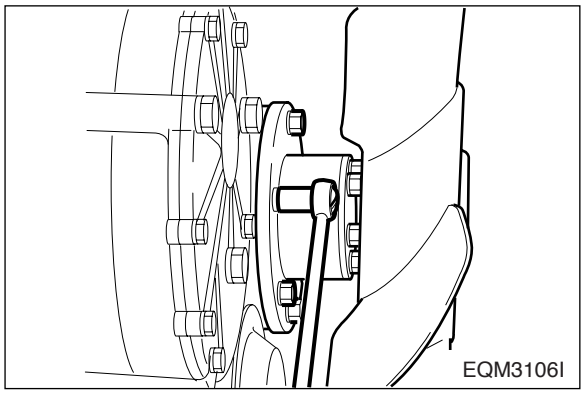
9.3.38. Alternator

- Install the alternator mounting bracket.
- Install the alternator with fixing bolts to the mounting bracket.



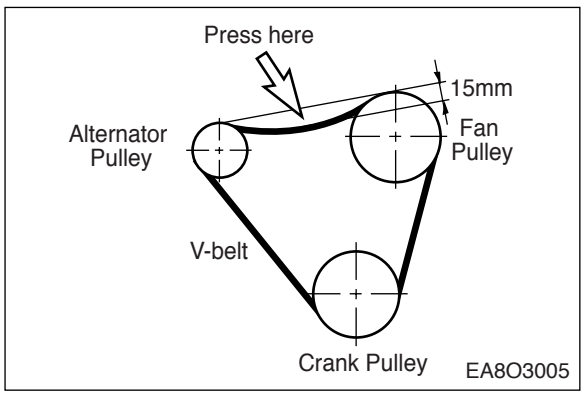
9.3.39. Cooling fan

- Install the cooling fan and flange, then tighten the fixing boltd.



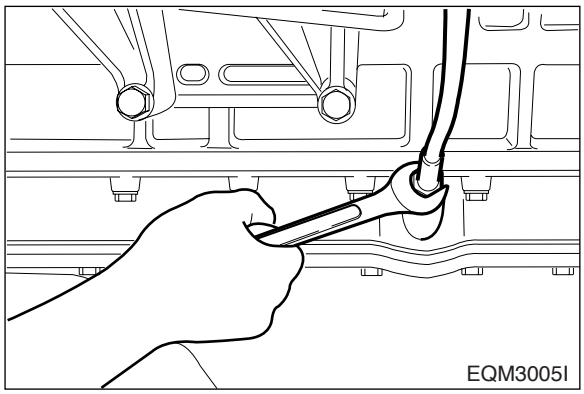
9.3.40. V- belt

- Install the V-belt on the crank pulley, alternator pulley and fan drive pulley.
- Adjust the V-belt tension using the tension adjusting bolt.



9.3.41. Oil level gauge

- Assemble the oil level gauge and guide tube on the oil pan.



9.4. Breaking-in

Refer to “Breaking-in” in chapter of “Commissioning and Operation”.

10. Maintenance of Major Components

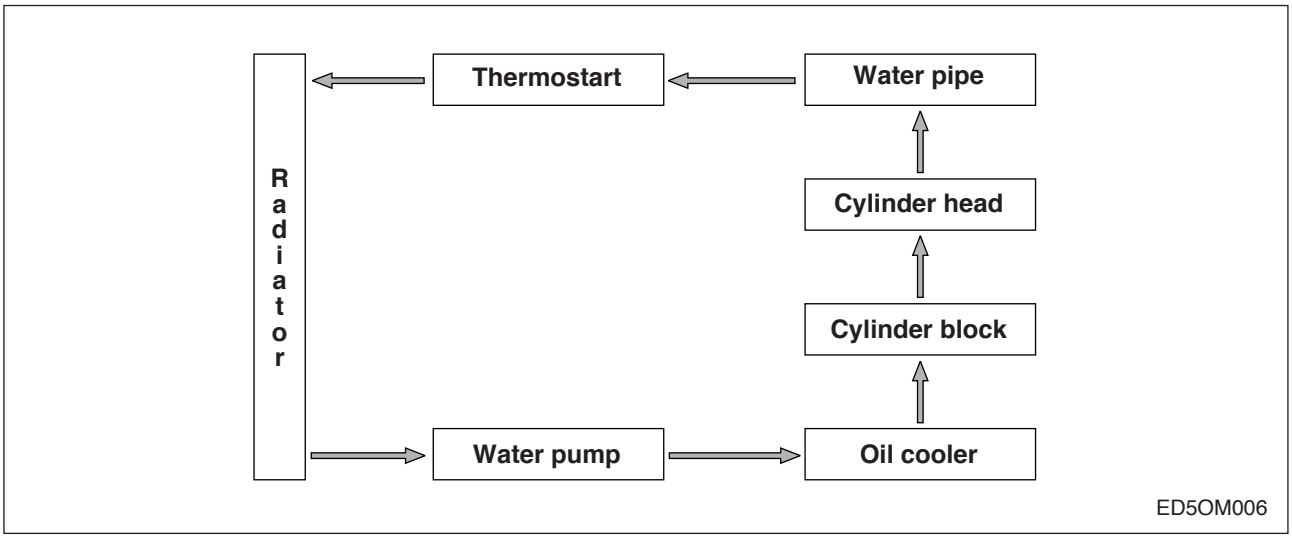
10.1. Cooling System

10.1.1. General information

This engine is water-cooling type. Heat from the combustion chamber and engine oil heat are cooled down by coolant and radiated to the outside, resulting in the normal operation of the engine.

Looking into the cooling system, the water pumped up by the water pump circulates around the oil cooler through the water pipe to absorb the oil heat, and then flows through the water jacket of the cylinder block and water passage of the cylinder head to absorb the heat of the combustion chamber.

The water absorbing the oil heat and combustion chamber heat goes on to the thermostat through the water pipe, and circulates to the water pump if water temperature is lower than the valve opening temperature on the thermostat, while circulating to the radiator at water temperature higher than the valve opening temperature. At the radiator, the heat absorbed in the coolant is radiated to cool down and the coolant recirculates to the water pump.

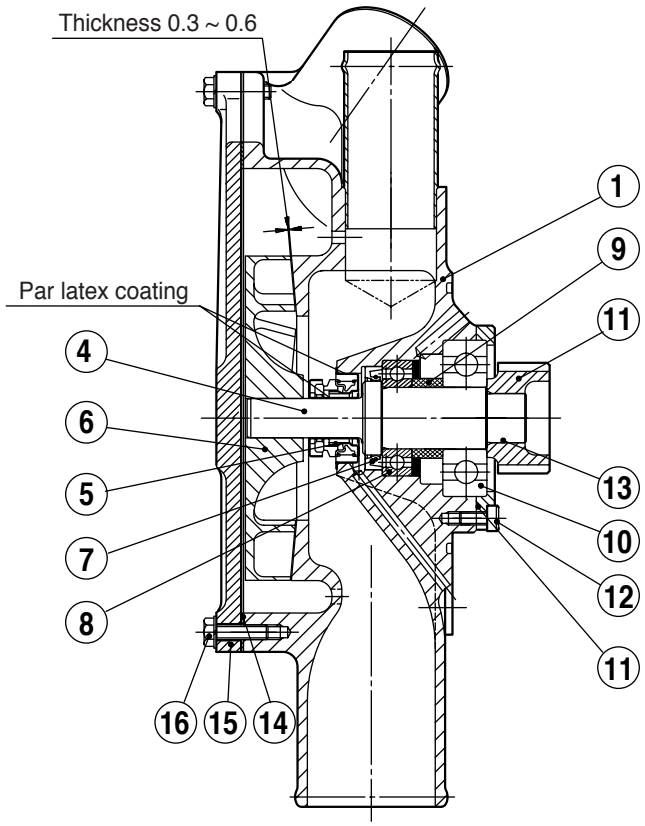


• **Specification**

Item	Specification
1. Water pump	Centrifugal type
type	
Delivery	About 280 liter/min
Pumping speed	2,234 rpm
Pumping back pressure	760 mmHg
2. Thermostat	
Operating temperature	71 ~ 85˚C
3. Cooling fan and belt	
Fan diameter - Number of blades	∅755 - 7
Fan belt tension	15mm/ deflection by thumb

10.1.2. Water pump

- Loosen the bolt (16) to disassemble the housing cover (15).
- Heat the impeller (6) slightly, then remove it using a puller jig.
- Remove the mechanical seal.
- Unscrew the socket bolt (12) and remove the shaft and bearing assembly from the housing.
- With a press, remove the spline shaft and bearing.
- Reverse the disassembly sequence for reassembly operation.
- Replace the oil seal (7) with a new one at reassembly.
- To reassemble the impeller, maintain a constant gap (0.3 ~ 0.6 mm) between the impeller and pump housing using a feeler gauge.



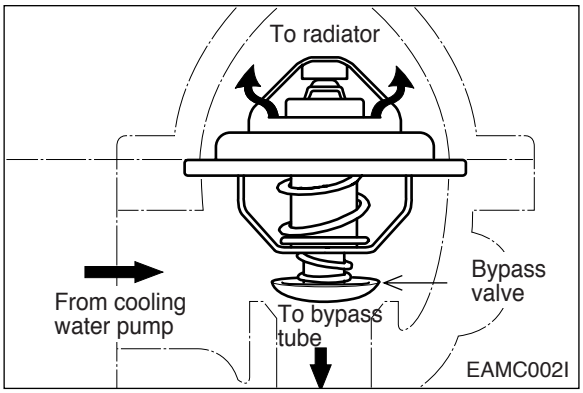
ED5OM007

<Construction of water pump>

1. Water pump housing
4. Shaft
5. Mechanical seal
6. Impeller
7. Oil seal
8. Ball bearing
9. Spacer
10. Ball bearing
11. Bearing cover
12. Socket bolt
13. Spline shaft
14. Gasket
15. Housing cover
16. Bolt

10.1.3. Thermostat

• General descriptions and main data

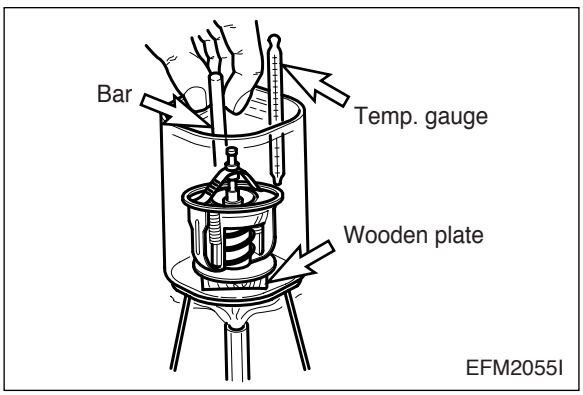


The thermostat maintains a constant temperature of coolant (71 ~ 85˚C) and improves thermal efficiency of the engine by preventing heat loss.

Namely, when the temperature of coolant is low, the thermostat valve is closed to make the coolant bypass to directly enter the water pump; when the coolant temperature rises to open wide the thermostat valve, the bypass circuit is closed and the water passage to the radiator is opened so that the coolant is forced to flow into the radiator.

Item	Specifications
Type	Wax-pallet type
Open at	71 ˚C
Open wide at	85 ˚C
Valve lift	8 mm or more

• Inspecting



(1) Check the wax pallet and spring for damage.

(2) Put the thermostat in a container of water, then heat the water slowly and check temperature with a thermometer. If the valve lift is 0.1 mm (starting to open) at temperature of 71 ˚C and 8 mm or more (opening wide) at temperature of 85 ˚C, the thermostat is normal.

• Replacing thermostat and precautions for handling

(1) Precautions for handling

The wax pallet type thermostat does not react as quickly as bellows type one to a variation of temperature of coolant. Such relatively slow reaction is mainly due to the large heat capacity of the wax pellet type thermostat. Therefore, to avoid a sharp rise of coolant temperature, it is essential to idle the engine sufficiently before running it. In cold weather, do not run the engine at overload or overspeed it immediately after starting off.

(2) When draining out or replenishing coolant, do it slowly so that air is bled sufficiently from the entire cooling system.

(3) Replacing thermostat

If the thermostat is detected defective, retrace with a new one.

10.1.4. Diagnostics and troubleshooting

Complaints	Possible causes	Corrections
1. Engine overheating	• Lack of coolant	• Replenish coolant
	• Radiator cap pressure valve spring weakened	• Replace cap
	• Fan belt loosened or broken	• Adjust or replace fan belt
	• Fan belt fouled with oil	• Replace fan belt
	• Thermostat inoperative	• Replace thermostat
	• Water pump defective	• Repair or replace
	• Restrictions in water passages due to deposit of scales	• Clean radiator and water passages
	• Injection timing incorrect rectly	• Adjust injection timing cor
	• Restriction in radiator core	• Clean exterior of radiator
	• Gases leaking into water jacket due to broken cyli nder head gasket	• Replace cylinder head gasket
2. Engine overcooling	• Thermostat inoperative	• Replace thermostat
	• Ambient temperature too low	• Install radiator curtain
3. Lack of coolant	• Radiator leaky	• Correct or replace
	• Radiator hoses loosely connected or damaged	• Retighten clamps or replace hoses
	• Radiator cap valve spring weakened	• Replace cap
	• Water pump leaky	• Repair or replace
	• Heater hoses loosely connected or broken	• Tighten or replace hoses
	• Cylinder head gasket leaky	• Replace cylinder head gasket
	• Cylinder head or cylinder block cracked	• Replace cylinder head block
4. Cooling system noisy	• Water pump bearing defective	• Replace bearing
	• Fan loosely fitted or bent	• Retighten or replace fan
	• Fan out of balance	• Replace fan
	• Fan belt defective	• Replace fan belt

10.2. Lubricating System

10.2.1. General descriptions and main data

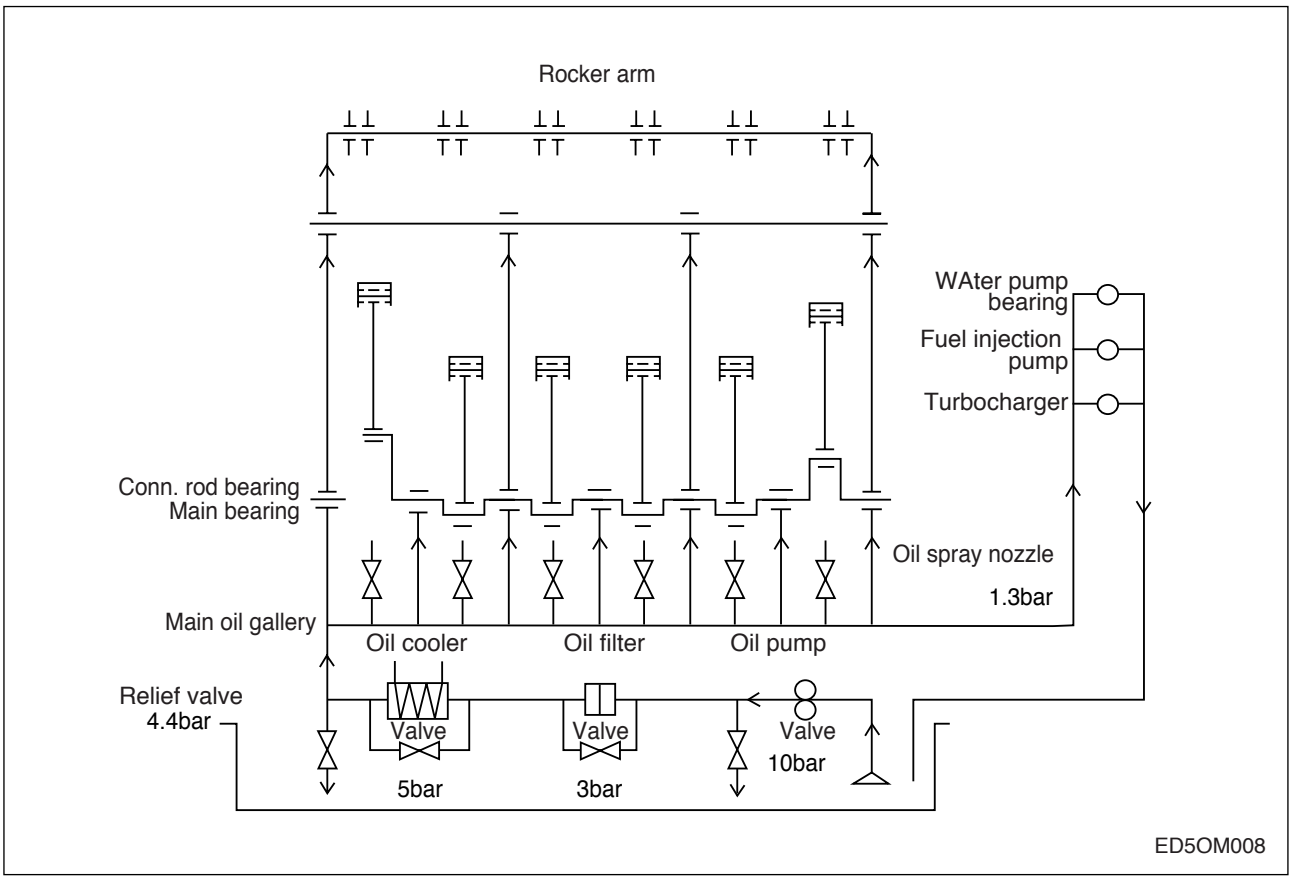
- **General descriptions**

  All the engine oil pumped up from the oil pan by the gear type oil pump is filtrated through the oil cooler and oil filter, and this filtrated oil is forced through the main oil gallery in the cylinder block from where it is distributed to lubricate the various sliding parts, and fuel injection pump in order to ensure normal engine performance.

- **Specifications**

Item	Specifications	Item	Specifications
Lubricating system	Forced pressure circulation	Oil filter type	Full flow
Oil pump type	Gear type	Bypass for filter element	
Relief valve opening pressure	10±1.5 kg·cm²	Valve opening pressure	1.8 ± 2.3 kg·cm²
Bypass for oil cooler		Bypass for entire oil filter	
Opening pressure	5+1 kg·cm²	Valve opening pressure	4.0 ~ 4.8 kg·cm²
Adjusting valve for spray nozzle			
Opening pressure	1.5 ~ 1.8 kg·cm²		

- **Diagram of lubricating system**



10.2.2. Oil pump

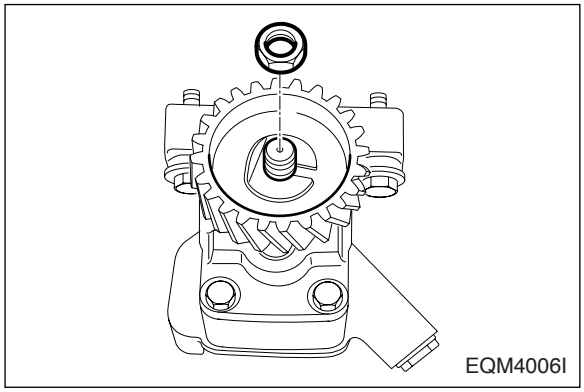
• Disassembly

(1) Disassembly of oil pump drive gear

a .Unscrew the screw and disassemble the oil relief valve.

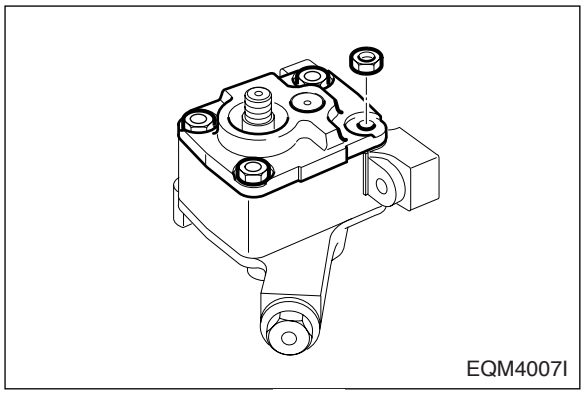
b. Unfold the washer for the oil pump drive gear fixing nut and remove the nut.

c. Disassemble the drive gear.


EQM4006I

(2) Remove the oil pump cover fixing nuts and disassemble the oil pump cover. The oil pump cover is fixed with the two dowel pins.

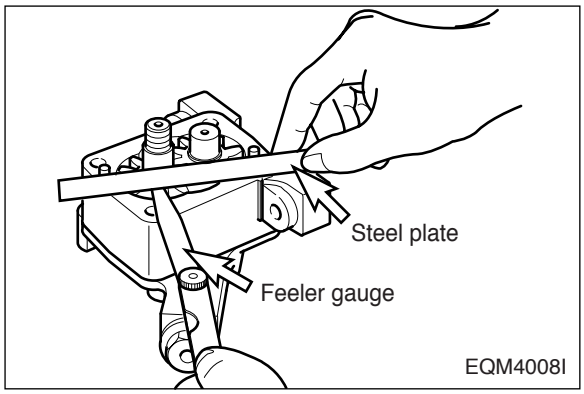
(3) Disassemble the drive gear and driven gear.


EQM4007I

• Inspection and correction

(1) With steel rule and feeler gauge, measure the axial end play of the oil pump gear. Replace if the measured value is beyond the limit.

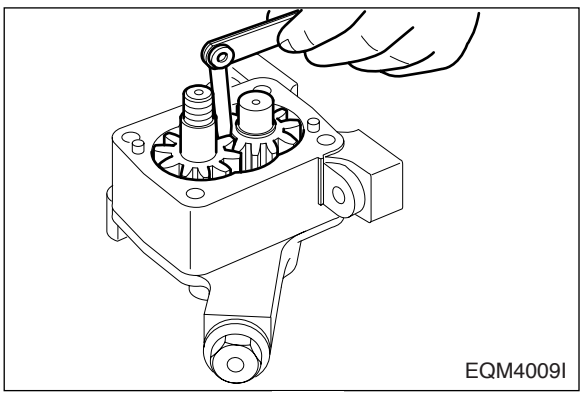
End play	0.025 ~ 0.089 mm



EQM4008I

(2) With a feeler gauge, measure the amount of backlash between the oil pump drive gear and driven gear. Replace if the measured value is beyond the limit.

Backlash	0.50 ~ 0.64 mm


EQM4009I

(3) Measuring clearance between drive shaft and bushing

a. Measure the outside diameters of the drive shaft and driven shaft, and replace if the measured values are less than the limit.

Limit	∅16.95 mm

b. Measure the inside diameter of the pump body bushing to determine the clearance between the bushing and shaft, and compare the measured value with the standard value to determine whether to replace or not.

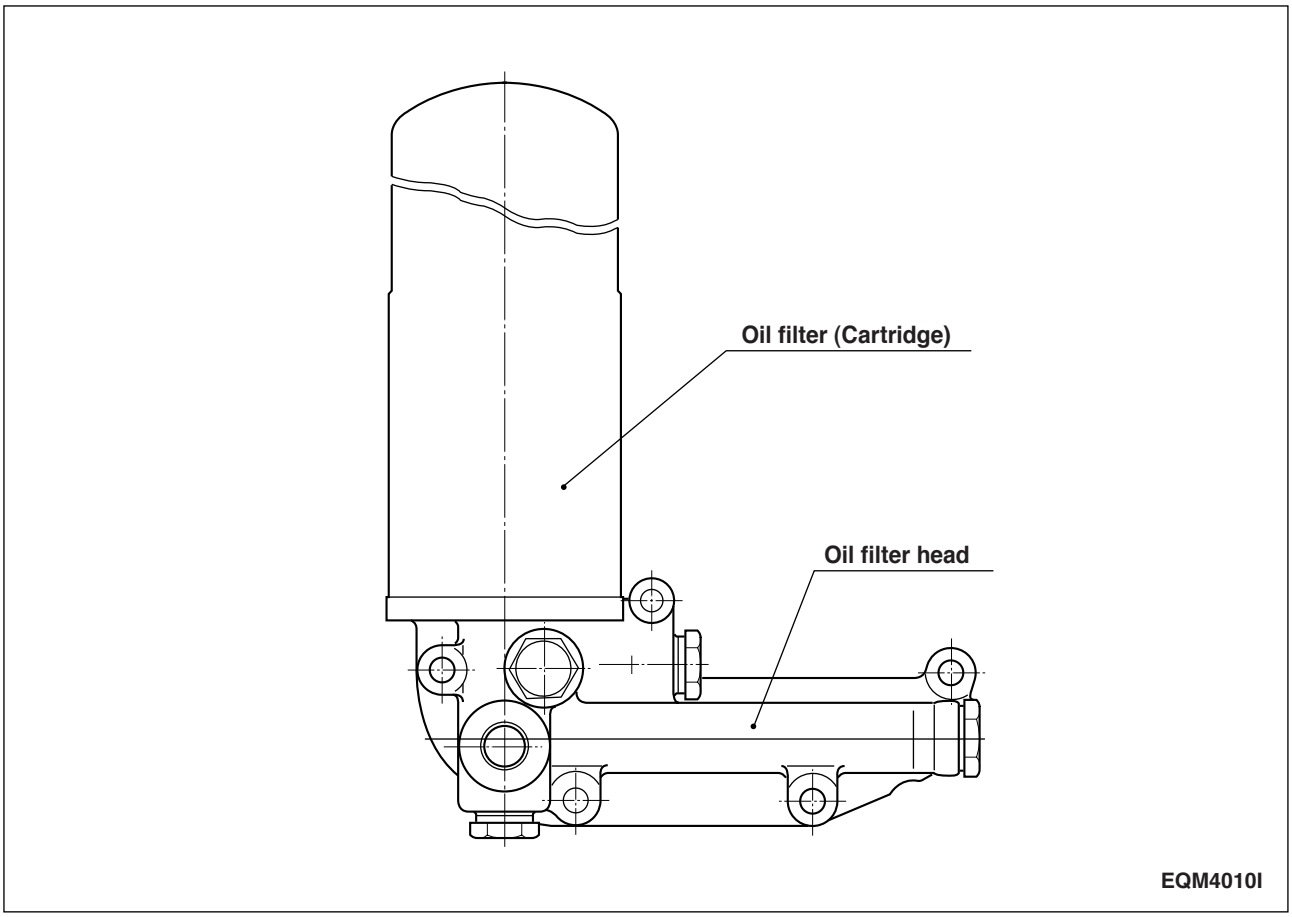
Clearance	0.032 ~ 0.077 mm

- **Reassembly**

(1) For reassembly, reverse the disassembly sequence.

10.2.3. Oil filter

The oil filter mounted in this engine is of cartridge type, so it is necessary to replace it with a new one at the specified intervals.



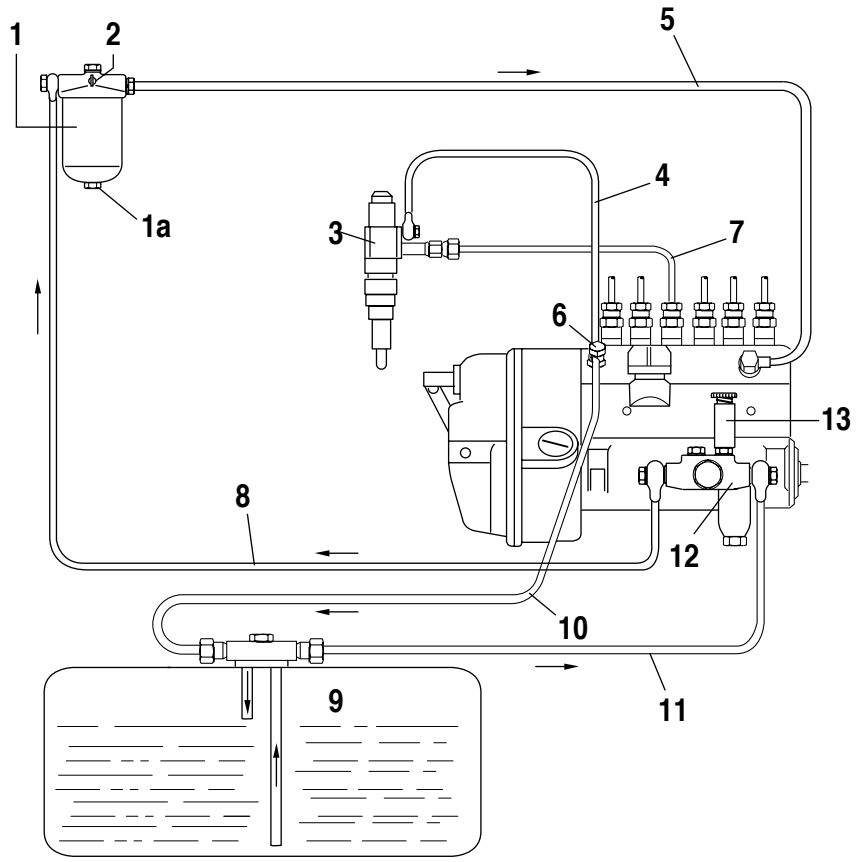
10.2.4. Diagnostics and troubleshooting

Complaints	Possible causes	Corrections
1. Oil consumption excessive	• Poor oil	• Use suggested oil
	• Oil seal or packing leaky	• Replace
	• Pistons or piston rings worn	• Replace pistons and/or pis ton rings
	• Cylinder liner worn	• Replace cylinder liner
	• Piston rings sticking	• Replace pistons and/or pis ton rings
	• Valve guide oil seals or valve guides, or valve stem worn	• Replace
2. Oil pressure too low	• Poor oil	• Use suggested oil
	• Relief valve sticking	• Replace
	• Restrictions in oil pump strainer	• Clean strainer
	• Oil pump gear worn	• Replace
	• Oil pump feed pipe cracked	• Replace
	• Oil pump defective	• Correct or replace
	• Oil pressure gauge defective	• Correct or replace
	• Various bearings worn	• Replace
3. Oil deteriorates quickly	• Restriction in oil filter	• Replace filter element
	• Gases leaking	• Replace piston rings and cylinder liner
	• Wrong oil used	• Use suggested oil

10.3. Fuel Injection Pump

10.3.1. General information of fuel system

The fuel system consists of the fuel tank, injection pump, injection nozzle, fuel filter, and fuel lines such as pipes and hoses necessary to connect those components.



1. Fuel filter
1a. Fuel water drain plug
2. Air bleeding screw (for fuel filter)
3. Injection nozzle
4. Overflow tube
5. Fuel pipe (filter → injection pump)
6. Overflow valve
7. Delivery pipe
8. Fuel pipe (manual pump → filter)
9. Fuel tank
10. Fuel return pipe
11. Suction pipe
12. Feed pump
13. Injection pump

10.3.2. Injection pump

The components relating to the injection pump should be serviced at regular intervals as the plunger and delivery valve may be worn after a given length of time for use and cause the deterioration of the engine.
Make sure that servicing should be performed at the professional maintenance shop as authorized by Bosch or Zexel Company.
For adjustment of fuel injection volume, refer to the 'Specifications of fuel injection pump' described on the following pages.

1) DE12T

(1) Main data and specifications

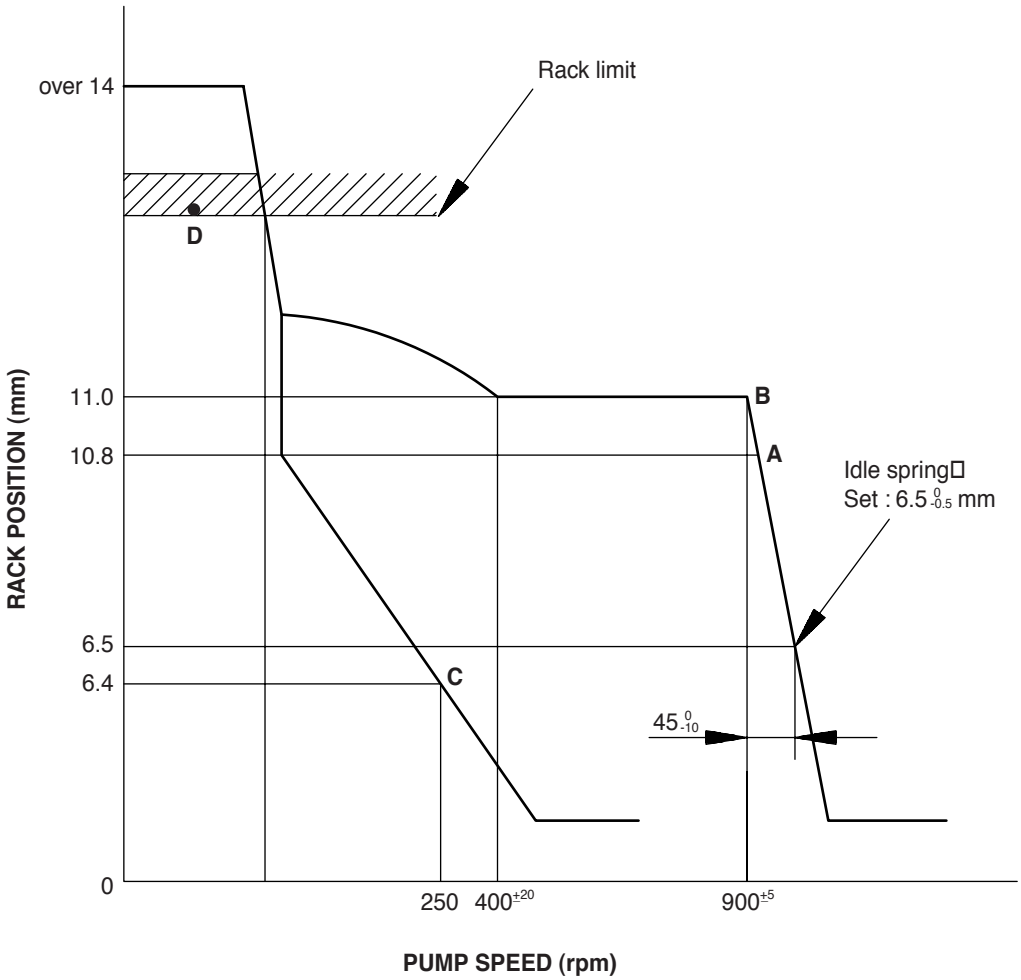
Part No.	: 65.11101-7222(106672-9920)
Model	: NP-PE6P120/720RS3000(106061-7250)
Governor	: NP-EP/RSV200-1200PD36C311(105407-4720)
Timer	: without timer
Plunger	: ∅12, right hand helix 30 lead
Delivery valve	: 120 mm^3/st(∅8 x 2.4mm)
Fuel feed pump	: NP-FP/K-P(105207-1400)
Pre-stroke	: 4.7 mm

(2) Nozzle holder assembly : 65.10101-7300(105160-4351)
(3) Nozzle : 65.10102-6046(105029-1330)
(4) Injection pipe : 65.10301-7004B
(5) Injection order : 1-5-3-6-2-4
(6) Injection timing : BTDC 12˚C
(7) Calibration data

Adjusting point	Rack position (mm)	Pump speed (rpm)	Injection volume (mm3/1,000st)	Variation rate (%)	Basic point	Fixing point	Ref.
A	10.8	900	129±2	±2			
B	11	875	(135)±3	-			
C	Approx. 6.4	250	14.5±1.5	±15			
D	-	100	193.5±10	-			

	Content	Specification	Engine Application
Adjusting conditions	Nozzle holder assembly	105780-8140	65.10101-7300
	Nozzle	105780-0000	65.10102-6046
	Nozzle holder	105780-2080	-
	Opening pressure	175 $kg·cm^2$	220 $kg·cm^2$
	Injection pipe	∅8 x ∅3 - 600 mm	∅6 x ∅2.2 - 650 mm
	Fuel delivery pressure	1.6 $kg·cm^2$	-
	Fuel temperature	35 ~ 45 ˚C	35 ~ 45 ˚C

(8) Governor adjustment



2) P126TI / P126TI-Ⅱ

(1) Main data and specifications

Part No. : 65.11101 -7310 (106674-4130 ZEXEL)

Model : NP-PE6P120/700RS3S (106067-6020)

Governor : Ghana Control (DWA-2000)

Plunger & barrel : ∅12, right hand double helix 30 lead

Delivery valve : 90mm²/st (∅7 x 2.35mm)

Fuel feed pump : NP-FP/KD-PS (105237-5470)

Pre-stroke : 3.9 ± 0.05 mm

(2) Nozzle holder assembly : 65.10101-7054 (10501-8520)

(3) Nozzle : 65.10102-6048 (105019-2450)

(4) Injection pipe : 65.10301-6042, 65.10301-6043

(5) Injection order : 1-5-3-6-2-4

(6) Injection timing : BTDC 16°

(A) Test condition for injection pump	Nozzle & Holder Ass'y	105780-8130	Opening pressure : 175 kg·cm²
	Injection pipe(ID ,OD ,L)	-	∅3.0 x ∅8.0 - 600 mm
	Test oil	ISO4113	Temperature :40 ± 5˚C
(B) Engine standard parts	Nozzle & holder Ass'y	65.10101-7054	Nozzle (5 x ∅0.37)
		65.10102-6048	1st pressure : 160 kg·cm² 2nd pressure : 220 kg·cm²
	Injection pipe(ID, OD ,L)	65.10301-6042 65.10301-6043	∅2.2 x ∅6 - 600mm

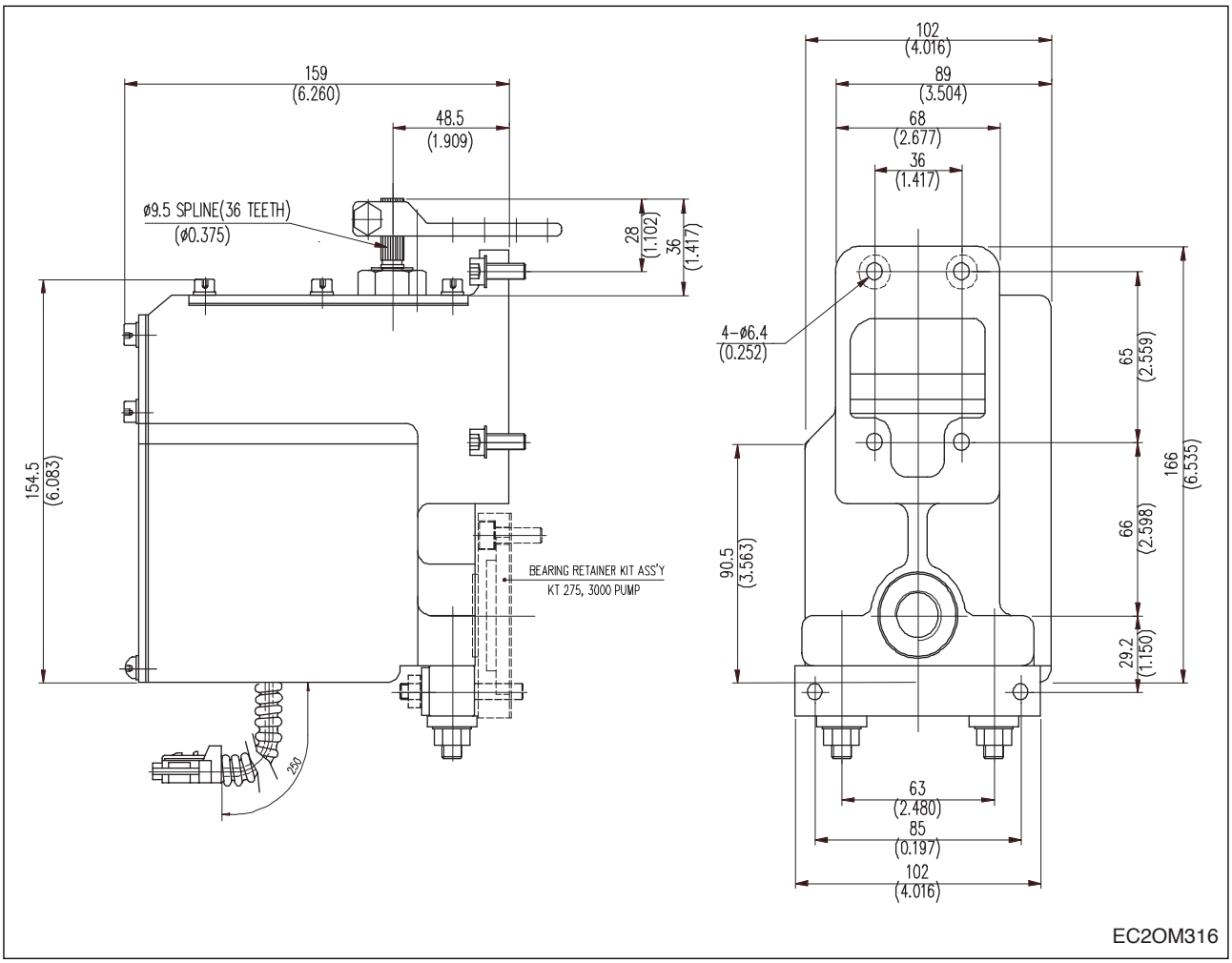
Rack diagram and setting valve at each point

	Check point	Rack position (mm)	Pump speed (rpm)	Injection Q'ty on RIG (mm3 / 1,000 st)		Press. (mmHg)
				(A) Test condition for inj. pump	(B) Engine standard parts	
Standby power	B		900		240±3	-
	-	-	-	-	-	-
	-	-	-	-	-	-
	-	-	-	-	-	-
	-	-	-	-	-	-

10.3.3. Governor System (P126TI/ P126TI-Ⅱ)

Governor system for fuel injection pump consists of “Integral Actuator” and “Speed Control Unit”.

10.3.3.1. Integral actuator



<Dimension View>

Fig. No.	Description	Q’ty	Remark
1	Frame	1	
2	Bearing retainer kit Ass’y	1	
3	Mounting bar	1	
8	SWP connector	1	Mg610320
11	Front cover	1	T3.2
13	Shaft	1	
15	Return spring guide Ass’y	1	
16	Oil seal	1	SC 0283 E0
17	Allen screw	8	M5 x 0.8 x L12
23	Manual stop device Ass’y	1	
30	Stop plate	1	T3.2
52	Return shaft Ass’y	1	
54	Stop level	1	
62	Lead wire		LG 16AWG
63	Corrugate tube		Dia.10, L250+-10

10.3.3.2. Speed Control Unit for Governor System
(DWC-2000 SERIES SPEED CONTROL UNIT)

<Introduction>

This speed control unit performs the electronic function of the engine governing system. The speed control unit senses the pulses from the magnetic speed sensor, compares them with the speed control unit's set point and supplies the appropriate current output to the actuator to control the engine's fuel system.

An integral, independent single element speed switch is provided internally which can be used to initiate engine shutdown in the event that an overspeed condition is reached. The performance of the speed control unit is fast and responsive in either isochronous or droop operation.

Adjustments are provided for: operating speed, idle speed, overspeed shutdown setting, droop, run ramp, crank ramp, starting fuel, speed ramping and two performance adjustments(gain and stability). All adjustments are accessible from the front cover. The primary features of the DWC-2000 Series speed control unit are the engine STARTING FUEL and SPEED RAMPING adjustments. The use of these features will minimize engine exhaust smoke experienced prior to attain engine operating speed. The speed control unit also includes other features such as adjustable droop and idle operation, inputs for accessories used in multi-engine or special applications and protection against reverse voltage polarity, transient voltages and accidental short circuit of the actuator. Loss of battery supply, loss of speed sensor and overspeed signaling are built-in to provide engine shutdown.

<Description>

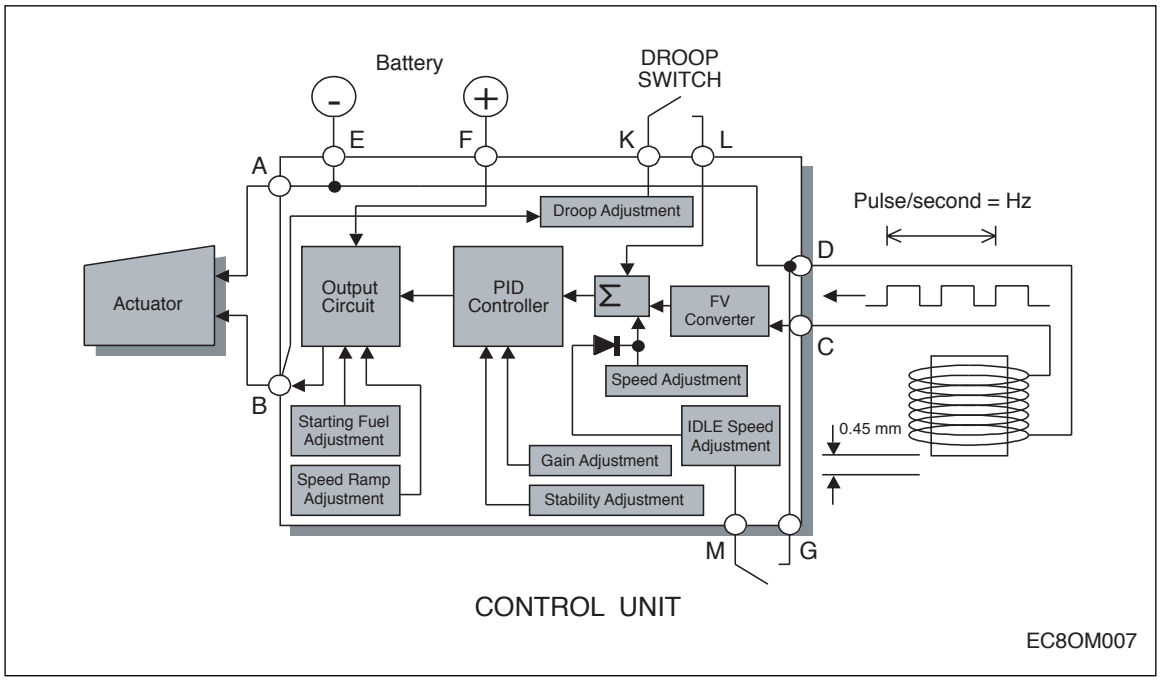


Figure 1. Governor system schemetic

The engine speed signal is usually obtained from a magnetic speed sensor mounted in close proximity to the teeth of a ferrous ring gear that is driven by the engine. The frequency of the speed sensor signal is proportional to the engine speed. The speed control unit will accept any signal if the frequency is proportional to engine signal, and in the frequency range of the speed control unit (1K to 7.5K Hz.). The speed sensor is typically mounted in close proximity to an engine driven ferrous gear, usually the engine ring gear. As the teeth of the gear pass the magnetic sensor, a signal is generated which is proportional to engine speed. The signal strength must also be within the range of the input amplifier. An amplitude of 1 to 120 volts RMS is required to allow the unit to function within its design specifications. The speed control unit has an input impedance of 20K-ohms between the speed sensor input terminals. ("C" & "D"). Terminal "D" is connected internally to the battery negative. Only one end of the shielded cable should be connected.

When a speed sensor signal is received by the controller, the signal is amplified and shaped by an internal circuit to form constant area pulses. If the speed sensor monitor does not detect a speed sensor signal, the output circuit of the speed control unit will turn off all current to the actuator.

The summing point of the speed sensor and the speed adjust control is the input to the dynamic control section of the governor. The dynamic control circuit, of which the gain and stability adjustments are part, has a control function that will provide isochronous and stable performance for most engine types and fuel systems.

The speed control unit circuit is influenced by the gain and stability performance adjustments. The governor system sensitivity is increased with clockwise rotation of the gain adjustment. The gain adjustment has a nonlinear range of 33:1. The stability adjustment, when advanced clockwise, increases the time rate of response of the governor system to match the various time constants of a wide variety of engines. The speed control unit is a PID device, the "D", derivative portion can be varied when required.(See Instability section.)

During the engine cranking cycle, STARTING FUEL can be adjusted from an almost closed, to a nearly full fuel position. Once the engine has started, the speed control point is determined, first by the IDLE speed set point and the SPEED RAMPING circuit, After engine speed ramp- ing has been completed, the engine will be at its governed operating speed. At the desired governed engine speed, the actuator will be energized with sufficient current to maintain the desired engine speed, independent of load (isochronous operation).

The output actuator current switching circuit provides current to drive the actuator. The output transistor is alternately switched off and on at a frequency of 300Hz. which is well beyond the natural frequency of the actuator, hence no visible motion from the switching results. Switching the output transistors reduces its internal power dissipation for efficient power control. The output circuit can provide current of up to 10amps continuous at 25°£C for 24VDC battery systems. The actuator responds to the average current to position the engine fuel control lever.

In standard operation, the speed control unit performance is isochronous. Droop governing can be selected by connecting terminals K & L and the percent of droop governing can be varied with the droop adjustment control. The droop range can be decreased by connecting Terminals G and H.

The speed control unit has several performance and protection features which enhance the governor system. A speed anticipation circuit minimizes speed overshoot on engine startup or when large increments of load are applied to the engine.

1) Specification

- **Performance**

Isochronous Operation / Steady State Stability ..... ±0.25% or better
Speed Range/Governor ..... 1K~7.5 K Hz continuous
Speed Drift with Temperature ..... ±0.5% Maximum
Idle Adjust CW ..... 60% of set speed
Idle Adjust CCW ..... Less than 1200Hz
Droop Range ..... 1-5% regulation *
Droop Adj. Max.(K-L Jumpered) ..... 450 Hz., ± 90 Hz. per 1.0A change
Droop Adj. min.(K-L Jumpered) ..... 20 Hz., ± 8 Hz. per 1.0A change
Speed Trim Range ..... ±210 Hz
Remote Variable Speed Range ..... 500~7.5 Hz. or any part thereof Terminal Sensitivity
J ..... 100 Hz ± 15 Hz/Volt @ 6.0K Impendence
L ..... 680 Hz ± 50 Hz/Volt @ 165K Impendence
N ..... 135 Hz ± 10 Hz/Volt @ 1MΩ Impendence
P ..... 10 VCD Supply @ 20 [mA] Max.

- **Environmental**

Ambient Operating Temperature Range ..... -40~85˚C
Relative Humidity ..... up to 95%
All Surface Finishes ..... Fungus Proof and Corrosion Resistant

- **Power input**

Supply ..... 24VDC Battery System(Transient and Reverse Voltage Protected)**
Polarity ..... Negative Ground(Case Isolated)
Power Consumption ..... 50[mA] continuous plus actuator current
Maximum controllable actuator current at 25˚C-(Inductive Load) ..... 10{A} continuous***
Magnetic Speed Sensor Signal ..... 1~120[V] RMS

- **Reliability**

vibration ..... 1G @ 20~100 Hz
Testing ..... 100% Functionally Tested

- **Physical**

Dimensions ..... See Outline(Dia. 1)
Weight ..... 705 grams
Mounting ..... Any Position, Vertical Preferred

* Droop is based on a speed sensor frequency of 4000Hz. and an actuator current change of 1amp from no load to full load. Applications with higher speed sensor signals will experience less percentage of droop. See droop description for specific details on operation of droop ranges.

** Protected against reverse voltage by a series diode. A 15 amp fuse must be installed in the positive battery lead.

*** Protected against short circuit to actuator(shuts off current to actuator), unit automatically turns back on when short is removed.

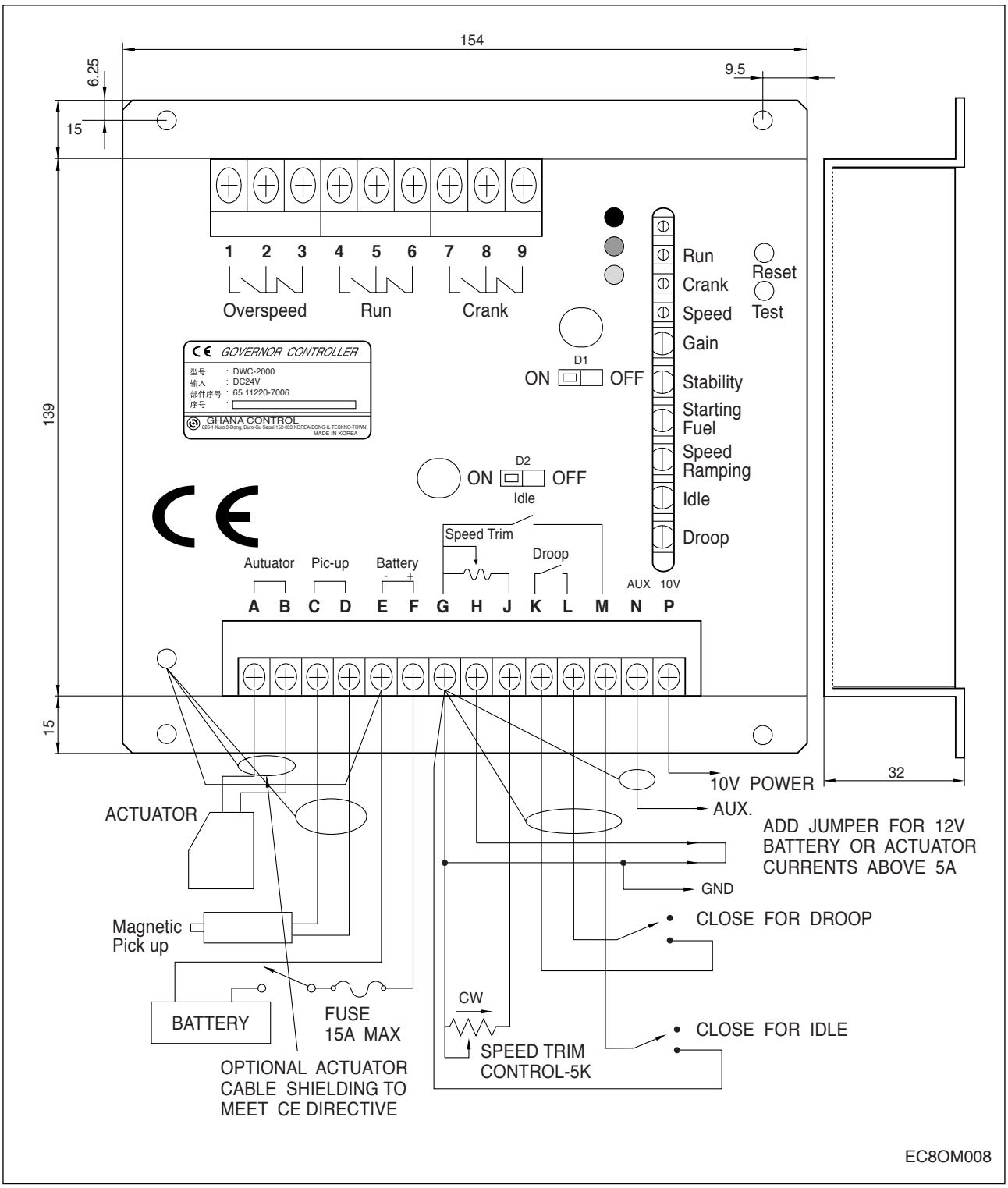


Diagram 1. DWC-2000 Wiring and Outline

2) Application and installation information

The speed control unit is rugged enough for mounting in a control cabinet or engine mounted enclosure or in a remote console up to 20 meters(65ft.) from the engine. Care should be taken to insure that the speed control unit, mount it vertically so that condensation will not accumulate in the speed control unit.

<Warning>

An overspeed shutdown device, independent of the governor system, should be provided to prevent loss of engine control which may cause personal injury or equipment damage. Do not rely exclusively on the governor system electric actuator to prevent over speed. A Secondary shutoff device, such as a fuel solenoid must be used.

3) Wiring

Wiring to the speed control unit should be as shown in Diagram 1. Wire leads to the battery and actuator from the speed control unit terminals A, B, E and F should be #16 AWG(1.3 mm sq.) or larger. Long cables require an increased wire size to minimize voltage drops. An external 15amp fuse is recommended in series with terminal F, the positive (+) battery input terminal.

The magnetic speed sensor leads must be twisted and/or shielded for their entire length. If shielded cables are used, connect all the shields to terminal D only. The shield should be insulated to insure no other part of the shield comes in contact with engine ground, otherwise stray speed signals may be introduced to the speed control unit. With the engine stopped, adjust the gap between the magnetic speed sensor and the ring gear teeth. The gap should not be any smaller than 0.020 in.(0.45mm). Usually, gear tooth will achieve a satisfactory air gap. The magnetic speed sensor voltage should be at least 1 VAC RMS during cranking.

4) Adjustments

- **Before starting engine**

Confirm the following adjustment positions. The adjustments are factory pre-set as follows :

Check to insure the GAIN and STABILITY adjustments, and if applied, the external SPEED TRIM CONTROL are set to mid position.

Preset the DWC-2000 as follows:

Gain ..... Minimum CCW
Stability ..... Mid-range
Speed Adjust 3650Hz
Idle 1950Hz
Droop ..... Maximum CCW (minimum setting)
Overspeed ..... Maximum CW
Run Ramp ..... Maximum CW
CRANK Ramp ..... Maximum CW
STARTING FUEL ..... FULL CW(Maximum Fuel)
SPEED RAMPING ..... FULL CCW(Fastest)

- **Start engine**

  The speed control unit governed speed setting is factory set at approximately engine idle speed. Crank the engine with DC power applied to the governor system. The actuator will energize to the maximum fuel position until the engine starts. The governor system should control the engine at a low idle speed. If the engine is unstable after starting, turn the GAIN and STABILITY adjustments counterclockwise until the engine is stable.

- **Governor speed setting**

  The governed speed set point is increased by clockwise rotation of the SPEED adjustment control. Remote speed adjustment can be obtained with an optional 5K Speed Trim Control.
  (See Diagram 1.)

- **Governor performance**

  Once the engine is at operating speed and at no load, the following governor performance adjustment can be made.

  A. At no load, turn the gain control CW until instability results. Then back-off slightly CCW (1/8 turn) beyond the point where stability returns.
  B. Turn the stability control CW until instability results. Then back-off slightly CCW (1/8 turn) beyond the point where stability returns. Excellent performance should result from these adjustments.

  If instability cannot be corrected or further performance improvements are required, refer to the section on SYSTEM TROUBLESHOOTING.

- **Starting fuel adjustment**

  The engine's exhaust smoke at start-up can be minimized by completing the following adjustments.

  A. Place the engine in idle by connecting Terminals M & G.
  B. Adjust the IDLE speed for as low a speed setting as the application allows.
  C. Adjust the STARTING FUEL CCW until the engine speed begins to fall. Increase the STARTING FUEL slightly so that the idle speed is returned to the desired level.
  D. Stop the engine.

One of two methods of operation for the DWC-2000 may now be selected.

Method 1 : Start the engine and accelerate directly to the operating speed(Gen Sets, etc.).

※ Remove the connection between Terminals M & G. Start the engine and adjust the SPEED RAMPING for the least smoke on acceleration from idle to rated speed. If the starting smoke is excessive, the STARTING FUEL may need to be adjusted slightly CCW. If the starting time is too long, the STARTING FUEL may need to be adjusted slightly CW.

Method 2 : Start the engine and control at an idle speed for a period of time prior to accelerating to the operating speed. This method separates the starting process so that each may be optimized for the lowest smoke emissions.

※ Replace the connection between Terminals M & G with a switch, usually an oil pressure switch. Start the engine. If the starting smoke is excessive, the STARTING FUEL may need to be adjusted slightly CCW. If the starting time is too long, the STARTING FUEL may need to be adjusted slightly CW.

When the switch opens, adjust the SPEED RAMPING for the least amount of smoke when accelerating from idle speed to rated speed.

- **Idle speed setting**

If the IDLE speed setting was not adjusted as detailed in "Starting Fuel Adjustment" section, then place the optional external selector switch in the IDLE position. The idle speed set point is increased by clockwise rotation of the IDLE adjustment control. When the engine is at idle speed, the speed control unit applies droop to the governor system to insure stable operation

- **Speed droop operation**

Droop is typically used for the paralleling of engine driven generators.

Place the optional external selector switch in the DROOP position, DROOP is increased by clockwise rotation of the DROOP adjustment control. When in droop operation, the engine speed will decrease as engine load increases. The percentage of droop is based on the actuator current change from engine no load to full load. A wide range of droop is available with the internal control. Droop level requirements above 10% are unusual.

If droop levels experienced are higher or lower than those required, contact the factory for assistance.

After the droop level has been adjusted, the rated engine speed setting may need to be reset. Check the engine speed and adjust the speed setting accordingly.

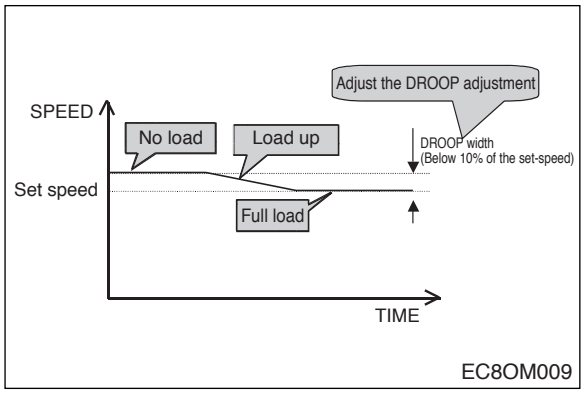


Figure 3. The relation between the speed and a amount of load.

- **Accessory input**

  The AUXiliary Terminal N accepts input signals from load sharing units, auto synchronizers, and other governor system accessories, DWC accessories are directly connected to this terminal. It is recommended that this connection from accessories be shielded as it is a sensitive input terminal.
  If the auto synchronizer is used alone, not in conjunction with a load sharing module, a 3M ohm resistor should be connected between Terminals N and P. This is required to match the voltage levels between the speed control unit and the synchronizer.
  when an accessory is connected to Terminal N, the speed will decrease and the speed adjustment must be reset.
  when operating in the upper end of the control unit frequency range, a jumperwire or frequency trim control may be required between Terminals G and J. This increases the frequency range of the speed control to over 7000Hz.

- **Accessory supply**

  the +10 volt regulated supply, Terminal P, can be utilized to provide power to DWC- 2000 governor system accessories. Up to 20ma of current can be drawn from this supply. Ground reference is Terminal G. Caution : a short circuit on this terminal can damage the speed control unit.

- **Wide range remote variable speed operation**

  Simple and effective remote variable speed can be obtained with the DWC-2000 Series control unit. A single remote speed adjustment potentiometer can be used to adjust the engine speed continuously over specific speed range. Select the desired speed range and the corresponding potentiometer value.(Refer to TABLE 1.) If the exact range cannot be found, select the next higher range potentiometer. An additional fixed resistor may be placed across the potentiometer to obtain the exact desired range. Connect the speed range potentiometer as shown in Diagram 2.
  To maintain engine stability at the minimum speed setting, a small amount of droop can be added using the DROOP adjustment. At the maximum speed setting the governor performance will be near isochronous, regardless of the droop adjustment setting.

TABLE 1. Variable Speed Range Potentiometer Value

Speed Range	Potentiometer Value
900 Hz	1K
2,400 Hz	5K
3,000 Hz	10K
3,500 Hz	25K
3,700 Hz	50K

Diagram 2.

- **OVERSPEED shutdown setting**

  DWC-2000 has a Test switch to determine the OVERSPEED set point and test the engine shutdown function. If you want to adjust the OVERSPEED set point at the speed about 10% higher than the RUN set speed, use the Test switch. When the engine is operating at the Run set speed in pushing the Test switch, rotate the Overspeed Adjust. by CCW until the Overspeed shutdown function is operated. When the Test switch is pushed, the Overspeed set point is reduced to 10/11 of the real set point.

- **RUN ramp turn-On speed setting**

  When the engine is operating at the Run set speed, adjust the Run lamp adjustment CCW until the lamp is on. Then, more rotate 1/2 turn by CCW.

- **CRANK ramp turn-on speed setting**

  When the engine is operating at the Idle set speed(800rpm), adjust the Crank lamp adjustment CCW until the lamp is on. Then, more rotate 1.5 turns by CCW.

5) System troubleshooting

- **System Inoperative**

  If the engine governing system does not function, the fault may be determined by performing the voltage tests described in steps 1,2,3,and 4. (+) and (-) refer to meter polarity. Should normal values be indicated as a result of following the trouble shooting steps, the fault may be with the actuator or the wiring to the actuator. See the actuator publication for testing details.

STEP	TERMINALS	NORMAL VALUE	PROBABLE CAUSE OF ABNORMAL READING
1	F(+) & E(-)	Battery Supply Voltage(24V)	1. DC battery power not connected. Check for blown fuse. 2. Low battery voltage. 3. Wiring error.
2	C & D	1.0VAC RMS min., while cranking	1. Gap between speed sensor and gear teeth too great. Check gap. 2. Improper or defective wiring to the speed sensor. Resistance between terminals C and D should be 30 to 1200ohms 3. Defective speed sensor.
3	P(+) & G(-)	10VDC, Internal Supply	1. Short on terminal P. (This will cause a defective unit.) 2. Defective Speed Control.
4	F(+) & A(-)	1.0 - 2.0 VDC while cranking	1. SPEED adjustment set too low. 2. Short/open in actuator wiring. 3. Defective speed control. 4. Defective actuator. See Actuator Troubleshooting.

• **Unsatisfactory performance**

If the governing system functions poorly, perform the following tests.

SYMPTOM	TEST	PROBABLE FAULT
Engine overspeeds	Do not crank. Apply DC power to the governor system.	Actuator goes to full fuel. then, disconnect speed sensor at Terminals C & D. • If actuator still at full fuel → speed control unit deffective. • If actuator at minimum fuel position → errorneousspeed signal. Check speed sensor data.
	Manually hold the engine at the desired running speed. Measure the DC voltage between Terminals A(-)&F(+) on the speed control unit.	1. If the voltage reading is 4.0to6.0VDC a) SPEED adjustemnt set above desired speed b) Defective speed control unit. 2. If the voltage reading is above 6.0VDC. a) Actuator or likage binding. 3. if the voltage reading is below 4.0VDC. 4. Gain set too low.
Actuator does not energize fully.	Measure the voltage at the battery while cranking.	If the voltage is less than 15V for a 24V system, replace the battery if it is weak or undersized.
	Momentarily connect Terminals A and F. The actuator should move to the full fuel position.	1. Actuator or battery wiring in error. 2. Actuator or linkage binding. 3. Defective actuator.See actuator troubleshooting. 4. Fuse opens. Check for short in actuator or actuator wiring harness.
Engine remains below desired governed speed.	Measure the actuator output. Terminals A&B, while running under governor control	1. If voltage measurement is within approximately 3 volts of the battery supply voltage, then fuel control restricted from reaching full fuel position. Possibly due to interference from the mechanical governor, carburetor spring or linkage alignment. 2. Speed setting too low.

• **Insufficient magnetic speed sensor signal**

A strong magnetic speed sensor signal will eliminate the possibility of missed or extra pulses. The speed control unit will govern well with 0.5volts RMS speed sensor signal. A speed sensor signal of 3 volts RMS or greater at governed speed is recommended. Measurement of the signal is made at Terminals C and D.

The amplitude of the speed sensor signal can be raised by reducing the gap between the speed sensor tip and the engine rind gear. The gap should not be any smaller than 0.020 in (0.45mm). when the engine is stopped, back the speed sensor out by 3/4 turn after touching the ring gear tooth to achieve a satisfactory air gap.

- **Electromagnetic compatibility (EMC)**

  EMI SUSCEPTIBILITY - The governor system can be adversely affected by large inter- fering signals that are conducted through the cabling or through direct radiation into the control circuits.

  All DWC-2000 speed control units contain filters and shielding designed to protect the units sensitive circuits from moderate external interfering sources.

  Although it is difficult to predict levels of interference, applications that include magnetos, solid state ignition systems, radio transmitters, voltage regulators or battery chargers should be considered suspect as possible interfering sources.

  If it is suspected that external fields, either those that are radiated or conducted, are or will affect the governor systems operation, it is recommended to use shielded cable for all including the speed sensor shield, is connected to a single point on the case of the speed control unit. Mount the speed control unit to a grounded metal back plate or place it in a sealed metal box.

  Conduction is when the interfering signal is conducted through the interconnecting wiring to the governor system electronics. Shielded cables and installing filters are common remedies.

  As an aid to help reduce the levels of EMI of a conductive nature, a battery line filter and shielded cables are conveniently supplied by DWC.

- **Instability**

  Instability in a closed loop speed control system can be categorized into two general types. PERIODIC appears to be sinusoidal and at a regular rate. NON-PERIODIC is a random wandering or an occasional deviation from a steady state band for no apparent reason.

  Switch D1 controls the Differential function. When the position of switch D1 is "ON", the function is operated. Move the switch to the "OFF" position if there is fast instability in the system.

  The PERIODIC type can be further classified as fast or slow instability. Fast instability is a 3Hz. or faster irregularity of the speed and is usually a jitter. Slow periodic instability is below 3Hz., can be very slow, and is sometimes violent.

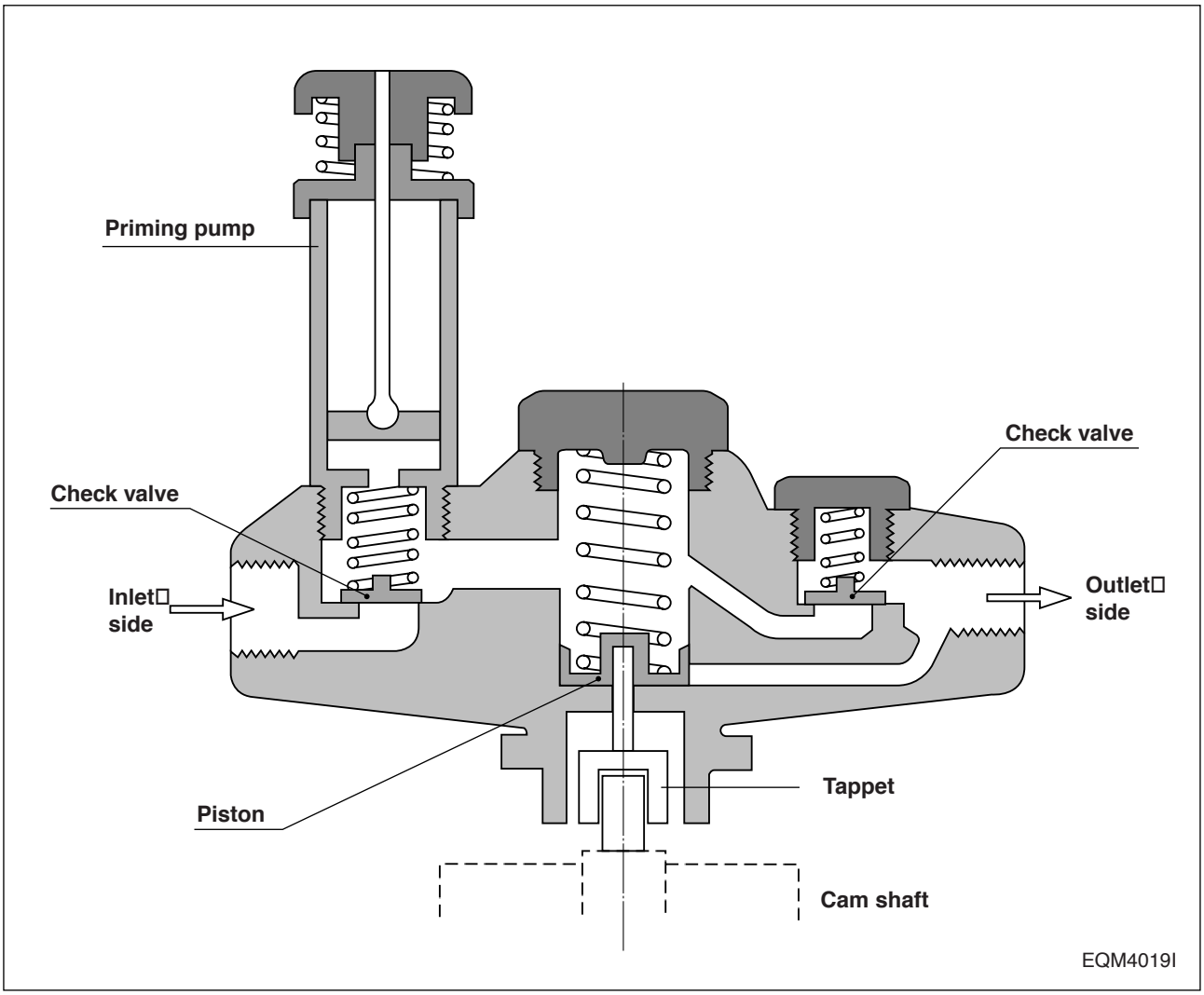
  If fast instability occurs, this is typically the governor responding to engine firings. Raising the engine speed increases the frequency of instability and vice versa. In this case, placing switch D1 in the "OFF" position will reduce the speed control unit's sensitivity to high frequency signals. Should instability still be present, placing switch D2 to the "OFF" position may help stabilize the engine. Again, readjust the GAIN and STABILITY for optimum control. Interference from powerful electrical signals can also be the cause. Turn off the battery chargers or other electrical equipment to see if the system disappears.

  Slow instability can have many causes. Adjustment of the GAIN and STABILITY usually cures most situations by matching the speed control unit dynamics. If slow instability is unaffected by this procedure, evaluate the fuel system and engine performance. Check the fuel system linkage for binding, high friction, or poor linkage. Be sure to check linkage during engine operation. Also look at the engine fuel system. Irregularities with carburetion or fuel injection systems can change engine power with a constant throttle setting. This can result in speed deviations beyond the control of the governor system. Adding a small amount of droop can help stabilize the system for troubleshooting.

  NON-PERIODIC instability should respond to the GAIN control. If increasing the gain reduces the instability, then the problem is probably with the engine. Higher gain allows the governor to respond faster and correct for disturbance. Look for engine mis-firings, an erratic fuel system, or load changes on the engine generator set voltage regulator. If the throttle is slightly erratic, but performance is fast, move switch D1 to the "OFF" position. This will tend to steady the system.

10.3.4. Fuel feed pump

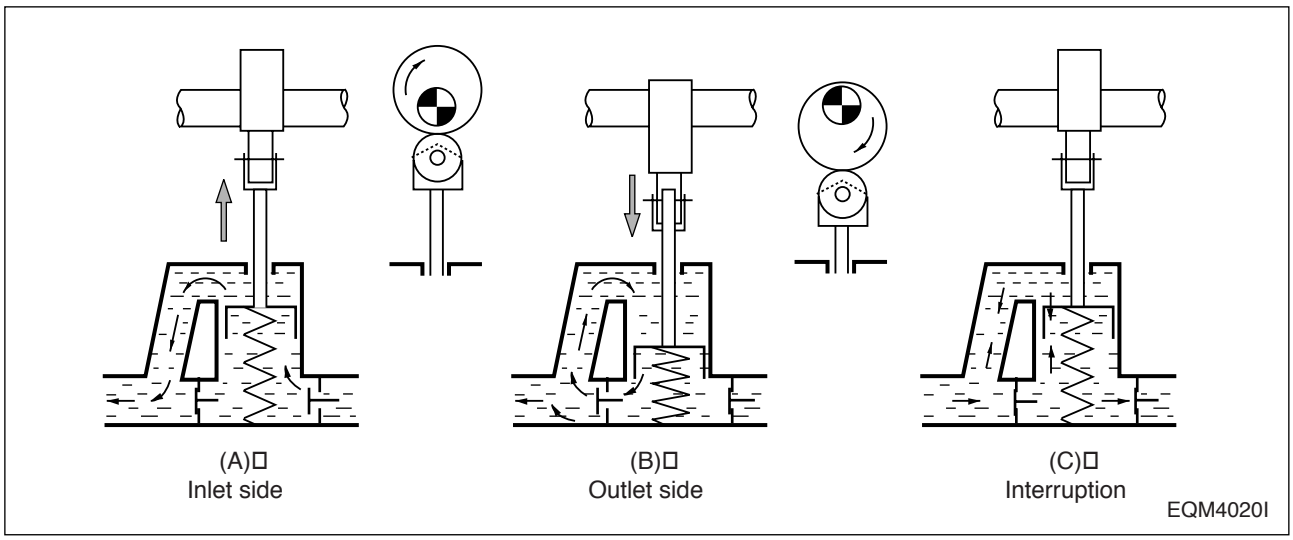
1) General descriptions and construction



The P-type injection pump is mounted with K-ADS or KP type feed pump. These pumps have the same basic construction and operation, and the general descriptions of the KP type pump are given below:

The figures show its construction (right figure) and operation (below figure). The piston in the fuel feed pump is driven by the push rod and tappet via the camshaft of injection pump and performs reciprocating operation to control the suction and delivery of fuel. When the cam reaches the Bottom Dead Center as shown in the figure, the fuel is drawn in through the check valve on the inlet side.

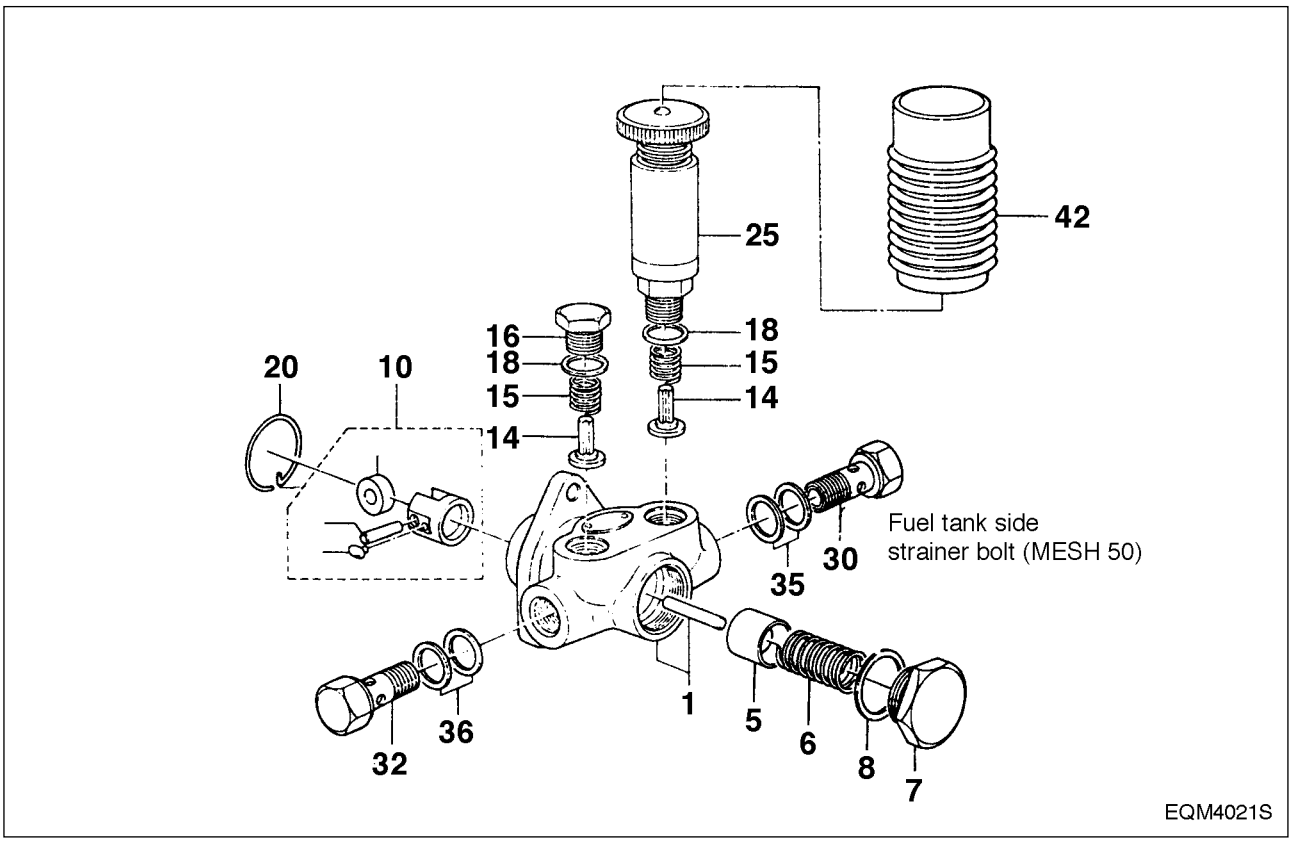
The fuel pressurized as the cam rotates on flows through the check valve on the outlet side as shown in (B). If the feeding pressure increases abnormally, the spring is compressed, resulting in interrupting further delivery of fuel as shown in (C).



This feed pump is mounted with a priming pump designed to permit manual feeding of fuel from the fuel tank with the injection pump mounted in the engine. During the manual feeding operation, air must be bled from the fuel lines.
When using the priming pump, fix it securely to prevent the possible entry of moisture or other foreign substances in the inside of feed pump.

In addition, a strainer is fitted into joint bolt on the inlet side of the fuel feed pump to filtrate any foreign substances possibly mixed in fuel.

2) disassembly



- Clamp the feed pump with a vise and disassemble the plugs (30, 32), strainer (31) and gaskets (35, 36).
- Take off the priming pump (25), plug (16), both gaskets (18), spring (15), and check valve (14).
- Take off the plug (7), gasket (8), spring (6), and piston (5) on the piston side.
- Pull out the snap ring (20) holding the tappet (10).
- Disassemble the snap ring, then take off the tappet (10) and push rod (1).

3) Inspection

- If the check valve is damaged or scored on its seat face, replace it with a new one.
- Inspect the piston and tappet for damage.
- Replace the push rod if excessively worn, and replace together with the pump housing if required. The inspection for wear should be performed in the same procedure as for suction pressure test described below.

4) Reassembly

Reassembly operation is performed in reverse order of disassembly. All the gaskets must be replaced with new ones at reassembly.

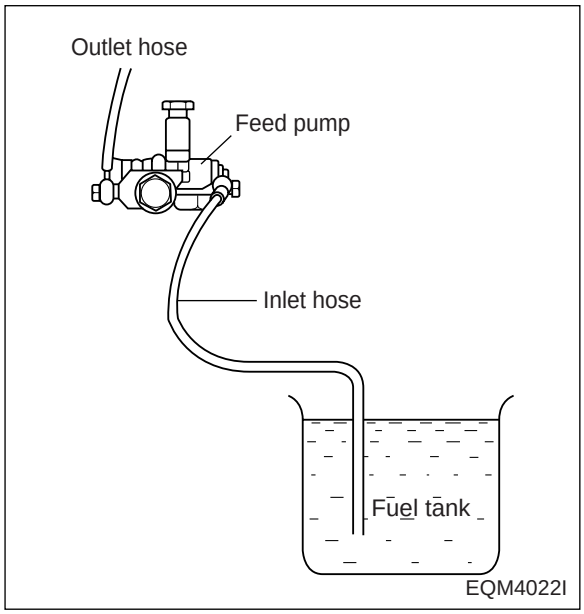
5) Testing

(1) Suction capacity test

Connect one end of a hose to the inlet side of the feed pump and immerse the other end of it into the fuel tank as illustrated.

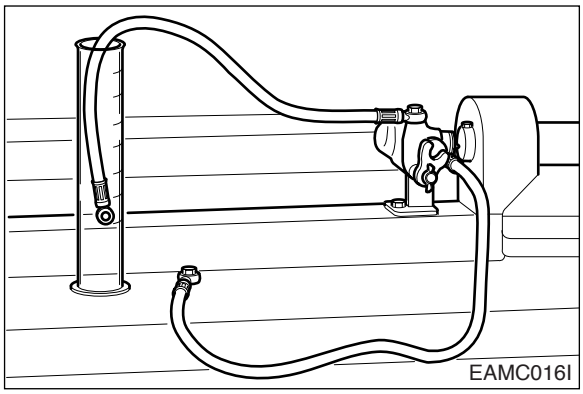
Hold the feed pump in position about 1m above the level of fuel in the fuel tank.

Operate the tappet at the rate of 100 rpm and check to see if fuel is drawn in and delivered for 40 seconds or so.



(2) Delivery test

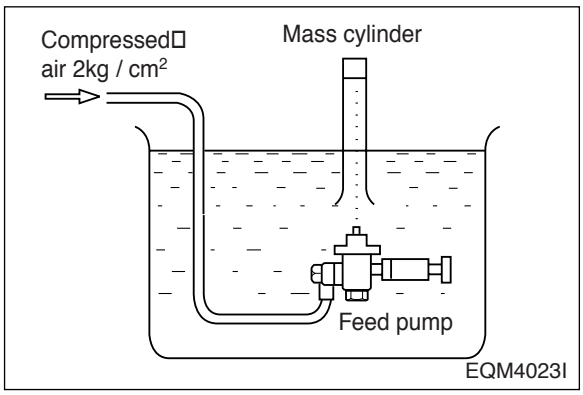
Make a test with the feed pump mounted on a pump tester as illustrated. Operate the pump at the rate of 1,000 rpm and check to see if the pump delivery is more than 405 cc/15 seconds.



(3) Sealing test

Plug up the delivery port on the feed pump and apply compressed air of 2 kg/cm² into the inlet side.

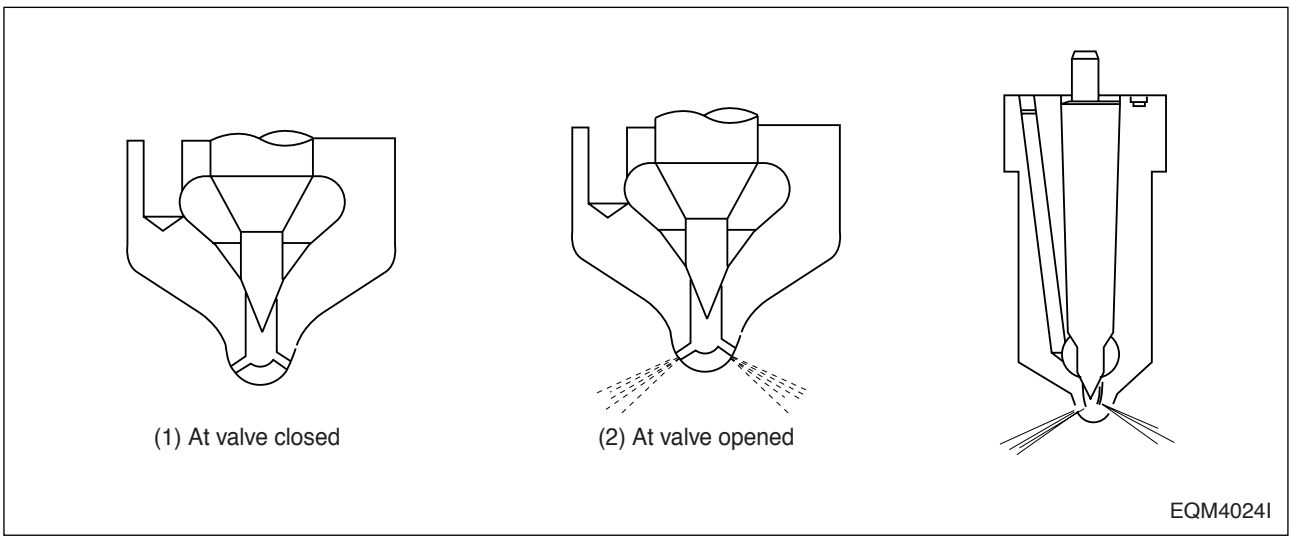
Submerge the feed pump in a container of diesel fuel and check for air leak.



10.3.5. Injection nozzle

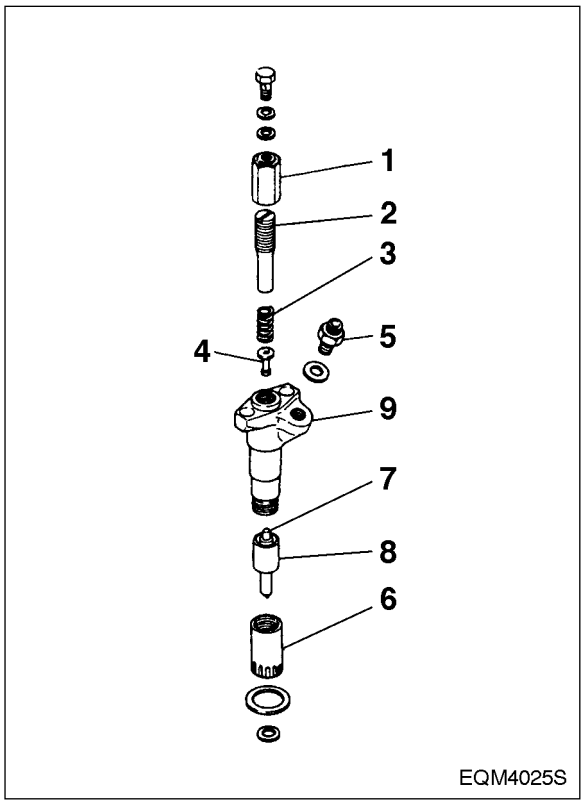
1) General descriptions

Pressurized fuel delivered from the fuel injection pump is sprayed into the combustion chamber past the injection nozzle at proper spray pressure and spray angle, then burnt completely to achieve effective engine performance.



2) 1-spring type

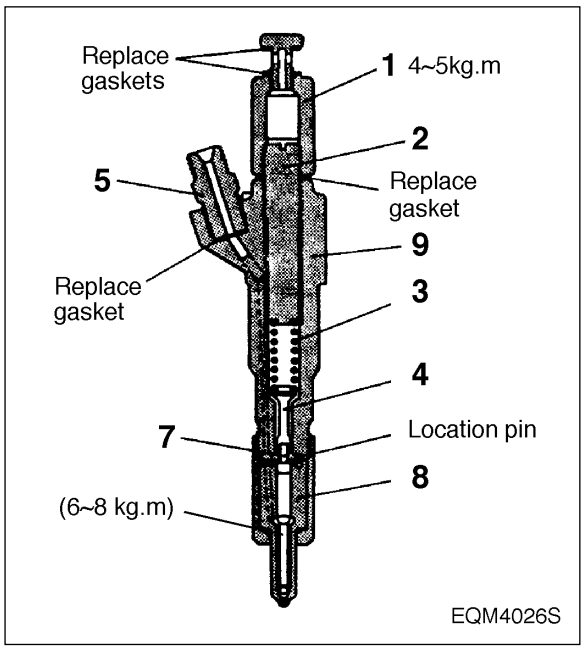
(1) Disassembly



1. Cap nut
2. Adjusting screw
3. Spring
4. Push rod
5. Connector
6. Retaining nut
7. Needing valve
8. Nozzle
9. Nozzle holder

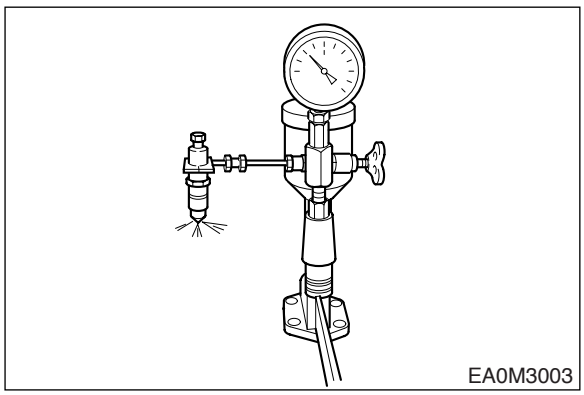
(2) Reassembly

- After removing carbon deposit, submerge the nozzle in diesel oil and clean it.
- Replace all the gaskets with new ones.
- Assemble the parts and tighten them to specified torque.



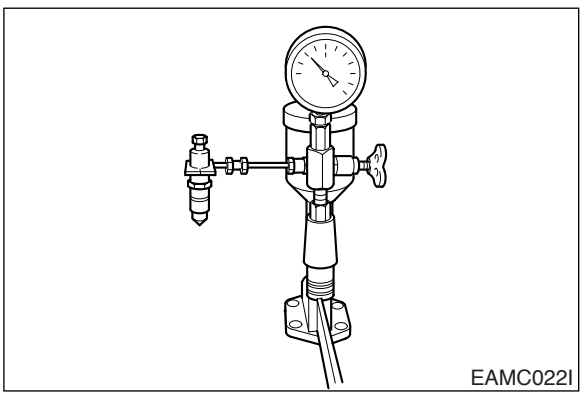
(3) Adjustment

- Remove the cap nut and assemble a nozzle to a nozzle tester.
- With the adjusting screw loosened, operate the nozzle 2 ~ 3 times to bleed it.
- Operate the nozzle tester lever at the specified rate.
- Adjust the injection pressure to the standard pressure using the adjusting screw.
- After adjusting the injection pressure, tighten the cap nut to specified torque.
- Re-check the injection pressure and see if the spray pattern is normal.



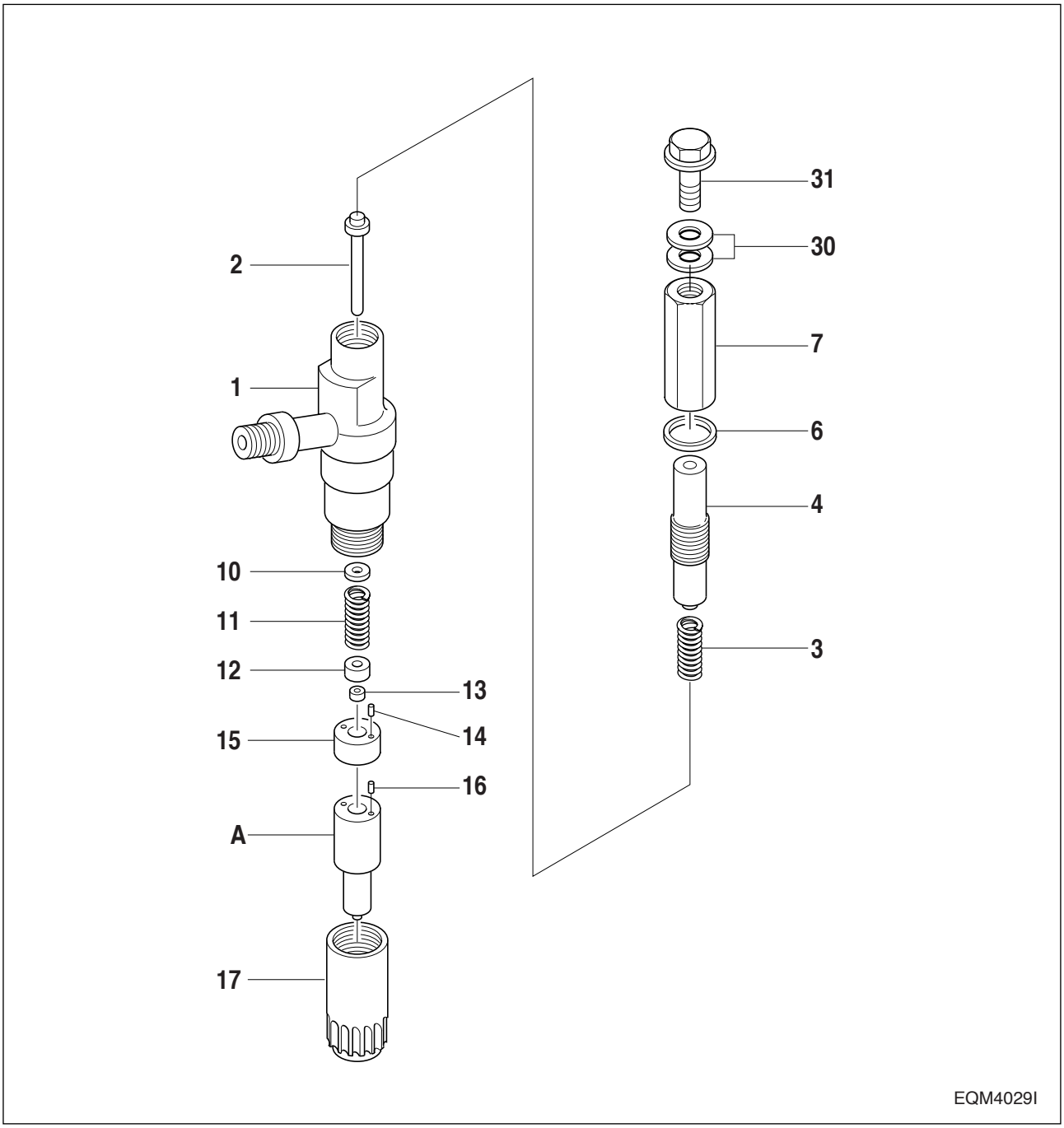
(4) Testing

With the nozzle assembled to a nozzle tester and pressure of 20 ~ 21 MPa (200 ~ 210 bar) applied, check the nozzle for fuel leakage.



3) 2-spring type

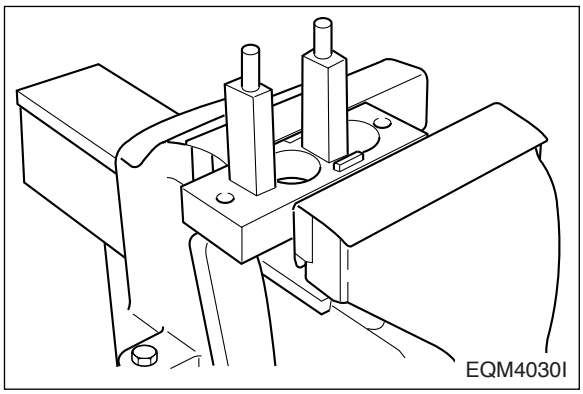
(1) Disassembly



1. Nozzle holder body
2. Push rod
3. Primary spring
4. Adjusting screw
6. Gasket
7. Cap nut
10. Adjusting shim
11. Secondary spring
12. Spring Seat
13. Lift pin
14. Pin
15. Spacer
16. Pin
17. Retaining nut
30. Gasket
31. Eye bolt
A. Nozzle

(2) Inspection and adjustment

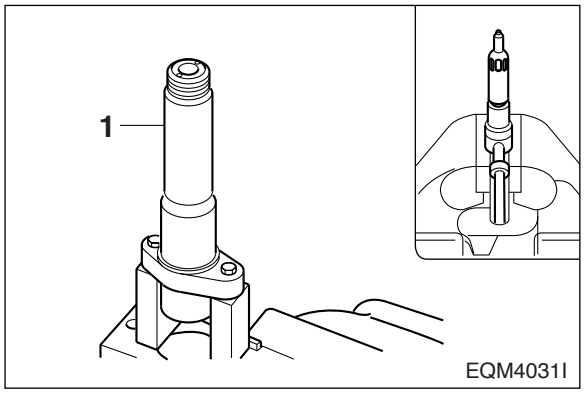
a. Adjusting the primary opening pressure. Install the plate of plate assembly (157944-9520) onto a vise.



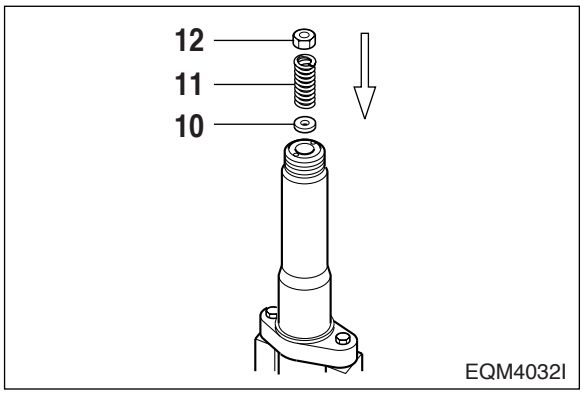
Note : Use the plate assembly (157944-9520) in fixing a nozzle holder having a flange. A nozzle holder without flange should be directly installed onto a vise.

b. With the nut, install the two pins on the plate.

c. Install the nozzle holder body (1) onto the plate with the cap nut side facing downward.

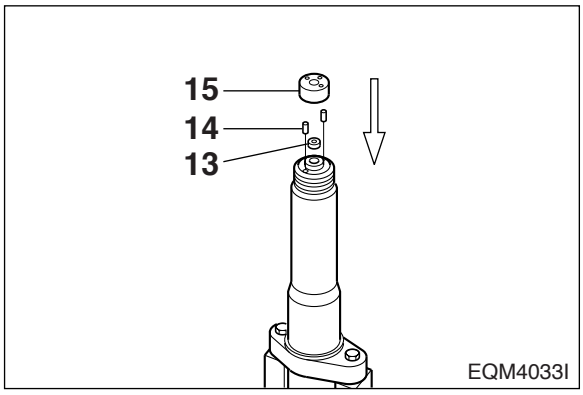


d. Assemble adjusting shim (10), secondary spring (11), and spring seat (12) on the nozzle holder body in the order as described.

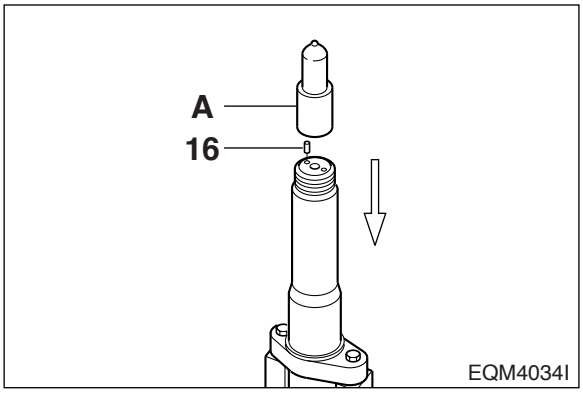


Note : The secondary spring is the same one as the primary spring.

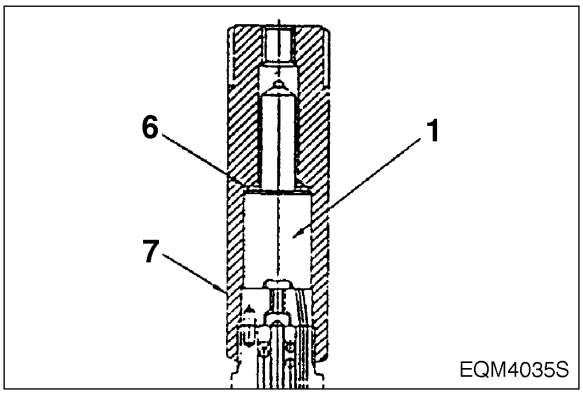
e. Assemble the pin (14), lift piece (13), and spacer (15) with the nozzle holder body.



f. Install the pin (16) and nozzle (A) onto the spacer.



g. After installing the gasket (6:157892-1500) on the nozzle, use the cap nut (7:157892-4000 : SW22mm) to fix the nozzle onto the nozzle holder.

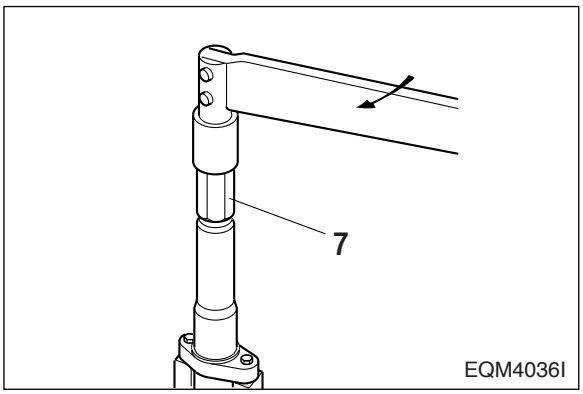


Note : While tightening the cap nut, keep checking to see if the lock pin comes all the way into the nozzle.

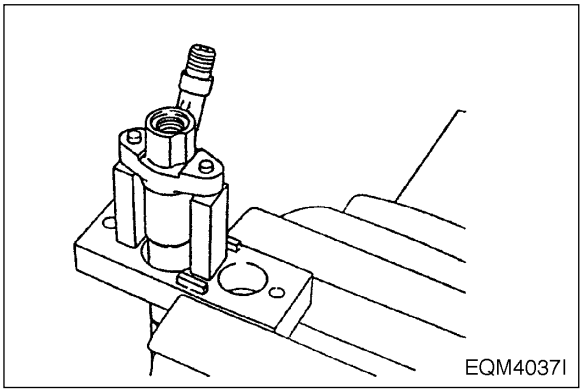
Note : Tighten the retaining nut until it resists hand tightening, then further tighten it using a torque wrench.

h. Be sure to follow the specified torque rating when tightening the adjusting retaining nut.

Torque	6.0 ~ 8.0 kg·m

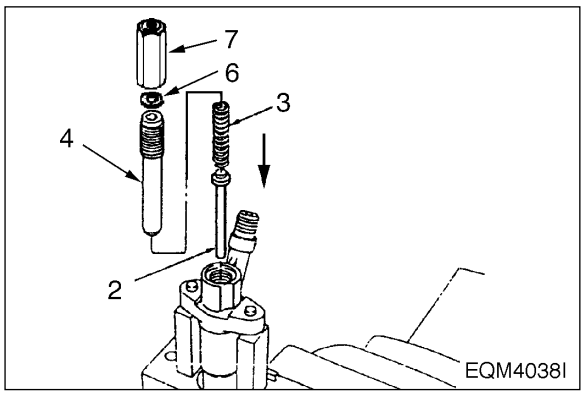


i. With the cap nut facing upward, install the nozzle holder on the plate.

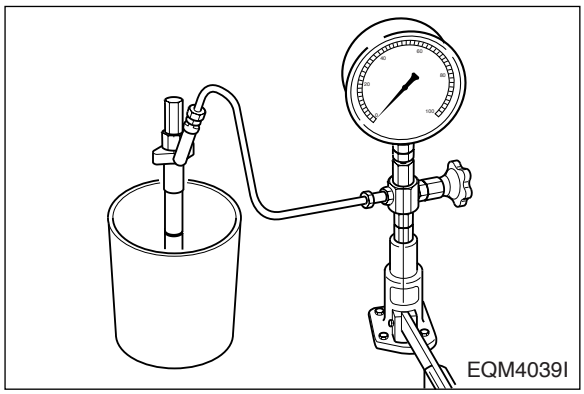


j. Assemble the push rod (2), primary spring (3), and adjusting screw (4) on the nozzle holder in the order described.

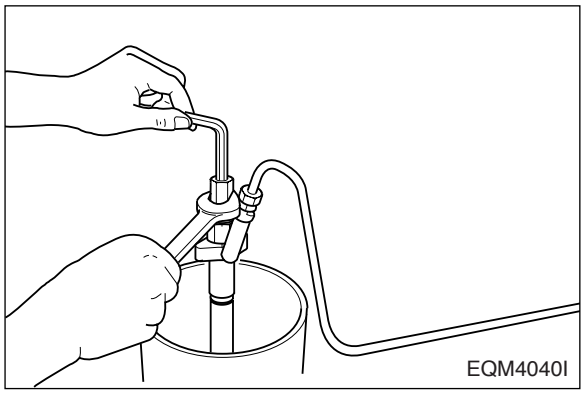
k. Install the gasket (6) and cap nut (7) onto the adjusting screw(4).



l. Assemble the nozzle and nozzle holder assembly to the nozzle tester (105785-1010).

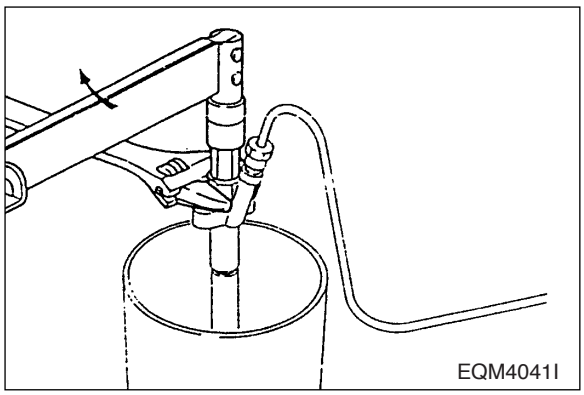


m. Adjust the primary opening pressure to the specified pressure using the adjusting screw (4).



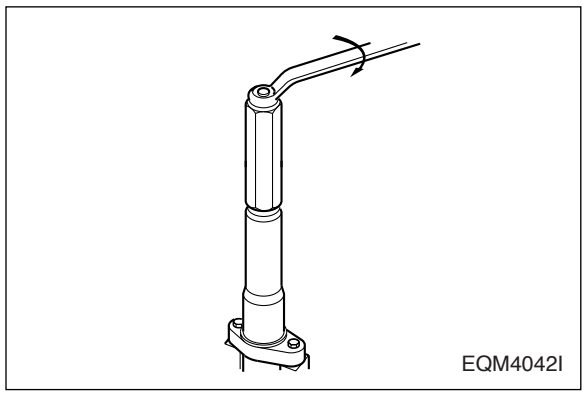
n. With a monkey wrench, fix the nozzle holder securely and tighten the cap nut (SW 19mm) to specified torque.

Torque	3.0 ~ 4.0 kg·m



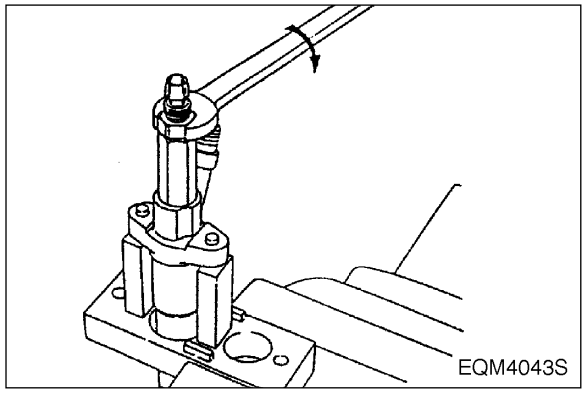
• **Inspecting the needle valve for full lift**

a. Install gasket (026508-1140) and plug (157892-1600 : SW12mm) onto the adjusting retaining nut (157892-1400).

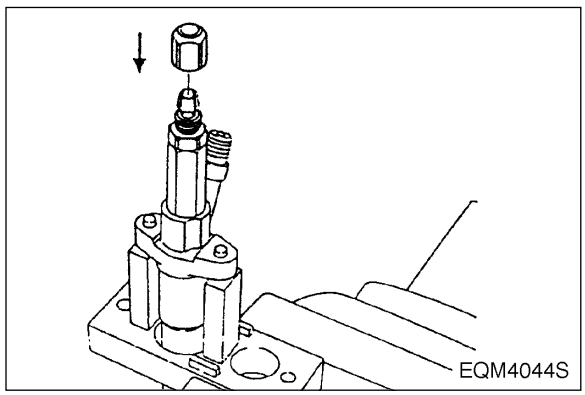


b. Install the nozzle holder on the plate with the cap nut facing upward.

c. Install the holder(157892-4100: SW12 mm) into the cap nut.

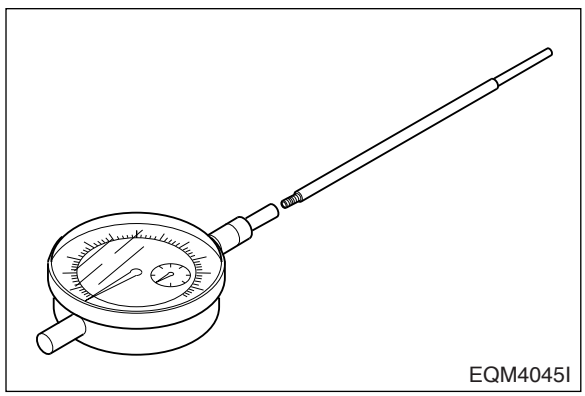


d. Install a nut (157892-1000 : SW 17mm) on the holder.



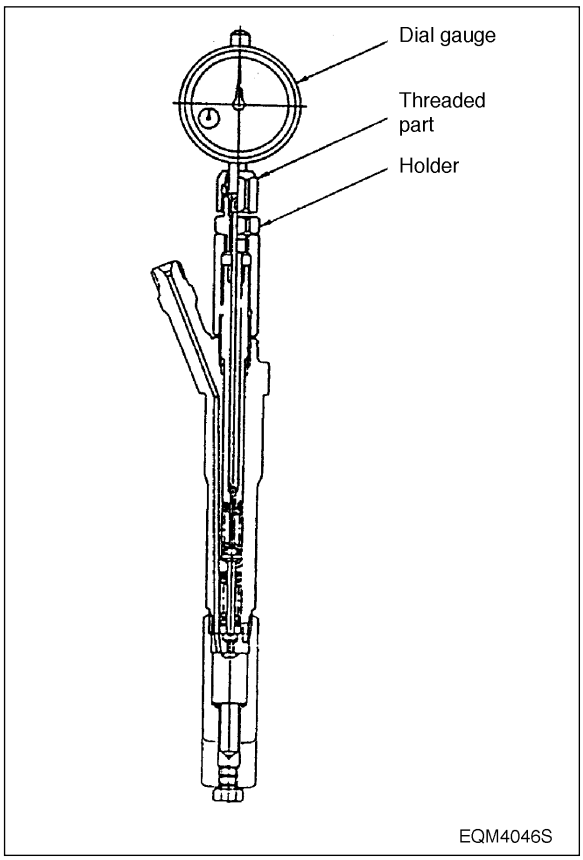
e. Assemble the pin (157892-4200 or 157892-4300) to the dial gauge (157954-3800).

Part No.	L (mm)
157892-4200	160
157892-4300	110



Note : "L" means the length of the pin except the threaded portion.

f. Install the dial gauge on the holder assembly so that the pin is brought into contact with the upper end of the push rod, then fix the pin with the nut.

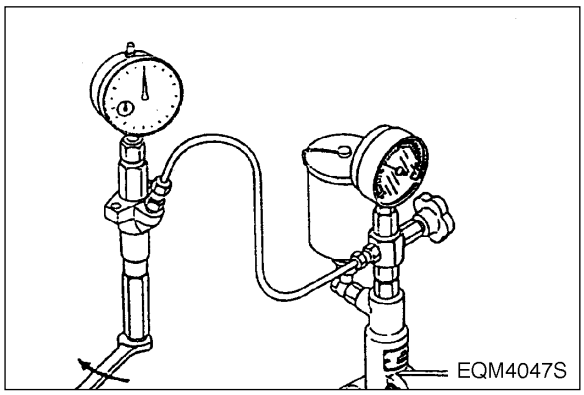


Note 1 : Fix the dial gauge so that a stroke of 2 mm or so can be measured.

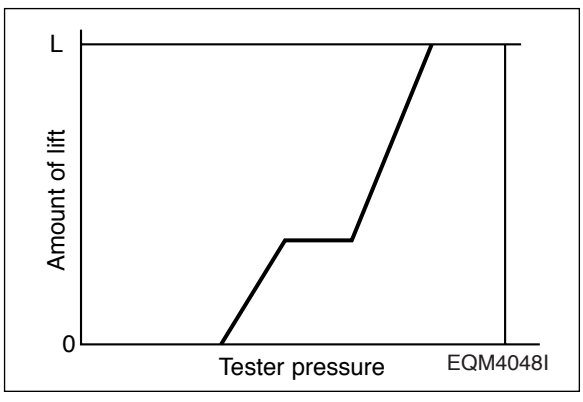
Note 2 : Overtightening the nut may cause a sticking of the dial gauge seat.

g. Assemble the nozzle and nozzle holder assembly to the nozzle tester and zero the dial gauge.

h. Operate the nozzle tester, bleed the retaining nut, and check for fuel leakage.



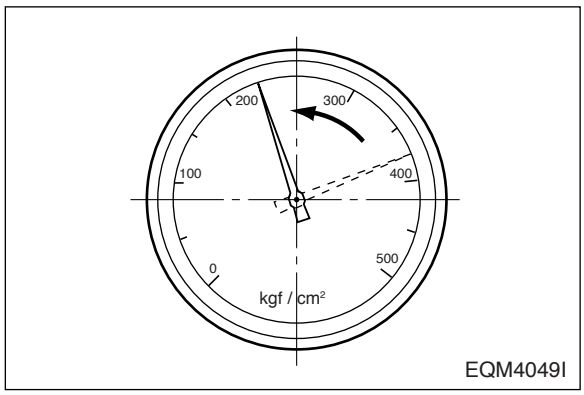
I. Operate the nozzle tester and increase the tester pressure up to 350 ~ 450kgf·cm^2 in order that the needle valve can be fully lifted. Then, record the full lift value “L”.

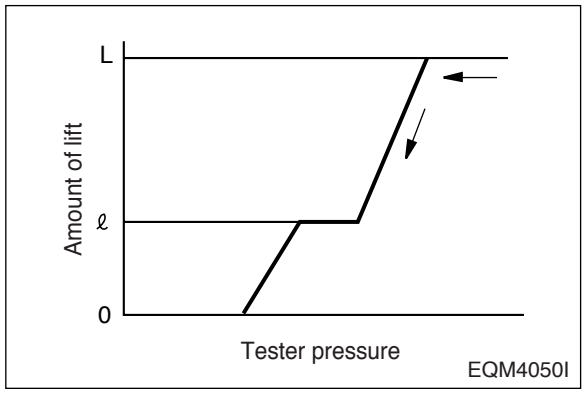


Note : This testing is to be made in order to check the nozzle seat portion for unusual wear or whether the nozzle assembly is a standard item.

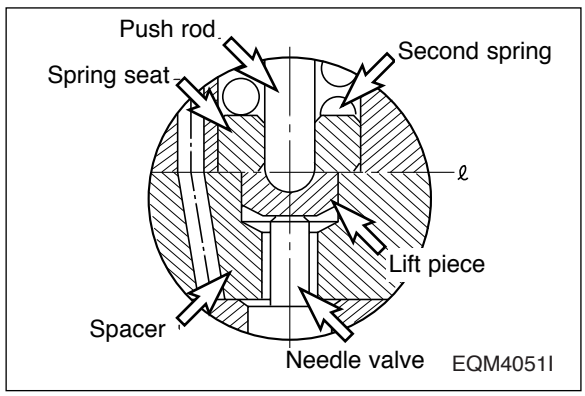
• Inspection of pre-lift

a. If the nozzle tester handle is released with the needle valve engaged in a full lift condition, the tester pressure drops, being accompanied by decrease in the needle valve lift value (indicated value on the dial gauge).





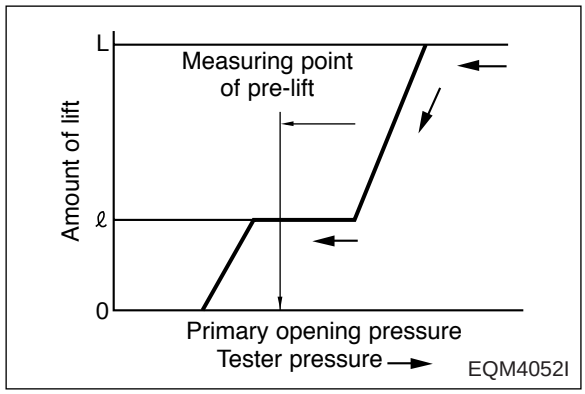
b. Take the indicated value on the dial gauge at the point of time when the secondary spring completes its operation and the needle valve puts an end to descent (the position of needle valve lift value "ℓ" as shown in the above and right figures) and check that the value is within the specified limit.



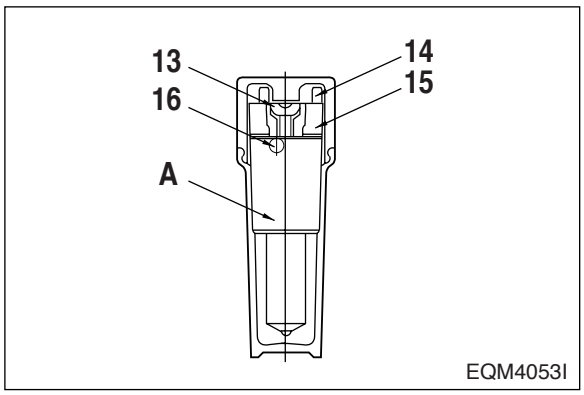
Measuring point for pre-lift

Take the indicated value on the dial gauge at a point of primary opening pressure approx. + 1 0 kgf·cm².

Note : Locate the point of primary opening pressure approx. + 10kgf·cm² while dropping the pressure.



c. If the measured pre-lift value deviates from the specified limit, replace the pin (14, 16), lift piece (13), spacer (15), and nozzle assembly (A) with a new “nozzle service kit”.

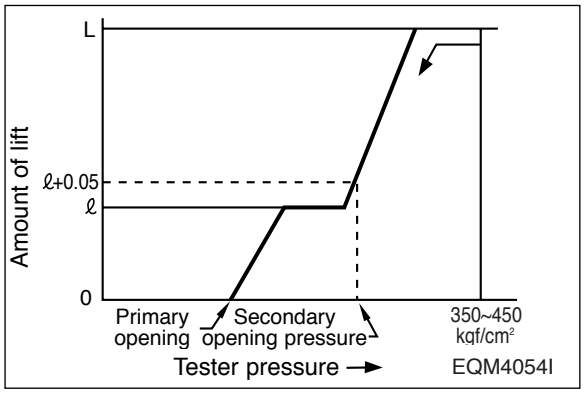


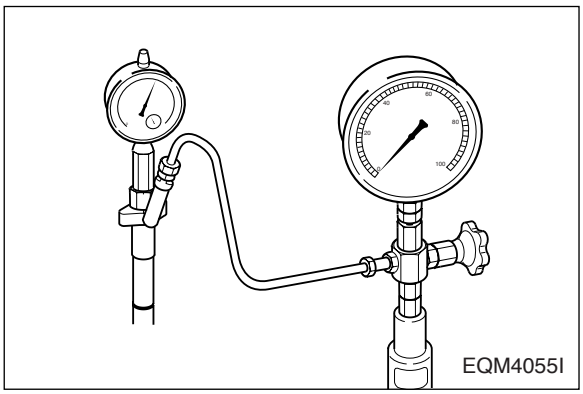
- **Inspection of secondary opening pressure**

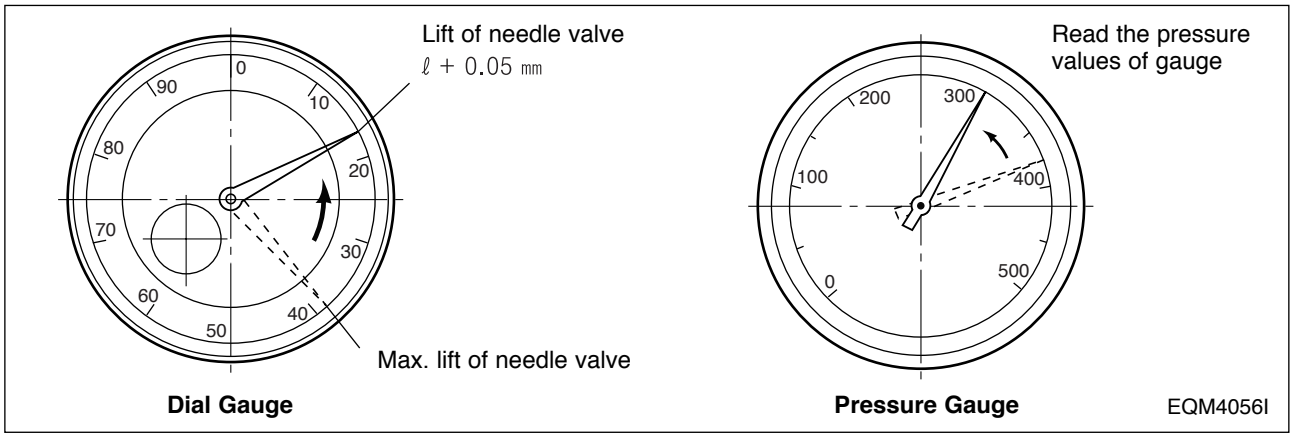
a. After confirming the pre-lift, operate the nozzle tester and increase the internal pressure up to 350 ~ 450 kgf/cm² to fully lift the needle valve.

b. Release the nozzle tester handle to decrease the tester pressure, then take a note of the movements of the dial gauge.

c. Take the indicated value on the pressure gauge at the point of time when the needle of the dial gauge indicates the specified needle valve lift value. (In general, pre-lift “ ℓ ” + 0.05mm. Refer to following figure).



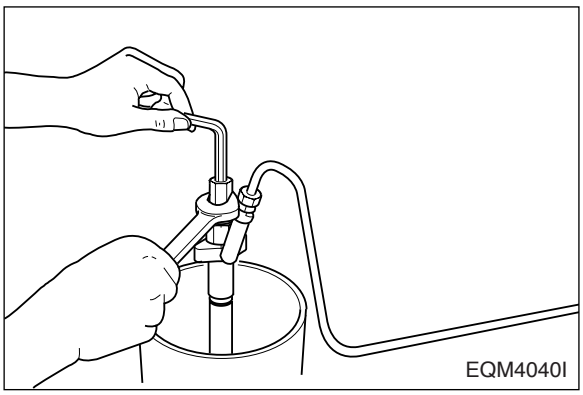




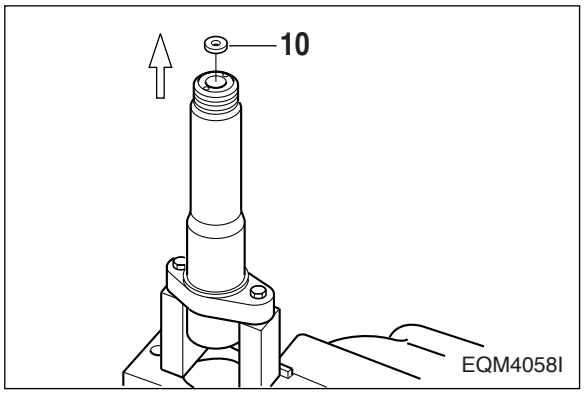
• **Adjusting secondary opening pressure**

a. In the event that the measured value deviates from the specified limit, readjust the primary opening pressure if the amount of deviation is small. (to the standard range of the primary opening pressure)

- If the secondary opening pressure is lower than the standard value: Adjust the primary opening pressure up to the top limit of the standard vague, and then measure the secondary opening pressure.
- If the secondary opening pressure is higher than the standard value: In a reverse manner, readjust the primary opening pressure down to the bottom limit of the standard value.



b. If the secondary opening pressure still deviates from the specified limit in spite of the readjusting the primary opening pressure, take off the nozzle fixing portion from the nozzle holder and remove the adjusting shim (10).



c. If the secondary opening pressure is higher than the standard value, fit a thinner adjusting shim than the existing one.

d. After replacing the existing adjusting shim, measure the secondary opening pressure and continue the adjustment until a value satisfying the standard value.

Adjusting shim for secondary opening pressure

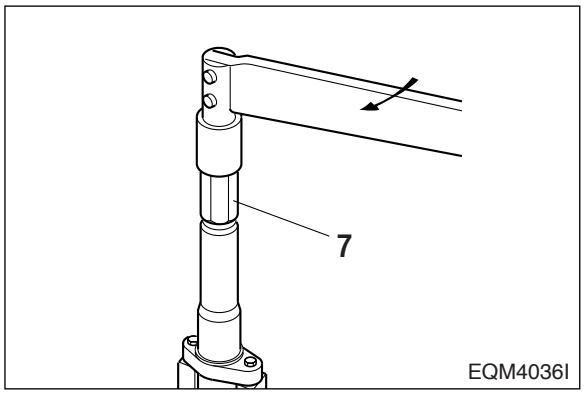
(Out diameter = ∅ 9.5 , Inner diameter = ∅ 4.5)

Part No.	Thickness(mm)	Part No.	Thickness(mm)
1505380-4900	0.40	1505380-5300	0.56
1505380-5000	0.50	1505380-5400	0.58
1505380-5100	0.52	1505380-5500	0.60
1505380-5200	0.54	1505380-5600	0.70

- **Retaining nut**

a. Take out the dial gauge, nut, holder and gasket from the cap nut (7).

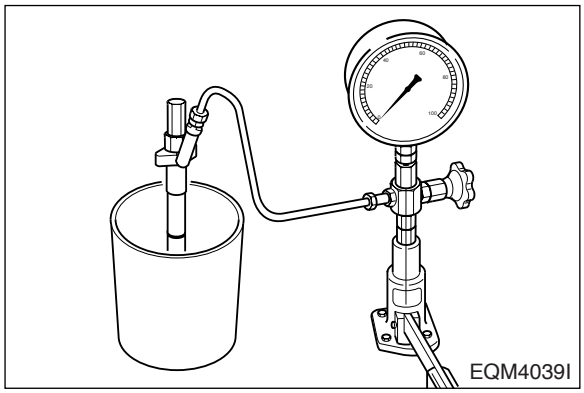
b. Remove the adjusting retaining nut and gasket, and install the original retaining nut(SW 19mm).



Cap nut Tightening torque	6.0 ~ 8.0 kg·m

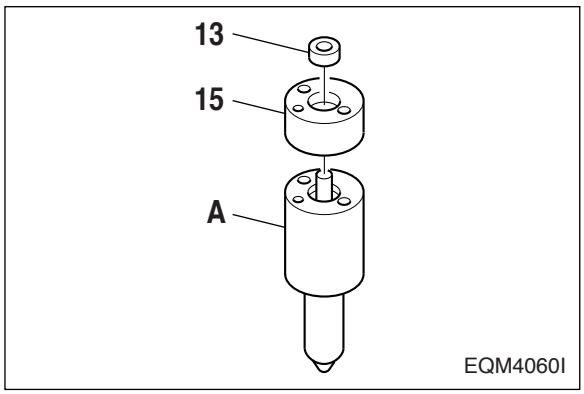
- **Inspection at completion**

a. Assemble the nozzle holder to a nozzle tester and check the primary opening pressure, spray patterns, oil tightness of seat portion, and oil leakage from each part.



b. When replacing the nozzle, replace it with a new “nozzle service kit” integrated with a nozzle, lift piece, and spacer as a complete set.

Note : If only a nozzle is replaced, the amount of pre-lift will deviate from the specified value.



10.3.6. Diagnostics and troubleshooting

Complaints	Possible causes	Corrections
1. Engine won't start	(1) Fuel pipes clogged or air into pipe line	Correct
1) Fuel not being pumped out from feed pump	(2) Feed pump valve defective	Replace
	(3) Feed pump piston or push rod sticking	Disassemble, correct
2) Fuel not being injected from injection pump	(1) Fuel filter element restricted	Clean
	(2) Air in fuel filter or injection pump	Bleed
	(3) Plunger and/or delivery valve sticking or defective	Disassemble, correct
3) Fuel injection timing incorrect	(1) Injection pump not properly installed on pump bracket	Check, correct
	(2) Injection pump tappet incorrectly adjusted	Check, correct
	(3) Cams on cam shaft worn excessively	Replace
4) Injection nozzles inoperative	(1) Needle valves sticking	Correct or replace
	(2) Fuel leaking past clearance between nozzle and needle valve	Correct or replace
	(3) Injection pressure incorrect	Adjust
2. Engine starts but stalls immediately	(1) Pipe from feed pump to injection pump clogged or filter clogged	Clean
	(2) Air in fuel	Bleed
	(3) Feed pump delivery insufficient	Disassemble, correct
	(4) Fuel delivery insufficient due to clogging of fuel tank air breather	Replace breather
3. Engine lacks power	(1) Plunger worn excessively	Replace
	(2) Injection timing incorrect	Adjust
	(3) Delivery valves defective	Replace
	(4) Nozzle leaks excessively	Correct or replace
	(5) Nozzle not working normally	Disassemble, correct
4. Engine knocking	(1) Injection timing too fast	Adjust
	(2) Nozzle injection pressure too high	Adjust
	(3) Nozzles not working normally	Disassemble, correct
5. Engine knocks seriously producing excessive exhaust smoke	(1) Injection timing incorrect	Adjust
	(2) Nozzle injection pressure too low	Adjust
	(3) Nozzle spring broken	Replace
	(4) Nozzles not working normally	Replace
	(5) Plungers worn excessively	Adjust
	(6) Delivery valves seat defective	Replace
	(7) Supply of fuel excessively	Check feed pump

Complaints	Possible causes	Corrections
6. Engine output unstable	(1) Supply of fuel insufficient	Check feed pump
	(2) Air in fuel	Bleed
	(3) Water in fuel	Replace fuel
	(4) Operation of plungers unsmooth	Disassemble, correct
	(5) Movement of control rack sluggish	Disassemble, correct
	(6) Nozzles defective	Disassemble, correct
	(7) Injection starting pressure of each barrel incorrect	Adjust
		Disassemble, correct
	(8) Automatic timer defective	Disassemble, correct
7. Engine does not reach maximum speed	(1) Nozzles not working normally	Disassemble, correct
	(2) Governor defective	Disassemble, correct
8. Engine idling unstable	(1) Movement of control rod sluggish	Disassemble, correct
	(2) Operation of plungers unsmooth	Disassemble, correct
	(3) Control pinions not engaged with control rod correctly	

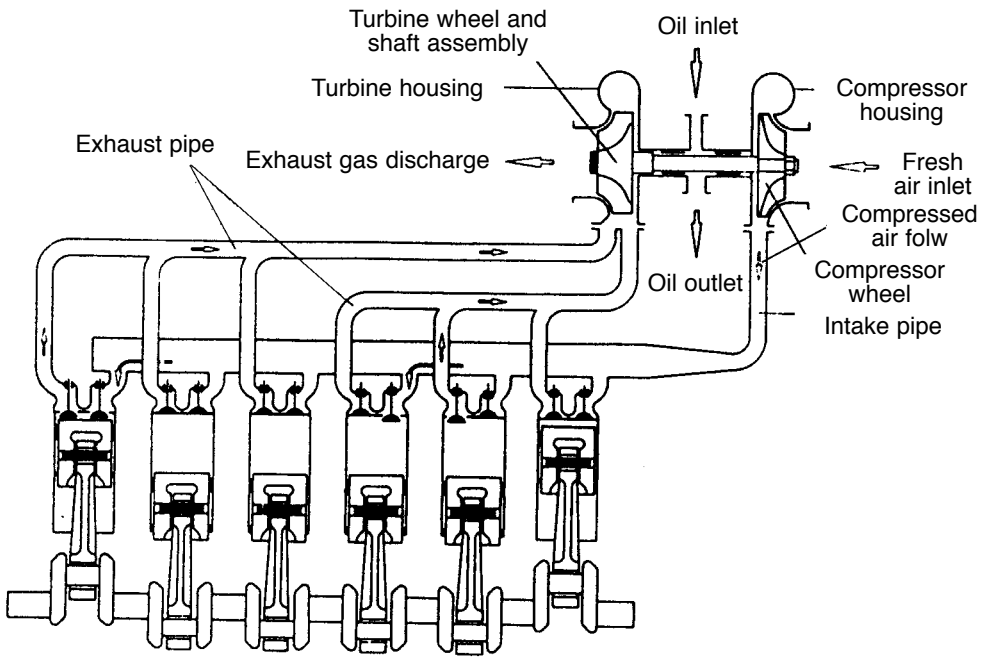
10.4. Turbocharger

10.4.1. Main data and specifications

1) Main data and specifications

Specification		DE12T	P126TI/P126TI-Ⅱ
Turbocharger Model		Allied Signal T45	Allied Signal TV51
At maximum output	Air pressure at compressor outlet	50Hz: Approx. 1.1 kg/cm^2 60Hz: Approx. 1.2 kg/cm^2	50Hz: Approx. 1.5 kg/cm^2 60Hz: Approx. 1.8 kg/cm^2
	Air suction volume	50Hz: Approx. 12.5 m^3/min 60Hz: Approx. 15.0 m^3/min	50Hz: Approx.18.0 m^3/min 60Hz: Approx. 23.6 m^3/min
	Speed of turbine revolution	50Hz: Approx 79.270 rpm 60Hz: Approx. 86.850 rpm	50Hz: Approx. 75910 rpm 60Hz: Approx. 83150 rpm
Maximum allowable speed		110,072 rpm	105,414 rpm
Max. allowable temperature of exhaust gas at turbine inlet		750 °C	750 °C
Lubricating system		External oil supply	External oil supply
Weight		14 kg	14 kg

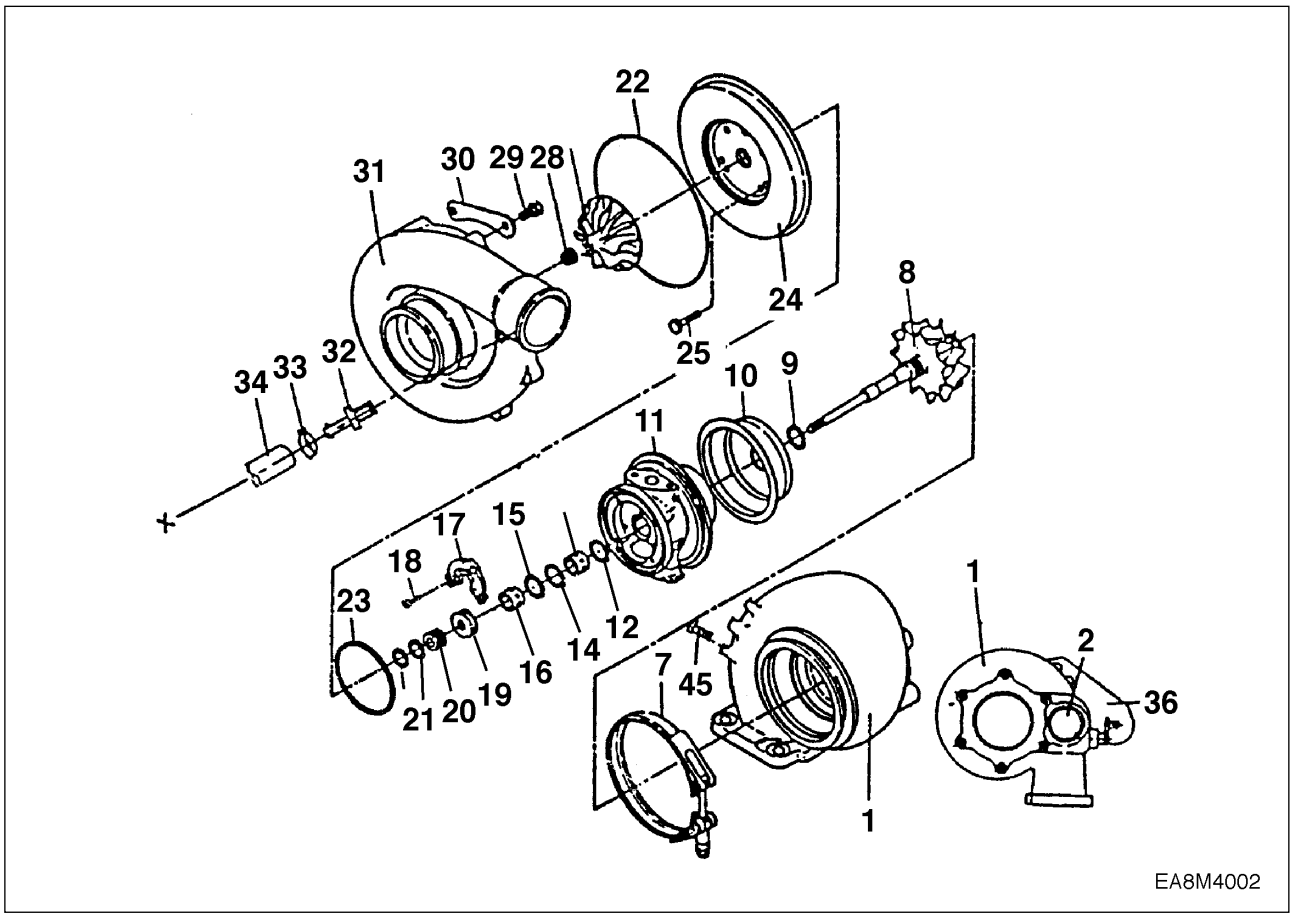
2) Operating principle



EM0A8001

The turbocharger is a system designed to make use of the engine exhaust gas energy to charge high-density air into the cylinders, thereby to increase the engine output.

3) Construction



1.	Turbine housing	15.	Retainer ring	25.	Bolt
2.	Plug	16.	Bearing	26.	O-ring
5.	Crank	17.	Thrust collar	27.	Compressor wheel
7.	V-band	18.	Screw	28.	Nut
8.	Wheel	19.	Thrust bearing	29.	Bolt
9.	Piston ring	20.	Thrust space	30.	Clamp
10.	Wheel shroud	21.	Piston ring	31.	Compressor housing
11.	Center housing	22.	Seal ring	32.	Elbow
12.	Retainer ring	23.	Seal ring	38.	Retainer
13.	Bearing	24.	Rear plate	45.	Bolt
14.	Retainer ring				

10.4.2. General descriptions

The engine output is determined by the fuel delivery volume and engine efficiency.

To burn the supplied fuel completely to change into effective power for the engine, the volume of air enough to burn the fuel completely should be supplied into the cylinders.

Therefore, the engine output is determined substantially by the cylinder capacity, and a greater volume of compressed air is charged into cylinders of given capacity, the greater engine output can be obtained as a greater volume of air charged into the cylinders burns so much more fuel.

As explained, the compressing of air to supply into the cylinders is called “Supercharging” and the making use of the energy of exhaust gas discharged from the combustion chamber to charge the compressed air into the cylinders is called “Turbocharging”.

10.4.3. Functions

1) Turbine

Exhaust gas discharged from the combustion chamber distributes its own energy to the turbine blades while passing the inside of the turbine housing, with the result that the turbine shaft can get rotating force. This is the operating principle of ‘turbine’, which is mounted with seal rings and heat protector to prevent exhaust gas from affecting the bearings adversely.

2) Compressor

The compressor, which is connected to the turbine over the one and same shaft to form a rotating body, takes in and compresses ambient air with rotating force transmitted from the turbine shaft. Then, the compressed air is delivered to the intake stake. This is the operating principle of the compressor.

3) Bearings

(1) Thrust bearing

The turbine wheel creates thrust force. Therefore, exercise care so that the shaft is not deviated from its the original position due to this thrust.

(2) Journal bearing

This journal bearing of floating type forms a dual oil film on both the inside and outside of the bearing so that the bearing can rotate independently. As the dual oil film plays a role as a damper, the sliding speed of the bearing surface becomes lower than the rotating speed of the shaft, resulting in assurance of stability in its movement.

4) Sealing-Compressor shaft

The compressor is of a dual construction type composed of seal plate and seal ring to prevent the leak of compressed air or lubricating oil.

10.4.4. Precautions for operation

1) Precautions for operation of engine

The following precautions should be observed when starting, operating, or stopping the engine:

Operations	Precautions	Reasons
When starting the engine	1) Check oil level 2) Crank the engine with starter to check the increase in oil pressure(until the needle of pressure gauge starts to move or pressure indicator lamp is actuated) before starting the engine. 3) When having replaced oil, oil filter element, or lubricating parts, or when having stopped the engine for extended period of time, or in a cold place, loosen the oil pipe connections and operate the starter motor until oil is discharged. After completing the operation, be sure to retighten the oil pipe connections portion before starting the engine.	2) Abrupt starting of the engine causes the engine to rotate with oil not being distributed not only to each part but also to the turbocharger, resulting in abnormal wear or seizure on the bearing due to insufficient supply of oil. 3) In the case of the engine stopped for extended time or in a cold place, oil fluidity within the pipes can be deteriorated.
Immediately after starting	1) Run the engine at idle for 5 minutes after starting off. 2) Check each part for leakage of oil, gas, and air, and take proper measure.	1) Applying load abruptly If load is abruptly applied with the engine and turbocharger rotating unsmoothly, such parts that a sufficient amount of oil has not reached can be seized up. 2) Leakage of oil, gas, and air (especially, oil leak) causes drop in oil pressure and loss of oil. resulting in seizure of the bearing.
During operation	Check the followings: 1) Oil pressure At idle: 0.8kg/cm^2 or more At full load: 3.0~4.8kg/cm^2 2) If unusual sound or vibration is heard or felt, reduce engine revolutions slowly and locate the cause.	1) Excessively low oil pressure causes unusual wear or seizure of the bearing. Too high pressure causes oil leakage. 2) The engine is operated continuously with unusual sound or vibration not corrected, it can be damaged beyond repair.
When stopping the engine	1) Run the engine at idle for 5 minutes before stopping.	1) If the engine is put to a stop after being operated at high load, heat from the red-hot turbine blades is transmitted to the bearing portion and burns oil to cause seizure of the bearing metal and rotating shaft.

10.4.5. Walk-around check and servicing

As the condition of turbocharger depends greatly on how well the engine is serviced, it is very important to maintain the engine in accordance with the specified maintenance procedure.

1) Intake system

Pay particular attention to the air cleaner when servicing the intake system.

In the case of wet-type air cleaner, if the level of oil surface is lower than specified, cleaning effect is poor; if too high, the cleaner draws in oil to foul the case.

Especially, if the rotor is fouled, the sophisticatedly-tuned balance is broken to create vibration and to cause seizure and unusual wear to the bearing.

Therefore, it is very important to use a good quality air cleaner all the time.

In the case of dry-type air cleaner, it is essential to clean it to reduce intake resistance as much as possible.

2) Exhaust system

Pay particular attention to prevent gas leaks and seizure when servicing the exhaust system because leakage of exhaust gas from discharge pipes, turbocharger fixing portions, etc. lowers charging effect.

As such components as turbine chamber that becomes red-hot during operation use heat resisting steel nuts, do not interchange these nuts with ordinary steel nuts. In addition, apply anti-seizure coating to fixing nuts on the portions as designated.

3) Fuel system

If the full load stopper regulating the maximum injection volume and the maximum speed stopper regulating the maximum speed in the fuel injection pump are adjusted without using a pump tester, the turbocharger rotates at excessively rapid speed and may suffer damage. Besides of it, if spray pattern from the fuel injection nozzles is bad or the injection timing is incorrect, temperature of exhaust gas rises up to affect the turbocharger adversely. To avoid such trouble, be sure to make a nozzle test.

4) Lubricating system

Pay particular attention to oil quality and oil filter change intervals when servicing the lubricating system. Deteriorated engine oil affects adversely not only the engine but torso the turbocharger. Suggested engine oils for the turbocharger-mounted engine are as follows:

- SAE 15W30
- API grade CD or CE

10.4.6. Periodical checking and servicing

Make it a rule to check the turbocharger assembly for condition and contamination periodically.

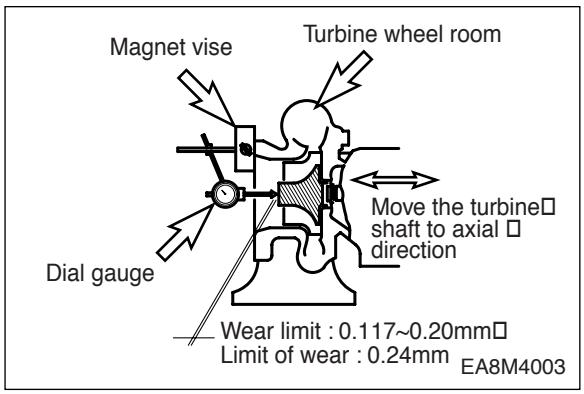
1) Guide for checking the rotor for rotating condition

The inspection of the rotor assembly for rotating condition should be performed by the degree of unusual sound. If a sound detecting bar is used, install its tip on the turbocharger housing and increase the engine revolutions slowly. If a high-pitch sound is heard continuously, it means that the rotor assembly is not normal. In this case, as the metal bearing and rotor are likely to be in abnormal conditions, the turbocharger should be replaced or repaired.

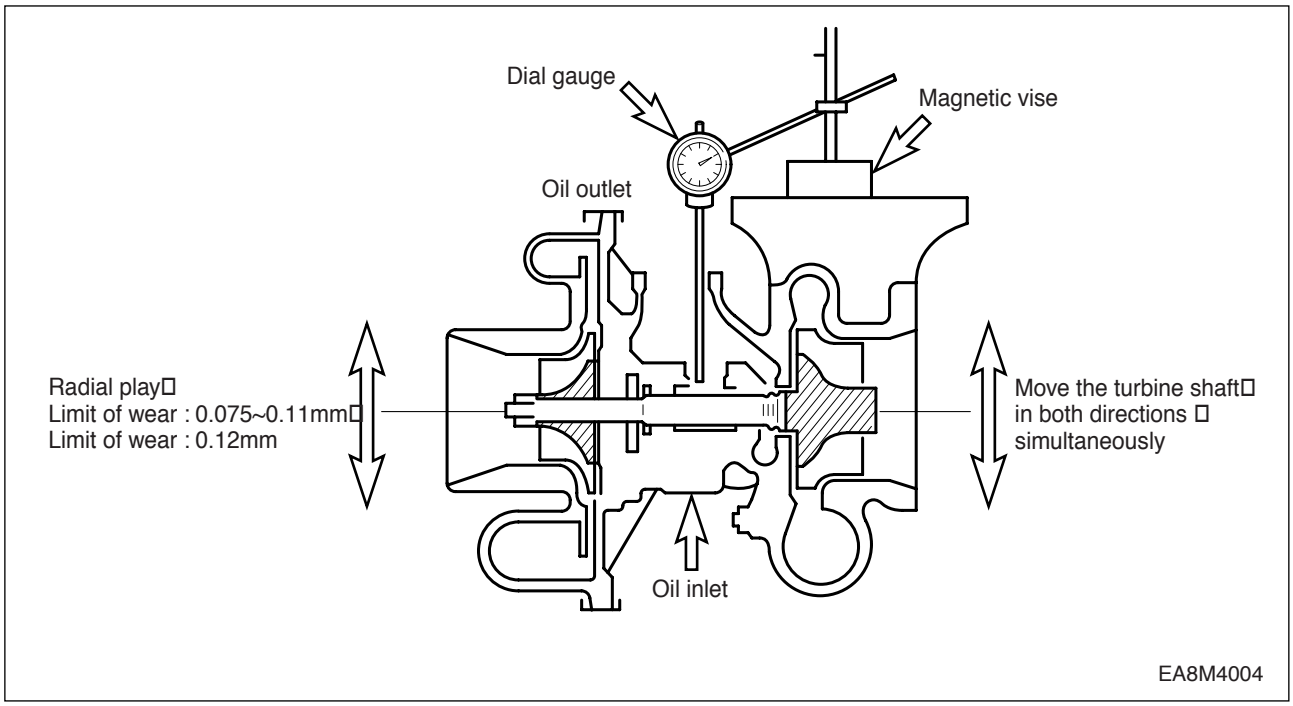
2) Guide for checking rotor end play

Disassemble the turbocharger from the engine, then check the rotor axial play and radial play. When disassembling the turbocharger, be sure to plug the oil inlet and outlet ports with taps, etc.

(1) Rotor axial play



(2) Rotor radial play



(3) If the measured axial and radial plays are beyond the limit of wear, replace or repair the turbocharger.

3) Guide for disassembling/cleaning and checking the turbocharger

First, disassemble the turbocharger from the engine and clean/check it with the oil inlet and outlet plugged with tape and so on.

4) Precautions for reassembling the tarbocharger onto the engine

For reassembly of the turbocharger or handling it after reassembly operation, be sure to observe the following precautions:

Especially, exercise extreme care to prevent foreign matters from entering the inside of the turbocharger.

(1) Lubricating system

- Before reassembling the turbocharger onto the engine, inject new oil in the oil inlet port and lubricate the journal and thrust bearings by rotating them with hand .
- Clean not only the pipes installed between the engine and oil inlet port but also the oil outlet pipe and check them for damage or foreign matters.
- Assemble each joint on oil pipes securely to prevent oil leaks.

(2) Intake system

- Check the inside of the intake system for foreign matters.
- Assemble each joint on the intake duct and air cleaner securely to prevent air leaks.

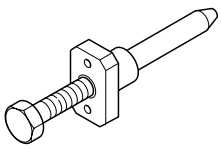
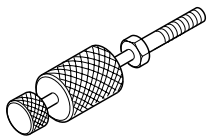
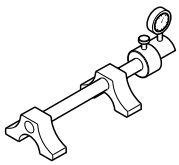
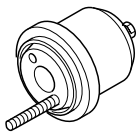
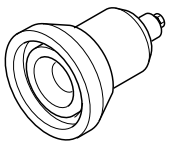
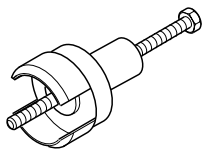
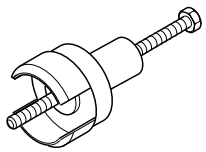
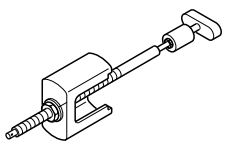
(3) Exhaust system

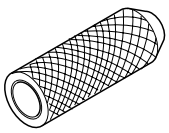
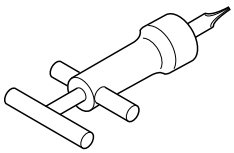
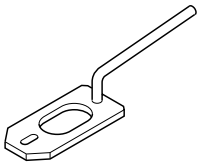
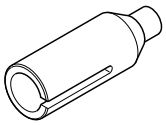
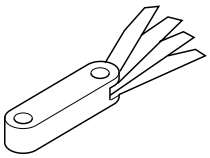
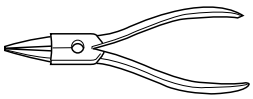
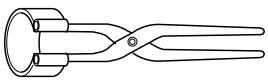
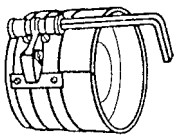
- Check the inside of the exhaust system for foreign matters.
- Be sure to use heat resisting steel bolts and nuts. Do not interchange them with ordinary steel bolts and nuts when performing reassembly operation. Apply anti-seizure coating to the bolts and nuts.
- Assemble each joint on the exhaust pipes securely to prevent gas leaks

10.4.7. Diagnostics and troubleshooting

Complaints	Possible causes	Corrections
1. Excessive black smoke	1) Air cleaner element clogged	Replace or clean
	2) Restrictions in air duct	Check and correct
	3) Leakage at intake manifold	Check and correct
	4) Turbocharger seized up and not rotating	Disassemble/repair or replace
	5) Turbine blades and compressor blades coming in contact with each other or damaged	Disassemble/repair or replace
	6) Exhaust piping deformed or clogged	Check and correct
2. Excessive white smoke	1) Oil leak into turbine and compressor	Disassemble/repair or replace
	2) Worn or damaged seal ring due to excessive wear of bearing	Disassemble/repair or replace
3. Low engine output	1) Gas leak at each part of exhaust system	Check and correct
	2) Air cleaner element restricted	Replace or clean
	3) Turbocharger fouled or damaged	Disassemble/repair or replace
	4) Leakage at discharge port on compressor side	Check and correct
4. Unusual sound or vibration	1) Rotor assembly coming in contact	Disassemble/repair or replace
	2) Unbalanced rotation of rotor	Disassemble/repair or replace
	3) Seized up	Disassemble/repair or replace
	4) Each joint loosened	Check and correct

11. Special Tool List

No.	Part No.	Figure	Tool Name
1	DPN-5337		Nozzle tube insert ass'y
2	EF.123-082		Nozzle tube extractor
3	EF.123-015		Injection pump setting ass'y
4	EF.123-173		Oil seal(NOK) insert ass'y (FR)
5	EF.123-194A		Oil seal(NOK) insert ass'y (RR)
6	EF.123-317A		Oil seal(NOK)puller ass'y (FR)
7	EF.123-316A		Oil seal(NOK) puller ass'y (RR)
8	EF.123-347		Cylinder pressure tester adapter
9	EF.123-087		Cylinder liner puller ass'y

No.	Part No.	Figure	Tool Name
10	EF.123-066		Valve stem seal punch
11	EU.2-0131		Valve clearance adjust ass'y
12	EF.123.-065		Valve spring press
13	EU.2-0647		Crankshaft gear punch
14	60.99901-0027		Feeler gauge
15	T7610001E		Snap ring plier
16	T7621010E		Piston ring plier
17	EF.120-208		Piston Ring Compressor

Appendix

● Tightening torque for major parts

Major Parts	Screw (Diameter x pitch)	Strength (grade)	Tightening Torque	Remarks
Cylinder head bolt	M14 x 1.5	10.9T	1st : 6kg.m 2nd : 90˚ 3rd: 90˚ Finished : 90˚ (angle torque)	Dodecagon
Cylinder head cover bolt	M8	8.8T	1.2 kg.m	
Connecting rod bearing cap bolt	M16 x 1.5	12.9T	1st : 15 kg.m 2nd : 22 kg.m 3rd : 30 kg.m	
Crankshaft main bearing cap bolt	M16 x 1.5	12.9T	1st : 15 kg.m 2nd : 25 kg.m 3rd : 30 kg.m	
Balance weight fixing bolt	M14 x 1.5	10.9T	14.0 kg.m	Split type
Flywheel fixing bolt	M14 x 1.5	10.9T	18.0 kg.m	
Crankshaft pulley fixing bolt	M12 x 1.5	12.9T	13.4 kg.m	
Oil spray nozzle	M6	8.8T	1.0 kg.m	

● Tightening torque for injection pump system

Major Parts	Screw (Diameter x pitch)	Strength (grade)	Tightening Torque	Remarks
Injection nozzle holder nut	M6	8.8T	1.0 kg.m	
Injection pump bracket	M10	8.8T	4.4 kg.m	
Injection pump coupling bolt	M10	-	6.0 kg.m	
Injection pump driving gear nut	M24 x 1.5	8.8T	25.0 kg.m	
High pressure injection pipe fixing cap nut	M14 x 1.5	8.8T	3.0 kg.m	
Injection pump delivery valve holder	-	-	13 ~ 14 kg.m	

●Standard bolt tightening torque table

Refer to the following table for bolts other than described above.

Diameter x pitch (mm)	Degree of strength										
	3.6	4.6	4.8	5.6	5.8	6.6	6.8	6.9	8.8	10.9	12.9
	(4A)	(4D)	(4S)	(5D)	(5S)	(6D)	(6S)	(6G)	(8G)	(10K)	(12K)
	Limit value for elasticity (kg/mm^2)										
	20	24	32	30	40	36	48	54	64	90	108
	Tightening torque (kg·m)										
M5	0.15	0.16	0.25	0.22	0.31	0.28	0.43	0.48	0.50	0.75	0.90
M6	0.28	0.30	0.45	0.40	0.55	0.47	0.77	0.85	0.90	1.25	0.5
M7	0.43	0.46	0.70	0.63	0.83	0.78	1.20	1.30	1.40	1.95	2.35
M8	0.70	0.75	1.10	1.00	1.40	1.25	1.90	2.10	2.20	3.10	3.80
M8x1	0.73	0.80	1.20	1.10	1.50	1.34	2.10	2.30	2.40	3.35	4.10
M10	1.35	1.40	2.20	1.90	2.70	2.35	3.70	4.20	4.40	6.20	7.40
M10x1	1.50	1.60	2.50	2.10	3.10	2.80	4.30	4.90	5.00	7.00	8.40
M12	2.40	2.50	3.70	3.30	4.70	4.20	6.30	7.20	7.50	10.50	12.50
M12x1.5	2.55	2.70	4.00	3.50	5.00	4.60	6.80	7.70	8.00	11.20	13.40
M14	3.70	3.90	6.00	5.20	7.50	7.00	10.00	11.50	12.00	17.00	20.00
M14x1.5	4.10	4.30	6.60	5.70	8.30	7.50	11.10	12.50	13.00	18.50	22.00
M16	5.60	6.00	9.00	8.00	11.50	10.50	17.90	18.50	18.00	26.00	31.00
M6x1.5	6.20	6.50	9.70	8.60	12.50	11.30	17.00	19.50	20.00	28.00	33.00
M18	7.80	8.30	12.50	11.00	16.00	14.50	21.00	24.20	25.00	36.00	43.00
M18x1.5	9.10	9.50	14.50	12.50	18.50	16.70	24.50	27.50	28.00	41.00	49.00
M20	11.50	12.00	18.00	16.00	22.00	19.00	31.50	35.00	36.00	51.00	60.00
M20x1.5	12.80	13.50	20.50	18.00	25.00	22.50	35.00	39.50	41.00	58.00	68.00
M22	15.50	16.00	24.50	21.00	30.00	26.00	42.00	46.00	49.00	67.00	75.00
M22x1.5	17.00	18.50	28.00	24.00	34.00	29.00	47.00	52.00	56.00	75.00	85.00
M24	20.50	21.50	33.00	27.00	40.00	34.00	55.00	58.00	63.00	82.00	92.00
M24x1.5	23.00	25.00	37.00	31.00	45.00	38.00	61.00	67.00	74.00	93.00	103.00

Others:

1. The above torque rating have been determined to 70% or so of the limit value for bolt elasticity.
2. Tension is calculated by multiplying tensile strength by cross section of thread.
3. Special screws should be tightened to 85% or so of the standard value. For example, a screw coated with MoS2 should be tightened to 60% or so of the standard value.

● Maintenance specification table

Group	Part	Check		Standard value for assembly	Limit for use	Correction	Remarks
Engine body	Cylinder block & liner	Inside diameter of Cylinder. liner for wear		∅123~∅123.023	∅123.223	Replace liner	Measure unworn portion beneath the rim of upper side
		Projected portion of liner		0.03~0.08	-		
		The upper surface of cylinder block for distortion		0.05/200	-	Correct with a surface grinder	Per distortion length for 200mm
		Hydraulic test for 1 minute (kg/cm²)		4	-		
	Cylinder head & valve	Valve seat depression	Intake	0~0.3	0.55		In case of new valve and seat
			Exhaust	0~0.3	0.55		
		Height		114.95~115	113.9	Replace cyl. head	
		Hydraulic test for 1 minute (kg/cm²)		4	-	Replace if leaky	Water temp : 70˚C
Major moving parts	Piston	Piston diameter (18mm from the lower side)		∅122.433~∅127.863	-		
		Clearance between piston and liner		0.109~0.166	-		
		Width of piston ring grooves	Top ring	3.5	-	Replace piston if groove width is beyond specified value	
			2nd ring	3.060~3.080	-		
			Oil ring	4.040~4.060	-		
		Piston projection from cylinder block upper surface		0~0.12	-		Measure unworn portion beneath the rim of upper side
		Permissible weight difference of each piston		±15g	Max.96g	Replace piston	
	Piston ring	Piston ring gap	Top ring	0.30~0.45	1.5		Standard gauge inside diameter : ∅123
			2nd ring	0.35~0.50	1.5		
			Oil ring	0.30~0.50	1.5		
		Piston ring groove clearance	Top ring	0.105~0.155	-	Replace ring or piston	Limit for use if for standard clearance
			2nd ring	0.07~0.102	0.15		
			Oil ring	0.05~0.085	0.15		
		Direction of ring gap		-	-	Install ring by 120°C	

Group	Part	Check	Standard value for assembly	Limit for use	Correction	Remarks
Major moving parts	Crank shaft	Axial run-out of journal and pin	0.05	0.1	Correct with a grinder	In horizontal and vertical directions
		Outside diameter of journal	∅95.966~∅95.988	∅95	Replace crank shaft	∅96 g6
		Outside diameter of pin	∅82.966~∅82.988	∅82	Replace crank shaft	∅83 g6
		Out of round of journal & pin	0.008	0.025		
		Permissible radial run-out of journal & pin	0.01	0.03		
		Permissible taper of journal & pin	0.01	0.03		
		Clearance between crankshaft and bearing	0.072~0.142	0.25	Replace bearing	Measure in the position of crown
		End play of crank shaft	0.15~0.325	0.5	Replace thrust bearing	
		Run-out of crank shaft	0.05	0.1 or less	Adjust by a press if bent	No.4 bearing(holding Nos. 1 & 7)
		Balance of crank shaft	60	60 or less	Check dynamic balance	Measure at 400 rpm
		Tightening torque of journal bearing cap bolt(kg.m)	30	-	Apply oil to bolt	No foreign matters on bearing cap installing surface
		Journal bearing crush	0.15~0.25	-		Measure by tightening metal cap and then loosening one stud bolt
		Oil seal for wear	-	-	Replace oil seal if oil leaking	Replace with new one, use shim
	Conn. rod	Clearance between conn. bearing & crank pin	0.032~0.102	0.20	Replace bearing	
		End play of conn. rod crush	0.22~0.319	0.5	Replace conn. rod	
		Clearance between small end bush & piston pin	0.050~0.080	0.12		
		Connecting rod bearing crush height	0.086~0.116	-		After completing installation of bearing, loosen one stud bolt and measure
		Permissible weight difference of each conn. rodrod	±18g	-		
		Tightening torque of con-rod bearing cap bolt (kg·m)	28	-	Apply oil to bolt	
	Cam shaft	Outside diameter of cam shaft	∅59.860~∅59.880	∅59.52		∅60
		Clearance between cam shaft and bush	0.050~0.128	0.20		
		Axial play of camshaft	0.13~0.27	0.3	Replace thrust plate	
	Timing gear	Clearance between idle gear shaft and inserting hole	0.025~0.091	0.15		
		End play of idle gear shaft	0.043~0.167	0.3	Replace thrust collar	

Group	Part	Check		Standard value for assembly	Limit for use	Correction	Remarks
Valve system	Timing gear	Between crank gear & idle gear		0.16~0.28	0.35	Replace gear	
		Between idle gear & cam shaft gear		0.16~0.28	0.35		
	Valve	Outside diameter of intake valve stem		∅8.950~∅8.970	∅0.02	Replace valve & valve guide	Replace valve guide together when replacing valve
		Outside diameter of exhaust valve stem		∅8.935~∅8.955	∅0.02		
		Clearance between valve stem and valve guide	Intake	0.030~0.065	0.15	Replace & valve guide	
			Exhaust	0.045~0.080	0.15	Replace	
		Thickness of valve	Intake	1.5	1 or more	Replace	
			Exhaust	1.5	0.9 or more		
		Perm. radial run-out between valve stem & valve head	Intake	0.04~0.07	0.2	Replace	
			Exhaust	0.06~0.09	0.25		
		Clearance between valve guide & cyl. head installing hole		0.01~0.39	-		Apply oil to valve guide and press in
		Clearance between valve guide & valve spring seat	Intake	22	-		
			Exhaust	22	-		
		Intake Spring	Free length	75.5	72		
			Spring tension(set length : 37mm) kg	61.8~68.3	61.8		
			Straightness(against free length)	1.0	2.0		
		Exhaust Spring	Inner Free length	65	61.75		
			Inner Spring tension(set length : 34mm) kg	36.1~39.9	36.1	Replace valve spring	
			Inner Straightness(against free length)	1.0	2.0		
			Outer Free length	75.5	72		
			Outer Spring tension(set length : 37mm) kg	61.8~68.3	61.8	Replace valve spring	
			Outer Straightness(against free length)	1.0	2.0		
		Valve clearance (at cold)	Intake	0.3	-	Adjust	
			Exhaust	0.3	-		
		Contacting face of valve stem & rocker arm		-	-	Correct or replace if severely pitted on tip of arm and stem	

Group	Part	Check	Standard value for assembly	Limit for use	Correction	Remarks
Valve System		Clearance between rocker arm shaft & rocker arm bush	0.020~0.093	0.25	Replace bush or shaft	
		Rocker arm shaft for wear	∅23.978~∅23.959	∅23.75	Replace	
		Permissible taper of push rod	0.3	-	Replace	
	Tappet	Clearance between tappet & cyl. block	0.035~0.077	0.1	Replace tappet	
		Outside diameter of tappet	∅19.944~∅19.965	19.89	Replace tappet	
		Contacting face of tappet & cam	-	-	Replace if excessively worn or deformed	
Lubricating System	Oil Pressure	Oil pressure(nominal speed) kg/cm²	4.5 or less	3.5	Correct oil leakage and clearance between each part	
		Oil pressure(idling) kg/cm²	0.8~1.4	0.6	Use suggested oil	
	Oil temp	Max. permissible oil temperature˚C	-	105		Temperature above this not allowable
		Permissible oil temperature in short time˚C	-	120		
	Oil pump	Axial play of oil pump gear	0.055~0.105	-	Replace gear or cover	
		Clearance between gear shaft & oil pump over hole	0.032~0.068	-		
		Clearance between drive gear bushing & cover hole	0.040~0.082	-	Replace bushing or cover	
		Outside diameter of gear shaft	∅16.950~∅16.968	-	Replace gear	∅17e7
		Outside diameter of drive gear bushing	∅27.939~∅27.960	-	Replace bushing	∅28e7
		Backlash: Between crank gear & oil pump drive gear	0.15~0.25	0.8	Adjust backlash	
		Backlash: Between oil pump drive gear and intermediate gear	0.15~0.25	0.8		
	Valve opening pressure	Oil pressure control valve (kg/cm²)	4.3~4.7	-	Replace valve	
		By-pass valve for filter element (kg/cm²)	1.8~2.3	-		
		By-pass valve for full oil filter (kg/cm²)	4.0~4.8	-		
		By-pass valve for oil cooler (kg/cm²)	5~6	-		
		Relief valve for oil pump (kg/cm²)	8.5~11.5	-		
		Control valve for spray nozzle (kg/cm²)	1.5~1.8	-		
	Oil filter	Oil filter element for damage	-	-	Clean or replace	

Group	Part	Check	Standard value for assembly	Limit for use	Correction	Remarks
Cooling system	Radiator	Radiator & water pump for corrosion, damage & improper connecting	-	-	Correct or replace	
		Test for leakage(air pressure) kg/cm²	1.0	-	Submerge in water and replace if air bubbles found	
		Pressure valve for opening pressure kg/cm²	0.5	-		
		Negative pressure valve for opening pressure (kg/cm²)	0.2	-		
	Water pump	Delivery volume ℓ /min Pumping speed 2,234rpm Operating temp 71~85˚C Back pressure:760mmHg	Approx. 280 ℓ	-		
		Clearance between pump impeller & pump body	0.3~0.6	-	Replace if contacted impeller and pump body	
	Cooling water temp	Operating temperature(permissible temp.) ˚C	90~95	95	Temperature above this notallow able	
		Permissible temperature in a short time ˚C	103	103		
	Thermostat	Thermostat opening temp. (under atmospheric pressure) ˚C	83	-	Replace if defective	
		Full opening temp. ˚C	95 or lower	-		Stroke : minimum 8mm
Fuel System	Piping and the other	Fuel pipe, injection pipe & Nozzle holder for damage, cracks, looseness, bad packing	-	-	Correct or replace	
		Fuel filter element for damage	-	-	Clean or replace	
	Injection pressure of injection nozzle (kg/cm²)		220	-	Adjust by shim	1st : 160, 2nd : 220
	Opening pressure of overflow valve (kg/cm²)		1.6	-	Replace valve	
	Height of projected nozzle on the cyl. head (mm)		4.3	-	Replace cyl. head and nozzle	
	Clearance between injection pump coupling and coupling (mm)		0.2~0.4	-		
Inspection at completion	Running-in the engine		-	-	Refer to supplement “running-in”	Retighten head bolt after running in
	Cylinder pressure	Cylinder compression Pressure of cylinder(kg/cm²)	25~28	24 or less	Overhaul the engine	
		Compression pressure difference of each cylinder	±10% or less against average	-	Correct	at 200rpm or more (20˚C)

DOOSAN Doosan Infracore

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Parts Book
부품목록
发动机零件目录

Generator Diesel Engine
발전기 엔진
柴油发电机引擎

DE12T

POLUS

P126TI-Ⅰ
P126TI
P126TI-Ⅱ

FOREWORD

●This parts list is shown the equipment components parts of 『DOOSAN Diesel Generator Engine DE12T, P126TI-1, P126TI, P126TI-Ⅱ』

1. HOW TO ORDER PARTS

When ordering parts, please specify the following items as shown in the following example.

Ex. 1) Model of Engine : DE12T
2) Machine Serial No. : EDIOA300001 — Shown on cylinder block
3) Part No. : 65.02501-0209
4) Description : Piston
5) Q'ty : 1
6) Purchaser's Name and Address:

2. HOW TO USE THIS PARTS LIST

Key No. : Key No. Shows the referring number of illustration.

Parts No. : Part No. is its own number.

Description : Part name. There is printed information such as size, specification with the part name or not. Components parts of one assembling part are shown with 『•』 mark and shown below of an assembling part. Also, if the components parts marked 『•』 consist of further components parts, these further component parts are with 『••』.

Q'ty : "Q'ty" shows the quantity used for one machine, however "Q'ty" of component parts shows the quantity used for one assembling part.

DE12T : DOOSAN DIESEL GENERTOR ENGINE

S.C : Abbreviation is service code of parts has its own meaning as shown below.

- B : The parts with this abbreviation show that they require some work on them before installing in the machine.
- D : The part with this abbreviation is a component of an assembling part and is not available independently. The assembling part containing this part should be orderd.
- R : The part with this abbreviation shows that the quantity of the part is changed depending on the machine, such as an adjusting shim etc.
- S : This part is specially provided as a service part, which was not provided in the machine before shipping from the factory.
- G : This part needs special care(grade control) to perform the maintenance job. Before order, the grade of the paart should be confirmed(It should be same with the grade of matching part.)
- OP : Optional parts.
- EX : Specific design parts.
- OS : Over-sized parts.
- US : Under-sized parts.
  (Part with abbreviation "OS" or "US" is described on the line below the standard sized part).
- * : The part with this abbreviation is not supplied for A/S.

I C A : ICA shows the interchangeability between the original and the improved parts. The improved part shows below the original part and with same key No. (key No.shows by 「-」.)

Abbreviations used in this column are as follows :

- Y : This part with "Y" in the ICA column can be used original and improved part.
- O : This part with "O" in the ICA column can not use improved part, use only this part.
- C : This part with "C" in the ICA column can be used instead of improved part but not vice versa.
- N : This part with "N" in the ICA column can not use interchange, use only part of Serial No.

Serial No. : Serial No. shows the machine serial number which the parts were applied. Parts without any applicable serial number are used in every machine.

- ●When repairing, it is recommended to use our standard parts.
- ●Researching the parts from Part No., see the 「Parts Index」 in finish of this parts list.
- ●Parts may be altered in a constant effort to improve machines. Then, it is recommended that customers contact our after service center.

Nov. 2003.

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Nov. 2003.

머 리 말

● 부품목록은「두산 디젤 발전기용 엔진 DE12T, P126TI-1, P126TI, P126TI-Ⅱ」전호기의 사용부품을 전개도와 부품표, 부품번호순 색인을 수록하였습니다.

1. 부품의 주문에 대하여

부품을 주문할 때에는 아래사항을 명기하여 가까운 서비스 센터로 연락하여 주십시오.

예. 1) 엔 진 의 형 식 : DE12T ——— 실린더 블럭에 각인
2) 제 조 번 호 : EDIOA300001
3) 부 품 번 호 : 65.02501-0209
4) 부 품 명 : 피스톤
5) 수 량 : 1
6) 주문자의 주소 및 성명 :

2. 부품목록을 보는 방법

지시번호(Key No.) : 전개도의 각 부품을 표시하는 번호입니다.
부품번호(Part No.) : 부품에 붙여진 고유번호입니다.
부 품 명 : 부품의 명칭입니다.
조립품을 구성하는 부품명 앞에『•』을 붙였으며,『•』부품이 조립품인 경우에는 그 구성부품에『••』이 표시되어 있습니다.
수 량 (Q'ty) : 부품이 사용되고 있는『1대분의 수량』이 기재되어 있습니다.
단, 조립품의 구성 부품은 그 조립품 1대분의 수량이 표시되어 있습니다.
DE12T : 두산 디젤 발전기용 엔진
서비스 코드 (S.C) : 아래와 같은 서비스 기호등이 기재되어 있습니다.

- B : 그 부품을 취부시키기 위해 현지 가공작업이 필요하므로 당사로 연락하여 주십시오.
- D : 단품 교환불가 부품으로 그 부품을 포함한 조립품으로 교환하여 주십시오.
- R : 조정용 쉼 등으로, 사용하는 수량이 매 호기마다 상이한 것을 표시합니다.
- S : 공장출하시 조립되는 부품이 아닌, 수리, 서비스용으로 공급되는 부품을 표시합니다.
- G : 이 부품은 등급(Grade)관리가 필요한 부품입니다. 따라서 조립되어지는 상대부품의 등급과 같은 등급으로 신청하여 주십시오.
- OP : 옵션 파트 부품을 표시합니다.
- EX : 특별한 형상부품을 표시합니다.
- OS : 오버 사이즈 부품을 표시합니다.
- US : 언더 사이즈 부품을 표시합니다.
(OS, US는 표준 시방 이후에 부품을 교환시 사용되는 부품입니다.)
- * : 서비스 공급이 불가능한 부품입니다.

호 환 성 (ICA) : 부품번호란에 표기된 부품과 밑줄에 같은 지시번호(-표시)로 표기된 부품사이에 호환성을 표시하였으며, 각 기호의 의미는 아래와 같습니다.

- Y : 신부품과 구부품중 어느 것이나 사용할 수 있습니다.
- O : 신부품을 사용할 수 없습니다. 구부품을 사용해 주십시오.
- C : 구부품을 사용할 수 없습니다. 따라서 신부품으로 교환해 주십시오.
- N : 구부품과 신부품간에 호환성이 없습니다. 적용호기에 맞는 부품을 사용해 주십시오.

적용호기(Serial No.) : 부품이 사용되고 있는 장비의 일련번호이며, 표시없는 부품은 공통사용 부품입니다.

● 부품은 필히 순정부품을 사용하고 부품번호 해당 조립품을 찾을때는 색인을 이용하십시오.
● 부품목록의 내용은 예고없이 변경될 수 있으므로 내용에 대한 자세한 문의사항은 아프터 서비스 센터로 연락하시기 바랍니다.

2003. 11.

前　　言

● 此零件目录列举了出现在『DOOSAN **DE12T, P126TI-1, P126TI, P126TI-Ⅱ**』上的设备构件。

1。配件订购

订购配件时，请提供以下内容

1) 引　擎　型　号 : DE12T ——┐
2) 机 器 序 列 号 : EDIOA300001 ——┘— 标注于汽缸上
3) 零　　件　　号 : 65.02501-0209
4) 名　　称 : 活 塞
5) 数　　量 : 1
6) 联系人名称及地址 :

2。目录使用方法 :

序 号 (Key No.)　: 序号与图中的编号相对应

零件号 (Part No.) : 即零件的编号

零件名称 : 零件名称。零件名称下面部分有时也印刷有了尺寸、规格等信息。总成的构件前带有『・』标志，并排在总成部件的后下面，如总成构件可分解为小总成，则小总成构件名称前带有『・・』标志。

数　　量 (Q'ty) : "数量"表示整个部件使用的零件数量，但总成构件的数量表示总成使用的零件数。
DE12T : DOOSAN

服 务 码 (S.C) : 零件服务码缩写的含义如下

- B　: 此类的零件在装配前要进行处理
- D　: 此类的零件不单独提供，要与包含此零件的总成一同订购
- R　: 此类的零件表示零件数量随机器的不同有所不同，例，调节垫片等
- S　: 此类的零件为专用维修备件，在出厂前不提供
- G　: 此类的零件在维修时，需要特殊维护（级别控制）。因此，订购前需要知道机器其余部件的级别，所以请订购与机器零件级别相同的零件
- OP : 选装件
- EX : 专门设计的零件
- OS : 超大尺寸零件
- US : 尺寸不足的零件
  (在标准尺寸零件线以下表示 "OS" 或"US")
- ＊　: 按规定，有这些缩写的零件不予提供。

互 换 号 (ICA) : ICA 表示原零件与改进零件的互换性，改进零件列在原零件下面，序号相同，(序号前带有[－])
此类所有内容如下 :

- Y　: ICA 栏为 "Y"，可同时使用原零件与改进零件
- O　: ICA 栏为 "O"，不可使用改进的零件，只能使用此零件
- C　: ICA 栏为 "C"，原零件可代替改进零件使用，但不可被改进零件代替使用。
- N　: ICA 栏为 "N"，不可同时使用原零件与改进零件，只能使用本序列号

序列号 (Serial No.) : 序列号表示零件所使用的机器的序列编号。没有序列号的零件可使用在所有的机器上。

● 当维修时，推荐使用标准零件
● 用零件号查询零件，请参阅目录后的 [零件索引]
● 本图册可能会随着机器的改进而有所改变。因此，建议客户与我们的售后服务中心联系。

2003. 11.

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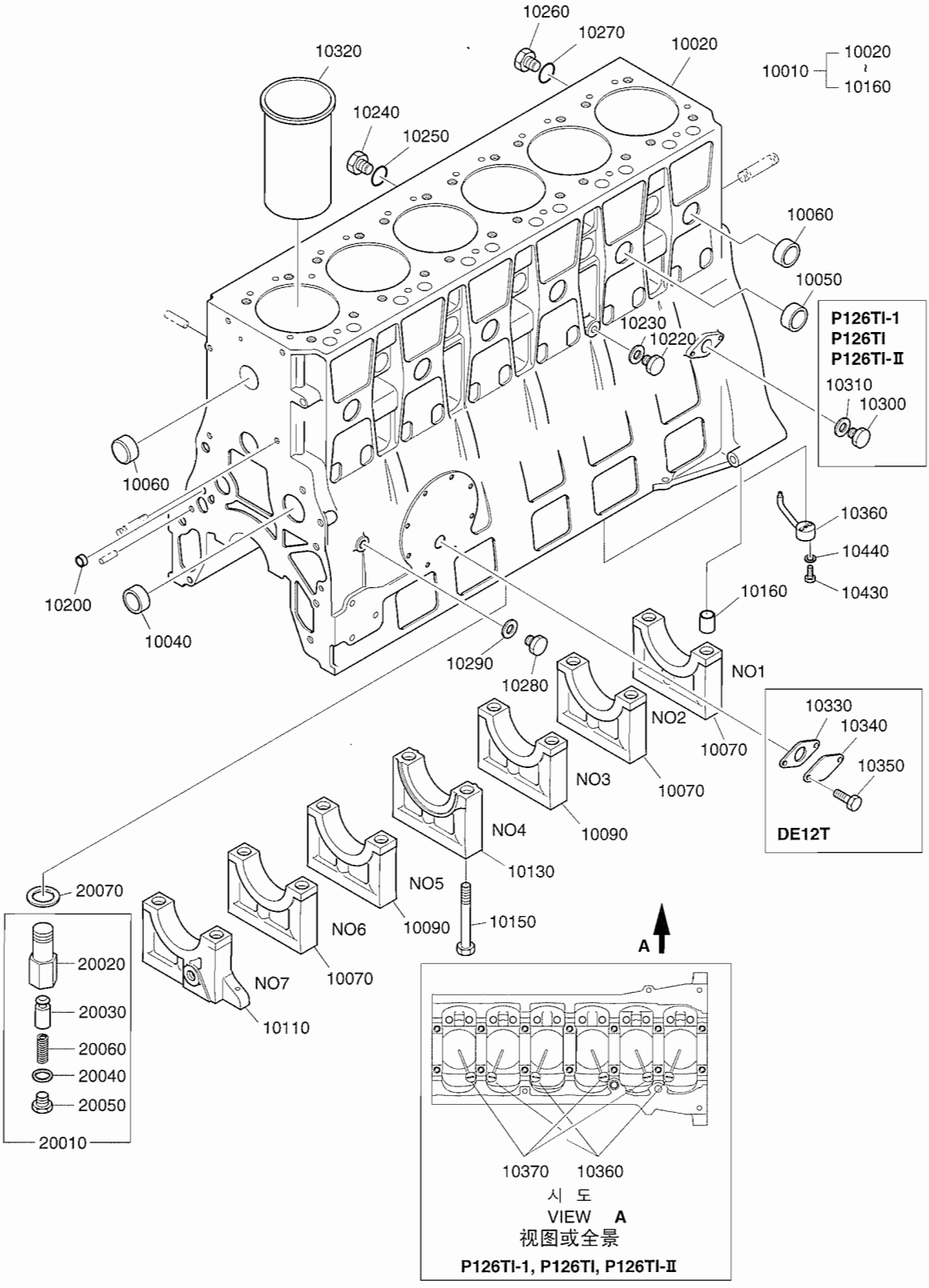


Fig.001
CYLINDER BLOCK | 실린더 블럭 | 气缸体

Key No.	Part No.	Description	부 품 명	零件名称	Q'ty				S.C	ICA	Serial No.
					DE 12 T	P 126 TI-1	P 126 TI	P 126 TI-II			
10010	65.01101-6212A	CYLINDER BLOCK ASS'Y	실린더 블럭 조립품	气缸体总成	1	-	-	-			
-	65.01101-6213B	CYLINDER BLOCK ASS'Y	실린더 블럭 조립품	气缸体总成	-	1	1	1			
10020	65.01101-0212A	· BLOCK ; CYLINDER	· 실린더 블럭	· 气缸体	1	1	1	1			
10040	65.04410-0016	· BUSH ; CAMSHAFT	· 캠 축 부쉬	· 凸轮轴衬套	4	4	4	4			
10050	65.90302-0048	· PLUG ; CORE	· 코어 플러그	· 中心孔塞	6	6	6	6			
10060	06.15091-0326	· PLUG ; CORE	· 코어 플러그	· 中心孔塞	15	15	15	15			
10070	65.01105-1161A	· CAP ; BEARING NO.1,2,6	· 베어링 캡	· 轴承盖	3	-	-	-			
-	65.01105-1177A	· CAP ; BEARING NO.1,2,6	· 베어링 캡	· 轴承盖	-	3	3	3			
10090	65.01105-1158F	· CAP ; BEARING NO.3,5	· 베어링 캡	· 轴承盖	2	-	-	-			
-	65.01105-1180A	· CAP ; BEARING	· 베어링 캡	· 轴承盖	-	2	2	2			
10110	65.01105-1157G	· CAP ; BEARING NO.7	· 베어링 캡	· 轴承盖	1	-	-	-			
-	65.01105-1179B	· CAP ; BEARING NO.1	· 베어링 캡	· 轴承盖	-	1	1	1			
10130	65.01105-1159F	· THRUST ; CAP BEARING	· 캡 베어링 스러스트	· 止推帽轴承	1	-	-	-			
-	65.01105-1178A	· THRUST ; CAP BEARING	· 캡 베어링 스러스트	· 止推帽轴承	-	1	1	1			
10150	65.90020-0036B	· BOLT ; BEARING CAP	· 베어링 캡 볼트	· 轴承盖固定螺栓	14	14	14	14			
10160	65.91710-0035B	· RING ; LOCATING	· 고정 링	· 定位环	14	14	14	14			
10200	65.91606-0041	PLUG ; CORE HOLE	코어 홀 플러그	铸孔螺塞	2	2	2	2			
10220	65.90310-0137	SCREW ; PLUG M16x1.5x20	플러그 스크류	螺塞	1	1	1	1			
10230	06.56190-0709	RING ; SEAL A16x22	시일 링	密封环	1	1	1	1			
10240	65.90310-0136	SCREW ; PLUG	플러그 스크류	螺塞	1	1	1	1			
10250	06.56190-0718	RING ; SEAL	시일 링	密封环	1	1	1	1			
10260	06.08092-2403	SCREW ; PLUG AM12x1.5	플러그 스크류	螺塞	1	1	1	1			
10270	06.56190-0703	RING ; SEAL A12x16	시일 링	密封环	1	1	1	1			
10280	65.90310-0131	SCREW ; PLUG	플러그 스크류	螺塞	1	1	1	1			
10290	06.56190-0712	RING ; SEAL 18x22	시일 링	密封环	1	1	1	1			
10300	65.90310-0149A	SCREW ; PLUG M26x1.5	플러그 스크류	螺塞	-	1	1	1			
10310	06.56190-0726	RING ; SEAL 26x31	시일 링	密封环	-	1	1	1			
10320	65.01201-0051	LINER ; CYLINDER	실린더 라이너	气缸套	6	-	-	-			
-	65.01201-0311C	LINER ; CYLINDER	실린더 라이너	气缸套	-	6	6	6			
10330	65.96601-0012	GASKET	가스켓	衬垫	1	-	-	-			
10340	65.91615-0015	COVER ; BLIND	블라인드 커버	盲板盖	1	-	-	-			
10350	06.01923-3113	BOLT ASS'Y M8x20	볼트 조립품	螺栓总成	2	-	-	-			
10360	65.01601-6002	OIL SPRAY NOZZLE ASS'Y	오일 스프레이 노즐 조립품	机油喷嘴总成	6	-	-	-			
-	65.01601-6006	OIL SPRAY NOZZLE ASS'Y	오일 스프레이 노즐 조립품	机油喷嘴总成	-	3	3	3			
10370	65.01601-6007	OIL SPRAY NOZZLE ASS'Y	오일 스프레이 노즐 조립품	机油喷嘴总成	-	3	3	3			
10380	65.01601-2009	· FLANGE	· 홀랜지	· 法兰	1	-	-	-			
10390	65.01601-2013	· PIPE	· 파이프	· 油管	1	-	-	-			
10400	65.05410-0016	· PLUNGER	· 플런저	· 活塞	1	1	1	1			
10410	65.97601-0074	· SPRING	· 스프링	· 弹簧	1	1	1	1			
10420	65.01601-2003	· WASHER ; LOCK	· 록크 와셔	· 锁止垫圈	1	1	1	1			
10430	65.90001-0126	BOLT ; HEX.	육각 볼트	六角螺栓	12	12	12	12			
10440	06.16044-0208	WASHER ; SPRING A6	스프링 와셔	弹簧垫圈	12	12	12	12			
20010	65.05405-7021	RELIEF VALVE ASS'Y	릴리프 밸브 조립품	安全阀总成	1	1	1	1			
20020	65.05406-0020	· HOUSING ; RELIEF VALVE	· 릴리프 밸브 하우징	· 安全阀壳	1	1	1	1			

Fig.001

CYLINDER BLOCK | 실린더 블럭 | 气缸体

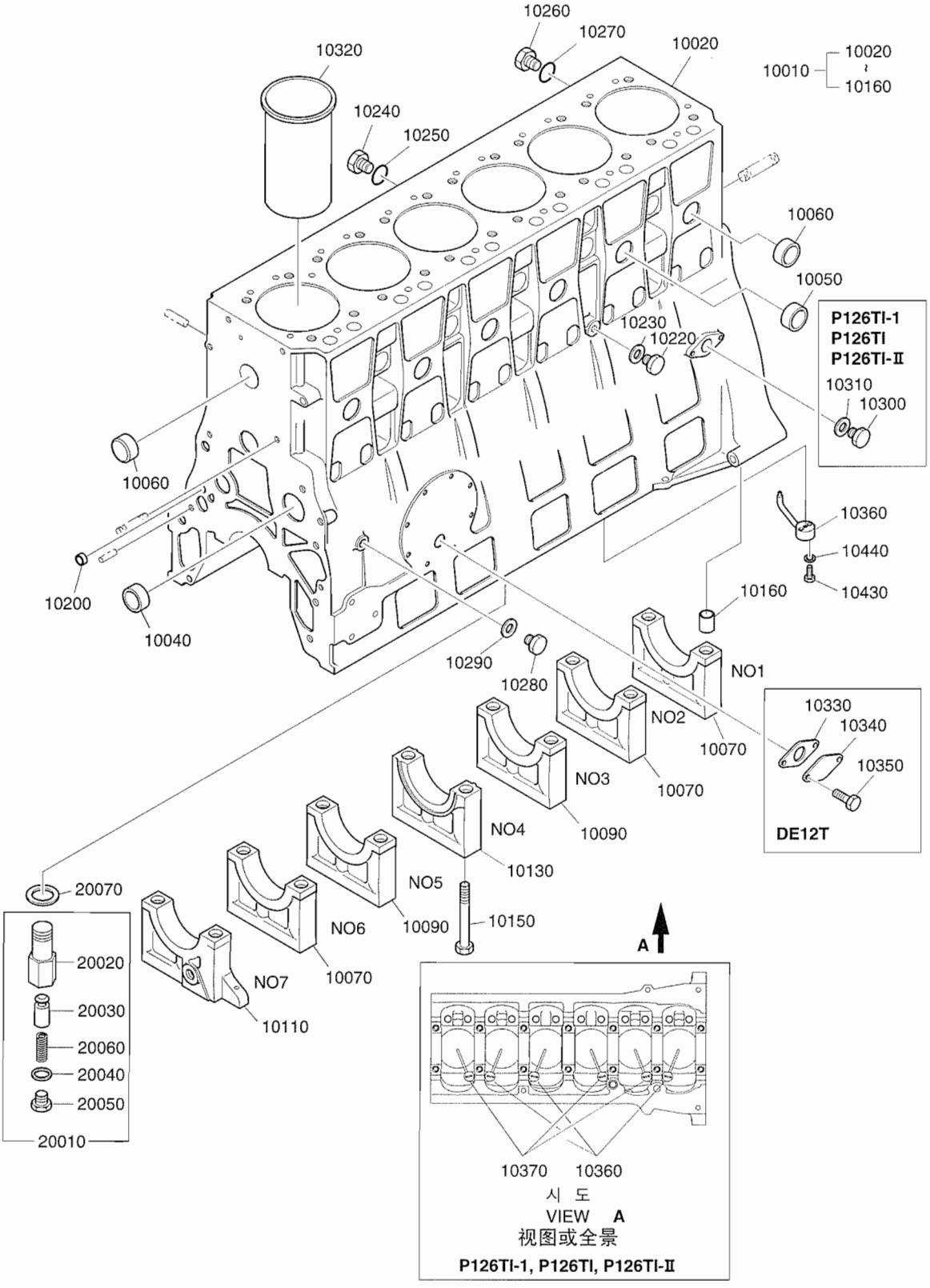


Fig.001

CYLINDER BLOCK | 실린더 블럭 | 气缸体

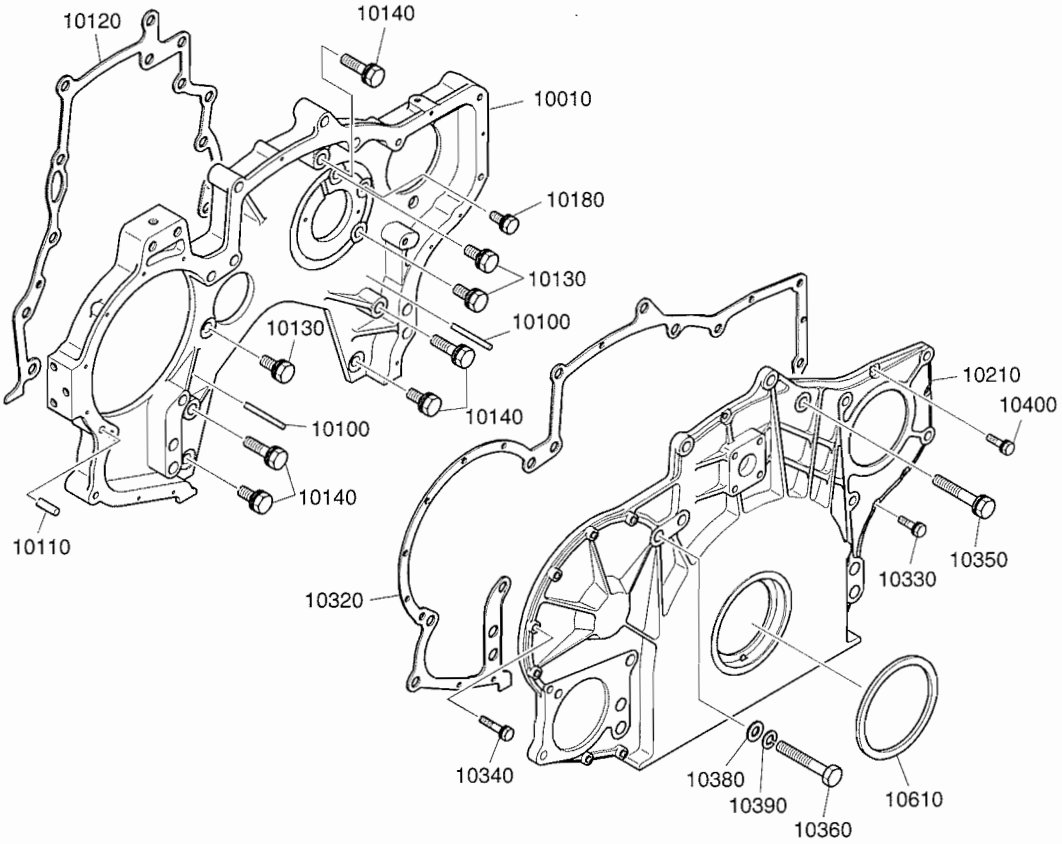
Key No.	Part No.	Description	부 품 명	零 件 名 称	Q'ty				S.C	ICA	Serial No.
					DE 12 T	P 126 TI-1	P 126 TI	P 126 TI-II			
20030	65.05410-0015	· PLUNGER ; RELIEF VALVE	· 릴리프 밸브 플런저	· 安全阀柱塞	1	1	1	1			
20040	65.90710-0071	· WASHER	· 와 셔	· 垫圈	1	1	1	1			
20050	65.90310-0056	· SCREW ; PLUG	· 플러그 스크류	· 螺塞	1	1	1	1			
20060	65.97601-0100	· SPRING	· 스프링	· 弹簧	1	1	1	1			
20070	06.56190-0704	RING ; SEAL A12x18	시일 링	密封环	1	1	1	1			

Fig.002

TIMING GEAR CASE & FLYWHEEL HOUSING

타이밍 기어 케이스 및 플라이휠 하우징

正时齿轮箱与飞轮壳



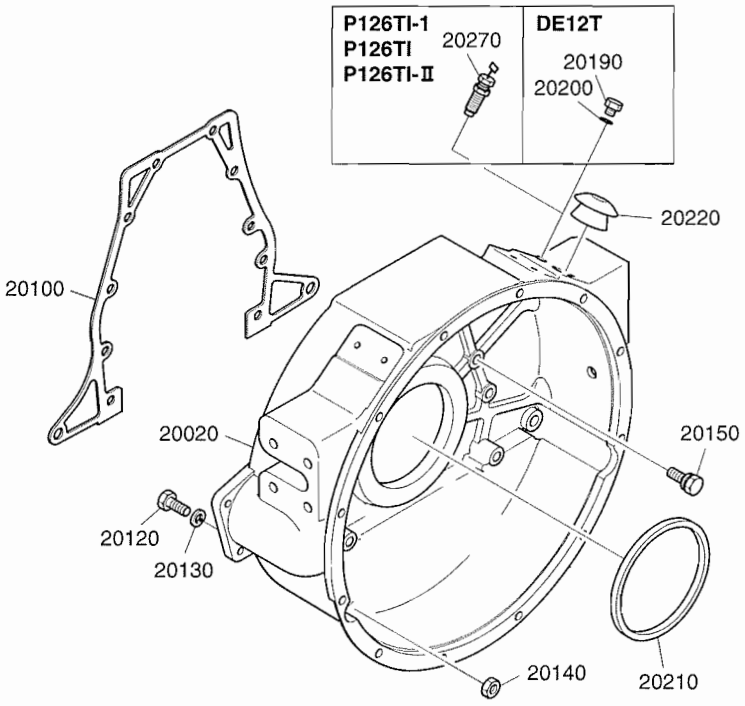


Fig.002

TIMING GEAR CASE & FLYWHEEL HOUSING | 타이밍 기어 케이스 및 훌라이휠 하우징 | 正时齿轮箱与飞轮壳

Key No.	Part No.	Description	부 품 명	零件名称	Q'ty				S.C	ICA	Serial No.
					DE 12 T	P 126 TI-1	P 126 TI	P 126 TI-II			
10010	65.01304-0023C	CASE ; TIMING GEAR	타이밍 기어 케이스	正时齿轮箱	1	1	1	1			
10100	65.91010-0017	PIN ; DOWEL 8M6x60	다우얼 핀	定位销	2	2	2	2			
10110	06.22022-1014	PIN ; DOWEL 8M6x28	다우얼 핀	定位销	1	1	1	1			
10120	65.01903-0048B	GASKET	가스켓	衬垫	1	1	1	1			
10130	06.01943-3317	BOLT ASS'Y M12x1.5x30	볼트 조립품	螺栓总成	3	3	3	3			
10140	06.01943-3320	BOLT ASS'Y M12x1.5x45	볼트 조립품	螺栓总成	5	5	5	5			
10180	06.01913-3215	BOLT ASS'Y M10x25	볼트 조립품	螺栓总成	1	1	1	1			
10210	65.01305-5049G	TIMING GEAR CASE COVER ASS'Y	타이밍 기어 케이스 커버 조립품	正时齿轮箱盖总成	1	1	1	1			
10320	65.01903-0050	GASKET ; TIMING GEAR CASE COVER	타이밍 기어 케이스 커버 가스켓	正时齿轮箱盖衬垫	1	1	1	1			
10330	06.01923-2914	BOLT ASS'Y M6x22	볼트 조립품	螺栓总成	6	6	6	6			
10340	06.01923-2917	BOLT ASS'Y M6x30	볼트 조립품	螺栓总成	7	7	7	7			
10350	06.01953-3326	BOLT ASS'Y M12x1.5x75	볼트 조립품	螺栓总成	2	2	2	2			
10360	06.01493-4315	BOLT ; HEX. M12x1.5x80	육각 볼트	六角螺栓	3	3	3	3			
10380	06.15010-2313	WASHER ; PLAIN	평 와셔	平垫圈	3	3	3	3			
10390	06.16731-2109	WASHER ; SPRING A12	스프링 와셔	弹簧垫圈	3	3	3	3			
10610	65.01510-0157	SEAL ; OIL	오일 시일	机油封	1	1	1	1			
20020	65.01401-0194H	HOUSING ; FLYWHEEL	훌라이휠 하우징	飞轮壳	1	1	1	1			
20100	65.01904-0022A	GASKET ; FLYWHEEL HOUSING	훌라이휠 하우징 가스켓	飞轮壳衬垫	1	1	1	1			
20120	06.02074-0317	BOLT ; REAMER M14x2x90	리머 볼트	绕孔螺栓	2	2	2	2			
20130	06.16731-2110	WASHER ; SPRING A14	스프링 와셔	弹簧垫圈	2	2	2	2			
20140	06.11063-8217	NUT ; HEX. M14	육각 너트	六角螺母	2	2	2	2			
20150	65.90001-6002	BOLT ASS'Y M12x1.5x45	볼트 조립품	螺栓总成	10	10	10	10			
20190	06.08092-2405	SCREW ; PLUG M16x1.5	플러그 스크류	螺塞	1	-	-	-			
20200	06.56190-0708	RING ; SEAL A16x22	시일 링	密封环	1	-	-	-			
20210	65.01510-0158	SEAL ; OIL	오일 시일	机油封	1	1	1	1			
20220	65.96002-0003	PLUG ; RUBBER	고무 마개	橡胶螺塞	1	1	1	1			
20270	65.27103-7007	SENSOR	센서	传感器	-	1	1	1			

Fig.003

DRIVING SYSTEM | 드라이빙 시스템 | 驱动系统

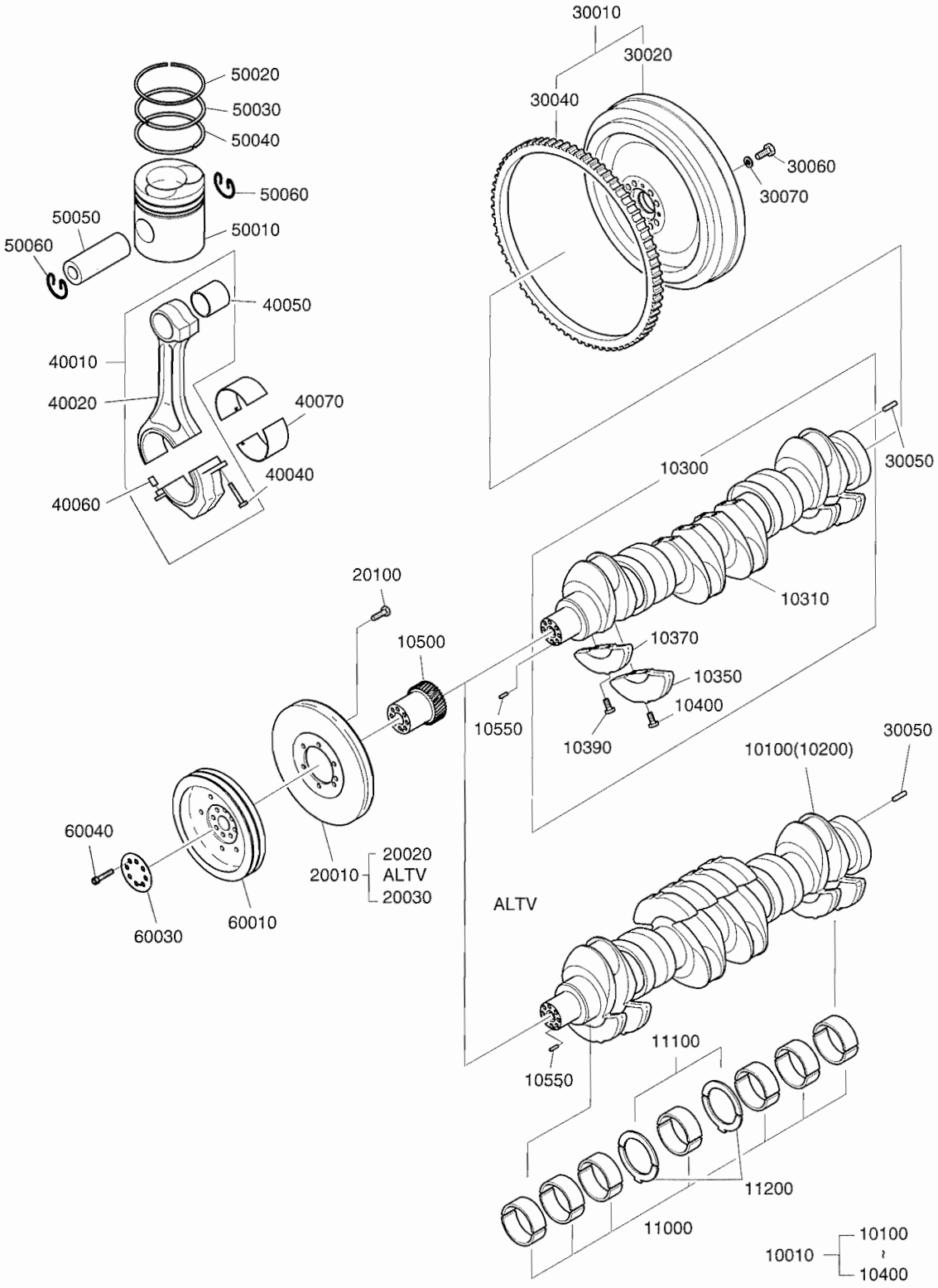


Fig.003
DRIVING SYSTEM | 드라이빙 시스템 | 驱动系统

Key No.	Part No.	Description	부 품 명	零 件 名 称	Q'ty				S.C	ICA	Serial No.
					DE 12 T	P 126 TI-1	P 126 TI	P 126 TI-II			
10010	65.02101-7541B	CRANK SHAFT ASS'Y	크랭크 축 조립품	曲轴总成	1	1	1	1			
10100	65.02101-0057A	· SHAFT ; CRANK	· 크랭크 축	· 曲柄轴	1	1	1	1			
10200	65.02101-0060A	· SHAFT ; CRANK	· 크랭크 축	· 曲柄轴	1	1	1	1			
10300	65.02101-7054B	· CRANK SHAFT ASS'Y	· 크랭크 축 조립품	· 曲轴总成	1	1	1	1			
10310	65.02101-0054A	· · SHAFT ; CRANK	· · 크랭크 축	· · 曲柄轴	1	1	1	1			
10350	65.02110-0013E	· · WEIGHT ; COUNTER	· · 카운터 웨이트	· · 平衡重	4	4	4	4			
10370	65.02110-0014E	· · WEIGHT ; COUNTER	· · 카운터 웨이트	· · 平衡重	4	4	4	4			
10390	65.90430-0012B	· · BOLT ; TENSION	· · 인장 볼트	· · 张紧螺栓	8	8	8	8			
10400	65.90430-0013B	· · BOLT ; CRANK SHAFT	· · 크랭크 축 볼트	· · 曲轴螺栓	8	8	8	8			
10500	65.02115-0008B	GEAR ; CRANK SHAFT	크랭크 축 기어	曲轴齿轮	1	1	1	1			
10550	06.22022-0912	PIN ; DOWEL 6M6x20	다우얼 핀	定位销	1	1	1	1			
11000	65.01110-6055A	BEARING ; MAIN	메인 베어링	主轴承	7	-	-	-			
-	65.01110-6115	BEARING ; MAIN	메인 베어링	主轴承	-	7	7	7			
11010	65.01110-6068A	· BEARING ; MAIN	· 메인 베어링	· 主轴承	7	-	-	-			
11020	65.01110-6069A	· BEARING ; MAIN	· 메인 베어링	· 主轴承	7	-	-	-			
11030	65.01110-6070A	· BEARING ; MAIN	· 메인 베어링	· 主轴承	7	-	-	-			
11040	65.01110-6071A	· BEARING ; MAIN	· 메인 베어링	· 主轴承	7	-	-	-			
11100	65.01150-0017A	WASHER ; THRUST(UP)	스러스트 와셔	止推垫圈	2	2	2	2			
11110	65.01150-0048A	· WASHER ; THRUST(UP)	· 스러스트 와셔	· 止推垫圈	2	2	2	2			
11120	65.01150-0049A	· WASHER ; THRUST(UP)	· 스러스트 와셔	· 止推垫圈	2	2	2	2			
11130	65.01150-0050A	· WASHER ; THRUST(UP)	· 스러스트 와셔	· 止推垫圈	2	2	2	2			
11140	65.01150-0051A	· WASHER ; THRUST(UP)	· 스러스트 와셔	· 止推垫圈	2	2	2	2			
11200	65.01150-0018B	WASHER ; THRUST(LOW)	스러스트 와셔	止推垫圈	2	2	2	2			
11210	65.01150-0052B	· WASHER ; THRUST(LOW)	· 스러스트 와셔	· 止推垫圈	2	2	2	2			
11220	65.01150-0053B	· WASHER ; THRUST(LOW)	· 스러스트 와셔	· 止推垫圈	2	2	2	2			
11230	65.01150-0054B	· WASHER ; THRUST(LOW)	· 스러스트 와셔	· 止推垫圈	2	2	2	2			
11240	65.01150-0055B	· WASHER ; THRUST(LOW)	· 스러스트 와셔	· 止推垫圈	2	2	2	2			
20010	65.02201-7005	DAMPER ; VIBRATION	진동 댐퍼	减震器	-	-	-	1			
-	65.02201-7032	VIBRATION DAMPER ASS'Y	진동 댐퍼 조립품	减震器总成	1	1	1	-			
20020	65.02201-7033	· VIBRATION DAMPER ASS'Y	· 진동 댐퍼 조립품	· 减震器总成	1	1	1	-			
20030	65.02201-7034	· VIBRATION DAMPER ASS'Y	· 진동 댐퍼 조립품	· 减震器总成	1	1	1	-			
20100	06.01914-3215	BOLT ASS'Y M10x25	볼트 조립품	螺栓总成	6	6	6	8			
30010	65.02301-5052	FLYWHEEL ASS'Y	휠라이휠 조립품	飞轮总成	1	1	1	1			
30020	65.02301-0199A	· FLYWHEEL	· 휠라이휠	· 飞轮	1	1	1	1			
30040	65.02310-0011A	· GEAR ; STARTER RING	· 스타터 링 기어	· 启动器环形齿轮	1	1	1	1			
30050	06.22022-1010	PIN ; DOWEL 8x16	다우얼 핀	定位销	1	1	1	1			
30060	06.01494-4408	BOLT ; HEX. M14x1.5x45	육각 볼트	六角螺栓	8	8	8	8			
30070	06.16731-2110	WASHER ; SPRING A14	스프링 와셔	弹簧垫圈	8	8	8	8			
40010	65.02401-6012F	CONNECTING-ROD ASS'Y	컨넥팅 로드 조립품	连杆总成	6	-	-	-			
-	65.02401-6017A	CONNECTING-ROD ASS'Y	컨넥팅 로드 조립품	连杆总成	-	6	6	6			
40020	65.02401-0045F	· ROD ; CONNECTING	· 컨넥팅 로드	· 连杆	1	1	1	1			
40040	65.90020-0010E	· BOLT ; CONNECTING-ROD	· 컨넥팅 로드 볼트	· 连杆螺栓	2	2	2	2			
40050	65.02405-1006	· BUSH ; CONNECTING-ROD	· 컨넥팅 로드 부쉬	· 连杆衬套	1	-	-	-			
-	65.02405-1010	· BUSH ; CONNECTING-ROD	· 컨넥팅 로드 부쉬	· 连杆衬套	-	1	1	1			
40060	65.91301-0010	· PIN ; DOWEL	· 다우얼 핀	· 定位销	2	2	2	2			

Fig.003

DRIVING SYSTEM | 드라이빙 시스템 | 驱动系统

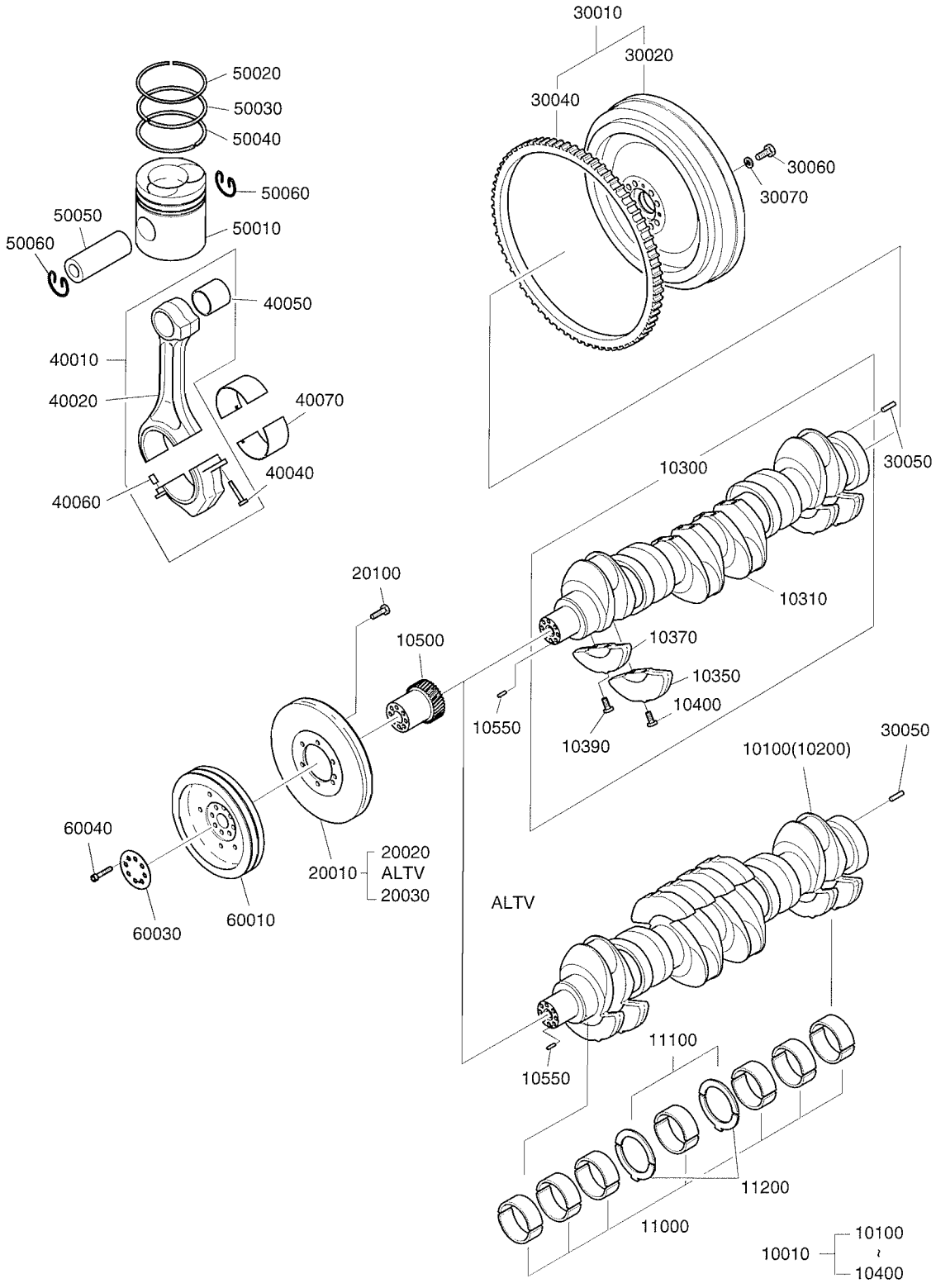


Fig.003

DRIVING SYSTEM | 드라이빙 시스템 | 驱动系统

Key No.	Part No.	Description	부 품 명	零件名称	Q'ty				S.C	ICA	Serial No.
					DE 12 T	P 126 TI-1	P 126 TI	P 126 TI-II			
40070	65.02410-6106	BEARING ; CONNECTING-ROD	컨넥팅 로드 베어링	连杆轴承	6	6	6	6			
50010	65.02501-0209	PISTON	피스톤	活塞	-	6	6	6			
-	65.02501-0778A	PISTON	피스톤	活塞	6	-	-	-			
50020	65.02503-0057	RING ; TOP	탑 링	顶环	6	6	6	6			
50030	65.02503-0097	RING 2ND	링	环	6	6	6	6			
50040	65.02503-0105	RING ; OIL	오일 링	油环	6	6	6	6			
50050	65.02502-0013	PIN ; PISTON	피스톤 핀	活塞销	-	6	6	6			
-	65.02502-0050	PIN ; PISTON	피스톤 핀	活塞销	6	-	-	-			
50060	06.29020-0127	RING ; SNAP 45x1.75	스냅 링	卡环	12	12	12	12			
60010	65.02601-0179	V-PULLEY	V-풀리	V-型皮带轮	1	1	1	-			
-	65.02601-0183	PULLEY ; V-BELT	V-벨트 풀리	V-型皮带轮	-	-	-	1			
60030	65.90701-0088	WASHER	와 셔	垫圈	1	1	1	1			
60040	65.90030-0013A	BOLT ; SOCKET HEAD	소켓 헤드 볼트	内六角螺栓	8	8	8	8			

Fig.004

CYLINDER HEAD & CYLINDER HEAD COVER | 실린더 헤드 및 실린더 헤드 커버 | 气缸盖与气门室盖

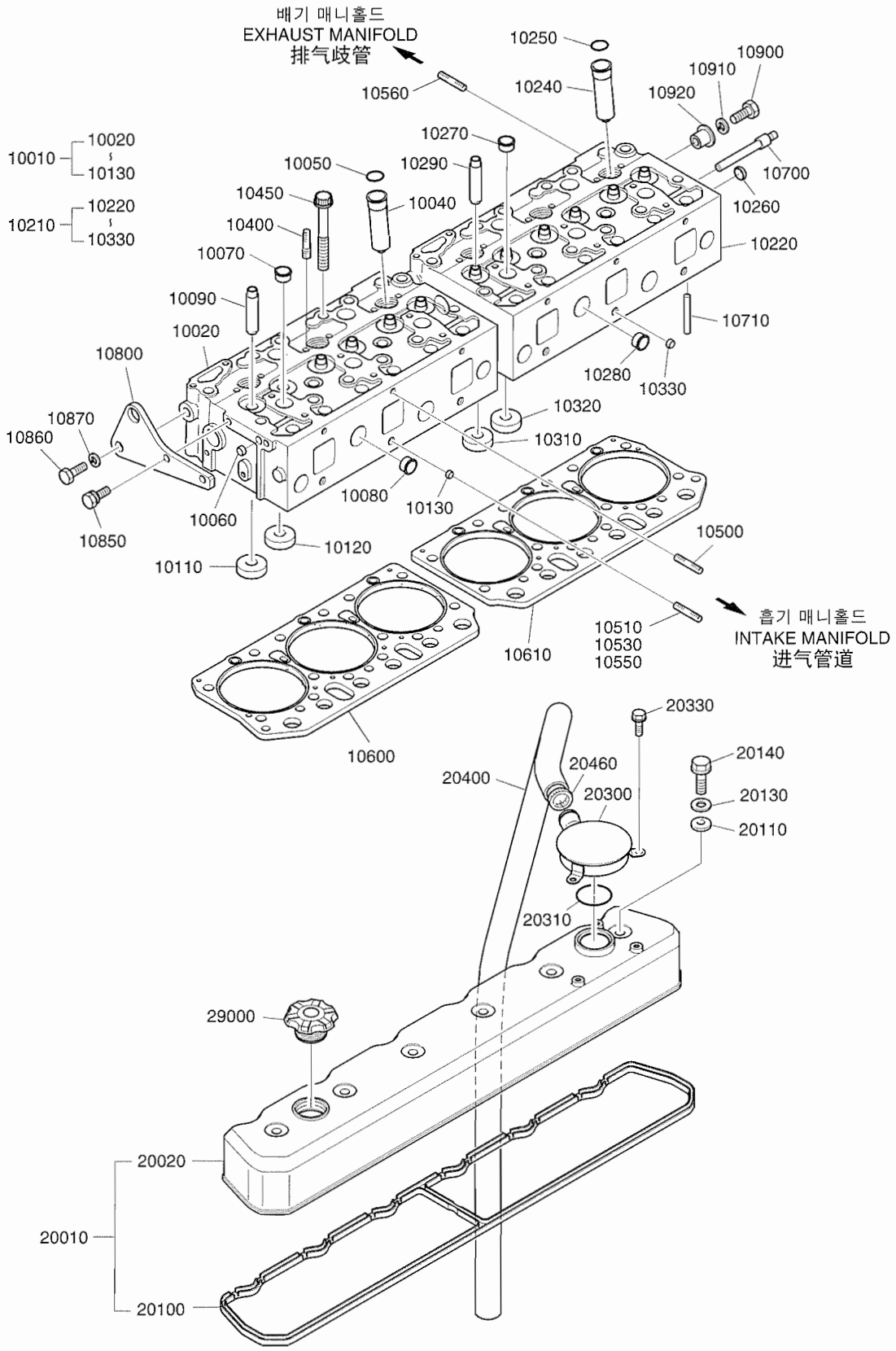


Fig.004

CYLINDER HEAD & CYLINDER HEAD COVER | 실린더 헤드 및 실린더 헤드 커버 | 气缸盖与气门室盖

Key No.	Part No.	Description	부 품 명	零件名称	Q'ty				S.C	ICA	Serial No.
					DE 12 T	P 126 TI-1	P 126 TI	P 126 TI-II			
10010	65.03101-6053G	CYLINDER HEAD ASS'Y(FRONT)	실린더 헤드 조립품(앞)	气缸盖总成(前)	1	1	1	1			
10020	65.03101-0003F	· HEAD ; CYLINDER	· 실린더 헤드	· 气缸盖	1	1	1	1			
10040	65.03205-0002	· TUBE ; INJECTION NOZZLE	· 분사 노즐 튜브	· 喷油嘴管	3	3	3	3			
10050	65.96501-0069	· O-RING	· O-링	· O-型环	3	3	3	3			
10060	65.90302-0041	· PLUG ; CORE	· 코어 플러그	· 中心孔塞	6	6	6	6			
10070	65.90302-0048	· PLUG ; CORE	· 코어 플러그	· 中心孔塞	3	3	3	3			
10080	65.90302-0042	· PLUG ; CORE	· 코어 플러그	· 中心孔塞	2	2	2	2			
10090	65.03201-1008E	· GUIDE ; VALVE	· 밸브 가이드	· 阀导杆	6	6	6	6			
10110	65.03203-1042	· RING ; VALVE SEAT	· 밸브 시트 링	· 阀座环	3	3	3	3			
10120	65.03203-1041	· RING ; VALVE SEAT	· 밸브 시트 링	· 阀座环	3	3	3	3			
10130	65.90302-0049	· PLUG ; CORE	· 코어 플러그	· 中心孔塞	3	3	3	3			
10210	65.03101-6054G	CYLINDER HEAD ASS'Y(REAR)	실린더 헤드 조립품(뒤)	气缸盖总成(后)	1	1	1	1			
10220	65.03101-0004F	· HEAD ; CYLINDER	· 실린더 헤드	· 气缸盖	1	1	1	1			
10240	65.03205-0002	· TUBE ; INJECTION NOZZLE	· 분사 노즐 튜브	· 喷油嘴管	3	3	3	3			
10250	65.96501-0069	· O-RING	· O-링	· O-型环	3	3	3	3			
10260	65.90302-0041	· PLUG ; CORE	· 코어 플러그	· 中心孔塞	6	6	6	6			
10270	65.90302-0048	· PLUG ; CORE	· 코어 플러그	· 中心孔塞	3	3	3	3			
10280	65.90302-0042	· PLUG ; CORE	· 코어 플러그	· 中心孔塞	2	2	2	2			
10290	65.03201-1008E	· GUIDE ; VALVE	· 밸브 가이드	· 阀导杆	6	6	6	6			
10310	65.03203-1042	· RING ; VALVE SEAT	· 밸브 시트 링	· 阀座环	3	3	3	3			
10320	65.03203-1041	· RING ; VALVE SEAT	· 밸브 시트 링	· 阀座环	3	3	3	3			
10330	65.90302-0049	· PLUG ; CORE	· 코어 플러그	· 中心孔塞	3	3	3	3			
10400	65.90201-0106	BOLT ; STUD M6	스터드 볼트	双头螺栓	12	12	12	12			
10450	65.90021-0001A	BOLT ; COLLARED DUO.	칼러드 12각 볼트	对套圈螺栓	28	28	28	28			
10500	65.90201-0094	BOLT ; STUD	스터드 볼트	双头螺栓	4	6	6	6			
10510	06.06226-0809	BOLT ; STUD M10	스터드 볼트	双头螺栓	2	-	-	-			
10530	65.90201-0154	BOLT ; STUD M12x1.5	스터드 볼트	双头螺栓	5	6	6	6			
10550	65.90201-0049	BOLT ; STUD M12x1.5x35	스터드 볼트	双头螺栓	1	-	-	-			
10560	65.90201-0080	BOLT ; STUD	스터드 볼트	双头螺栓	2	2	2	2			
10600	65.03901-0063A	GASKET ; CYLINDER HEAD	실린더 헤드 가스켓	气缸盖衬垫	1	1	1	1			
10610	65.03901-0064A	GASKET ; CYLINDER HEAD	실린더 헤드 가스켓	气缸盖衬垫	1	1	1	1			
10700	65.91001-0013	AV SEAL	AV 시일	AV 密封	2	2	2	2			
10710	06.22022-0907	PIN ; DOWEL 6M6x10	다우얼 핀	定位销	4	4	4	4			
10800	65.41520-0003	BRACKET ; HANGER	행거 브라켓	提升钩	1	1	1	1			
10850	06.01913-3217	BOLT ASS'Y M10x30	볼트 조립품	螺栓总成	2	2	2	2			
10860	06.01734-4411	BOLT ; HEX. M14x1.5x30	육각 볼트	六角螺栓	1	1	1	1			
10870	06.16731-2110	WASHER ; SPRING A14	스프링 와셔	弹簧垫圈	1	1	1	1			
10900	06.01494-4408	BOLT ; HEX. M14x1.5x45	육각 볼트	六角螺栓	1	1	1	1			
10910	06.16731-2110	WASHER ; SPRING A14	스프링 와셔	弹簧垫圈	-	1	1	1			
10920	65.91701-0275	SPACER	스페이서	衬套	1	1	1	1			
20010	65.03401-6046B	COVER ASS'Y	커버 조립품	箱盖总成	1	1	1	1			
20020	65.03401-0048B	· COVER ; CYLINDER HEAD	· 실린더 헤드 커버	· 气缸盖罩	1	1	1	1			
20100	65.03905-0020	· PACKING;CYLINDER HEAD COVER	· 실린더 헤드 커버 팩킹	· 气门室盖包装	1	1	1	1			
20110	65.03905-0023A	GASKET;CYLINDER HEAD COVER	실린더 헤드 커버 가스켓	气缸盖罩衬垫	6	6	6	6			

Fig.004

CYLINDER HEAD & | 실린더 헤드 및 | 气缸盖与气门室盖
CYLINDER HEAD COVER 실린더 헤드 커버

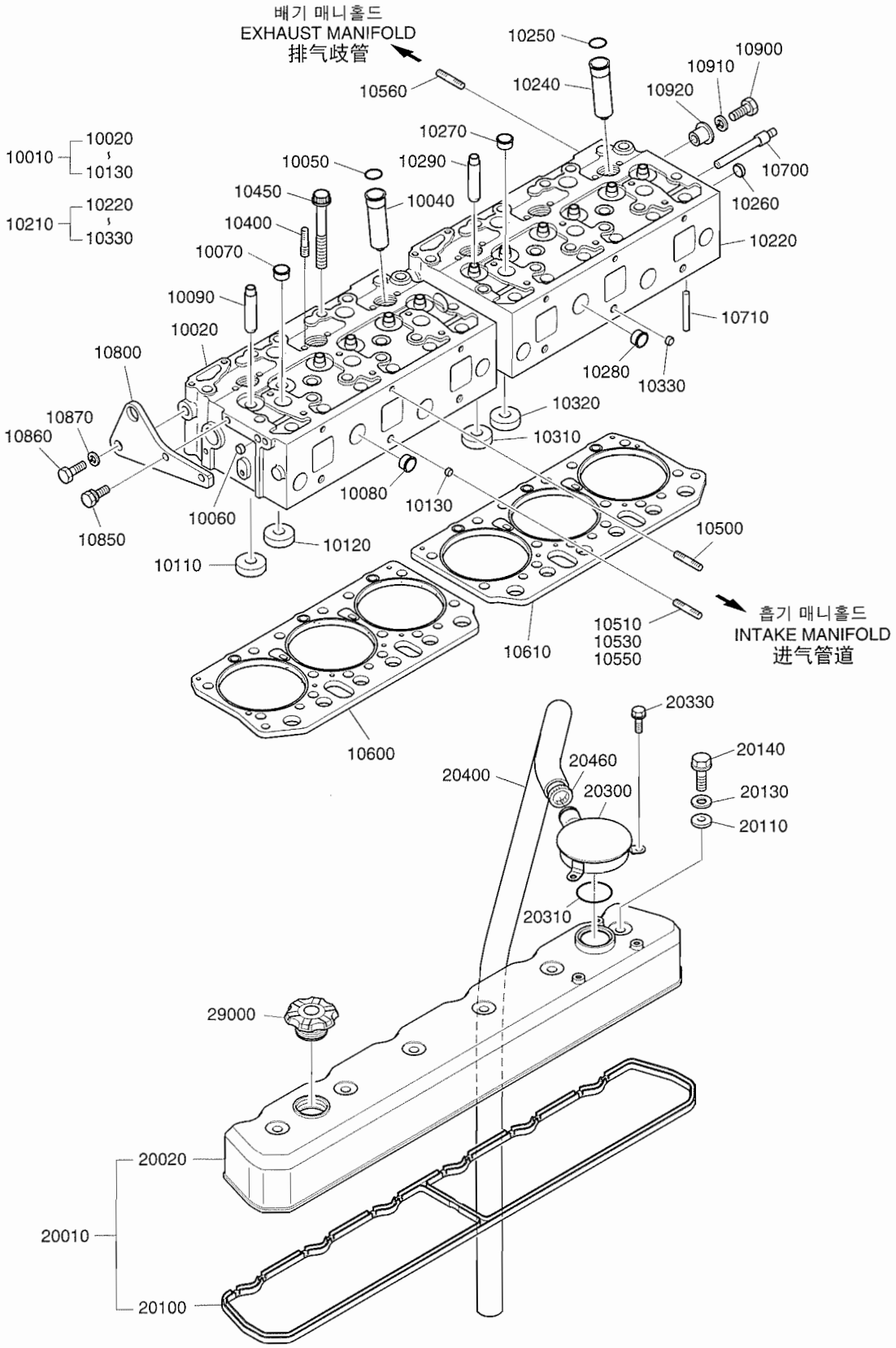


Fig.004

CYLINDER HEAD & CYLINDER HEAD COVER | 실린더 헤드 및 실린더 헤드 커버 | 气缸盖与气门室盖

Key No.	Part No.	Description	부 품 명	零件名称	Q'ty				S.C	ICA	Serial No.
					DE 12 T	P 126 TI-1	P 126 TI	P 126 TI-II			
20130	65.90701-0202	WASHER	와 셔	垫圈	6	6	6	6			
20140	65.90020-0074	BOLT ; COLLARED HEX.	칼러드 육각 볼트	套圈式六角螺栓	6	6	6	6			
20300	65.01801-5099B	HOUSING ; BREATHER	브리더 하우징	轴承座	1	1	1	1			
20310	65.96501-0033B	O-RING	O-링	0-型环	1	1	1	1			
20330	06.01923-3113	BOLT ASS'Y M8x20	볼트 조립품	螺栓总成	3	3	3	3			
20400	65.96301-0305	HOSE ; RUBBER	고무 호스	橡胶软管	1	1	1	1			
20460	06.67020-0105	CLAMP ; HOSE NW S16	호스 클램프	软管夹	1	1	1	1			
29000	65.01810-5007	OIL FILLER CAP ASS'Y	오일 휠터 캡 조립품	加油盖总成	1	1	1	1			

Fig.005

TIMING SYSTEM | 타이밍 시스템 | 正时系统

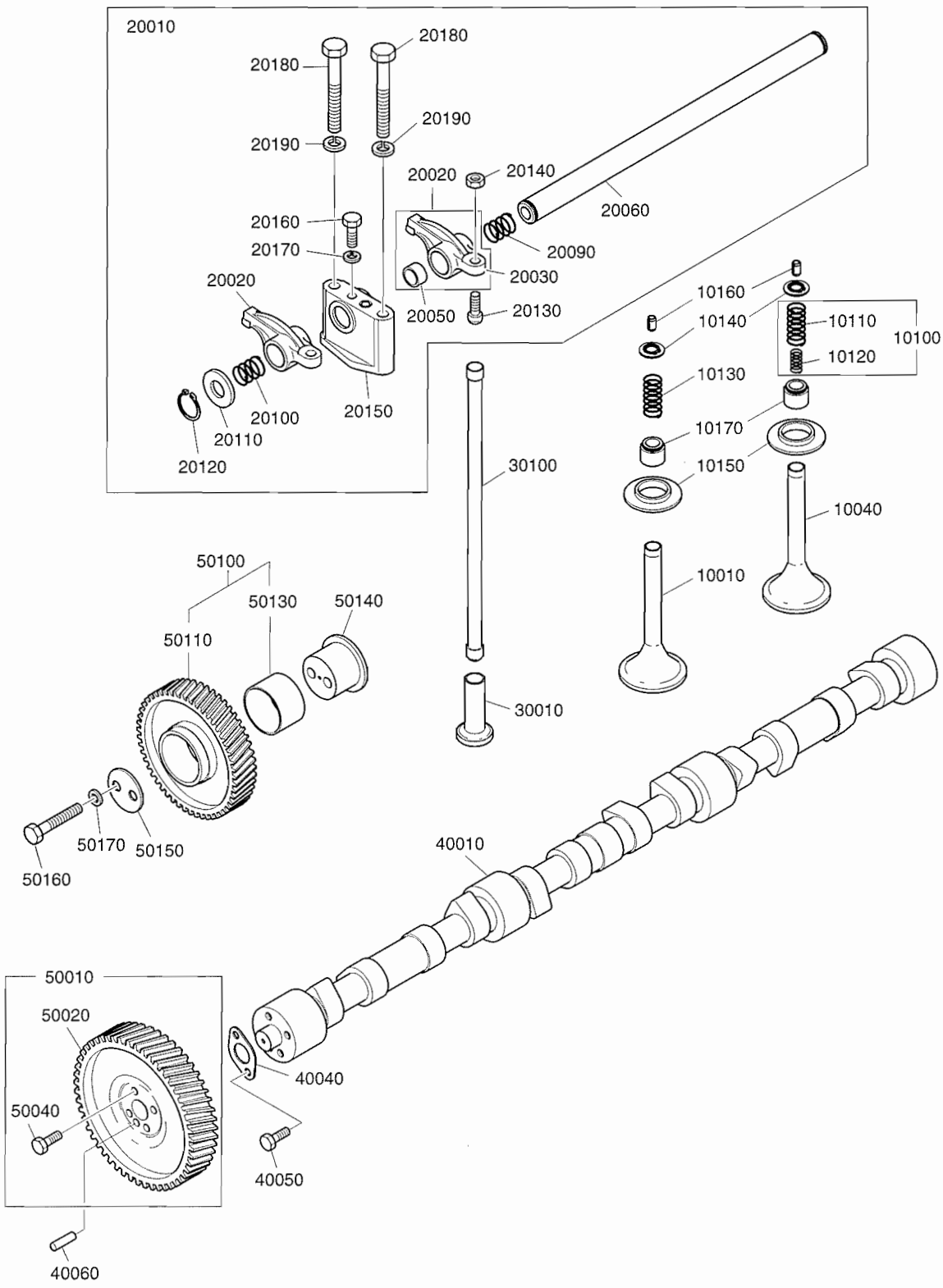


Fig.005

TIMING SYSTEM | 타이밍 시스템 | 正时系统

Key No.	Part No.	Description	부 품 명	零件名称	Q'ty				S.C	ICA	Serial No.
					DE 12 T	P 126 TI-1	P 126 TI	P 126 TI-II			
10010	65.04101-0043	VALVE ; INLET	인렛 밸브	进管阀	6	6	6	6			
10020	65.04101-0036	· VALVE ; INLET	· 인렛 밸브	· 进管阀	1	1	1	1			
10030	65.04101-0039	· VALVE ; INLET	· 인렛 밸브	· 进管阀	1	1	1	1			
10040	65.04101-0044	VALVE ; EXHAUST(ALTV)	배기 밸브	排气阀	6	6	6	6			
10050	65.04101-0029	· VALVE ; EXHAUST	· 배기 밸브	· 排气阀	1	1	1	1			
10060	65.04101-0040	· VALVE ; EXHAUST	· 배기 밸브	· 排气阀	1	1	1	1			
10100	65.04102-6004A	SPRING VALVE ASS'Y	밸브 스프링 조립품	阀弹簧总成	6	6	6	6			
10110	65.04102-0066	· SPRING ; VALVE	· 밸브 스프링	· 气门弹簧	1	1	1	1			
10120	65.04102-0002A	· SPRING ; VALVE(INNER)	· 밸브 스프링(안)	· 内排气门弹簧	1	1	1	1			
10130	65.04102-0066	SPRING ; VALVE	밸브 스프링	气门弹簧	6	6	6	6			
10140	65.04103-0014	RETAINER ; VALVE SPRING	밸브 스프링 리테이너	气门弹簧座	12	12	12	12			
10150	65.04103-0078	SEAT ; VALVE SPRING	밸브 스프링 시트	阀弹簧座	12	12	12	12			
10160	65.04104-0007	COTTER ; VALVE	밸브 코터	气门销	24	24	24	24			
10170	65.04902-0010	SEAL ; VALVE STEM	밸브 스팀 시일	阀杆油封	12	12	12	12			
20010	65.04200-6027C	ROCKER ARM & SHAFT ASS'Y	록커 암 및 축 조립품	摇臂与轴总成	2	2	2	2			
20020	65.04201-5014E	· ROCKER ARM ASS'Y	· 록커 암 조립품	· 摇臂总成	6	6	6	6			
20030	65.04201-0007K	· · ARM ; ROCKER	· · 록커 암	· · 摇臂	1	1	1	1			
20050	65.93020-0033D	· · BUSH	· · 부 쉬	· · 衬套	1	1	1	1			
20060	65.04203-5010	· SHAFT ASS'Y	· 축 조립품	· 轴总成	1	1	1	1			
20210	65.04203-0010A	· · SHAFT ; ROCKER ARM	· · 록커 암 축	· · 摇臂轴	1	1	1	1			
20220	65.90302-0012	· · PLUG	· · 플러그	· · 柱塞	2	2	2	2			
20090	65.97601-0104	· SPRING ; COMPRESSION	· 압축 스프링	· 压缩弹簧	2	2	2	2			
20100	65.97601-0053	· SPRING ; COMPRESSION	· 압축 스프링	· 压缩弹簧	2	2	2	2			
20110	65.90710-0039	· WASHER ; ROCKER ARM	· 록커 암 와셔	· 摇臂垫圈	2	2	2	2			
20120	06.29010-0120	· RING ; SNAP 24x1.2	· 스냅 링	· 卡环	2	2	2	2			
20130	65.04205-0003	· BOLT ; ADJUSTING M10x1.0	· 조정 볼트	· 调节螺栓	6	6	6	6			
20140	65.90501-0003	· NUT ; HEX. M10x1.0	· 육각 너트	· 六角螺母	6	6	6	6			
20150	65.04202-0014A	· BRACKET ; ROCKER ARM	· 록커 암 브라켓	· 摇臂支架	3	3	3	3			
20160	06.01283-7112	· BOLT ; HEX. M8x18	· 육각 볼트	· 六角螺栓	3	3	3	3			
20170	06.15010-2311	· WASHER 8.4	· 와 셔	· 垫圈	3	3	3	3			
20180	06.01013-9221	· BOLT ; HEX. M10x80	· 육각 볼트	· 六角螺栓	6	6	6	6			
20190	06.16731-2108	· WASHER ; SPRING A10	· 스프링 와셔	· 弹簧垫圈	6	6	6	6			
30010	65.04301-0006	TAPPET	타 펫	挺杆	12	12	12	12			
30100	65.04302-5011	ROD ; PUSH	푸쉬 로드	推杆	12	12	12	12			
40010	65.04401-0010K	SHAFT ; CAM	캠 축	凸轮轴	1	1	1	1			
40040	65.98112-0038	FLANGE	홀랜지	法兰	1	1	1	1			
40050	65.90001-6003	BOLT ASS'Y	볼트 조립품	螺栓总成	2	2	2	2			
40060	06.22022-1014	PIN ; DOWEL 8M6x28	다우얼 핀	定位销	1	1	1	1			
50010	65.04500-6006B	CAMSHAFT ASS'Y	캠 축 조립품	凸轮轴总成	1	1	1	1			
50020	65.04501-0007A	· GEAR ; CAM SHAFT	· 캠 축 기어	· 凸轮轴齿轮	1	1	1	1			
50040	06.01914-3119	· BOLT ASS'Y	· 볼트 조립품	· 螺栓总成	4	4	4	4			
50100	65.04505-5016	IDLE GEAR ASS'Y	아이들 기어 조립품	惰轮总成	1	1	1	1			
50110	65.04505-0033	· GEAR ; IDLE	· 아이들 기어	· 惰轮	1	1	1	1			
50130	65.04507-0004	· BUSH ; IDLE GEAR	· 아이들 기어 부쉬	· 惰轮衬套	1	1	1	1			

Fig.005

TIMING SYSTEM | 타이밍 시스템 | 正时系统

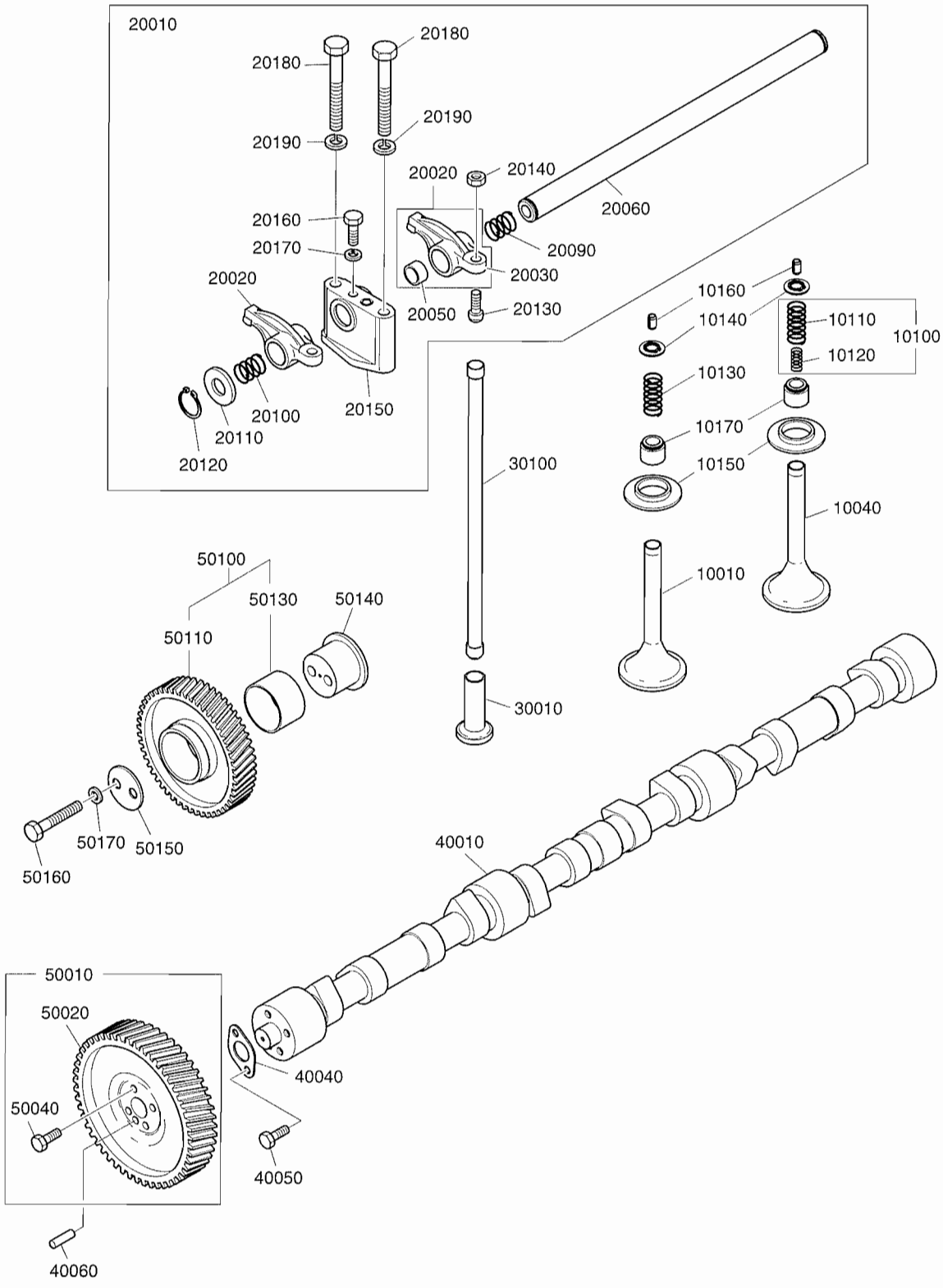


Fig.005

TIMING SYSTEM | 타이밍 시스템 | 正时系统

Key No.	Part No.	Description	부 품 명	零 件 名 称	Q'ty				S.C	ICA	Serial No.
					DE 12 T	P 126 TI-1	P 126 TI	P 126 TI-II			
50140	65.04506-0033	PIN ; IDLE GEAR	아이들 기어 핀	惰轮销	1	1	1	1			
50150	65.90720-0018	WASHER ; THRUST	스러스트 와셔	止推垫圈	1	1	1	1			
50160	06.01015-7220	BOLT ; HEX. M10x1.5x75	육각 볼트	六角螺栓	2	2	2	2			
50170	06.16731-2108	WASHER ; SPRING A10	스프링 와셔	弹簧垫圈	2	2	2	2			

Fig.006

OIL PUMP & OIL FILTER | 오일 펌프 및 오일 휠터 | 机油泵与机油滤清器

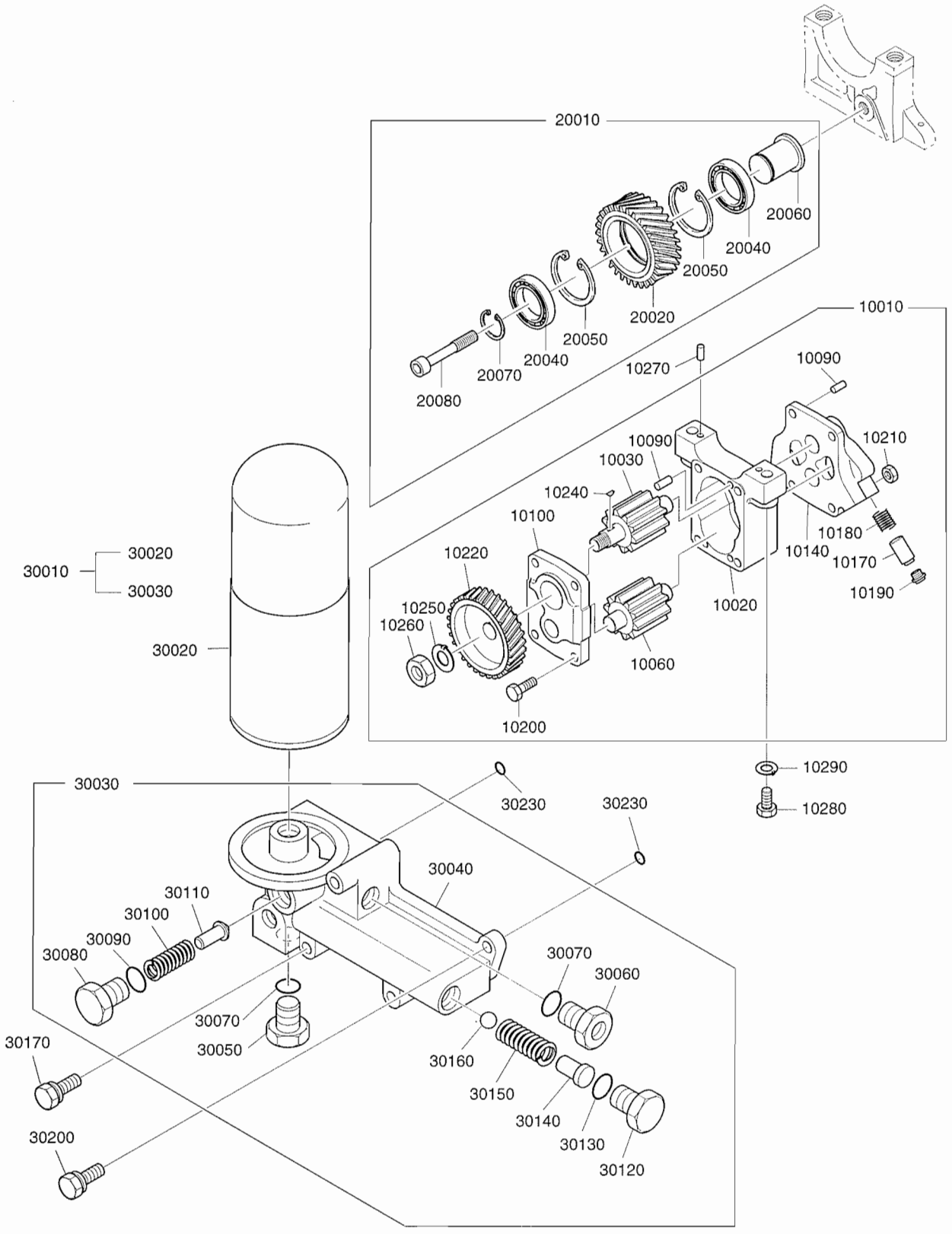


Fig.006

OIL PUMP & OIL FILTER | 오일 펌프 및 오일 휠터 | 机油泵与机油滤清器

Key No.	Part No.	Description	부 품 명	零件名称	Q'ty				S.C	ICA	Serial No.
					DE 12 T	P 126 TI-1	P 126 TI	P 126 TI-II			
10010	65.05100-6042A	OIL PUMP ASS'Y	오일 펌프 조립품	机油泵总成	1	-	-	-			
-	65.05100-6044	OIL PUMP ASS'Y	오일 펌프 조립품	机油泵总成	-	1	1	1			
10020	65.05102-0015	· HOUSING ; OIL PUMP	· 오일 펌프 하우징	· 机油泵壳	1	-	-	-			
-	65.05102-0021	· HOUSING ; OIL PUMP	· 오일 펌프 하우징	· 机油泵壳	-	1	1	1			
10030	65.05104-5004	· GEAR ; OIL PUMP	· 오일 펌프 기어	· 机油泵齿轮	1	-	-	-			
-	65.05104-5007	· GEAR ; OIL PUMP	· 오일 펌프 기어	· 机油泵齿轮	-	1	1	1			
10040	65.05104-5005	· GEAR ; OIL PUMP	· 오일 펌프 기어	· 机油泵齿轮	1	-	-	-			
-	65.05104-5006	· GEAR ; OIL PUMP	· 오일 펌프 기어	· 机油泵齿轮	-	1	1	1			
10090	06.22022-0907	· PIN ; DOWEL 6M6x10	· 다우얼 핀	· 定位销	4	4	4	4			
10100	65.05103-5006A	· COVER ASS'Y(FRONT)	· 커버 조립품(앞)	· 箱盖总成(前)	1	-	-	-			
-	65.05103-5009	· COVER ASS'Y(FRONT)	· 커버 조립품(앞)	· 箱盖总成(前)	-	1	1	1			
10140	65.05103-5008	· COVER ASS'Y(REAR)	· 커버 조립품(뒤)	· 箱盖总成(后)	1	-	-	-			
-	65.05103-5003	· COVER ASS'Y(REAR)	· 커버 조립품(뒤)	· 箱盖总成(后)	-	1	1	1			
10170	65.05410-0007	· PLUNGER ; VALVE	· 밸브 플런저	· 阀门柱塞	1	1	1	1			
10180	65.97601-0105	· SPRING	· 스프링	· 弹簧	1	1	1	1			
10190	65.90310-0104	· SCREW ; PLUG	· 플러그 스크류	· 螺塞	1	1	1	1			
10200	06.01013-9118	· BOLT ; HEX. M8x65	· 육각 볼트	· 六角螺栓	4	-	-	-			
-	06.01013-9120	· BOLT ; HEX. M8x75	· 육각 볼트	· 六角螺栓	-	4	4	4			
10210	65.90510-0012	· NUT	· 너 트	· 螺母	4	4	4	4			
10220	65.05201-0008A	· GEAR ; DRIVE	· 구동 기어	· 驱动齿轮	1	1	1	1			
10240	06.29141-0207	· KEY ; WOODRUFT	· 반달 키	· 半圆键	1	1	1	1			
10250	06.16050-0311	· WASHER ; LOCK	· 록크 와셔	· 锁止垫圈	1	1	1	1			
10260	06.11056-9217	· NUT ; HEX. M14x1.5	· 육각 너트	· 六角螺母	1	1	1	1			
10270	06.22022-0907	PIN ; DOWEL 6M6x10	다우얼 핀	定位销	2	2	2	2			
10280	06.01013-9215	BOLT ; HEX. M10x1.5x50	육각 볼트	六角螺栓	2	2	2	2			
10290	65.90801-0018	WASHER ; LOCK	록크 와셔	锁止垫圈	2	2	2	2			
20010	65.05200-6004A	OIL PUMP DRIVE ASS'Y	오일 펌프 구동 조립품	机油泵驱动总成	1	1	1	1			
20020	65.05204-0003A	· GEAR ; OIL PUMP IDLE	· 오일 펌프 아이들 기어	· 机油泵怠速齿轮	1	1	1	1			
20040	06.31420-0314	· BEARING ; BALL	· 볼 베어링	· 球形轴承	2	2	2	2			
20050	06.29020-0132	· RING ; SNAP 55x2	· 스냅 링	· 卡环	2	2	2	2			
20060	65.05205-0018	· PIN ; IDLE GEAR	· 아이들 기어 핀	· 惰轮销	1	1	1	1			
20070	06.29010-0125	· RING ; SNAP 30x2	· 스냅 링	· 卡环	1	1	1	1			
20080	65.90030-0009	· BOLT ; SOCKET HEAD M10x60	· 소켓 헤드 볼트	· 内六角螺栓	1	1	1	1			
30010	65.05501-7058E	OIL FILTER ASS'Y	오일 휠터 조립품	机油滤清器总成	1	1	1	1			
30020	65.05510-5020A	· CARTRIDGE ASS'Y	· 카트리지 조립품	· 滤心总成	1	1	1	1			
30030	65.05503-5038B	· OIL FILTER HEAD ASS'Y	· 오일 휠터 헤드 조립품	· 机油滤清器顶盖	1	1	1	1			
30040	65.05503-0031B	· · HEAD ; OIL FILTER	· · 오일 휠터 헤드	· · 机油滤清器顶盖	1	1	1	1			
30050	65.90310-0121	· · SCREW ; PLUG AM24x1.5	· · 플러그 스크류	· · 螺塞	1	1	1	1			
30060	06.08062-1208	· · SCREW ; PLUG M24x1.5	· · 플러그 스크류	· · 螺塞	1	1	1	1			
30070	06.56190-0722	· · RING ; SEAL 24x29	· · 시일 링	· · 密封环	2	2	2	2			
30080	65.90310-0115	· · PLUG	· · 플러그	· · 柱塞	1	1	1	1			
30090	06.56190-0726	· · RING ; SEAL 26x31	· · 시일 링	· · 密封环	1	1	1	1			
30100	65.97601-0075	· · SPRING	· · 스프링	· · 弹簧	1	1	1	1			
30110	06.31641-0433	· · BALL ; STEEL	· · 스틸 볼	· · 钢球	1	1	1	1			

Fig.006

OIL PUMP & OIL FILTER | 오일 펌프 및 오일 휠터 | 机油泵与机油滤清器

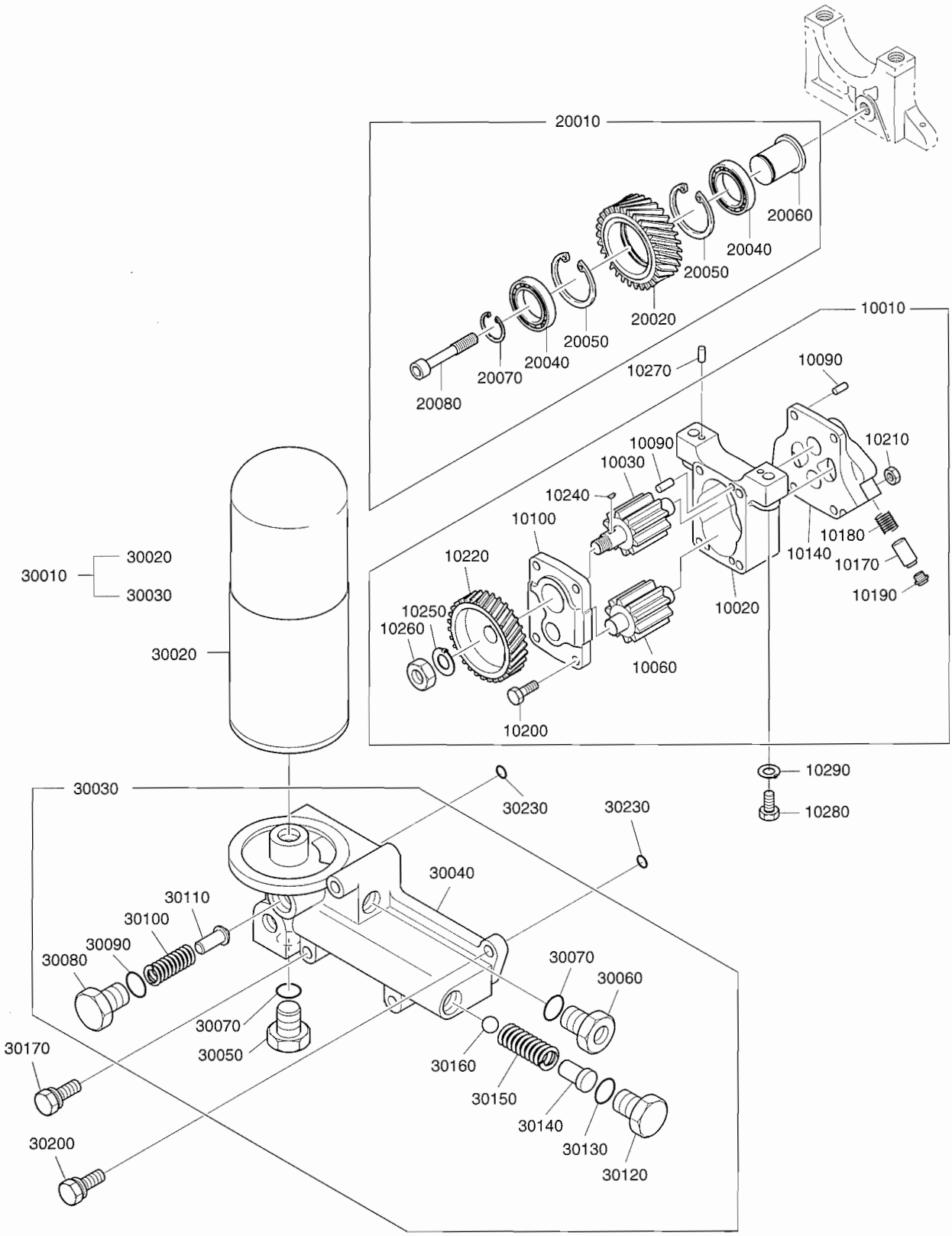


Fig.006

OIL PUMP & OIL FILTER | 오일 펌프 및 오일 휠터 | 机油泵与机油滤清器

Key No.	Part No.	Description	부 품 명	零件名称	Q'ty				S.C	ICA	Serial No.
					DE 12 T	P 126 TI-1	P 126 TI	P 126 TI-II			
30120	65.90310-0034	· · SCREW ; PLUG M26x1.5	· · 플러그 스크류	· · 螺塞	1	1	1	1			
30130	06.56190-0728	· · RING ; SEAL A26x32	· · 시일 링	· · 密封环	1	1	1	1			
30140	06.22230-1214	· · PIN ; SPRING 8x32	· · 스프링 핀	· · 弹簧销	1	1	1	1			
30150	65.97601-0004	· · SPRING	· · 스프링	· · 弹簧	1	1	1	1			
30160	06.31641-0433	· · BALL ; STEEL	· · 스틸 볼	· · 钢球	1	1	1	1			
30170	06.01953-3331	BOLT ASS'Y M12x1.5x100	볼트 조립품	螺栓总成	4	4	4	4			
30200	06.01953-3318	BOLT ASS'Y M12x1.5x35	볼트 조립품	螺栓总成	1	1	1	1			
30230	65.96501-0061	O-RING	O-링	O-型环	2	2	2	2			

Fig.007

OIL COOLER | 오일 쿨러 | 机油冷却器

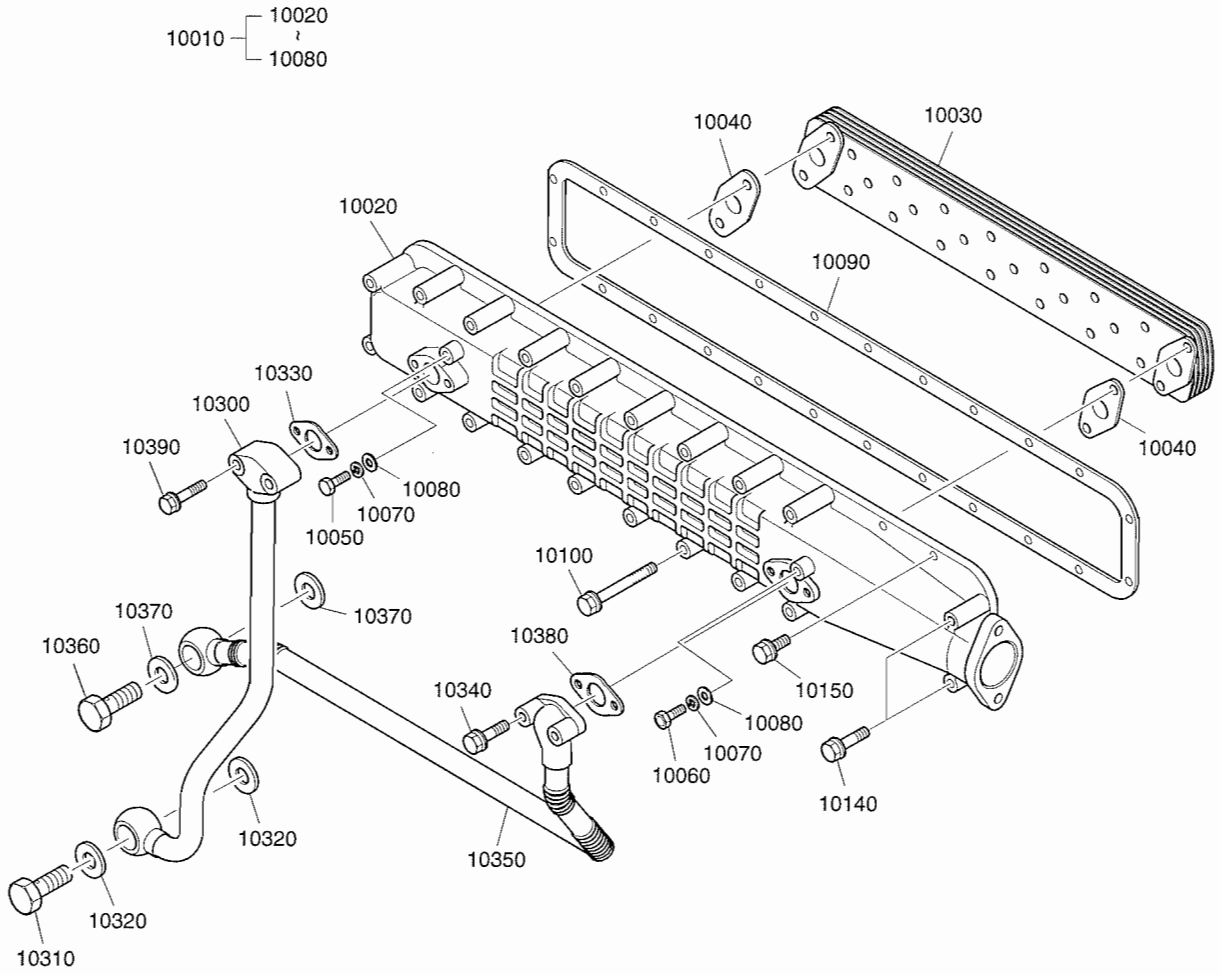


Fig.007

OIL COOLER | 오일 쿨러 | 机油冷却器

Key No.	Part No.	Description	부 품 명	零件名称	Q'ty				S.C	ICA	Serial No.
					DE 12 T	P 126 TI-1	P 126 TI	P 126 TI-II			
10010	65.05601-7072C	OIL COOLER ASS'Y	오일 쿨러 조립품	机油冷却器总成	1	1	1	1			
10020	65.05604-0019B	· COVER	· 커 버	· 盖垫	1	1	1	1			
10030	65.05606-5027B	· ELEMENT ; OIL COOLER	· 오일 쿨러 엘레멘트	· 机油冷却器芯	1	1	1	1			
10040	65.05903-0028	· GASKET ; OIL COOLER	· 오일 쿨러 가스켓	· 机油冷却器衬垫	2	2	2	2			
10050	06.02090-0512	· BOLT ; SOCKET HEAD M10x25	· 소켓 헤드 볼트	· 内六角螺栓	2	2	2	2			
10060	06.02090-0513	· BOLT ; SOCKET HEAD	· 소켓 헤드 볼트	· 内六角螺栓	2	2	2	2			
10070	06.16731-2108	· WASHER ; SPRING A10	· 스프링 와셔	· 弹簧垫圈	4	4	4	4			
10080	06.15010-2312	· WASHER ; PLAIN 10.5	· 평 와셔	· 平垫圈	4	4	4	4			
10090	65.01907-0008A	GASKET ; WATER CHAMBER COVER	냉각수 챔버 커버 가스켓	水箱盖衬垫	1	1	1	1			
10100	06.01923-3124	BOLT ASS'Y M8x65	볼트 조립품	螺栓总成	18	18	18	18			
10140	06.01923-3122	BOLT ASS'Y M8x55	볼트 조립품	螺栓总成	2	2	2	2			
10150	06.01923-3115	BOLT ASS'Y M8x25	볼트 조립품	螺栓总成	4	4	4	4			
10300	65.05701-5325	OIL PIPE ASS'Y	오일 파이프 조립품	机油管总成	1	1	1	1			
10310	06.78140-2408	SCREW ; HOLLOW	홀로우 스크류	空心螺钉	1	1	1	1			
10320	06.56190-0727	RING ; SEAL A26x34	시일 링	密封环	2	2	2	2			
10330	65.05903-0030A	GASKET ; OIL RETURN PIPE	오일 리턴 파이프 가스켓	回油管衬垫	1	1	1	1			
10340	06.01913-3120	BOLT ASS'Y M8x45	볼트 조립품	螺栓总成	2	2	2	2			
10350	65.05701-5964A	OIL PIPE ASS'Y	오일 파이프 조립품	机油管总成	1	1	1	1			
10360	06.78140-2408	SCREW ; HOLLOW	홀로우 스크류	空心螺钉	1	1	1	1			
10370	06.56190-0728	RING ; SEAL A26x32	시일 링	密封环	2	2	2	2			
10380	65.05903-0030A	GASKET ; OIL RETURN PIPE	오일 리턴 파이프 가스켓	回油管衬垫	1	1	1	1			
10390	06.01913-3120	BOLT ASS'Y M8x45	볼트 조립품	螺栓总成	2	2	2	2			

Fig.008

OIL PAN | 오일 팬 | 油底壳

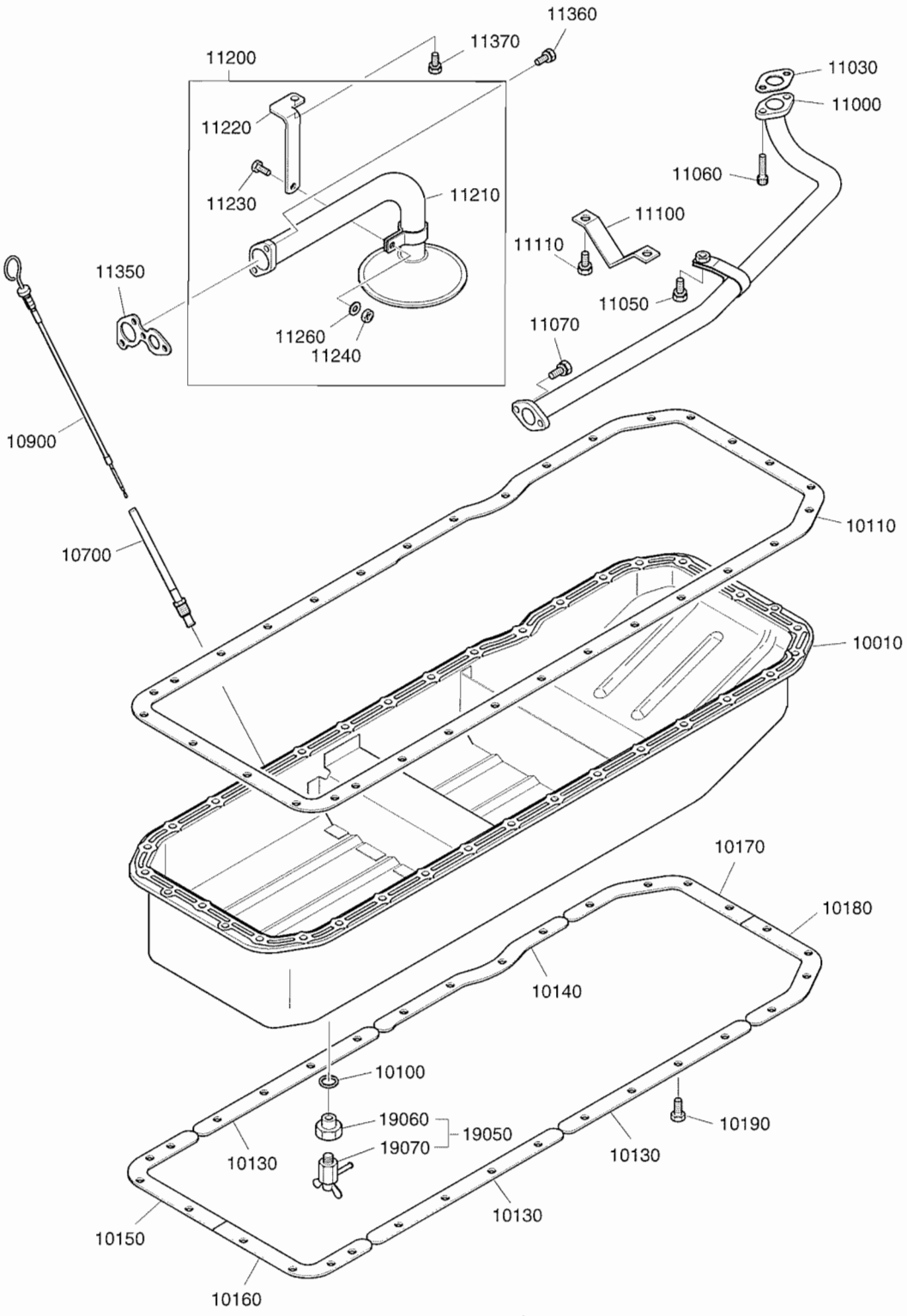
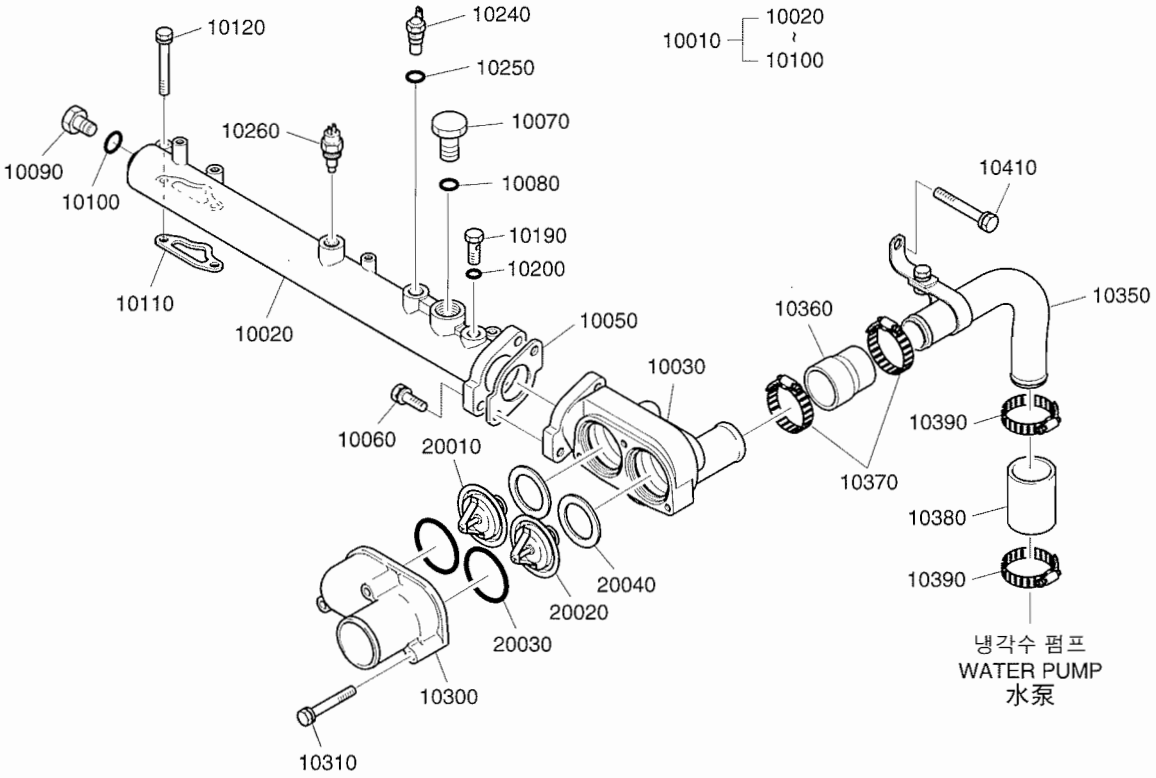


Fig.008
OIL PAN | 오일 팬 | 油底壳

Key No.	Part No.	Description	부 품 명	零件名称	Q'ty				S.C	ICA	Serial No.
					DE 12 T	P 126 TI-1	P 126 TI	P 126 TI-II			
10010	65.05801-5141C	PAN ; OIL	오일 팬	油底壳	1	1	1	1			
10100	06.56190-0732	RING ; SEAL A30x36	시일 링	密封环	1	1	1	1			
10110	65.05904-0096A	GASKET ; OIL PAN	오일 팬 가스켓	油底壳衬垫	1	1	1	1			
10130	65.05809-0052	STIFFNER	스티프너	加强环	3	3	3	3			
10140	65.05809-0053	STIFFNER	스티프너	加强环	1	1	1	1			
10150	65.05809-0056	STIFFNER	스티프너	加强环	1	1	1	1			
10160	65.05809-0057	STIFFNER	스티프너	加强环	1	1	1	1			
10170	65.05809-0058	STIFFNER	스티프너	加强环	1	1	1	1			
10180	65.05809-0059	STIFFNER	스티프너	加强环	1	1	1	1			
10190	65.90001-0136	BOLT ; HEX. M8x45	육각 볼트	六角螺栓	32	32	32	32			
10700	65.05806-6052	GUIDE TUBE ASS'Y	가이드 튜브 조립품	导管总成	1	1	1	1			
10900	65.05805-5137	OIL LEVEL GAUGE ASS'Y	오일 레벨 게이지 조립품	机油量尺总成	1	1	1	1			
11000	65.05701-5322A	OIL PIPE ASS'Y	오일 파이프 조립품	机油管总成	1	-	-	-			
-	65.05701-5349	OIL PIPE ASS'Y	오일 파이프 조립품	机油管总成	-	1	1	1			
11030	65.96601-0043	GASKET	가스켓	衬垫	1	1	1	1			
11050	06.01913-3115	BOLT ASS'Y M8x25	볼트 조립품	螺栓总成	1	1	1	1			
11060	65.90001-6005	SOCKET BOLT ASS'Y	소켓 볼트 조립품	内六角螺栓总成	2	2	2	2			
11070	06.01913-3113	BOLT ASS'Y M8x20	볼트 조립품	螺栓总成	2	2	2	2			
11100	65.05740-2042	BRACKET ASS'Y	브라켓 조립품	支架总成	1	1	1	1			
11110	06.01923-3112	BOLT ASS'Y M8x18	볼트 조립품	螺栓总成	2	2	2	2			
11200	65.05701-6025A	OIL SUCTION PIPE ASS'Y	오일 흡입 파이프 조립품	吸油管总成	1	1	1	1			
11210	65.05701-5810A	· OIL SUCTION PIPE ASS'Y	· 오일 흡입 파이프 조립품	· 吸油管总成	1	1	1	1			
11220	65.05740-0017	· BRACKET ; OIL SUCTION PIPE	· 오일 흡입 파이프 브라켓	· 吸油管支架	1	1	1	1			
11230	06.01283-7114	· BOLT ; HEX. M8x22	· 육각 볼트	· 六角螺栓	1	1	1	1			
11240	65.90510-0012	· NUT	· 너 트	· 螺母	1	1	1	1			
11260	06.15010-2311	· WASHER 8.4	· 와 셔	· 垫圈	1	1	1	1			
11350	65.05903-0027A	GASKET	가스켓	衬垫	1	1	1	1			
11360	06.01913-3113	BOLT ASS'Y M8x20	볼트 조립품	螺栓总成	2	2	2	2			
11370	65.90020-0068	BOLT ; COLLARED HEX.	칼러드 육각 볼트	套圈式六角螺栓	1	1	1	1			
19050	65.98125-5011	COCK ; DRAIN	드레인 콕크	排气阀	1	1	1	1			
19060	65.98130-0006	· ADAPTER	· 어댑터	· 接头	1	1	1	1			
19070	65.98125-5010	· COCK ; DRAIN	· 드레인 콕크	· 排气阀	1	1	1	1			

Fig.009

COOLING WATER PIPE | 냉각수 파이프 | 冷却水管



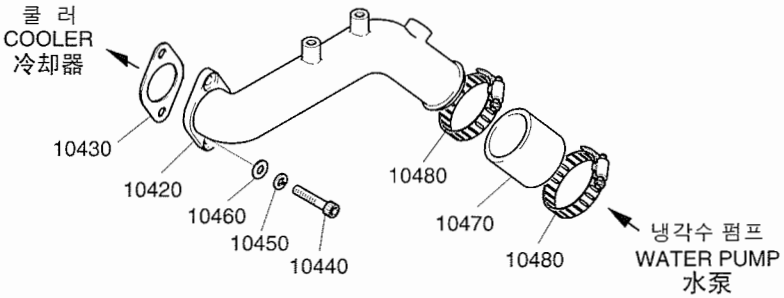


Fig.009
COOLING WATER PIPE | 냉각수 파이프 | 冷却水管

Key No.	Part No.	Description	부 품 명	零件名称	Q'ty				S.C	ICA	Serial No.
					DE 12 T	P 126 TI-1	P 126 TI	P 126 TI-II			
10010	65.06301-6034	WATER PIPE ASS'Y	냉각수 파이프 조립품	水管总成	1	1	1	1			
10020	65.06301-5147	· PIPE ; COOLING WATER	· 냉각수 파이프	· 冷却水管	1	1	1	1			
10030	65.06404-0028	· HOUSING ; THERMOSTAT	· 서모스타트 하우징	· 节温器壳	1	1	1	1			
10050	65.06903-0021	· GASKET	· 가스켓	· 衬垫	1	1	1	1			
10060	06.01923-3218	· BOLT ASS'Y M10x35	· 볼트 조립품	· 螺栓总成	2	2	2	2			
10070	65.90310-0149A	· SCREW ; PLUG M26x1.5	· 플러그 스크류	· 螺塞	1	1	1	1			
10080	06.56190-0727	· RING ; SEAL A26x34	· 시일 링	· 密封环	1	1	1	1			
10090	06.08092-2406	· SCREW ; PLUG M18x1.5 DS	· 플러그 스크류	· 螺塞	1	1	1	1			
10100	06.56190-0712	· RING ; SEAL 18x22	· 시일 링	· 密封环	1	1	1	1			
10110	65.06903-0018	GASKET ; COOLING WATER PIPE	냉각수 파이프 가스켓	冷却水管密封	2	2	2	2			
10120	06.01923-3124	BOLT ASS'Y M8x65	볼트 조립품	螺栓总成	4	4	4	4			
10190	65.98131-0075	PIPE ; CONNECTION	컨넥션 파이프	连接管路	1	1	1	1			
10200	06.56190-0706	RING ; SEAL A14x20	시일 링	密封环	1	1	1	1			
10240	65.27405-5005	SENDER ; THERMOSTAT	서모스타트 센더	温度传送器	1	1	1	1			
10250	06.56190-0708	RING ; SEAL A16x22	시일 링	密封环	1	1	1	1			
10260	66.27435-6008	SWITCH ; THERMOSTAT	서모스타트 스위치	温度调节器开关	1	1	1	1			
10300	65.06405-0025	PIPE ; WATER	냉각수 파이프	水管	1	1	1	1			
10310	06.01923-3124	BOLT ASS'Y M8x65	볼트 조립품	螺栓总成	3	3	3	3			
10350	65.06301-6037B	PIPE ; COOLING WATER	냉각수 파이프	冷却水管	1	1	1	1			
10360	65.96301-0204B	HOSE ; RUBBER	고무 호스	橡胶软管	1	1	1	1			
10370	06.67020-0108	CLAMP ; HOSE NW28	호스 클램프	软管夹	2	2	2	2			
10380	04.27405-1506	HOSE ; RUBBER 38x47x70	고무 호스	橡胶软管	1	1	1	1			
10390	06.67020-0107	CLAMP ; HOSE NW24	호스 클램프	软管夹	2	2	2	2			
10410	06.01913-3213	BOLT ASS'Y M10x20	볼트 조립품	螺栓总成	1	1	1	1			
10420	65.06301-0057A	PIPE ; COOLING WATER	냉각수 파이프	冷却水管	1	1	1	1			
10430	65.06903-0020	GASKET ; COOLING WATER PIPE	냉각수 파이프 가스켓	冷却水管密封	1	1	1	1			
10440	06.02090-0513	BOLT ; SOCKET HEAD	소켓 헤드 볼트	内六角螺栓	2	2	2	2			
10450	06.16731-2108	WASHER ; SPRING A10	스프링 와셔	弹簧垫圈	2	2	2	2			
10460	06.15010-2312	WASHER ; PLAIN 10.5	평 와셔	平垫圈	2	2	2	2			
10470	65.96301-0205A	HOSE ; RUBBER	고무 호스	橡胶软管	1	1	1	1			
10480	06.67020-0110	CLAMP ; HOSE NW S40	호스 클램프	软管夹	2	2	2	2			
20010	51.06402-0060	THERMOSTAT	서모스타트	节温器总成	1	-	-	-			
-	51.06402-0062	THERMOSTAT	서모스타트	节温器总成	-	2	2	2			
20020	65.06402-0002A	THERMOSTAT	서모스타트	节温器总成	1	-	-	-			
20030	06.56342-1208	O-RING	O-링	O-型环	2	2	2	2			
20040	65.06901A0069	GASKET	가스켓	衬垫	2	2	2	2			

Fig.010

WATER PUMP & COOLING FAN | 냉각수 펌프 및 냉각 휀 | 水泵与冷却风扇

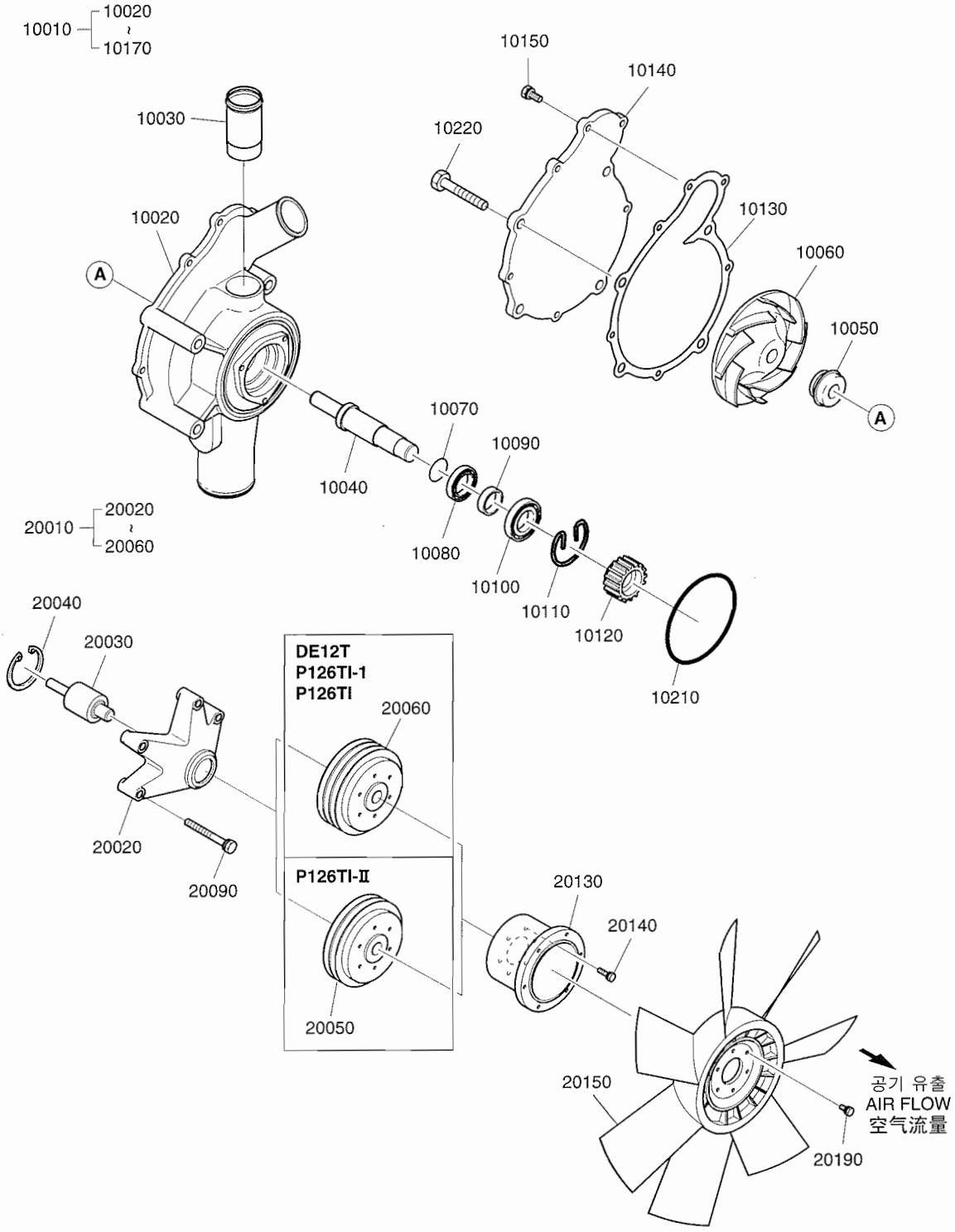


Fig.010

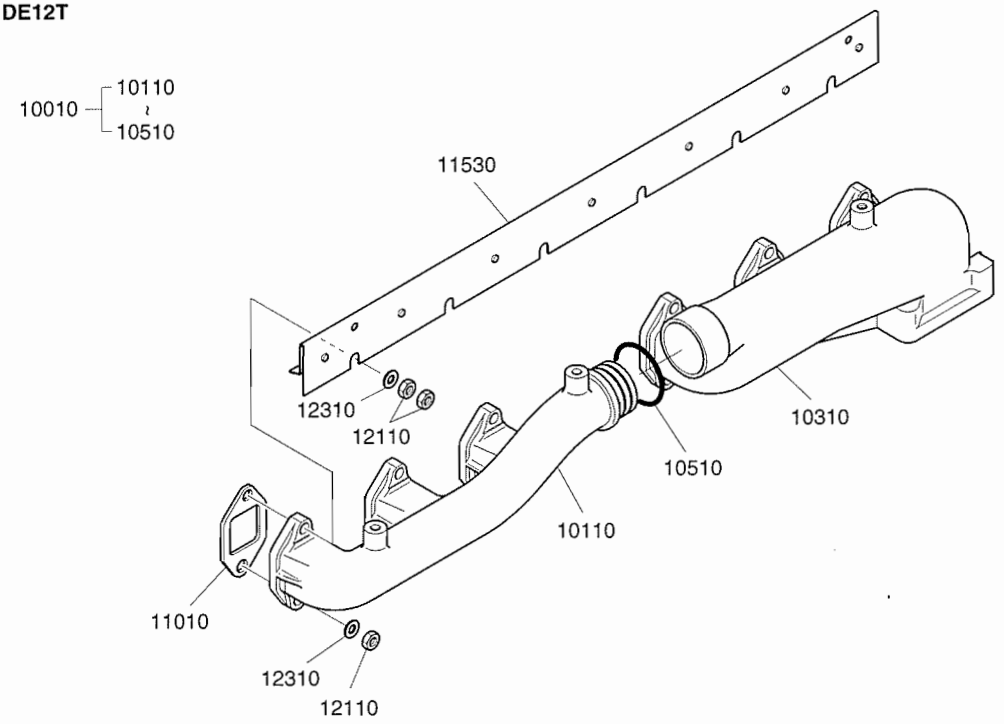
WATER PUMP & COOLING FAN | 냉각수 펌프 및 냉각 휀 | 水泵与冷却风扇

Key No.	Part No.	Description	부 품 명	零件名称	Q'ty				S.C	ICA	Serial No.
					DE 12 T	P 126 TI-1	P 126 TI	P 126 TI-II			
10010	65.06500-6157D	WATER PUMP ASS'Y	냉각수 펌프 조립품	水泵总成	1	1	1	1			
10020	65.06501-0077C	· HOUSING ; WATER PUMP	· 냉각수 펌프 하우징	· 水泵壳	1	1	1	1			
10030	65.06301-0673	· PIPE ; COOLING WATER	· 냉각수 파이프	· 冷却水管	1	1	1	1			
10040	65.06505-0041	· SHAFT	· 축	· 轴	1	1	1	1			
10050	65.06520-6007	· SEAL ; MECHANICAL	· 메카니컬 시일	· 机械密封	1	1	1	1			
10060	65.06506-0024A	· IMPELLER	· 임펠러	· 叶轮	1	1	1	1			
10070	65.01510-0103	· SEAL ; OIL	· 오일 시일	· 机油封	1	1	1	1			
10080	06.31420-4513	· BEARING ; BALL	· 볼 베어링	· 球形轴承	1	1	1	1			
10090	65.06508-0012	· SPACER	· 스페이서	· 衬套	1	1	1	1			
10100	65.93410-0038	· BEARING	· 베어링	· 轴承	1	1	1	1			
10110	06.29020-0131	· RING ; SNAP 52x2	· 스냅 링	· 卡环	1	1	1	1			
10120	65.06507-0005A	· GEAR ; WATER PUMP DRIVE	· 냉각수 펌프 구동 기어	· 水泵驱动齿轮	1	1	1	1			
10130	65.06901-0076	· GASKET ; WATER PUMP	· 냉각수 펌프 가스켓	· 冷却水泵衬垫	1	1	1	1			
10140	65.06512-0014	· COVER ; WATER PUMP HOUSING	· 냉각수 펌프 하우징 커버	· 水泵壳盖	1	1	1	1			
10150	06.01913-2914	· BOLT ASS'Y M6x22	· 볼트 조립품	· 螺栓总成	5	5	5	5			
10210	65.96501-0068	O-RING	O-링	O-型环	1	1	1	1			
10220	06.01913-3234	BOLT ASS'Y M10x130	볼트 조립품	螺栓总成	4	4	4	4			
20010	65.95800-6026	FAN MOUNTING ASS'Y	휀 마운팅 조립품	风扇固定架总成	1	1	1	-			
-	65.95800-6030	IDLE PULLEY ASS'Y	아이들 풀리 조립품	怠速皮带轮总成	-	-	-	1			
20020	65.06602-0003	· BRACKET ; IDLER	· 아이들 브라켓	· 惰轮支架	1	1	1	1			
20030	65.93410-0027	· BEARING ; WATER PUMP	· 냉각수 펌프 베어링	· 水泵轴承	1	1	1	1			
20040	06.29020-0132	· RING ; SNAP 55x2	· 스냅 링	· 卡环	1	1	1	1			
20050	65.06606-0051	· PULLEY ; FAN	· 휀 풀리	· 风扇皮带	-	-	-	1			
20060	65.06606-0041	· PULLEY ; FAN	· 휀 풀리	· 风扇皮带	1	1	1	-			
20090	06.01943-3332	BOLT ASS'Y M12x1.5x110	볼트 조립품	螺栓总成	4	4	4	4			
20130	65.06611-0112A	FLANGE ; FAN	휀 휠랜지	风扇法兰	1	1	1	1			
20140	06.01913-3117	BOLT ASS'Y M8x30	볼트 조립품	螺栓总成	6	6	6	6			
20150	65.06601-5055	FAN ; COOLING	쿨링 휀	冷却风扇	1	1	1	1			
20190	06.01913-3113	BOLT ASS'Y M8x20	볼트 조립품	螺栓总成	6	6	6	6			

Fig.011

EXHAUST MANIFOLD | 배기 매니홀드 | 排气歧管

DE12T



P126TI-1, P126TI, P126TI-Ⅱ

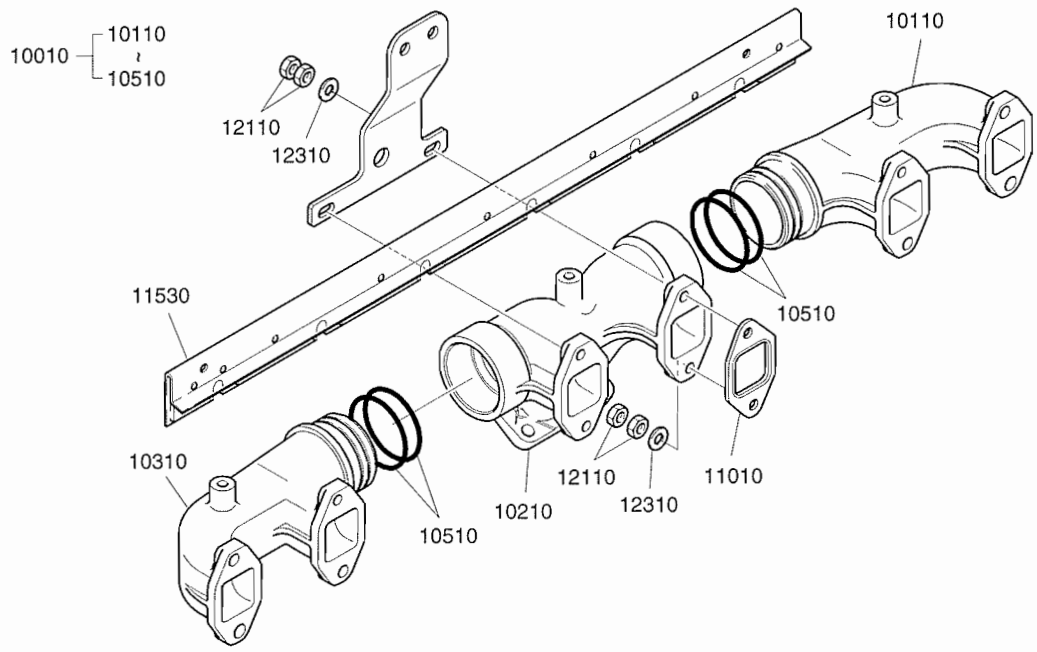


Fig.011

EXHAUST MANIFOLD | 배기 매니홀드 | 排气歧管

Key No.	Part No.	Description	부 품 명	零件名称	Q'ty				S.C	ICA	Serial No.
					DE 12 T	P 126 TI-1	P 126 TI	P 126 TI-II			
10010	65.08100-6042	EXHAUST MANIFOLD ASS'Y	배기 매니홀드 조립품	排气歧管总成	1	-	-	-			
-	65.08100-6048	EXHAUST MANIFOLD ASS'Y	배기 매니홀드 조립품	排气歧管总成	-	1	1	1			
10110	65.08101-0170	· MANIFOLD ; EXHAUST(REAR)	· 배기 매니홀드	· 排气歧管(后)	1	-	-	-			
-	65.08101-0181A	· MANIFOLD ; EXHAUST(FRONT)	· 배기 매니홀드	· 排气歧管(前)	-	1	1	1			
10210	65.08101-0182	· MANIFOLD ; EXHAUST(CENTER)	· 배기 매니홀드	· 排气歧管(中)	-	1	1	1			
10310	65.08101-0171	· MANIFOLD ; EXHAUST(REAR)	· 배기 매니홀드	· 排气歧管(后)	1	-	-	-			
-	65.08101-0183A	· MANIFOLD ; EXHAUST(REAR)	· 배기 매니홀드	· 排气歧管(后)	-	1	1	1			
10510	65.08105-0001	· RING 55.2x60	· 링	· 环	2	4	4	4			
11010	65.08901A0012	GASKET ; EXHAUST MANIFOLD	배기 매니홀드 가스켓	排气歧管衬垫	6	6	6	6			
11530	65.08120-5008G	SCREEN ; HEAT	방열판	防热屏	1	1	1	1			
12110	06.11063-8215	NUT ; HEX. M10	육각 너트	六角螺母	21	24	24	24			
12310	06.15010-2312	WASHER ; PLAIN 10.5	평 와셔	平垫圈	12	12	12	12			

Fig.012
INTAKE MANIFOLD | 흡기 매니홀드 | 进气管道

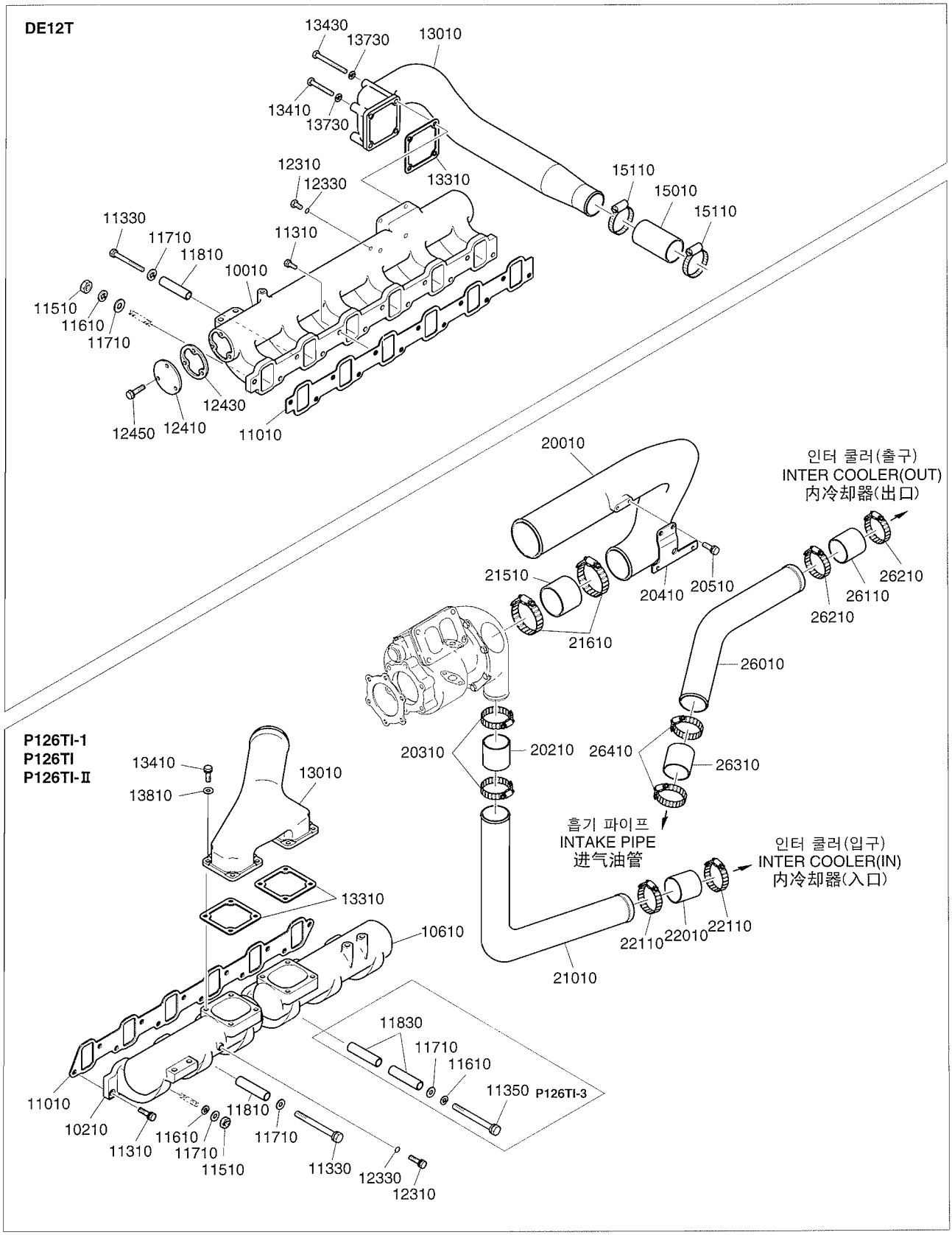
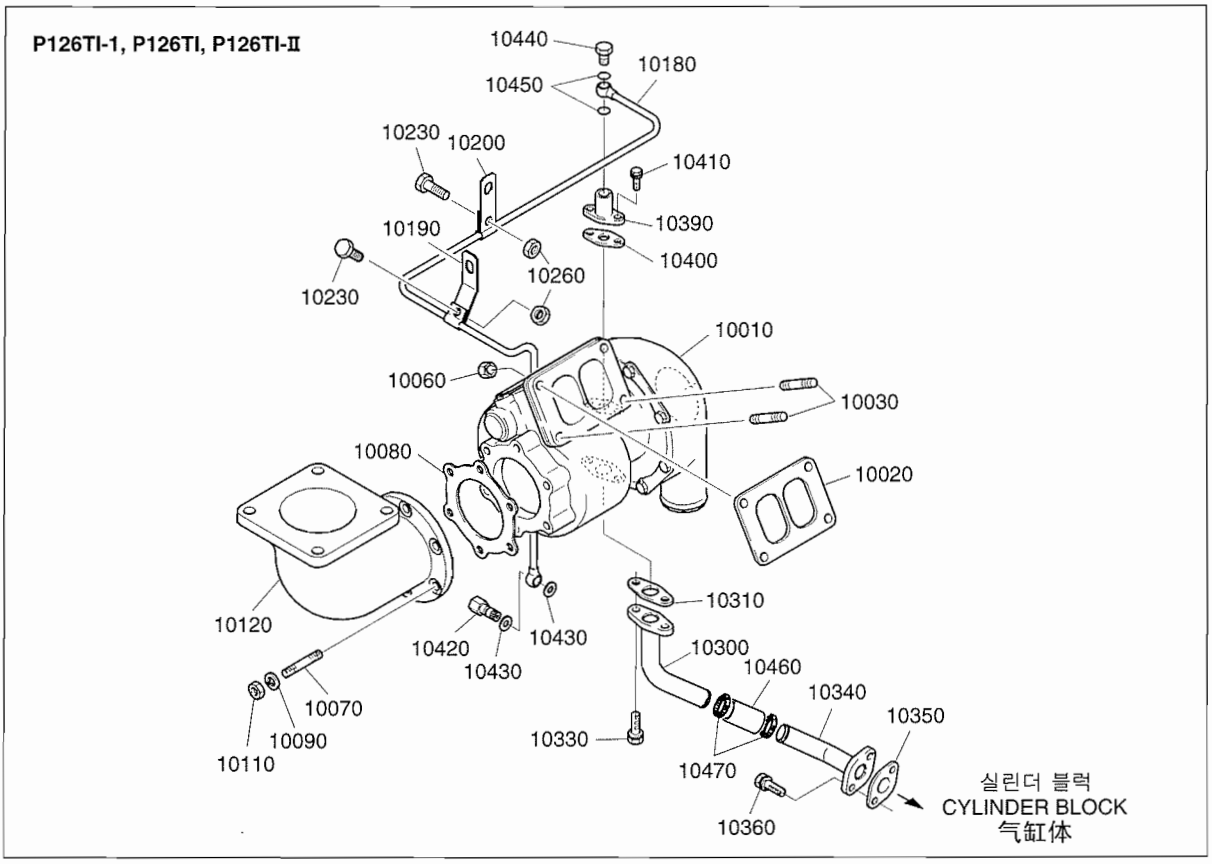


Fig.012
INTAKE MANIFOLD | 흡기 매니홀드 | 进气管道

Key No.	Part No.	Description	부 품 명	零件名称	Q'ty				S.C	ICA	Serial No.
					DE 12 T	P 126 TI-1	P 126 TI	P 126 TI-II			
10010	65.08201-5049	INTAKE MANIFOLD ASS'Y	흡기 매니홀드 조립품	进气歧管总成	1	-	-	-			
10210	65.08201-5041C	INTAKE MANIFOLD ASS'Y(REAR)	흡기 매니홀드 조립품	进气歧管总成(后)	-	1	1	1			
10610	65.08201-5045A	INTAKE MANIFOLD ASS'Y(FRONT)	흡기 매니홀드 조립품	进气歧管总成(前)	-	1	1	1			
11010	65.08902-0025	GASKET ; INTAKE MANIFOLD	흡기 매니홀드 가스켓	进气歧管衬垫	1	1	1	1			
11310	06.01923-3218	BOLT ASS'Y M10x35	볼트 조립품	螺栓总成	9	9	9	8			
11330	06.01913-3234	BOLT ASS'Y M10x130	볼트 조립품	螺栓总成	1	1	1	1			
11350	06.01014-9230	BOLT ; HEX. M10x150	육각 볼트	六角螺栓	-	-	-	1			
11510	06.11063-8215	NUT ; HEX. M10	육각 너트	六角螺母	2	2	2	2			
11610	06.16731-2108	WASHER ; SPRING A10	스프링 와셔	弹簧垫圈	2	2	2	3			
11710	06.15010-2312	WASHER ; PLAIN 10.5	평 와셔	平垫圈	3	3	3	4			
11810	65.91701-0470	SPACER	스페이서	衬套	1	1	1	1			
11830	65.91701-0171	SPACER	스페이서	衬套	-	-	-	2			
12310	65.90001-0036	BOLT ; HEX. M10x1.0x10	육각 볼트	六角螺栓	1	1	1	1			
12330	06.56180-0714	RING ; SEAL A10x15	시일 링	密封环	1	1	1	1			
12410	65.98112-0039	COVER ; INTAKE MANIFOLD	흡기 매니홀드 커버	进气歧管盖	1	-	-	-			
12430	65.08902-0074	GASKET ; INTAKE MANIFOLD	흡기 매니홀드 가스켓	进气歧管衬垫	1	-	-	-			
12450	06.01913-3120	BOLT ASS'Y M8x45	볼트 조립품	螺栓总成	3	-	-	-			
13010	65.08202-0261	PIPE ; INTAKE	흡기 파이프	进气油管	1	-	-	-			
-	65.09411-0053	PIPE ; AIR	에어 파이프	空气管	-	1	1	1			
13310	60.08904-0001	GASKET ; AIR BEND	에어 밴드 가스켓	气体弯头衬垫	1	-	-	-			
-	65.08904-0002	GASKET ; AIR HEATER	에어 히터 가스켓	暖风机衬垫	-	2	2	2			
13410	06.01013-9221	BOLT ; HEX. M10x80	육각 볼트	六角螺栓	2	-	-	-			
-	06.01913-3116	BOLT ASS'Y M8x28	볼트 조립품	螺栓总成	-	8	8	8			
13430	06.01013-9241	BOLT ; HEX. M10x115	육각 볼트	六角螺栓	2	-	-	-			
13730	06.16731-2108	WASHER ; SPRING A10	스프링 와셔	弹簧垫圈	4	-	-	-			
13810	06.15010-2311	WASHER 8.4	와 셔	垫圈	-	8	8	8			
15010	65.96301-0267	HOSE ; SILICON D65x70	실리콘 호스	硅制软管	1	-	-	-			
15110	65.97440-0097	CLAMP ; HOSE(BAND TYPE)	호스 클램프(밴드형)	软管夹(滚边形)	2	-	-	-			
20010	65.08202-5051	STAKE ; INTAKE	흡기관	进气管	-	1	1	1			
20210	65.96301-0313	HOSE ; RUBBER	고무 호스	橡胶软管	-	1	1	1			
20310	06.67020-0120	CLAMP ; HOSE	호스 클램프	软管夹	-	2	2	2			
20410	65.09443-0018	BRACKET	브라켓	支架	-	1	1	1			
20510	06.01923-3214	BOLT ASS'Y M10x22	볼트 조립품	螺栓总成	-	2	2	2			
21010	65.09411-5023	PIPE ; AIR	에어 파이프	空气管	-	1	1	1			
21510	65.96301-0315	HOSE ; SILICON	실리콘 호스	硅制软管	-	1	1	1			
21610	06.67020-0115	CLAMP ; HOSE NEW64	호스 클램프	软管夹	-	2	2	2			
22010	65.96301-0270	HOSE ; SILICON D75x80	실리콘 호스	硅制软管	-	1	1	1			
22110	65.97440-0096	CLAMP ; HOSE(BAND TYPE)	호스 클램프(밴드형)	软管夹(滚边形)	-	2	2	2			
23010	65.97480-0035	PIPE ; HOLDER	홀더 파이프	支承架油管	-	2	2	2			
23110	06.01923-3215	BOLT ASS'Y M10x25	볼트 조립품	螺栓总成	-	2	2	2			
26010	65.09411-0052	PIPE ; AIR	에어 파이프	空气管	-	1	1	1			
26110	65.96301-0271	HOSE ; SILICON D75x100	실리콘 호스	硅制软管	-	1	1	1			
26210	65.97440-0096	CLAMP ; HOSE(BAND TYPE)	호스 클램프(밴드형)	软管夹(滚边形)	-	2	2	2			
26310	65.96301-0331	HOSE ; RUBBER	고무 호스	橡胶软管	-	1	1	1			
26410	65.97440-0094	CLAMP ; HOSE(BAND TYPE)	호스 클램프(밴드형)	软管夹(滚边形)	-	2	2	2			

Fig.013

TURBO CHARGER | 터보 챠저 | 涡轮增压器



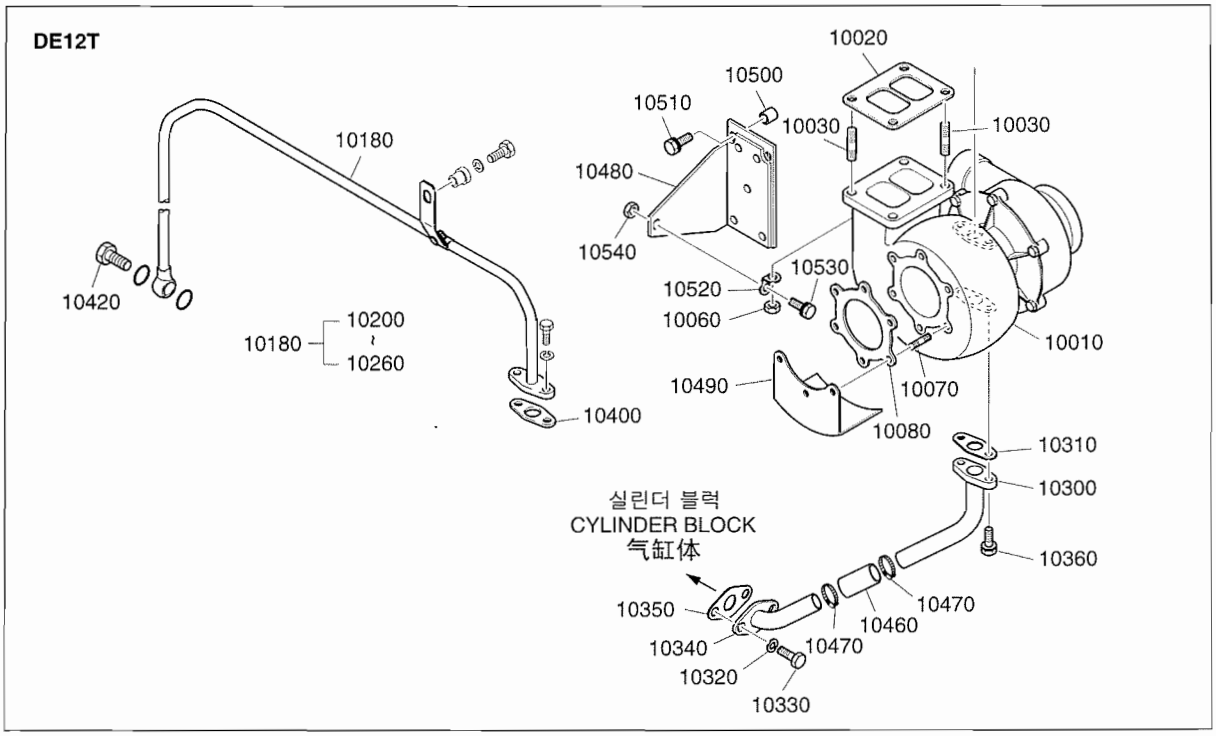


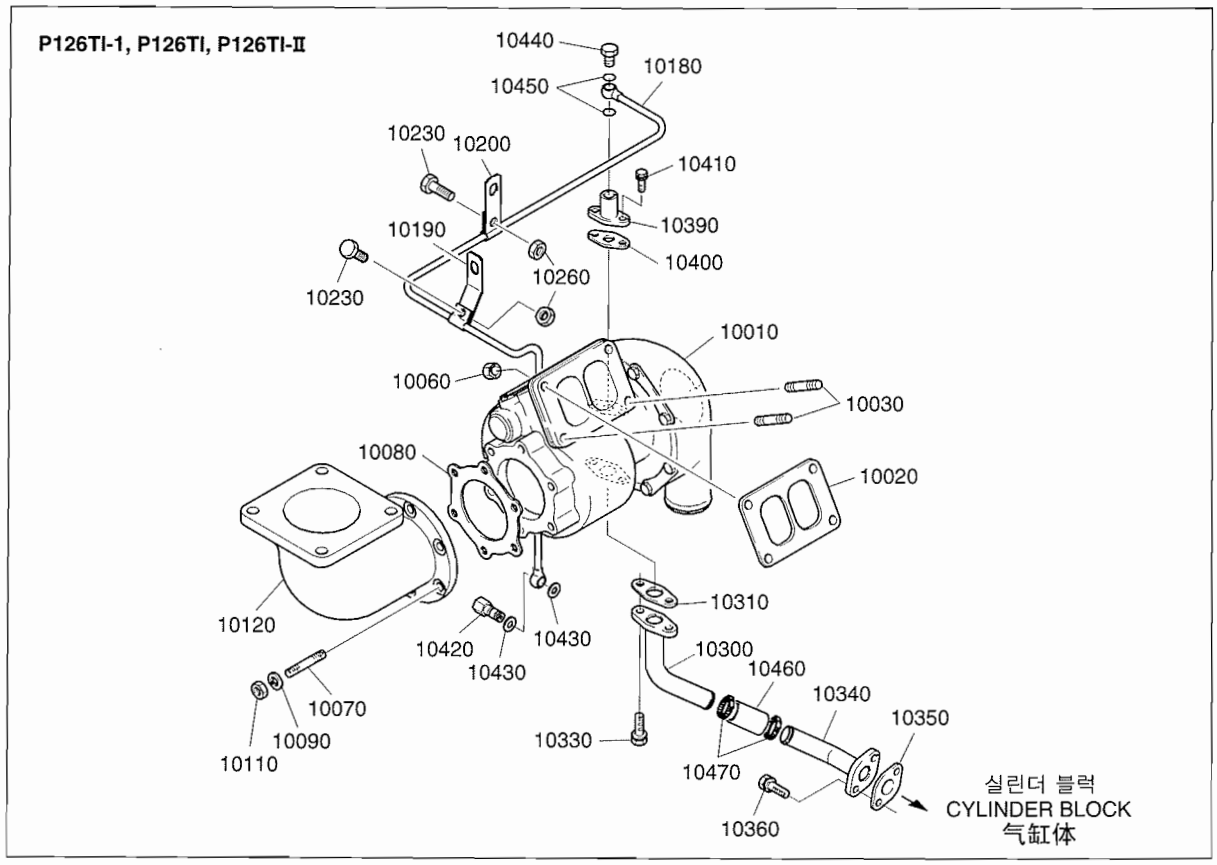
Fig.013

TURBO CHARGER | 터보 챠저 | 涡轮增压器

Key No.	Part No.	Description	부 품 명	零 件 名 称	Q'ty				S.C	ICA	Serial No.
					DE 12 T	P 126 TI-1	P 126 TI	P 126 TI-II			
10010	65.09100-7046	TURBO CHARGER ASS'Y	터보 챠저 조립품	涡轮增压器总成	-	1	1	1			
-	65.09100-7193	TURBO CHARGER ASS'Y	터보 챠저 조립품	涡轮增压器总成	1	-	-	-			
10020	65.09901-0025	GASKET ; TURBO CHARGER	터보 챠저 가스켓	涡轮增压器衬垫	1	1	1	1			
10030	65.90201-0076	BOLT ; STUD M10x1.25x30	스터드 볼트	双头螺栓	4	4	4	4			
10060	65.90535-0001	NUT ; HEX.	육각 너트	六角螺母	4	4	4	4			
10070	06.06226-0809	BOLT ; STUD M10	스터드 볼트	双头螺栓	6	6	6	6			
10080	65.08901-0063	GASKET ; EXHAUST ELBOW	배기 엘보우 가스켓	排气弯管接头衬垫	1	1	1	1			
10090	06.16731-2108	WASHER ; SPRING A10	스프링 와셔	弹簧垫圈	-	6	6	6			
10110	06.11063-8215	NUT ; HEX. M10	육각 너트	六角螺母	-	6	6	6			
10120	65.08112-0022	ELBOW ; EXHAUST(R.H.)	배기 엘보우	排气弯管接头	-	1	1	1			
10180	65.05701-~~5283A~~ 5652	OIL PIPE ASS'Y	오일 파이프 조립품	机油管总成	-	1	1	1			
-	65.05701-~~5283~~ 5683	PIPE ; OIL DELIVERY	오일 공급 파이프	输油管	1	-	-	-			
10190	65.97401-0155	· CLIP ; PIPE	· 파이프 클립	· 管夹	-	1	1	1			
10200	65.97401-0154A	· CLIP ; PIPE	· 파이프 클립	· 管夹	-	1	1	1			
-	65.97401-2016	· CLIP ; PIPE	· 파이프 클립	· 管夹	1	-	-	-			
10230	06.01283-6910	· BOLT ; HEX. M6x12	· 육각 볼트	· 六角螺栓	1	-	-	-			
-	06.01913-2910	· BOLT ; HEX. M6x12	· 육각 볼트	· 六角螺栓	-	2	2	2			
10250	06.16731-2105	· WASHER ; SPRING A6	· 스프링 와셔	· 弹簧垫圈	1	-	-	-			
10260	06.11063-8212	· NUT ; HEX. M6	· 육각 너트	· 六角螺母	1	2	2	2			
10300	65.05701-5376	PIPE ; OIL	오일 파이프	机油管	-	1	1	1			
-	65.05701-5807	PIPE ; OIL RETURN	오일 리턴 파이프	回油管	1	-	-	-			
10310	65.96601-0045A	GASKET ; TURBO CHARGER OIL RETURN	터보 챠저 오일 리턴 가스켓	涡轮增压器回油衬垫	1	1	1	1			
10320	06.16731-2109	WASHER ; SPRING A12	스프링 와셔	弹簧垫圈	2	-	-	-			
10330	06.01733-4307	BOLT ; HEX. M12x1.5x20	육각 볼트	六角螺栓	2	-	-	-			
-	06.01913-3114	BOLT ASS'Y M8x22	볼트 조립품	螺栓总成	-	2	2	2			
10340	65.05701-5377	PIPE ; OIL	오일 파이프	机油管	-	1	1	1			
-	65.05701-5806	PIPE ; OIL RETURN	오일 리턴 파이프	回油管	1	-	-	-			
10350	65.05903-0030A	GASKET ; OIL RETURN PIPE	오일 리턴 파이프 가스켓	回油管衬垫	1	-	-	-			
-	65.96601-0012	GASKET ; TURBO CHARGER OIL RETURN	터보 챠저 오일 리턴 가스켓	涡轮增压器回油衬垫	-	1	1	1			
10360	06.01913-3112	BOLT ASS'Y M8x18	볼트 조립품	螺栓总成	-	2	2	2			
10390	65.98131-5008	ADAPTER FLANGE ASS'Y	어댑터 플랜지 조립품	接头法兰总成	-	1	1	1			
10400	65.96601-0046A	GASKET ; OIL PIPE ADAPTER	오일 파이프 어댑터 가스켓	油管接头衬垫	1	1	1	1			
10410	06.01913-3113	BOLT ASS'Y M8x20	볼트 조립품	螺栓总成	-	2	2	2			
10420	65.98131-0037	NIPPLE	니 플	喷嘴	1	1	1	1			
10430	06.56190-0704	RING ; SEAL A12x18	시일 링	密封环	-	2	2	2			
10440	06.78144-2403	SCREW ; HOLLOW M12x1.5	홀로우 스크류	空心螺钉	-	1	1	1			
10450	06.56190-0704	RING ; SEAL A12x18	시일 링	密封环	-	2	2	2			
10460	65.96301-0327	HOSE ; RUBBER	고무 호스	橡胶软管	1	1	1	1			
10470	06.67020-0106	CLAMP ; HOSE NW S20	호스 클램프	软管夹	2	2	2	2			
10480	65.09141-0007	SCREEN ; HEAT	방열판	防热屏	1	-	-	-			
10490	65.09141-0017	SCREEN ; HEAT	방열판	防热屏	1	-	-	-			
10500	65.91701-0031	SPACER	스페이서	衬套	2	-	-	-			
10510	06.01914-3215	BOLT ASS'Y M10x25	볼트 조립품	螺栓总成	2	-	-	-			
10520	65.09140-0001	BRACKET	브라켓	支架	1	-	-	-			

Fig.013

TURBO CHARGER | 터보 챠저 | 涡轮增压器



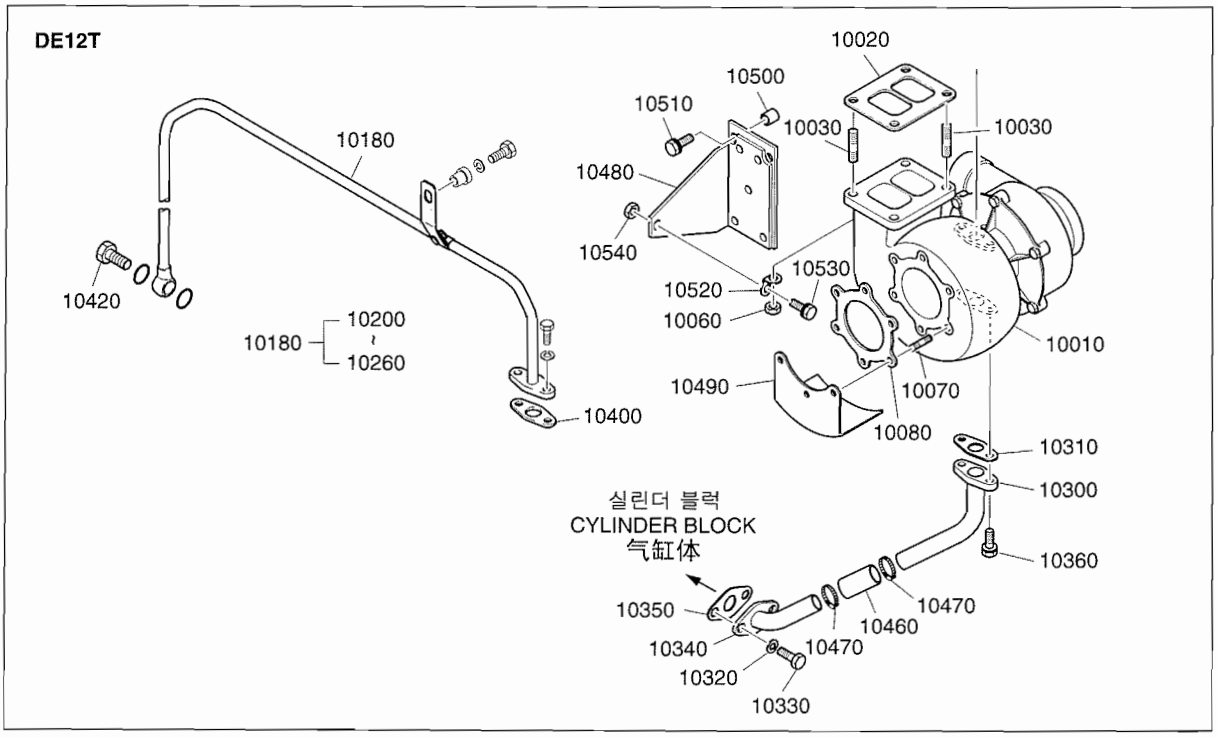


Fig.013

TURBO CHARGER | 터보 챠저 | 涡轮增压器

Key No.	Part No.	Description	부 품 명	零 件 名 称	Q'ty				S.C	ICA	Serial No.
					DE 12 T	P 126 TI-1	P 126 TI	P 126 TI-II			
10530	06.01913-3111	BOLT ASS'Y M8x16	볼트 조립품	螺栓总成	1	-	-	-			
10540	06.11063-8214	NUT ; HEX. M8	육각 너트	六角螺母	1	-	-	-			

Fig.014

INJECTION NOZZLE & INJECTION PIPE | 분사 노즐 및 분사 파이프 | 喷嘴和喷管

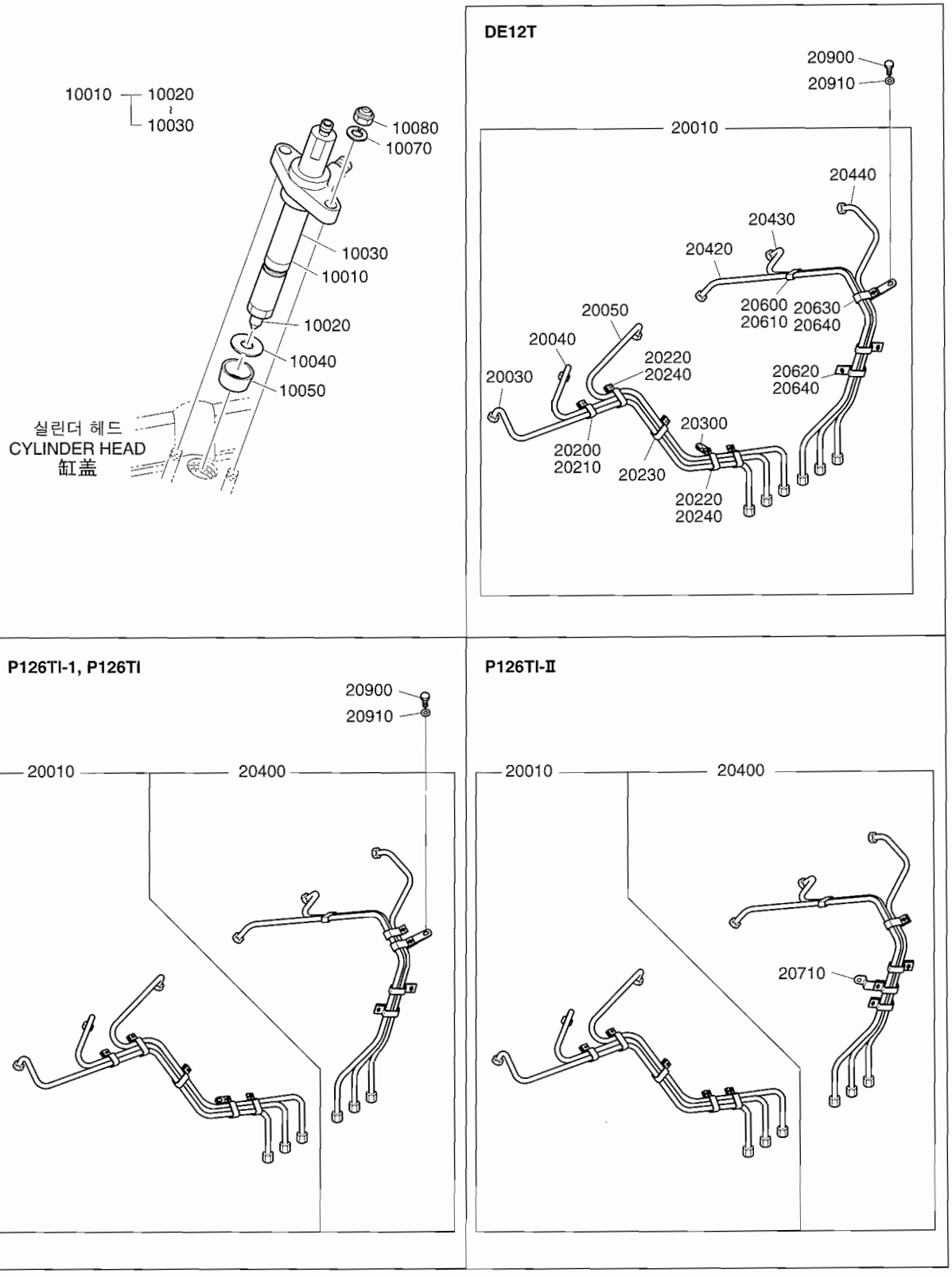


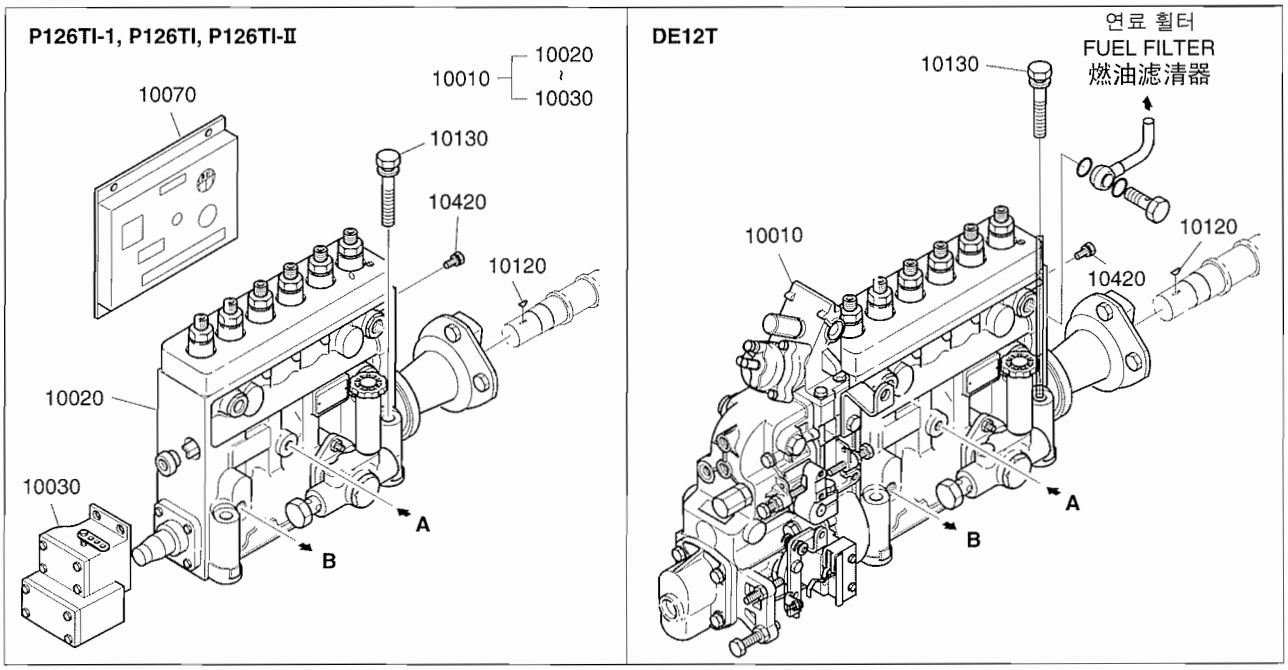
Fig.014

INJECTION NOZZLE & INJECTION PIPE | 분사 노즐 및 분사 파이프 | 喷嘴和喷管

Key No.	Part No.	Description	부 품 명	零件名称	Q'ty				S.C	ICA	Serial No.
					DE 12 T	P 126 TI-1	P 126 TI	P 126 TI-II			
10010	65.10101-7054	NOZZLE & HOLDER ASS'Y	노즐 및 홀더 조립품	喷油嘴座总成	-	6	6	6			
-	65.10101-7300	NOZZLE & HOLDER ASS'Y	노즐 및 홀더 조립품	喷油嘴座总成	6	-	-	-			
10020	65.10102-6046	· NOZZLE ASS'Y	· 노즐 조립품	· 喷油嘴总成	1	-	-	-			
-	65.10102-6048	· NOZZLE	· 노 즐	· 喷油嘴	-	1	1	1			
10030	65.10115-6001	· HOLDER ; NOZZLE	· 노즐 홀더	· 喷油嘴座	-	1	1	1			
10040	65.98701-0010	RING ; SEAL	시일 링	密封环	6	6	6	6			
10050	65.96401-0011	SEAL ; DUST	더스트 시일	集尘密封	6	6	6	6			
10070	06.16731-2105	WASHER ; SPRING A6	스프링 와셔	弹簧垫圈	12	12	12	12			
10080	06.11063-8212	NUT ; HEX. M6	육각 너트	六角螺母	12	12	12	12			
20010	65.10301-6043A	PIPE ; INJECTION	분사 파이프	喷油管	-	1	1	1			
-	65.10301-7004B	INJECTION PIPE ASS'Y	분사 파이프 조립품	喷油管总成	1	-	-	-			
20030	65.10301-5247	· PIPE ; INJECTION	· 분사 파이프	· 喷油管	1	-	-	-			
20040	65.10301-5248	· PIPE ; INJECTION	· 분사 파이프	· 喷油管	1	-	-	-			
20050	65.10301-5249	· PIPE ; INJECTION	· 분사 파이프	· 喷油管	1	-	-	-			
20200	65.97401-6001A	· PIPE CLIP ASS'Y	· 파이프 클립 조립품	· 管夹总成	1	-	-	-			
20210	65.96230-0001	· INSULATOR ; RUBBER	· 고무 인슐레이터	· 橡胶绝缘体	1	-	-	-			
20220	65.97401-6002A	· PIPE CLIP ASS'Y	· 파이프 클립 조립품	· 管夹总成	3	-	-	-			
20230	65.97401-6004	· PIPE CLIP ASS'Y	· 파이프 클립 조립품	· 管夹总成	1	-	-	-			
20240	65.96230-0002	· INSULATOR ; RUBBER	· 고무 인슐레이터	· 橡胶绝缘体	4	-	-	-			
20300	65.97480-0166	· HOLDER ; INJECTION PIPE	· 분사 파이프 홀더	· 喷油管支承架	1	-	-	-			
20400	65.10301-6042B	PIPE ; INJECTION	분사 파이프	喷油管	-	1	1	-			
-	65.10301-6078	PIPE ; INJECTION	분사 파이프	喷油管	-	-	-	1			
20420	65.10301-5250	· PIPE ; INJECTION	· 분사 파이프	· 喷油管	1	-	-	-			
20430	65.10301-5251	· PIPE ; INJECTION	· 분사 파이프	· 喷油管	1	-	-	-			
20440	65.10301-5252	· PIPE ; INJECTION	· 분사 파이프	· 喷油管	1	-	-	-			
20600	65.97401-6001A	· PIPE CLIP ASS'Y	· 파이프 클립 조립품	· 管夹总成	1	-	-	-			
20610	65.96230-0001	· INSULATOR ; RUBBER	· 고무 인슐레이터	· 橡胶绝缘体	1	-	-	-			
20620	65.97401-6002A	· PIPE CLIP ASS'Y	· 파이프 클립 조립품	· 管夹总成	3	-	-	-			
20630	65.97401-6004	· PIPE CLIP ASS'Y	· 파이프 클립 조립품	· 管夹总成	1	-	-	-			
20640	65.96230-0002	· INSULATOR ; RUBBER	· 고무 인슐레이터	· 橡胶绝缘体	4	-	-	-			
20710	65.97401-0171	· CLIP ; PIPE	· 파이프 클립	· 管夹	-	-	-	1			
20900	06.01913-3213	BOLT ASS'Y M10x20	볼트 조립품	螺栓总成	1	1	1	-			
20910	06.15010-2312	WASHER ; PLAIN 10.5	평 와셔	平垫圈	1	1	1	-			

Fig.015

INJECTION PUMP | 분사 펌프 | 喷射泵



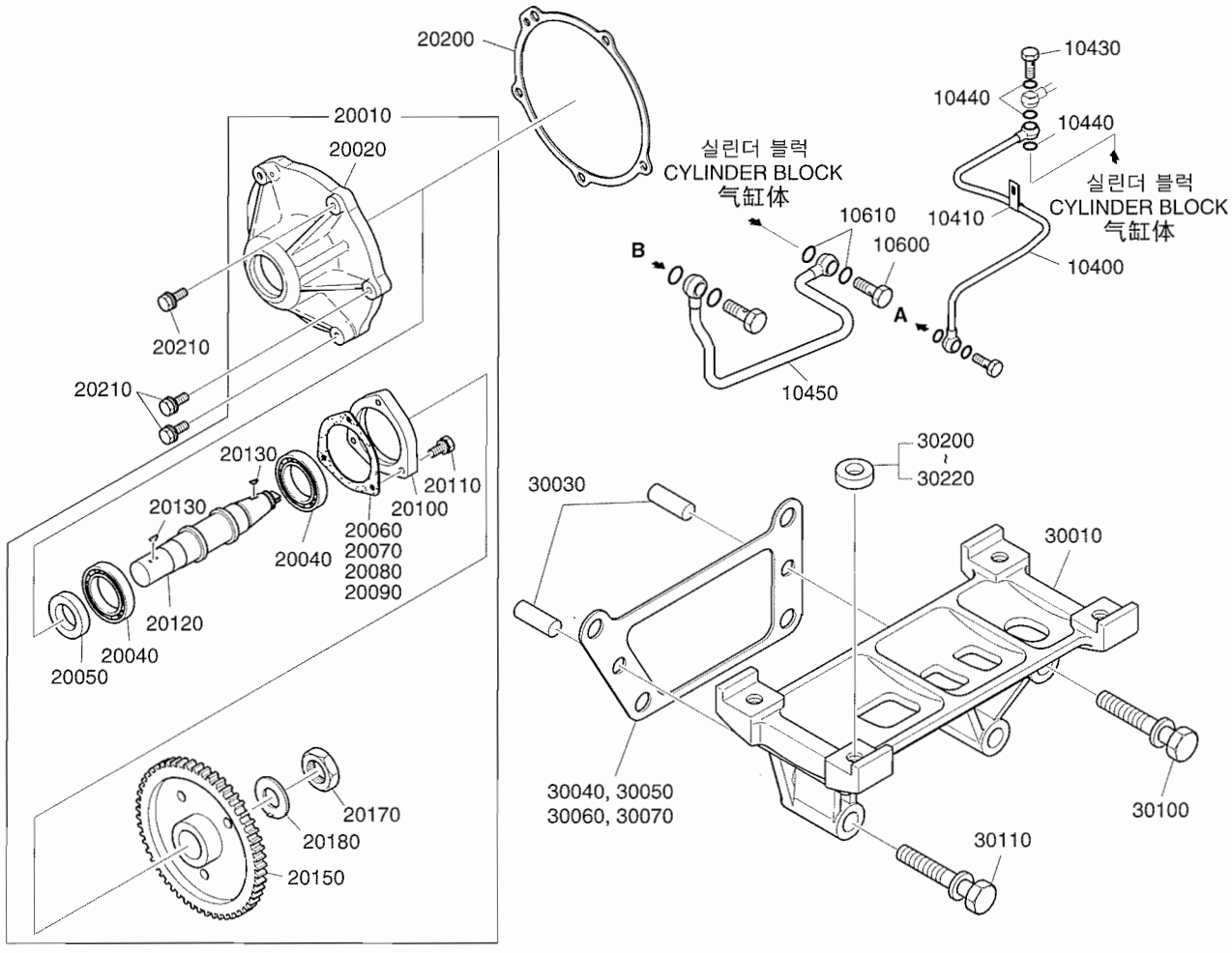


Fig.015
INJECTION PUMP | 분사 펌프 | 喷射泵

Key No.	Part No.	Description	부 품 명	零 件 名 称	Q'ty				S.C	ICA	Serial No.
					DE 12 T	P 126 TI-1	P 126 TI	P 126 TI-II			
10010	65.11101-7222	INJECTION PUMP ASS'Y	분사 펌프 조립품	喷射泵总成	1	-	-	-			
-	65.11101-8008	INJECTION PUMP ASS'Y	분사 펌프 조립품	喷射泵总成	-	1	1	1			
10020	65.11101-7376	· INJECTION PUMP ASS'Y	· 분사 펌프 조립품	· 喷射泵总成	-	1	1	1			
10030	65.11501-7006	· GOVERNOR ASS'Y	· 가버너 조립품	· 调节器总成	-	1	1	1			
10070	65.11220-7006	CONTROLLER ; ACTUATOR	엑츄에이터 컨트롤러	控制器执行器	-	1	1	1			
10120	06.29141-0215	KEY ; WOODRUFF 6x22	반달 키	半圆键	1	1	1	1			
10130	06.01923-3228	BOLT ASS'Y M10x85	볼트 조립품	螺栓总成	4	4	4	4			
10400	65.05701-5313	PIPE ; OIL	오일 파이프	机油管	1	1	1	1			
10410	65.97401-0143	· CLIP ; PIPE	· 파이프 클립	· 管夹	1	1	1	1			
10420	06.01923-2910	BOLT ASS'Y M6x12	볼트 조립품	螺栓总成	1	1	1	1			
10430	65.98150-0050	SCREW ; HOLLOW	홀로우 스크류	空心螺钉	1	1	1	1			
10440	06.56180-0714	RING ; SEAL A10x15	시일 링	密封环	3	3	3	3			
10450	65.05701-5624	PIPE ; OIL	오일 파이프	机油管	1	1	1	1			
10600	06.78144-2204	SCREW ; HOLLOW NW10	홀로우 스크류	空心螺钉	1	1	1	1			
10610	06.56190-0706	RING ; SEAL A14x20	시일 링	密封环	2	2	2	2			
20010	65.11301-7010F	INJECTION DRIVE ASS'Y	분사 구동 조립품	喷射驱动总成	1	1	1	1			
20020	65.11309-0007A	· CASE ; BEARING	· 베어링 케이스	· 球形轴承箱	1	1	1	1			
20040	06.32092-0307	· BEARING ; TAPER ROLLER	· 테이퍼 롤러 베이링	· 圆锥滚子轴承	2	2	2	2			
20050	65.01510-0039	· SEAL ; OIL	· 오일 시일	· 机油封	1	1	1	1			
20060	65.11308-0001	· SHIM 0.5MM	· 쉼	· 垫片	1	1	1	1			
20070	65.11308-0002	· SHIM 0.2MM(ALTV)	· 쉼	· 垫片	1	1	1	1			
20080	65.11308-0003	· SHIM 0.15MM(ALTV)	· 쉼	· 垫片	1	1	1	1			
20090	65.11308-0004	· SHIM 0.1MM(ALTV)	· 쉼	· 垫片	1	1	1	1			
20100	65.11312-0007	· COVER ; INJECTION PUMP BEARING	· 분사 펌프 베어링 커버	· 喷油泵轴承盖	1	1	1	1			
20110	06.01913-3115	· BOLT ASS'Y M8x25	· 볼트 조립품	· 螺栓总成	3	3	3	3			
20120	65.11302-0009A	· SHAFT	· 축	· 轴	1	1	1	1			
20130	06.29141-0215	· KEY ; WOODRUFF 6x22	· 반달 키	· 半圆键	1	1	1	1			
20150	65.11301-0013C	· GEAR ; DRIVE	· 구동 기어	· 驱动齿轮	1	1	1	1			
20170	06.11250-4329	· NUT ; HEX. M24x1.5	· 육각 너트	· 六角螺母	1	1	1	1			
20180	06.16050-0316	· WASHER ; LOCK	· 록크 와셔	· 锁止垫圈	1	1	1	1			
20200	65.11902-0017	GASKET	가스켓	衬垫	1	1	1	1			
20210	65.90020-0079	BOLT ; COLLARED HEX.	칼러드 육각 볼트	套圈式六角螺栓	3	3	3	3			
30010	65.11401-0033	BRACKET ; INJECTION PUMP MOUNTING	분사 펌프 마운팅 브라켓	喷油泵安装支架	1	1	1	1			
30030	06.22022-1112	PIN ; DOWEL 10M6x20	다우얼 핀	定位销	2	2	2	2			
30040	65.11405-0005	SHIM 0.1MM	쉼	垫片	1	1	1	1			
30050	65.11405-0006	SHIM 0.15MM(ALTV)	쉼	垫片	1	1	1	1			
30060	65.11405-0007	SHIM 0.2MM(ALTV)	쉼	垫片	1	1	1	1			
30070	65.11405-0008	SHIM 0.5MM(ALTV)	쉼	垫片	1	1	1	1			
30100	06.01943-3332	BOLT ASS'Y M12x1.5x110	볼트 조립품	螺栓总成	2	2	2	2			
30110	06.01943-7324	BOLT ASS'Y M12x65	볼트 조립품	螺栓总成	2	2	2	2			
30200	65.11405-0009	SHIM 0.1MM	쉼	垫片	4	4	4	4			
30210	65.11405-0010	SHIM 0.3MM	쉼	垫片	4	4	4	4			
30220	65.11405-0013	SHIM 0.2MM	쉼	垫片	1	1	1	1			

Fig.016

FUEL PIPE & FUEL FILTER | 연료 파이프 및 연료 휠터 | 燃油管与燃油滤清器

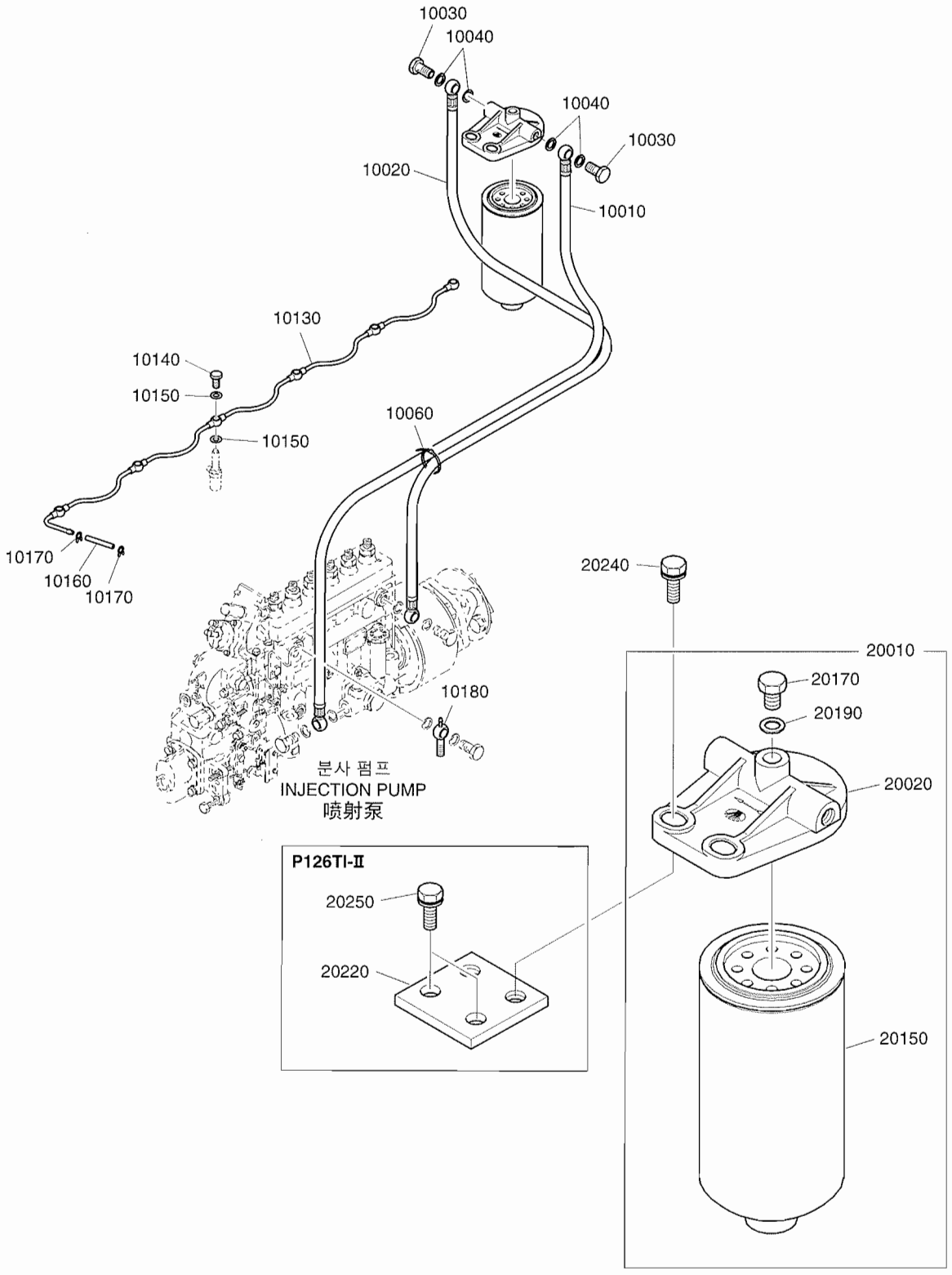


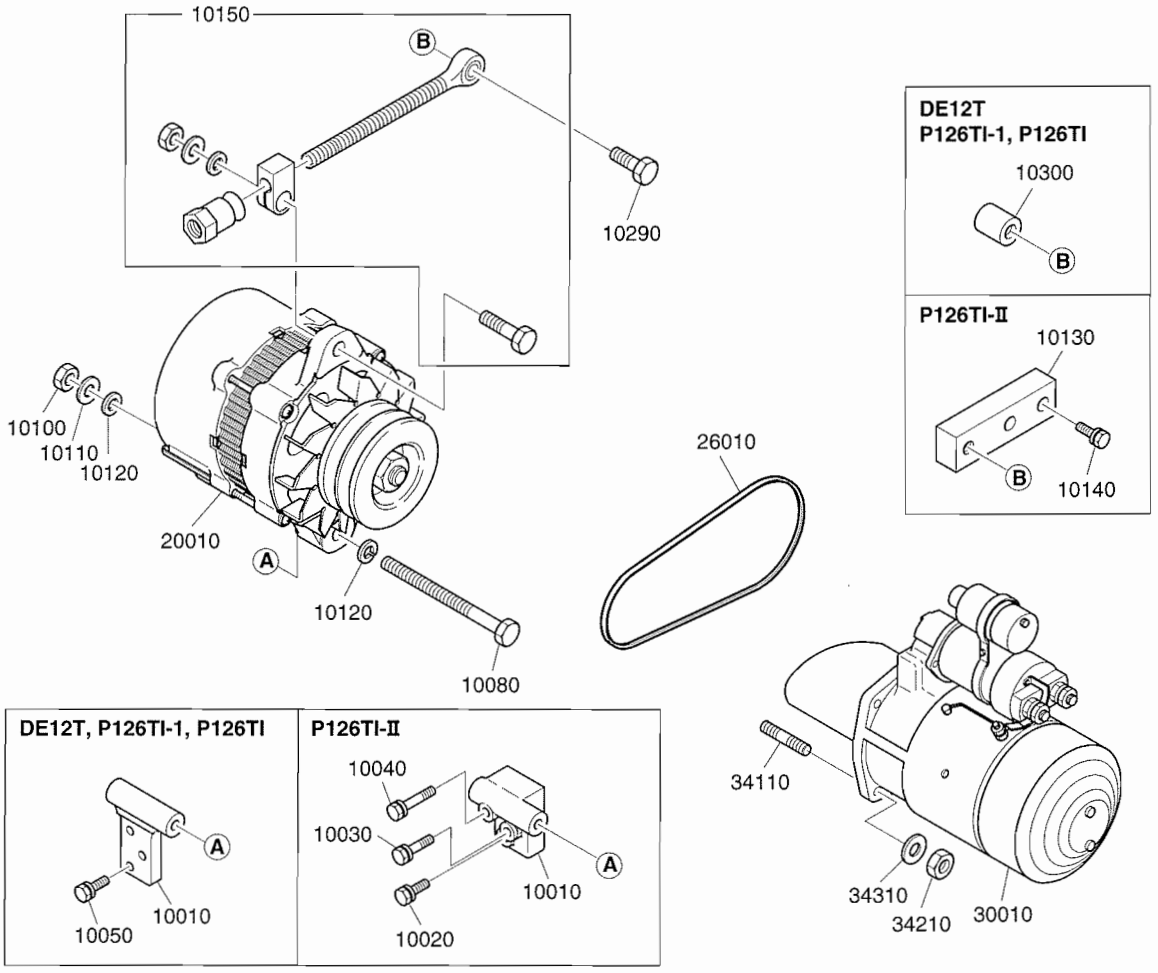
Fig.016

FUEL PIPE & FUEL FILTER | 연료 파이프 및 연료 휠터 | 燃油管与燃油滤清器

Key No.	Part No.	Description	부 품 명	零件名称	Q'ty				S.C	ICA	Serial No.
					DE 12 T	P 126 TI-1	P 126 TI	P 126 TI-II			
10010	60.96340-5015	HOSE ; FUEL 550L	연료 호스	燃油软管	1	1	1	1			
10020	60.96340-5023	HOSE ; FUEL 550L	연료 호스	燃油软管	1	1	1	1			
10030	06.78144-2204	SCREW ; HOLLOW NW10	홀로우 스크류	空心螺钉	2	2	2	2			
10040	06.56190-0706	RING ; SEAL A14x20	시일 링	密封环	4	4	4	4			
10060	65.97460-0001	BAND ; TENSION	인장 밴드	张紧带	1	1	1	1			
10130	65.12301-5165A	FUEL PIPE ASS'Y	연료 파이프 조립품	输油管总成	1	1	1	1			
10140	65.98150-0042A	SCREW ; HOLLOW M8x1	홀로우 스크류	空心螺钉	6	6	6	6			
10150	06.56180-0712	RING ; SEAL A8x14	시일 링	密封环	12	12	12	12			
10160	65.96330-0134	HOSE ; FUEL	연료 호스	燃油软管	1	1	1	1			
10170	65.97445-0001	CLAMP ; SPRING	스프링 클램프	弹簧夹	2	2	2	2			
10180	65.98101-5005	DOUBLE BANJO UNION ASS'Y	더블 벤조 유니언 조립품	双向鼓形管接头总成	1	1	1	1			
20010	65.12501-7023	FUEL FILTER ASS'Y	연료 휠터 조립품	燃油滤清器总成	1	1	1	1			
20020	65.12504-5013A	· HEAD ; FUEL FILTER	· 연료 휠터 헤드	· 燃油滤清器盖	1	1	1	1			
20150	65.12503-5016	· ELEMENT ; FUEL FILTER	· 연료 휠터 엘레멘트	· 燃油滤清器芯	1	1	1	1			
20170	65.90310-0143	· SCREW ; PLUG M10x1.5	· 플러그 스크류	· 螺塞	1	1	1	1			
20190	06.56180-0716	· RING ; SEAL A10x16	· 시일 링	· 密封环	1	1	1	1			
20220	65.19101-0013	BRACKET ; ALTERNATOR MOUNTING	발전기 마운팅 브라켓	发电机壳体支架	-	-	-	1			
20240	06.01953-3318	BOLT ASS'Y M12x1.5x35	볼트 조립품	螺栓总成	2	2	2	2			
20250	06.01943-3317	BOLT ASS'Y M12x1.5x30	볼트 조립품	螺栓总成	-	-	-	2			

Fig.017

ALTERNATOR & STARTER | 발전기 및 시동 전동기 | 发电机与启动器



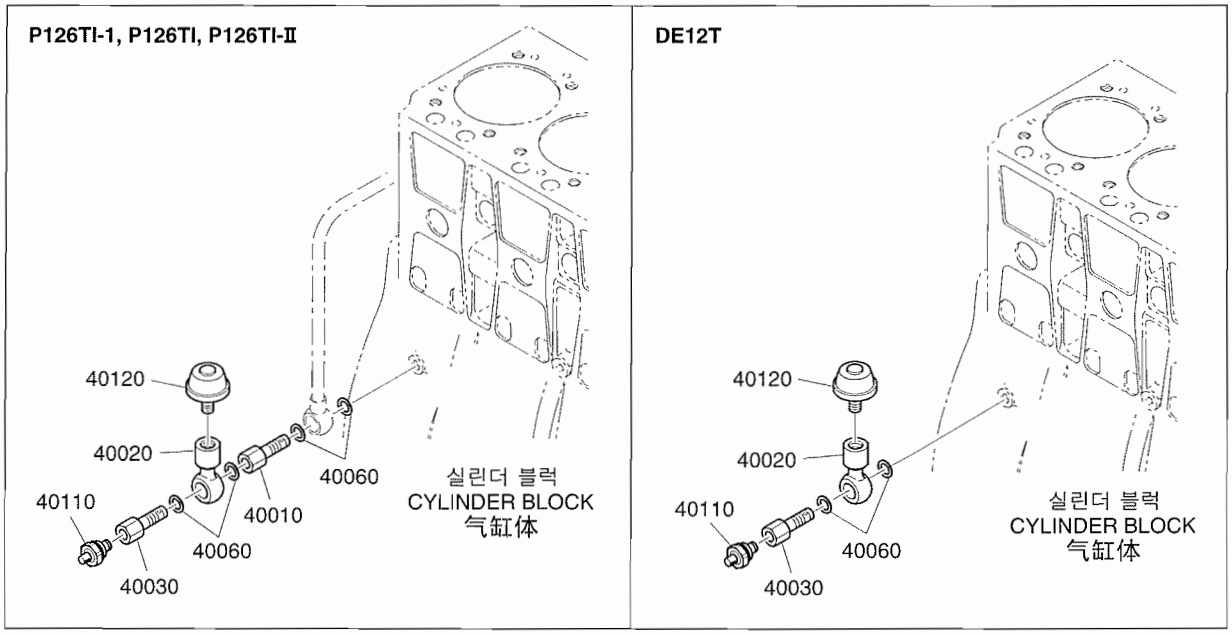


Fig.017

ALTERNATOR & STARTER | 발전기 및 시동 전동기 | 发电机与启动器

Key No.	Part No.	Description	부 품 명	零件名称	Q'ty				S.C	ICA	Serial No.
					DE 12 T	P 126 TI-1	P 126 TI	P 126 TI-II			
10010	65.19101-0085	BRACKET	브라켓	支架	1	1	1	-			
-	65.19102-0080	BRACKET ; ALTERNATOR MOUNTING	발전기 마운팅 브라켓	发电机壳体支架	-	-	-	1			
10020	06.01913-3219	BOLT ASS'Y M10x40	볼트 조립품	螺栓总成	-	-	-	1			
10030	06.01913-3222	BOLT ; HEX. M10x1.5x55	육각 볼트	六角螺栓	-	-	-	1			
10040	06.01914-3225	BOLT ASS'Y M10x70	볼트 조립품	螺栓总成	-	-	-	1			
10050	06.01913-3217	BOLT ASS'Y M10x30	볼트 조립품	螺栓总成	3	3	3	-			
10080	06.01494-4327	BOLT ; HEX.	육각 볼트	六角螺栓	1	1	1	1			
10100	06.11063-9216	NUT ; HEX. M12x1.5	육각 너트	六角螺母	1	1	1	1			
10110	06.16731-6109	WASHER ; SPRING A12	스프링 와셔	弹簧垫圈	1	1	1	1			
10120	06.15010-2313	WASHER ; PLAIN	평 와셔	平垫圈	2	2	2	1			
10130	65.19101-0012	BRACKET ; ALTERNATOR MOUNTING	발전기 마운팅 브라켓	发电机壳体支架	-	-	-	1			
10140	06.01943-3321	BOLT ASS'Y M12x1.5x50	볼트 조립품	螺栓总成	-	-	-	2			
10150	65.19103-6011A	EYE BOLT ASS'Y	아이 볼트 조립품	吊环螺栓总成	1	1	1	1			
10290	06.01943-3319	BOLT ASS'Y M12x1.5x40	볼트 조립품	螺栓总成	-	-	-	1			
-	06.01943-3321	BOLT ASS'Y M12x1.5x50	볼트 조립품	螺栓总成	1	1	1	-			
10300	65.91701-0542	SPACER	스페이서	衬套	1	1	1	-			
20010	65.26101-7153A	ALTERNATOR	발전기	发电机	1	1	1	1			
26010	65.96801-0~~050~~	V-BELT 1575L	V-벨트	V型皮带	-	-	-	1			
-	65.96801-0084	V-BELT 2x13x1500	V-벨트	V型皮带	1	1	1	-			
30010	65.26201-7049A	STARTER	시동 전동기	启动器	1	1	1	1			
34110	06.06225-0808	BOLT ; STUD M10x30	스터드 볼트	双头螺栓	3	3	3	3			
34210	06.11063-8215	NUT ; HEX. M10	육각 너트	六角螺母	3	3	3	3			
34310	06.16731-2108	WASHER ; SPRING A10	스프링 와셔	弹簧垫圈	3	3	3	3			
40010	65.98131-0037	NIPPLE	니 플	喷嘴	-	1	1	1			
40020	65.98130-0076	ADAPTER	어댑터	接头	1	1	1	1			
40030	65.98150-0002	ADAPTER ; OIL PRESSURE	오일 압력 어댑터	机油压力接头	1	1	1	1			
40060	06.56190-0704	RING ; SEAL A12x18	시일 링	密封环	2	4	4	4			
40110	65.27441-7007	SWITCH ; OIL PRESSURE	오일 압력 스위치	机油压力开关	1	1	1	1			
40120	67.27435-6003	SENDER ; OIL PRESSURE	오일 압력 센더	油压计发射器	1	1	1	1			

Fig.018

ENGINE MOUNTING & ETC | 엔진 마운팅 및 기타 | 发动机固定架及其它

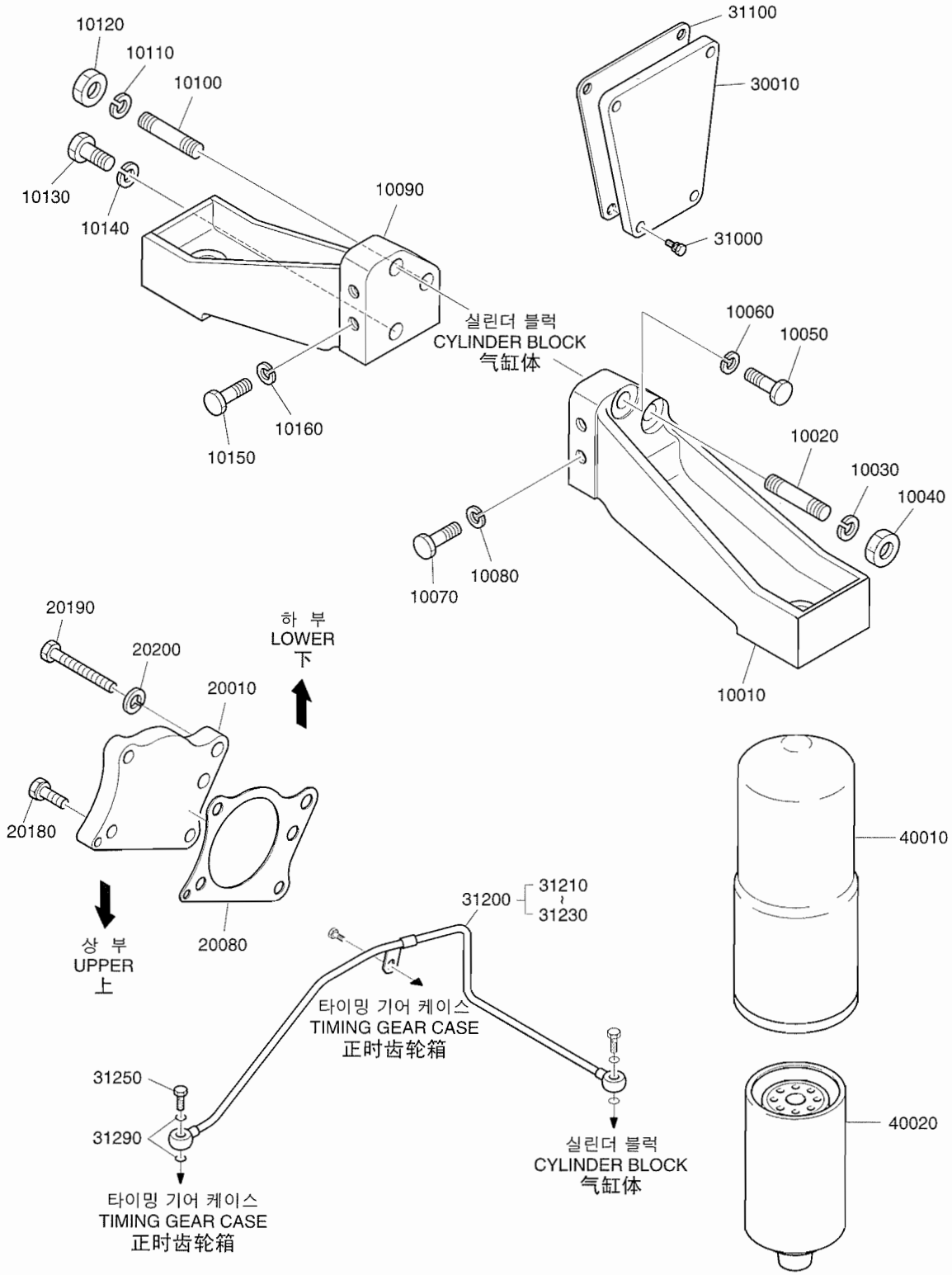


Fig.018

ENGINE MOUNTING & ETC | 엔진 마운팅 및 기타 | 发动机固定架及其它

Key No.	Part No.	Description	부 품 명	零件名称	Q'ty				S.C	ICA	Serial No.
					DE 12 T	P 126 TI-1	P 126 TI	P 126 TI-II			
10010	65.41530-0152	BRACKET ; MOUNTING(FRONT)	마운팅 브라켓(앞)	壳体右支架(前)	1	1	1	1			
10020	65.90201-0058	BOLT ; STUD M14x1.5x45	스터드 볼트	双头螺栓	1	1	1	1			
10030	06.16731-2110	WASHER ; SPRING A14	스프링 와셔	弹簧垫圈	1	1	1	1			
10040	06.11063-9217	NUT ; HEX.	육각 너트	六角螺母	1	1	1	1			
10050	06.01494-4410	BOLT ; HEX. M14x1.5x55	육각 볼트	六角螺栓	2	2	2	2			
10060	06.16731-2110	WASHER ; SPRING A14	스프링 와셔	弹簧垫圈	2	2	2	2			
10070	06.01494-4414	BOLT ; HEX. M14x1.5x75	육각 볼트	六角螺栓	2	2	2	2			
10080	06.16731-2110	WASHER ; SPRING A14	스프링 와셔	弹簧垫圈	2	2	2	2			
10090	65.41530-0151	BRACKET ; MOUNTING(FRONT)	마운팅 브라켓(앞)	壳体右支架(前)	1	1	1	1			
10100	65.90201-0058	BOLT ; STUD M14x1.5x45	스터드 볼트	双头螺栓	1	1	1	1			
10110	06.16731-2110	WASHER ; SPRING A14	스프링 와셔	弹簧垫圈	1	1	1	1			
10120	06.11063-9217	NUT ; HEX.	육각 너트	六角螺母	1	1	1	1			
10130	06.01494-4410	BOLT ; HEX. M14x1.5x55	육각 볼트	六角螺栓	2	2	2	2			
10140	06.16731-2110	WASHER ; SPRING A14	스프링 와셔	弹簧垫圈	2	2	2	2			
10150	06.01494-4416	BOLT ; HEX. M14x1.5x85	육각 볼트	六角螺栓	2	2	2	2			
10160	06.16731-2110	WASHER ; SPRING A14	스프링 와셔	弹簧垫圈	1	1	1	1			
20010	60.91601-0010	COVER	커 버	盖垫	1	1	1	1			
20080	65.47901-0010	GASKET	가스켓	衬垫	1	1	1	1			
20180	06.01913-3219	BOLT ASS'Y M10x40	볼트 조립품	螺栓总成	2	2	2	2			
20190	06.01013-9221	BOLT ; HEX. M10x80	육각 볼트	六角螺栓	1	1	1	1			
20200	06.16731-2108	WASHER ; SPRING A10	스프링 와셔	弹簧垫圈	1	1	1	1			
30010	65.91601-0003	COVER ; BLIND	블라인드 커버	盲板盖	1	1	1	1			
31000	06.01924-3217	BOLT ASS'Y M10x30	볼트 조립품	螺栓总成	4	4	4	4			
31100	65.54901-0025A	GASKET	가스켓	衬垫	1	1	1	1			
31200	65.05701-5361	OIL PIPE ASS'Y	오일 파이프 조립품	机油管总成	1	1	1	1			
31210	65.97401-0152	· CLIP ; PIPE	· 파이프 클립	· 管夹	1	1	1	1			
31220	06.01913-2910	· BOLT ; HEX. M6x12	· 육각 볼트	· 六角螺栓	1	1	1	1			
31230	06.11063-8212	· NUT ; HEX. M6	· 육각 너트	· 六角螺母	1	1	1	1			
31250	65.98150-0056	SCREW ; HOLLOW	홀로우 스크류	空心螺钉	1	1	1	1			
31290	06.56180-0712	RING ; SEAL A8x14	시일 링	密封环	2	2	2	2			
40010	65.05510-5020A	CARTRIDGE ASS'Y	카트리지 조립품	滤心总成	1	1	1	1			
40020	65.12503-5016	ELEMENT ; FUEL FILTER	연료 휠터 엘레멘트	燃油滤清器芯	1	1	1	1			

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	017	10050	06.06226-0809	004	10510	06.16731-2109	002	10390

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	006	30160	60.91601-0010	018	20010	65.01801-5099B	004	20300
06.32092-0307	015	20040	60.96340-5015	016	10010	65.01810-5007	004	29000
06.56180-0712	016	10150	60.96340-5023	016	10020	65.01903-0048B	002	10120
	018	31290	65.01101-0212A	001	10020	65.01903-0050	002	10320
06.56180-0714	012	12330		001	10010	65.01904-0022A	002	20100
	015	10440	65.01101-6213B	001	10010	65.01907-0008A	007	10090
06.56180-0716	016	20190	65.01105-1157G	001	10110	65.02101-0054A	003	10310
06.56190-0703	001	10270	65.01105-1158F	001	10090	65.02101-0057A	003	10100
06.56190-0704	001	20070	65.01105-1159F	001	10130	65.02101-0060A	003	10200
	013	10430	65.01105-1161A	001	10070	65.02101-7054B	003	10300
	013	10450	65.01105-1177A	001	10070	65.02101-7541B	003	10010
	017	40060	65.01105-1178A	001	10130	65.02110-0013E	003	10350

Part No.	Fig. No.	Key No.	Part No.	Fig. No.	Key No.	Part No.	Fig. No.	Key No.
65.02110-0014E	003	10370	65.04101-0040	005	10060	65.05406-0020	001	20020
65.02115-0008B	003	10500	65.04101-0043	005	10010	65.05410-0007	006	10170
65.02201-7005	003	20010	65.04101-0044	005	10040	65.05410-0015	001	20030
65.02201-7032	003	20010	65.04102-0002A	005	10120	65.05410-0016	001	10400
65.02201-7033	003	20020	65.04102-0066	005	10110	65.05501-7058E	006	30010
65.02201-7034	003	20030		005	10130	65.05503-0031B	006	30040
65.02301-0199A	003	30020	65.04102-6004A	005	10100	65.05503-5038B	006	30030
65.02301-5052	003	30010	65.04103-0014	005	10140	65.05510-5020A	006	30020
65.02310-0011A	003	30040	65.04103-0078	005	10150		018	40010
65.02401-0045F	003	40020	65.04104-0007	005	10160	65.05601-7072C	007	10010
65.02401-6012F	003	40010	65.04200-6027C	005	20010	65.05604-0019B	007	10020
65.02401-6017A	003	40010	65.04201-0007K	005	20030	65.05606-5027B	007	10030
65.02405-1006	003	40050	65.04201-5014E	005	20020	65.05701-5288A	013	10180
65.02405-1010	003	40050	65.04202-0014A	005	20150	65.05701-5313	015	10400
65.02410-6106	003	40070	65.04203-0010A	005	20210	65.05701-5322A	008	11000
65.02501-0209	003	50010	65.04203-5010	005	20060	65.05701-5325	007	10300
65.02501-0778A	003	50010	65.04205-0003	005	20130	65.05701-5349	008	11000
65.02502-0013	003	50050	65.04301-0006	005	30010	65.05701-5361	018	31200
65.02502-0050	003	50050	65.04302-5011	005	30100	65.05701-5376	013	10300
65.02503-0057	003	50020	65.04401-0010K	005	40010	65.05701-5377	013	10340
65.02503-0097	003	50030	65.04410-0016	001	10040	65.05701-5624	015	10450
65.02503-0105	003	50040	65.04500-6006B	005	50010	65.05701-5805	013	10180
65.02601-0179	003	60010	65.04501-0007A	005	50020	65.05701-5806	013	10340
65.02601-0183	003	60010	65.04505-0033	005	50110	65.05701-5807	013	10300
65.03101-0003F	004	10020	65.04505-5016	005	50100	65.05701-5810A	008	11210
65.03101-0004F	004	10220	65.04506-0033	005	50140	65.05701-5964A	007	10350
65.03101-6053G	004	10010	65.04507-0004	005	50130	65.05701-6025A	008	11200
65.03101-6054G	004	10210	65.04902-0010	005	10170	65.05740-0017	008	11220
65.03201-1008E	004	10090	65.05100-6042A	006	10010	65.05740-2042	008	11100
	004	10290	65.05100-6044	006	10010	65.05801-5141C	008	10010
65.03203-1041	004	10120	65.05102-0015	006	10020	65.05805-5137	008	10900
	004	10320	65.05102-0021	006	10020	65.05806-6052	008	10700
65.03203-1042	004	10110	65.05103-5003	006	10140	65.05809-0052	008	10130
	004	10310	65.05103-5006A	006	10100	65.05809-0053	008	10140
65.03205-0002	004	10040	65.05103-5008	006	10140	65.05809-0056	008	10150
	004	10240	65.05103-5009	006	10100	65.05809-0057	008	10160
65.03401-0048B	004	20020	65.05104-5004	006	10030	65.05809-0058	008	10170
65.03401-6046B	004	20010	65.05104-5005	006	10040	65.05809-0059	008	10180
65.03901-0063A	004	10600	65.05104-5006	006	10040	65.05903-0027A	008	11350
65.03901-0064A	004	10610	65.05104-5007	006	10030	65.05903-0028	007	10040
65.03905-0020	004	20100	65.05200-6004A	006	20010	65.05903-0030A	007	10330
65.03905-0023A	004	20110	65.05201-0008A	006	10220		007	10380
65.04101-0029	005	10050	65.05204-0003A	006	20020		013	10350
65.04101-0036	005	10020	65.05205-0018	006	20060	65.05904-0096A	008	10110
65.04101-0039	005	10030	65.05405-7021	001	20010	65.06301-0057A	009	10420

Part No.	Fig. No.	Key No.	Part No.	Fig. No.	Key No.	Part No.	Fig. No.	Key No.
65.06301-0673	010	10030	65.09100-7046	013	10010	65.11405-0013	015	30220
65.06301-5147	009	10020	65.09100-7193	013	10010	65.11501-7006	015	10030
65.06301-6034	009	10010	65.09140-0001	013	10520	65.11902-0017	015	20200
65.06301-6037B	009	10350	65.09141-0007	013	10480	65.12301-5165A	016	10130
65.06402-0002A	009	20020	65.09141-0017	013	10490	65.12501-7023	016	20010
65.06404-0028	009	10030	65.09411-0052	012	26010	65.12503-5016	016	20150
65.06405-0025	009	10300	65.09411-0053	012	13010		018	40020
65.06500-6157D	010	10010	65.09411-5023	012	21010	65.12504-5013A	016	20020
65.06501-0077C	010	10020	65.09443-0018	012	20410	65.19101-0012	017	10130
65.06505-0041	010	10040	65.09901-0025	013	10020	65.19101-0013	016	20220
65.06506-0024A	010	10060	65.10101-7054	014	10010	65.19101-0085	017	10010
65.06507-0005A	010	10120	65.10101-7300	014	10010	65.19102-0080	017	10010
65.06508-0012	010	10090	65.10102-6046	014	10020	65.19103-6011A	017	10150
65.06512-0014	010	10140	65.10102-6048	014	10020	65.26101-7153A	017	20010
65.06520-6007	010	10050	65.10115-6001	014	10030	65.26201-7049A	017	30010
65.06601-5055	010	20150	65.10301-5247	014	20030	65.27103-7007	002	20270
65.06602-0003	010	20020	65.10301-5248	014	20040	65.27405-5005	009	10240
65.06606-0041	010	20060	65.10301-5249	014	20050	65.27441-7007	017	40110
65.06606-0051	010	20050	65.10301-5250	014	20420	65.41520-0003	004	10800
65.06611-0112A	010	20130	65.10301-5251	014	20430	65.41530-0151	018	10090
65.06901-0076	010	10130	65.10301-5252	014	20440	65.41530-0152	018	10010
65.06901A0069	009	20040	65.10301-6042B	014	20400	65.47901-0010	018	20080
65.06903-0018	009	10110	65.10301-6043A	014	20010	65.54901-0025A	018	31100
65.06903-0020	009	10430	65.10301-6078	014	20400	65.90001-0036	012	12310
65.06903-0021	009	10050	65.10301-7004B	014	20010	65.90001-0126	001	10430
65.08100-6042	011	10010	65.11101-7222	015	10010	65.90001-0136	008	10190
65.08100-6048	011	10010	65.11101-7376	015	10020	65.90001-6002	002	20150
65.08101-0170	011	10110	65.11101-8008	015	10010	65.90001-6003	005	40050
65.08101-0171	011	10310	65.11220-7006	015	10070	65.90001-6005	008	11060
65.08101-0181A	011	10110	65.11301-0013C	015	20150	65.90020-0010E	003	40040
65.08101-0182	011	10210	65.11301-7010F	015	20010	65.90020-0036B	001	10150
65.08101-0183A	011	10310	65.11302-0009A	015	20120	65.90020-0068	008	11370
65.08105-0001	011	10510	65.11308-0001	015	20060	65.90020-0074	004	20140
65.08112-0022	013	10120	65.11308-0002	015	20070	65.90020-0079	015	20210
65.08120-5008G	011	11530	65.11308-0003	015	20080	65.90021-0001A	004	10450
65.08201-5041C	012	10210	65.11308-0004	015	20090	65.90030-0009	006	20080
65.08201-5045A	012	10610	65.11309-0007A	015	20020	65.90030-0013A	003	60040
65.08201-5049	012	10010	65.11312-0007	015	20100	65.90201-0049	004	10550
65.08202-0261	012	13010	65.11401-0033	015	30010	65.90201-0058	018	10020
65.08202-5051	012	20010	65.11405-0005	015	30040		018	10100
65.08901-0063	013	10080	65.11405-0006	015	30050	65.90201-0076	013	10030
65.08901A0012	011	11010	65.11405-0007	015	30060	65.90201-0080	004	10560
65.08902-0025	012	11010	65.11405-0008	015	30070	65.90201-0094	004	10500
65.08902-0074	012	12430	65.11405-0009	015	30200	65.90201-0106	004	10400
65.08904-0002	012	13310	65.11405-0010	015	30210	65.90201-0154	004	10530

Part No.	Fig. No.	Key No.
65.90302-0012	005	20220
65.90302-0041	004	10060
	004	10260
65.90302-0042	004	10080
	004	10280
65.90302-0048	001	10050
	004	10070
	004	10270
65.90302-0049	004	10130
	004	10330
65.90310-0034	006	30120
65.90310-0056	001	20050
65.90310-0104	006	10190
65.90310-0115	006	30080
65.90310-0121	006	30050
65.90310-0131	001	10280
65.90310-0136	001	10240
65.90310-0137	001	10220
65.90310-0143	016	20170
65.90310-0149A	001	10300
	009	10070
65.90430-0012B	003	10390
65.90430-0013B	003	10400
65.90501-0003	005	20140
65.90510-0012	006	10210
	008	11240
65.90535-0001	013	10060
65.90701-0088	003	60030
65.90701-0202	004	20130
65.90710-0039	005	20110
65.90710-0071	001	20040
65.90720-0018	005	50150
65.90801-0018	006	10290
65.91001-0013	004	10700
65.91010-0017	002	10100
65.91301-0010	003	40060
65.91601-0003	018	30010
65.91606-0041	001	10200
65.91615-0015	001	10340
65.91701-0031	013	10500
65.91701-0171	012	11830
65.91701-0275	004	10920
65.91701-0470	012	11810
65.91701-0542	017	10300
65.91710-0035B	001	10160
65.93020-0033D	005	20050
65.93410-0027	010	20030
65.93410-0038	010	10100
65.95800-6026	010	20010
65.95800-6030	010	20010
65.96002-0003	002	20220
65.96230-0001	014	20210
	014	20610
65.96230-0002	014	20240
	014	20640
65.96301-0204B	009	10360
65.96301-0205A	009	10470
65.96301-0267	012	15010
65.96301-0270	012	22010
65.96301-0271	012	26110
65.96301-0305	004	20400
65.96301-0313	012	20210
65.96301-0315	012	21510
65.96301-0327	013	10460
65.96301-0331	012	26310
65.96330-0134	016	10160
65.96401-0011	014	10050
65.96501-0033B	004	20310
65.96501-0061	006	30230
65.96501-0068	010	10210
65.96501-0069	004	10050
	004	10250
65.96601-0012	001	10330
	013	10350
65.96601-0043	008	11030
65.96601-0045A	013	10310
65.96601-0046A	013	10400
65.96801-0058	017	26010
65.96801-0084	017	26010
65.97401-0143	015	10410
65.97401-0152	018	31210
65.97401-0154A	013	10200
65.97401-0155	013	10190
65.97401-0171	014	20710
65.97401-2016	013	10200
65.97401-6001A	014	20200
	014	20600
65.97401-6002A	014	20220
	014	20620
65.97401-6004	014	20230
65.97401-6004	014	20630
65.97440-0094	012	26410
65.97440-0096	012	22110
	012	26210
65.97440-0097	012	15110
65.97445-0001	016	10170
65.97460-0001	016	10060
65.97480-0035	012	23010
65.97480-0166	014	20300
65.97601-0004	006	30150
65.97601-0053	005	20100
65.97601-0074	001	10410
65.97601-0075	006	30100
65.97601-0100	001	20060
65.97601-0104	005	20090
65.97601-0105	006	10180
65.98101-5005	016	10180
65.98112-0038	005	40040
65.98112-0039	012	12410
65.98125-5010	008	19070
65.98125-5011	008	19050
65.98130-0006	008	19060
65.98130-0076	017	40020
65.98131-0037	013	10420
	017	40010
65.98131-0075	009	10190
65.98131-5008	013	10390
65.98150-0002	017	40030
65.98150-0042A	016	10140
65.98150-0050	015	10430
65.98150-0056	018	31250
65.98701-0010	014	10040
66.27435-6008	009	10260
67.27435-6003	017	40120

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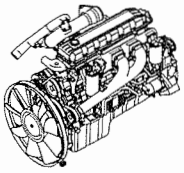
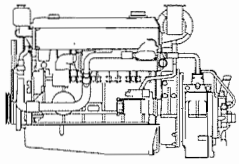
● Applications for DOOSAN Engine



▪ Automotive & Industrial Engines

Model		Power kW(PS)/rpm	Model	Power kW(PS)/rpm
For Vehicle	D1146	133(181)/2,500	DL08	235(320)/2,200
	D1146TI	158(215)/2,200	DV11	309(420)/1,800
	DE08TIS	176(240)/2,300	DV15T	272(370)/2,300
	DE12	169(230)/2,200	DV15TI	309(420)/2,100
	DE12T	220(300)/2,200	DV15TIS	309(420)/2,100
	DE12TI	250(340)/2,100	GE08TI	191(260)/2,300
	DE12TIS	250(340)/2,100	GE12TI	250(340)/2,100
For Industrial	D1146	115(156)/2,200	DB58TIS	127(173)/2,000
	D1146T	140(190)/2,200	DE08TIS	151(205)/1,900
	D1146TI	162(220)/2,200	DE12T	188(255)/2,000
	DB33	53(72)/3,000	DE12TI	213(290)/2,000
	DB33A	46(63)/2,300	DE12TIS	238(323)/2,000
	DB58	96(130)/2,800	DV15T	238(324)/2,300
	DB58S	75(102)/2,200	DL08	191(260)/1,750
	DB58T	104(142)/2,500	DV11	245(333)/1,800
	DB58TI	112(152)/2,200		



▪ Marine Propulsion Engines

Model	Power kW(PS)/rpm	Model	Power kW(PS)/rpm
L034	51(70)/3,000	MD196T	206(280)/2,000
L034TIH	88(120)/3,000	MD196TI	235(320)/2,000
L034TIM	107(145)/3,300	V158TIH	353(480)/1,800
L086TI	265(360)/2,500	V158TIM	397(540)/2,100
L086TIH	210(285)/2,100	V158TIL	500(680)/2,300
L086TIM	232(315)/2,300	V180TIH	441(600)/1,800
L126TIH	265(360)/2,000	V180TIM	478(650)/2,100
L126TIM	294(400)/2,100	V180TIL	820(603)/2,300
L136	118(160)/2,200	V222TIH	530(720)/1,800
L136T	147(200)/2,200	V222TIM	588(800)/2,100
L136TI	169(230)/2,200	V222TIL	736(1,000)/2,300
L136TL	177(240)/2,500		

▪ Generator Set Engines (G-Drive & G-Pac)

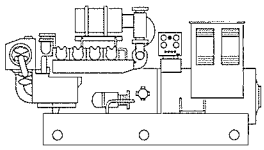
Model	Power (Output ISO 3046)				Model	Power (Output ISO 3046)			
	@1,800rpm		@1,500rpm			@1,800rpm		@1,500rpm	
	Power (Stand-by)	Power (Prime)	Power (Stand-by)	Power (Prime)		Power (Stand-by)	Power (Prime)	Power (Stand-by)	Power (Prime)
	kW(PS)	kW(PS)	kW(PS)	kW(PS)		kW(PS)	kW(PS)	kW(PS)	kW(PS)
D1146	105(143)	96(130)	85(116)	77(105)	P158LE-1	402(546)	366(498)	362(492)	327(444)
D1146T	138(187)	125(170)	118(160)	107(145)	P158LE-2	361(491)	329(447)	321(437)	293(399)
DB33	35(47)	32(43)	29(39)	26(35)	P158LE-S	481(654)	441(660)	441(600)	402(546)
DB58	70(95)	64(87)	59(80)	54(73)	P180LE	540(734)	497(676)	496(674)	443(602)
DE12T	199(270)	180(245)	166(226)	151(205)	P180LE-1	498(677)	454(617)	442(601)	403(548)
P034TI	60(82)	55(75)	48(65)	42(57)	P180LE-S	567(771)	519(705)	496(674)	452(615)
P086TI	223(260)	205(237)	199(223)	177(203)	P222LE	649(883)	591(803)	574(781)	532(723)
P086TI-1	191(303)	174(279)	164(270)	149(420)	P222LE-1	625(850)	563(765)	552(750)	496(675)
P126TI	298(405)	278(378)	272(370)	241(328)	P222LE-S	682(927)	625(850)	603(820)	552(750)
P126TI-1	288(392)	262(356)	-	-	P158FE	492(669)	441(600)	441(600)	402(546)
P126TI-Ⅱ	342(465)	-	-	-	P222FE	711(967)	659(896)	612(832)	569(774)
P158LE	443(602)	402(547)	414(563)	363(494)					

▪ Natural Gas Engines

Model	Power (Output ISO 3046)				Model	Power (Output ISO 3046)			
	@1,800rpm		@1,500rpm			@1,800rpm		@1,500rpm	
	Power (Stand-by)	Power (Prime)	Power (Stand-by)	Power (Prime)		Power (Stand-by)	Power (Prime)	Power (Stand-by)	Power (Prime)
	kW(PS)	kW(PS)	kW(PS)	kW(PS)		kW(PS)	kW(PS)	kW(PS)	kW(PS)
GE08TIC	165(224)	150(204)	141(192)	128(174)	GV180TIC	375(510)	340(462)	319(434)	290(394)
GE12TIC	225(306)	200(272)	187(254)	175(238)	GV222TIC	451(613)	410(557)	385(523)	350(476)
GV158TIC	300(408)	270(367)	253(344)	230(313)					

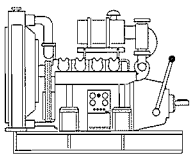
▪ Marine Auxiliary Engines

Model	Power (Output ISO 3046) kW(PS) @ 1,500rpm	Model	Power (Output ISO 3046) kW(PS) @ 1,500rpm	Model	Power (Output ISO 3046) kW(PS) @ 1,800rpm	Model	Power (Output ISO 3046) kW(PS) @ 1,800rpm
AD034F	26(35)	AD136TIF	121(165)	AD034S	32(43)	AD136TIS	143(195)
AD034TIF	42(57)	AD158TIF	302(410)	AD034TIS	55(75)	AD158TIS	353(480)
AD086TIF	151(205)	AD180TIF	357(485)	AD086TIS	186(253)	AD180TIS	441(600)
AD126TIF	206(280)	AD196TF	155(210)	AD126TIS	247(336)	AD196TS	181(246)
AD136F	77(105)	AD196TIF	173(235)	AD136S	93(126)	AD196TIS	199(270)
AD136TF	107(145)	AD222TIF	446(606)	AD136TS	125(170)	AD222TIS	530(720)



▪ Marine Generator Sets

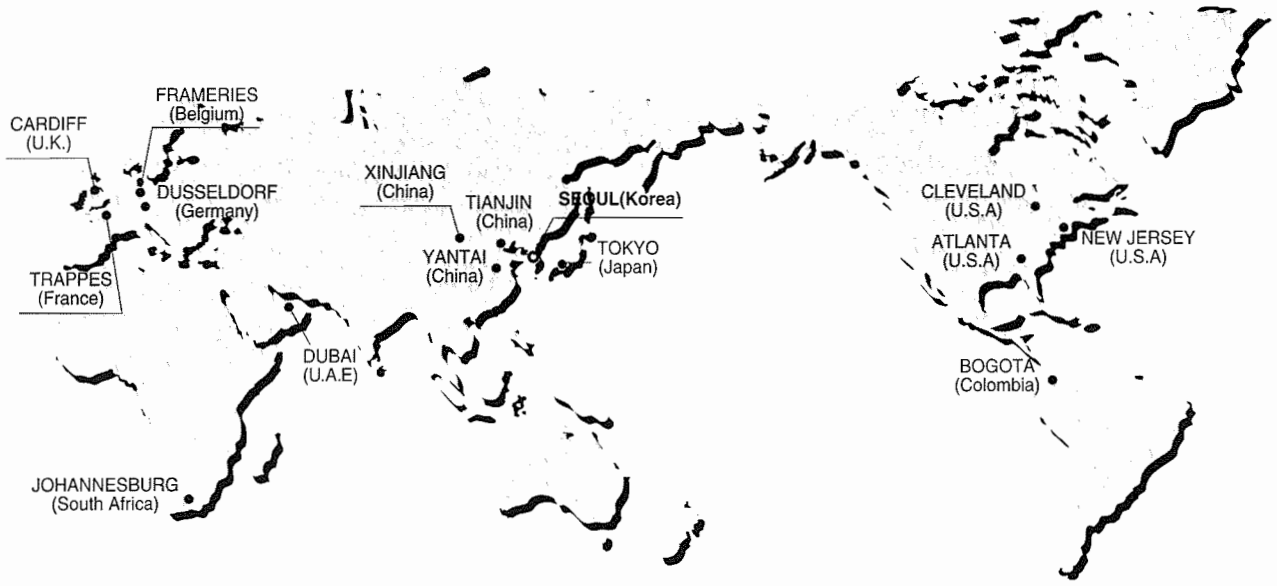
Generator Set	Engine Model	Power (kW/kVA) 1800rpm(60Hz) Power (Prime) kW/kVA	Power (kW/kVA) 1500rpm(50Hz) Power (Prime) kW/kVA
PNM	DB33	24/30	20/25
PNB	AD034TI	50/63	36/45
PNJ	AD136	80/100	68/85
PNK	AD136T	104/130	96/120
PND	AD136TI	132/165	108/135
PNE	AD086TI	172/215	136/170
PNL	AD196TI	176/220	160/200
PNI	AD126TI	224/280	192/240
PNZ	AD158TI	328/410	276/345
PNS	AD180TI	400/500	332/415
PNY	AD222TI	500/625	408/510



▪ Power Units

Model	Power kW(PS)/rpm
PU034	50(68)/3,000
PU066	85(116)/2,800
PU086	116(158)/2,200
PU086T(EADPA)	151(205)/2,200
PU086T(EADPB)	151(205)/2,300
PU086TI	213(290)/2,200
PU126TI	294(400)/2,100
PU158TI	397(540)/2,100
PU180TI	478(650)/2,100
PU222TI	588(800)/2,100

DOOSAN INFRACORE CO., LTD.
AROUND THE WORLD



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7. Identification.

DOOSAN

엔 진 제 작 증 명 서

Certificate of Engine Production

1. Engine Model : **PU126TI**
2. Serial Number : **EDIPA** **214457**
3. Rating : Stand by : ps(kW), Prime : **400(294)** ps(kW)
4. Engine Speed : **2,100** rpm
5. Displacement : **11.051** liters. **6 - 123 x 155** (Cyl. - Bore x Stroke, mm)
6. Production Date: **2012** 년(Year)

상기 엔진은 두산인프라코어(주)의 품질보증시스템에 따라 제작된 엔진임을 증명합니다.

We, Doosan Infracore Co., Ltd., as the manufacturer, hereby certify that the above-stated engine was produced based on the quailty assurance system of Doosan Infracore Co., Ltd.

20 **12** 년(Y) **8** 월(M) **21** 일(D)

두 산 인 프 라 코 어 (주)

DOOSAN INFRACORE CO., Ltd.

대 표 이 사 **김 용 성**

Hydraulic Pump

Hydraulic Motor 1

Hydraulic Motor 2