

2-1 ENGINE ADJUSTMENT STANDARDS

Adjustment Item		Adjustment Standard Value	
Valve timing	Inlet valve opened	18° BTDC	
	Inlet valve closed	50° ABDC	
	Exhaust valve opened	50° BBDC	
	Exhaust valve closed	18° ATDC	
Valve clearance (when cold)	Inlet side	0.4 mm	
	Exhaust side	0.6 mm	
Fuel injection timing		Vary on different specifications.	
No-load minimum speed(idling)			
No-load maximum speed			
Tension of V-belt(deflection of V-belt when pressed down at middle under approx. 98N or 10 kgf pressure)		10 to 15 mm	
Compression pressure (With engine at 200rpm)	Standard value	2 750 kpa(28 kgf/cm ²)	
	Repair limit	1 960 kPa(20 kgf/cm ²)	
	Difference between cylinders	390kPa(4 kgf/cm ²) or less	
Oil pressure (oil temperature : 70°C)	Air idling speed	Standard value	145 to 290 kPa (1.5 to 3.0 kgf/cm ²)
		Repair limit	49kPa (0.5kgf/cm ²)
	At maximum speed	Standard value	290 to 490 kPa
		Repair limit	195kPa(2.0kgf/cm ²)

2-2 SERVICE STANDARDS

2-2-1 Engine Proper

All values in mm unless otherwise specified.

Description		Nominal value (Basic diameter)	Repair limit	Service limit	Correction and remarks
Clearance between rocker and rocker shaft		[28] 0.03 to 0.08	0.2		Replace bushing.
Outer valve spring	Free length	89.38		85	Replace.
	Installed load (installed length : 58.35)	450N(46.1kgf)		380N (39kgf)	
	Squareness			2.5	
Inner valve spring	Free length	65.04		62.0	Replace.
	Installed load (installed length : 50.35)	115 N (12 kgf)		100N (10.2kgf)	
	Squareness			2.5	
Clearance between crankcase tappet hole and tappet		[35] 0.06 to 0.10		0.2	Replace tappet.
Push rod runout				0.6	Replace.
Cylinder head bottom surface distortion		0.07 or less	0.08		May be ground to cylinder head height of 129.8 mm maximum
Valve stem O.D.	Inlet	11.95 to 11.96		11.85	Replace.
	Exhaust	11.91 to 11.93			
Clearance between valve stem and valve guide	Inlet	[12] 0.05 to 0.09		0.2	Replace valve guide.
	Exhaust	[12] 0.09 to 0.12			
Depth of valve from cylinder head bottom surface	Inlet	0.25 to 0.75		1.0	Replace valve seat insert. Service limit shows value when new valve is instal- led. (Minus value shows amount of projec- tion.)
	Exhaust	-0.05 to 0.45		0.7	
Valve seat angle		45°			

Description		Nominal value (Basic diameter)	Repair limit	Service limit	Correction and remarks
Valve margin	Inlet	2.2		1.7	Replace.
	Exhaust	2.5		2.0	
Valve seat insert seat width		2.69 to 2.96	3.5		
Eccentricity of flywheel housing			0.2		Correct installed condition.
Flywheel	Runout		0.2		Correct installed condition
	Friction surface distortion	0.1 or less	0.2		Correct.
	Depth from clutch cover mounting surface to friction surface	48		49.5	Replace.
Timing gear backlash	Between crankshaft gear and idler gear "B"	0.12 to 0.26		0.4	Replace.
	Between idler gear "A" and camshaft gear	0.11 to 0.23		0.4	
	Between idler gear "A" and idler gear "C"	0.11 to 0.24		0.4	
	Between injection pump gear and idler gear "C"	0.12 to 0.25		0.4	
	Between power steering gear and idler gear "C"	0.10 to 0.23		0.4	
End play of idler gear		0.1 to 0.28	0.4		Replace thrust plate.
Clearance between idler shaft and idler gear bushing		[40] 0.03 to 0.06	0.2		Replace bushing.
Camshaft gear end play		0.05 to 0.22	0.4		Replace thrust plate.
Clearance between camshaft journal and camshaft bushing	No.1 journal	[65] 0.03 to 0.08	0.25		Replace bushing
	No. 2 journal	[65.25] 0.03 to 0.08			
	No. 3 journal	[65.50] 0.03 to 0.08			
	No. 4 journal	0.03 to 0.08			

Description		Nominal value (Basic diameter)	Repair limit	Service limit	Correction and remarks
	No. 5 journal	[65.75]	0.25		Replace bushing
	No. 6 journal	0.03 to 0.08			
	No. 7 journal	[66] 0.03 to 0.08			
Cam profile(difference between lobe height and base circle diameter)				8.3	Inlet Lobe height : 56.167 Base circle diameter : 47.334 Exhaust Lobe height : 56. 036 Base circle diameter : 47.216
Camshaft bend		0.05 or less	0.08		Correct or replace.
Crankcase top surface distortion		0.07 or less	0.2		Regrind very slightly.
Cylinder liner	I.D.	130.014 to 130.054	130.25		Replace or correct to oversize.
	Cylindricity (diametral method)	0.02 or less	0.3		
	Projection of flanged portion	0 to 0.08			Replace.
Clearance between piston and cylinder liner(selection fit)		[130] 0.178 to 0.204			
Clearance between piston ring groove and piston ring	1st ring	0.11~0.13		0.25	Replace.
	2nd ring	0.05 to 0.08		0.15	
	Oil ring	0.03 to 0.06		0.15	
Clearance between open ends of piston ring		0.4 to 0.6		1.5	Replace.
Projection of piston from top surface of crankcase		0.87 to 1.33			Replace parts.
Clearance between piston pin hole and piston pin		[50] 0.01 to 0.02		0.1	Replace.

Description		Nominal value 〔Basic diameter〕	Repair limit	Service limit	Correction and remarks
Connecting rod	Clearance between con- necting rod bushing and piston pin	〔50〕 0.02 to 0.05	0.1		Replace bushing.
	Bend and torsion	〔50〕 0.02~0.05	0.05 or less		Correct or replace.
	End play	0.2 to 0.5		1.0	Replace.
Connecting rod bearing	Oil clearance	〔84〕 0.07 to 0.13	0.25		Replace.
	Tension when free			Less than 90.5	
Crankshaft	End play	0.09 to 0.23	0.4		Adjust by oversize thrust plate.
	Bend	0.04 or less	0.1		Correct or replace.
	Out-of-round- ness of journal and pin	0.01 or less	0.08		Grind and correct to undersize.
	Cylindricity of journal and pin	0.006 or less			
Main bearing	Oil clearance	〔100〕 0.08 to 0.15	0.25		Replace.
	Tension when free			Less than 106.5	

2-2-2 Inlet and Exhaust

All values in mm unless otherwise specified.

Description		Nominal value (Basic diameter)	Repair limit	Service limit	Correction and remarks
Turbo-charger (3LM)	I.D. of bearing inserting portion of bearing housing			19.06	Replace.
	Turbine wheel shaft journal diameter			11.18	Replace.
	Turbine wheel shaft journal diameter			0.015	Replace.
	Piston ring open end clearance	0.015 to 0.18			Replace insert.
	Clearance between turbine wheel and turbine housing	0.53 to 1.04			Check.
	End play of turbine wheel shaft	0.05 to 0.13			Check.
	Clearance between turbine back plate and turbine wheel back surface	0.74 to 1.55			Check.
Dust indicator operating resistance value		700±50 mmAg (7.47±0.57kpa)			Replace.

2-2-3 Lubrication

All values in mm unless otherwise specified.

Description		Nominal value (Basic diameter)	Repair limit	Service limit	Correction and remarks
Oil pump	Backlash between crankshaft gear and oil pump idler gear	0.13 to 0.24		0.4	If backlash is less than 0.13, adjust shims.
	Backlash between idler gear and oil pump gear	0.11 to 0.22		0.4	Replace.
	Difference between pump case depth and gear height	0.05 to 0.11		0.15	Replace.

Description		Nominal value [Basic diameter]	Repair limit	Service limit	Correction and remarks
Oil pump	Clearance between gear tooth end and pump case	0.11 to 0.18		0.2	Replace.
	Clearance between drive gear shaft and case and cover	[20] 0.04 to 0.07		0.15	Replace.
	Clearance between driven gear shaft and driven gear	[20] 0.04 to 0.07		0.15	Replace.
	Clearance between idler gear shaft and idler gear	[22] 0.03 to 0.05		0.15	Replace bushing.
Relief valve	Valve opening pressure	1 180kPa (12kgf/m ²)			Replace.
	Spring load (Installed length : 46 : 3)	158± 7.8N (16.1± 0.8kgf)			
Oil bypass alarm valve opening pressure (ON start pressure)		295 to 345 kPa (3 to 3.5kgf/m ²)			
Oil cooler bypass valve opening pressure		175 to 215 kPa (1.8 to 2.2kgf/m ²)			
Regulator valve	Valve opening pressure	360 to 420 kPa (3.7 to 4.3kgf/m ²)			Replace.
	Spring load (Installed length : 50)	76~80N (7.8~8.2kgf)			

2-2-4 Cooling

All values in mm unless otherwise specified.

Description		Nominal value [Basic diameter]	Repair limit	Service limit	Correction and remarks
Thermostat	Valve Opening start temperature	69 to 73 °C			Replace.
	Valve lift/temperature	10mm or more/ 85°C			
Water pump	Interference between pump shaft and pulley	0.05 to 0.08		Reassembly tolerated up to two times	Replace.
	Interference between pump shaft and impeller	0.04 to 0.06			

2-2-5 Fuel

All values in mm unless otherwise specified.

Description			Nominal value [Basic diameter]	Repair limit	Service limit	Correction and remarks
Injection pump proper	Injection spacing		60° ±30'			Adjust.
	Prestroke	AD type	4.5			Adjust.
		P type	4.8			
	Overall tappet clearance	AD type			0.3	Replace.
		P type			0.2	
	Clearance between tappet and housing	AD type	26] 0.03 to 0.07		0.2	Replace.
		P type			0.15	
	Clearance between plunger driving face and control sleeve	AD type	0.03 to 0.08		0.12	Replace.
	Wear of plunger contacting surface of lower spring seat	P type			0.2	Replace.

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Description				Nominal value 〔Basic diameter〕	Repair limit	Service limit	Correction and remarks
Injection pump proper	End play of camshaft			0.02 to 0.06			Adjust shims.
	Sliding resistance of control rack (when stationary)	AD type		1.5N or less (150 gf or less)			Check.
	Sliding resistance of control rod (when stationary)	P type		1.3N or less (130 gf or less)			Check.
	Tappet clearance	AD type		0.3 or more			Adjust.
	Backlash between control rack and pinion	AD type		0.15		0.3	Replace.
	Overflow valve opening pressure	AD type		157 kPa (1.6 kgf/m ²)			Replace.
		AD type, P type		255 kPa (2.6kgf/m ²)			
Governor	Dimension from governor housing to shifter	RSV type		19 to 19.2			Adjust shims.
		RFD type		33 to 33.4			
Feed pump	Overall tappet clearance					0.2	Replace.
	Lifting capacity	Number of strokes pump goes through before lifting of fuel when operated at 60 to 100 strokes a minute		25 strokes or less			
	Air tightness	When 196 kPa (2kgf/m ²) air pressure is applied		Occ(No leaks tolerated)			
	Delivery rate	For 15 seconds at 1000 rpm	AD type		350cc		
P type				530cc			
Injection nozzle injection pres- sure	1-spring nozzle			21.6 to 22.5 kPa (220 to 230 kgf/cm ²)			Adjust or replace.
	2-spring nozzle			17.2~18.1 kPa (175~185 kgf/cm ²)			

2-2-6 Electrical

(1) Starter

All values in mm unless otherwise specified.

Description		Nominal value (Basic diameter)	Repair limit	Service limit	Correction and remarks
Commutator O.D.		38.7		37.7	Replace.
Commutator periphery runout		0 to 0.03	0.1		Replace or correct.
Depth of groove between segmets		0.7 to 0.9	0.3		Correct.
Brush length		17		11	Replace.
Brush spring pressure		25 to 33N (2.55 to 3.45kgf)		18N(1.8kgf)	Replace.
Pinion gap		0.1 to 2.0			Adjust washers.
Gear shaft thrust gap		0.1 to 0.5			Adjust washers.
No-load-character- istics	Voltage	23V			Check.
	Current	110A or less			
	Rotating speed	3 100 rpm or more			
Magnet switch operating voltage		16V or less			Check.
Starter relay coil resistance		10.4Ω			Replace.

(2) Alternator

All values in mm unless otherwise specified.

Procedures

Description				Nominal value (Basic diameter)	Repair limit	Service limit	Correction and remarks
Slip ring portion O.D.				41		40.4	Replace.
Brush spring pressure				3.7N(380gf)		2N (200gf)	Replace.
Brush length				23		8	Replace.
Field coil resistance(at 20℃)				10Ω			
Load character- istics	Rotating speed (1500 rpm)	Terminal voltage		27V			Check.
		Cur- rent	when cold	26A or more			
			When hot	22A or more			
	Rotating speed 2500 rpm	Terminal voltage		27V			
		Cur- rent	When cold	37A or more			
			When hot	33A or more			
IC regulator regulated voltage (5000rpm, 5A or less)				28 to 29V			Replace.

(3) Preheating Equipment

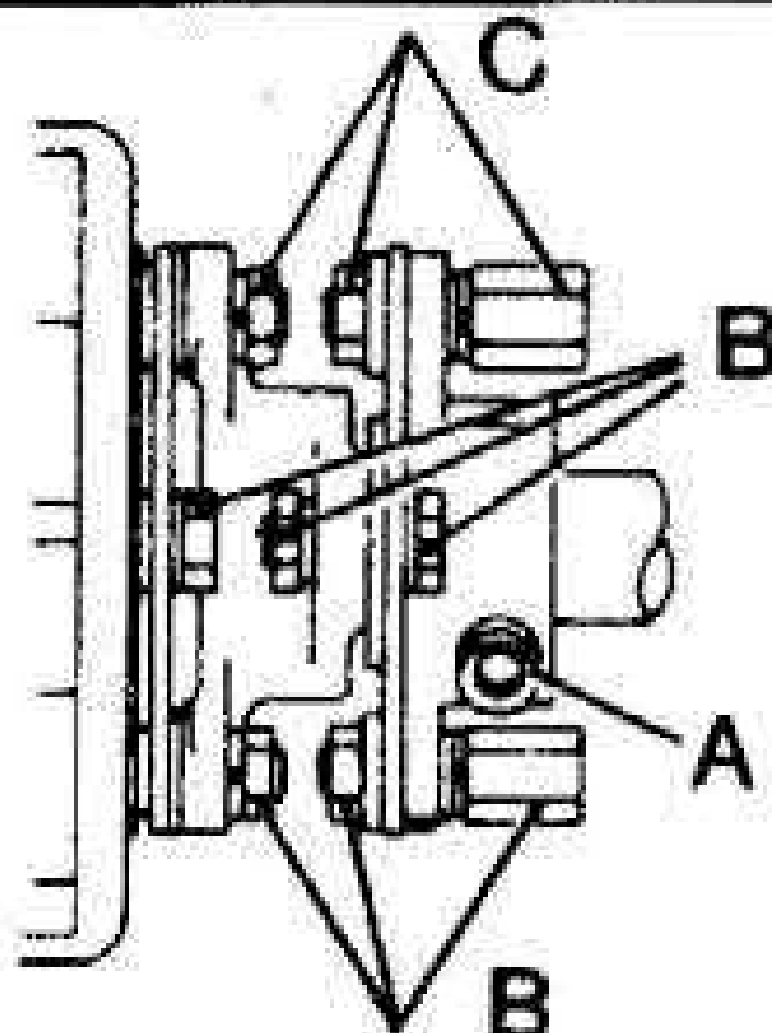
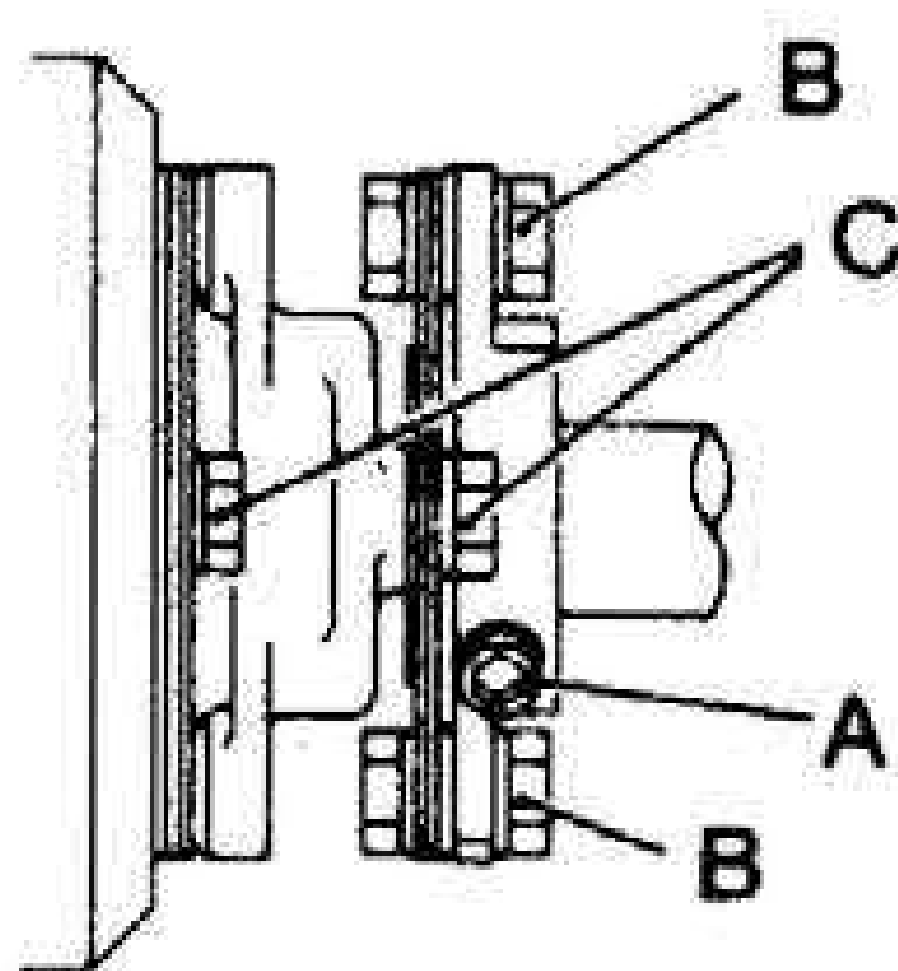
All values in mm unless otherwise specified.

Description	Nominal value (Basic diameter)	Repair limit	Service limit	Correction and remarks
Air heater resistance	0.23 to 0.27 Ω			Replace.
Heater relay resistance	10.4 Ω			Replace.
Indicator resistance	12.2 Ω			Replace.
Time required before indicator becomes red hot	40 to 60 secs.			Check.

2-3 TIGHTENING TORQUE TABLE

2-3-1 Tightening Torque of Major Bolts and Nuts

Description		Thread size Dia. x Pitch mm	Torque N m(kgf m)	Remarks
Engine proper	Main bearing cap bolt	M18×2.5	370(38)	Wet
	Connecting rod nut	M13×1.25	115(12)	Wet
	Crankshaft pulley attaching bolt	M14×1.5	175(18)	
	Idler shaft bolt	M16×2	115(12)	
	Camshaft gear attaching nut	M27×1.5	265(27)	Wet
	Flywheel housing attaching bolt	M12×1.75	59(6)	
	Idler shaft nut (for attaching collar)	M16×1.5	98(10)	
	Flywheel attaching bolt	M16×1.5	255(26)	Wet
	Cylinder head bolt	M14×2	195(20)	Wet
	Rocker bracket attaching bolt	M10×1.5	34(3.5)	
	Rocker cover attaching screw	M10×1.25	9.8(1)	
Inlet and exhaust	Inlet manifold bolt	M10×1.5	29(3)	
	Exhaust manifold nut	M10×1.25	33(3.4)	
	Turbo-charger	Compressor wheel attaching nut	17 to 20 (1.73 to 2.07)	
		Compressor cover attaching bolt	6.9(0.7)	
		Turbine housing attaching bolt	17(1.7)	
Lubrication	Oil pump idler gear shaft nut	M12×1.25	59 to 78 (6 to 8)	LOCTITE No.262 to be applied
	Oil filter center bolt	M16×1.5	59 to 69 (6 to 7)	
	Regulator valve	M27×1.5	98(10)	
	Check valve(to be mounted to crankcase)	M12×1.75	34(3.5)	
Cooling	Fan coupling bolt(to retain damper as well)	M12×1.75	59(6)	
	Cooling fan bolt	M10×1.5	42(4.3)	
		M12×1.75	59(6)	

Description			Thread size Dia. x Pitch mm	Torque N m(kgf m)	Remarks	
Fuel	Injection pump bracket attaching bolt		M10×1.5	42(4.3)		
	Injection pump	Flange sleeve nut	P type		39 to 44 (4 to 4.5)	Tighten to specified torque repeatedly three times.
		Delivery valve holder	AD type		64 to 69 (6.5 to 7)	
			P type		110 to 115 (11 to 12)	
		Governor flyweight nut			49 to 59 (5 to 6)	
		Automatic timer round nut	AD type		83 to 98 (8.5 to 10)	
	P type			125 to 145 (13 to 15)		
	Injection pump	[AD type] 	A bolt		49 to 54 (5 to 5.5)	
			B bolt		29 to 34 (3 to 3.5)	
			C bolt		29 to 34 (3 to 3.5)	
		[P type] 	A bolt		74 to 83 (7.5 to 8.5)	
			B bolt		44 to 49 (4.5 to 5)	
			C bolt		44 to 49 (4.5 to 5)	
	Injection pipe union nut		M14×1.5	29(3)		
			M12×1.5	20(2)		
	Injection nozzle	Nozzle bolt(for attaching to cylinder head)		M8×1.25	15(1.5)	
		Inlet connector		M14×1.5	135(14)	
		Retaining nut			59 to 78 (6 to 8)	
		Nozzle cap nut			39 to 49 (4 to 5)	

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Description			Thread size Dia. x Pitch mm	Torque N m(kgf m)	Remarks
Fuel	Fuel filter	Element		12 to 20 (1.2 to 2)	
		Connector bolt		34(3.5)	

2-3-2 Tightening Torque of General Bolts and Nuts

When parts are tightened, use the bolts and nuts specified in the specifications. Parts for which no bolts and nuts are specified should be tightened with general bolts and nuts torqued as shown below.

Unit : N m(kgf m)

Thread diameter mm	Pitch mm	4T (Head mark : 4 or ○)	7T (Head mark : 7 or ☉)	8T (Head mark : 8 or ⊕)
5	0.8	2.0 to 2.9 (0.2 to 0.3)	4.0 to 5.8 (0.4 to 0.6)	5.0 to 6.8 (0.5 to 0.7)
6	1.0	4.0 to 5.8 (0.4 to 0.6)	6.9 to 10 (0.7 to 1.1)	7.9 to 11 (0.8 to 1.2)
		{ 4.0 to 5.8 0.4 to 0.6 }	{ 7.9 to 11 (0.8 to 1.2) }	{ 8.9 to 13 (0.9 to 1.4) }
8	1.25	8.9 to 13 (0.9 to 1.4)	17 to 25 (1.7 to 2.6)	20 to 29 (2.0 to 3.0)
		{ 9.9 to 14 (1.0 to 1.5) }	{ 19 to 27 (1.9 to 2.8) }	{ 22 to 32 (2.2 to 3.3) }
10	1.25	19 to 27 (1.9 to 2.8)	35 to 53 (3.5 to 5.5)	45 to 58 (4.5 to 6.0)
		{ 21 to 30 (2.1 to 3.1) }	{ 39 to 58 (3.9 to 6.0) }	{ 50 to 63 (5.0 to 6.5) }
	1.5	18 to 26 (1.8 to 2.7)	33 to 49 (3.3 to 5.0)	43 to 105 (4.3 to 6.0)
12	1.25	34 to 49 (3.4 to 5.0)	69 to 93 (7.0 to 9.5)	84 to 105 (8.5 to 11)
		{ 38 to 53 3.8 to 5.5 }	{ 79 to 105 (8.0 to 11) }	{ 89 to 115 (9.0 to 12) }
	1.75	31 to 46 (3.1 to 4.7)	64 to 83 (6.5 to 8.5)	74 to 98 (7.5 to 10)
14	1.5	59 to 83 (6.0 to 8.5)	120 to 155 (12 to 16)	130 to 175 (13 to 18)
	2.0	54 to 73 (5.5 to 7.5)	110 to 135 (11 to 14)	120 to 165 (12 to 17)
16	1.5	94 to 125 (9.5 to 14)	180 to 235 (18 to 24)	200 to 260 (20 to 27)
	2.0	89 to 115 (9.0 to 12)	160 to 215 (16 to 22)	190 to 250 (19 to 26)

NOTE : 1. Threaded portion and bearing surface are in dry state.
2. Tightening torque of flange bolts and nuts is shown in().

2-4 SEALANT, OIL AND GREASE

Location		Sealant, oil or grease	Application procedure
Oil main gallery plug and connector		HERMESEAL S2 or equivalent	Apply to threaded portions.
Idler gear shaft of oil pump		LOCTITE No. 262 or equivalent	Apply to threaded portions.
		MOLYCOAT or equivalent	Apply to portion sliding with idler gear bushing.
Water pump case		JT-6 grease or equivalent	Put 70g in case and pack bearing.
Water pump unit seal	Seat	Silicone oil	Portion for fitting impeller
	Outer cylinder	THREEBOND 1101 or equivalent	Portion for fitting case
Water thermo gage and water temperature sending unit in thermostat case		THREEBOND 1102C or equivalent	Apply to threaded portions.
SA type automatic timer		AUTO TIMER GREASE (ZEXEL Co., Ltd. product) or equivalent	Put 150g in case.
SP type automatic timer		Engine oil	Pour in 250 cc in case.
Starter	Sleeve bearing	MULTEMP PS-2 (KYODO YUSHI) or equivalent	Apply to inside.
	Internal gear		Apply to gear.
	Gear shaft		Apply to splines.
	Plunger		Apply to sliding portion.
	Lever		Apply to portion contacting plunger and clutch.
	Rear bracket		Put in rear.
	Thrust gap adjusting washer of gear shaft		Apply to all surfaces.
	Gear shaft	ALVANIA or equivalent	Apply to pinion sliding portion.