SERVICE SPECIFICATIONS

ENGINE MECHANICAL

Specifications

Engine tune-up	Coolant capacity			
	w/o Heater			
	PZJ70, 73, 75	9.6 liters	1O.1USqts	8.4 Imp. qts
	HZJ70, 73, 75			
	M/T	9.9 liters	10.5 US qts	8.7 Imp. qts
	A/T	9.7 liters	10.3 US qts	8.5 Imp. qts
	HZJ80and HDJ80			
	M/T	10.4 liters	11.0 US qts	9.2 Imp. qts
	A/T	10.2 liters	10.8 US qts	9.0 Imp. qts
	HZB30and HDB30	10.2 liters	10.8 US qts	9.0 Imp. qts
	w/ Heater			
	PZJ70, 73, 75	10.3 liters	10.9 US qts	9.1 Imp. qts
	HZJ70, 73, 75			
	M/T	10.6 liters	11.2 US qts	9.3 Imp. qts
	A/T	10.4 liters	11.0 US qts	9.2 Imp. qts
	HZJ80and HDJ80			
	M/T	11.1 liters	11.6 US qts	9.8 Imp. qts
	A/T	10.9 liters	11.5 US qts	9.6 Imp. qts
	HZB30and HDB30	14.6 liters	15.4 US qts	12.8 Imp. qts
	w/ Front and rear heaters			
	PZJ70, 73, 75	11.3 liters	11.9 US qts	9.9 Imp. qts
	HZJ70, 73, 75	11.6 liters	12.2 US qts	10.2 Imp. qts
	HZJ80and HDJ80			
	M/T (Europe)	12.0 liters	12.7 US qts	10.6 Imp. qts
	A/T (Europe)	11.8 liters	12.5 US qts	10.4 Imp. qts
	M/T (Othres)	11.9 liters	12.6 US qts	10.5 Imp. qts
	A/T (Others)	11.7 liters	12.4 US qts	10.3 Imp. qts
	Engine oil capacity (PZJ70, 73, 75)			
	Drain and refill w/ Oil filter change	9.0 liters	9.5 US qts	7.9 Imp. qts
	w/o Oil filter change	7.7 liters	8.1 US qts	6.8 Imp. qts
	Dry fill	9.3 liters	9.8 US qts	8.2 Imp. qts
	Engine oil capacity (HZJ70, 73, 75)			
	Drain and refill w/ Oil filter change	9.5 liters	10.0 US qts	8.4 Imp. qts
	w/o Oil filter change	8.2 liters	8.7 US qts	7.2 Imp. qts
	Dry fill	9.8 liters	10.4 US qts	8.6 Imp. qts
	Engine oil capacity (HZJ80 and HDJ80)			
	Drain and refill w/ Oil filter change	9.3 liters	9.8 US qts	8.1 Imp. qts
	w/o Oil filter change	8.0 liters	8.5 US qts	7.0 Imp. qts
	Dry fill	9.6 liters	10.1 US qts	8.4 Imp. qts
	Engine oil capacity (HZB30 and HDB30)			
	Drain and refill w/ Oil filter change	9.8 liters	10.4 US qts	8.6 Imp. qts
	w/o Oil filter change	8.5 liters	9.0 US qts	7.5 Imp. qts
	Dry fill	10.1 liters	10.7 US qts	8.9 Imp. qts
	Engine oil API grade			
	Europe	CD or better		
	Others	CC, CD or better		
	Alternator drive belt			
	Deflection New belt	6-7 mm	0.24-0.28 in.	
	Used belt	8-11 mm	0.31 -0.43 in.	
	Tension (Reference) New belt	45 - 55 kg		
	Used belt	20 - 35 kg		
	Battery specific gravity			
	When fully charged at 20°C (68°F)			
	95D31R and 95D31 L	1.27-1.29		
	ex. (95D31R and 95D31 L)	1.25-1.27		

Specification (Cont'd)

Engine tune-up (cont'd)	Valve clearance	Intake	0.1 5 - 0.25 mm	0.006 - 0.010 in.
		Exhaust	0.35 - 0.45 mm	0.014 - 0.018 in.
	New valve adjusting shim thickness		2.35 mm	0.0925 in.
			2.40 mm	0.0945 in.
			2.45 mm	0.0965 in.
			2.50 mm	0.0984 in.
			2.55 mm	0.1004 in.
			2.60 mm	0.1024 in.
			2.65 mm	0.1043 in.
			2.70 mm	0.1063 in.
			2.75 mm	0.1083 in.
			2.80 mm	0.1102 in.
			2.85 mm	0.1122 in.
			2.90 mm	0.1142 in.
			2.95 mm	0.1161 in.
			3.00 mm	0.1181 in.
			3.05 mm	0.1201 in.
			3.10 mm	0.1220 in.
			3.15 mm	0.1240 in.
			3.20 mm	0.1260 in.
			3.25 mm	0.1280 in.
			3.30 mm	0.1299 in.
	Injection timing			
	Plunger stroke	1 PZ	0.82 - 0.88 mm	0.0323 - 0.0346 in.
		1HZ	1.03-1.09 mm	0.0406-0.0429 in.
		1HD-T	1.29-1.35 mm	0.0508-0.0531 in.
	Idle speed	1 PZ	650 rpm	
		1HZ (M/T)	650 rpm	
		1 HZ (A/T)	710 rpm	
		1HD-T(M/T)	650 rpm	
		1HD-T (A/T)	800 rpm	
	Maximum speed	1 PZ and 1 HZ	4,600 rpm	
		1HD-T	4,400 rpm	
	A/C idle-up setting speed		950 rpm	
	Injection order	1 PZ	1 - 2 - 4 - 5 - 3	
		1 HZ and 1HD-T	1 _ 4 _ 2 - 6 - 3 - 5	
Compression pressure	Engine revolution at 250 rpm			
	1PZand1HZ	STD	37.0 kg/cm^2 (526 psi, 3,628 kPa) or more	
		Limit	27.0 kg/cm^2 (384 psi, 2,648 kPa)	
	1HD-T	STD	35.0 kg/cm^2 (498 psi, 3,432 kPa) or more	
		Limit	25.0 kg/cm^2 (356 psi, 2,452 kPa)	
	Difference of pressure between each cylinder		5.0 kg/cm^2 (71 psi, 490 kPa) or less	
Idler pulley tension spring	Free length		72.7 mm	2.862 in.
	Installed load at 90.1 mm (3.547 in.)		23 - 28 kg (50.7 - 61.7 lb, 225 - 275 N)	
Timing gear	Idler gear inside diameter		45.000-45.025 mm	1.7717 - 1.7726 in.
	Idler gear shaft diameter		44.950 - 44.975 mm	1.7679 - 1.7707 in.
	Idler gear oil clearance	STD	0.025 - 0.075 mm	0.0010 - 0.0030 in.
		Limit	0.20 mm	0.0079 in.
	Gear backlash	STD	0.05 - 0.1 5 mm	0.0020 - 0.0059 in.
		Limit	0.30 mm	0.0118 in.
	Idler gear thrust clearance	STD	0.05 - 0.1 5 mm	0.0020 - 0.059 in.
		Limit	0.30 mm	0.0118 in.

Specifications (Cont'd)

Cylinder head	Warpage			Limit	0.20 mm 0.0079 in.
	Valve seat	Refacing angle		Intake	25°, 45°, 70"
				Exhaust	25°, 45°, 60°
		Contacting angle			45°
		Contacting width		Intake	1.5-1.9 mm 0.059 - 0.075 in.
				Exhaust	1.8-2.2 mm 0.071 -0.087 in.
	Cylinder head bolt outer diameter			STD	10.800-11.000 mm 0.4252-0.4331 in.
				Limit	10.55 mm 0.41 54 in.
	New cylinder head gasket thickness				
	1 PZ	Hole number " 1 "			1.16-1.24 mm 0.0457 - 0.0488 in.
		Hole number "3"			1.26-1.34 mm 0.0496-0.0528 in.
		Hole number "5"			1.36-1.44 mm 0.0535 - 0.0567 in.
	1HZand1HD-T	Cutout number " 1 "			1.15-1.25 mm 0.0453-0.0492 in.
		Cutout number "3"			1.25-1.35 mm 0.0492-0.0531 in.
		Cutout number "5"			1.35-1.45 mm 0.0531 - 0.0571 in.
Valve guide bushing	Inside diameter				8.010 - 8.030 mm 0.31 54 - 0.3161 in.
	Outside diameter			STD	13.004-13.025 mm 0.5112-0.5128 in.
				0/S 0.05	13.054-13.075 mm 0.51 54 - 0.5148 in.
Valve	Valve overall length		STD	Intake	103.29 – 103.69 mm 4.0655 - 4.0823 in.
				Exhaust	103.14-103.54 mm 4.0606-4.0764 in.
			Limit	Intake	102.79 mm 4.0468 in.
				Exhaust	102.64 mm 4.0409 in.
	Valve face angle				44.5°
	Stem diameter			Intake	7.975-7.990 mm 0.3140 - 0.3146 in.
				Exhaust	7.960 - 7.975 mm 0.31 34 - 0.3140 in.
	Stem oil clearance		STD	Intake	0.020- 0.055 mm 0.0008-0.0022 in.
				Exhaust	0.035 - 0.070 mm 0.0014 - 0.0028 in.
			Limit	Intake	0.08 mm 0.0031 in.
				Exhaust	0.10 mm 0.0039 in.
	Margin thickness		STD	Intake	1.6 mm 0.063 in.
				Exhaust	1.7 mm 0.067 in.
			Limit	Intake	1.1 mm 0.043 in.
				Exhaust	1.2 mm 0.047 in.
Valve spring	Free length				
	Yellow painted mark				46.20 mm 1.8189 in.
	Blue painted mark				49.14 mm 1.9346 in.
	Installed tension at 37.0 mm (1.457 in.)				30.7-33.9 kg (67.7-74.7 lb, 301 -332 N)
	Squareness			Limit	2.0 mm 0.075 in.
Valve lifter	Lifter diameter				40.892-40.902 mm 1.6099 - 1.6103 in.
	Cylinder head lifter bore diameter				40.960-40.980 mm 1.6126 - 1.6134 in.
	Oil clearance			STD	0.058 - 0.083 mm 0.0023 - 0.0033 in.
				Limit	0.10 mm 0.0039 in.
Manifold	Warpage			Limit	0.40 mm 0.0157 in.

Specifications (Cont'd)

Camshaft	Thrust clearance		STD	0.10-0.20 mm	0.0039-0.0079 in.
			Limit	0.30 mm	0.0118 in.
	Journal oil clearance				
	No.1 journal		STD	0.022 - 0.074 mm	0.0009 – 0.0029 in.
			Limit	0.10 mm	0.0039 in.
	Others		STD	0.030 - 0.066 mm	0.001 2 - 0.0026 in.
			Limit	0.10 mm	0.0039 in.
	Journal diameter				
	No.1 journal		STD	34.969 - 34.985 mm	1.3767 - 1.3774 in.
	Others			27.986-27.998 mm	1.1018 - 1.1023 in.
	Circle runout		Limit	0.10 mm	0.0039 in.
	Cam lobe height				
	1PZand1HZ	STD	Intake	55.090-55.110 mm	2.1689 - 2.1 697 in.
			Exhaust	55.940-55.960 mm	2.2024-2.2031 in.
		Limit	Intake	54.59 mm	2.1419 in.
			Exhaust	55.44 mm	2.1827 in.
	1HD-T	STD	Intake	54.440-54.460 mm	2.1433-2.1441 in.
			Exhaust	55.940 - 55.960 mm	2.2024 - 2.2031 in.
		Limit	Intake	53.94 mm	2.1236 in.
			Exhaust	55.44 mm	2.1827 in.
Combustion chamber (IPZand 1HZ)	Protrusion			Minus 0.04- Plus 0.04 mm	Minus 0.0016- Plus 0.0016 in.
	Shim thickness			0.03 mm	0.0012 in.
Cylinder block	Cylinder head surface warpage		Limit	0.20 mm	0.0079 in.
	Cylinder bore diameter				
		STD	Mark"1"	94.000 - 94.010 mm	3.7008 - 3.701 2 in.
			Mark "2"	94.010 - 94.020 mm	3.701 2 - 3.7016 in.
			Mark "3"	94.020-94.030 mm	3.7016 - 3.7020 in.
		Limit	STD	94.23 mm	3.7098 in.
			0/S 0.50	94.73 mm	3.7295 in.
	Main journal bore diameter				
	(Reference)	STD	Mark " 1 "	71.000 - 71.006 mm	2.7953 - 2.7955 in.
			Mark "2"	71.006-71.01 2 mm	2.7955 - 2.7957 in.
			Mark "3"	71.01 2-71.01 8 mm	2.7957 - 2.7960 in.
Piston and piston ring	Piston diameter	STD	Mark'T'	93.95 - 93.96 mm	3.6988 - 3.6992 in.
			Mark "2"	93.96 – 93.97 mm	3.6992 - 3.7000 in.
			Mark "3"	93.97 – 93.98 mm	3.7000 - 3.7000 in.
		0/S 0.50		94.45 _ 94.48 mm	3.7185 - 3.71 97 in.
	Piston oil clearance		STD	0.04-0.06 mm	0.0016-0.0024 in.
			Limit	0.14 mm	0.0055 in.
	Piston ring groove clearance		No.1	0.050 - 0.095 mm	0.0020 - 0.0037 in.
			No.2	0.060-0.100 mm	0.0024-0.0039 in.
			Oil	0.030 - 0.070 mm	0.0012 - 0.0028 in.
	Piston ring end gap	STD	No.1	0.27-0.54 mm	0.0106-0.0213 in.
			No.2	0.40 - 0.62 mm	0.0118 - 0.0244 in.
			Oil	0.20 - 0.52 mm	0.0079 - 0.0205 in.
		Limit	No.1	1.34 mm	0.0591 in.
			No.2	1.42 mm	0.0551 in.
			Oil	1.32 mm	0.0520 in.

Specification (Cont'd)

Connecting rod	Thrust clearance	STD	0.10-0.20 mm	0.0039-0.0079 in.
		Limit	0.30 mm	0.0118 in.
	Connecting rod oil clearance			
	STD STD		0.036 - 0.054 mm	0.0014 - 0.0021 in.
		U/S 0.25, U/S 0.50	0.037-0.077 mm	0.0015-0.0030 in.
	Limit		0.10 mm	0.0039 in.
	Connecting rod bearing center wall thickness			
	(Reference) STD	Mark "2"	1.486 - 1.489 mm	0.0585 - 0.0586 in.
		Mark "3"	1.489-1.492 mm	0.0586 - 0.0587 in.
		Mark "4"	1.492-1.495 mm	0.0587 - 0.0589 in.
		Mark "5"	1.495-1.498 mm	0.0589 - 0.0590 in.
		Mark "6"	1.498-1.501 mm	0.0590-0.0591 in.
	Rod bending Limit per 100 mm (3.94 in.)		0.03 mm	0.0012 in.
	Twist Limit per 100 mm (3.94 in.)		0.15 mm	0.0059 in.
	Connecting rod bolt outer diameter	STD	8.300 - 8.400 mm	0.3268 - 0.3307 in.
		Limit	7.95 mm	0.3130 in.
	Bushing inside diameter			
	IPZand 1HZ		29.008-29.020 mm	1.1 420 - 1.1 425 in.
	1HD-T		33.008-33.020mm	1.2995 - 1.3000 in.
	Piston pin diameter			
	IPZand 1HZ		29.000-29.012mm	1.1417 - 1.1422 in.
	1HD-T		33.000 - 33.01 2 mm	1.2992 - 1.2997 in.
	Piston pin oil clearance	STD	0.004 - 0.01 2 mm	0.0002 - 0.0005 in.
		Limit	0.03 mm	0.0012 in.
	Big end inner diameter			
	(Reference) STD	Mark " 1 "	62.014 - 62.020 mm	2.441 5 - 2.4417 in.
		Mark "2"	62.020 - 62.026 mm	2.4417 - 2.4420 in.
		Mark "3"	62.026 - 62.032 mm	2.4420 - 2.4422 in.
Crankshaft	Thrust clearance	STD	0.04-0.24 mm	0.0016-0.0094 in.
		Limit	0.30 mm	0.0118 in.
	Thrust washer thickness	STD	2.930-2.980 mm	0.11 54 - 0.11 73 in.
	Main journal oil clearance			
	STD STD		0.036-0.054 mm	0.0014-0.0021 in.
		U/S 0.25, U/S 0.50	0.037-0.077 mm	0.001 5-0.0030 in.
	Limit		0.10 mm	0.0039 in.
	Main journal diameter STD	Mark'T'	66.994 - 57.000 mm	2.7953 - 2.7955 in.
		Mark "2"	66.988 - 66.994 mm	2.7955 - 2.7957 in.
		Mark "3"	66.982 - 66.988 mm	2.7957 - 2.7960 in.
	U/S 0.25		66.745 - 66.755 mm	2.6278 - 2.3132 in.
	U/S 0.50		66.495 - 66.505 mm	2.61 79 - 2.3033 in.
	Main bearing center wall thickness			
	(Reference) STD	Mark "2"	1.486 - 1.489 mm	0.0585 - 0.0586 in.
		Mark "3"	1.489 - 1.492 mm	0.0586 - 0.0587 in.
		Mark "4"	1.492 - 1.495 mm	0.0587 - 0.0589 in.
		Mark "5"	1.495 - 1.498 mm	0.0589 - 0.0590 in.
		Mark "6"	1.498-1.501 mm	0.0590-0.0591 in.
	Crank pin diameter STD	Mark"1"	58.994 - 59.000 mm	2.3226 - 2.3228 in.
		Mark "2"	58.988 - 58.994 mm	2.3224 - 2.3226 in.
		Mark "3"	58.982 - 58.988 mm	2.3221 - 2.3224 in.
	U/S0.25		58.745 - 58.755 mm	2.3128 - 2.3132 in.
	U/S0.50		58.495 - 58.505 mm	2.3029 - 2.3033 in.
	Circle runout	Limit	0.06 mm	0.0024 in.
	Main journal taper and out-of-round	Limit	0.02 mm	0.0008 in.
	Crank pin taper and out-of-round	Limit	0.02 mm	0.0008 in.
Main bearing	Main bearing cap bolt outer diameter			
		STD	11.800-12.000 mm	0.4646-0.4724 in.
		Limit	11.50 mm	0.4528 in.

Torque Specifications

Part tightened			kg-cm	ft-lb	Nm
Injection pump x Timing gear case			185	13	18
Injection pump x Injection pump stay			700	51	69
Injection pump distributive head plug bolt					
IPZand 1HZ			170	12	17
1HD-T			250	18	25
No.1 camshaft timing pulley x Camshaft			1,000	72	98
No.2 camshaft timing pulley x Injection pump drive gear			315	23	31
Idler pulley bolt x Cylinder head			270	20	26
Spring bolt x Cylinder head			270	20	26
Injection pump drive gear x Injection pump			1,000	27	98
Idler gear (thrust plate) x Cylinder block			400	29	39
Timing gear cover x Timing gear case			200	14	20
Timing gear cover x Cylinder block			200	14	20
No.1 crankshaft pulley x Crankshaft			5,000	362	490
No.2 crankshaft pulley x No.1 crankshaft pulley			250	18	25
Vacuum pump x Timing gear case			400	29	39
Oil pipe * Vacuum pump			185	13	18
Oil pipe x Cylinder block			185	13	18
Cylinder head x Cylinder block		1st	700	51	69
		2nd	90° turns		
		3rd	90° turns		
Camshaft bearing cap x Cylinder head	No.1 journal		250	18	25
	Others		185	13	18
Camshaft oil seal retainer x Cylinder head			200	14	20
Exhaust manifold x Cylinder head			400	29	39
(For additional tighteninig torque)			330	24	32
Glow plug x Cylinder head			130	9	13
Injection nozzle x Cylinder head	1 PZ and 1 HZ		650	47	64
	1HD-T		400	29	39
Nozzle leakage pipe x Injection nozzle	1 PZ and 1 HZ		300	22	29
	1HD-T		125	9	12
Water outlet x Cylinder head			200	14	20
Intake manifold x Cylinder head			200	14	20
Oil dipstick guide x Intake manifold			200	14	20
Oil dipstick guide x Oil cooler cover			200	14	20
Main bearing cap x Cylinder head			1,050	76	103
Connecting rod cap x Connecting rod		1st	375	27	37
		2nd	90° turns		
Main bearing cap x Cylinder block		1st	1,050	76	103
		2nd	90° turns		
Oil nozzle x Cylinder block			275	20	27
Rear oil seal retainer x Cylinder block			65	56 in.-lb	6.4
Rear end plate x Cylinder block			185	13	18
Flywheel (M/T) x Crankshaft			1,300	94	127
Flywheel (drive plate) (A/T) x Crankshaft			1,300	94	127

TURBOCHARGER SYSTEM

Specifications

Turbocharger	Turbocharging pressure	0.50-0.65 kg/cn^2 (7.1 -9.2 psi, 49-64 kPa)
	Impeller wheel axial play	0.13 mm (0.0051 in.) or less
	Impeller wheel radial play	0.18 mm (0.0071 in.) or less

Torque Specifications

Part tightened	kg-cm	ft-lb	Nm
Turbine outlet elbow x Turbocharger	530	38	52
No.1 turbo water pipe x Turbocharger	80	69 in.-lb	7.8
No.2 turbo heat insulator x Turbocharger	80	69 in.-lb	7.8
Turbocharger * Exhaust manifold	530	38	52
Exhaust manifold x Cylinder head	400	29	39
(For additional tighteninig torque)	330	24	32
Turbo oil pipe x Cylinder block (Union bolt)	185	13	18
Turbo oil pipe x Turbocharger	250	18	25
Turbocharger stay x Cylinder block	1,200	87	118
Turbocharger stay x Turbocharger	1,200	87	118
Turbocharger heat insulator x Turbocharger	185	13	8
Exhaust manifold heat insulator x Exhaust manifold	185	13	18
Intake pipe x Intake manifold	200	14	20

FUEL SYSTEM
Specifications

Fuel heater	Resistance at 20°C (68°F)		0.5 - 2.0 Ω
Injection nozzles ("IPZand 1HZ)	Nozzle type		DN20PD32
	Nozzle opening pressure	New nozzle	145-155 kg/cm^2 (2,062 - 2,205 psi, 14,220 - 15,200 kPa)
		Reused nozzle	135-155 kg/cm^2 (1,920 - 2,205 psi, 13,239 - 15,200 kPa)
	Adjusting shim thickness		0.900 mm 0.0354 in.
			0.925 mm 0.0364 in.
			0.950 mm 0.0374 in.
			0.975 mm 0.0384 in.
			1.000 mm 0.0394 in.
			1.025 mm 0.0404 in.
			1.050 mm 0.0413 in.
			1.075 mm 0.0423 in.
			1.100 mm 0.0433 in.
			1.125 mm 0.0443 in.
			1.150 mm 0.0453 in.
			1.175 mm 0.0463 in.
			1.200 mm 0.0472 in.
			1.225 mm 0.0482 in.
			1.250 mm 0.0492 in.
			1.275 mm 0.0502 in.
			1.300 mm 0.0512 in.
			1.325 mm 0.0522 in.
			1.350 mm 0.0531 in.
			1.375 mm 0.0541 in.
			1.400 mm 0.0551 in.
			1.425 mm 0.0561 in.
			1.450 mm 0.0571 in.
			1.475 mm 0.0581 in.
			1.500 mm 0.0591 in.
			1.525 mm 0.0600 in.
			1.550 mm 0.0610 in.
			1.575 mm 0.0620 in.
			1.600 mm 0.0630 in.
			1.625 mm 0.0640 in.
			1.650 mm 0.0650 in.
			1.675 mm 0.0659 in.
			1.700 mm 0.0669 in.
			1.725 mm 0.0679 in.
			1.750 mm 0.0689 in.
			1.775 mm 0.0699 in.
			1.800 mm 0.0709 in.
			1.825 mm 0.0719 in.
			1.850 mm 0.0728 in.
			1.875 mm 0.0738 in.
			1.900 mm 0.0748 in.
			1.925 mm 0.0758 in.
			1.950 mm 0.0768 in.

Specification (Cont'd)

Injection nozzle (1HD-T)	Nozzle type	KBAL
	Pre-lift dimension	0.08 - 0.10 mm 0.0031 - 0.0039 in.
	Nozzle opening pressure	
	No.2 (Inspection pressure)	132-138 kg/cm^2 (1,877 - 1,963 psi, 1 2,945 - 13,533 kPa)
	No.1	180-190 kg/cm^2 (2,560-2,702 psi, 17,652-18,633 kPa)
	Pre-lift and nozzle opening pressure adjusting shim thickness	0.700 mm 0.0276 in.
		0.750 mm 0.0295 in.
		0.800 mm 0.0315 in.
		0.850 mm 0.0335 in.
		0.900 mm 0.0354 in.
		0.950 mm 0.0374 in.
		0.975 mm 0.0384 in.
		1.000 mm 0.0394 in.
		1.025 mm 0.0404 in.
		1.050 mm 0.0413 in.
		1.075 mm 0.0423 in.
		1.100 mm 0.0433 in.
		1.125 mm 0.0443 in.
		1.150 mm 0.0453 in.
		1.175 mm 0.0463 in.
		1.200 mm 0.0472 in.
		1.225 mm 0.0482 in.
		1.250 mm 0.0492 in.
		1.280 mm 0.0504 in.
		1.290 mm 0.0508 in.
		1.300 mm 0.0512 in.
		1.310 mm 0.0516 in.
		1.320 mm 0.0520 in.
		1.330 mm 0.0524 in.
		1.340 mm 0.0528 in.
		1.350 mm 0.0531 in.
		1.360 mm 0.0535 in.
		1.370 mm 0.0539 in.
		1.380 mm 0.0543 in.
		1.390 mm 0.0547 in.
		1.400 mm 0.0551 in.
		1.410 mm 0.0555 in.
		1.420 mm 0.0559 in.
		1.430 mm 0.0563 in.
		1.440 mm 0.0567 in.
		1.450 mm 0.0571 in.
		1.460 mm 0.0575 in.
		1.470 mm 0.0579 in.
		1.480 mm 0.0583 in.
		1.490 mm 0.0587 in.
		1.500 mm 0.0591 in.
		1.510 mm 0.0594 in.
		1.520 mm 0.0598 in.
		1.530 mm 0.0602 in.
		1.540 mm 0.0606 in.
		1.550 mm 0.0610 in.
		1.560 mm 0.0614 in.
		1.570 mm 0.0618 in.
		1.580 mm 0.0622 in.
		1.590 mm 0.0626 in.
		1.600 mm 0.0630 in.

Specification (Cont'd)

Injection nozzles (1HD-T) (cont'd)	Pre-lift and nozzle opening pressure adjusting shim thickness (cont'd)	1.610 mm	0.0634 in.
		1.620 mm	0.0638 in.
		1.630 mm	0.0641 in.
		1.640 mm	0.0646 in.
		1.650 mm	0.0650 in.
		1.660 mm	0.0654 in.
		1.670 mm	0.0657 in.
		1.680 mm	0.0661 in.
		1.690 mm	0.0665 in.
		1.700 mm	0.0669 in.
		1.750 mm	0.0689 in.
		1.800 mm	0.0709 in.
Injection pump	Direction of rotation	Clockwise as seen from drive side	
	Injection order 1 PZ	1 - 2 - 4 - 5 - 3 (D - E - A - B - C)	
	1 HZ and 1HD-T	1 - 4 - 2 - 6 - 3 - 5 (D - E - F - A - B - C)	
	Roller height variation	0.02 mm	0.0008 in.
	Plunger spring squareness	2.0 mm	0.079 in.
	Spring free length		
	Delivery valve spring		
	IPZand 1HZ	24.4 mm	0.961 in.
	1HD-T	19.1 mm	0.752 in.
	Plunger spring		
	IPZand 1HZ	30.0 mm	1.181 in.
	1HD-T	31.2 mm	1.228 in.
	Coupling spring		
	IPZand 1HZ	16.6 mm	0.654 in.
	1HD-T	15.5 mm	0.610 in.
	Pneumatic bellows spring		
	IPZand 1HZ (w/ HAC)	35.0 mm	1.378 in.
	Boost compensator spring		
	1HD-T (Europe)	19.7 mm	0.776 in.
	1HD-T (Others w/o BACS)	19.6 mm	0.772 in.
	1HD-T (Others w/ BACS)	21.8 mm	0.858 in.
	Pickup sensor resistance	600 - 800 Q	
	Timer adjusting screw protrusion pre-setting	7.5 - 8.0 mm	0.295 - 0.31 5 in.
	Plunger spring shim thickness	0.5 mm	0.020 in.
		0.8 mm	0.031 in.
		1.0 mm	0.039 in.
		1.2 mm	0.047 in.
		1.5 mm	0.059 in.
		1.8 mm	0.071 in.
		2.0 mm	0.079 in.
	Plunger adjusting shim thickness 1PZ	1.9 mm	0.075 in.
		2.0 mm	0.079 in.
		2.1 mm	0.083 in.
		2.2 mm	0.087 in.
		2.3 mm	0.091 in.
		2.4 mm	0.094 in.
		2.5 mm	0.098 in.
		2.6 mm	0.102 in.
		2.7 mm	0.106 in.
		2.8 mm	0.110 in.
		2.9 mm	0.114 in.

Specification (Cont'd)

Injection pump (cont'd)	Plunger adjusting shim thickness 1HZ and 1HD-T (for pre-stroke)	1.90 mm	0.0748 in.
		1.95 mm	0.0768 in.
		2.00 mm	0.0787 in.
		2.05 mm	0.0807 in.
		2.10 mm	0.0827 in.
		2.15 mm	0.0846 in.
		2.20 mm	0.0866 in.
		2.25 mm	0.0886 in.
		2.30 mm	0.0906 in.
		2.35 mm	0.0925 in.
		2.40 mm	0.0945 in.
		2.45 mm	0.0965 in.
		2.50 mm	0.0984 in
		2.55 mm	0.1004 in.
		2.60 mm	0.1024 in.
		2.65 mm	0.1043 in.
		2.70 mm	0.1063 in.
		2.75 mm	0.1083 in.
		2.80 mm	0.1102 in.
		2.85 mm	0.1122 in.
		2.90 mm	0.1142 in.
		2.94 mm	0.1157 in.
		2.99 mm	0.1177 in.
		3.04 mm	0.1197 in.
		3.09 mm	0.1216 in.
		3.14 mm	0.1236 in.
		3.19 mm	0.1256 in.
	Flyweight holder thrust clearance	0.1 5-0.35 mm	0.0059-0.0138 in.
	Governor shaft protrusion	0.5-2.0 mm	0.020 - 0.079 in.
	Governor gear adjusting washer thickness	1.05 mm	0.0413 in.
		1.25 mm	0.0492 in.
		1.45 mm	0.0571 in.
		1.65 mm	0.0650 in.
		1.85 mm	0.0728 in.
	Boost compensator adjusting shim thickness	1.1 mm	0.039 in.
		1.3mm	0.051 in.
		1.5 mm	0.059 in.
		1.7 mm	0.067 in.
		1.9 mm	0.075 in.
		2.1 mm	0.083 in.
		2.3 mm	0.090 in.
		2.5 mm	0.098 in.
		2.7 mm	0.106 in.
		2.9mm	0.114 in.
		3.1mm	0.122 in.
		3.3mm	0.130 in.

Injection Pump Adjustment

Preparations of pump tester	Test nozzle type Test nozzle opening pressure Injection pipe Outer diameter Inner diameter Length Minimum bending radius Fuel temperature Fuel feeding pressure		DN12SD12 145-155 kg/cm^2 (2,062 - 2,205 psi, 14,220 - 15,200 kPa) 6.0 mm 0.236 in. 2.0 mm 0.079 in. 840 mm 33.07 in. 25 mm (0.98 in.) or more 40-45°C 0.2 kg/cm^2 (2.8 psi, 20 kPa)		
Full load injection volume pre-setting	Item	Adjusting lever position	Pump rpm	No. of measuring strokes	Injection volume cc (cu in.)
	1PZ	Maximum speed side	1,200	200	11.78-12.18 (0.72-0.74)
	1HZ	Maximum speed side	1,200	200	11.80-12.20 (0.72-0.74)
	1HD-T (w/o BACS)	Maximum speed side	1,800	200	13.58-14.18 (0.83-0.87)
	1HD-T (w/ BACS)	Maximum speed side	1,800	200	13.14-13.74 (0.80-0.84)
Maximum speed pre-setting	Item	Adjusting lever position	Pump rpm	No. of measuring strokes	Injection volume cc (cu in.)
	1PZ	Maximum speed side	2,300	200	4.0-6.0 (0.24-0.37)
	1HZ	Maximum speed side	2,300	200	3.0-5.0 (0.18-0.31)
	1HD-T	Maximum speed side	2,200	200	3.0-5.0 (0.18-0.31)
Pump inner pressure	Item	Pump rpm	Inner pressure kg/cm^2 (psi, kPa)		
	1PZ	500	2.45 - 3.05 (35 - 43, 240 - 299)		
		2,000	6.4-7.0 (91 -100, 628-686)		
	1HZ	500	2.5 -3.1 (36-44, 245-304)		
		2,000	7.1 -7.7 (101-110, 696-755)		
	1HD-T (w/o BACS)	400	2.2-3.1 (31 -44, 216-304)		
		1,900	8.1 -8.4 (115-119, 794-824)		
		2,200	9.0 (128, 883) or less		
	1HD-T (w/ BACS)	400	2.7-3.6 (38-51, 265-353)		
		2,200	8.7-9.0 (124-128, 853-883)		

Injection Pump Adjustment (Cont'd)

Overflow volume	Item	Pump rpm	Overflow volume cc/min. (cu in./min.)		
	IPZand 1HZ	2,000	366-800 (22.3-48.8)		
	1HD-T	1,900	583-1,083 (35.6-66.1)		
Automatic timer	Item	Pump rpm	Piston stroke mm (in.)		
	1PZ	600	0.58 - 1.58 (0.0228 - 0.0622)		
		1,200	3.02 - 4.02 (0.1189 - 0.1583)		
		1,600	4.65-5.65 (0.1830-0.2224)		
		2,000	6.28-7.28 (0.2472-0.2866)		
		2,500	6.88-7.88 (0.2709-0.3102) (LST non-operational)		
	1HZ	600	0.43-1.43 (0.0169-0.0563)		
		1,200	3.23-4.23 (0.1272-0.1665)		
		1,600	5.09 - 6.09 (0.2004 - 0.2398)		
		2,000	6.88-7.88 (0.2709-0.3102)		
		2,500	6.88-7.88 (0.2709-0.3102) (LST non-operational)		
	1HD-T (Europe)	1,300	1.4-2.4 (0.055-0.094)		
		1,440	3.0-4.0 (0.118-0.157)		
		1,700	5.9-6.9 (0.232-0.272)		
		1,900	7.7 -8.7 (0.303-0.343)		
	1HD-T (Others)	800	1.05-2.05 (0.0413-0.0807)		
		1,440	4.9-5.9 (0.193-0.232)		
		1,700	6.42 - 7.42 (0.2528 - 0.2921)		
		1,900	7.7-8.7 (0.303-0.343)		
Full load injection volume	Item	Adjusting lever angle position	Pump rpm	No. of measuring strokes	Injection volume cc (cu in.)
	1PZ	Plus 21 -31°	1,200	200	11.78-12.18 (0.72-0.74)
	1HZ	Plus 21 -31°	1,200	200	11.80-12.20 (0.72-0.74)
	1HD-T (w/o BACS)	Plus 21 -31°	1,100	200	13.58-14.18 (0.83-0.87)
	1HD-T (w/ BACS)	Plus 21 -31°	1,100	200	13.14-13.74 (0.80-0.84)

Injection Pump Adjustment (Cont'd)

Maximum speed	Item	Adjusting lever angle	Pump rpm	No. of measuring strokes	Injection volume cc (cu in.)	
	1PZ	Plus 21 -31°	2,300	200	4.0-6.0 (0.24-0.37)	
			2,500	200	1.0 (0.06) or less	
	1HZ	Plus 21 -31°	2,300	200	3.0-5.0 (0.18-0.31)	
			2,550	200	1.0 (0.06) or less	
	1HD-T	Plus 21 -31°	2,200	200	3.0-5.0 (0.18-0.31)	
			2,350	200	1.0 (0.06) or less	
Injection volume	Item	Adjusting lever angle	Pump rpm	No. of measuring strokes	Injection volume cc (cu in.)	Variation limit cc (cu in.)
	1PZ	Plus 21 -31°	1,200	200	11.78-12.18 (0.72-0.74)	0.4 (0.02)
			100	200	9.60-14.40 (0.59-0.88)	1.2 (0.07)
			500	200	10.56-11.76 (0.64-0.72)	0.6 (0.04)
			2,000	200	11.62-12.82 (0.71 -0.78)	0.6 (0.04)
	1HZ	Plus 21 -31°	1,200	200	11.80-12.20 (0.72-0.74)	0.4 (0.02)
			100	200	9.60-14.40 (0.59-0.88)	1.2 (0.07)
			500	200	9.74-10.94 (0.59-0.67)	0.6 (0.04)
			2,000	200	10.96-12.16 (0.67-0.74)	0.6 (0.04)
	1HD-T (Europe)	Plus 21-31°	1,100	200	13.52-14.72 (0.83-0.90)	0.6 (0.04)
			100	200	11.60-16.40 (0.71 -1.00)	1.2 (0.07)
			500	200	8.32-9.12 (0.51 -0.56)	0.6 (0.04)
			1,800	200	13.58-14.18 (0.83-0.87)	1.2 (0.07)
	1HD-T (Others w/o BACS)	Plus 21 -31°	1,100	200	11.70-12.90 (0.71 -0.79)	0.6 (0.04)
			100	200	11.60-16.40 (0.71 -1.00)	1.2 (0.07)
			500	200	8.68-9.48 (0.53-0.58)	0.6 (0.04)
			1,800	200	13.58-14.18 (0.83-0.87)	1.2 (0.07)

Injection Pump Adjustment (Cont'd)

Injection volume (cont'd)	Item	Adjusting lever angle	Pump rpm	No. of measuring strokes	Injection volume cc (cu in.)	Variation limit cc (cu in.)
	1HD-T (Others w/ BACS)	Plus 21-31°	1,100	200	11.70-12.90 (0.71 -0.79)	0.6 (0.04)
			100	200	11.60-16.40 (0.71 -1.00)	1.2 (0.07)
			500	200	8.20-9.20 (0.50-0.56)	0.6 (0.04)
			1,800	200	13.14 – 14.74 (0.80 – 0.84)	1.2 (0.07)

Governor sleeve plug head thickness		
IPZand 1HZ	3.0 mm	0.118 in.
	3.1 mm	0.122 in.
	3.2 mm	0.126 in.
	3.3 mm	0.130 in.
	3.4 mm	0.134 in.
	3.5 mm	0.138 in.
	3.6 mm	0.142 in.
	3.7 mm	0.146 in.
	3.8 mm	0.150 in.
	3.9 mm	0.154 in.
	4.0 mm	0.158 in.
	4.1 mm	0.161 in.
	4.2 mm	0.165 in.
1HD-T	3.0 mm	0.118 in.
	3.1 mm	0.122 in.
	3.2 mm	0.1 26 in.
	3.3 mm	0.130 in.
	3.4 mm	0.134 in.
	3.5 mm	0.138 in.
	3.6 mm	0.142 in.
	3.7 mm	0.146 in.
	3.8 mm	0.150 in.
	3.9 mm	0.154 in.
	4.0 mm	0.158 in.
	4.1 mm	0.161 in.
	4.2 mm	0.165 in.
	4.3 mm	0.169 in.
	4.4 mm	0.173 in.
	4.5 mm	0.177 in.
	4.6 mm	0.181 in.
	4.7 mm	0.185 in.
	4.8 mm	0.189 in.
	4.9 mm	0.193 in.
	5.0 mm	0.197 in.
	5.1 mm	0.201 in.
	5.2 mm	0.205 in.
	5.3 mm	0.209 in.
	5.4 mm	0.213 in.
	5.5 mm	0.216 in.
	5.6 mm	0.220 in.
	5.7 mm	0.224 in.
	5.8 mm	0.228 in.

Injection Pump Adjustment (Cont'd)

Injection volume (cont'd)	Governor sleeve plug head thickness 1HD-T (cont'd)	5.9 mm 0.232 in. 6.0 mm 0.236 in. 6.1 mm 0.240 in. 6.2 mm 0.244 in. 6.3 mm 0.248 in. 6.4 mm 0.252 in. 6.5 mm 0.256 in. 6.6 mm 0.260 in.

	Item	Pump rpm	No. of measuring stroke	Injection volume cc(cu in.)
Full-load minimum injection volume (1HD-Tonly)	(Europe)	500	200	8.32-9.12 (0.51 -0.56)
	(Others) (w/o BACS)	500	200	8.68-9.48 (0.53-0.58)
	(Others) (w/ BACS)	500	200	7.54-8.34 (0.46-0.51)

	Item	Pump rpm	Boost	No. of measuring stroke	Injection volume cc (cu in.)
Boost compensator characteristic (1HD-T only)	(Europe)	1,100	0.48 (6.8, 47)	200	12.44-13.44 (0.76-0.82)
	(Others) (w/o BACS)	1,100	0.54 (7.7, 53)	200	10.86-11.86 (0.66-0.72)
	(Others) (w/ BACS)	500	0.50 (7.1,49)	200	8.20-9.20 (0.50-0.56)

	Item	Pump rpm	Pressure kg/cm^2 (psi, kPa)	No. of measuring stroke	Injection volume cc (cu in.)	Hysterises cc (cu in.)
Boost compensator characteristic tendency (1HD-T only)	(Europe)	1,100	0.81 (11.5, 79)	200	13.52-14.72 (0.82-0.90)	–
		1,100	0.48 (6.8, 47)	200	12.44-13.44 (0.76-0.82)	–
		1,100	0.27 (3.8, 26)	200	10.50-11.70 (0.64-0.71)	0.3 (0.02) or less
		1,100	0 (0, 0)	200	9.70-11.10 (0.59-0.68)	–
	(Others) (w/o BACS)	1,100	0.81 (11.5, 79)	200	11.70-12.90 (0.71 -0.79)	–
		1,100	0.54 (7.7, 53)	200	10.86-11.86 (0.66-0.72)	–
		1,100	0.41 (5.8, 40)	200	9.48-10.68 (0.58-0.65)	0.3 (0.02) or less
		1,100	0 (0, 0)	200	8.62-10.02 (0.453-0.61)	–
	(Others) (w/ BACS)	1,100	1.29 (18.3, 127)	200	11.70-12.90 (0.71 -0.79)	–
		500	0.81 (11.5, 79)	200	9.80-11.00 (0.60-0.67)	0.3 (0.02) or less
		500	0.50 (7.1, 49)	200	8.20-9.20 (0.50-0.56)	–
		500	0 (0, 0)	200	7.54-8.34 (0.46-0.51)	–

Injection Pump Adjustment (Cont'd)

Load sensing timer (w/o HAC only)	Item	Pump rpm	No. of measuring strokes	Injection volume cc (cu in.)	Remark
	1PZ	1,600	200	Measured value at step (f) minus 1.4 (0.09) ± 0.3 (0.02)	Set to starting point
	1HZ	1,600	200	Measured value at step (f) minus 1.4 (0.09) ± 0.3 (0.02)	
	1HD-T (Europe)	1,800	200	Measured value at step (f) minus 1.6 (0.10) ± 0.6 (0.04)	
	1HD-T (Others)	1,800	200	Measured value at step (f) minus 1.2 (0.07) ± 0.2 (0.01)	
	1PZ	1,600	200	9.08-9.88 (0.55-0.60)	Check ending point
	1HZ	1,600	200	8.2 (0.50) or more	
	Item	Pump rpm		Timer piston fluctuation mm (in.)	
	1PZ	1,600		2.19 - 3.1 9 (0.0862 - 0.1 256)	
	1HZ	1,600		2.73 - 3.73 (0.1075 - 0.1 469)	
	1HD-T (Europe)	1,440		0.70 - 1.70 (0.0276 - 0.0670)	
	1HD-T (Others)	1,440		1.96 - 2.96 (0.0772 - 0.1165)	

Idle speed	Item	Adjusting lever angle	Pump rpm	No. of measuring strokes	Injection volume cc (cu in.)	Variation limit cc (cu in.)
	1PZ	Minus 12-22°	325	200	q = 2.94-3.94 (0.18-0.24)	0.4 (0.02)
			300	200	More than q plus 0.5 (0.03)	–
			400	200	q minus 1.2 - 2.2 (0.07-0.13)	–
	1HZ (M/T)	Minus 12-22°	375	200	q = 2.30-3.30 (0.14-0.20)	0.4 (0.02)
			350	200	More than q plus 0.5 (0.03)	–
			450	200	q minus 1.2-2.2 (0.07-0.13)	–
			325	200	2.60-3.60 (0.16-0.22)	0.4 (0.02)
	1HZ(A/T)	Minus 12-22°	375	200	q = 2.30-3.30 (0.07-0.20)	0.4 (0.02)
			350	200	More than q plus 0.5 (0.03)	–
			450	200	q minus 1.2 - 2.2 (0.07-0.13)	–
			375	200	1.64-2.64 (0.10-0.16)	0.4 (0.02)

Injection Pump Adjustment (Cont'd)

Idle speed (cont'd)	Item	Adjusting lever angle	Pump rpm	No. of measuring strokes	Injection volume cc (cu in.)	Variation limit cc (cu in.)
	1HD-T (Europe M/T)	Full position	400	200	9.32-11.72 (0.57-0.72)	–
		Minus 12-22°	325	200	q = 3.70-4.70 (0.23-0.29)	0.4 (0.02)
			300	200	More than q plus 0.5 (0.03)	–
	1HD-T (Europe A/T)	Full position	400	200	10.30-12.70 (0.63-0.77)	–
		Minus 12-22°	325	200	q = 2.84-3.84 (0.17-0.23)	0.4 (0.02)
			300	200	More than q plus 0.5 (0.03)	–
	1HD-T (Others M/T)	Full position	400	200	9.20-11.60 (0.56-0.71)	–
		Minus 12-22°	325	200	q = 3.70-4.70 (0.23-0.29)	0.4 (0.02)
			300	200	More than q plus 0.5 (0.03)	–
	1HD-T (Others A/T)	Full position	400	200	10.18-12.58 (0.62-0.77)	–
		Minus 12-22°	325	200	q = 2.84-3.84 (0.17-0.23)	0.4 (0.02)
			300	200	More than q plus 0.5 (0.03)	–

Dash pot	Item	Pump rpm	No. of measuring stroke	Injection volume cc (cu in.)	Remark
	1HZ	700	200	q = 0.5-0.9 (0.03-0.05)	Lever set
		700	200	q Plus 0.2-0.3 (0.01 -0.02)	Adjust
	1HD-T	400	200	q = 0.1 -0.3 (0.01 -0.02)	Lever set
		400	200	q Plus 0.2-0.3 (0.01 -0.02)	Adjust

Fast idle (w/ ACSD)	IPZand 1HZ at fuel temperature 15°C (59°F) at fuel temperature 30°C (86°F) 1HD-T at fuel temperature 15°C (59°F) at fuel temperature 40°C (104°F)	1.3 mm 0 mm 1.6 mm 0 mm	0.051 in. 0 in. 0.063 in. 0 in.
Adjusting lever	Lever moving angle	38 - 48°	

Torque Specifications

Part tightened	kg-cm	ft-lb	N-m
Nozzle holder body * Nozzle holder retaining nut (IPZand 1HZ)	375	27	37
Injection nozzle x Cylinder head (IPZand 1HZ)	650	47	64
Nozzle leakage pipe * Injection nozzle (IPZand 1HZ)	300	22	29
Injection pipe x Injection nozzle (IPZand 1HZ)	150	11	15
Injection pipe x Injection pump (IPZand 1HZ)	150	11	15
Nozzle holder body * Nozzle holder retaining nut (1HD-T)	350	25	34
Injection nozzle x Cylinder head (1HD-T)	400	29	39
Nozzle leakage pipe x Injection nozzle (1HD-T)	125	9	12
Injection pipe x Injection nozzle (1HD-T)	250	18	25
Injection pipe x Injection pump (1HD-T)	250	18	25
Fuel inlet hollow screw x Injection pump body	375	27	37
Regulator valve x Injection pump body	90	78 in.-lb	8.8
Feed pump cover x Injection pump body	25	25 in.-lb	2.5
Distributive head x Injection pump body	120	9	12
Governor link support bolt	140	10	14
Delivery valve holder x Distributive head (IPZand 1HZ)	500	36	49
(1HD-T)	550	40	54
Distributive head plug x Distributive head (IPZand 1HZ)	700	51	69
(1HD-T)	900	65	88
Governor cover x Injection pump body	85	74 in.-lb	8.3
Fuel cut solenoid x Distributive head	225	16	22
Pickup sensor x Injection pump body	210	15	21
Fuel inlet pipe x Injection pump	230	17	23
Fuel outlet pipe x Injection pump	230	17	23
Injection pump x Timing gear case	185	13	18
Pump stay x Injection pump	700	51	69
Injection pump drive gear x Injection pump	1,000	72	98
Distributive head plug bolt	170	12	17

COOLING SYSTEM

Specifications

Engine coolant capacity		See page A-2
Radiator cap	Relief valve opening pressure STD	0.75-1.05 kg/cm^2 (10.7-14.9 psi, 74-103 kPa)
	Limit	0.6 kg/cm^2 (8.5 psi, 59 kPa)
Thermostat	Valve opening temperature	74-78°C 187-194T
	Valve lift at 90°C (194°F)	10 mm (0.39 in.) or more

Torque Specifications

Part tightened	kg-cm	ft-lb	Nm
Cylinder block x Drain plug	250	18	25
Water pump x Cylinder block	200	14	20
Alternator adjusting bar (water pump) x Cylinder block	400	29	39
Water pump pulley x Pulley seat	200	14	20
Water inlet x Water inlet housing	200	14	20

LUBRICATION SYSTEM

Specifications

Engine oil capacity			See page A-2	
Oil pressure		at idling	0.3 kg/cm^2 (4.3 psi, 29 kPa) or more	
		at 3,000 rpm	2.5 kg/cm^2 (36 psi, 245 kPa) or more	
Oil pump	Body clearance	STD	0.10 - 0.17 mm	0.0039 - 0.0067 in.
		Limit	0.20 mm	0.0079 in.
	Side clearance	STD	0.03 - 0.09 mm	0.0012 - 0.0035 in.
		Limit	0.15 mm	0.0059 in.
	Tip clearance	STD	0.08 - 0.16 mm	0.0031 - 0.0063 in.
		Limit	0.21 mm	0.0083 in.

Torque specifications

Part tightened	kg-cm	ft-lb	Nm
Engine oil drain plug	250	18	25
Relief valve plug x Timing gear case	425	31	42
Oil pump (timing gear case) x Cylinder block	200	14	20
Oil pump (timing gear case) x Injection pump	185	13	18
Oil strainer x Cylinder Block	90	78 in.-lb	8.8
Oil pan x Cylinder block (timing gear case, rear oil seal retainer)	100	7	10
Engine drain cock x Oil cooler cover	200	14	20
Check valve x Oil cooler cover	275	20	27
Oil cooler cover x Cylinder block	200	14	20
Oil dipstick guide x Intake manifold	200	14	20
Oil dipstick guide x Oil cooler cover	200	14	20
Oil nozzle check valve x Cylinder block	275	20	27

STARTING SYSTEM

Pre-heating system	Light lighting time		
	Supper glow type		See pages ST-3, 4
	Fixed delay type		
	HZJ and HDJ ex. (Europe and Australia)		Approx. 5 seconds
	PZJ, HZJ75, HZB and HDB		
	ex. (Europe and Australia)	12 V type	Approx. 6 seconds
		24 V type	Approx. 5 seconds
	Water temp, sensor resistance		
		at-2O°C (-4°F)	10 - 20 kfi
		at 0°C (32°F)	4 - 7 k O
		at 20°C (68°F)	2 - 3 kfl
		at40°C (104°F)	0.9 - 1.3 kQ
		at 60°C (140°F)	0.4-0.7 kfi
		at 80°C (176°F)	0.2-0.4 *kQ*
Starter	Rated voltage and output power		12 V 2.5 kW, 24 V 4.5 kW
	No-load characteristic		
	Current	12 V type	180 A or less at 11.0 V
		24 V type	90 A or less at 23.0 V
	rpm		3,500 rpm or more
	Commutator Outer diameter	STD	36.0 mm 1.417 in.
		Limit	35.0 mm 1.378 in.
	Undercut depth	STD	0.7-0.9 mm 0.028 - 0.035 in
		Limit	0.2 mm 0.008 in.
	Circle runout	Limit	0.05 mm 0.0020 in.
	Brush Length	STD	20.5-21.0 mm 0.807-0.827 in.
		Limit	13.0 mm 0.512 in.
	Spring installed load		3.2-4.0 kg (7.1 -8.8 lb, 31 -39 N)

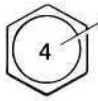
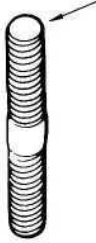
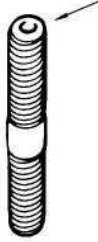
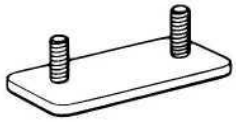
CHARGING SYSTEM

Drive belt deflection and tension			See page A-2
Battery specific gravity	when fully charge at 20°C (68°F)		
	95D31R and 95D31 L		1.25-1.27
	ex. (95D31R and 95D31 L)		1.27-1.29
Alternator	Rated output		1 2 V 45 A, 1 2 V 55 A, 1 2 V 60 A, 1 2 V 80 A, 1 2 V 1 00 A, 24 V 30A, 24 V 55 A
	Rotor coil resistance	12V type	2.7-3.1 Q
		24 V type	1,0-1,4 SI
	Slip ring diameter	STD	14.2-14.4 mm 0.559 - 0.567 in.
		Limit	12.8 mm 0.504 in.
	Brush exposed length	STD	10.5 mm 0.413 in.
		Limit	1.5 mm 0.059 in.
Alternator regulator	Regulating voltage		
	12 V type	at 25°C (77°F)	14.0-15.0 V
		at115°C (239°F)	13.5-14.3 V
	24 V type	at 25°C (77°F)	27.7-28.7 V
		at115°C (239°F)	26.0-28.7 V

STANDARD BOLT TORQUE SPECIFICATIONS

STANDARD BOLT TORQUE SPECIFICATIONS

HOW TO DETERMINE BOLT STRENGTH

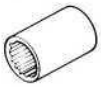
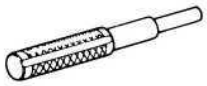
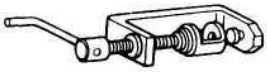
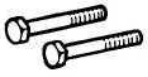
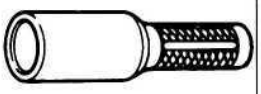
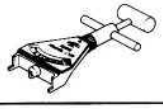
	Mark	Class		Mark	Class
Hexagon head bolt	 Bolt head No. 4– 4T 5– 5T 6– 6T 7– 7T 8– 8T 9– 9T 10– 10T 11– 11T		Stud bolt	 No mark	4T
	 No mark	4T		 Grooved	6T
Hexagon flange bolt w/ washer hexagon bolt	 No mark	4T			
Hexagon head bolt	 Two protruding lines	5T			
Hexagon flange bolt w/ washer hexagon bolt	 Two protruding lines	6T	Welded bolt		4T
Hexagon head bolt	 Three protruding lines	7T			
Hexagon head bolt	 Four protruding lines	8T			

SPECIFIED TORQUE FOR STANDARD BOLTS

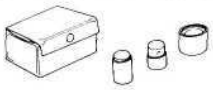
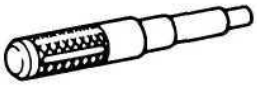
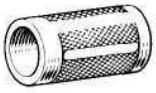
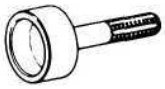
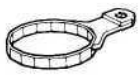
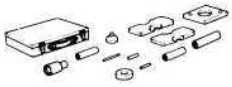
Class	Diameter mm	Pitch mm	Specified torque					
			Hexagon head bolt			Hexagon flange bolt		
			kg-cm	ft-lb	N-m	kg-cm	ft-lb	N-m
4T	6	1	55	48 in.-lb	5	60	52 in.-lb	6
	8	1.25	130	9	12.5	145	10	14
	10	1.25	260	19	26	290	21	29
	12	1.25	480	35	47	540	39	53
	14	1.5	760	55	74	850	61	84
	16	1.5	1,150	83	115	—	—	—
5T	6	1	65	56 in.-lb	6.5	75	65 in.-lb	7.5
	8	1.25	160	12	15.5	175	13	17.5
	10	1.25	330	24	32	360	26	36
	12	1.25	600	43	59	670	48	65
	14	1.5	930	67	91	1,050	76	100
	16	1.5	1,400	101	140	—	—	—
6T	6	1	80	69 in.-lb	8	90	78 in.-lb	9
	8	1.25	195	14	19	210	15	21
	10	1.25	400	29	39	440	32	44
	12	1.25	730	53	71	810	59	80
	14	1.5	1,100	80	110	1,250	90	125
	16	1.5	1,750	127	170	—	—	—
7T	6	1	110	8	10.5	120	9	12
	8	1.25	260	19	25	290	21	28
	10	1.25	530	38	52	590	43	58
	12	1.25	970	70	95	1,050	76	105
	14	1.5	1,500	108	145	1,700	123	165
	16	1.5	2,300	166	230	—	—	—
8T	8	1.25	300	22	29	330	24	33
	10	1.25	620	45	61	690	50	68
	12	1.25	1,100	80	110	1,250	90	120
9T	8	1.25	340	25	34	380	27	37
	10	1.25	710	51	70	790	57	78
	12	1.25	1,300	94	125	1,450	105	140
10T	8	1.25	390	28	38	430	31	42
	10	1.25	800	58	78	890	64	88
	12	1.25	1,450	105	140	1,600	116	155
11T	8	1.25	430	31	42	480	35	47
	10	1.25	890	64	87	990	72	97
	12	1.25	1,600	116	155	1,800	130	175

SSTAND SSM

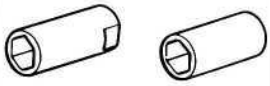
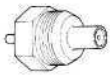
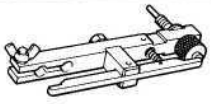
SST (SPECIAL SERVICE TOOLS)

Section / Part Name / Part No. / Illustration			EM	TC	FU	CO	LU	ST	CH	Note
	09011-38121	1 2 mm Socket Wrench for 1 2 Pointed Head	●							
	**09032-00100**	Oil Pan Seal Cutter					●			
	**09201-60011**	Valve Guide Bushing Remover & Replacer	●							
	**09202-43013**	Valve Spring Compressor	●							
	**09208-48010**	Combustion Chamber Remover	●							IPZand 1HZ
	**09213-36020**	Timing Gear Remover	●							
	09213-58011	Crankshaft Pulley Holding Tool	●							
	09213-60017	Crankshaft Pulley & Gear Puller Set	●		●					
	**(09213-00020)**	(Body with Bolt)	●		*●					Injection pump
	**(09213-00030)**	(Handle)	●		*●					Injection pump
	**(09213-00060)**	(Bolt Set)	●		*●					Injection pump
	**09214-60010**	Crankshaft Pulley & Gear Replacer	●							
	**09214-76011**	Crankshaft **Pulley Replacer**	●							Pump drive gear oil seal
	**09216-00020**	**Belt** Tension **Gauge**							●	

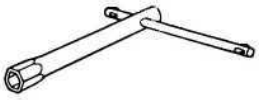
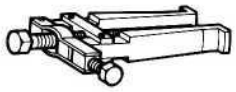
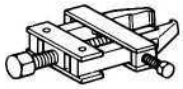
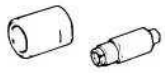
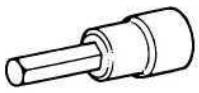
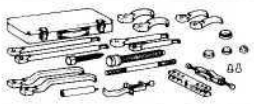
SST (SPECIAL SERVICE TOOLS) (Cont'd)

Section / Part Name / Part No. / Illustration			EM	TC	FU	CO	LU	ST	CH	Note
	**09216-00030**	**Belt Tension Gauge Cable**							●	
	09222-17010	Connecting Rod Bushing Remover & Replacer	●							
	(09222-05020)	(Remover & Replacer)	●							1HD-T
	(09222-05030)	(Guide)	●							1HD-T
	(09222-05040)	(Base)	●							1HD-T
	**09222-66010**	**Connecting Rod Bushing Remover & Replacer**	●							1PZ and 1HZ
	**09223-00010**	Cover & Seal Replacer	●							Timing gear
	**09223-46011**	**Crankshaft Front Oil Seal Replacer**	●							Camshaft retainer oil seal
	**09223-56010**	**Crankshaft Rear Oil Seal Replacer**	●							
	**09223-78010**	**Crankshaft Oil Seal Replacer**	●							
	**09228-10001**	Oil Filter Wrench					●			
	**09228-64010**	**Fuel Filter Wrench**			●					
	**09236-00101**	**Water Pump Overhaul Tool Set**			●					
	**(09237-00070)**	**(Shaft** "C")			●					Governor sleeve plug

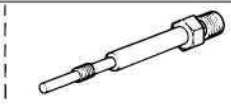
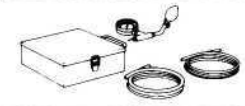
SST (SPECIAL SERVICE TOOLS) (Cont'd)

Section / Part Name / Part No. / Illustration			EM	TC	FU	CO	LU	ST	CH	Note
	**09241-76022**	**Injection Pump Stand Set**			●					
	**09245-54010**	**Injection Pump Stand Arm**			●					
	09248-64011	Valve Clearance Adjusting Tool	●							
	**09260-54012**	Injection Pump Tool **Set**			●					
	**(09262-54010)**	(Distributor Head Plug \ \ Wrench /			●					
	**(09262-54020)**	(Regulator Valve \ \ Wrench j			●					
	**(09269-54020)**	(Socket 14 mm)			●					
	**(09269-54030)**	(Tweezers)			●					
	**(09269-54040)**	(Governor Lever \ \ Support Bolt Wrench /			●					
	09268-17010	2 Spring Nozzle Tool Set			●					1HD-T
	**09268-64010**	Injection Nozzle Wrench Set	●		●					1PZ and 1HZ
	0927517010	Pre-stroke Mearing Adapter			●					1HZ and 1HD-T
	(09751-19004)	(O-Ring)			●					1HZ and 1HD-T
	09275-54011	Plunger Stroke Measuring Tool	●							

SST (SPECIAL SERVICE TOOLS) (Cont'd)

Section / Part Name / Part No. / Illustration			EM	TC	FU	CO	LU	ST	CH	Note
	**09275-54020**	**Maximum Speed Adjusting Screw Lock Nut Wrench**	●							w/ HAC and 1HD-T
	**09285-76010**	Injection Pump Camshaft Bearing Cone Replacer						*1 ●	*2 ●	*1 Starter front bearing *2 Rotor rear bearing
	**09286-46011**	Injection Pump Spline Shaft Puller						*1 ●	*2 ●	*1 Starter bearing *2 Rectifier end frame
	**09308-10010**	**Oil Seal Puller**	●							
	**09330-00021**	Companion Flange Holding Tool	*1*2 ●		*3 ●					*1 Crankshaft pulley *2 Pump drive gear *3 Injection pump
	**09608-20012**	Front Hub & Drive Pinion Bearing Tool Set							●	
	**(09608-00030)**	(Replacer)							●	Rotor front bearing
	09717-20010	Brake Shoe Return Spring Remover	●							Timing belt tension spring
	09718-20010	Brake Shoe Return Spring Replacer	●							Timing belt tension spring
	**09820-00021**	**Alternator Rear Bearing Puller**							●	
	**09820-63010**	Alternator Pulley Set Nut Wrench Set							●	
	**09923-00020**	Hexago 8 mm Wrench	●							
	**09950-20017**	Universal Puller	●							
	**09992-00024**	Cylinder Compression Check Gauge Set	●							

SST (SPECIAL SERVICE TOOLS) (Cont'd)

Section / Part Name / Part No. / Illustration			EM	TC	FU	CO	LU	ST	CH	Note
	(09992-00160)	(No. 5 Attachment)	●							
	(09992-00211)	(Gauge Assy)	●							
	09992-00241	Turbocharger Pressure Gauge		●	●					

SSM (SPECIAL SERVICE MATERIALS)

Part Name	Part No.	Sec.	Use etc.
Seal packing or equivalent	08826-00080	EM	Harf circular plug Camshaft oil seal retainer Cylinder head cover Main bearing cap Rear oil seal retainer Timing belt cover Timing gear cover
		LU	Oil pump (Timing gear case) Oil Pan
Adhesive 1324, Three bond 1324 or equivalent	08833-00070	LU	Engine drain cock Screw plug (Oil pump)