

ENGINE MECHANICAL

SERVICE DATA

SSOMI-03

Compression pressure	1ZZ-FE:	at 250 rpm STD	1,500 kPa (15.3 kgf/cm ² , 218 psi)
		Minimum	1,000 kPa (10.2 kgf/cm ² , 145 psi)
	Difference of pressure between each cylinder		100 kPa (1.0 kgf/cm ² , 15 psi) or less
	2ZZ-GE:	at 250 rpm STD	1,400 kPa (14.3 kgf/cm ² , 203 psi)
		Minimum	1,000 kPa (10.2 kgf/cm ² , 145 psi)
	Difference of pressure between each cylinder		110 kPa (1.1 kgf/cm ² , 16 psi) or less
Valve clearance	1ZZ-FE:	at cold Intake	0.15 – 0.25 mm (0.006 – 0.010 in.)
		Exhaust	0.25 – 0.35 mm (0.010 – 0.014 in.)
	Valve clearance adjusting shim		
		No. 06	5.060 mm (0.1992 in.)
		No. 08	5.080 mm (0.2000 in.)
		No. 10	5.100 mm (0.2008 in.)
		No. 12	5.120 mm (0.2016 in.)
		No. 14	5.140 mm (0.2024 in.)
		No. 16	5.160 mm (0.2031 in.)
		No. 18	5.180 mm (0.2039 in.)
		No. 20	5.200 mm (0.2047 in.)
		No. 22	5.220 mm (0.2055 in.)
		No. 24	5.240 mm (0.2063 in.)
		No. 26	5.260 mm (0.2071 in.)
		No. 28	5.280 mm (0.2079 in.)
		No. 30	5.300 mm (0.2087 in.)
		No. 32	5.320 mm (0.2094 in.)
		No. 34	5.340 mm (0.2102 in.)
		No. 36	5.360 mm (0.2110 in.)
		No. 38	5.380 mm (0.2118 in.)
		No. 40	5.400 mm (0.2126 in.)
		No. 42	5.420 mm (0.2134 in.)
		No. 44	5.440 mm (0.2142 in.)
		No. 46	5.460 mm (0.2150 in.)
		No. 48	5.480 mm (0.2157 in.)
		No. 50	5.500 mm (0.2165 in.)
		No. 52	5.520 mm (0.2173 in.)
		No. 54	5.540 mm (0.2181 in.)
		No. 56	5.560 mm (0.2189 in.)
		No. 58	5.580 mm (0.2197 in.)
		No. 60	5.600 mm (0.2205 in.)
		No. 62	5.620 mm (0.2213 in.)
		No. 64	5.640 mm (0.2220 in.)
		No. 66	5.660 mm (0.2228 in.)
		No. 68	5.680 mm (0.2236 in.)
		No. 70	5.700 mm (0.2244 in.)
		No. 72	5.720 mm (0.2252 in.)
		No. 74	5.740 mm (0.2260 in.)

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Valve clearance	2ZZ-GE:	at cold Intake	0.15 – 0.25 mm (0.006 – 0.010 in.)
		Exhaust	0.35 – 0.45 mm (0.014 – 0.018 in.)
	Valve clearance adjusting shim		
		No. 00	2.000 mm (0.0787 in.)
		No. 02	2.020 mm (0.0795 in.)
		No. 04	2.040 mm (0.0803 in.)
		No. 06	2.060 mm (0.0811 in.)
		No. 08	2.080 mm (0.0819 in.)
		No. 10	2.100 mm (0.0827 in.)
		No. 12	2.120 mm (0.0835 in.)
		No. 14	2.140 mm (0.0843 in.)
		No. 16	2.160 mm (0.0850 in.)
		No. 18	2.180 mm (0.0858 in.)
		No. 20	2.200 mm (0.0866 in.)
		No. 22	2.220 mm (0.0874 in.)
		No. 24	2.240 mm (0.0882 in.)
		No. 26	2.260 mm (0.0890 in.)
		No. 28	2.280 mm (0.0898 in.)
		No. 30	2.300 mm (0.0906 in.)
		No. 32	2.320 mm (0.0913 in.)
		No. 34	2.340 mm (0.0921 in.)
		No. 36	2.360 mm (0.0929 in.)
		No. 38	2.380 mm (0.0937 in.)
		No. 40	2.400 mm (0.0945 in.)
		No. 42	2.420 mm (0.0953 in.)
		No. 44	2.440 mm (0.0961 in.)
		No. 46	2.460 mm (0.0969 in.)
		No. 48	2.480 mm (0.0976 in.)
		No. 50	2.500 mm (0.0984 in.)
		No. 52	2.520 mm (0.0992 in.)
		No. 54	2.540 mm (0.1000 in.)
		No. 56	2.560 mm (0.1008 in.)
		No. 58	2.580 mm (0.1016 in.)
		No. 60	2.600 mm (0.1024 in.)
		No. 62	2.620 mm (0.1031 in.)
		No. 64	2.640 mm (0.1039 in.)
		No. 66	2.660 mm (0.1047 in.)
		No. 68	2.680 mm (0.1055 in.)
		No. 70	2.700 mm (0.1063 in.)
		No. 72	2.720 mm (0.1071 in.)
		No. 74	2.740 mm (0.1079 in.)
		No. 76	2.760 mm (0.1087 in.)
		No. 78	2.780 mm (0.1094 in.)
		No. 80	2.800 mm (0.1102 in.)
Ignition timing	1ZZ-FE:		10 – 18° BTDC @ idle
	2ZZ-GE:		8 – 12° BTDC @ idle
Idle speed	1ZZ-FE:	M/T	700 ± 50 rpm
		A/T	750 ± 50 rpm
	2ZZ-GE:	M/T	800 ± 50 rpm
		A/T	750 ± 50 rpm
Chain and timing sprocket	Chain length at 16 links	Maximum	122.6 mm (4.827 in.)
	Camshaft timing sprocket wear (w/ chain)	Minimum	97.3 mm (3.831 in.)
	Crankshaft timing sprocket wear (w/ chain)	Minimum	51.6 mm (2.031 in.)
Chain tensioner slipper and vibration damper	Wear	Maximum	1.0 mm (0.039 in.)

Cylinder head	Warpage	Maximum	0.05 mm (0.0020 in.)
	Valve seat		
	Refacing angle		30°, 45°, 75°
	Contacting angle		45°
	Contacting width		1.0 – 1.4 mm (0.039 – 0.055 in.)
	Residuary width	Minimum Intake	3.3 mm (0.130 in.)
		Exhaust	3.2 mm (0.126 in.)
	Valve guide bushing bore diameter	1ZZ-FE	
		STD	10.285 – 10.306 mm (0.4049 – 0.4057 in.)
		O/S 0.05	10.335 – 10.356 mm (0.4068 – 0.4077 in.)
Valve		2ZZ-GE	
		STD	10.488 – 10.506 mm (0.41291 – 0.41362 in.)
		O/S 0.05	10.538 – 10.556 mm (0.41488 – 0.41559 in.)
	Cylinder head bolt diameter		
		at tension portion STD	9.0 – 9.2 mm (0.354 – 0.362 in.)
		Minimum	9.0 mm (0.354 in.)
Valve guide bushing	1ZZ-FE:		
	Inside diameter		5.510 – 5.530 mm (0.2169 – 0.2177 in.)
	Protrusion height		8.7 – 9.1 mm (0.342 – 0.358 in.)
	2ZZ-GE:		
	Inside diameter		5.500 – 5.518 mm (0.2165 – 0.2172 in.)
	Protrusion height		15.3 – 15.7 mm (0.602 – 0.618 in.)
Valve	1ZZ-FE:		
	Valve overall length	STD Intake	88.65 mm (3.4902 in.)
		Exhaust	88.69 mm (3.4917 in.)
		Minimum Intake	88.35 mm (3.4783 in.)
		Exhaust	88.39 mm (3.4799 in.)
	Valve face angle		44.5°
	Stem diameter	Intake	5.470 – 5.485 mm (0.2154 – 0.2159 in.)
		Exhaust	5.465 – 5.480 mm (0.2152 – 0.2157 in.)
	Stem oil clearance	STD Intake	0.025 – 0.060 mm (0.0010 – 0.0024 in.)
		Exhaust	0.030 – 0.065 mm (0.0012 – 0.0026 in.)
		Maximum Intake	0.08 mm (0.0031 in.)
		Exhaust	0.10 mm (0.0039 in.)
	Margin thickness	STD	1.0 mm (0.039 in.)
		Minimum	0.7 mm (0.028 in.)
	2ZZ-GE:		
	Valve overall length	STD Intake	111.3 mm (4.382 in.)
		Exhaust	111.7 mm (4.398 in.)
		Minimum Intake	110.9 mm (4.366 in.)
		Exhaust	111.3 mm (4.382 in.)
	Valve face angle		44.5°
	Stem diameter	Intake	5.460 – 5.475 mm (0.21496 – 0.21555 in.)
		Exhaust	5.445 – 5.470 mm (0.21437 – 0.21535 in.)
	Stem oil clearance	STD Intake	0.025 – 0.058 mm (0.00098 – 0.00228 in.)
		Exhaust	0.030 – 0.063 mm (0.00118 – 0.00248 in.)
		Maximum	0.10 mm (0.0039 in.)
	Margin thickness	STD	1.0 mm (0.039 in.)
		Minimum	0.7 mm (0.028 in.)

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Valve spring	1ZZ-FE:		
	Deviation	Maximum	1.6 mm (0.063 in.)
	Angle (Reference)	Maximum	2°
	Free length		45.90 mm (1.807 in.)
	Installed tension at 33.6 mm (1.323 in.)		139.6 – 154.4 N (14.2 – 15.8 kgf, 31.3 – 34.8 lbf)
	Maximum working tension at 24.6 mm (0.969 in.)		244.9 – 276.1 N (25.5 – 28.1 kgf, 56.2 – 61.9 lbf)
	2ZZ-GE:		
	Deviation	Maximum	1.6 mm (0.063 in.)
	Angle (Reference)	Maximum	2°
	Free length	Intake	46.4 mm (1.830 in.)
Valve lifter		Exhaust	46.5 mm (1.831 in.)
	Installed tension at 38.5 mm (1.516 in.)	Intake	220.2 – 243.8 N (22.5 – 24.7 kgf, 49.6 – 55.5 lbf)
		Exhaust	208.2 – 229.8 N (21.2 – 23.4 kgf, 47.6 – 52.6 lbf)
	Maximum working tension	Intake at 27.3 mm (1.075 in.)	533 – 589 N (54.4 – 60.1 kgf, 119.9 – 132.5 lbf)
		Exhaust at 28.5 mm (1.122 in.)	495.5 – 548.5 N (50.5 – 55.9 kgf, 111.3 – 123.3 lbf)
	1ZZ-FE:		
	Lifter diameter		30.966 – 30.976 mm (1.2191 – 1.2195 in.)
	Lifter bore diameter		31.000 – 31.025 mm (1.2205 – 1.2215 in.)
	Oil clearance	STD	0.024 – 0.059 mm (0.0009 – 0.0023 in.)
		Maximum	0.079 mm (0.0031 in.)
Camshaft	1ZZ-FE:		
	Thrust clearance	STD	0.040 – 0.095 mm (0.0016 – 0.0037 in.)
		Maximum	0.11 mm (0.0043 in.)
	Journal oil clearance	STD	0.035 – 0.072 mm (0.0014 – 0.0028 in.)
		Maximum	0.10 mm (0.0039 in.)
	Journal diameter	No. 1	34.449 – 34.465 mm (1.3563 – 1.3569 in.)
		Others	22.949 – 22.965 mm (0.9035 – 0.9041 in.)
	Circle runout	Maximum	0.03 mm (0.0012 in.)
	Cam lobe height	STD Intake	44.333 – 44.433 mm (1.7454 – 1.7493 in.)
		Exhaust	43.761 – 43.861 mm (1.7229 – 1.7268 in.)
		Minimum Intake	44.18 mm (1.7394 in.)
		Exhaust	43.61 mm (1.7169 in.)
	2ZZ-GE:		
	Thrust clearance	STD	0.04 – 0.14 mm (0.0016 – 0.0055 in.)
		Maximum	0.15 mm (0.0059 in.)
	Journal oil clearance	STD	
		No. 1	0.035 – 0.076 mm (0.00138 – 0.00299 in.)
		Others	0.035 – 0.072 mm (0.00138 – 0.00283 in.)
		Maximum	0.1 mm (0.039 in.)
	Journal diameter	No. 1	34.449 – 34.465 mm (1.35626 – 1.35689 in.)
		Others	27.949 – 27.965 mm (1.10035 – 1.10098 in.)
	Circle runout	Maximum	0.03 mm (0.0012 in.)
	Cam lobe height	STD Intake	
		No. 1	40.607 – 40.707 mm (1.59586 – 1.59979 in.)
		No. 2	38.769 – 38.869 mm (1.52362 – 1.52755 in.)
		Exhaust	
		No. 1	40.019 – 40.119 mm (1.57275 – 1.57668 in.)
		No. 2	38.863 – 38.963 mm (1.52732 – 1.53125 in.)
		Minimum Intake	
		No. 1	40.45 mm (1.5925 in.)
		No. 2	38.61 mm (1.5201 in.)
		Exhaust	
		No. 1	39.86 mm (1.5693 in.)
		No. 2	38.71 mm (1.5240 in.)
Intake manifold	Warpage	Maximum	0.10 mm (0.0039 in.)
Exhaust manifold	Warpage	Maximum	0.70 mm (0.0276 in.)

Cylinder block	1ZZ-FE:		
	Cylinder head surface warpage	Maximum	0.05 mm (0.0020 in.)
	Cylinder bore diameter	STD	79.000 – 79.013 mm (3.1102 – 3.1107 in.)
		Maximum	79.013 mm (3.1107 in.)
	12 pointed head bearing cap sub-assembly bolt diameter		
	at tension portion	STD	7.3 – 7.5 mm (0.287 – 0.295 in.)
		Minimum	7.3 mm (0.287 in.)
	2ZZ-GE:		
	Cylinder head surface warpage	Maximum	0.05 mm (0.0020 in.)
	Cylinder bore diameter	STD	82.000 – 82.013 mm (3.2283 – 3.2289 in.)
Piston and piston ring		Maximum	82.013 mm (3.2289 in.)
	12 pointed head bearing cap sub-assembly bolt diameter		
	at tension portion	STD	7.3 – 7.5 mm (0.287 – 0.295 in.)
		Minimum	7.3 mm (0.287 in.)
	1ZZ-FE:		
	Piston diameter		
	at 25.6 mm (1.008 in.) from the piston head		78.925 – 78.935 mm (3.1073 – 3.1077 in.)
	Piston oil clearance	STD	0.065 – 0.088 mm (0.0026 – 0.0035 in.)
		Maximum	0.10 mm (0.0039 in.)
	Piston ring groove clearance		0.030 – 0.070 mm (0.0012 – 0.0028 in.)
Piston and piston ring	Piston ring end gap	STD No. 1	0.25 – 0.35 mm (0.0098 – 0.0138 in.)
		No. 2	0.35 – 0.50 mm (0.0138 – 0.0197 in.)
		Oil	0.15 – 0.40 mm (0.0059 – 0.0157 in.)
		Maximum No. 1	1.05 mm (0.0413 in.)
		No. 2	1.20 mm (0.0472 in.)
		Oil	1.05 mm (0.0413 in.)
	2ZZ-GE:		
	Piston diameter		
	at 12.0 mm (0.048 in.) from the piston head		81.975 – 81.993 mm (3.2274 – 3.2281 in.)
	Piston oil clearance	STD	0.007 – 0.038 mm (0.0003 – 0.0015 in.)
Piston and piston ring		Maximum	0.10 mm (0.0039 in.)
	Piston ring groove clearance		0.030 – 0.070 mm (0.0012 – 0.0028 in.)
	Piston ring end gap	STD No. 1	0.25 – 0.35 mm (0.0098 – 0.0138 in.)
		No. 2	0.35 – 0.50 mm (0.0138 – 0.0197 in.)
		Oil	0.15 – 0.40 mm (0.0059 – 0.0157 in.)
		Maximum No. 1	1.05 mm (0.0413 in.)
		No. 2	1.20 mm (0.0472 in.)
		Oil	1.05 mm (0.0413 in.)

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Connecting rod	1ZZ-FE:		
	Thrust clearance	STD	0.160 – 0.342 mm (0.0063 – 0.0135 in.)
		Maximum	0.342 mm (0.0135 in.)
	Connecting rod thickness		19.788 – 19.840 mm (0.7791 – 0.7811 in.)
	Connecting rod bearing center wall thickness		
	Reference	Mark 1	1.486 – 1.490 mm (0.0585 – 0.0587 in.)
		Mark 2	1.490 – 1.494 mm (0.0587 – 0.0588 in.)
		Mark 3	1.494 – 1.498 mm (0.0588 – 0.0590 in.)
	Connecting rod oil clearance	STD	0.028 – 0.060 mm (0.0011 – 0.0024 in.)
		Maximum	0.08 mm (0.0031 in.)
	Rod out-of-alignment	Maximum per/100 mm (3.94 in.)	0.05 mm (0.0020 in.)
	Rod twist	Maximum per/100 mm (3.94 in.)	0.05 mm (0.0020 in.)
	Bushing inside diameter		20.012 – 20.021 mm (0.7879 – 0.7882 in.)
	Piston pin diameter		20.004 – 20.013 mm (0.7876 – 0.7879 in.)
	Bushing oil clearance	STD	0.005 – 0.011 mm (0.0002 – 0.0004 in.)
		Maximum	0.05 mm (0.0020 in.)
	Connecting rod bolt diameter		
		at tension portion STD	6.6 – 6.7 mm (0.260 – 0.264 in.)
		Minimum	6.4 mm (0.252 in.)
	2ZZ-GE:		
	Thrust clearance	STD	0.160 – 0.342 mm (0.0063 – 0.0135 in.)
		Maximum	0.342 mm (0.0135 in.)
	Connecting rod thickness		19.788 – 19.840 mm (0.7791 – 0.7811 in.)
	Connecting rod bearing center wall thickness		
	Reference	Mark 1	1.482 – 1.486 mm (0.0583 – 0.0585 in.)
		Mark 2	1.486 – 1.490 mm (0.0585 – 0.0587 in.)
		Mark 3	1.490 – 1.494 mm (0.0587 – 0.0588 in.)
	Connecting rod oil clearance	STD	0.028 – 0.052 mm (0.0011 – 0.0020 in.)
		Maximum	0.08 mm (0.0031 in.)
	Rod out-of-alignment	Maximum per/100 mm (3.94 in.)	0.05 mm (0.0020 in.)
	Rod twist	Maximum per/100 mm (3.94 in.)	0.05 mm (0.0020 in.)
	Bushing inside diameter	Connecting rod	20.011 – 20.023 mm (0.7878 – 0.7883 in.)
		Piston	20.013 – 20.025 mm (0.7879 – 0.7884 in.)
	Piston pin diameter		20.004 – 20.016 mm (0.7876 – 0.7880 in.)
	Bushing oil clearance	STD Piston x Piston pin	0.005 – 0.013 mm (0.0002 – 0.0005 in.)
		Piston pin x Connecting rod	0.005 – 0.009 mm (0.0002 – 0.0004 in.)
		Maximum	0.05 mm (0.0020 in.)
	Connecting rod bolt diameter		
		at tension portion STD	6.6 – 6.7 mm (0.260 – 0.264 in.)
		Minimum	6.4 mm (0.252 in.)

Crankshaft	1ZZ-FE:		
	Thrust clearance	STD	0.04 – 0.24 mm (0.0016 – 0.0094 in.)
		Maximum	0.30 mm (0.0118 in.)
	Thrust washer thickness		2.430 – 2.480 mm (0.0957 – 0.0976 in.)
	Main journal oil clearance	STD	0.015 – 0.032 mm (0.0006 – 0.0013 in.)
		Maximum	0.050 mm (0.0020 in.)
	Main journal diameter	Mark 0	47.998 – 48.000 mm (1.8897 – 1.8898 in.)
		Mark 1	47.996 – 47.998 mm (1.8896 – 1.8897 in.)
		Mark 2	47.994 – 47.996 mm (1.8895 – 1.8896 in.)
		Mark 3	47.992 – 47.994 mm (1.8894 – 1.8895 in.)
		Mark 4	47.990 – 47.992 mm (1.8893 – 1.8894 in.)
		Mark 5	47.988 – 47.990 mm (1.8892 – 1.8893 in.)
	Main bearing center wall thickness		
	Reference	Mark 1	1.993 – 1.996 mm (0.0785 – 0.0786 in.)
		Mark 2	1.996 – 1.999 mm (0.0786 – 0.0787 in.)
		Mark 3	1.999 – 2.002 mm (0.0787 – 0.0788 in.)
		Mark 4	2.002 – 2.005 mm (0.0788 – 0.0789 in.)
	Crank pin diameter		43.992 – 44.000 mm (1.7320 – 1.7323 in.)
	Circle runout	Maximum	0.03 mm (0.0012 in.)
	Main journal taper and out-of round	Maximum	0.02 mm (0.0008 in.)
	Crank pin taper and out-of round	Maximum	0.02 mm (0.0008 in.)
	2ZZ-GE:		
	Thrust clearance	STD	0.04 – 0.24 mm (0.0016 – 0.0094 in.)
		Maximum	0.30 mm (0.0118 in.)
	Thrust washer thickness		2.430 – 2.480 mm (0.0957 – 0.0976 in.)
	Main journal oil clearance	STD	0.016 – 0.032 mm (0.0006 – 0.0013 in.)
		Maximum	0.050 mm (0.0020 in.)
	Main journal diameter	Mark 0	47.998 – 48.000 mm (1.8897 – 1.8898 in.)
		Mark 1	47.996 – 47.998 mm (1.8896 – 1.8897 in.)
		Mark 2	47.994 – 47.996 mm (1.8895 – 1.8896 in.)
		Mark 3	47.992 – 47.994 mm (1.8894 – 1.8895 in.)
		Mark 4	47.990 – 47.992 mm (1.8893 – 1.8894 in.)
		Mark 5	47.988 – 47.990 mm (1.8892 – 1.8893 in.)
	Main bearing center wall thickness		
	Reference	Mark 1	1.989 – 1.992 mm (0.0783 – 0.0784 in.)
		Mark 2	1.992 – 1.995 mm (0.0784 – 0.0785 in.)
		Mark 3	1.995 – 1.998 mm (0.0785 – 0.0787 in.)
		Mark 4	1.998 – 2.001 mm (0.0787 – 0.0788 in.)
		Mark 5	2.001 – 2.004 mm (0.0788 – 0.0789 in.)
	Crank pin diameter		44.992 – 45.000 mm (1.7713 – 1.7717 in.)
	Circle runout	Maximum	0.03 mm (0.0012 in.)
	Main journal taper and out-of round	Maximum	0.02 mm (0.0008 in.)
	Crank pin taper and out-of round	Maximum	0.02 mm (0.0008 in.)