

# ENGINE MECHANICAL

## SERVICE DATA

0300G-01

### 1ZZ-FE

Ignition timing	w/ Terminal TC and CG of DLC3 connected W/ Terminal TC and CG of DLC3 disconnected	8 – 12° BTDC 10 – 18° BTDC
Idle speed		650 – 750 rpm
Compression Compression pressure Minimum pressure Difference between each cylinder		1,300 kPa (13.3 kgf·cm <sup>2</sup> , 189 psi) 1,000 kPa (10.2 kgf·cm <sup>2</sup> , 145 psi) 100 kPa (1.0 kgf·cm <sup>2</sup> , 15 psi)
Cylinder head set bolt Length	Standard Maximum	146.8 – 148.2 mm (5.780 – 5.835 in.) 148.5 mm (5.846 in.)
Valve clearance (Cold) No. 1 Cylinder TDC/Compression No. 4 Cylinder TDC/Compression	Intake Exhaust Intake Exhaust	0.15 – 0.25 mm (0.0059 – 0.0098 in.) 0.25 – 0.35 mm (0.0098 – 0.0138 in.) 0.15 – 0.25 mm (0.0059 – 0.0098 in.) 0.25 – 0.35 mm (0.0098 – 0.0138 in.)
Chain elongation	Maximum	122.6 mm (4.827 in.)
Camshaft timing gear diameter (w/ chain)	Minimum	97.3 mm (3.831 in.)
Crankshaft timing gear Diameter (w/ chain)	Minimum	51.6 mm (2.032 in.)
Chain tensioner slipper wear	Maximum	1.0 mm (0.039 in.)
Chain vibration damper wear	Maximum	1.0 mm (0.039 in.)
Camshaft Circle runout Cam lobe height	Maximum Standard Intake Exhaust Minimum Intake Exhaust	0.03 mm (0.0012 in.) 44.333 – 44.433 mm (1.7454 – 1.7493 in.) 43.761 – 43.861 mm (1.7229 – 1.7268 in.) 44.18 mm (1.7394 in.) 43.61 mm (1.7169 in.)
Journal diameter	No. 1 Others	34.449 – 34.465 mm (1.3563 – 1.3569 in.) 22.949 – 22.965 mm (0.9035 – 0.9041 in.)
Cylinder head warpage	Cylinder block side Intake manifold side Exhaust manifold side	0.05 mm (0.0020 in.) 0.10 mm (0.0039 in.) 0.10 mm (0.0039 in.)
Camshaft thrust clearance	Standard Maximum	0.040 – 0.095 mm (0.0016 – 0.0037 in.) 0.110 mm (0.0043 in.)
Camshaft oil clearance	Standard Maximum	0.035 – 0.072 mm (0.0014 – 0.0028 in.) 0.10 mm (0.0039 in.)
Valve lifter diameter		30.966 – 30.976 mm (1.2191 – 1.2195 in.)
Valve lifter bore diameter		31.000 – 31.025 mm (1.2205 – 1.2215 in.)
Valve lifter oil clearance	Standard Maximum	0.024 – 0.059 mm (0.0009 – 0.0023 in.) 0.079 mm (0.0031 in.)
Inner compression spring Free length Deviation Angle (reference) Installed tension Maximum working tension	at 33.6 mm (1.323 in.) at 24.1 mm (0.949 in.)	43.40 mm (1.7087 in.) 1.6 mm (0.063 in.) 2° 158.6 – 175.4 N (16.2 – 17.9 kgf, 35.7 – 39.5 lbf) 335.3 – 370.7 N (34.2 – 37.8 kgf, 75.4 – 83.3 lbf)
Valve Overall length Valve stem diameter Margin thickness	Standard Intake Exhaust Minimum Intake Exhaust Intake Exhaust Standard Minimum	88.65 mm (3.4902 in.) 88.69 mm (3.4917 in.) 88.35 mm (3.4784 in.) 88.39 mm (3.4799 in.) 5.470 – 5.485 mm (0.2154 – 0.2159 in.) 5.465 – 5.480 mm (0.2152 – 0.2158 in.) 1.0 mm (0.039 in.) 0.7 mm (0.028 in.)
Valve guide bushing inside diameter		5.510 – 5.530 mm (0.2169 – 0.2177 in.)

Valve guide Bushing oil clearance	Standard 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 (0.0032 in.)	
	Exhaust	0.10 mm (0.0039 in.)	
Valve guide bushing bore diameter	STD	10.285 – 10.306 mm (0.4049 – 0.4058 in.)	
	O/S 0.05	10.335 – 10.356 mm (0.4069 – 0.4077 in.)	
Valve guide bushing protrusion height		8.7 – 9.1 mm (0.343 – 0.358 in.)	
Straight pin protrusion height (cylinder head)		5 mm (0.197 in.)	
Union protrusion height	A	29 mm (1.142 in.)	
	B	66.5 mm (2.618 in.)	
	C	24 mm (0.945 in.)	
Connecting rod thrust clearance	Standard	0.160 – 0.342 mm (0.063 – 0.135 in.)	
	Maximum	0.342 mm (0.135 in.)	
Connecting rod oil clearance	Standard	0.028 – 0.060 mm (0.0011 – 0.0024 in.)	
	Maximum	0.080 mm (0.0032 in.)	
Connecting rod large end bore diameter	1	47.000 – 47.008 mm (1.85039 – 1.85071 in.)	
	2	47.009 – 47.016 mm (1.85075 – 1.85102 in.)	
	3	47.017 – 47.024 mm (1.85106 – 1.85134 in.)	
Connecting rod bearing thickness	1	1.486 – 1.490 mm (0.05850 – 0.05866 in.)	
	2	1.491 – 1.494 mm (0.05870 – 0.05882 in.)	
	3	1.495 – 1.498 mm (0.05886 – 0.05898 in.)	
Crankshaft pin outer diameter		43.992 – 44.000 mm (1.73197 – 1.73228 in.)	
Crankshaft thrust clearance	Standard	0.04 – 0.24 mm (0.0016 – 0.0095 in.)	
	Maximum	0.30 mm (0.0118 in.)	
Cylinder block warpage	Maximum	0.05 mm (0.0020 in.)	
Cylinder bore diameter		79.000 – 79.013 mm (3.1102 – 3.1108 in.)	
Piston diameter	at 25.6 mm (1.008 in.) from piston head	78.872 – 78.972 mm (3.1052 – 3.1091 in.)	
Piston oil clearance	Standard	0.065 – 0.088 mm (0.0026 – 0.0035 in.)	
	Maximum	0.088 mm (0.0035 in.)	
Piston pin bore diameter	A	20.006 – 20.009 mm (0.78764 – 0.78776 in.)	
	B	20.010 – 20.012 mm (0.78780 – 0.78787 in.)	
	C	20.013 – 20.015 mm (0.78791 – 0.78799 in.)	
Piston pin outer diameter	A	20.004 – 20.007 mm (0.78756 – 0.78768 in.)	
	B	20.008 – 20.010 mm (0.78772 – 0.78780 in.)	
	C	20.011 – 20.013 mm (0.78783 – 0.78791 in.)	
Connecting rod small end bore diameter	A	20.012 – 20.015 mm (0.78787 – 0.78799 in.)	
	B	20.016 – 20.018 mm (0.78803 – 0.78811 in.)	
	C	20.019 – 20.021 mm (0.78815 – 0.78823 in.)	
Piston pin oil clearance	Standard	0.002 – 0.011 mm (0.0001 – 0.0004 in.)	
		Maximum	0.011 mm (0.0004 in.)
	Piston pin x Connecting rod	Standard	–0.001 – 0.017 mm (–0.00004 – 0.0007 in.)
Maximum		0.017 mm (0.0007 in.)	
Ring groove clearance	No. 1	0.020 – 0.070 mm (0.0008 – 0.0028 in.)	
	No. 2	0.030 – 0.070 mm (0.0012 – 0.0028 in.)	
	Oil	0.03 – 0.11 mm (0.0012 – 0.0043 in.)	
Piston ring end gap	Standard	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 (0.0059 – 0.158 in.)	
	Maximum	No. 1	1.05 mm (0.0413 in.)
		No. 2	1.20 mm (0.0472 in.)
Connecting rod Out-of alignment	Maximum	0.05 mm (0.0020 in.) per 100 mm (3.94 in.)	
		Twist	0.05 mm (0.0020 in.) per 100 mm (3.94 in.)
Connecting rod bolt diameter	Standard	6.6 – 6.7 mm (0.260 – 0.264 in.)	
	Maximum	6.4 mm (0.252 in.)	

## SERVICE SPECIFICATIONS - ENGINE MECHANICAL

Crankshaft Circle runout	Maximum	0.03 mm (0.0012 in.)
Main journal diameter		47.988 – 48.000 mm (1.8893 – 1.8898 in.)
Taper and out-of-round	Maximum	0.020 mm (0.0008 in.)
Crank pin diameter		43.992 – 44.000 mm (1.7320 – 1.7323 in.)
Taper and out-of-round	Maximum	0.020 mm (0.0008 in.)
Crankshaft bearing cap set bolt diameter	Standard	7.3 – 7.5 mm (0.287 – 0.295 in.)
	Minimum	7.3 mm (0.287 in.)
Crankshaft oil clearance	Standard	0.015 – 0.032 mm (0.0006 – 0.0013 in.)
	Minimum	0.05 mm (0.0020 in.)
Cylinder block journal bore diameter	0	52.000 – 52.002 mm (2.04724 – 2.04732 in.)
	1	52.003 – 52.004 mm (2.04736 – 2.04740 in.)
	2	52.005 – 52.006 mm (2.04744 – 2.04748 in.)
	3	52.007 – 52.009 mm (2.04752 – 2.04760 in.)
	4	52.010 – 52.011 mm (2.04764 – 2.04768 in.)
	5	52.012 – 52.013 mm (2.04772 – 2.04776 in.)
	6	52.014 – 52.015 mm (2.04788 – 2.04783 in.)
Crankshaft journal diameter	0	47.999 – 48.000 mm (1.88972 – 1.88976 in.)
	1	47.997 – 47.998 mm (1.88965 – 1.88969 in.)
	2	47.995 – 47.996 mm (1.88957 – 1.88961 in.)
	3	47.993 – 47.994 mm (1.88949 – 1.88953 in.)
	4	47.991 – 47.992 mm (1.88941 – 1.88945 in.)
	5	47.988 – 47.990 mm (1.88929 – 1.88922 in.)
Standard bearing center wall thickness	1	1.994 – 1.997 mm (0.07850 – 0.07862 in.)
	2	1.998 – 2.000 mm (0.07866 – 0.07874 in.)
	3	2.001 – 2.003 mm (0.07878 – 0.07886 in.)
	4	2.004 – 2.006 mm (0.07890 – 0.07898 in.)
Straight pin (Cylinder block)	A	5 mm (0.200 in.)
	B	7.5 mm (0.295 in.)
	C	12 mm (0.472 in.)
	D	8 mm (0.315 in.)
Ring pin (Cylinder block)	A	6 mm (0.236 in.)
	B	7 mm (0.276 in.)
	C	10 mm (0.394 in.)

## 2ZZ-GE

Ignition timing	w/ Terminal TC and CG of DLC3 connected W/ Terminal TC and CG of DLC3 disconnected	8 – 12° BTDC 4 – 12° BTDC (M/T) 10 – 18° BTDC (A/T)
Idle speed		750 – 850 rpm (M/T) 700 – 800 rpm (A/T)
Compression Compression pressure Minimum pressure Difference between each cylinder		1,400 kPa (14.3kgf/cm <sup>2</sup> 203 psi) 1,000 kPa (10.3 kgf/cm <sup>2</sup> 145 psi) 110 kPa (1.1kgf/cm <sup>2</sup> 16 psi)
Cylinder head set bolt Length	Standard	146.0 – 148.2 mm (5.780 – 5.835 in.)
	Maximum	148.5 mm (5.846 in.)
Valve clearance (cold)	Intake	0.08 – 0.18 mm (0.0031 – 0.0071 in.)
	Exhaust	0.22 – 0.32 mm (0.0087 – 0.0126 in.)
Chain length at 16 links	Maximum	122.6 mm (4.827 in.)
Camshaft timing sprocket diameter (w / chain)	Minimum	97.3mm (3.831 in.)
Crankshaft timing sprocket diameter (w / chain)	Minimum	51.6mm (2.031in.)
Chain tensioner slipper wear	Maximum	1.0 mm (0.039 in.)
Chain tensioner vibration damper wear	Maximum	1.0 mm (0.039 in.)
Camshaft circle runout	Maximum	0.03 mm (0.0012 in.)

Camshaft lobe height	Standard	
	Intake No. 1	40.607 – 40.707 mm (1.5987 – 1.6026 in.)
	Intake No. 2	38.769 – 38.869 mm (1.5236 – 1.5303 in.)
	Exhaust No. 1	40.019 – 40.119 mm (1.5756 – 1.5795 in.)
	Exhaust No. 2	38.863 – 38.963 mm (1.5300 – 1.5340 in.)
	Minimum	
	Intake No. 1	40.45 mm (1.5925 in.)
	Intake No. 2	38.61 mm (1.5201 in.)
	Exhaust No. 1	39.86 mm (1.5693 in.)
	Exhaust No. 2	38.71 mm (1.5240 in.)
Camshaft journal diameter	No. 1	34.449 – 34.465 mm (1.3563 – 1.3569 in.)
	Others	27.949 – 27.965 mm (1.1004 – 1.1010 in.)
Cylinder head warpage	Maximum	
	Cylinder block side	0.2 mm (0.0080 in.)
	Intake manifold side	0.2 mm (0.0080 in.)
	Exhaust manifold side	0.3 mm (0.0120 in.)
Busing oil clearance inside diameter		5.500 – 5.518 mm (0.2165 – 0.2172 in.)
Valve stem diameter	Intake	5.460 – 5.475 mm (0.2145 – 0.2156 in.)
	Exhaust	5.445 – 5.470 mm (0.2144 – 0.2154 in.)
Valve stem oil clearance	Standard	
	Intake	0.025 – 0.058 mm (0.0010 – 0.0023 in.)
	Exhaust	0.030 – 0.063 mm (0.0012 – 0.0025 in.)
	Maximum	
	Intake	0.10 mm (0.0039 in.)
	Exhaust	0.10 mm (0.0039 in.)
Valve guide bush diameter	Use STD	10.448 – 10.506 mm (0.4129 – 0.4136 in.)
	Use O/S	10.538 – 10.556 mm (0.4149 – 0.4156 in.)
Valve spring free length	Intake	46.4 mm (1.827 in.)
	Exhaust	46.5 mm (1.831 in.)
Valve spring deviation	Maximum	1.6 mm (0.063 in.)
Valve spring angle (reference)	Maximum	2°
Valve overall length	Standard Intake	111.3 mm (4.382 in.)
	Exhaust	111.7 mm (4.392 in.)
	Minimum Intake	110.9 mm (4.366 in.)
	Exhaust	111.3 mm (4.382 in.)
Valve head margin thickness	Standard	1.0 mm (0.039 in.)
	Minimum	0.7 mm (0.028 in.)
Valve rocker shaft diameter		15.965 – 15.985 mm (0.6285 – 0.6293 in.)
Camshaft thrust clearance	Standard	0.10 – 0.24 mm (0.0039 – 0.0095 in.)
	Maximum	0.15 mm (0.0059 in.)
Camshaft oil clearance	Standard	0.025 – 0.062 mm (0.001 – 0.0024 in.)
	Maximum	0.062 mm (0.0024 in.)
Water hose union protrusion	Standard A	29 mm (1.14 in.)
	B	69.8 mm (2.748 in.)
	C	24 mm (0.95 in.)
Valve guide bush protrusion height		15.3 – 15.7 mm (0.602 – 0.618 in.)
Connecting rod thrust clearance	Standard	0.160 – 0.342 mm (0.0063 – 0.0135 in.)
	Maximum	0.342 mm (0.0135 in.)
Connecting rod oil clearance	Standard	0.028 – 0.052 mm (0.0011 – 0.0020 in.)
	Maximum	0.080 mm (0.0031 in.)
Connecting rod bearing center wall thickness	1	1.482 – 1.486 mm (0.0583 – 0.0585 in.)
	2	1.486 – 1.490 mm (0.0585 – 0.0587 in.)
	3	1.490 – 1.494 mm (0.0587 – 0.0588 in.)
Connecting rod large end bore diameter	1	48.000 – 48.008 mm (1.8898 – 1.8901 in.)
	2	48.008 – 48.016 mm (1.8901 – 1.8904 in.)
	3	48.016 – 48.024 mm (1.8904 – 1.8907 in.)

## SERVICE SPECIFICATIONS – ENGINE MECHANICAL

Crankshaft pin outer diameter		44.992 – 45.000 mm (1.7713 – 1.7717 in.)
Crankshaft thrust clearance	Standard Maximum	0.04 – 0.24 mm (0.0016 – 0.0094 in.) 0.24 mm (0.0094 in.)
Crankshaft Thrust washer thickness		2.430 – 2.480 mm (0.0957 – 0.0976 in.)
Cylinder block surface warpage	Maximum	0.05 mm (0.0020 in.)
Cylinder bore diameter	Standard Maximum	82.000 – 82.013 mm (3.2283 – 3.2289 in.) 82.013 mm (3.2289 in.)
Piston diameter (at 12 mm (0.472 in.) from the piston head)		81.975 – 81.933 mm (3.2274 – 3.2281 in.)
Connecting rod out-of alignment	Maximum per/100 mm (3.94 in.)	0.05 mm (0.0020 in.)
Connecting rod twist	Maximum per/100 mm (3.94 in.)	0.05 mm (0.0020 in.)
Piston oil clearance	Standard Maximum	0.007 – 0.038 mm (0.0003 – 0.0015 in.) 0.10 mm (0.0039 in.)
Piston ring groove clearance	No. 1 No. 2	0.020 – 0.070 mm (0.0009 – 0.0028 in.) 0.030 – 0.070 mm (0.0012 – 0.0028 in.)
Piston ring end gap	Standard No. 1 No. 2 Maximum No. 1 No. 2	0.25 – 0.35 mm (0.0098 – 0.0138 in.) 0.35 – 0.50 mm (0.0138 – 0.0197 in.) 1.05 mm (0.041 in.) 1.20 mm (0.047 in.)
Piston pin diameter		20.004 – 20.016 mm (0.7876 – 0.7880 in.)
Piston bushing inside diameter		20.013 – 20.025 mm (0.7879 – 0.7884 in.)
Connecting rod bushing inside diameter		20.011 – 20.023 mm (0.7878 – 0.7883 in.)
Piston x Piston pin oil clearance		0.005 – 0.013 mm (0.0002 – 0.0005 in.)
Piston x Connecting rod oil clearance		0.005 – 0.009 mm (0.0002 – 0.0004 in.)
Connecting rod bolt diameter	Standard Maximum	6.6 – 6.7 mm (0.260 – 0.264 in.) 6.7 mm (0.263 in.)
Crankshaft circle runout	Maximum	0.03 mm (0.0012 in.)
Crankshaft main journal diameter	Maximum taper and out-of-round	47.988 – 48.000 mm (1.8893 – 1.8898 in.) 0.02 mm (0.0008 in.)
Crank pin diameter	Maximum taper and out-of-round	44.992 – 45.000 mm (1.7713 – 1.7717 in.) 0.02 mm (0.0008 in.)
Crankshaft bearing cap set bolt diameter	Standard Minimum	7.3 – 7.5 mm (0.287 – 0.295 in.) 7.2 mm (0.287 in.)
Crankshaft main journal oil clearance	Standard Maximum	0.016 – 0.032 mm (0.0006 – 0.0013 in.) 0.08 mm (0.0031 in.)
Cylinder block main journal bore diameter	0 1 2 3 4 5 6	52.000 – 52.003 mm (2.0472 – 2.0473 in.) 52.003 – 52.005 mm (2.0473 – 2.0474 in.) 52.005 – 52.007 mm (2.0474 – 2.0475 in.) 52.007 – 52.010 mm (2.0475 – 2.0476 in.) 52.010 – 52.012 mm (2.0476 – 2.0477 in.) 52.012 – 52.014 mm (2.0477 – 2.0478 in.) 52.014 – 52.016 mm (2.0478 – 2.0479 in.)
Crankshaft main journal diameter	0 1 2 3 4 5	47.998 – 48.000 mm (1.8897 – 1.8898 in.) 47.996 – 47.998 mm (1.8896 – 1.8897 in.) 47.994 – 47.996 mm (1.8895 – 1.8896 in.) 47.992 – 47.994 mm (1.8894 – 1.8895 in.) 47.990 – 47.992 mm (1.8893 – 1.8894 in.) 47.988 – 47.990 mm (1.8892 – 1.8893 in.)
Standard bearing center wall thickness	1 2 3 4 5	1.989 – 1.992 mm (0.0783 – 0.0784 in.) 1.992 – 1.995 mm (0.0784 – 0.0785 in.) 1.995 – 1.998 mm (0.0785 – 0.0787 in.) 1.998 – 2.001 mm (0.0787 – 0.0788 in.) 2.001 – 2.004 mm (0.0788 – 0.0789 in.)