

ENGINE MECHANICAL

SERVICE DATA

030ET-04

2AZ-FE

Ignition timing	w/ Terminals TC and CG of DLC3 connected w/ Terminals TC and CG of DLC3 disconnected	8 to 12° BTDC @ idle 5 to 15° BTDC @ idle
Idle speed	M/T A/T	650 to 750 rpm 610 to 710 rpm
Compression		
Compression pressure	PZEV	1.300 MPa (13.3 kgf/cm ² , 189 psi)
	Except PZEV	1.360 MPa (13.9 kgf/cm ² , 198 psi)
Minimum pressure	PZEV	1.000 MPa (10.2 kgf/cm ² , 145 psi)
	Except PZEV	0.98 MPa (10 kgf/cm ² , 142 psi)
Difference between each cylinder	PZEV	29 kPa (0.3 kgf/cm ² , 4.3 psi)
	Except PZEV	100 kPa (1.0 kgf/cm ² , 14 psi)
Valve clearance (cold)	Intake Exhaust	0.19 to 0.29 mm (0.008 to 0.011 in.) 0.30 to 0.40 mm (0.012 to 0.016 in.)
Balanceshaft		
Specified thrust clearance		0.050 to 0.090 mm (0.0020 to 0.0035 in.)
Specified oil clearance		0.004 to 0.031 mm (0.0002 to 0.0012 in.)
Housing journal bore diameter	Mark 1	26.000 to 26.006 mm (1.0236 to 1.0239 in.)
	Mark 2	26.006 to 26.012 mm (1.0239 to 1.0241 in.)
	Mark 3	26.012 to 26.018 mm (1.0241 to 1.0243 in.)
Journal diameter		22.985 to 23.000 mm (0.9049 to 0.9055 in.)
Bearing center wall thickness	Mark 1	1.486 to 1.489 mm (0.0585 to 0.0586 in.)
	Mark 2	1.489 to 1.492 mm (0.0586 to 0.0587 in.)
	Mark 3	1.492 to 1.495 mm (0.0587 to 0.0589 in.)
Oil pump drive sprocket		
Minimum sprocket diameter (w/ chain)		48.2 mm (1.898 in.)
Oil pump drive shaft sprocket		
Minimum sprocket diameter (w/ chain)		48.2 mm (1.898 in.)
Crankshaft timing sprocket		
Minimum sprcket diameter (w/ chain)		51.6 mm (2.031 in.)
Chain tensioner slipper		
Maximum wear		1.0 mm (0.039 in.)
Chain vibration damper No. 1		
Maximum wear		1.0 mm (0.039 in.)
Cylinder head set bolt		
Specified bolt length		161.3 to 164.2 mm (6.350 to 6.465 in.)
Chain sub-assy		
Maximum chain elongation		115.4 mm (4.543 in.)
Camshaft timing gear or sprocket		
Minimum gear or sprocket diameter (w/ chain)		97.3 mm (3.831 in.)
Intake manifold		
Maximum warpage		0.20 mm (0.0079 in.)
Exhaust manifold		
Maximum warpage		0.70 mm (0.0276 in.)

Camshaft (Intake)		
Maximum circle runout		0.03 mm (0.0012 in.)
Specified cam lobe height		46.599 to 46.809 mm (1.8346 to 1.8429 in.)
No. 1 journal diameter		35.971 to 35.985 mm (1.4162 to 1.4167 in.)
Other journal diameter		22.959 to 22.975 mm (0.9039 to 0.9045 in.)
Specified journal thrust clearance		0.040 to 0.110 mm (0.0016 to 0.0043 in.)
Specified journal oil clearance	No. 1 journal bearing mark 1	0.007 to 0.070 mm (0.0003 to 0.0028 in.)
	No. 1 journal bearing mark 2	0.008 to 0.070 mm (0.0003 to 0.0028 in.)
	No. 1 journal bearing mark 3	0.008 to 0.070 mm (0.0003 to 0.0028 in.)
	Other journals	0.025 to 0.100 mm (0.0010 to 0.0039 in.)
Cylinder head journal bore diameter	Mark 1	40.000 to 40.009 mm (1.5748 to 1.5752 in.)
	Mark 2	40.009 to 40.017 mm (1.5752 to 1.5755 in.)
	Mark 3	40.017 to 40.025 mm (1.5755 to 1.5758 in.)
Standard bearing center wall thickness	Mark 1	2.000 to 2.004 mm (0.0787 to 0.0789 in.)
	Mark 2	2.004 to 2.008 mm (0.0789 to 0.0791 in.)
	Mark 3	2.008 to 2.012 mm (0.0791 to 0.0792 in.)
Camshaft journal diameter		35.971 to 35.985 mm (1.4162 to 1.4167 in.)
Camshaft No. 2 (Exhaust)		
Maximum circle runout		0.03 mm (0.0012 in.)
Specified cam lobe height		46.599 to 46.809 mm (1.8346 to 1.8429 in.)
No. 1 journal diameter		35.971 to 35.985 mm (1.4162 to 1.4167 in.)
Other journal diameter		22.959 to 22.975 mm (0.9039 to 0.9045 in.)
Specified thrust clearance		0.080 to 0.150 mm (0.0032 to 0.0059 in.)
Specified journal oil clearance	No. 1 journal	0.040 to 0.100 mm (0.0016 to 0.0039 in.)
	Other journals	0.025 to 0.100 mm (0.0010 to 0.0039 in.)
Cylinder head journal bore diameter	Mark 1	40.000 to 40.009 mm (1.5748 to 1.5752 in.)
	Mark 2	40.009 to 40.017 mm (1.5752 to 1.5755 in.)
	Mark 3	40.017 to 40.025 mm (1.5755 to 1.5758 in.)
Standard bearing center wall thickness	Mark 1	2.000 to 2.004 mm (0.0787 to 0.0789 in.)
	Mark 2	2.004 to 2.008 mm (0.0789 to 0.0791 in.)
	Mark 3	2.008 to 2.012 mm (0.0791 to 0.0792 in.)
Camshaft journal diameter		35.971 to 35.985 mm (1.4162 to 1.4167 in.)
Cylinder head		
Maximum warpage	Cylinder block side	0.05 mm (0.0020 in.)
	Intake manifold side	0.08 mm (0.0031 in.)
	Exhaust manifold side	0.08 mm (0.0031 in.)
Inner compression spring		
Free length		45.7 mm (1.799 in.)
Maximum deviation		1.6 mm (0.063 in.)
Intake valve		
Specified overall length		101.21 to 101.71 mm (3.9846 to 4.0043 in.)
Valve stem diameter		5.470 to 5.485 mm (0.2154 to 0.2159 in.)
Minimum margin thickness		0.50 to 1.45 mm (0.0197 to 0.0571 in.)
Exhaust valve		
Specified overall length		100.70 to 101.15 mm (3.9646 to 3.9823 in.)
Valve stem diameter		5.465 to 5.480 mm (0.2152 to 0.2157 in.)
Minimum margin thickness		0.50 to 1.60 mm (0.0197 to 0.0630 in.)
Intake valve guide bush		
Bush inside diameter		5.510 to 5.530 mm (0.2169 to 0.2177 in.)
Specified bush oil clearance		0.025 to 0.080 mm (0.0010 to 0.0031 in.)
Exhaust valve guide bush		
Bush inside diameter		5.510 to 5.530 mm (0.2169 to 0.2177 in.)
Specified bush oil clearance		0.030 to 0.100 mm (0.0012 to 0.0039 in.)
Valve lifter		
Lifter diameter		30.966 to 30.976 mm (1.2191 to 1.2195 in.)
Lifter bore diameter		31.009 to 31.025 mm (1.2208 to 1.2215 in.)
Specified oil clearance		0.033 to 0.070 mm (0.0013 to 0.0028 in.)
Cylinder block		
Maximum warpage		0.05 mm (0.0020 in.)
Specified cylinder bore diameter		88.500 to 88.633 mm (3.4843 to 3.4894 in.)

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Connecting rod		
Specified thrust clearance		0.160 to 0.362 mm (0.0063 to 0.0143 in.)
Specified oil clearance		0.024 to 0.080 mm (0.0009 to 0.0031 in.)
Connecting rod bearing center wall thickness (Reference)	Mark 1	1.485 to 1.488 mm (0.0585 to 0.0586 in.)
	Mark 2	1.488 to 1.491 mm (0.0586 to 0.0587 in.)
	Mark 3	1.491 to 1.494 mm (0.0587 to 0.0588 in.)
Bush inside diameter		22.005 to 22.014 mm (0.8663 to 0.8667 in.)
Bush inside diameter (Reference)	Mark A	22.005 to 22.008 mm (0.8663 to 0.8665 in.)
	Mark B	22.008 to 22.011 mm (0.8665 to 0.8666 in.)
	Mark C	22.011 to 22.014 mm (0.8666 to 0.8667 in.)
Maximum rod out-of-alignment per 100 mm (3.94 in.)		0.05 mm (0.0020 in.)
Maximum rod twist per 100 mm (3.94 in.)		0.15 mm (0.0059 in.)
Piston		
Piston diameter		88.439 to 88.449 mm (3.4818 to 3.4822 in.)
Specified piston oil clearance		0.051 to 0.100 mm (0.0020 to 0.0039 in.)
Piston pin hole bush inside diameter		22.001 to 22.010 mm (0.8662 to 0.8665 in.)
Piston pin hole bush inside diameter (Reference)	Mark 1	22.001 to 22.004 mm (0.8662 to 0.8663 in.)
	Mark 2	22.004 to 22.007 mm (0.8663 to 0.8664 in.)
	Mark 3	22.007 to 22.010 mm (0.8664 to 0.8665 in.)
Piston ring		
Ring groove clearance		0.030 to 0.070 mm (0.0012 to 0.0028 in.)
Specified end gap	No. 1	0.22 to 0.892 mm (0.0087 to 0.0350 in.)
	No. 2	0.50 to 1.35 mm (0.0197 to 0.0531 in.)
	Oil (side rail)	0.10 to 0.73 mm (0.0039 to 0.0287 in.)
Piston pin		
Piston pin diameter		21.997 to 22.009 mm (0.8660 to 0.8665 in.)
Piston pin diameter (Reference)	Mark A	21.997 to 22.000 mm (0.8660 to 0.8661 in.)
	Mark B	22.000 to 22.003 mm (0.8661 to 0.8663 in.)
	Mark C	22.003 to 22.006 mm (0.8663 to 0.8664 in.)
	Mark D	22.006 to 22.009 mm (0.8664 to 0.8665 in.)
Specified oil clearance		0.001 – 0.010 mm (0.00004 – 0.00039 in.)
Connecting rod bolt		
Specified diameter		7.0 to 7.3 mm (0.276 to 0.287 in.)
Crankshaft		
Specified thrust clearance		0.040 to 0.300 mm (0.0016 to 0.0118 in.)
Thrust washer thickness		1.930 to 1.980 mm (0.0760 to 0.0780 in.)
Cylinder block main journal bore diameter (Reference)	Mark 0	59.000 to 59.002 mm (2.3228 to 2.3229 in.)
	Mark 1	59.002 to 59.004 mm (2.3229 to 2.3230 in.)
	Mark 2	59.004 to 59.006 mm (2.3230 to 2.3231 in.)
	Mark 3	59.006 to 59.009 mm (2.3231 to 2.3232 in.)
	Mark 4	59.009 to 59.011 mm (2.3232 to 2.3233 in.)
	Mark 5	59.011 to 59.013 mm (2.3233 to 2.3233 in.)
	Mark 6	59.013 to 59.016 mm (2.3233 to 2.3235 in.)
Main journal diameter		54.988 to 55.000 mm (2.1648 to 2.1654 in.)
Main journal diameter (Reference)	Mark 0	54.998 to 55.000 mm (2.1653 to 2.1654 in.)
	Mark 1	54.996 to 54.998 mm (2.1652 to 2.1653 in.)
	Mark 2	54.994 to 54.996 mm (2.1651 to 2.1652 in.)
	Mark 3	54.992 to 54.994 mm (2.1650 to 2.1651 in.)
	Mark 4	54.990 to 54.992 mm (2.1650 to 2.1650 in.)
	Mark 5	54.988 to 54.990 (2.1649 to 2.1650 in.)
Standard main bearing center wall thickness (Reference)	Mark 1	1.993 to 1.996 mm (0.0785 to 0.0786 in.)
	Mark 2	1.996 to 1.999 mm (0.0786 to 0.0787 in.)
	Mark 3	1.999 to 2.002 mm (0.0787 to 0.0788 in.)
	Mark 4	2.002 to 2.005 mm (0.0788 to 0.0789 in.)
Maximum circle runout		0.03 mm (0.0012 in.)
Specified main journal oil clearance		0.008 to 0.024 mm (0.00031 to 0.00094 in.)
Maximum main journal taper and out-of-round		0.003 mm (0.0001 in.)
Maximum crank pin taper and out-of-round		0.003 mm (0.0001 in.)
Crank pin diameter		47.990 to 48.000 mm (1.8894 to 1.8898 in.)
Crankshaft bearing cap set bolt		
Specified diameter		7.2 to 7.6 mm (0.283 to 0.299 in.)

1MZ-FE/3MZ-FE

V-Rebbed belt New drive belt tension	Cooler compressor to crankshaft	139 to 192 lbf
	Vane pump	154 to 176 lbf
Used drive belt tension	Cooler compressor to crankshaft	66 to 110 lbf
	Vane pump	77 to 110 lbf
Ignition timing	w/ Terminals TC and CG of DLC3 connected	8 to 12° BTDC @ idle
	w/ Terminals TC and CG of DLC3 disconnected	7 to 24° BTDC @ idle
Idle speed	1MZ-FE	550 – 650 rpm
	3MZ-FE	630 – 730 rpm
Compression	Compression pressure	1.47 MPa (15 kgf/cm ² , 213 psi)
	Minimum pressure	1.0 MPa (10.2 kgf/cm ² , 145 psi)
	Difference between each cylinder	100 kPa (1.0 kgf/cm ² , 15 psi)
Valve clearance (cold)	Intake	0.15 to 0.25 mm (0.006 to 0.010 in.)
	Exhaust	0.25 to 0.35 mm (0.010 to 0.014 in.)
Intake air surge tank Maximum warpage		0.10 mm (0.0039 in.)
Intake manifold Maximum warpage	Air intake surge tank side	0.15 mm (0.0059 in.)
	Cylinder head side	0.08 mm (0.0031 in.)
Exhaust manifold Maximum warpage		0.50 mm (0.0196 in.)
Camshaft Maximum circle runout Specified cam lobe height Camshaft Journal diameter Specified gear backlash Specified journal thrust clearance Specified journal oil clearance	1MZ-FE Intake	0.06 mm (0.0024 in.)
	Exhaust	42.780 to 43.032 mm (1.6842 to 1.6942 in.)
	3MZ-FE Intake	42.610 to 42.864 mm (1.6776 to 1.6876 in.)
	Exhaust	42.980 to 43.232 mm (1.6921 to 1.7020 in.)
		42.960 to 43.110 mm (1.6874 to 1.6972 in.)
		26.959 to 26.975 mm (1.0614 to 1.0620 in.)
		0.020 to 0.300 mm (0.0008 to 0.0118 in.)
		0.040 to 0.120 mm (0.0016 to 0.0047 in.)
Cylinder head set bolt Specified outside diameter at tension portion		0.025 to 0.100 mm (0.0010 to 0.0039 in.)
		8.75 to 9.05 mm (0.3445 to 0.3563 in.)
Cylinder head Maximum warpage	Cylinder block side	0.05 mm (0.0020 in.)
	Intake manifold side	0.10 mm (0.0039 in.)
	Exhaust manifold side	0.10 mm (0.0039 in.)
Intake valve Specified overall length Valve stem diameter Minimum margin thickness		94.95 to 95.45 mm (3.7382 to 3.7579 in.)
		5.470 to 5.485 mm (0.2154 to 0.2159 in.)
		0.5 to 1.0 mm (0.020 to 0.039 in.)
Exhaust valve Specified overall length Valve stem diameter Minimum margin thickness		94.90 to 95.40 mm (3.7362 to 3.7559 in.)
		5.465 to 5.480 mm (0.2152 to 0.2157 in.)
		0.5 to 1.0 mm (0.020 to 0.039 in.)
Inner compression spring Free length Maximum deviation Installed tension at 33.8 mm (1.331 in.)		45.50 mm (1.7913 in.)
		2.0 mm (0.079 in.)
		186 to 206 N (19.0 to 21.0 kgf, 41.9 to 46.3 lbf)
Valve guide bush Bush inside diameter Specified bush oil clearance Cylinder head valve guide bush bore diameter Bush diameter	Intake	5.510 to 5.530 mm (0.2169 to 0.2177 in.)
	Exhaust	0.025 to 0.080 mm (0.0010 to 0.0031 in.)
		0.030 to 0.100 mm (0.0012 to 0.0039 in.)
	STD	10.295 to 10.313 mm (0.4053 to 0.4060 in.)
	O/S 0.05	10.345 to 10.363 mm (0.4073 to 0.4080 in.)
	STD	10.333 to 10.344 mm (0.4068 to 0.4072 in.)
	O/S 0.05	10.383 to 10.394 mm (0.4088 to 0.4092 in.)

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Valve lifter		
Lifter diameter		30.966 to 30.976 mm (1.2191 to 1.2195 in.)
Lifter bore diameter		31.009 to 31.025 mm (1.2208 to 1.2215 in.)
Specified oil clearance	Standard	0.033 to 0.070 mm (0.0013 to 0.0028 in.)
Connecting rod		
Specified thrust clearance		0.15 to 0.35 mm (0.0059 to 0.0138 in.)
Connecting rod thickness		20.80 to 20.85 mm (0.8189 to 0.8209 in.)
Specified connecting rod oil clearance		0.038 to 0.080 mm (0.0015 to 0.0031 in.)
Connecting rod bearing center wall thickness	Mark 1	1.484 to 1.487 mm (0.0584 to 0.0585 in.)
	Mark 2	1.487 to 1.490 mm (0.0585 to 0.0587 in.)
	Mark 3	1.490 to 1.493 mm (0.0587 to 0.0588 in.)
	Mark 4	1.493 to 1.496 mm (0.0588 to 0.0589 in.)
Crankshaft		
Crankshaft thrust clearance		0.04 to 0.30 mm (0.0016 to 0.0118 in.)
Thrust washer thickness		1.93 to 1.98 mm (0.0760 to 0.0780 in.)
Specified main journal oil clearance	No. 1 and No. 4 journals	0.014 to 0.050 mm (0.0006 to 0.0020 in.)
	No. 2 and No. 3 journals	0.026 to 0.060 mm (0.0010 to 0.0024 in.)
Cylinder block main journal bore diameter (Reference)	Mark 00	66.000 mm (2.5984 in.)
	Mark 01	66.001 mm (2.5985 in.)
	Mark 02	66.002 mm (2.5985 in.)
	Mark 03	66.003 mm (2.5985 in.)
	Mark 04	66.004 mm (2.5986 in.)
	Mark 05	66.005 mm (2.5986 in.)
	Mark 06	66.006 mm (2.5987 in.)
	Mark 07	66.007 mm (2.5987 in.)
	Mark 08	66.008 mm (2.5987 in.)
	Mark 09	66.009 mm (2.5988 in.)
	Mark 10	66.010 mm (2.5988 in.)
	Mark 11	66.011 mm (2.5989 in.)
	Mark 12	66.012 mm (2.5989 in.)
	Mark 13	66.013 mm (2.5989 in.)
	Mark 14	66.014 mm (2.5990 in.)
	Mark 15	66.015 mm (2.5990 in.)
	Mark 16	66.016 mm (2.5990 in.)
Main journal diameter		61.000 mm (4.1016 in.)
Main journal diameter (Reference)	Mark 00	60.999 mm (4.4015 in.)
	Mark 01	60.998 mm (4.4015 in.)
	Mark 02	60.997 mm (4.4015 in.)
	Mark 03	60.996 mm (4.4014 in.)
	Mark 04	60.995 mm (4.4014 in.)
	Mark 05	60.994 mm (4.4013 in.)
	Mark 06	60.993 mm (4.4012 in.)
	Mark 07	60.992 mm (4.4012 in.)
	Mark 08	60.991 mm (4.4012 in.)
	Mark 09	60.990 mm (4.4012 in.)
	Mark 10	60.989 mm (4.4011 in.)
	Mark 11	60.988 mm (4.4011 in.)
	Mark 12	2.486 to 2.489 mm (0.0979 to 0.0980 in.)
Standard main bearing center wall thickness (Reference)	Mark 1	2.489 to 2.492 mm (0.0980 to 0.0981 in.)
	Mark 2	2.492 to 2.495 mm (0.0981 to 0.0982 in.)
	Mark 3	2.495 to 2.498 mm (0.0982 to 0.0983 in.)
	Mark 4	2.498 to 2.501 mm (0.0983 to 0.0985 in.)
	Mark 5	2.501 to 2.504 mm (0.0985 to 0.0986 in.)
	Mark 6	2.504 to 2.507 mm (0.0986 to 0.0987 in.)
	Mark 7	0.06 mm (0.0024 in.)
Maximum circle runout		60.988 to 61.000 mm (2.4011 to 2.4016 in.)
Main journal taper and out-of-round		0.02 mm (0.0008 in.)
Crank pin diameter		52.992 to 53.000 mm (2.0863 to 2.0866 in.)
Maximum crank pin taper and out-of-round		0.02 mm (0.0008 in.)
Cylinder block		
Maximum warpage		0.05 mm (0.0020 in.)
Specified cylinder bore diameter	1MZ-FE	87.500 to 87.632 mm (3.4449 to 3.4501 in.)
	3MZ-FE	92.000 to 92.132 mm (3.6220 to 3.6272 in.)

Piston			
Piston diameter	1MZ-FE for AISIN made	87.106 to 87.416 mm (3.4412 to 3.4416 in.)	
	1MZ-FE for MAHLE made	87.453 to 87.467 mm (3.4430 to 3.4436 in.)	
	3MZ-FE	91.983 to 91.967 mm (3.6202 to 3.6207 in.)	
Specified oil clearance	1MZ-FE for AISIN made	0.084 to 0.130 mm (0.0033 to 0.0051 in.)	
	1MZ-FE for MAHLE made	0.033 to 0.130 mm (0.0013 to 0.0051 in.)	
	3MZ-FE	0.033 to 0.130 mm (0.0013 to 0.0051 in.)	
Connecting rod			
Maximum misalignment per 100 mm (3.94 in.)		0.05 mm (0.0020 in.) per 100 mm (3.94 in.)	
Maximum rod twist per 100 mm (3.94 in.)		0.15 mm (0.0059 in.) per 100 mm (3.94 in.)	
Bush inside diameter		22.005 to 22.014 mm (0.8663 to 0.8667 in.)	
Piston pin			
Piston pin diameter		21.997 to 22.006 mm (0.8660 to 0.8664 in.)	
Specified oil clearance		0.005 to 0.050 mm (0.0002 to 0.0020 in.)	
Piston ring			
Piston ring groove clearance	1MZ-FE No. 1	0.02 to 0.07 mm (0.0008 to 0.0028 in.)	
	No. 2	0.02 to 0.06 mm (0.0008 to 0.0024 in.)	
	Oil	0.04 to 0.12 mm (0.0016 to 0.0047 in.)	
	3MZ-FE No. 1	0.03 to 0.08 mm (0.0012 to 0.0031 in.)	
	No. 2	0.02 to 0.06 mm (0.0008 to 0.0024 in.)	
	Oil	0.03 to 0.11 mm (0.0012 to 0.0043 in.)	
Specified end gap	1MZ-FE No. 1	0.25 to 0.95 mm (0.0098 to 0.0374 in.)	
	No. 2	0.35 to 1.05 mm (0.0138 to 0.0413 in.)	
	Oil (Side rail)	0.15 to 1.00 mm (0.0059 to 0.0394 in.)	
	3MZ-FE No. 1	0.30 to 0.95 mm (0.0118 to 0.0374 in.)	
	No. 2	0.50 to 1.05 mm (0.0197 to 0.0413 in.)	
	Oil	0.15 to 1.00 mm (0.0059 to 0.0394 in.)	
Connecting rod bolt			
Specified diameter		7.0 to 7.3 mm (0.276 to 0.287 in.)	
Crankshaft bearing cap set bolt			
Specified diameter		7.2 to 7.6 mm (0.283 to 0.299 in.)	