SERVICE MANUAL
6WG1T ISUZU
ENGINES

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NOTICE

Before using this Workshop Manual to assist you in performing service and maintenance operations, it is recommended that you carefully read and thoroughly understand the information contained in Section 00 under the heading "GENERAL INFORMATION".

This manual is applicable to 2000 model year engines.

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GENERAL INFORMATION

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GENERAL INFORMATION

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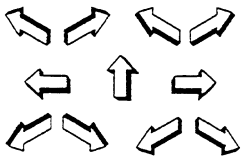
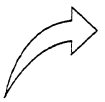
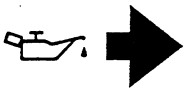
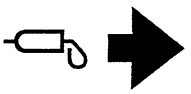
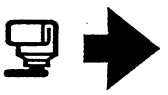
General Repair Instruction

1. Before performing service operations, disconnect the ground cable from the battery to reduce the chance of cable damage and burning due to short circuiting.
2. Use a cover on body, seats and floor to protect them against damage and contamination.
3. Brake fluid and anti-freeze solution must be handled with care because they can cause paint damage.
4. The use of proper tools and special tools, where specified, is important for efficient and reliable performance of service repairs.
5. Use genuine parts.
6. Used cotter pins, plastic clips, gaskets, O-rings oil seals, lock washers, and self-locking nuts should be discarded and new ones should be installed. Normal function of the parts cannot be maintained if these parts are reused.
7. To facilitate proper and smooth reassembly operation, keep disassembled parts neatly in groups. Keeping fixing nuts and bolts separate is very important, as they vary in hardness and design depending on position of installation.
8. Clean the parts before inspection or reassembly. Also clean oil ports, etc. using compressed air, and make certain they are free from restrictions.
9. Lubricate rotating and sliding faces of the parts with oil or grease before installation.
10. When necessary, use a sealer on gaskets to prevent leakage.
11. Carefully observe all specifications for nuts and bolts torques.
12. When a service operation is completed, make a final check to be sure the service has been done properly and the problem has been corrected.
13. Allow the engine to cool before beginning any service procedure.
    This will eliminate the danger of fire and possible injury.
14. Hot steam under pressure may escape from the radiator if the coolant is drained while the engine is hot. This can result in serious burns. Allow the engine to cool before draining the coolant.
15. Hot engine oil can cause severe skin burns. Allow the engine to cool before draining the engine oil.
16. While working around a running engine, avoid contact with moving parts and hot surfaces to prevent injury.
17. Wear safety glasses when using compressed air. Flying dirt particles may cause eye injury.
18. Always wear safety goggles when working with fuel to protect the eyes from fuel splash.
19. Test fluid from the injection nozzle tester will spray out of the injection nozzle under great pressure.
    It can easily puncture a person's skin.
    Keep your hands away from the injection nozzle at all times.
20. Do not use your fingers to feel for fuel leaks at fittings. Fuel pressure is high enough to penetrate the skin.
21. Be careful when changing fuel system components: Diesel fuel is flammable. Be sure that the ignition key of OFF. Do not smoke or allow open flame in the area while changing fuel system components.

Illustration Arrows

Arrows help you to understand technical illustration.

Arrow Type	Application
	Front of Engine
	Up Side
	Task Related
	View Detail
	View Angle
	Dimension (1:2)
	Sectioning (1:3)

Arrow Type	Application
	• Ambient/Clean air flow • Cool air flow
	• Gas other than ambient air • Hot air flow
	• Ambient air mixed with another gas • Temperature change
	Direction
	Lubrication point (Oil or fluid)
	Lubrication point (Grease)
	Lubrication point (Jelly)

Abbreviations

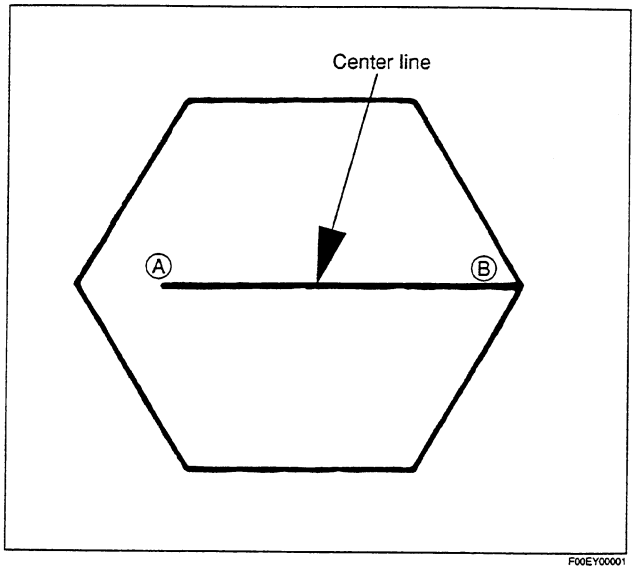
List of abbreviations which may be used in this manual

A – Ampere(s)
AC – Alternating Current
ACL – Air Cleaner
Adj – Adjust
AMP – Ampere(s)
ASM –Assembly
ATDC – After Top Dead Center
Auto – Automatic
Bat – Battery
B+ – Battery Positive Voltage
BHP – Brake Horsepower
BTDC – Before Top Dead Center
°C – Degrees Celsius
cc – Cubic Centimeter
CID – Cubic Inch Displacement
CO – Carbon Monoxide
Conn – Connector
Crank – Crankshaft
Cu. In. – Cubic Inch
Cyl – Cylinder(s)
DOHC – Double Overhead Camshaft
DTC – Diagnostic Trouble Code
DTM – Diagnostic Test Mode
DTT – Diagnostic Test Terminal
ECM – Engine Control Module
ECT – Engine Coolant Temperature
EGR – Exhaust Gas Recirculation
Exh – Exhaust
°F – Degrees Fahrenheit
FL – Fusible Link
FLW – Fusible Link Wire
FP – Fuel Pump
FRT – Front
ft – Foot
Gal – Gallon
GND – Ground
Gov – Governor
g – Gram
Harn – Harness
HC – Hydrocarbons
HD – Heavy Duty
Hg – Hydrargyrum (Mercury)
IC – Integrated Circuit / Ignition Control
ID – Identification / Inside Diameter
IGN – Ignition
INJ – Injection
Int – Intake
kg – Kilograms
km – Kilometers
km/h – Kilometer per Hour
kPa – Kilopascals
kV – Kilovolts (thousands of volts)
kW – Kilowatts
L – Liter
lb ft – Foot Pounds
lb in – Inch Pounds
LF – Left Front
LH – Left Hand
LR – Left Rear
LS – Left Side
L-4 – In-Line Four Cylinder Engine
Max – Maximum
Min – Minimum
mm – Millimeter
N – Newtons
NA – Naturally Aspirated
NC – Normally Closed
N·m – Newton Meters
NO – Normally Open
NOX – Nitrogen Oxides
OD – Outside Diameter
OHC – Overhead Camshaft
PCV – Positive Crankcase Ventilation
PRESS – Pressure
PROM – Programmable Read Only Memory
psi – Pounds per Square Inch
PSP – Power Steering Pressure
Pt. – Pint
PWM – Pulse Width Modulate
Qt. – Quart
REF – Reference
RF – Right Front
RH – Right Hand
RPM – Revolutions Per Minute
RPM Sensor – Engine Speed Sensor
RR – Right Rear
RS – Right Side
RTV –Room Temperature Vulcanizing
SAE – Society of Automotive Engineers
Sec – Secondary
SI – System International
SOHC – Single Overhead Camshaft
Sol – Solenoid
SPEC – Specification
Speedo – Speedometer
ST – Start / Scan Tool
Sw – Switch
SYN – Synchronize
Tach – Tachometer
TDC – Top Dead Center
Term – Terminal
TEMP – Temperature
TURBO – Turbocharger
V – Volt(s)
VAC – Vacuum
V-ref – ECM Reference Voltage
VSS – Vehicle Speed Sensor
VSV – Vacuum Switch Valve
V-6 – Six Cylinder "Vee" Engine
V-8 – Eight Cylinder "Vee" Engine
W – Watt(s)
w/ – With
w/o – Without
WOT – Wide Open Throttle

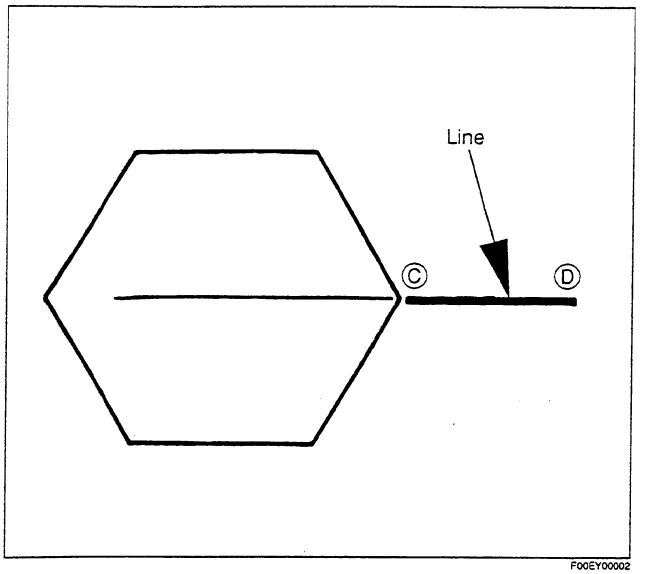
Nut and Bolt Angular Tightening Method

The angular tightening method uses the plastic region of high tensile steel nuts and bolts to precision tighten important engine fasteners.
Because of the method's nature, there is a limit to the number of times a particular fastener may be reused. This limit is specified in this Manual where applicable.

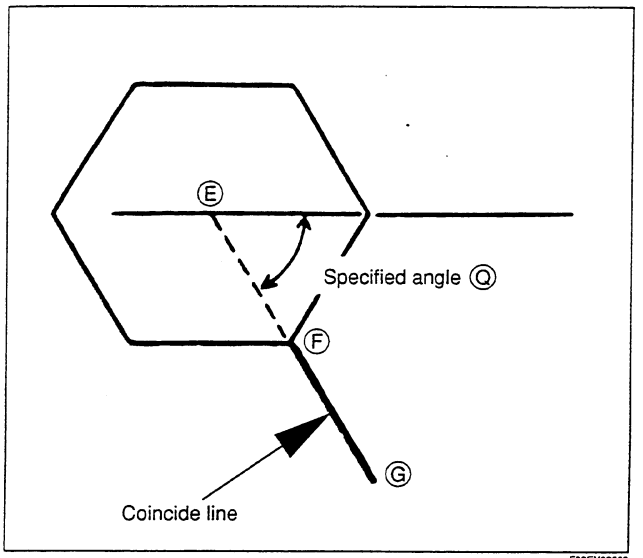
1. Carefully wash the nuts and bolts to remove all oil and grease.
2. Apply a coat of molybdenum disulfide grease to the threads and setting faces of the nuts and bolts.
3. Tighten the nuts and bolts to the specified torque (snug torque) with a torque wrench.
4. Draw a line Ⓐ–Ⓑ across the center of each nut or bolt.



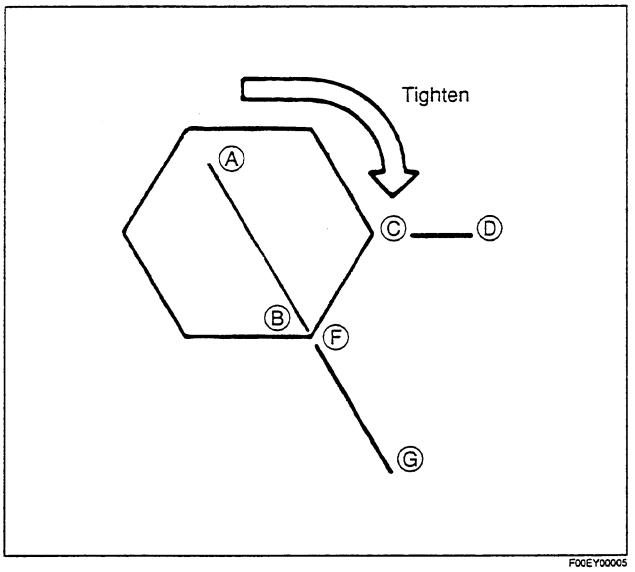
5. Draw another line Ⓒ – Ⓓ on the face of each of the parts to be clamped. This line should be an extension of the line Ⓐ – Ⓑ.



6. Draw another line Ⓕ – Ⓖ on the face of each of the parts to be clamped. This line will be in the direction of the specified angle Ⓠ across the center Ⓔ of the nut or bolt.

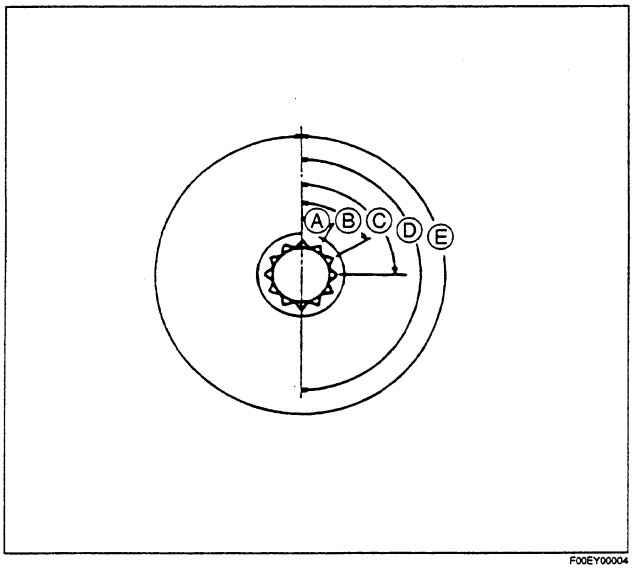


7. Use a socket wrench to tighten each nut or bolt to the point where the line Ⓐ – Ⓑ is aligned with the line Ⓕ – Ⓖ.



Example: Specified Angle and Tightening Rotation

A	30°	1 / 12 of a turn
B	60°	1 / 6 of a turn
C	90°	1 / 4 of a turn
D	180°	1 / 2 of a turn
E	360°	One full turn



Standard Bolt Torque Specifications

The tightening torque values given in the table below are applicable to all bolts unless otherwise specified.

STANDARD BOLT

N·m (kgf·m/lb.ft)

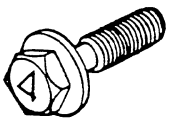
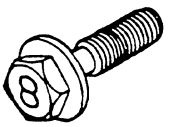
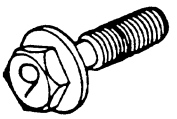
Bolt Identification / Bolt Diameter × pitch (mm)		 	
		 	
M6 × 1.0	4 – 8 (0.4 – 0.8/3 – 6)	5 – 10 (0.5 – 1.0/4 – 7)	———
M8 × 1.25	8 – 18 (0.8 – 1.8/6– 13)	12 – 23 (1.2 – 2.3/9 – 17)	17 – 30 (1.7 – 3.1/12 – 22)
M10 × 1.25	21 – 34 (2.1 – 3.5/5 – 25)	28 – 46 (2.8 – 4.7/20 – 33)	37 – 62 (3.8 – 6.4/28 – 46)
* M10 × 1.5	20 – 33 (2.0 – 3.4/15 – 25)	28 – 45 (2.8 – 4.6/20 – 33)	36 – 60 (3.7 – 6.1/27– 44)
M12 × 1.25	49 – 74 (5.0 – 7.5/36 – 54)	61 – 91 (6.2 – 9.3/45 – 67)	76 – 114 (7.7 – 11.6/56 – 84)
* M12 × 1.75	45 – 69 (4.6 – 7.0/33 – 51)	57 – 84 (5.8 – 8.6/42 – 62)	72 – 107 (7.3 – 10.9/53 – 79)
M14 × 1.5	77 – 115 (7.8 – 11.7/56 – 85)	93 – 139 (9.5 – 14.2/69 – 103)	114 – 171 (11.6 – 17.4/84 – 126)
* M14 × 2.0	72 – 107 (7.3 – 10.9/53 – 79)	88 – 131 (9.0 – 13.4/65 – 97)	107 – 160 (10.9 – 16.3/79 – 118)
M16 × 1.5	104 – 157 (10.6 – 16.0/77 – 116)	135 – 204 (13.8 – 20.8/100 – 150)	160 – 240 (16.3 – 24.5/118 – 177)
* M16 × 2.0	100 – 149 (10.2 – 15.2/74 – 110)	129 – 194 (13.2 – 19.8/96 – 143)	153 – 230 (15.6 – 23.4/113 – 169)
M18 × 1.5	151 – 226 (15.4 – 23.0/110 – 166)	195 – 293 (19.9 – 29.9/144 – 216)	230 – 345 (23.4 – 35.2/169 – 255)
* M18 × 2.5	151 – 226 (15.4 – 23.0/110 – 166)	196 – 294 (20.0 – 30.0/145 – 217)	231 – 346 (23.6 – 35.5/171 – 255)
M20× 1.5	206 – 310 (21.0 – 31.6/152 – 229)	270 – 405 (27.5 – 41.3/199 – 299)	317 – 476 (32.3 – 48.5/234 – 351)
* M20× 2.5	190 – 286 (19.4 – 29.2/140 – 211)	249 – 375 (25.4 – 38.2/184 – 276)	293 – 440 (29.9 – 44.9/216 – 325)
M22× 1.5	251 – 414 (25.6 – 42.2/185 – 305)	363 – 544 (37.0 – 55.5/268 – 401)	425 – 637 (43.3 – 64.9/313 – 469)
* M22× 2.5	218 – 328 (22.2 – 23.4/161 – 242)	338 – 507 (34.5 – 51.7/250 – 374)	394 – 592 (40.2 – 60.4/291 – 437)
M24× 2.0	359 – 540 (36.6 – 55.0/265 – 398)	431 – 711 (43.9 – 72.5/318 – 524)	554 – 831 (56.5 – 84.7/409 – 613)
* M24× 3.0	338 – 507 (34.5 – 51.7/250 – 374)	406 – 608 (41.4 – 62.0/299 – 448)	521 – 782 (53.1 – 79.7/384 – 576)

An asterisk (*) indicates that the bolts are used for female threaded parts that are made of soft materials such as casting.

The tightening torque values given in the table below are applicable to all bolts unless otherwise specified.

FLANGED HEAD BOLT

N·m (kgf·m/lb.ft)

Bolt Identification / Bolt Diameter × pitch (mm)			
M6 × 1.0	5 – 9 (0.5 – 0.9/4 – 7)	6 – 12 (0.6 – 1.2/4 – 9)	———
M8 × 1.25	11 – 20 (1.1 – 2.0/8 – 15)	15 – 28 (1.6 – 2.9/12 – 21)	18 – 34 (2.1 – 3.4/15 – 25)
M10 × 1.25	23 – 39 (2.4 – 3.9/17 – 28)	35 – 59 (3.6 – 6.1/26 – 44)	42 – 71 (4.3 – 7.2/31 – 52)
* M10 × 1.5	22 – 37 (2.3 – 3.8/17 – 28)	35 – 58 (3.5 – 5.8/25 – 42)	40 – 67 (4.1 – 6.8/30 – 49)
M12 × 1.25	55 – 82 (5.6 – 8.4/40 – 61)	77 – 117 (7.9 – 11.9/57 – 86)	85 – 128 (8.7 – 13.0/63 – 94)
* M12 × 1.75	51 – 77 (5.2 – 7.8/38 – 56)	71 – 107 (7.3 – 10.9/53 – 79)	80 – 119 (8.1 – 12.2/59 – 88)
M14 × 1.5	83 – 125 (8.5 – 12.7/62 – 92)	115 – 172 (11.7 –17.6/85 – 127)	123 – 185 (12.6 – 18.9/91 – 137)
* M14 × 2.0	77 – 116 (7.9 – 11.8/57 – 85)	108 – 162 (11.1 – 16.6/80 – 120)	116 – 173 (11.8 – 17.7/85 – 128)
M16 × 1.5	116 – 173 (11.8 – 17.7/85 – 128)	171 – 257 (17.4 – 26.2/126 – 190)	177 – 265 (18.0 – 17.1/130 – 196)
* M16 × 2.0	109 – 164 (11.2 – 16.7/81 – 121)	163 – 244 (16.6 – 24.9/120 – 180)	169 – 253 (17.2 – 25.8/124 – 187)

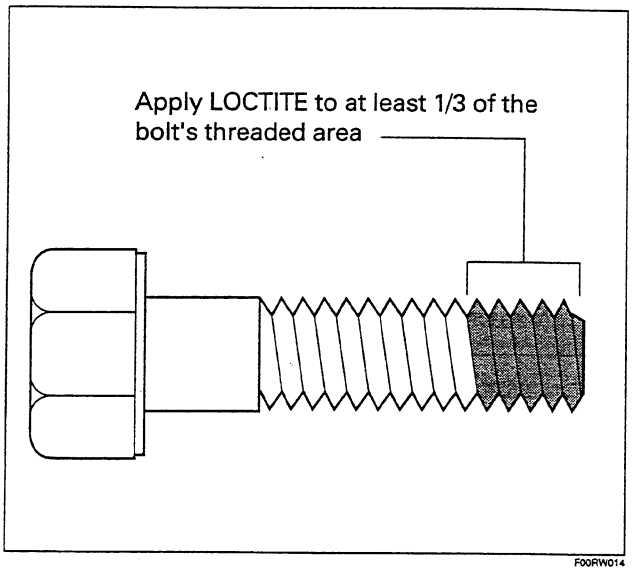
A bolt with an asterisk (*) is used for female screws that are made of soft material such as cast iron.

Recommended Thread Locking Agents

LOCTITE Type	LOCTITE Color
LOCTITE 242	Blue
LOCTITE 262	Red
LOCTITE 271	Red

Application Steps

1. Completely remove all lubricant and moisture from the bolts and the female-threaded surfaces of the parts to be joined.
   The surfaces must be perfectly dry.
2. Apply LOCTITE to the bolts.



3. Tighten the bolts to the specified torque.
   After tightening, be sure to keep the bolts free from vibration and torque for at least an hour until the LOCTITE hardens.

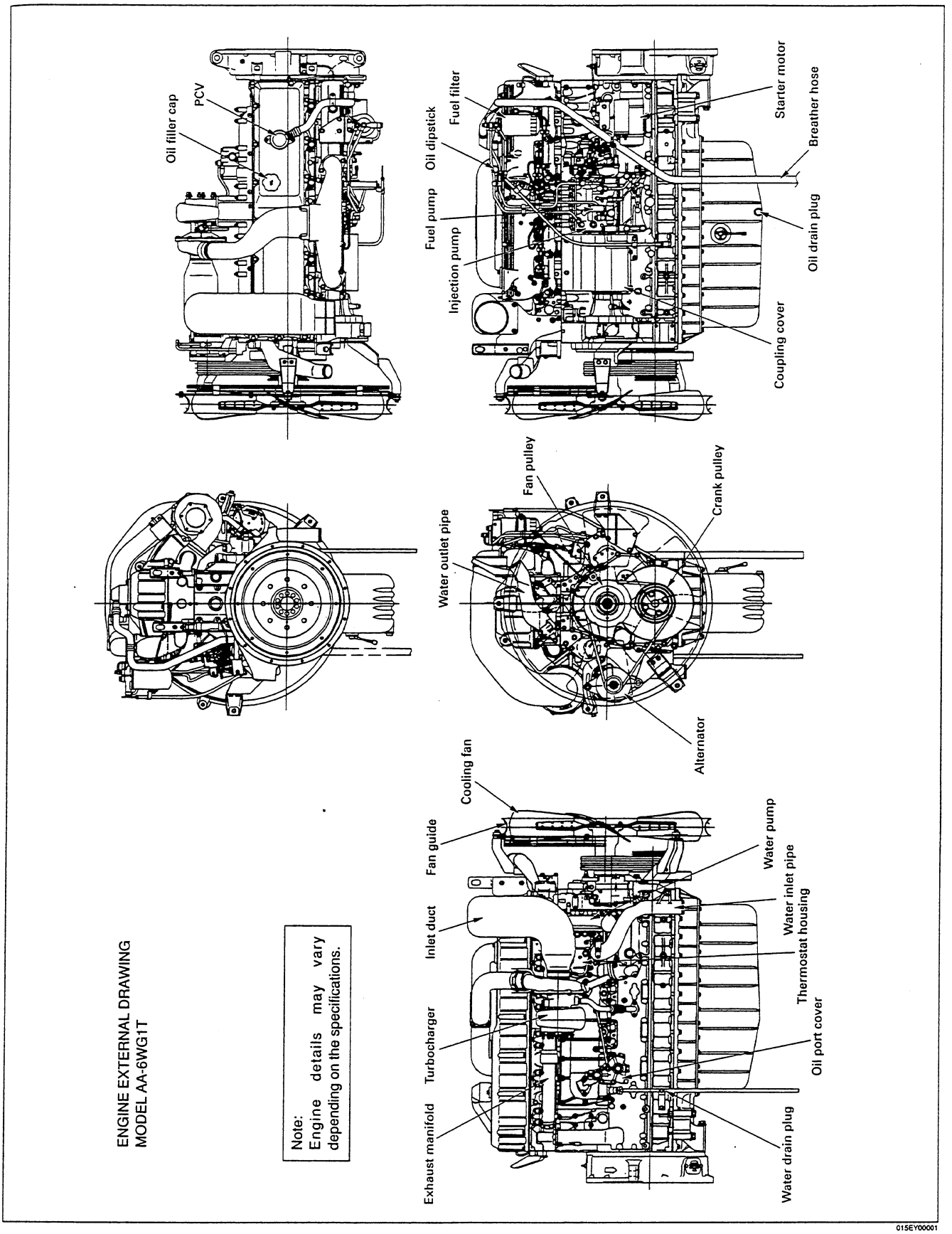
NOTE: When the application procedures are specified in this manual, follow them.

Main Data and Specifications

ITEMS			6WG1T
Engine type			Four cycle, water cooled, in-line, overhead camshaft direct injection
Combustion chamber			Open type in piston crown
Cylinder liner			Dry
Timing drive system			Gear drive
No. of cylinders – bore × stroke		mm (in)	6 – 147 × 154 (5.79 × 6.06)
No. of piston rings			Four rings (Compression rings: 3, Oil ring: 1)
Total piston displacement		L (cid)	15.681 (956.9)
Compression ratio (to 1)			16.4
Compression pressure at 200 min^{-1}		MPa (kg/cm^2/psi)	2.75 (28/400) or more
Engine dimensions*		mm (in)	1,642 × 1007 × 1,287 (64.6 × 39.6 × 50.7)
Engine weight (Dry)*		kg (lb)	1,252 (2,764)
Fuel injection order			1 – 5 – 3 – 6 – 2 – 4
Fuel injection timing (TDC)*		deg	10
Specified fuel type			SAE No.2 diesel fuel
Idling speed*		min^{-1}	900
Valve clearances	Intake	mm (in)	0.40 (0.016)
	Exhaust	mm (in)	0.40 (0.016)
Intake valves	Open at (BTDC)	deg	21
	Close at (ABDC)	deg	27
Exhaust valves	Open at (BBDC)	deg	52
	Close at (ATDC)	deg	17
Injection pump			Bosch, in-line P-Type
Governor type*			Mechanical
Injection nozzles			Multi-hole
Injection nozzle opening pressure		MPa (kg/cm^2/psi)	20.1 (205/2,920)
Main fuel filter			Paper element
Lubrication system			
Lubrication method			Full flow pressure circulation
Specified engine oil (API grade)			CD
Oil pressure (at oil gallery)		kPa (kg/cm^2/psi)/min^{-1}	300 (3.1/44.1)/1,200 390 (4.0/56.9)/2,000 Condition:·SAE 30 API CD grade engine oil at an oil temperature of 80°C (176°F)
Oil pump			Gear (Timing gear drive)

ITEMS	6WG1T
Relief valve opening pressure kPa (kg/cm²/psi)	
1st stage	440 (4.5/64.0)
2nd stage	690 (7.0/99.5)
Oil pressure switch operating pressure kPa (kg/cm²/psi)	10 (0.1/0.7)
Main oil filter	Paper element
Bypass valve opening pressure kPa (kg/cm²/psi)	200 (2.0/28.4)
Oil volume* L (qts)	52 (55) with combined main and partial oil filter
Oil cooler	Plate type – Water cooled in water jacket
Oil thermostat opening temperature °C (°F)	98.0 (208)
Cooling system	Pressured compulsory circulation water
Coolant volume L (qts)	36 (38)
Water pump	Centrifugal impeller, gear drive
Delivery volume Lit/min. (Imp. gal/US gal)	420 (92.4/111.0) Pump speed at 2,840 rpm
Thermostat	Wax pellet
Valve initial opening temperature* °C (°F)	82 (180)
Valve lift mm (in)	11.0 (0.433)
Air cleaner	
Alternator capacity* V – A	24 – 50 (Mitsubishi)
Regulator	IC (Built-in)
Brush length mm (in)	Brush less
Starter motor output* V – kW	24 – 7 (Mitsubishi)
Number of poles	4
Turbocharger model	RHC 92
Manufacturer	Ishikawajima Harima Heavy Industry (IHI)

Specification for items marked with an asterisk (*) may vary according to the type of equipment in which the engine is installed.


ENGINE EXTERNAL DRAWING
MODEL AA-6WG1T
Note:
Engine details may vary depending on the specifications.
Oil filler cap
PCV
Fuel pump
Oil dipstick
Fuel filter
Injection pump
Starter motor
Breather hose
Oil drain plug
Coupling cover
Water outlet pipe
Fan pulley
Crank pulley
Alternator
Exhaust manifold
Turbocharger
Inlet duct
Fan guide
Cooling fan
Water pump
Water inlet pipe
Thermostat housing
Oil port cover
Water drain plug

015EY00001

Service Standards

ITEMS		SERVICE STANDARD		SERVICE LIMIT
ENGINE				
Compression Pressure MPa(kg/cm²/psi)/min⁻¹		27.5 (28 / 400) / 200 or more, after warm up the engine.		21.6 (22 / 312)
CYLINDER HEAD and VALVE				
Camshaft End Play	mm(in)	0.085 – 0.170 (0.0033-0.0067)		0.25 (0.0098)
Clearance between Camshaft and Bracket	mm(in)	0.065 – 0.125 (0.0026-0.0049)		0.15 (0.0059)
Idler Gear C End Play	mm(in)	0.05 – 0.14 (0.0020-0.0055)		0.25 (0.0098)
Clearance between Shaft and Idler Gear C	mm(in)	0.04 – 0.105 (0.0016-0.0041)		0.2 (0.0079)
Valve Spring Free Height	mm(in)	Outer		
		Inlet	79.3 (3.1220)	75.3 (2.965)
		Exhaust	102.7 (4.0433)	97.6 (3.843)
		Inner		
		Inlet	–	–
		Exhaust	96.5 (3.7992)	91.7 (3.6102)
Valve Spring Squareness	mm(in)	Inlet	3.5 (0.1378)	4.8 (0.1890)
		Exhaust		
		Outer	4.5 (0.1772)	6.2 (0.2441)
		Inner	4.2 (0.1654)	5.9 (0.2323)
Valve Spring tension	N(kg/lb)/mm	Outer		
		Inlet	392 (40.0/88.2)/64	372 (37.9/83.6)/64
		Exhaust	610 (62.2/137)/69	579 (59.0/130)/69
		Inner		
		Inlet	–	–
		Exhaust	224 (22.8/50.3)/66	213 (21.7/47.8)/66
Valve Stem and Guide Clearance	mm(in)	Inlet	0.040 – 0.077 (0.0016 – 0.0030)	0.15 (0.0059)
		Exhaust	0.065 – 0.102 (0.0026 – 0.0040)	0.25 (0.0098)

ITEMS		SERVICE STANDARD		SERVICE LIMIT
Valve Stem Outside Diameter	mm(in)	Inlet	10.0 (0.3937)	9.92 (0.3906)
		Exhaust	10.0 (0.3937)	9.90 (0.3898)
Bridge Guide and Bridge Clearance	mm(in)	0.020 – 0.057 (0.0080-0.0022)		0.10 (0.0039)
Valve Thickness	mm(in)	Inlet	2.14 (0.0843)	1.64 (0.0646)
		Exhaust	2.3 (0.0906)	1.8 (0.0709)
Valve Depression	mm(in)	Inlet	1.9 (0.0748)	2.9 (0.1142)
		Exhaust	1.8 (0.0709)	2.8 (0.1102)
Valve Contact Width	mm(in)	Inlet	3.3 (0.1299)	3.7 (0.1457)
		Exhaust	2.6 (0.1024)	3.0 (0.1181)
Valve Contact Surface Angle	deg	Inlet	30	–
		Exhaust	45	–
Valve Seat Angle	deg	Inlet	30	–
		Exhaust	45	–
Valve Bridge Guide Upper End Height	mm(in)	49.0 (1.9291)		–
Valve Guide Upper End Height	mm(in)	Inlet	27.0 (1.0630)	–
		Exhaust	29.0 (1.1417)	–
ROCKER ARM AND CAMSHAFT				
Rocker Arm Shaft Run Out	mm(in)	–		0.3 (0.012)
Rocker Arm Shaft Outside Diameter	mm(in)	27.979 – 28.000 (1.1015-1.1024)		27.85 (1.0965)
Rocker Arm Bushing Inside Diameter	mm(in)	28.020 – 28.053 (1.1031 – 1.1044)		–
Rocker Arm and Rocker Arm Shaft Clearance	mm(in)	0.020 – 0.074 (0.0008 – 0.0029)		0.2 (0.0079)
Rocker Arm Roller and Pin Clearance	mm(in)	0.036 – 0.069 (0.0014 – 0.0027)		0.15 (0.0059)
Camshaft Journal Diameter	mm(in)	39.915 – 39.940 (1.5715 – 1.5724)		39.89 (1.57047)
Cam Height (Nose Height)	mm(in)	Inlet	9.4 (0.3700)	8.85 (0.3484)
		Exhaust	10.4 (0.4094)	9.75 (0.3839)
Camshaft Run Out	mm(in)	0.080 (0.0031)		0.100 (0.0039)
Camshaft Bearing Inside Diameter	mm(in)	40.015 – 40.040 (1.5754 – 1.5764)		–
Clearance Camshaft and Cam Bearing	mm(in)	0.065 – 0.125 (0.0026 – 0.0049)		0.15 (0.0059)

ITEMS		SERVICE STANDARD		SERVICE LIMIT
TIMING GEAR TRAIN				
Idler Gear Backlash	mm(in)	0.095 – 0.135 (0.0037 – 0.0053)		0.25 (0.0098)
Idler Gear End Play	mm(in)	"A"	0.155 – 0.220 (0.0061 – 0.0089)	0.35 (0.0138)
		"B"	0.050 – 0.140 (0.0020 – 0.0055)	0.25 (0.0098)
		"C"	0.050 – 0.140 (0.0020 – 0.0055)	0.25 (0.0098)
Idler Gear Spindle Outside Diameter	mm(in)	"A"	56.93 – 56.96 (2.2413 – 2.2425)	56.85 (2.2382)
		"B"	141.93 – 141.96 (5.5878 – 5.5890)	141.85 (5.5846)
		"C"	48.93 – 48.96 (1.9264 – 1.9286)	48.85 (1.9232)
Clearance Between Idler Gear and Spindle	mm(in)	"A" "B" "C"	0.040 – 0.105 (0.0015 – 0.0041)	0.20 (0.0079)
CRANKSHAFT				
Crankshaft End Play	mm(in)	0.10 – 0.28 (0.0039-0.0110)		0.35 (0.0138)
Crankshaft Journal Diameter	mm(in)	No.4	104.850 – 104.875 (4.1279 – 4.1289)	–
		Others	104.880 – 104.905 (4.1291 – 4.1309)	–
Crankpin Diameter	mm(in)	91.895 – 91.925 (3.6179 – 3.6191)		–
Crankshaft Run Out	mm(in)	0.120 (0.0005)		0.15 (0.0059)
Crankshaft End Play	mm(in)	0.10 – 0.28 (0.0039 – 0.0110)		0.30 (0.0121)
Crank Bearing Spread	mm(in)	–		111.5 (4.3898)
Clearance Crankshaft journal and Bearing	mm(in)	No.4 Journal	0.075 – 0.150 (0.0030 – 0.0059)	0.16 (0.0063)
		Others	0.045 – 0.120 (0.0018 – 0.0047)	

ITEMS		SERVICE STANDARD		SERVICE LIMIT
PISTON AND CONNECTING ROD				
Piston Ring Gap	mm(in)	1st, 3rd	0.35 – 0.50 (0.0138 – 0.0197)	1.00 (0.0394)
		2nd	0.80 – 0.95 (0.0315 – 0.0374)	
		Oil	0.30 – 0.50 (0.0118 – 0.0197)	
Clearance Piston Ring and Groove	mm(in)	1st	0.115 – 0.160 (0.0045 – 0.0063)	0.24 (0.0094)
		2nd 3rd	0.10 – 0.135 (0.0039 – 0.0053)	0.20 (0.0079)
		Oil	0.025 – 0.065 (0.0010 – 0.0026)	0.15 (0.0059)
Piston Pin Diameter	mm(in)	55.995 – 56.000 (2.2015 – 2.2047)		55.970 (2.2035)
Clearance Piston Pin and Hole	mm(in)	0.008 – 0.021 (0.0003 – 0.0008)		0.05 (0.0020)
Clearance Connecting Rod Small End Bushing and Piston Pin	mm(in)	0.020 – 0.037 (0.0008 – 0.0015)		0.10 (0.0039)
Connecting Rod Alignment	mm(in)	0.05 (0.002 or less)		0.10 (0.0039)
Clearance Crankpin and Connecting Rod Bearing	mm(in)	0.033 – 0.103 (0.0013 – 0.0041)		0.16 (0.0063)
Clearance Connecting Rod and Crankshaft	mm(in)	0.175 – 0.290 (0.0069 – 0.0114)		0.35 (0.0138)
Clearance Piston and Cylinder Liner	mm(in)	0.166 – 0.200 (0.0065 – 0.0079)		–
PISTON AND CYLINDER LINER GRADE				
Cylinder Measuring point	mm(in)	130 (5.1181)		
Cylinder Liner Inside Diameter	mm(in)	147.011 – 147.030 (5.7878 – 5.7886)		–
Piston Measuring Point from Piston Top	mm(in)	113 (4.4488)		–
Piston Outside Diameter	mm(in)	146.830 – 146.845 (5.7807 – 5.7813)		–
Clearance Cylinder Liner and Cylinder Block	mm(in)	0.001 – 0.030 (0.00004 – 0.00118)		

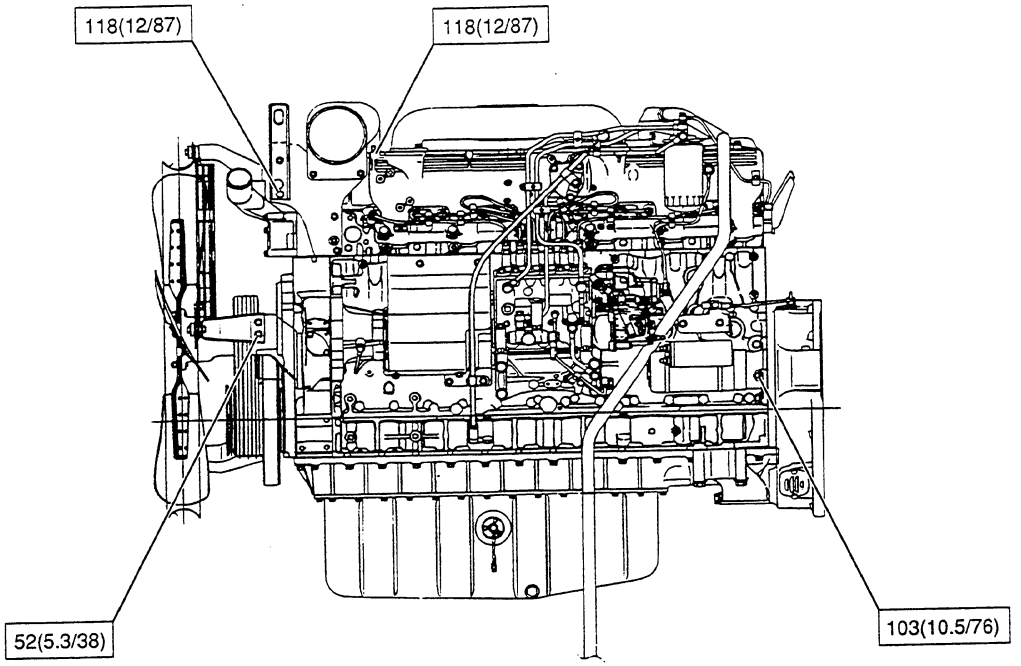
ITEMS		SERVICE STANDARD		SERVICE LIMIT
CYLINDER BLOCK AND CYLINDER LINER GRADE				
Cylinder Block Bore Diameter	mm(in)	Grade		
		"1"	151.600 – 151.610 (5.9685 – 5.9689)	–
		"2" "3"	151.611 – 151.630 (5.9689 – 5.9697)	–
Cylinder Liner Outside Diameter	mm(in)	Grade		
		"1X"	151.590 – 151.599 (5.9681 – 5.9685)	–
		"3X"	151.600 – 151.610 (5.9685 – 5.9689)	–
CYLINDER BODY				
Cylinder Liner Bore	mm(in)	Nominal Measurement 147.0 (5.7874)		147.3 (5.7992)
Cylinder Block Upper Face Warpage	mm(in)	0.0075 (0.0030) or less		0.2 (0.008)
Cylinder Liner Projection	mm(in)	0.05 – 0.09 (0.0020 – 0.0035)		–
Projection Height Between Adjacent Cylinder	mm(in)	0.02 (0.0008) or less		–
LUBRICATING SYSTEM				
Clearance Oil Pump Body and Driven Gear	mm(in)	0.050 – 0.098 (0.0020 – 0.0039)		0.15 (0.0059)
Side Clearance Oil Pump Cover and Gear	mm(in)	0.040 – 0.094 (0.0016 – 0.0037)		–
Oil Pump Gear Shaft Diameter	mm(in)	20.0 (0.7874)		19.9(0.7835)
Clearance Oil Pump Gear Shaft and Body	mm(in)	0.040 – 0.074 (0.0015 – 0.0029)		–
An Interference Oil Pump Drive Gear and Driven Gear	mm(in)	0.019 – 0.047 (0.0007 – 0.0019)		–
Oil Thermostat Opening Temperature	°C (°F)	98.0 (208.4)		–
ENGINE COOLING SYSTEM				
Clearance Water Pump Impeller and Pump Body	mm(in)	1.7 – 2.7 (0.0669 – 0.1063)		3.2 (0.1260)
Thermostat Opening Temperature	°C (°F)	Initial Opening	82 (180.0)	–
		Full Opening	95 (203.0)	–
Thermostat Full Valve Lift	mm(in)	11 (0.433)		–

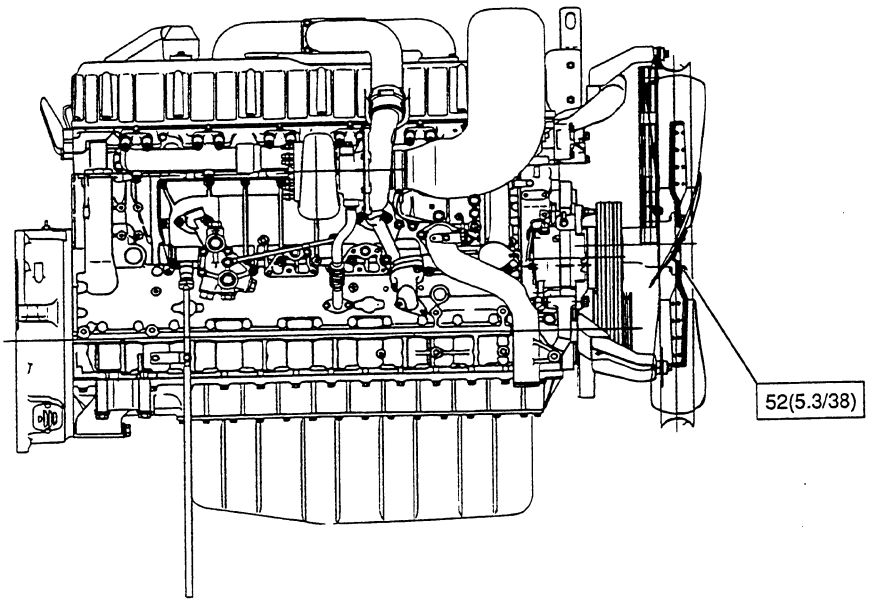
ITEMS		SERVICE STANDARD	SERVICE LIMIT
ENGINE ELECTRICAL			
Alternator			
Rotor Coil Resistance	ohm	11.7	–
Starter Motor			
Commutator Undercut	mm(in)	0.5 (0.197)	0.2 (0.0079)
Commutator Outside Diameter	mm(in)	32 (1.26)	31.4 (1.24)
Brush Length	mm(in)	18 (0.709)	11 (0.43)
TURBOCHARGER			
Turbine Shaft End Play	mm(in)	0.075 – 0.110 (0.0030 – 0.0043)	0.12 (0.0047)
Clearance Turbine Shaft and Bearing	mm(in)	0.130 – 0.235 (0.0051 – 0.0093)	0.275 (0.0108)

Torque Specifications

Auxiliary Parts

N·m (kgf·m/lb ft)





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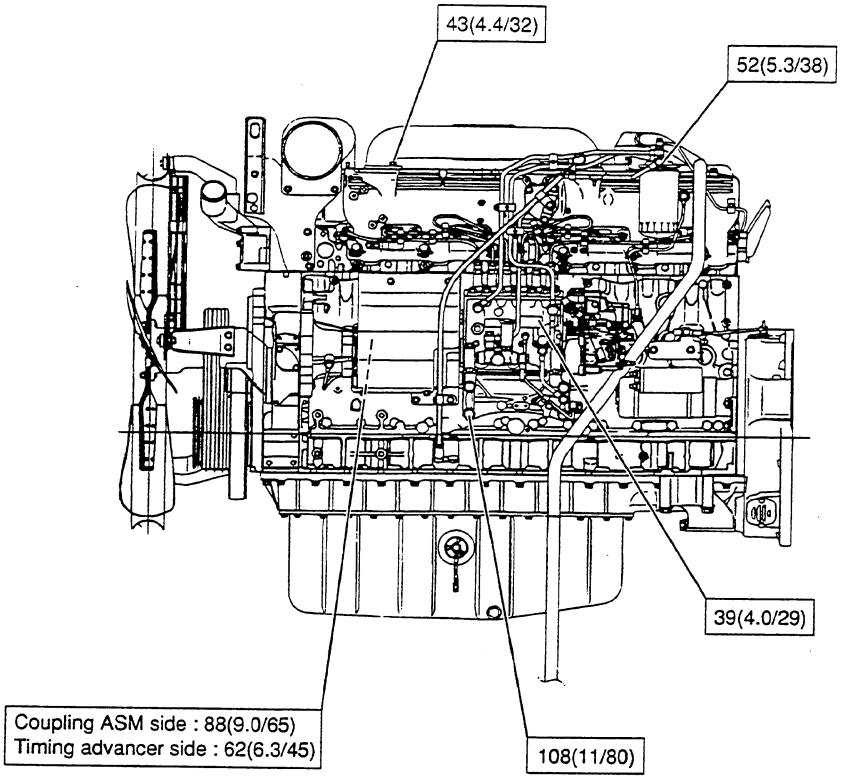
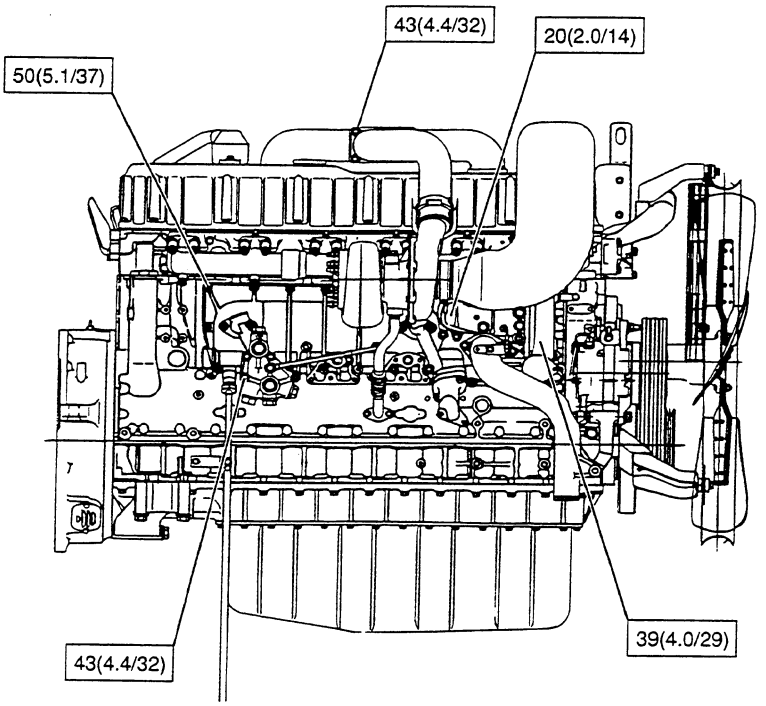
Engine External Parts

N·m (kgf·m/lb ft)





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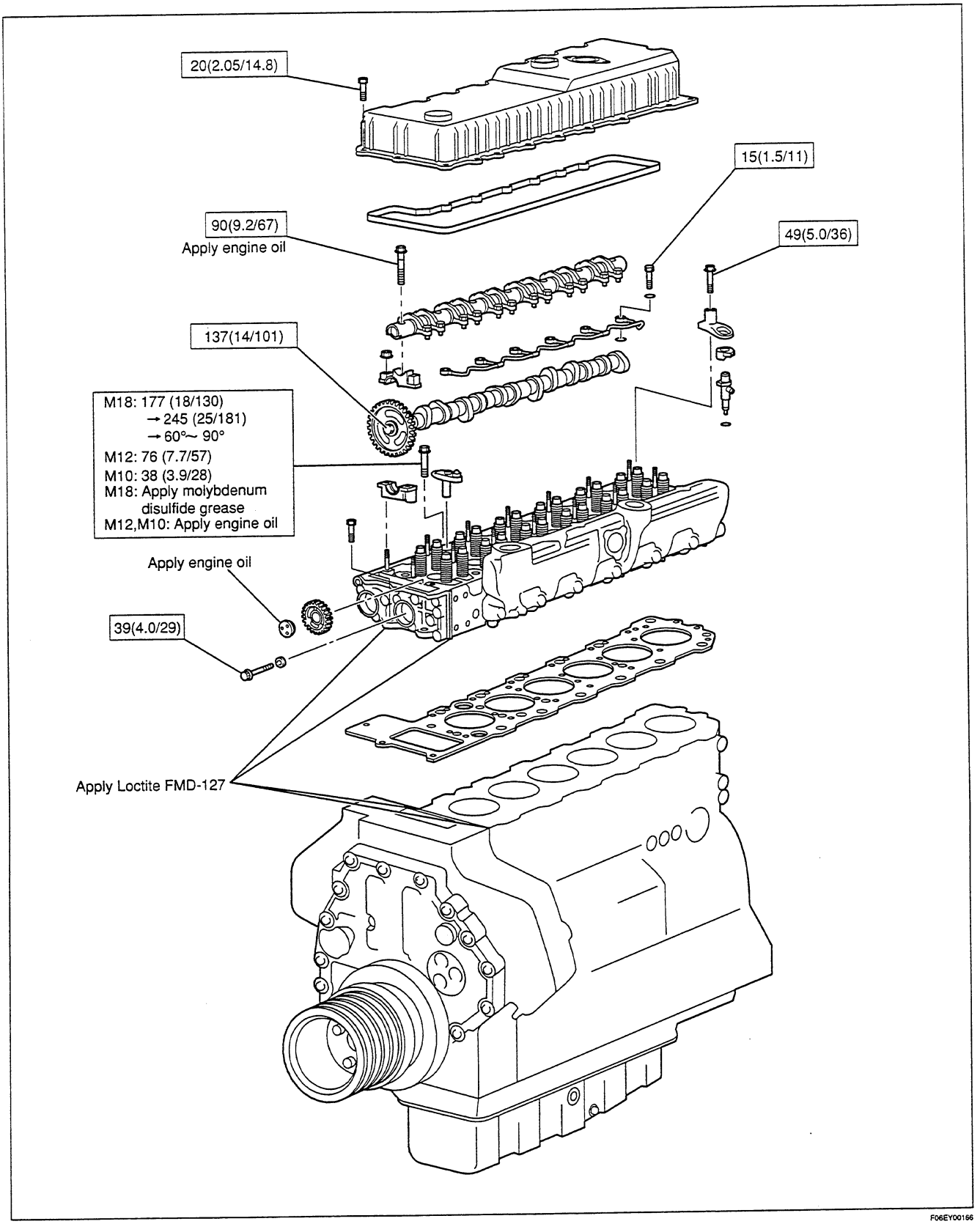
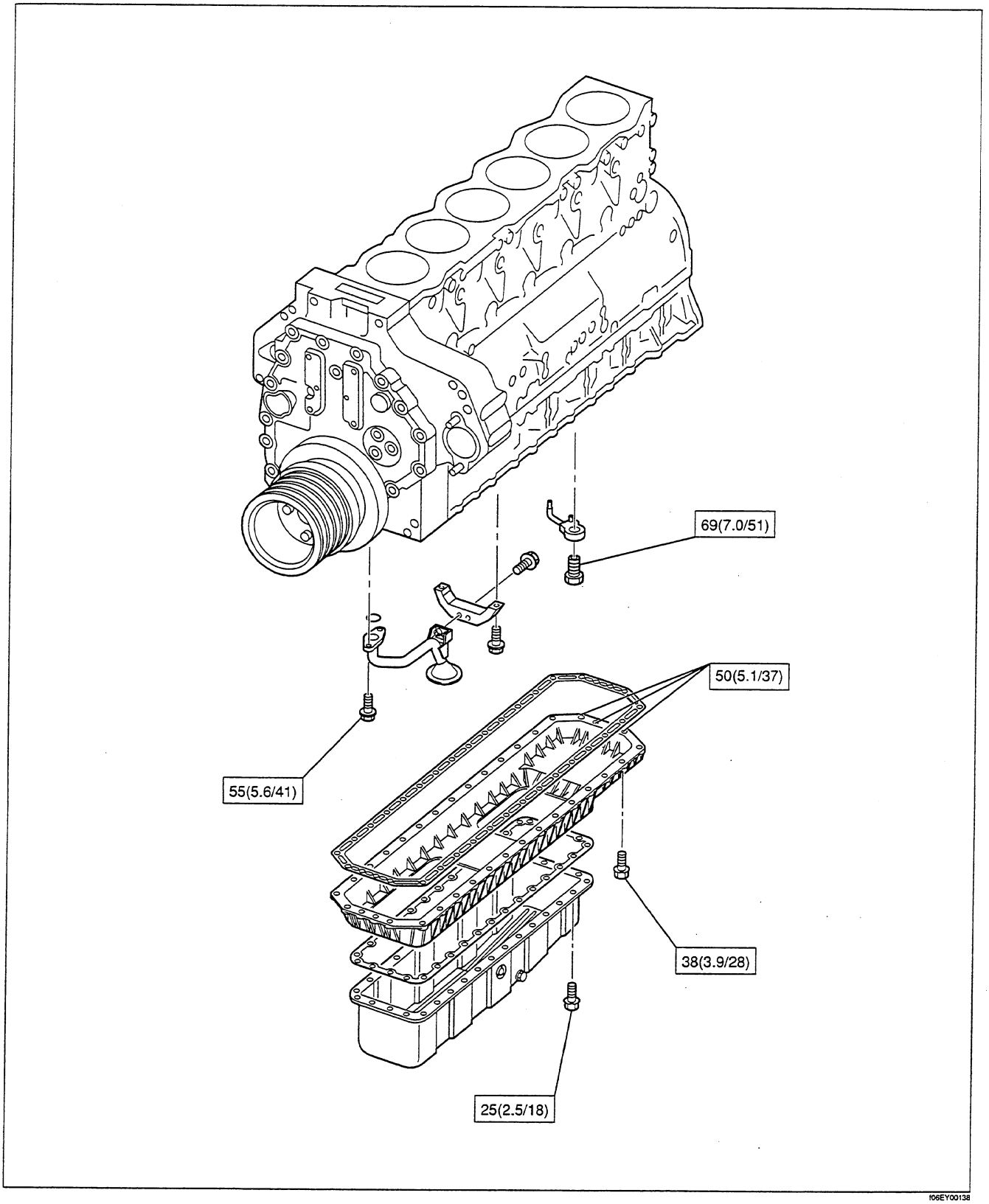
Cylinder Head

N·m (kgf·m/lb ft)



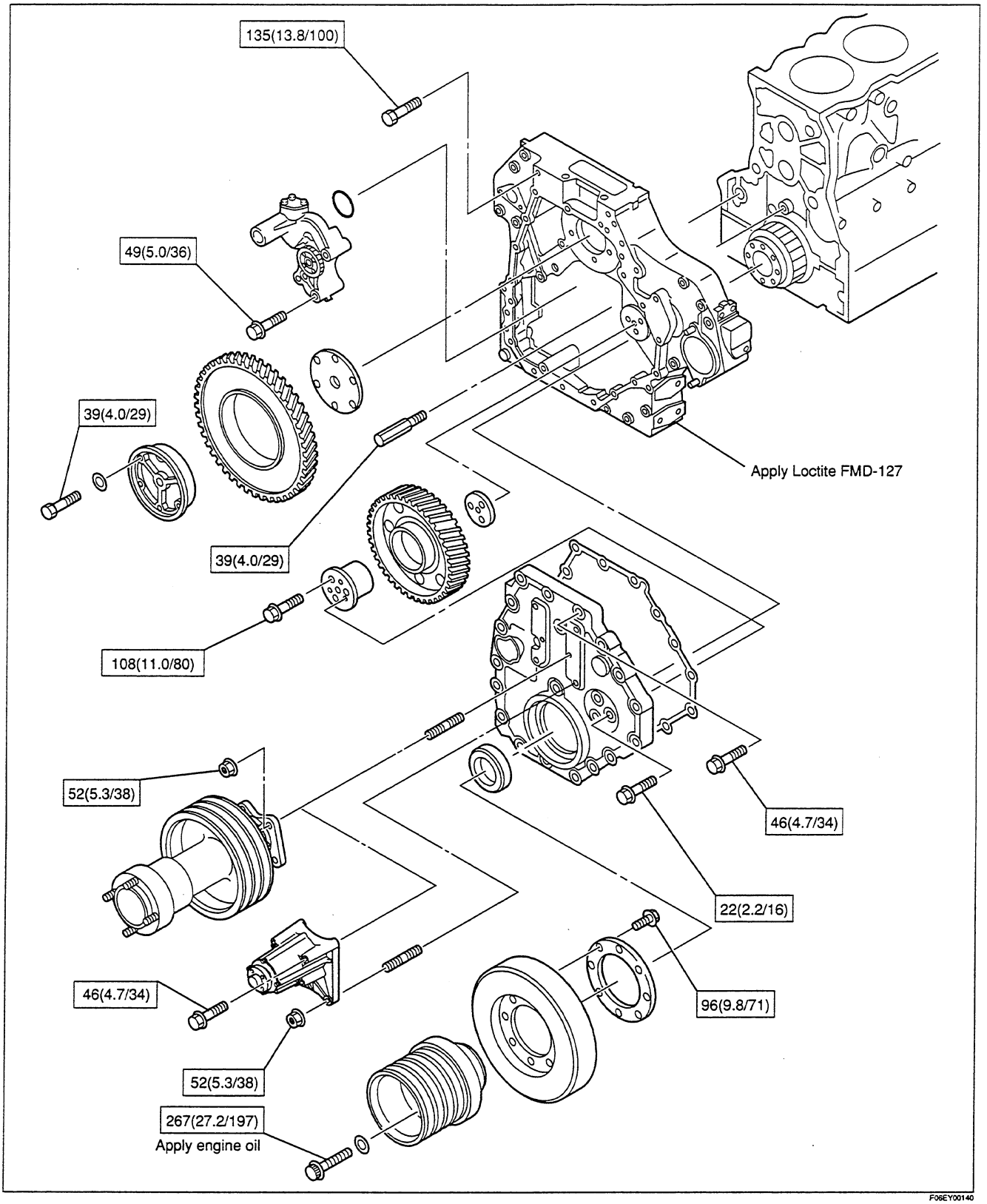
Oil Pan

N·m (kgf·m/lb ft)



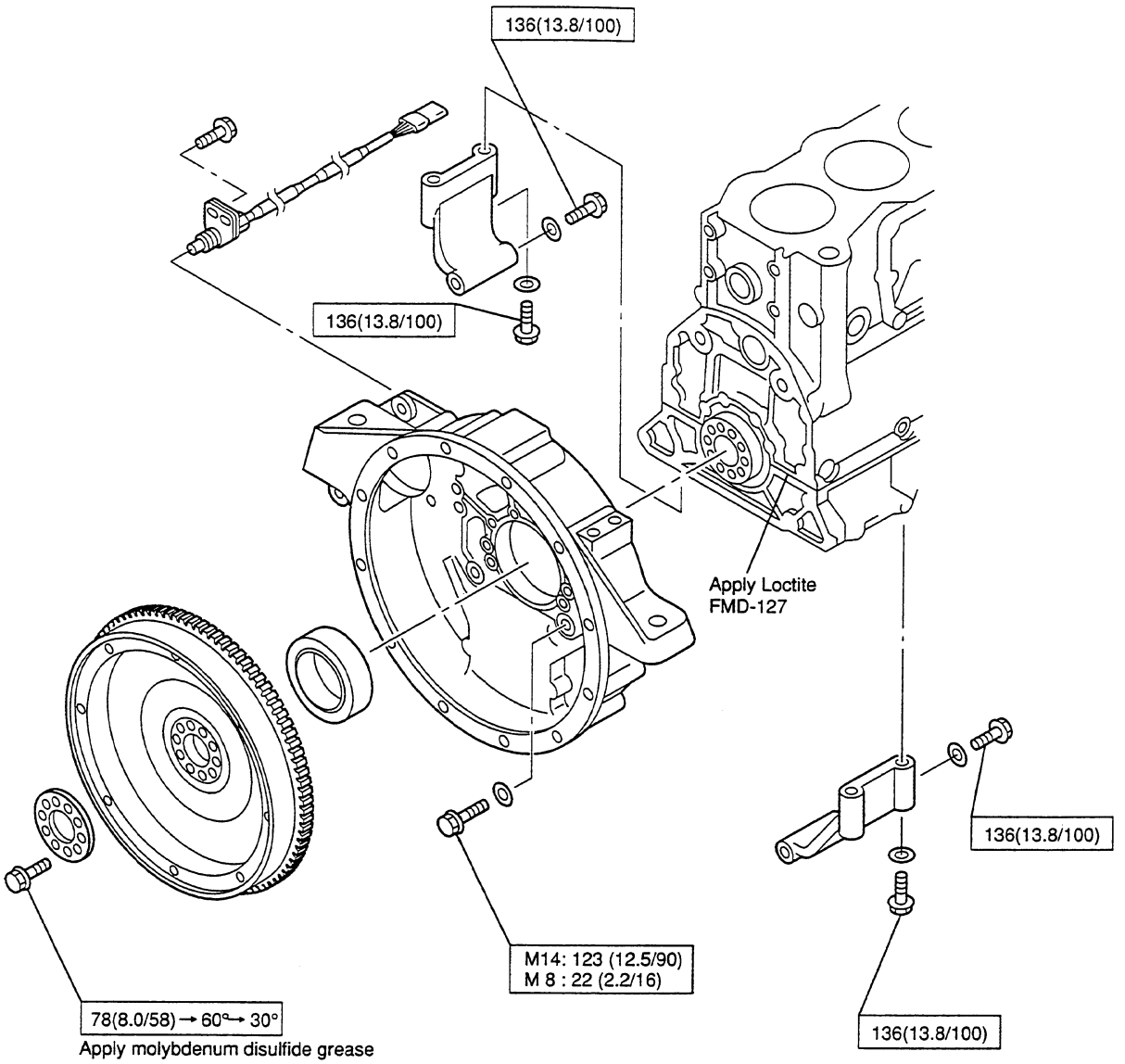
Timing Gears

N·m (kgf·m/lb ft)



Flywheel

N·m (kgf·m/lb ft)



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Piston, Connecting Rod and Crankshaft

N·m (kgf·m/lb ft)