PART NO. EDAG-EN-00

HITACHI

Reliable solutions

Engine Manual

4BG1

Tier 2

4BG1 TIER 2 ENGINE MANUAL

Hitachi Construction Machinery Co., Ltd.

URL:http://www.hitachi-c-m.com

PRINTED IN JAPAN (K) 2013, 07

EDAG-EN-00

Service Manual consists of the following
Technical Manual (Operational Principle)
Technical Manual (Troubleshooting)
Workshop Manual
Engine Manual

SECTION 1

GENERAL INFORMATION

TABLE OF CONTENTS

GENERAL REPAIR INSTRUCTIONS

1. Before performing any service operation with the engine mounted, disconnect the grounding cable from the battery.

   This will reduce the chance of cable damage and burning due to short circuiting.
2. Always use the proper tool or tools for the job at hand.

   Where specified, use the specially designed tool or tools.
3. Use genuine ISUZU parts referring ISUZU PARTS CATALOG for the engines surely.
4. Never reuse cotter pins, gaskets, O-rings, lock washers, and self locking nuts. Discard them as you remove them. Replace them with new ones.
5. Always keep disassembled parts neatly in groups. This will ensure a smooth reassembly operation.

   It is especially important to keep fastening parts separate. These parts vary in hardness and design, depending on their installation position.
6. All parts should be carefully cleaned before inspection or reassembly.

   Oil ports and other openings should be cleaned with compressed air to make sure that they are completely free of obstructions.
7. Rotating and sliding part surfaces should be lubricated with oil or grease before reassembly.
8. If necessary, use a sealer on gaskets to prevent leakage.
9. Nut and bolt torque specifications should be carefully followed.
10. Always release the air pressure from any machine-mounted air tank(s) before dismounting the engine or disconnecting pipes and hoses. To not do so is extremely dangerous.
11. Always check and recheck you work. No service operation is complete until you have done this.
12. Information contained in the "Main Data and Specifications" of the Workshop Manual and the Instruction Book may differ. In this case, the information contained in the Instruction Book should be considered applicable.

NOTES ON THE FORMAT OF THIS MANUAL

This Workshop Manual is applicable to the CC-4BG1TCG, BB-4BG1TRG family of industrial diesel engines. Unless otherwise specified, these engines have common parts and components as well as data and specifications.

Illustrations used in this Workshop Manual are based on the 4BG1T engines.

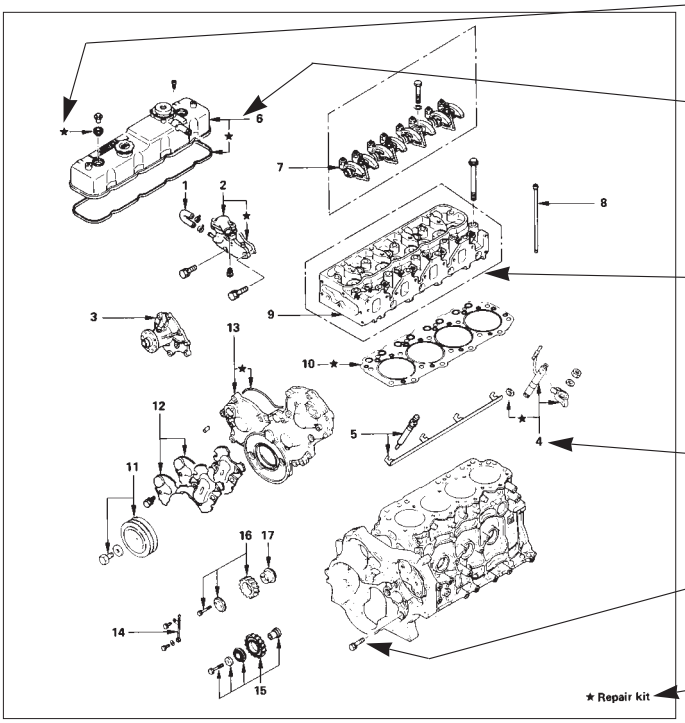
The 4BG1T engine is turbocharged.

1. Find the applicable section by referring to the Table of Contents at the beginning of the Manual.
2. Common technical data such as general maintenance items, service specifications, and tightening torques are included in the "General Information" section.
3. Each section is divided into sub-sections dealing with disassembly, inspection and repair, and reassembly.

   The section ENGINE ASSEMBLY is an exception. This part is divided into three sections to facilitates quick indexing.
4. When the same servicing operation is applicable to several different units, the manual will direct you to the appropriate page.
5. For the sake of brevity, self-explanatory removal and installation procedures are omitted.

   More complex procedures are covered in detail.

6. Each service operation section in this Workshop Manual begins with an exploded view of the applicable area. A brief explanation of the notation used follows.



Disassembly Steps - 2

1. Water by-pass hose
2. Thermostat housing
3. Water pump
▲ 4. Injection nozzle holder
5. Glow plug and glow plug connector
6. Cylinder head cover
▲ 7. Rocker arm shaft and rocker arm
8. Push rod
▲ 9. Cylinder head
10. Cylinder head gasket
▲ 11. Crankshaft damper pulley with dust seal
12. Timing gear case cover (Option)
13. Timing gear cover
14. Timing gear oil pipe
15. Idler gear "B" and shaft
▲ 16. Idler gear "A"
▲ 17. Idler gear shaft

Inverted Engine

Parts marked with an asterisk (*) are included in the repair kit.

Parts within a square frame are to be removed and installed as a single unit.

All parts within an irregularly shaped frame form a single assembly. They are considered a "major component".
Individual parts within the irregularly shaped frame are considered "minor components".

The number tells you the service operation sequence.

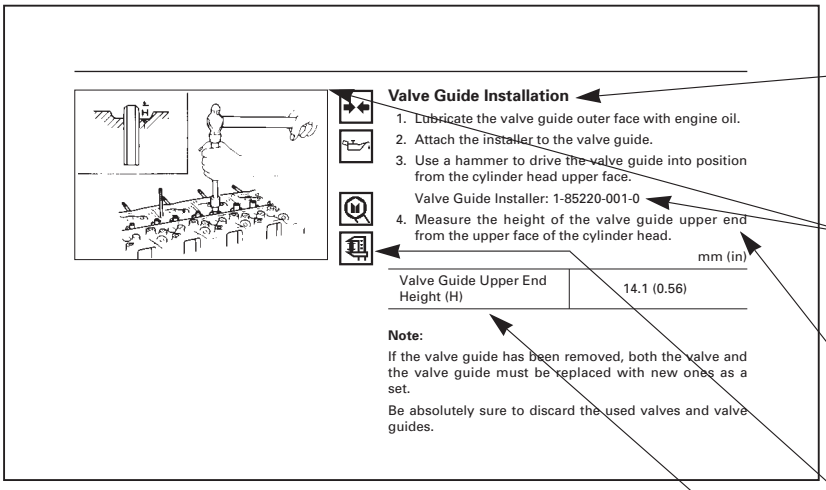
Removal of unnumbered parts is unnecessary unless replacement is required.

The "* Repair Kit" indicates that a repair kit is available.

The parts listed under "Reassembly Steps" or "Installation Steps" are in the service operation sequence.

The removal or installation of parts marked with a triangle (▲) is an important operation. Detailed information is given in the text.

7. Below is a sample of the text of the Workshop Manual.



Valve Guide Installation

1. Lubricate the valve guide outer face with engine oil.
2. Attach the installer to the valve guide.
3. Use a hammer to drive the valve guide into position from the cylinder head upper face.
   Valve Guide Installer: 1-85220-001-0
4. Measure the height of the valve guide upper end from the upper face of the cylinder head.

mm (in)

Valve Guide Upper End Height (H)	14.1 (0.56)

Note:

If the valve guide has been removed, both the valve and the valve guide must be replaced with new ones as a set.

Be absolutely sure to discard the used valves and valve guides.

This is the item shown in the illustration. It is marked with a triangle (▲) on the Major Components page.

Special tools are identified by the tool name and/or number.

The illustration shows how the special tool is to be used.

Letters and numbers contained in a circle refer to the illustration.

Symbols indicate the type of service operation or step to be performed. A detailed explanation of these symbols follows.

Service data and specifications are given in this table.

8. The following symbols appear throughout this Workshop Manual. They tell you the type of service operation or step to perform.

	. . . Removal		. . . Adjustment
	. . . Installation		. . . Cleaning
	. . . Disassembly		. . . Important Operation Requiring Extra Care
	. . . Reassembly		. . . Specified Torque (Tighten)
	. . . Alignment (Marks)		. . . Special Tool Use Required or Recommended (Isuzu Tool or Tools)
	. . . Directional Indication		. . . Commercially Available Tool Use Required or Recommended
	. . . Inspection		. . . Lubrication (Oil)
	. . . Measurement		. . . Lubrication (Grease)
	. . . Sealant Application		

9. Measurement criteria are defined by the terms "standard" and "limit".

   A measurement falling within the "standard" range indicates that the applicable part or parts are serviceable.

   "Limit" should be thought of as an absolute value.

   A measurement which is outside the "limit" indicates that the applicable part or parts must be either repaired or replaced.

10. Components and parts are listed in the singular form throughout the Manual.
11. Directions used in this Manual are as follows:

    Front

    The cooling fan side of the engine viewed from the flywheel.

    Right

    The injection pump side of the engine.

    Left

    The exhaust manifold side of the engine.

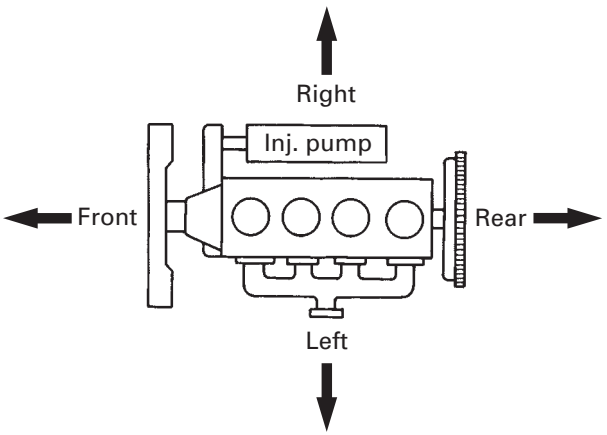
    Rear

    The flywheel side of the engine.

    Cylinder numbers are counted from the front of the engine.

    The front most cylinder is No. 1 and rear most cylinder is No. 4.

    The engine's direction of rotation is counterclockwise viewed from the flywheel.



MAIN DATA AND SPECIFICATIONS

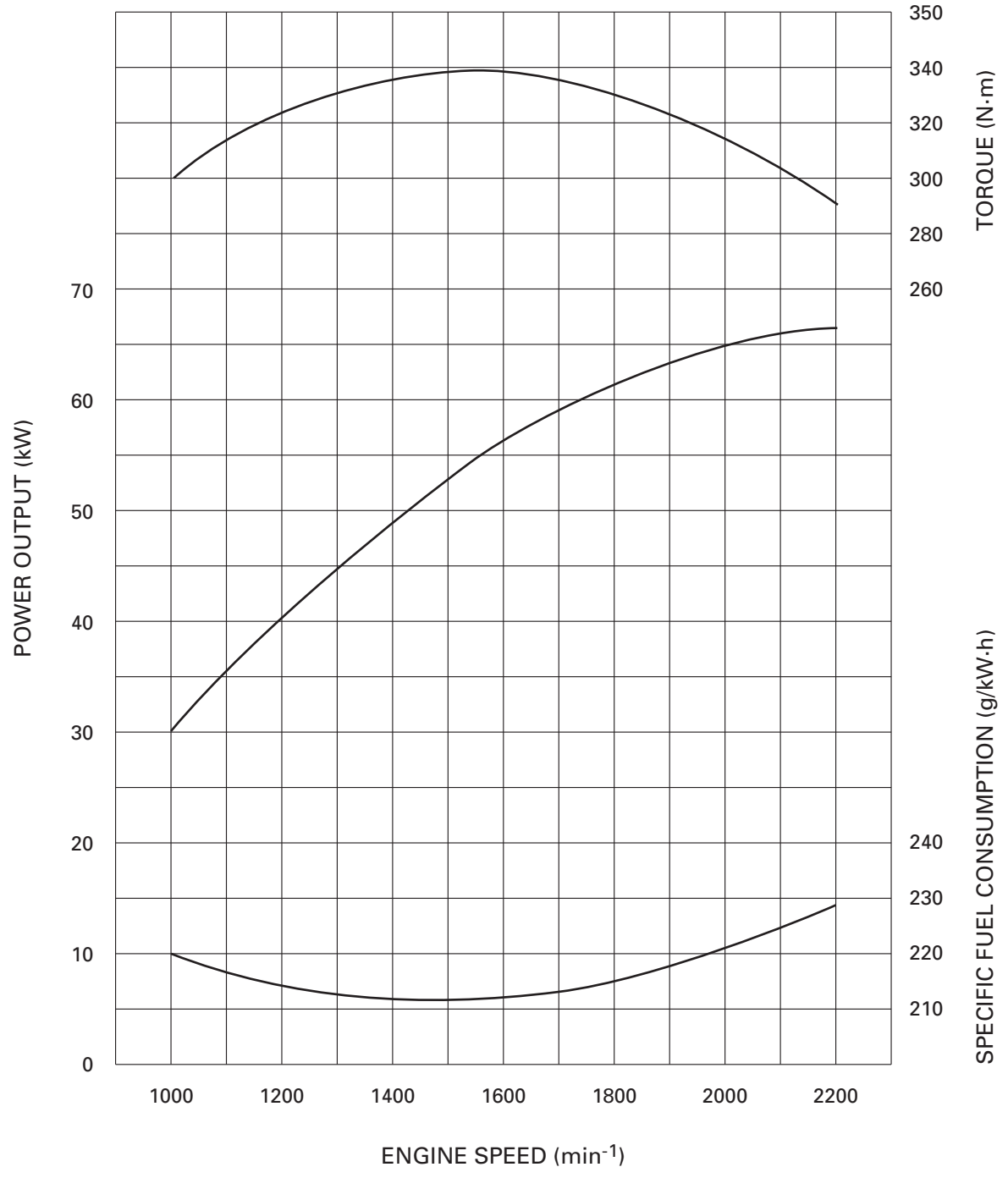
Item \ Engine Model		CC-4BG1TCG	BB-4BG1TRG
Engine type		Water cooled, four cycle, vertical in-line overhead valve	
Combustion chamber type		Direct injection	
Cylinder liner type		Dry	
No. of cylinders – bore × stroke	mm (in)	4 – 105 × 125 (4.13 × 4.92)	
Total piston displacement	L (cid)	4.329 (464)	
Compression ratio		18 to 1	
Engine dimensions Length × width × height	mm (in)	908 × 698 × 892 (35.7 × 27.5 × 27.5)	900 × 718 × 892 (35.4 x 28.3 x 35.1)
Engine weight (Dry)	kg (lb)	370 (816)	360 (794)
Fuel injection order		1–3–4–2	
Specified fuel		Diesel fuel (ASTM D975 No. 2D)	
Injection pump		In-line plunger, Bosch A type	
Governor		Mechanical, RSV type	
Injection nozzle		Multi hole	
Injection starting pressure	MPa (kgf/cm^2/psi)	18.1 (185/2,630)	
Fuel filter type		Cartridge (spin-on)	
Water sedimentor	(If so equipped)	Sediment/water level indicating type	
Compression pressure (At warm)	MPa (kgf/cm^2/psi)	3.04 (31/441) at 200 min^{-1} at sea level	
Valve clearances (At cold) Intake	mm (in)	0.40 (0.016)	
Exhaust	mm (in)	0.40 (0.016)	
Lubrication method		Pressurized circulation	
Oil pump		Gear type	
Main oil filter type		Full flow, cartridge (spin-on)	
Engine oil capacity OIL PAN	L (US gal)	MAX 13.2 (3.49), MIN 10 (2.64)	
TOTAL SYSTEM capacity		MAX 15.8 (4.17), MIN 12.6 (3.33)	
Oil cooler		Water cooled integral type	
Cooling method		Pressurized forced circulation	
Coolant volume (engine only)	L (US gal)	8.5 (2.25)	
Water pump		Belt driven impeller type	
Thermostat type		Wax pellet type	
Alternator	V-A	24–50	
Starter	V-KW	24–4.5	
Turbocharger manufacturer		MITSUBISHI	
Turbocharger model		TD04HL	

PERFORMANCE CURVE

MODEL CC-4BG1TCG

CONDITION:

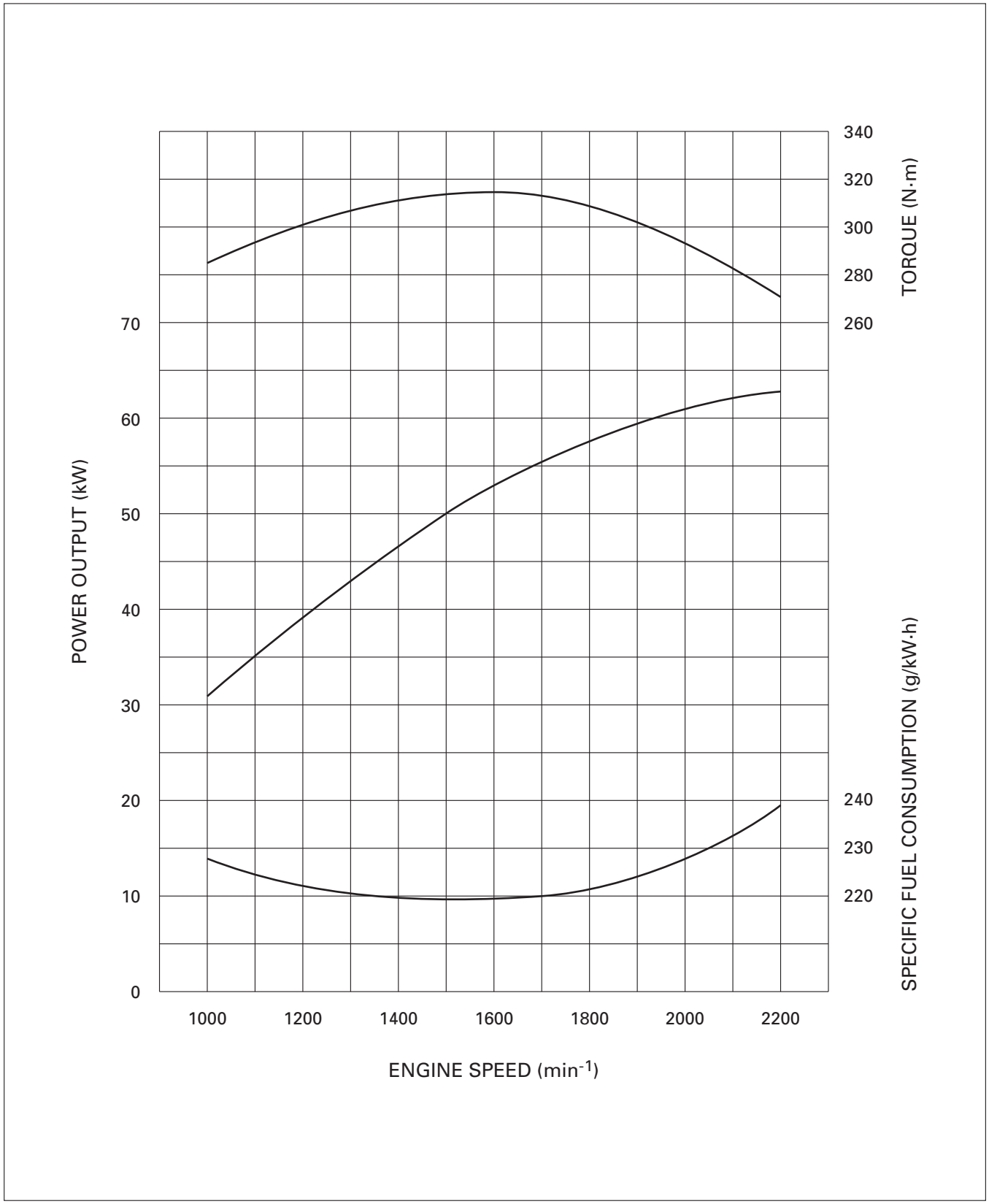
Ambient condition	: JIS standard	Air cleaner	: None
Break-in	: More than 30 hours	Alternator	: No Load
Cooling fan	: ϕ500	Exhaust silencer	: None
With intercooler			



MODEL BB-4BG1TRG

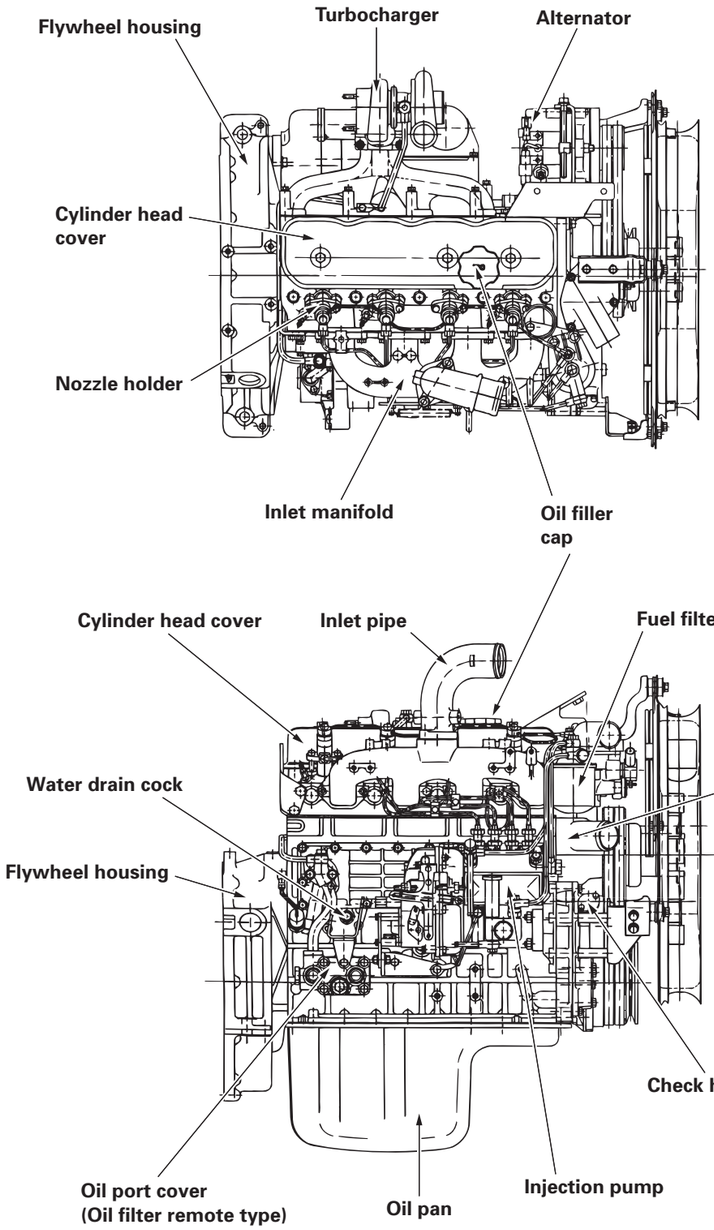
CONDITION:

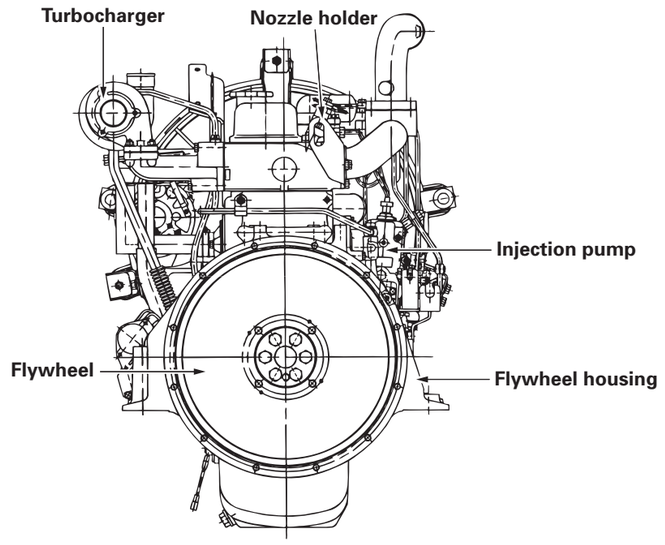
Ambient condition	: JIS standard	Air cleaner	: None
Break-in	: More than 30 hours	Alternator	: No Load
Cooling fan	: ϕ500	Exhaust silencer	: None
With intercooler			

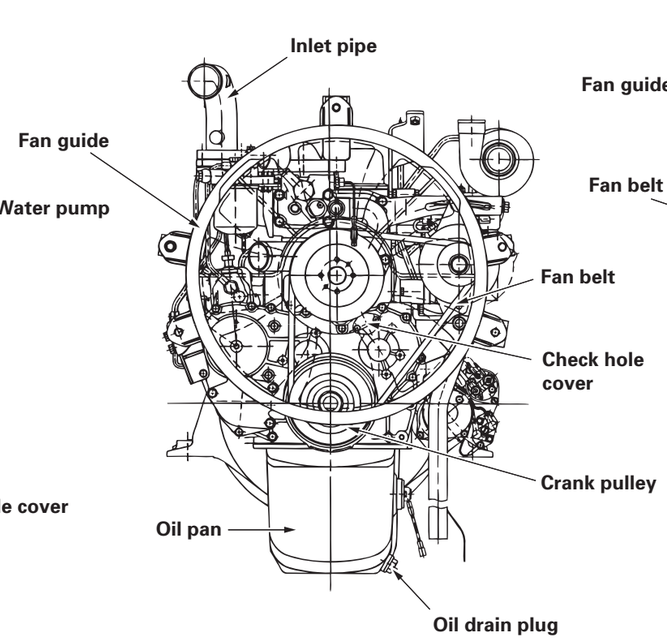


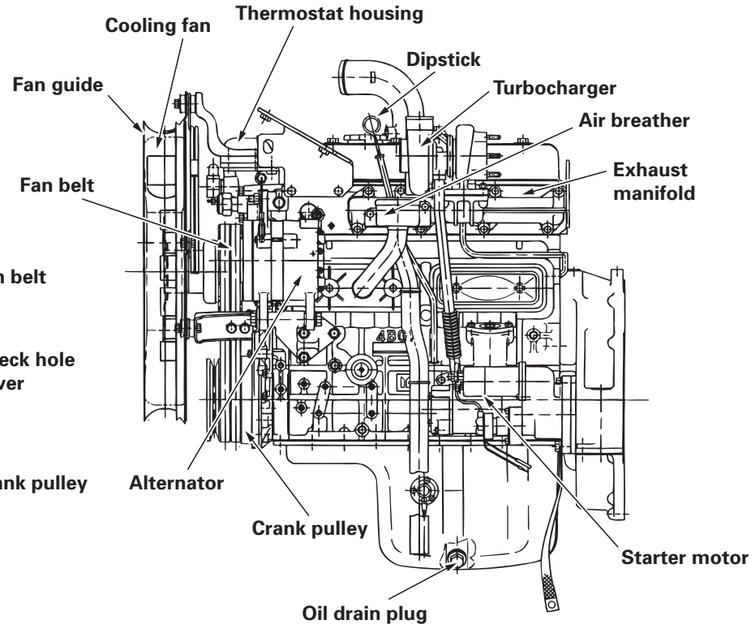
EXTERNAL VIEW

MODEL CC-4BG1TCG



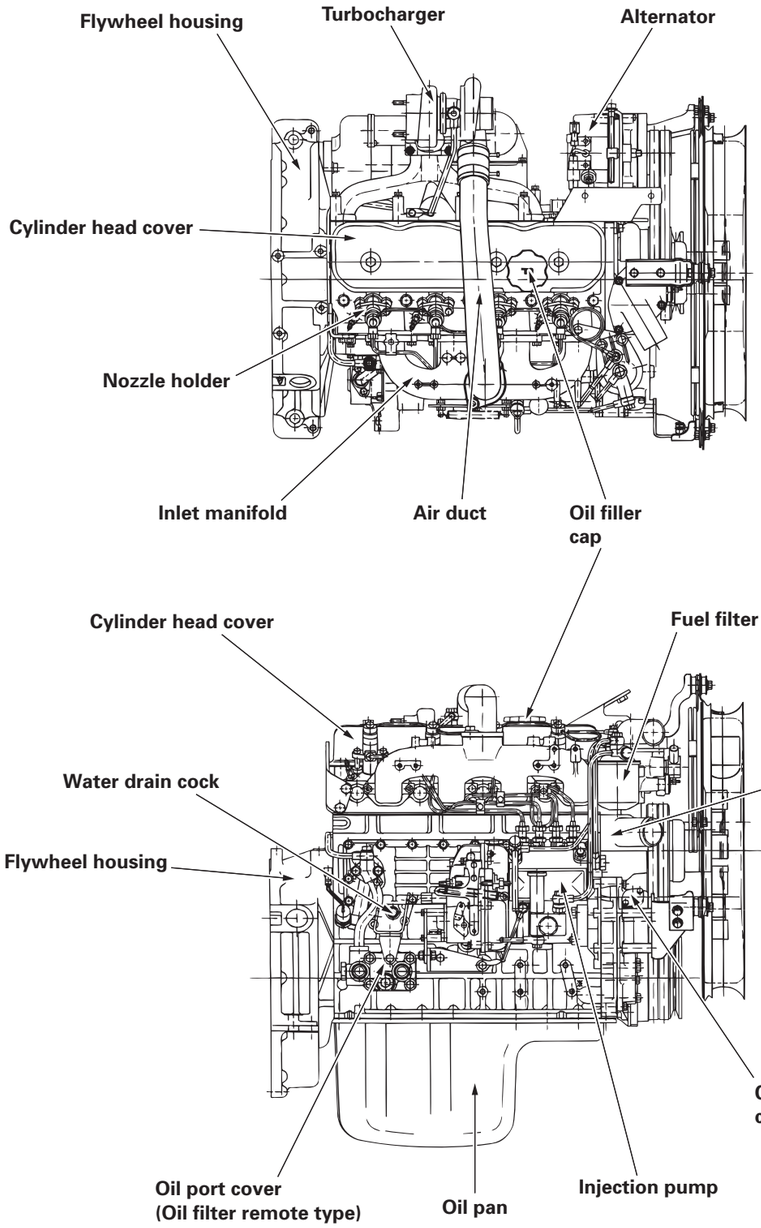


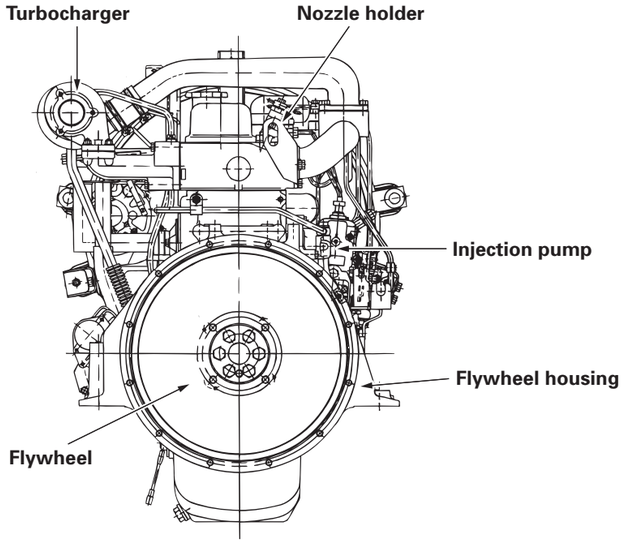


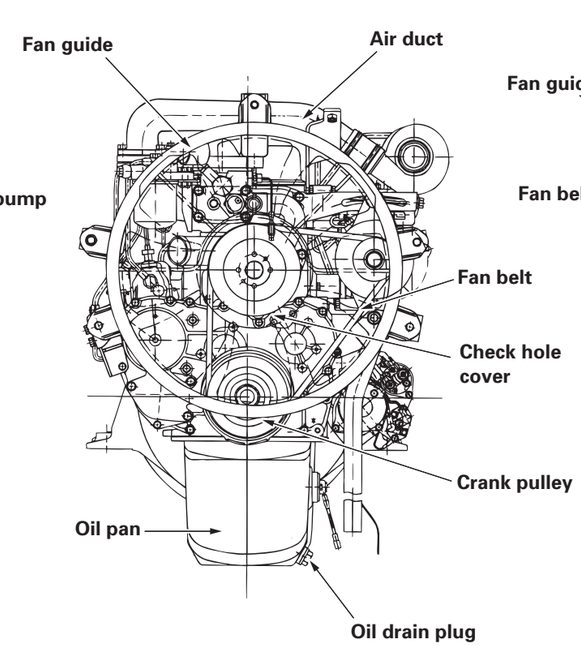


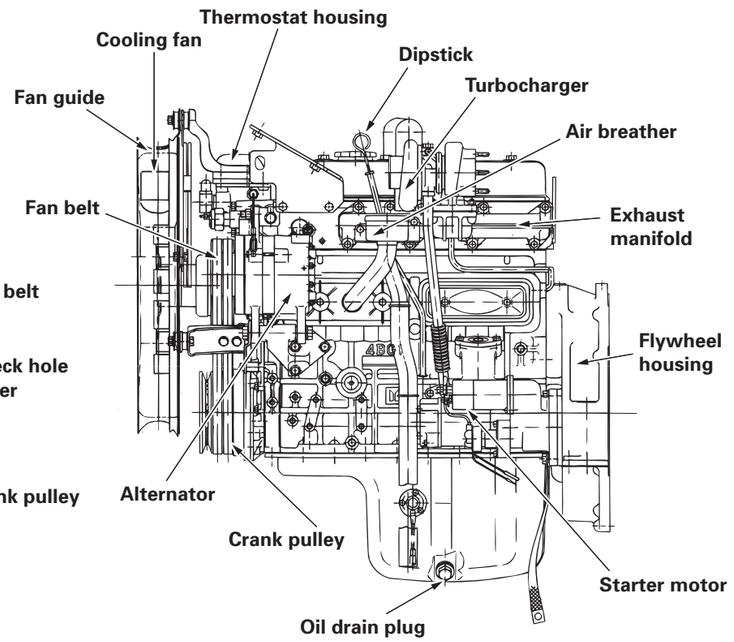
EXTERNAL VIEW

MODEL BB-4BG1TRG









TIGHTENING TORQUE SPECIFICATIONS

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

STANDARD BOLT

N·m (kgf·m/lb.ft)

Bolt Identification / Bolt Diameter × pitch (mm)		 	
		 	
M 6 × 1.0	3.9–7.8 (0.4–0.8/2.9–5.8)	4.9–9.8 (0.5–1.0/3.6–7.2)	———
M 8 × 1.25	7.8–17.7 (0.8–1.8/5.8–13.0)	11.8–22.6 (1.2–2.3/8.7–16.6)	16.7–30.4 (1.7–3.1/12.3–22.4)
M10 × 1.25	20.6–34.3 (2.1–3.5/5.2–25.3)	27.5–46.1 (2.8–4.7/20.3–33.4)	37.3–62.8 (3.8–6.4/27.5–46.3)
* **M10 × 1.5**	19.6–33.4 (2.0–3.4/14.5–24.6)	27.5–45.1 (2.8–4.6/20.3–33.3)	36.3–59.8 (3.7–6.1/26.8–44.1)
M12 × 1.25	49.1–73.6 (5.0–7.5/36.2–54.2)	60.8–91.2 (6.2–9.3/44.8–67.3)	75.5–114.0 (7.7–11.6/55.7–83.9)
* **M12 × 1.75**	45.1–68.7 (4.6–7.0/33.3–50.6)	56.9–84.4 (5.8–8.6/42.0–62.2)	71.6–107.0 (7.3–10.9/52.8–78.8)
M14 × 1.5	76.5～115.0 (7.8～11.7/56.4～84.6)	93.2–139.0 (9.5–14.2/68.7–103.0)	114.0–.0 (11.6–17.4/83.9–126.0)
* **M14 × 2.0**	71.6–107.0 (7.3–10.9/52.8–78.8)	88.3–131.0 (9.0–13.4/65.1–96.9)	107.0–160.0 (10.9–16.3/78.8–118.0)
M16 × 1.5	104.0–157.0 (10.6–16.0/76.7–115.7)	135.0–204.0 (13.8–20.8/99.8–150.0)	160.0–240.0 (16.3–24.5/118.0–177.0)
* **M16 × 2.0**	100.0–149.0 (10.2–15.2/73.8–110.0)	129.0–194.0 (13.2–19.8/95.5–143.0)	153.0–230.0 (15.6–23.4/113.0–169.0)
M18 × 1.5	151.0–226.0 (15.4–23.0/111.0–166.0)	195.0–293.0 (19.9–29.9/144.0–216.0)	230.0–345.0 (23.4–35.2/169.0–255.0)
* **M18 × 2.5**	151.0–226.0 (15.4–23.0/111.0–166.0)	196.0–294.0 (20.0–30.0/145.0–217.0)	231.0–346.0 (23.6–35.3/171.0–255.0)
M20 × 1.5	206.0–310.0 (21.0–31.6/152.0–229.0)	270.0–405.0 (27.5–41.3/199.0–299.0)	317.0–476.0 (32.3–48.5/234.0–351.0)
* **M20 × 2.5**	190.0–286.0 (19.4–29.2/140.0–211.0)	249.0–375.0 (25.4–38.2/184.0–276.0)	293.0–440.0 (29.9–44.9/216.0–325.0)
M22 × 1.5	251.0–414.0 (25.6–42.2/185.0–305.0)	363.0–544.0 (37.0–55.5/268.0–401.0)	425.0–637.0 (43.3–64.9/313.0–469.0)
* **M22 × 2.5**	218.0–328.0 (22.2–33.4/161.0–242.0)	338.0–507.0 (34.5–51.7/250.0–374.0)	394.0–592.0 (40.2–60.4/291.0–437.0)
M24 × 2.0	359.0–540.0 (36.6–55.0/265.0–398.0)	431.0–711.0 (43.9–72.5/318.0–524.0)	554.0–831.0 (56.5–84.7/409.0–613.0)
* **M24 × 3.0**	338.0–507.0 (34.5–51.7/250.0–374.0)	406.0–608.0 (41.4–62.0/299.0–448.0)	521.0–782.0 (53.1–79.7/384.0–576.0)

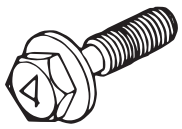
An asterisk (*) indicates that the bolts are used for female threaded parts that are made of soft materials such as casting.

TIGHTENING TORQUE SPECIFICATIONS

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

FLANGED HEAD BOLT

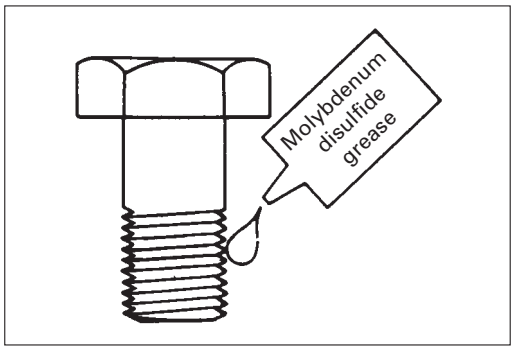
N·m (kgf·m/lb.ft)

Bolt Identification / Bolt Diameter × pitch (mm)			
M 6 × 1.0	4.6–8.5 (0.5–0.9/3.6–6.5)	6.6–12.2 (0.6–1.2/4.3–8.7)	———
M 8 × 1.25	10.5–196 (1.1–2.0/8.0–14.5)	15.3–28.4 (1.6–2.9/11.6–21.0)	18.1–33.6 (2.1–3.4/15.2–25.0)
M10 × 1.25	23.1–38.5 (2.4–3.9/17.4–28.2)	35.4–58.9 (3.6–6.1/26.0–44.1)	42.3–70.5 (4.3–7.2/31.1–52.1)
* **M10 × 1.5**	22.3–37.2 (2.3–3.8/16.6–27.5)	34.5–57.5 (3.5–5.8/25.3–42.0)	40.1–66.9 (4.1–6.8/29.7–49.2)
M12 × 1.25	54.9–82.3 (5.6–8.4/40.1–60.8)	77.7–117.0 (7.9–11.9/57.1–86.1)	85.0–128.0 (8.7–13.0/62.9–94.0)
* **M12 × 1.75**	51.0–76.5 (5.2–7.8/37.6–56.4)	71.4–107.0 (7.3–10.9/52.8–78.8)	79.5–119.0 (8.1–12.2/58.6–88.2)
M14 × 1.5	83.0–125.0 (8.5–12.7/61.5–91.9)	115.0–172.0 (11.7–17.6/84.6–127.0)	123.0–185.0 (12.6–18.9/91.1–137.0)
* **M14 × 2.0**	77.2–116.0 (7.9–11.8/57.1–85.3)	108.0–162.0 (11.1–16.6/80.3–120.0)	116.0–173.0 (11.8–17.7/85.3–128)
M16 × 1.5	116.0–173.0 (11.8–17.7/85.3–128)	171.0–257.0 (17.4–26.2/26.0–190)	177.0–265.0 (18.0–27.1/130.0–196.0)
* **M16 × 2.0**	109.0–164.0 (11.2–16.7/81.0–121.0)	163.0–244.0 (16.6–24.9/120.0–180.0)	169.0–253.0 (17.2–25.8/124.0–187.0)

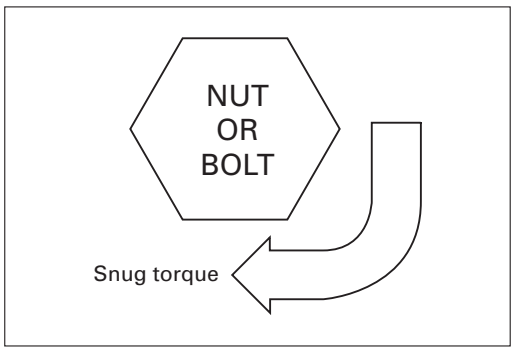
A bolt with an asterisk (*) is used for female screws of soft material such as cast iron.

ANGULAR NUT AND BOLT TIGHTENING METHOD

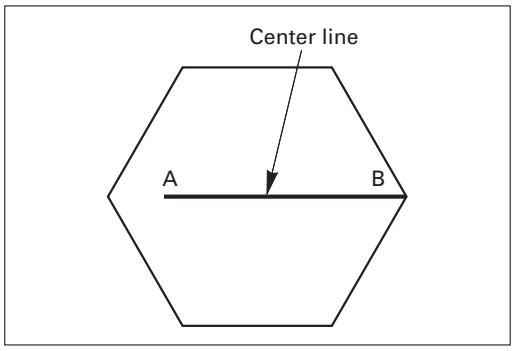
1. Carefully wash the nuts and bolts to remove all oil and grease.



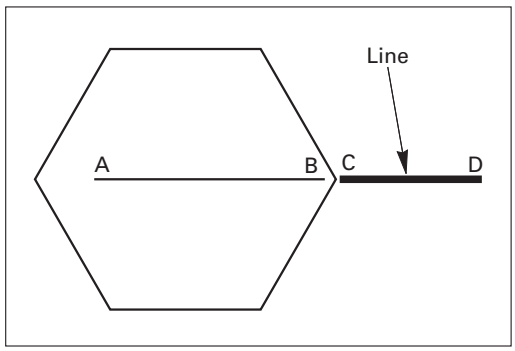
2. Apply a coat of molybdenum disulfide grease to the threads and setting faces of the nuts and bolts.



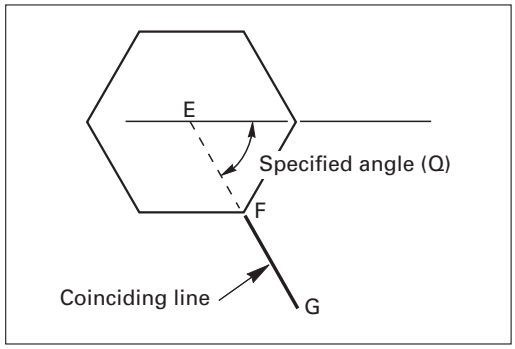
3. Tighten the nuts and bolts to the specified torque (snug torque) with a torque wrench.



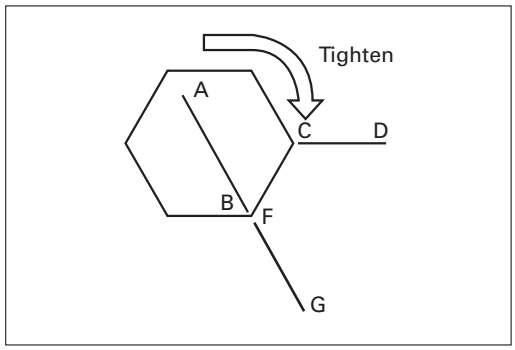
4. Draw a line [A-B] across the center of each bolt.



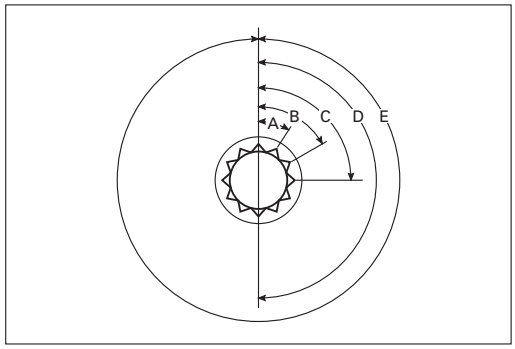
5. Draw another line (C-D) on the face of each of the parts to be clamped. This line should be an extension of the line [A-B].



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



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



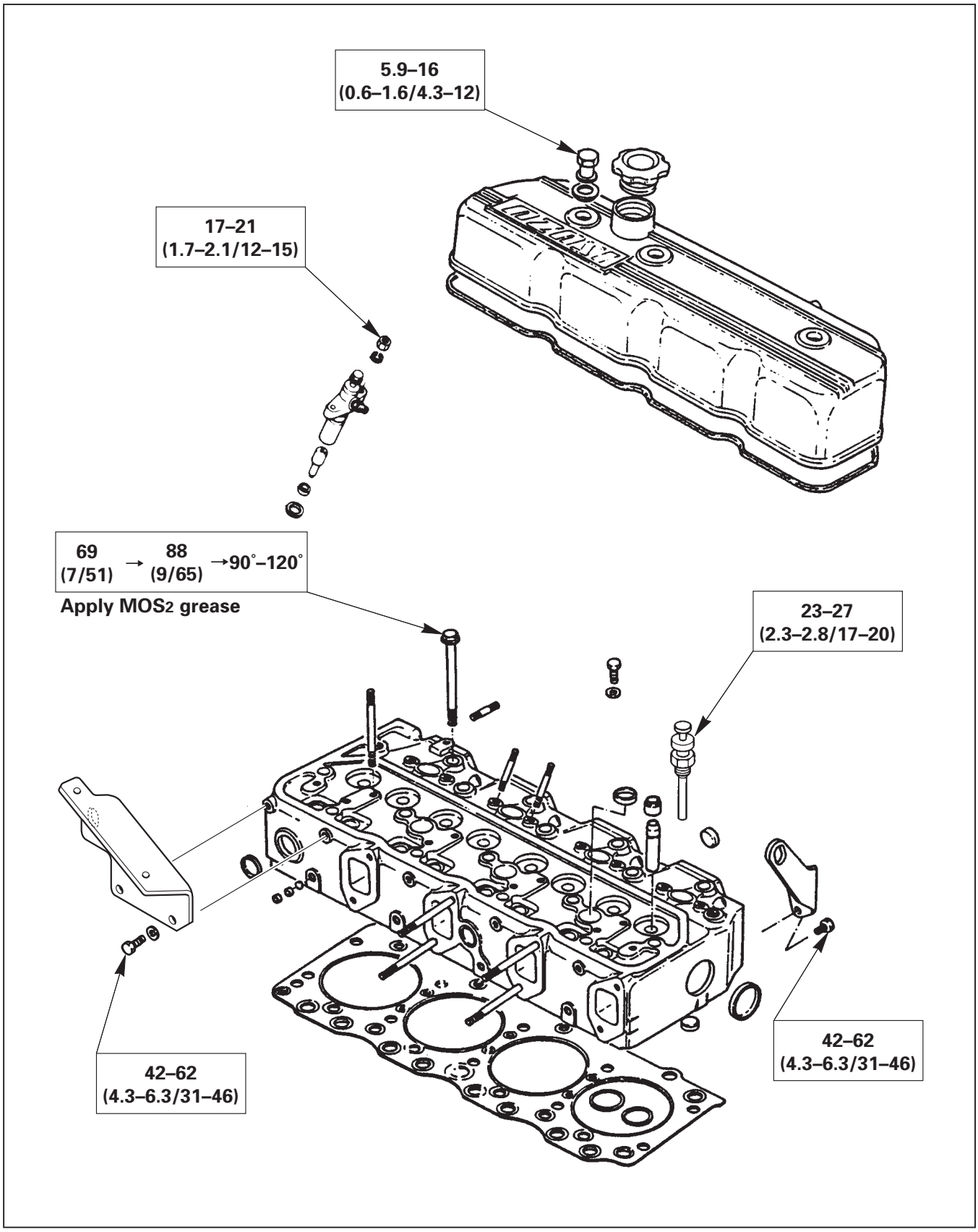
Example: Specified Angle and Tightening Rotation

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

MAJOR PART FIXING NUTS AND BOLTS

Cylinder Head and Cover

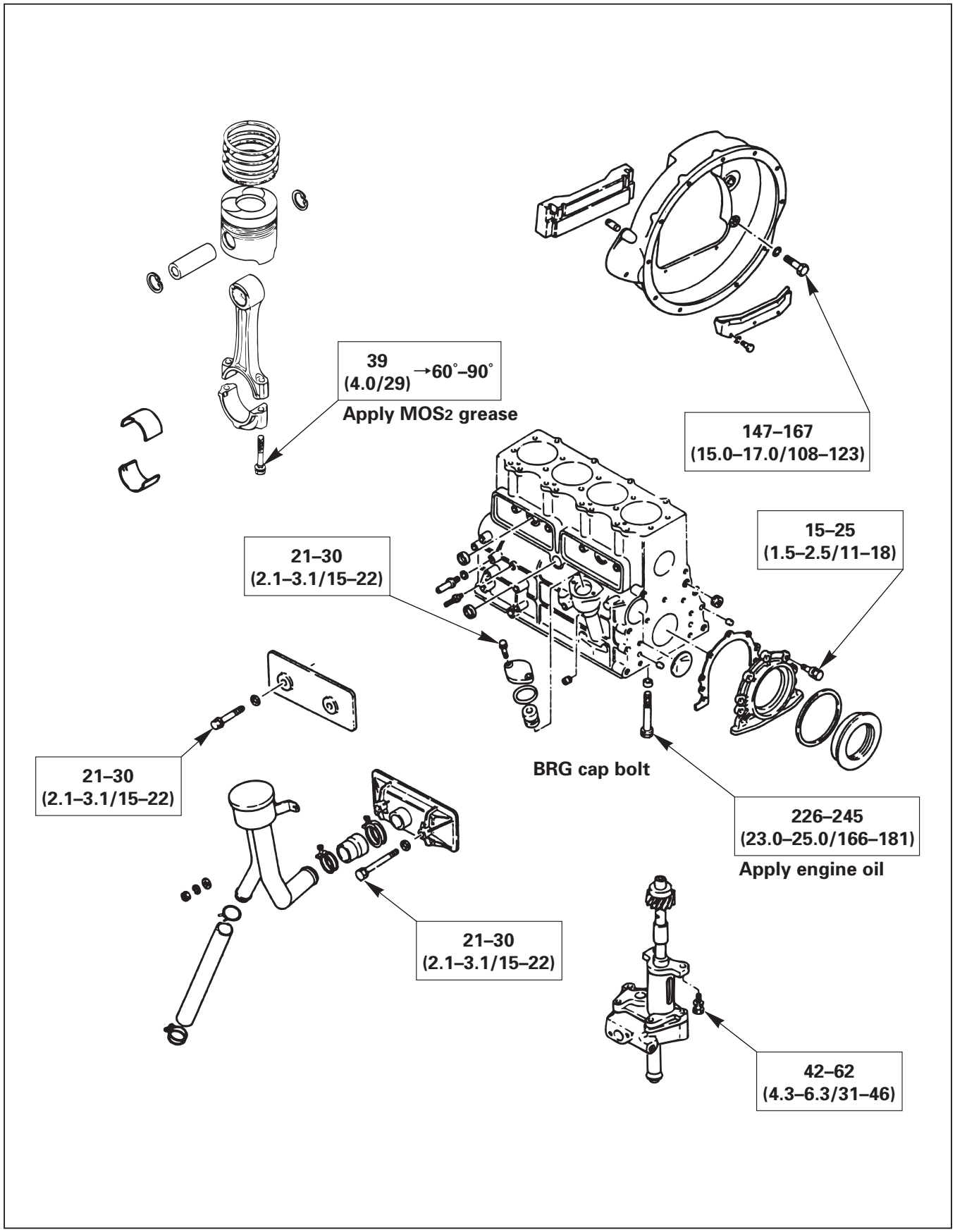
N·m (kgf·m/lb.ft)



Mos2 . . . . . Molybdenum disulfide paste.

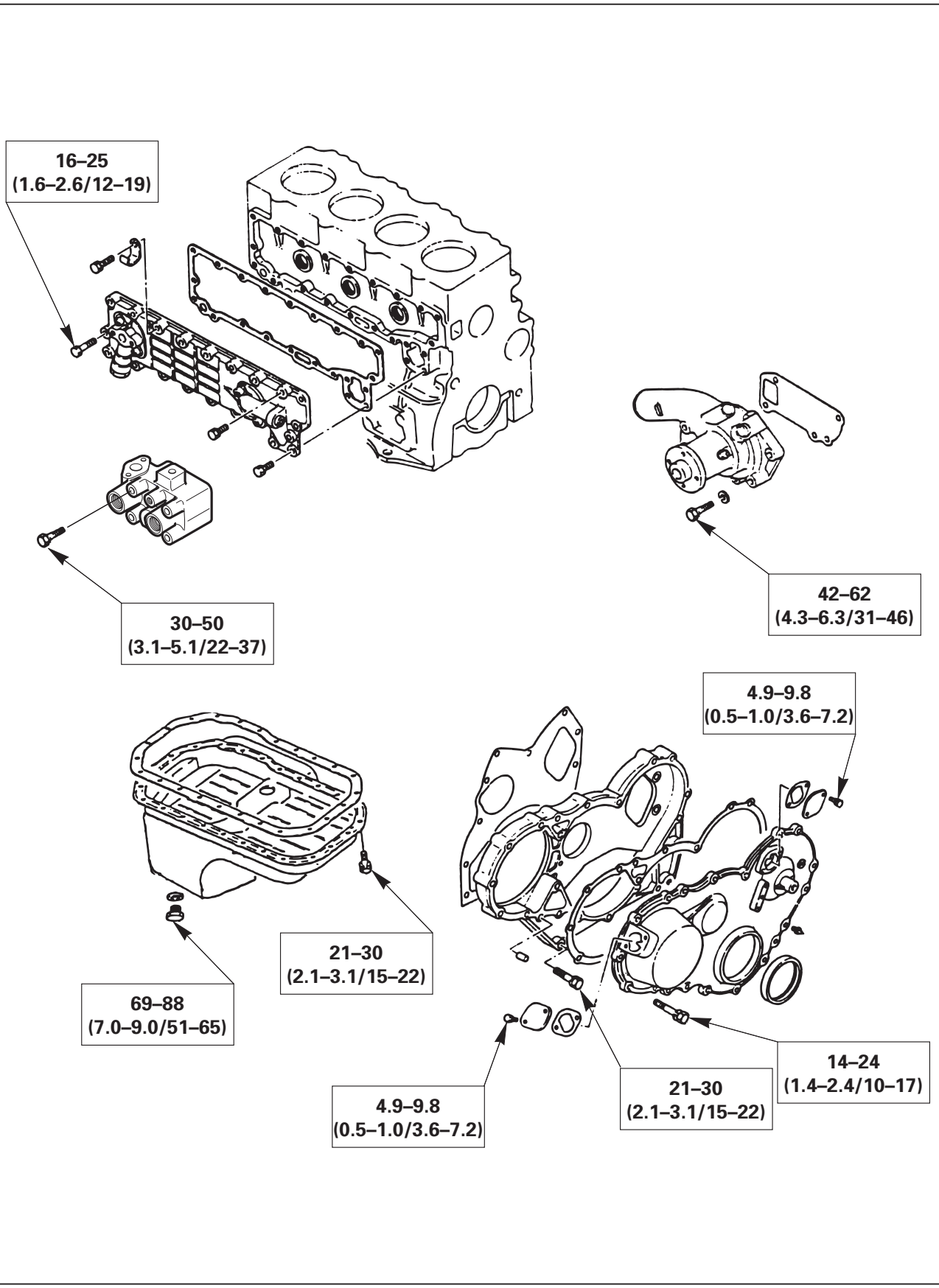
Cylinder Body, Cohn Rod, Oil Pump, Flywheel housing, Tappet Chamber Cover, Oil retainer

N·m (kgf·m/lb.ft)



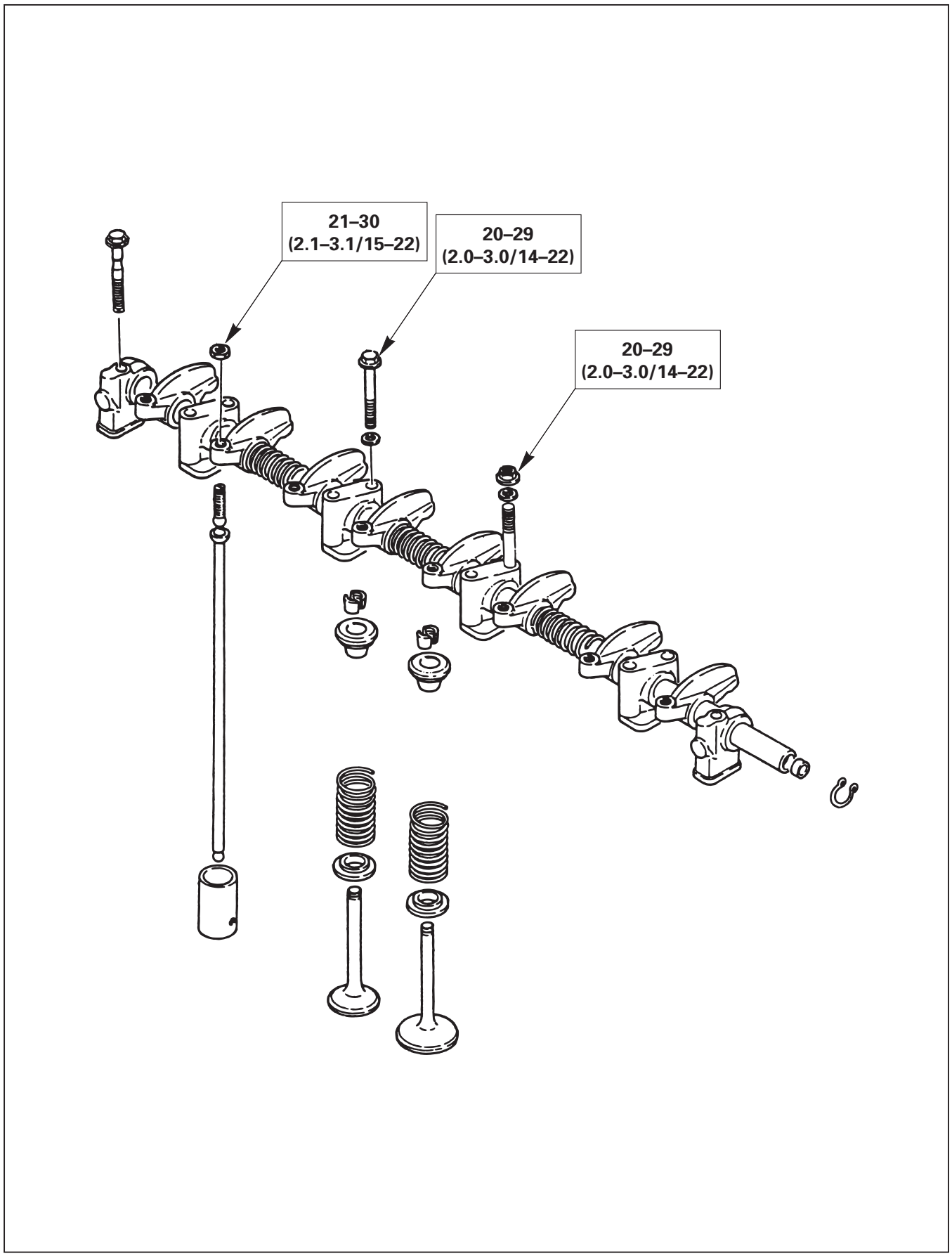
Oil Pan, Timing Gear Case and Cover, Water Pump, Oil Cooler, Oil Cover

N·m (kgf·m/lb.ft)



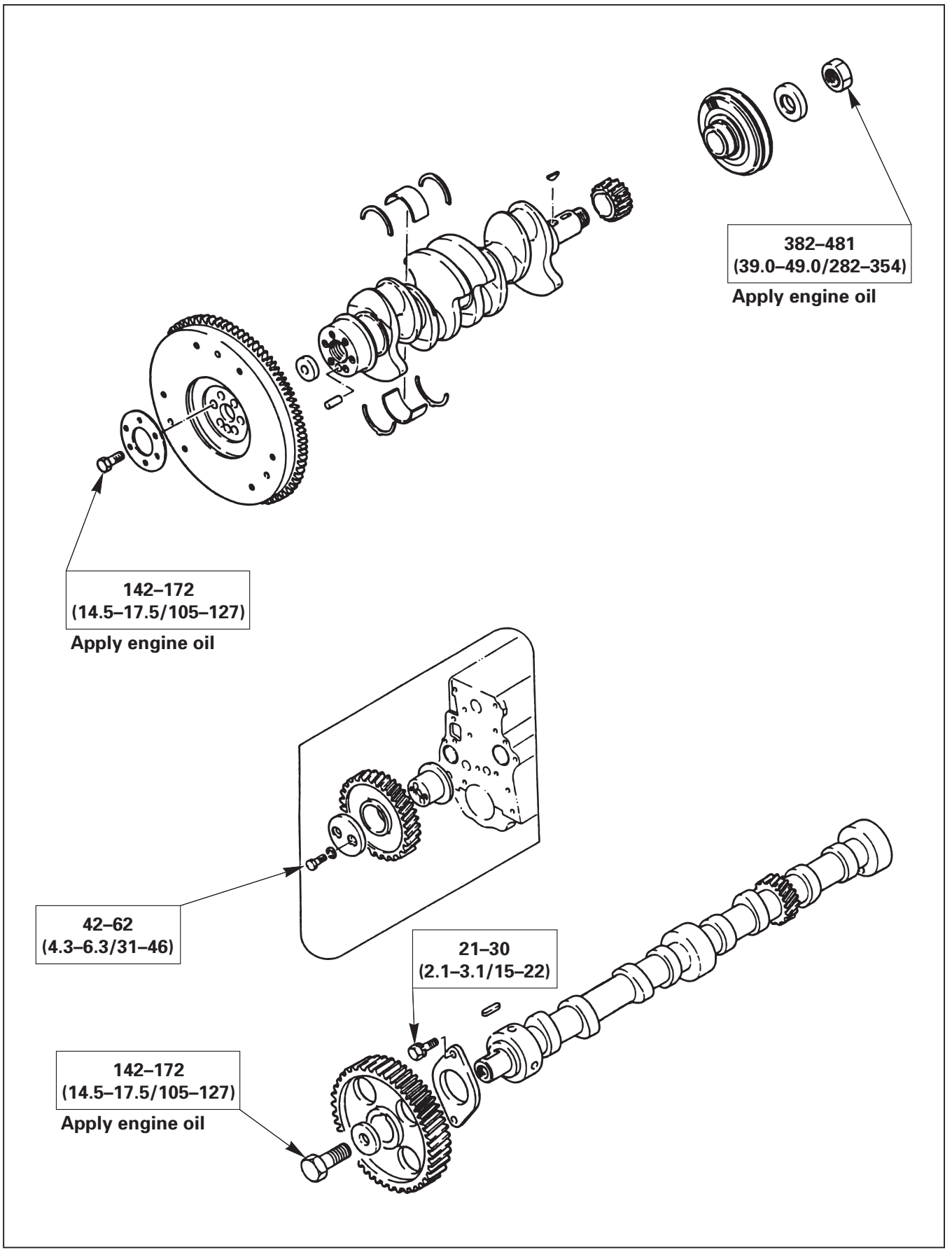
Rocker Arm

N·m (kgf·m/lb.ft)



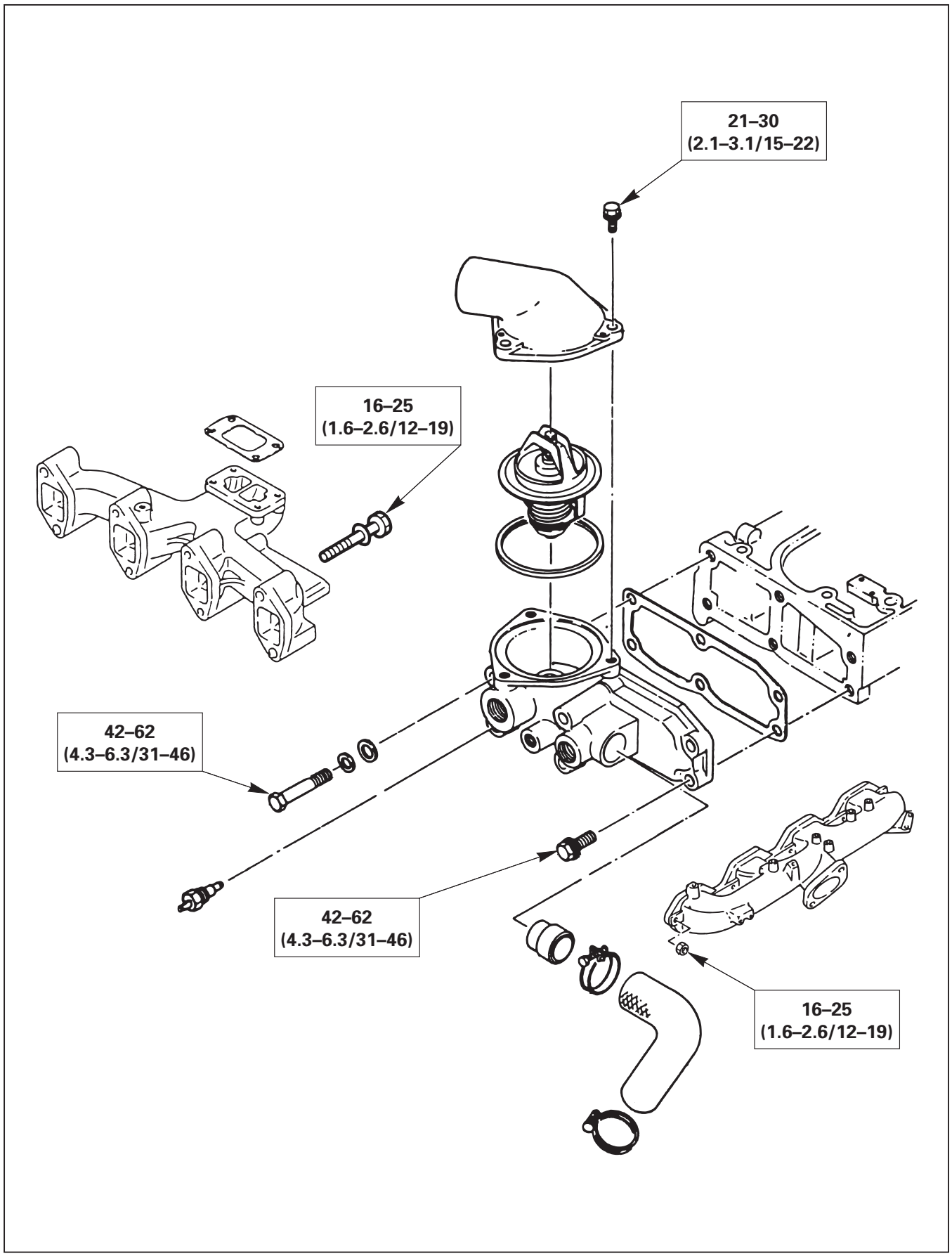
Crankshaft, Flywheel, Cam Gear, Idle Gear, Crank Pulley

N·m (kgf·m/lb.ft)



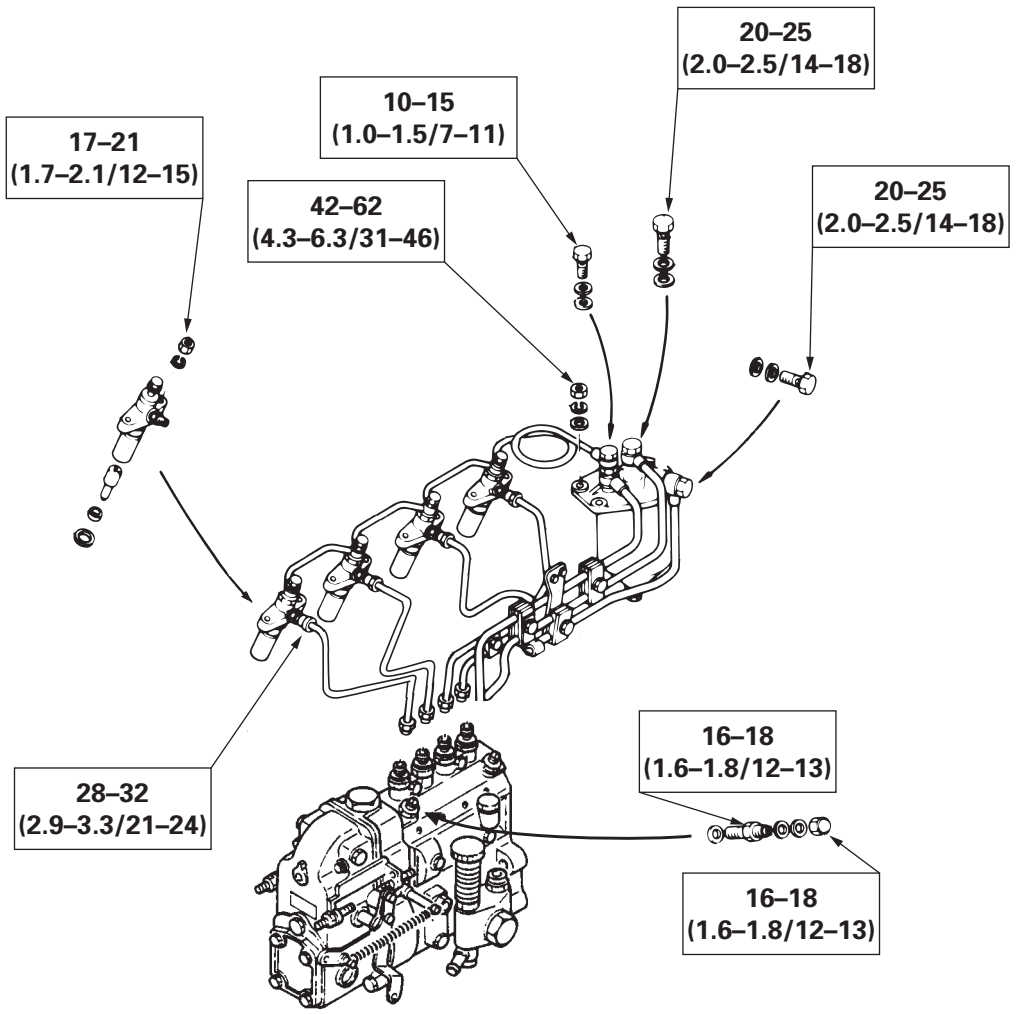
Thermostat and Thermostat Housing, Turbocharger

N·m (kgf·m/lb.ft)



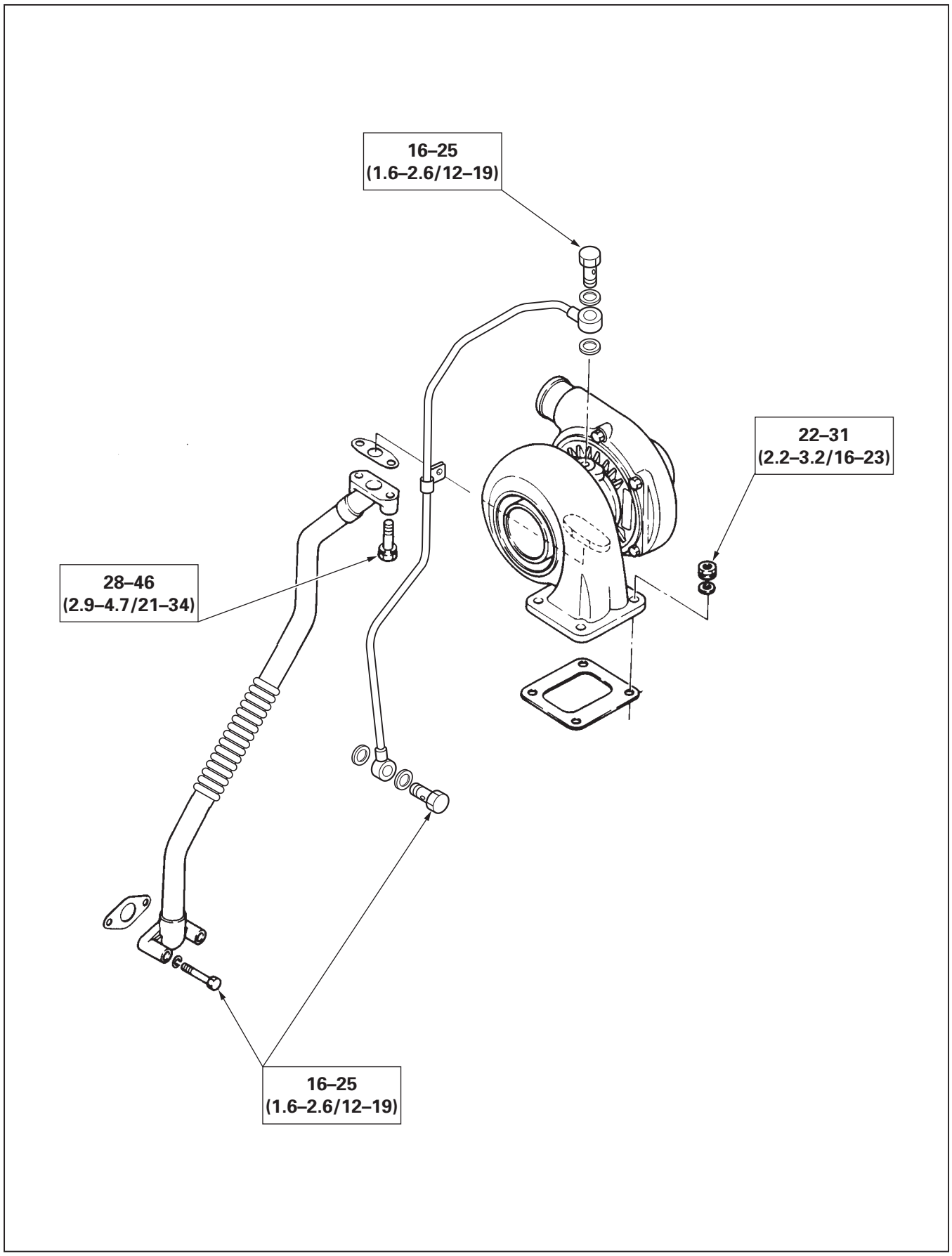
Fuel System

N·m (kgf·m/lb.ft)

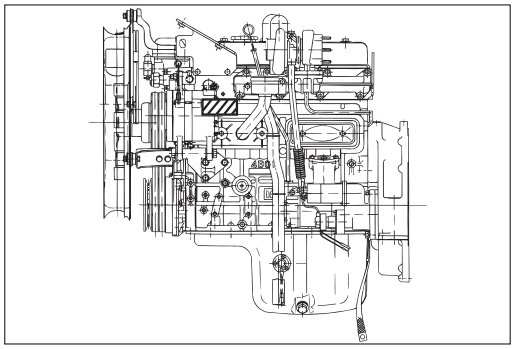


Turbocharger

N·m (kgf·m/lb.ft)



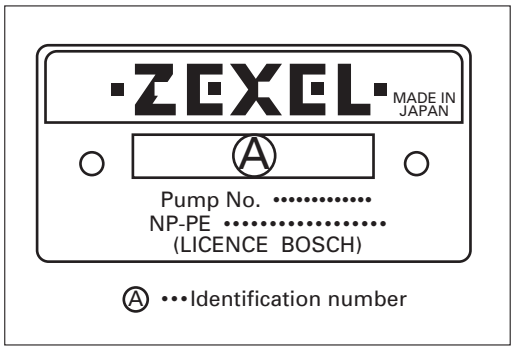
IDENTIFICATIONS



MODEL IDENTIFICATION

Engine Serial Number

The engine number is stamped on the front left hand side of the cylinder body.



INJECTION PUMP IDENTIFICATION

Injection Pump Number

Injection volume should be adjusted after referring to the adjustment data applicable to the injection pump installed.

The injection pump identification number (A) is stamped on the injection pump identification plate.

Note:

Always check the identification number before beginning a service operation.

Applicable service data will vary according to the identification number. Use of the wrong service data will result in reduced engine performance and engine damage.

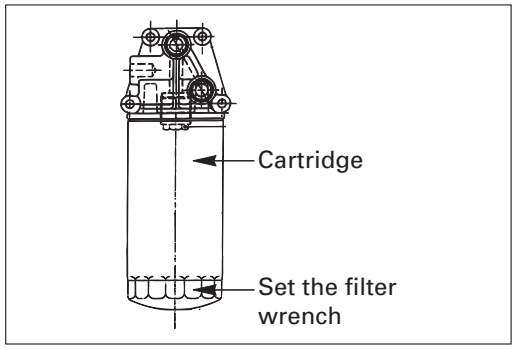
MEMO

SECTION 2

MAINTENANCE

TABLE OF CONTENTS

Note: Maintenance intervals such as fuel or oil filter changes should be referred to INSTRUCTION BOOK.



LUBRICATING SYSTEM

Oil Filter Cartridge Replacement

This Oil Filter is a Remote Control Type and Fixed on the Excavator.

Removal

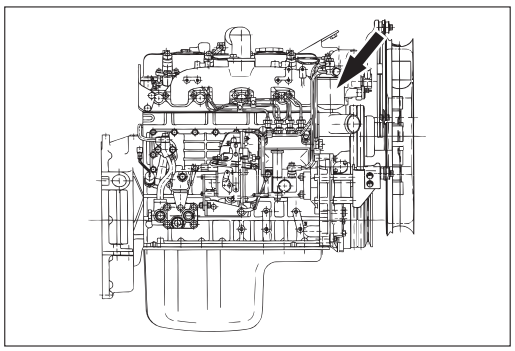
Removal and Installer: Filter Wrench

1. Loosen the used oil filter by turning it counterclockwise with the filter wrench.
2. Discard the used oil filter.

Installation

1. Wipe the oil filter mounting face with a clean rag.

   This will allow the new oil filter to seat properly.
2. Lightly oil the O-ring.
3. Turn in the new oil filter until the sealing face is fitted against the O-ring.
4. Use the filter wrench to turn in the oil filter an additional 3/4 of a turn or one turn.
5. Check the engine oil level and replenish to the specified level if required.
6. Start the engine and check for oil leakage from the oil filter.



FUEL SYSTEM

Fuel Filter Replacement

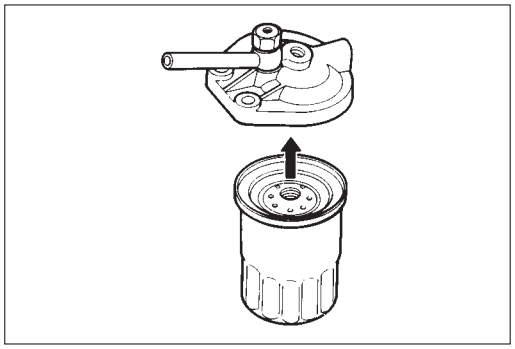
Removal

1. Loosen the fuel filter by turning it counterclockwise with the filter wrench or your hand. Discard the used filter.

   Filter Wrench

2. Wipe the fuel filter fitting face clean with a rag.

   This will allow the new fuel filter to seat properly.

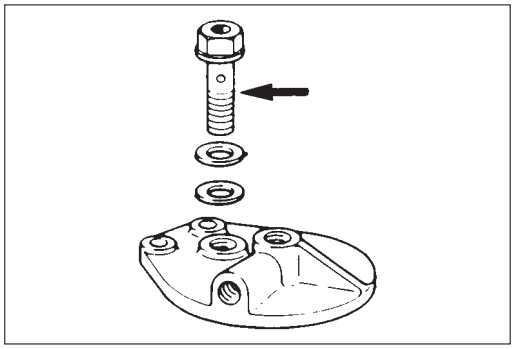


Installation

1. Apply a light coat of engine oil to the O-ring.
2. Supply fuel to the new fuel filter.

   This will facilitate air bleeding.

3. Turn in the new fuel filter until the filter O-ring is fitted against the sealing face.
4. Use the filter wrench to turn in the fuel filter an additional 2/3 of a turn.



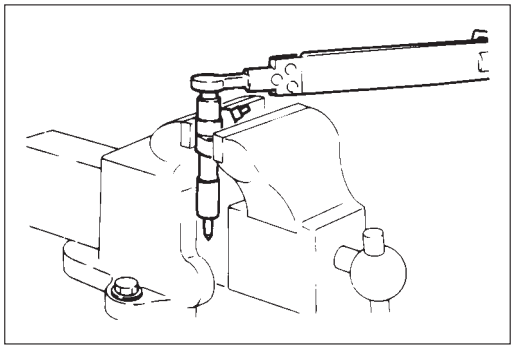
Overflow Valve

Check the overflow valve for clogging.

Check the ball side for suction leakage

kPa (kgf/cm^2/psi)

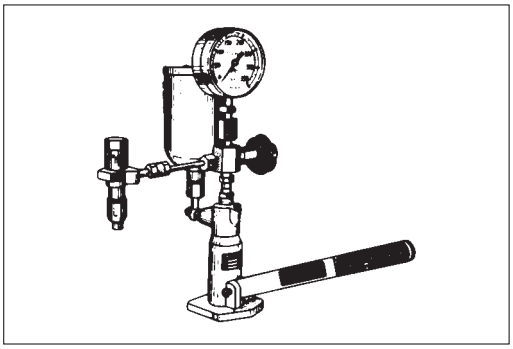
Overflow Valve Opening Pressure (Reference)	147 (1.5/21)

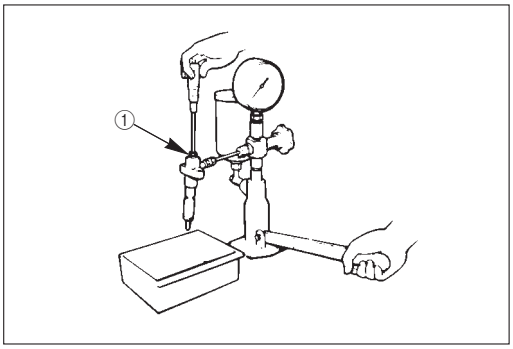


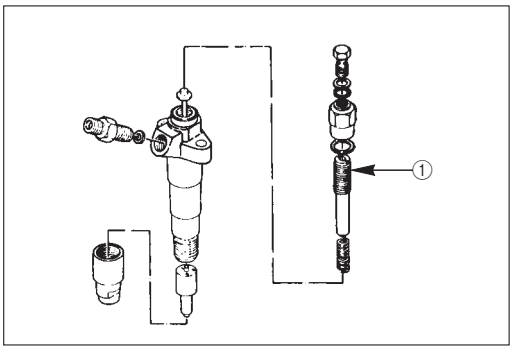
Injection Nozzle

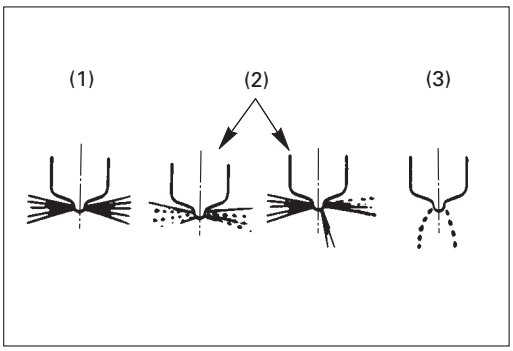
Inspection procedure

1. Clamp the injection nozzle holder in a vise.
2. Use a wrench to remove the injection nozzle holder cap.
3. Remove the injection nozzle holder from the vise.









Adjusting Procedure

Injection Starting Pressure Check

1. Attach the injection nozzle holder to the injection nozzle tester.
2. Loosen the adjusting screw ①.
3. Check the injection nozzle starting pressure and the spray condition by operating the injection nozzle tester.
4. Adjust the injection nozzle starting pressure.

   Turn the adjusting screw clockwise while operating the injection nozzle tester handle.

MPa (kgf/cm^2/psi)

Injection Starting Pressure	18.1 (185/2630)

WARNING
TEST FLUID FROM THE NOZZLE TESTER WILL SPRAY OUT UNDER GREAT PRESSURE. IT CAN EASILY PUNCTURE A PERSON'S SKIN. KEEP YOUR HANDS AWAY FROM THE NOZZLE TESTER AT ALL TIMES.

Spray Condition Check (During Injection Nozzle Tester Operation)

1. Tighten the cap nut.
2. Check the injection nozzle starting pressure.
3. Check the injection nozzle spray condition.

Operate the injection nozzle tester hand lever 4 to 6 times a second while looking for abnormal injection nozzle spray conditions.
Refer to the illustration for different spray conditions.

(1) Good

(2) Bad (Restrictions in orifice)

(3) Bad (Dripping)