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INDUSTRIAL DIESEL ENGINE

**AA-4BG1T, AA-6BG1
BB-4BG1T, BB-6BG1T
MODELS**

WORKSHOP MANUAL

ISUZU MOTORS LIMITED

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ISUZU WORKSHOP MANUAL INDUSTRIAL DIESEL ENGINE AA-4BG1T, AA-6BG1 BB-4BG1T, BB-6BG1T MODELS

FOREWORD

This Workshop Manual is designed to help you perform necessary maintenance, service, and repair procedures on applicable Isuzu industrial engines.

Information contained in this Workshop Manual is the latest available at the time of publication.

Isuzu reserves the right to make changes at any time without prior notice.

The Table of Contents at the right hand side of this page shows you the general arrangement of the material in this Workshop Manual. A more detailed Table of Contents precedes each individual section.

The black spot at the right hand side of some pages indicates the first page of a given section.

This Workshop Manual is applicable to 1999 and later models.

| TABLE OF CONTENTS | |
|--------------------------|---|
| SECTION | NAME |
| 1 | GENERAL INFORMATION |
| 2 | MAINTENANCE |
| 3 | ENGINE ASSEMBLY I (DISASSEMBLY) |
| 4 | ENGINE ASSEMBLY II (INSPECTION & REPAIR) |
| 5 | ENGINE ASSEMBLY III (REASSEMBLY) |
| 6 | LUBRICATING SYSTEM |
| 7 | COOLING SYSTEM |
| 8 | FUEL SYSTEM |
| 9 | TURBOCHARGER |
| 10 | AIR COMPRESSOR |
| 11 | ENGINE ELECTRICALS |
| 12 | TROUBLESHOOTING |
| 13 | SPECIAL TOOL LIST |
| 14 | REPAIR STANDARD |
| 15 | CONVERSION TABLE |

SECTION 1

GENERAL INFORMATION

TABLE OF CONTENTS

| ITEM | PAGE |
|--|-------------|
| General repair instructions | 1- 2 |
| Notes on the format of this manual..... | 1- 2 |
| Main data and specifications | 1- 6 |
| External view | 1- 9 |
| Tightening torque specifications | 1-15 |
| Angular nut and bolt tightening method..... | 1-17 |
| Major parts fixing nuts and bolts | 1-19 |
| Identifications | 1-30 |

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 dismantling 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 4BG1, 4BG1T, 6BG1, and 6BG1T 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 AA-6BG1 and BB-6BG1T engines.

The AA-4BG1T engine and the BB-4BG1T engine are 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 "A" and shaft
- ▲ 16. Idler gear "B"
- ▲ 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.

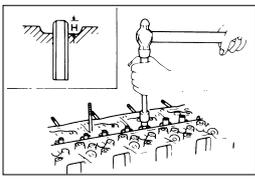
The "* Repair Kit" indicates that a repair kit is available.

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.

1-4 GENERAL INFORMATION

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



Valve Guide Installation

- Lubricate the valve guide outer face with engine oil.
- Attach the installer to the valve guide.
- Use a hammer to drive the valve guide into position from the cylinder head upper face.
- Measure the height of the valve guide upper end from the upper face of the cylinder head.

Valve Guide Installer: 1-85220-001-0

| | 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.

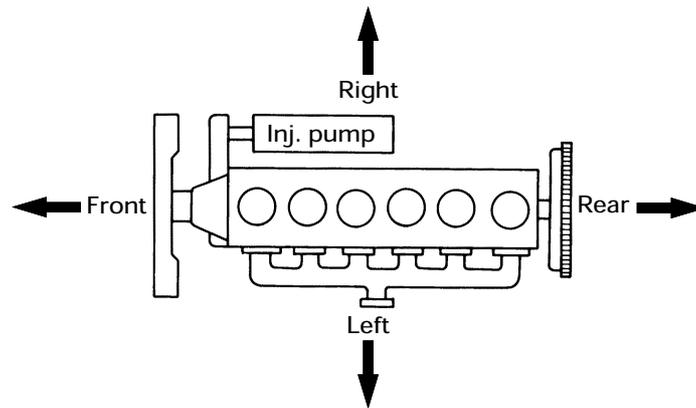
Rear

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 or No. 6.

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



MAIN DATA AND SPECIFICATIONS

| Item | Engine Model | AA-4BG1T | BB-4BG1T |
|----------------------------------|-------------------------------|---|------------|
| 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 | | 18.0 to 1 | |
| * Engine dimensions | mm (in) | 904 × 684.8 × 907 | |
| Length × width × height | | (35.6 × 27.0 × 35.7) | |
| * Engine weight (Dry) | kg (lb) | 361 (796) | 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 | MPa kgf/cm ² (psi) | 3.0 (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) | |
| * Lubricating oil volume | L (US gal) | 13.2 (3.5) | 13.0 (3.4) |
| 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 | |
| * Generator | V-A | 24-40 | |
| * Starter | V-KW | 24-4.5 | |
| * Turbocharger manufacturer | | MITSUBISHI | MITSUBISHI |
| * Turbocharger model | | TD04H | TD04H |

- Note:**
1. These specifications are based on the standard engine.
 2. Specifications for items marked with an asterisk (*) will vary according to the type of equipment on which the engine is installed.
- If you are unable to locate the data applicable to these specifications, please contact Isuzu Motors LTD through your machine supplier.

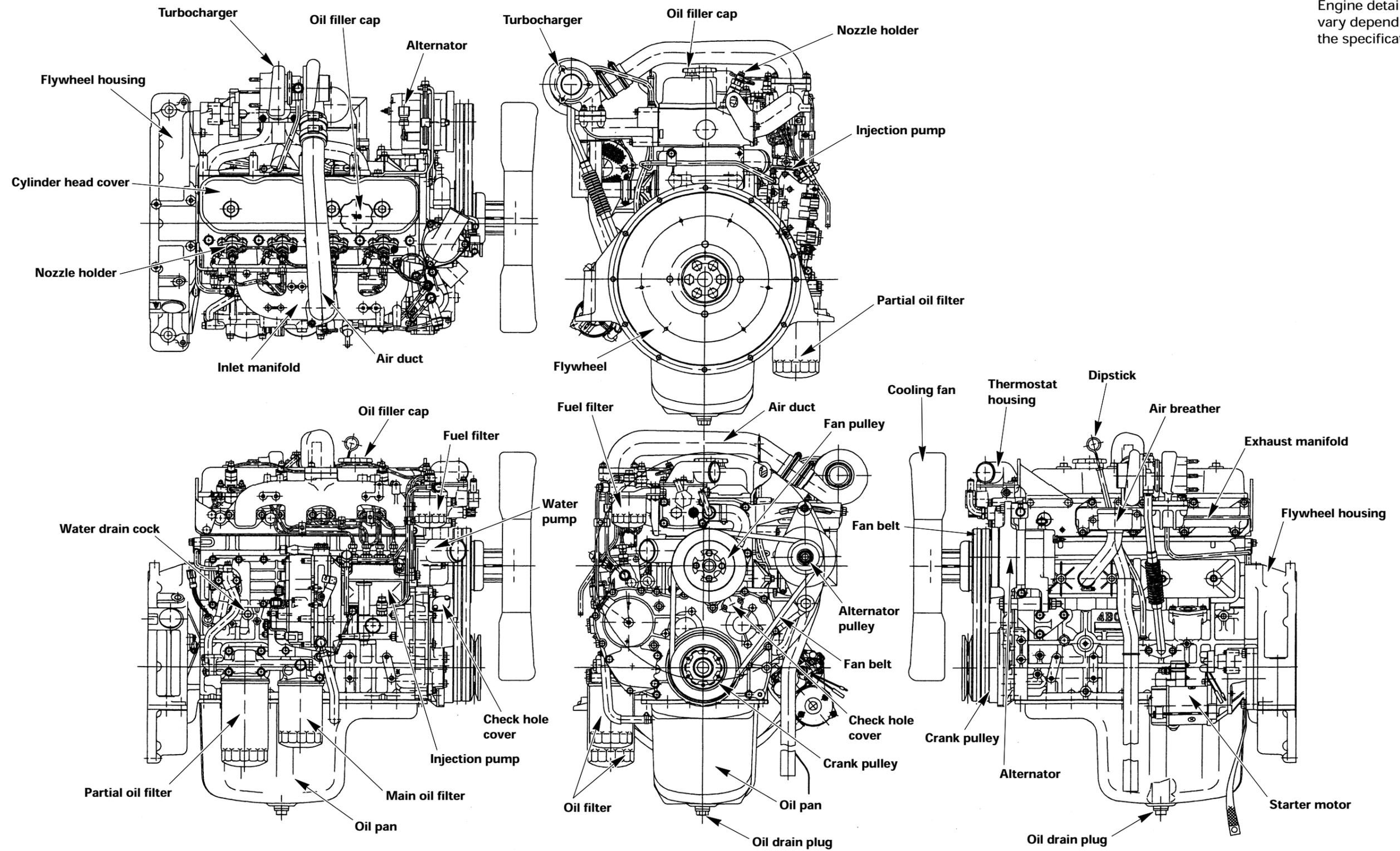
MAIN DATA AND SPECIFICATIONS

| Engine Model | | AA-6BG1 | BB-6BG1T |
|----------------------------------|--------------------------------|---|----------------------|
| Item | | | |
| 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) | 6 - 105.0 × 125.0 (4.13 × 4.92) | |
| Total piston displacement | L (cid) | 6.494 (396) | |
| Compression ratio | | 18.0 to 1 | |
| * Engine dimensions | mm (in) | 1143 × 672 × 797 | 1204 × 762 × 961 |
| Length × width × height | | (45.0 × 26.5 × 31.4) | (47.4 × 30.0 × 37.8) |
| * Engine weight (Dry) | kg (lb) | 458 (1009) | 484 (1067) |
| Fuel injection order | | 1-5-3-6-2-4 | |
| Specified fuel | | Diesel fuel (ASTM D975 No. 2D) | |
| Injection pump | | In-line plunger, Bosch AD 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) | Sedimenter/water level indicating type | |
| Compression pressure | MPa (kgf/cm ² /psi) | 3.0 (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 | | Cartridge (spin-on) | |
| * Lubricating oil volume | L (US gal) | 13.0 (3.4) | 21.5 (5.68) |
| Oil cooler | | Water cooled integral type | |
| Cooling method | | Pressurized forced circulation | |
| Coolant volume (engine only) | L (US gal) | 12 (3.2) | |
| Water pump | | Belt driven impeller type | |
| Thermostat type | | Wax pellet type | |
| * Generator | V-A | 24-25 | 24-40 |
| * Starter | V-KW | 24-4.5 | |
| * Turbocharger manufacturer | | - | IHI |
| * Turbocharger model | | - | RHG6 |

- Note:** 1. These specifications are based on the standard engine.
 2. Specifications for items marked with an asterisk (*) will vary according to the type of equipment on which the engine is installed.
 If you are unable to locate the data applicable to these specifications, please contact Isuzu Motors LTD through your machine supplier.

EXTERNAL VIEW

MODEL AA-4BG1T, BB-4BG1T

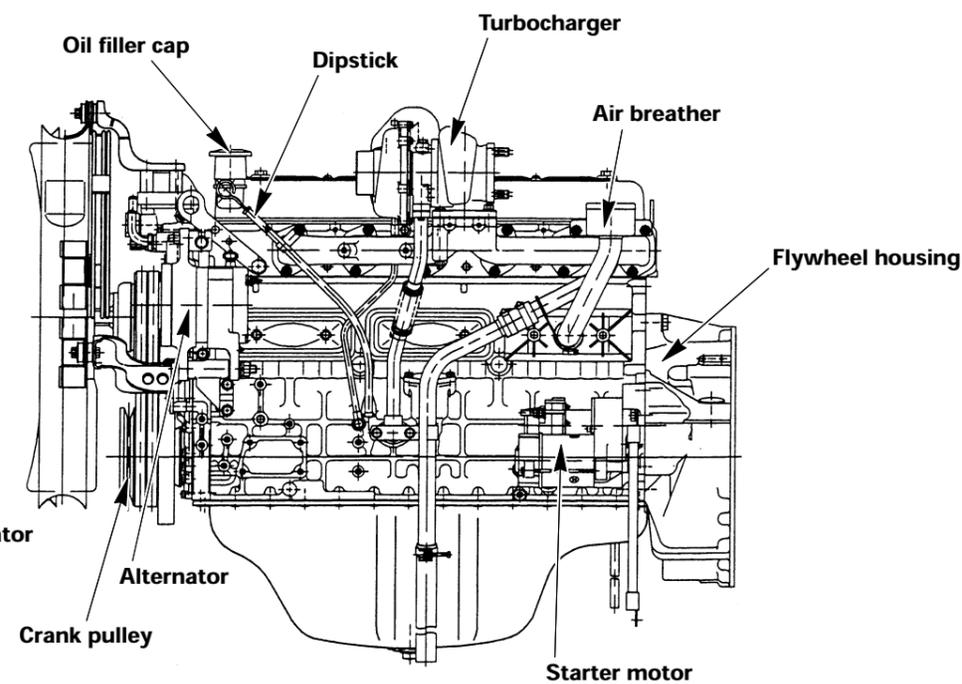
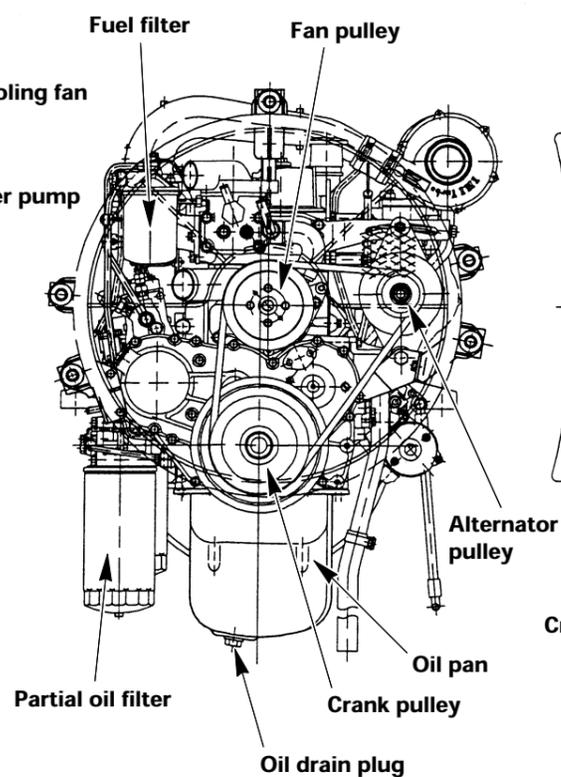
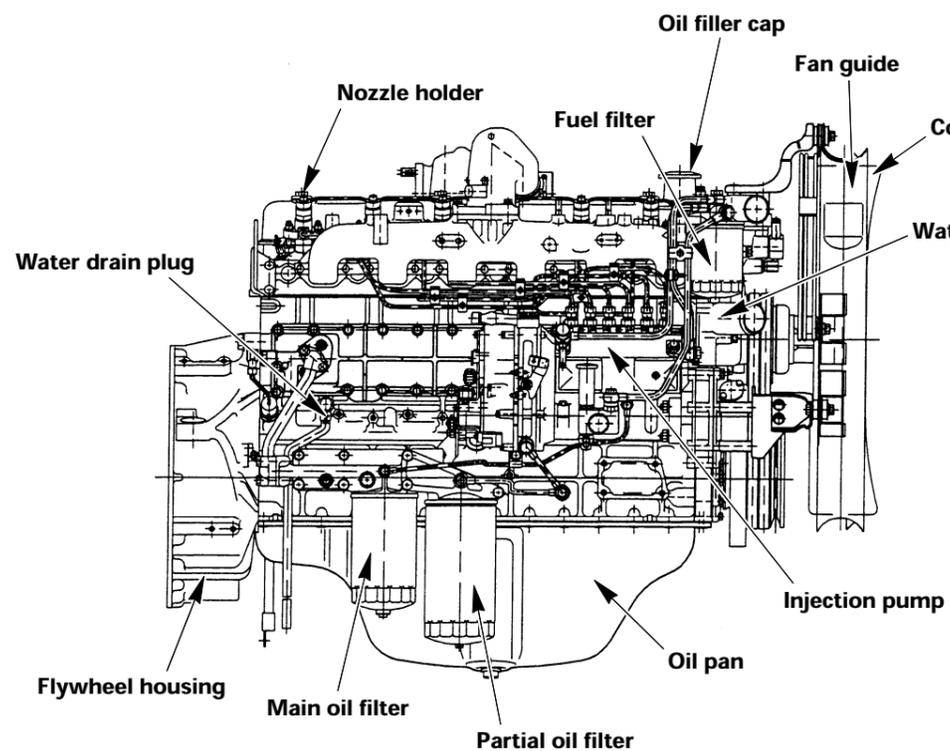
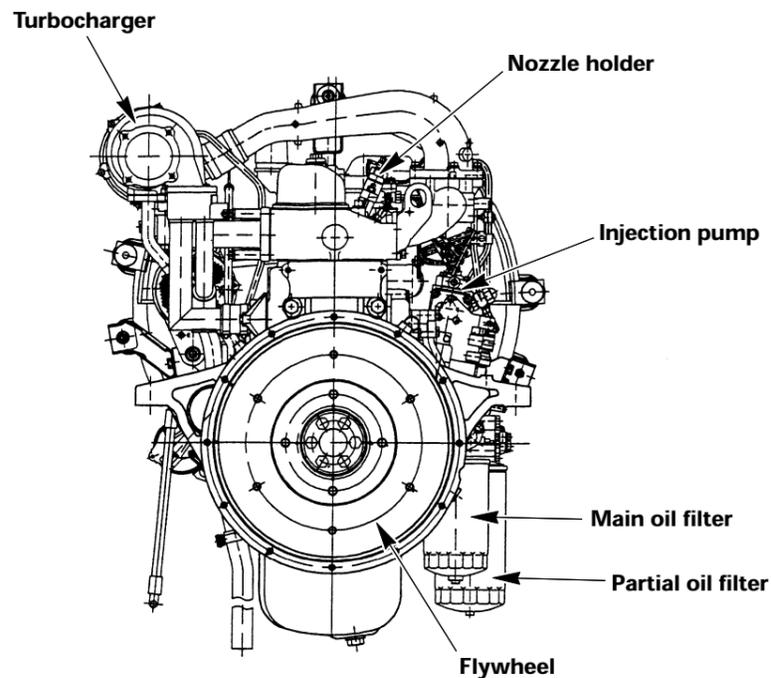
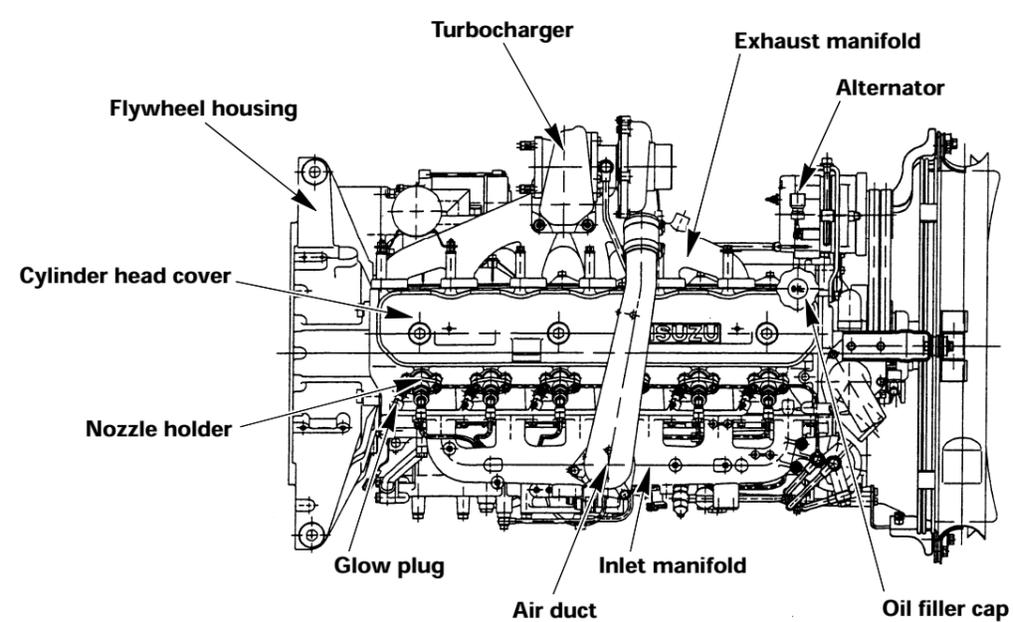


Note:
Engine details may vary depending on the specifications.

EXTERNAL VIEW

MODEL BB-6BG1T

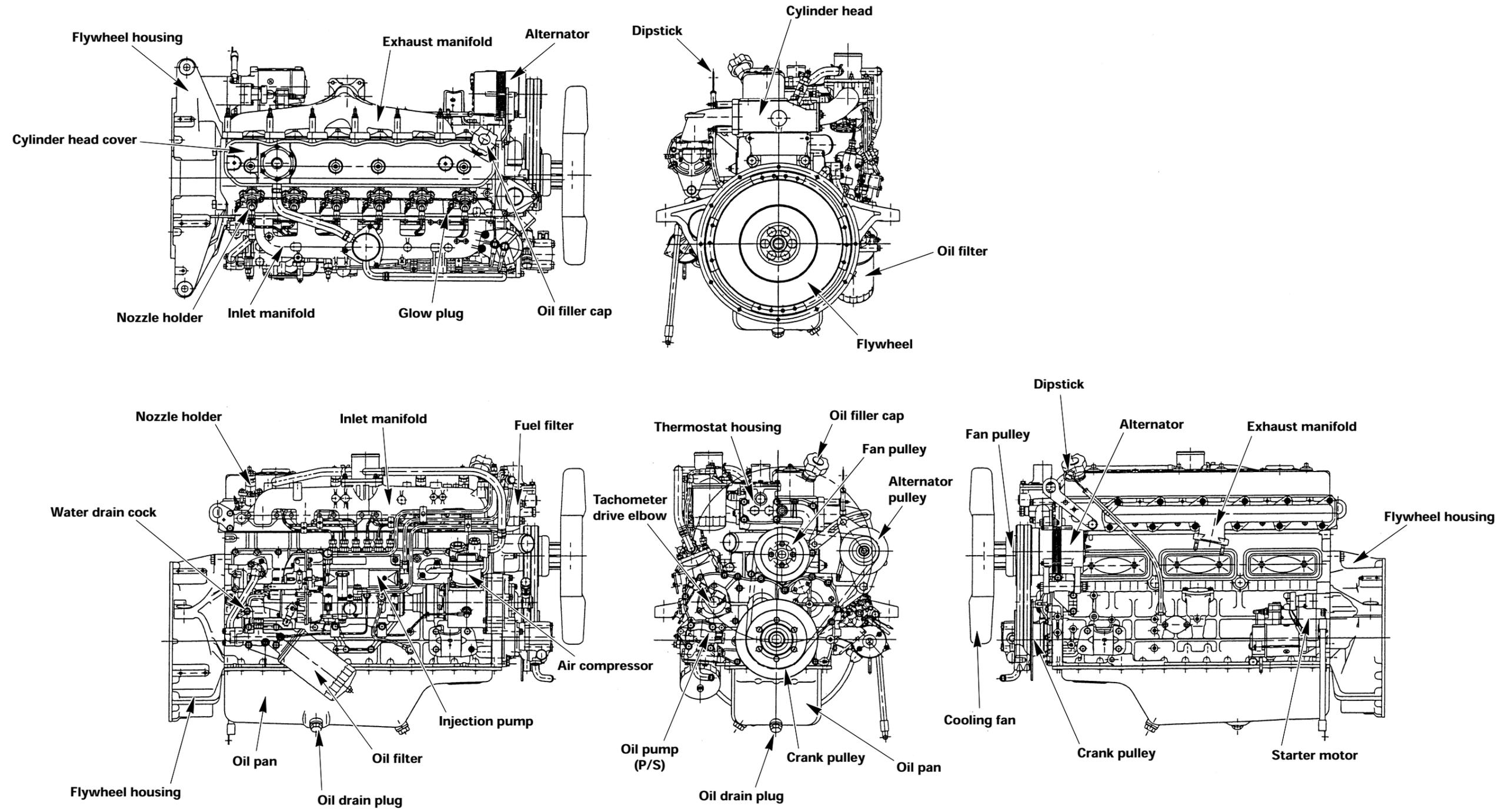
Note:
Engine details may vary depending on the specifications.



EXTERNAL VIEW

MODEL AA-6BG1

Note:
Engine details may vary depending on the specifications.



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)

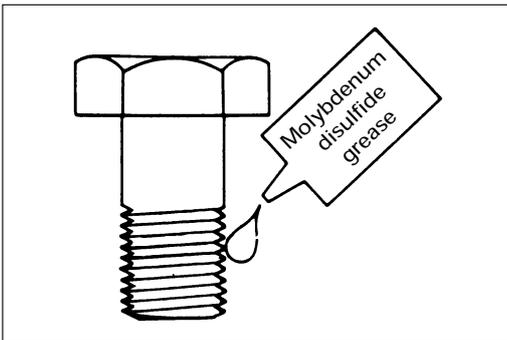
| Bolt Identification Bolt Diameter × pitch (mm) |  |  |  |
|---|---|---|---|
| M 6 × 1.0 | 4.6–8.5 (0.5–0.9/3.6–6.5) | 6.6–12.2 (0.6–1.2/4.3–8.7) | ————— |
| M 8 × 1.25 | 10.5–196 (1.1–2.0/8.0–14.5) | 15.3–28.4 (1.6–2.9/11.6–21.0) | 18.1–33.6 (2.1–3.4/15.2–25.0) |
| M10 × 1.25 | 23.1–38.5 (2.4–3.9/17.4–28.2) | 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 (17.4–26.2/126.0–190) | 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.

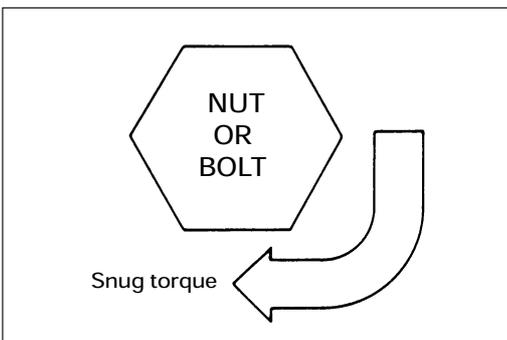
ANGULAR NUT AND BOLT TIGHTENING METHOD



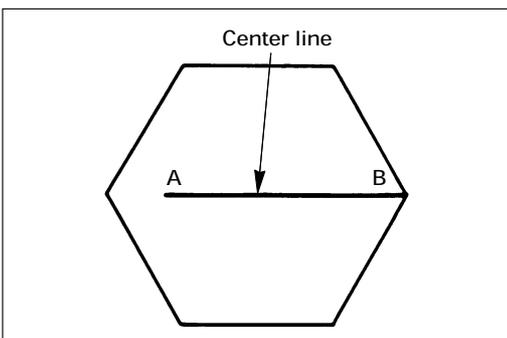
1. Carefully wash the nuts and bolts to remove all oil and grease.



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

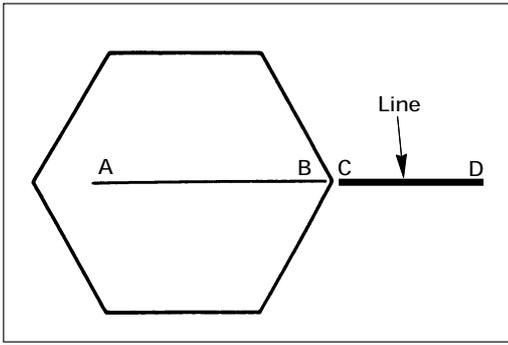


3. Tighten the nuts and bolts to the specified torque (snug torque) with a torque wrench.

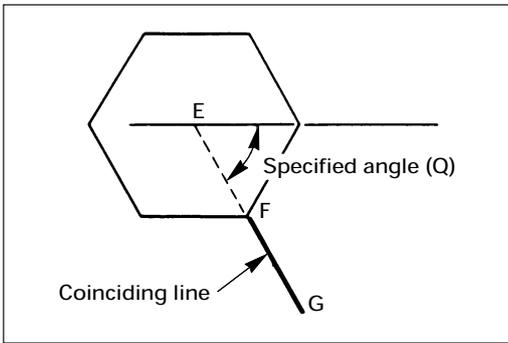


4. Draw a line [A-B] across the center of each bolt.

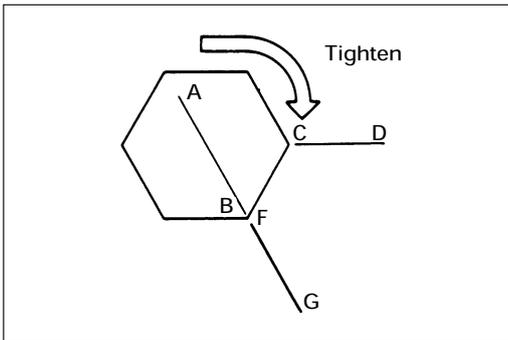
1-18 GENERAL INFORMATION



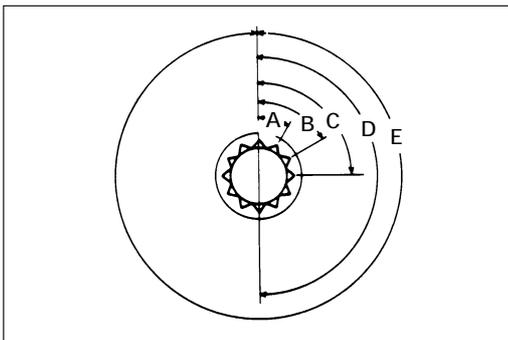
5. Draw another line (C-D) on the face of each of the parts to be clamped. This line should be an extension of the line [A-B].



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

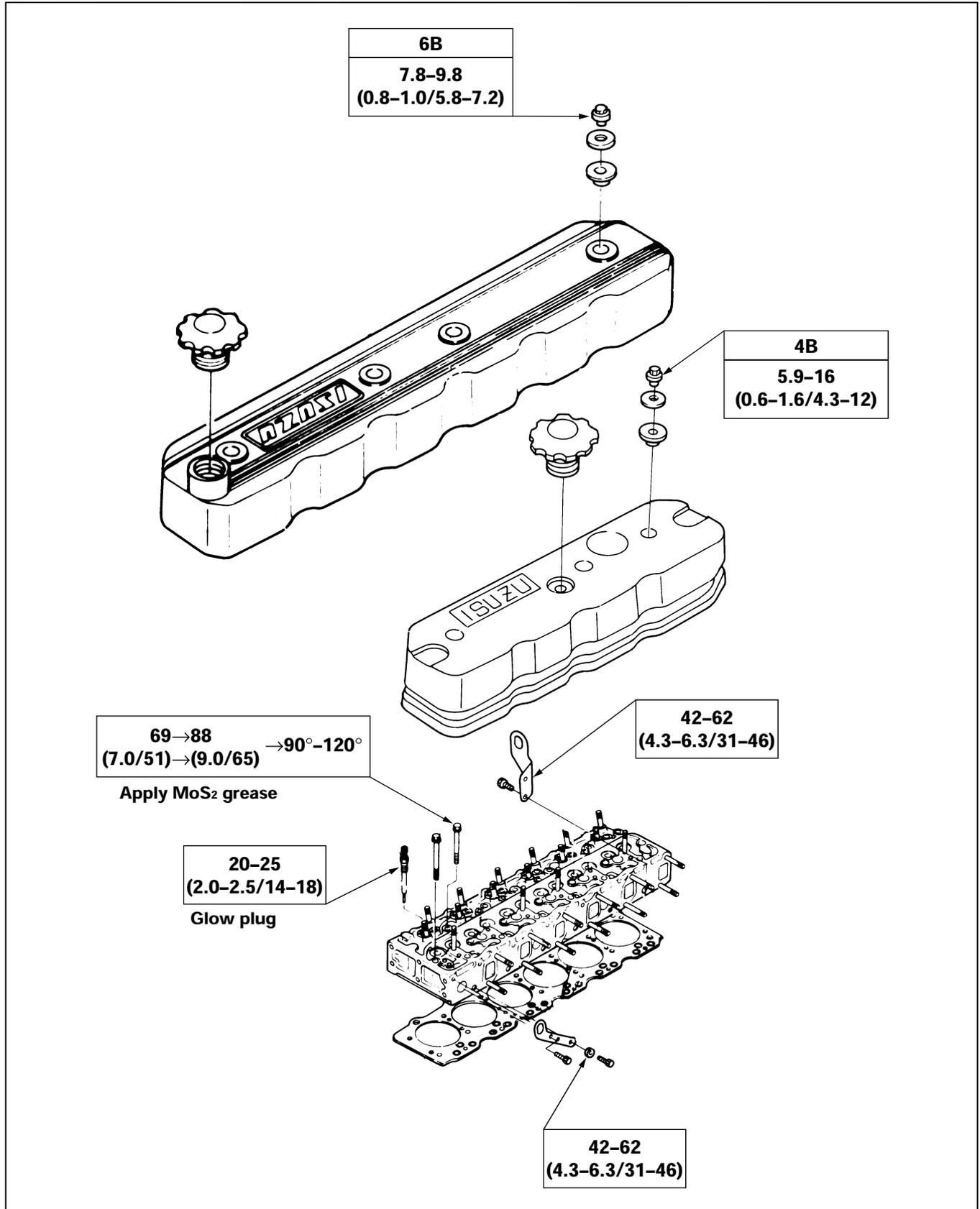
| | | |
|---|------|----------------|
| A | 30° | 1/12 of a turn |
| B | 60° | 1/6 of a turn |
| C | 90° | 1/4 of a turn |
| D | 180° | 1/2 of a turn |
| E | 360° | One full turn |



MAJOR PART FIXING NUTS AND BOLTS

Cylinder Head and Cover

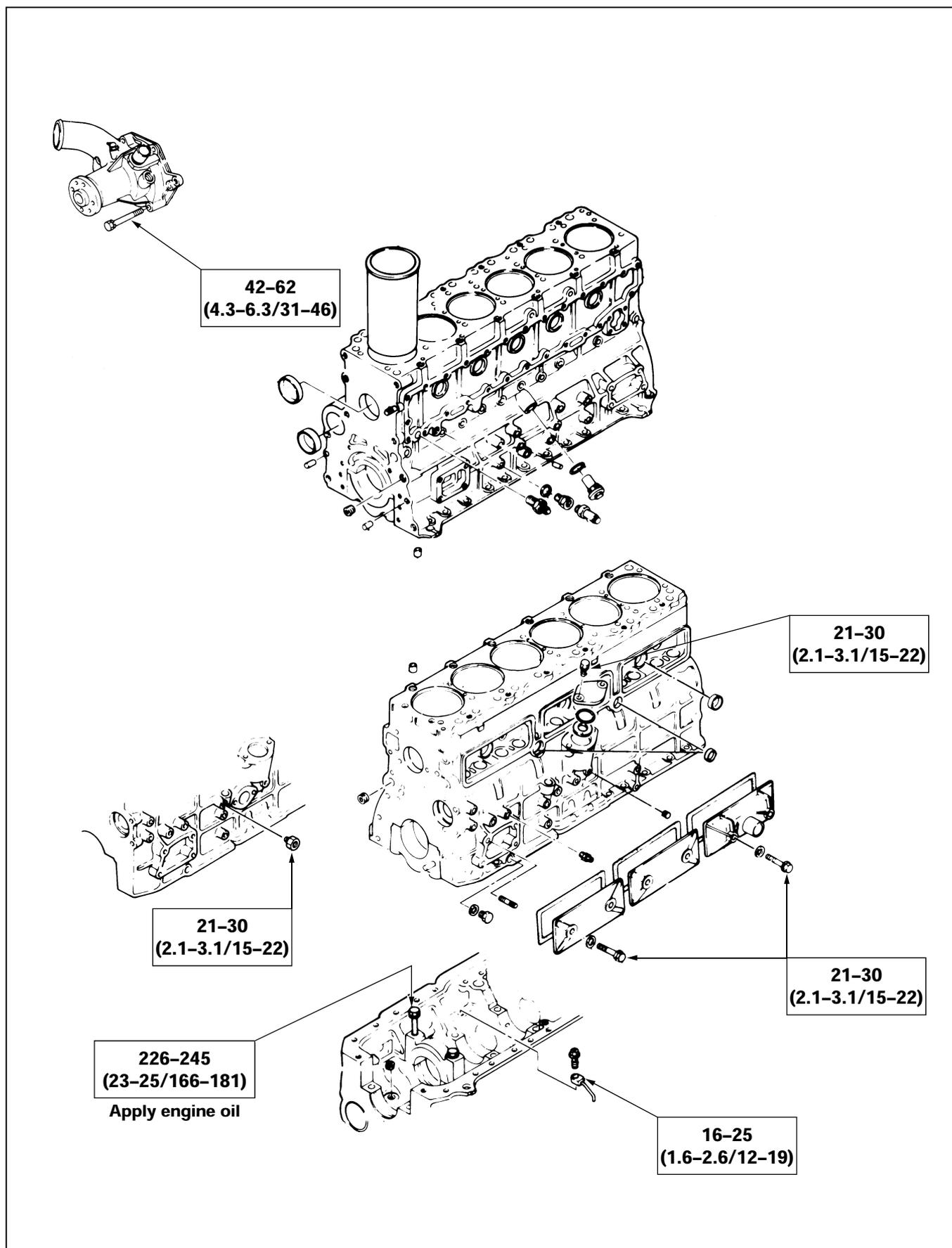
N·m (kgf·m/lb.ft)



Mos2 Molybdenum disulfide paste.

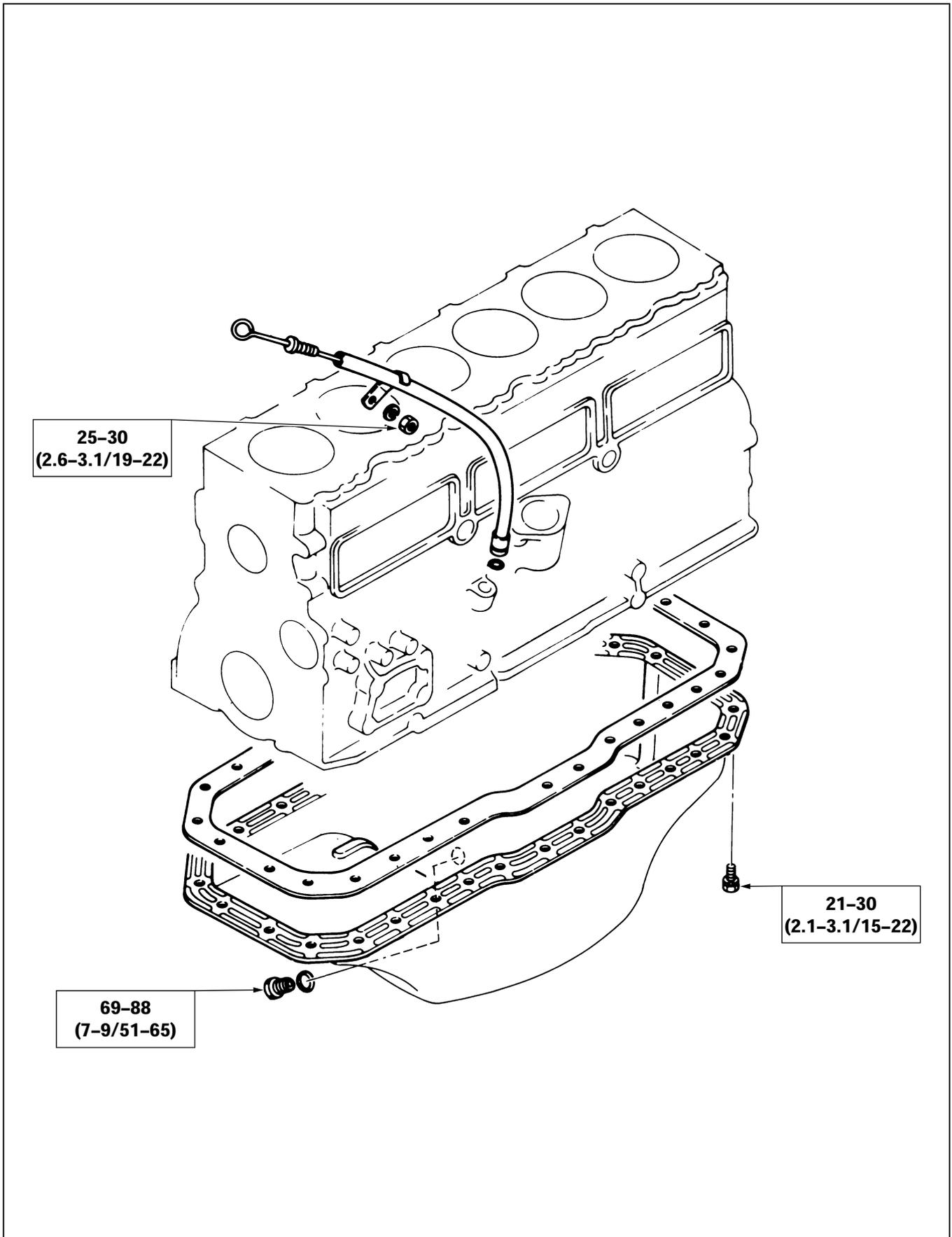
Cylinder Body

N·m (kgf·m/lb.ft)



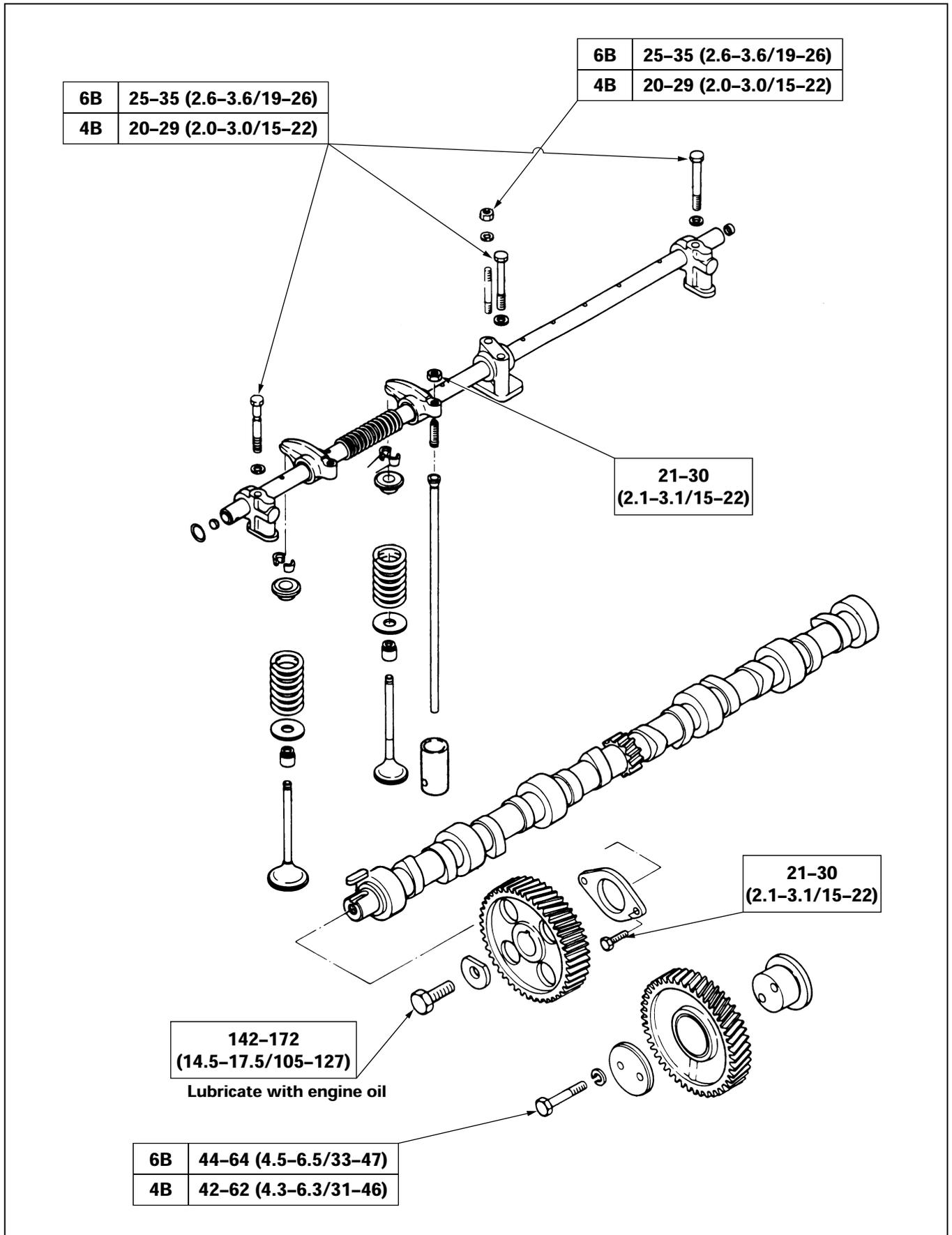
Oil Pan and Dipstick

N·m (kgf·m/lb.ft)



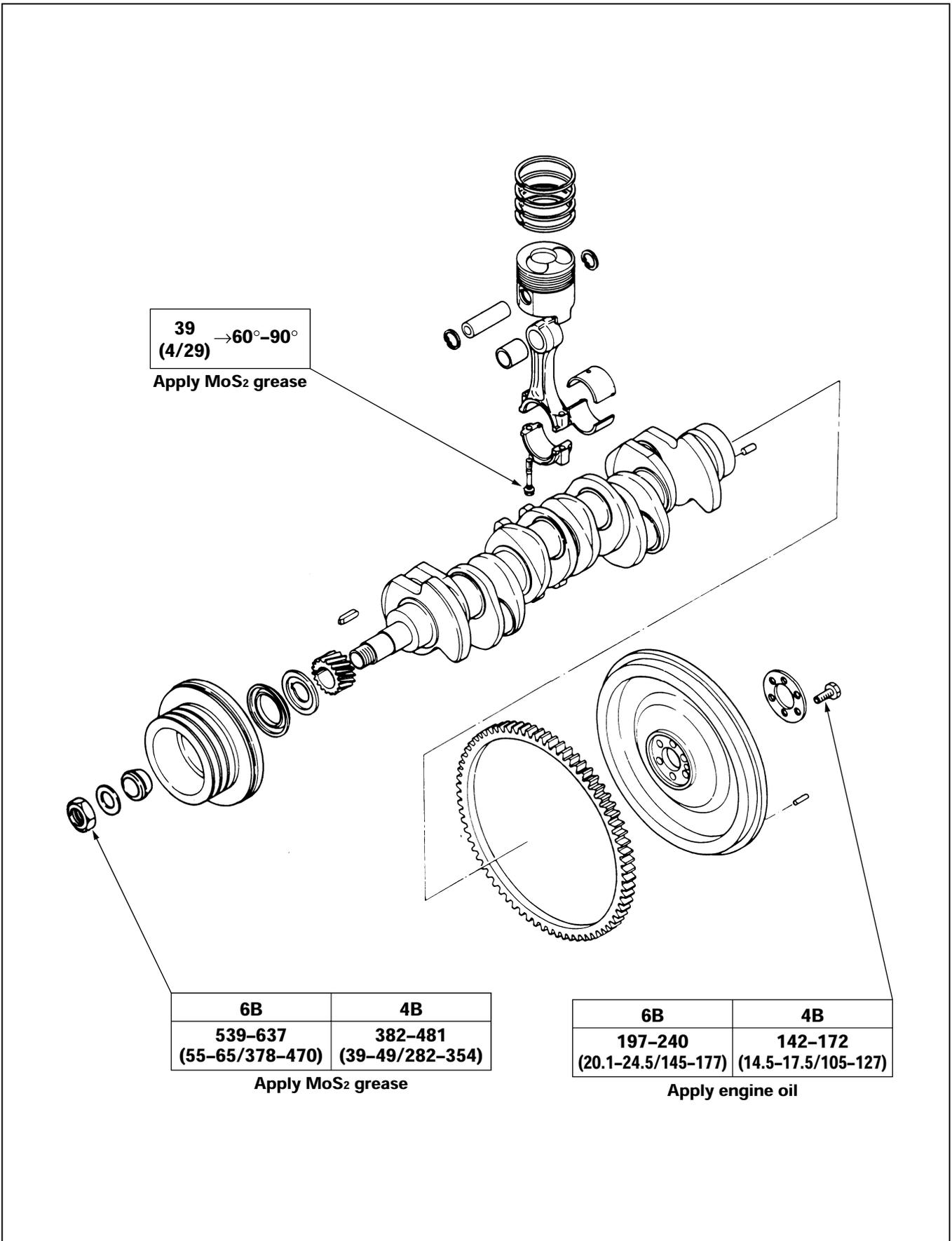
Camshaft and Rocker Arm

N·m (kgf·m/lb.ft)



Crankshaft, Piston, and Flywheel

N·m (kgf·m/lb.ft)



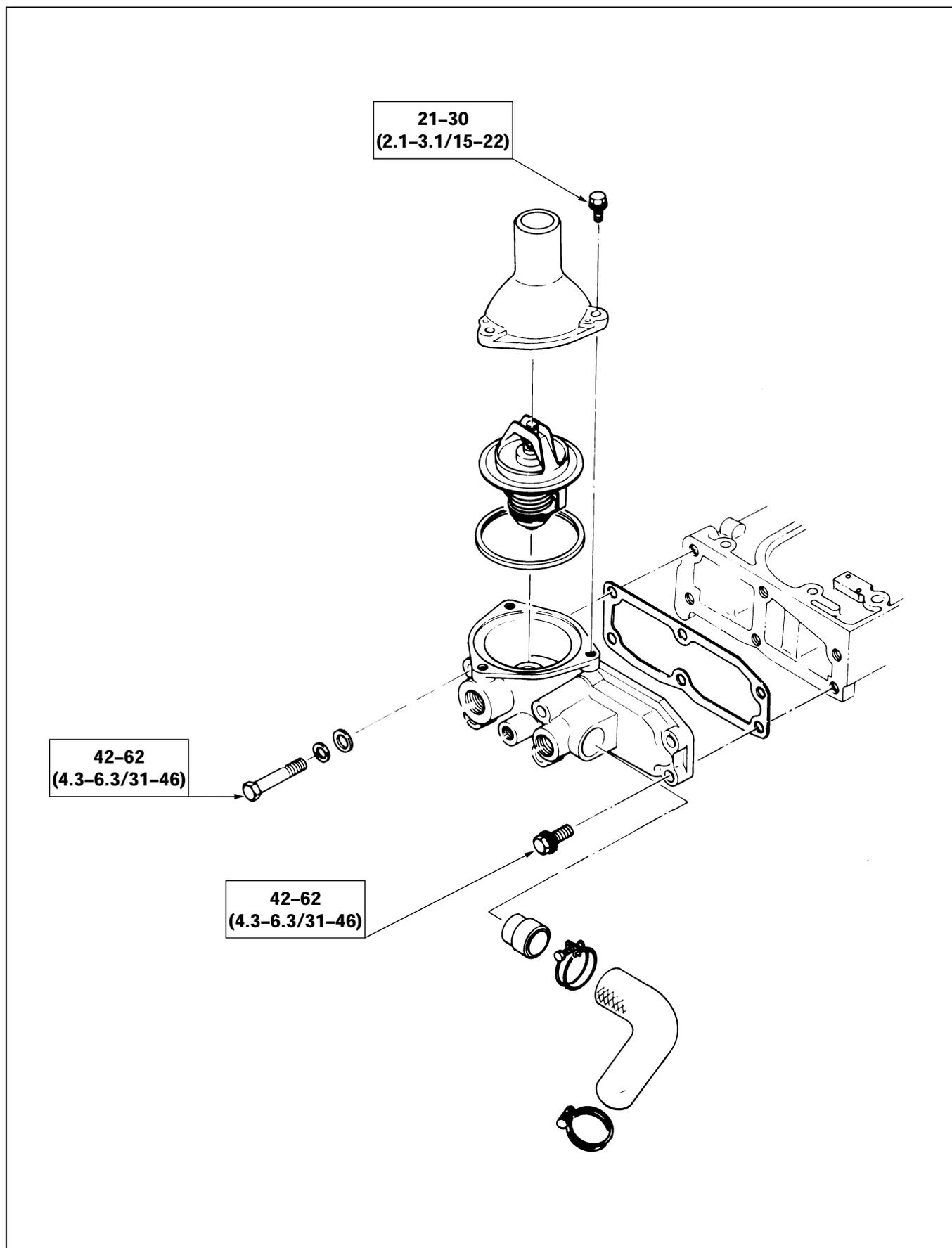
39
(4/29) →60°-90°
Apply MoS₂ grease

| 6B | 4B |
|-------------------------------|-----------------|
| 539-637 | 382-481 |
| (55-65/378-470) | (39-49/282-354) |
| Apply MoS ₂ grease | |

| 6B | 4B |
|---------------------|---------------------|
| 197-240 | 142-172 |
| (20.1-24.5/145-177) | (14.5-17.5/105-127) |
| Apply engine oil | |

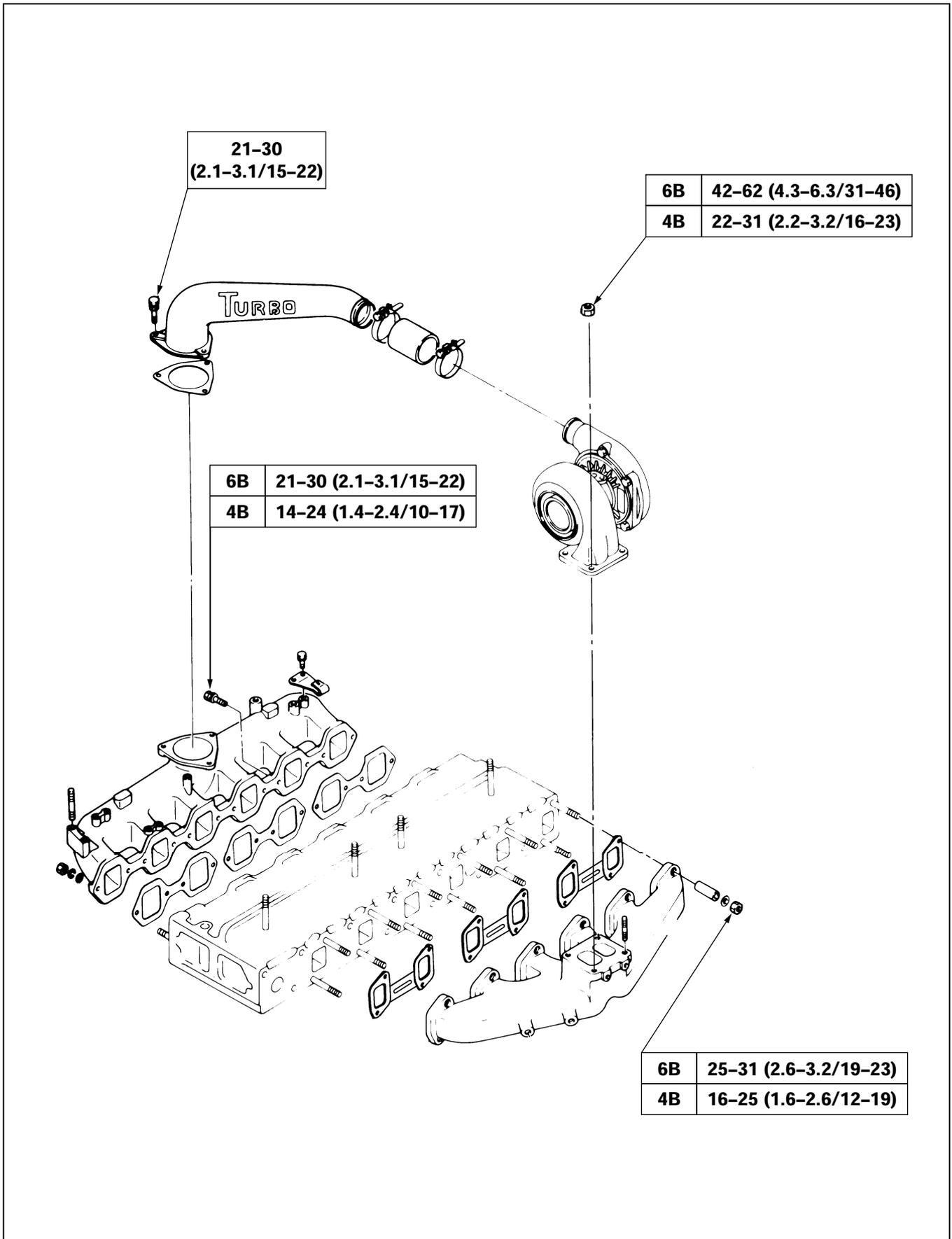
Thermostat and Thermostat Housing

N·m (kgf·m/lb.ft)



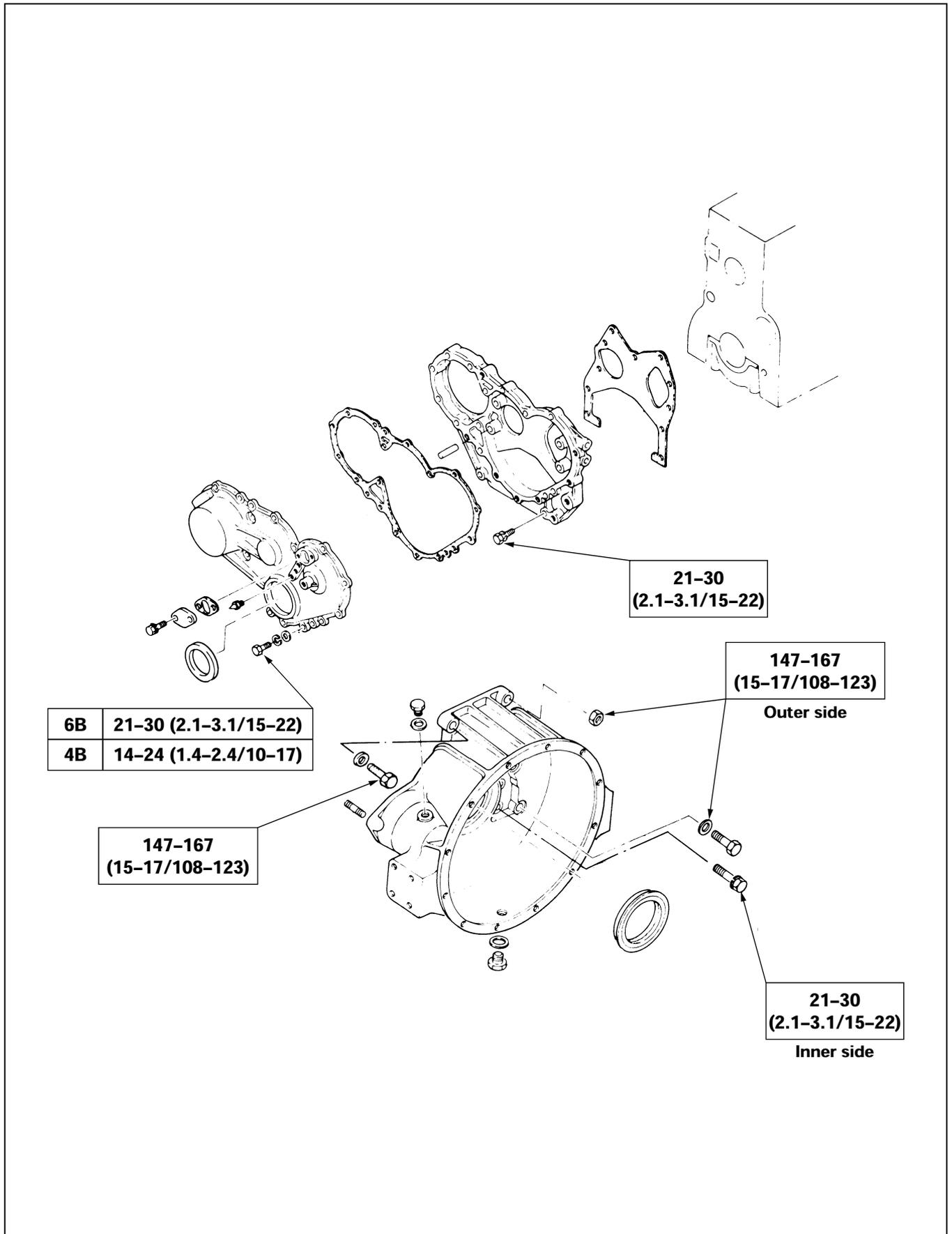
Intake and Exhaust Manifold

N·m (kgf·m/lb.ft)



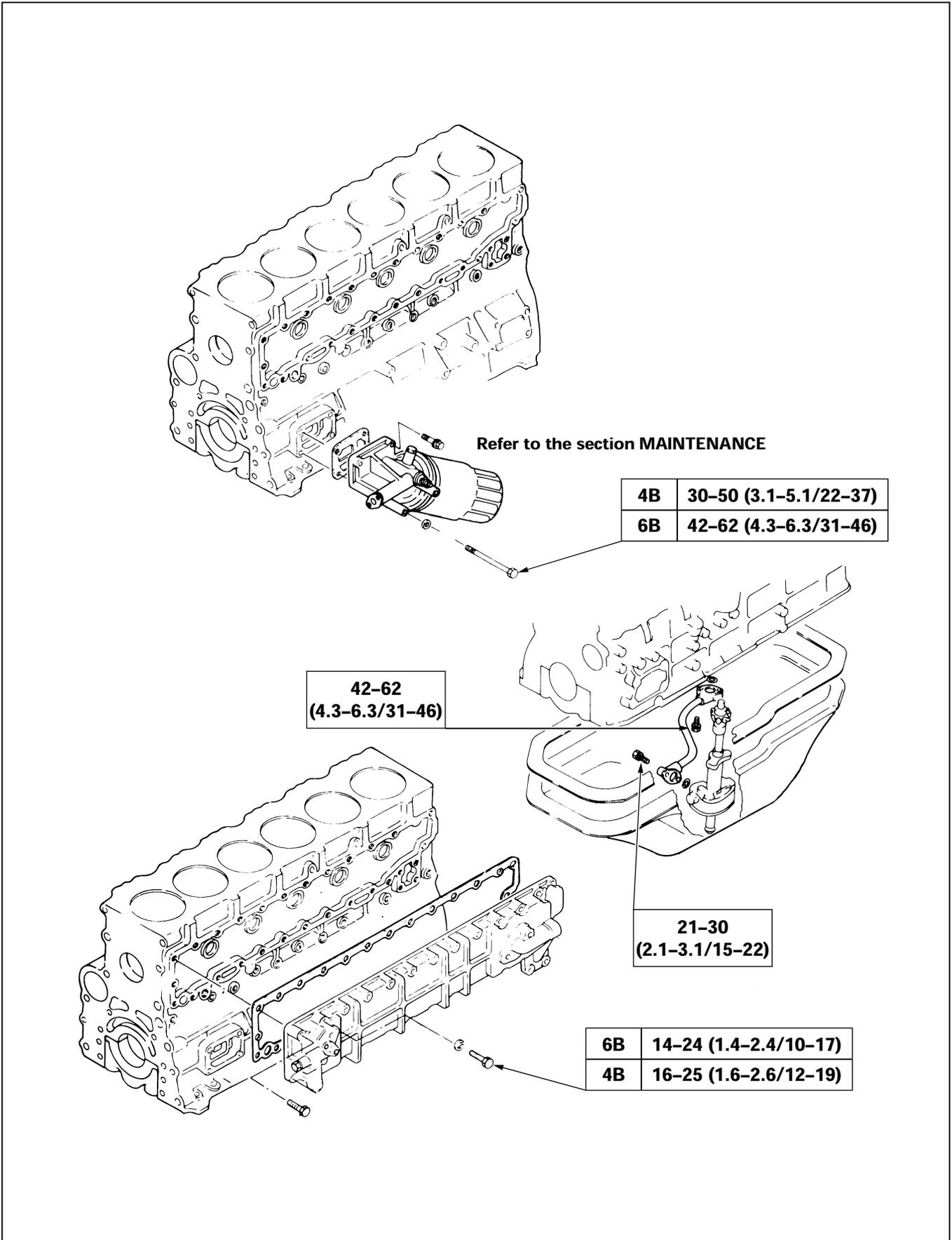
Timing Gear Case and Flywheel Housing

N·m (kgf·m/lb.ft)



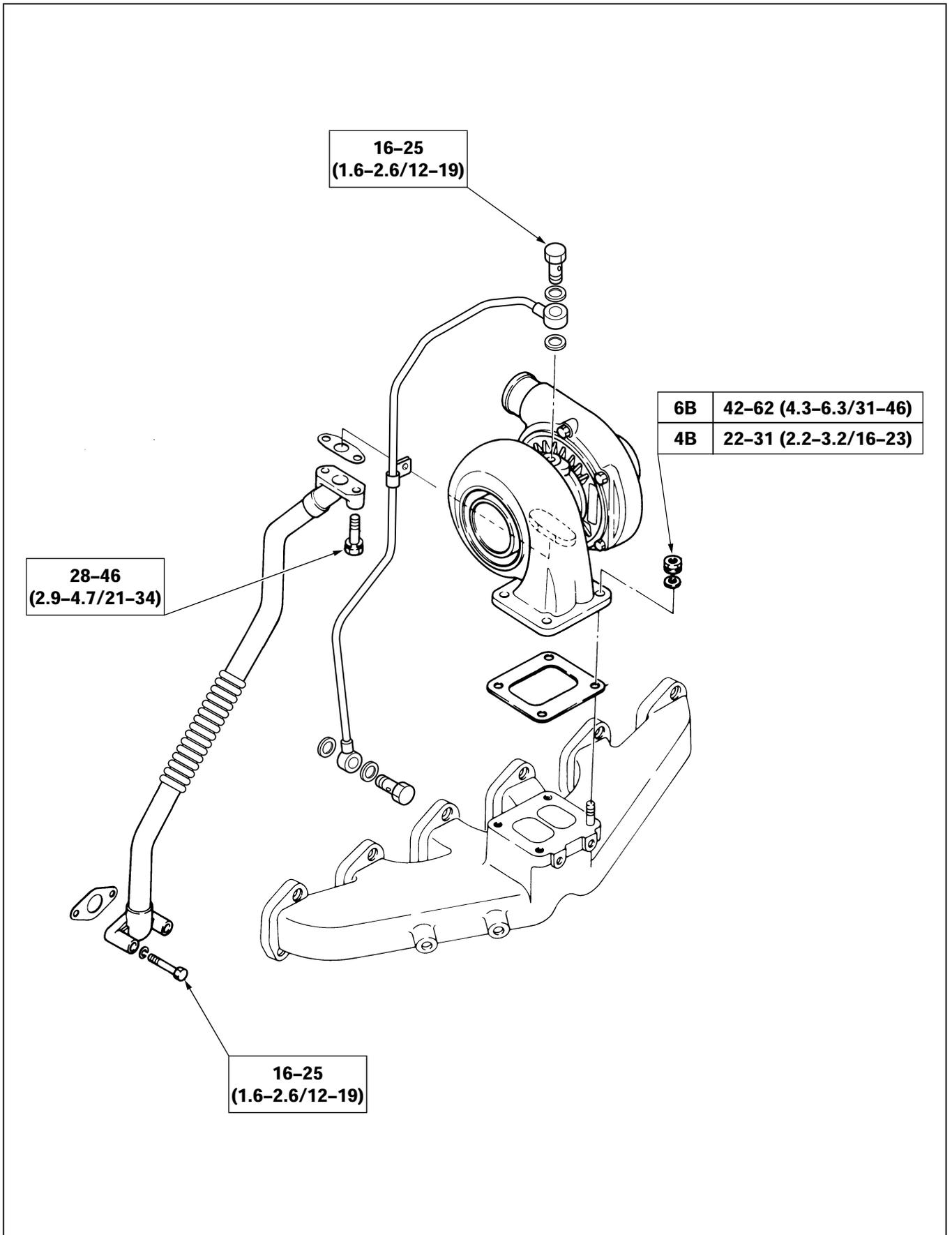
Oil Cooler, Oil Filter, and Oil Pump

N·m (kgf·m/lb.ft)

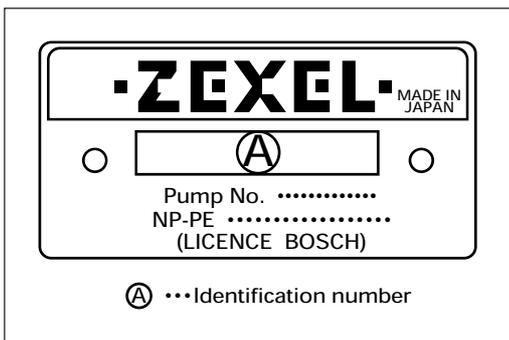
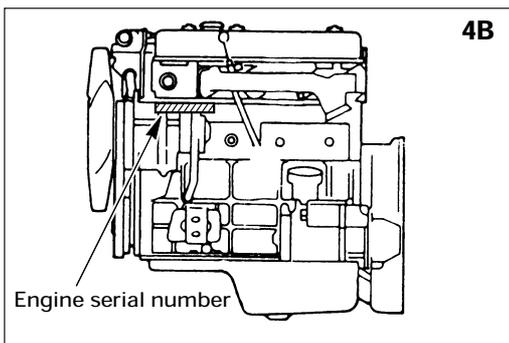
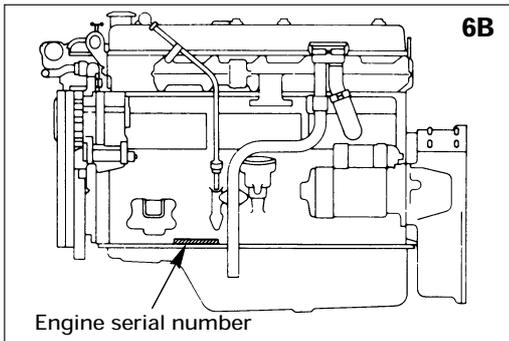


Turbocharger

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.

SECTION 2

MAINTENANCE

TABLE OF CONTENTS

| ITEM | PAGE |
|---------------------------------------|------|
| Lubricating system | 2- 2 |
| Fuel system | 2- 3 |
| Cooling system | 2- 7 |
| Valve clearance adjustment | 2- 7 |
| Injection timing | 2- 9 |
| Compression pressure measurement..... | 2-15 |
| Turbocharger inspection | 2-16 |
| Engine repair kit..... | 2-17 |
| Recommended lubricants..... | 2-19 |
| Engine oil viscosity chart | 2-19 |

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

2-2 MAINTENANCE

LUBRICATING SYSTEM

Main Oil Filter Replacement Cartridge (Spin-On) Type

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 $\frac{3}{4}$ 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.

