

Product: Case 4HK1-6HK1 ISUZU ENGINES Service Manual

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The CASE logo is displayed in a bold, white, sans-serif font. It is positioned on a black background that is part of a larger graphic element consisting of a black trapezoidal shape with a white diagonal line on the left side, and a horizontal orange bar below the text.

PROFESSIONAL PARTNER

SERVICE MANUAL

4HK1-6HK1 ISUZU ENGINES

9-44061 NA

Replaces 9-44060 NA

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SERVICE MANUAL

4HK1-6HK1 ISUZU ENGINES

CNH America, LLC reserves the right to make improvements in design or changes in specifications at any time without incurring any obligation to install them on units previously sold.

All data given in this publication is subject to production variations. Dimensions and weights are only approximate. Illustrations do not necessarily show products in standard condition. For exact information about any particular product, please consult your Dealer

REVISION HISTORY			
Issue	Issue Date	Applicable Machines	Remarks
First Edition	02-2006	4HK1- 6HK1 ISUZU ENGINES	9-44060 NA
Revision 1	05-2006	4HK1- 6HK1 ISUZU ENGINES	9-44061 NA

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EXHAUST SYSTEM AND TURBOCHARGER.....	1F

NOTE: CNH Company reserves the right to make changes in the specification and design of the machine without prior notice and without incurring any obligation to modify units previously sold.

The description of the models shown in this manual has been made in accordance with the technical specifications known as of the date of design of this document.

IN-2 Introduction

UNITS OF MEASURE

This manual adopts the units of measure based on International System.

The MKSA system units of measure are indicated within brackets after the units of measure of the International System.

Example: 24.5 MPa (250 kgf/cm²)

The following table converts the International System units of measure in some of the main units belonging to other system.

Quantity	To convert from (IS)	Into (Others)	Multiply by	Quantity	To convert from (IS)	Into (Others)	Multiply by
Lenght	mm	in	0.03937	Pressure	MPa	kgf/cm ²	10.197
	mm	ft	0.003281		MPa	psi	145.0
Volume	L	US gal	0.2642	Power	kW	CV-PS	1.360
	L	US qt	1.057		kW	HP	1.341
	m ³	yd ³	1.308	Temperature	°C	°F	°C x 1.8 + 32
Mass	kg	lb	2.205	Speed	km/h	mph	0.6214
Force	N	kgf	0.10197		min ⁻¹	rpm	1.0
	N	lbf	0.2248	Capacity	L/min	US gpm	0.2642
Torque	N.m	kgf.m	0.10197		mL/rev	cc/rev	1.0
	N.m	lbf.ft	0.7375				

GENERAL INFORMATION

General Information

Contents

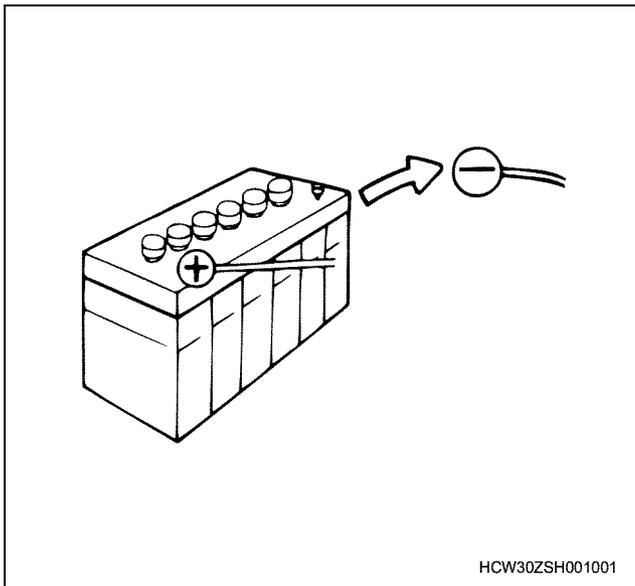
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General Information

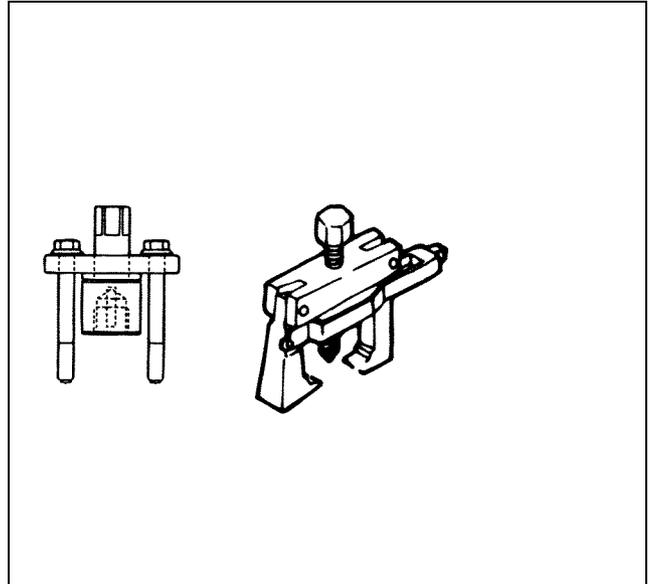
Service Precautions

In order to carry out work safely

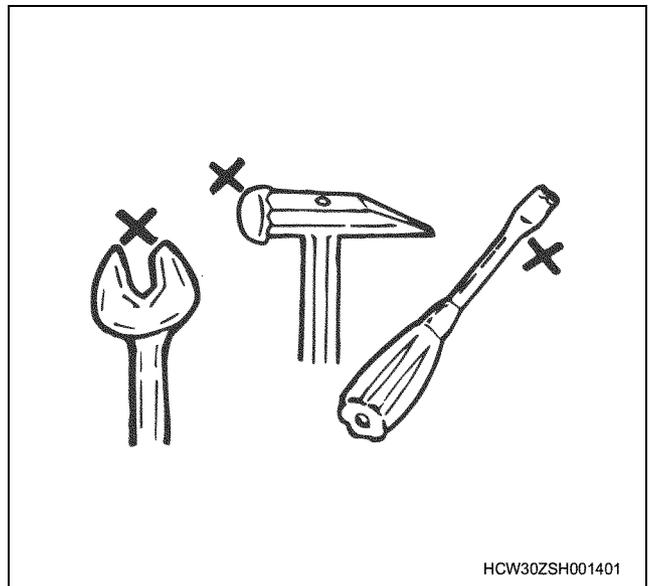
1. Always use an engine stand when taking the engine down from the vehicle.
Do not place the engine directly onto the ground, or place in a manner that interferes with the oil pan.
2. If you are working together with others, always pay attention to each other's safety.
3. If you are repairing any part of the electrical system, always remove the minus side cable from the battery terminal before starting work. If you are removing the battery cover, always remove the cover in a place that is away from sources of fire/heat.



4. Do not perform painting work or leave the engine running for long periods of time in an enclosed or badly ventilated indoor workshop.
5. Always use the correct specialized tool indicated in the instructions. Using the incorrect tool may cause damage to the parts or injury to the person using the tool.



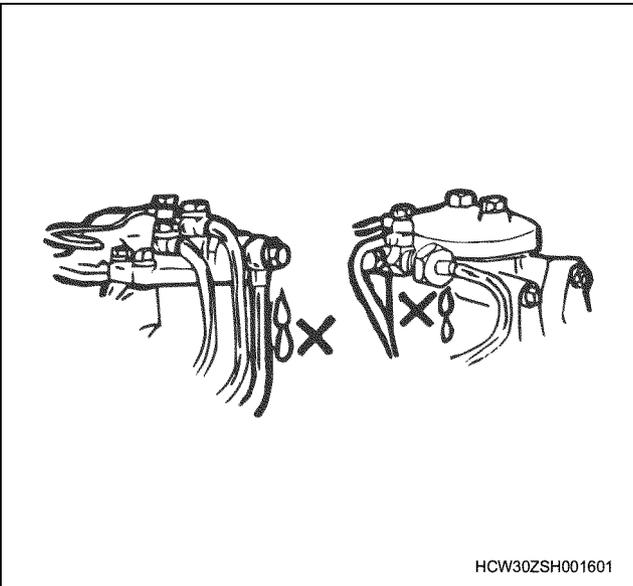
6. All regular tools, gauges and special tools should be regularly inspected, and prepared before starting work. Do not use bent spanners, hammers with damaged edges, chipped chisels, or any other faulty or damaged tools.



7. Always pay close attention to safety and handling requirements when using grinders, cranes, welders, and other such equipment. Moreover, always wear the correct protective garments and use the necessary safety tools for the job in hand.

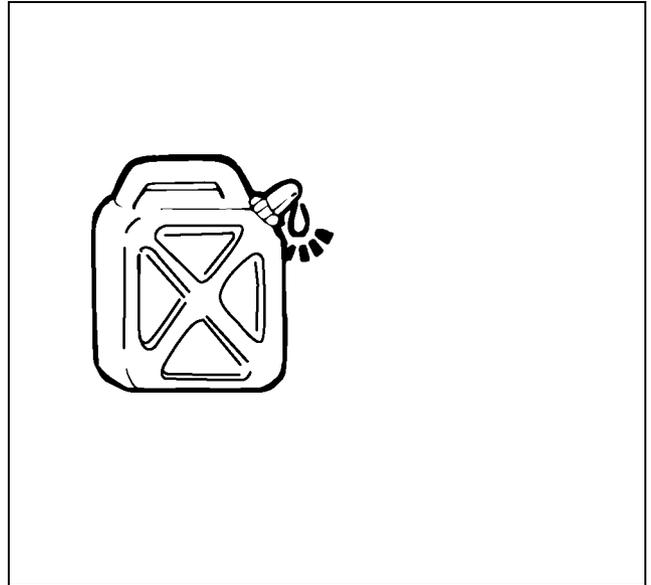


8. Always check that there are no fuel leaks when performing maintenance work on the fuel system. (It may cause a fire.)



9. Pay close attention to the risk of ignition if you are handling parts that carry a high voltage. Furthermore, any oil or fat spilt onto rubber parts must be wiped off immediately, as it will cause deterioration of the rubber.

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Replacement parts and part numbers.

1. Always replace packing, oil seals, o-rings, caulking lock nuts, folding lock plates, split pins and other such parts with brand new parts.
2. The parts numbers contained in this manual may not represent the supply condition of the parts, and the part numbers may be changed due to revisions. Therefore, parts should always be checked against a parts catalogue before use.

Liquid gasket

1. Each time you disassemble parts that use liquid gasket, completely remove the old gasket residue from each of the parts and matching sections using a scraper, then clean each of the parts to completely remove oil, water, and dirt etc. from the various surfaces. Using the specified type of liquid gasket, apply new liquid gasket to each of the surfaces before reassembling the parts.
2. In order to make it easier to clean liquid gasket surfaces, apply gasket remover liquid (Pando-391D made by Three Bond Co., Ltd.) and leave the part to stand for approximately 10 minutes, after which the old liquid gasket residue will be easier to remove.
However, this should not be used on resin components or painted components.
3. Please take care not to apply too much or too little liquid gasket.
Also, you should always re-apply the liquid gasket upon itself when you start and finish application.
4. Make sure that there are no gaps when re-installing the liquid gasket parts to each other. If there are gaps between the two parts, re-apply the liquid gasket. Some parts, especially the oil pan, use the same size studs as a guide to eliminate the need for knock pin positioning etc.
5. Re-install these parts within 7 minutes of applying the liquid gasket.

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If more than 7 minutes passes, remove the previous liquid gasket and re-apply it.

- Please wait for at least 30 minutes since the last part is installed before starting the engine.

Liquid gasket

Seal section	Product name	Manufacturer's name
Between cylinder block and – Flywheel housing	1207B	Three Bond
Between cylinder block and – Flywheel housing and – Crankcase	1207B	Three Bond
Between cylinder block and – Crank case	1207B	Three Bond
Between cylinder block and – Front cover	1207B	Three Bond
Cylinder block, head plug nipple, unit, switches	262	Loctite

- Always use the liquid gasket products listed above, or a liquid gasket identical to the ones listed above.
- Use the correct quantity of liquid gasket. Always follow the handling instructions for each product.

Application procedure

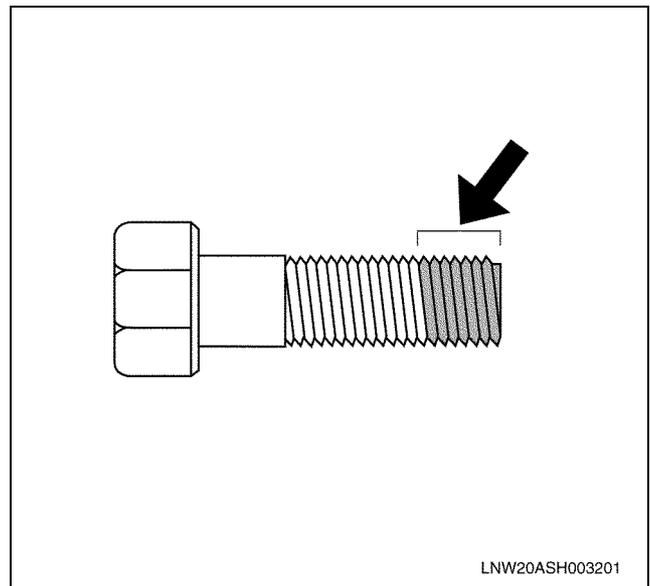
- Wipe the contact surfaces clean of all water, fat or oil. The contact surfaces should be dry.
- Apply a regular bead width of liquid gasket to one of the contact surfaces. Make sure that the bead does not break at this point.

Notes:

If there are special regulations concerning the application procedure in the repair document, please follow those regulations.

Work procedure

- Wipe the joint surfaces of the bolt, bolt hole, and screw thread section clean of water, fat, and oil. The contact surfaces should be dry.
- Apply Loctite to the top 1/3 of the screw.
- Tighten the bolt to the correct tightening torque.



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Important:

After tightening the bolt, do not apply excessive torque or try to rotate the bolt until at least one hour has passed, and the Loctite has hardened.

Procedure for using the Plastiguage

Type	Measurable range mm (in)
PG-1 (Green)	0.025 – 0.076 (0.001 – 0.003)
PR-1 (Red)	0.051 – 0.152 (0.002 – 0.006)
PB-1 (Blue)	0.102 – 0.229 (0.004 – 0.009)

Example: Procedure for measuring the clearance between the connecting rod bearing and crank pin.

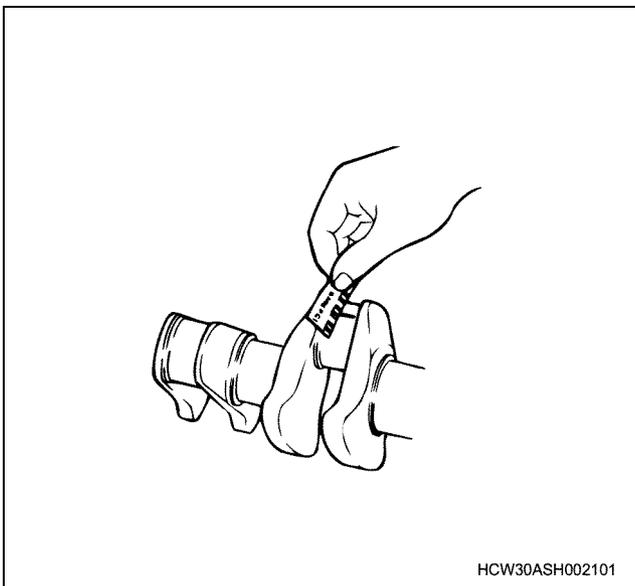
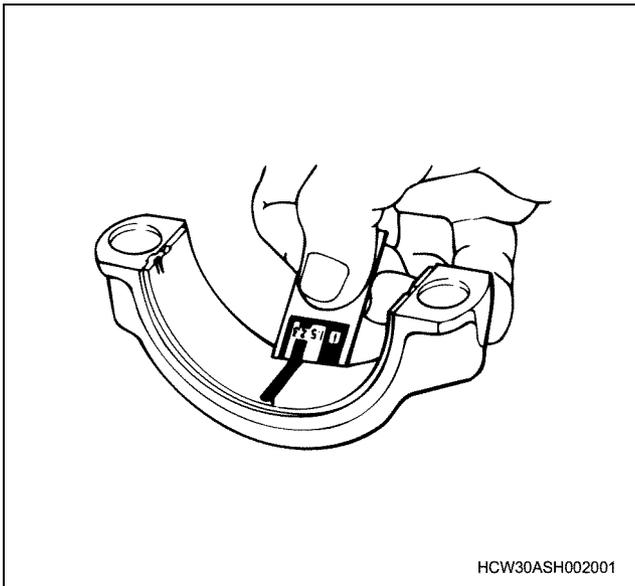
- Clean the connecting rod and bearing, and install the bearing to the rod.
- Cut the plastiguage to the same width as the crank pin, and while avoiding the oil pore of the crank pin lay the gauge parallel to the pin.

- Line up the marks on the connecting rod and cap and install the crank pin, apply molybdenum disulphide to the thread section and bearing surface of the fastening bolt, and rotate both cap and bolt to the correct torque.

Important:

Do not move the connecting rod while using the plastiguage.

- Gently remove the cap and connecting rod, and measure the crushed width of the plastiguage (clearance between rod and pin) using the scale printed on the bag.



Example: Measuring the clearance between the crank bearing and crank journal

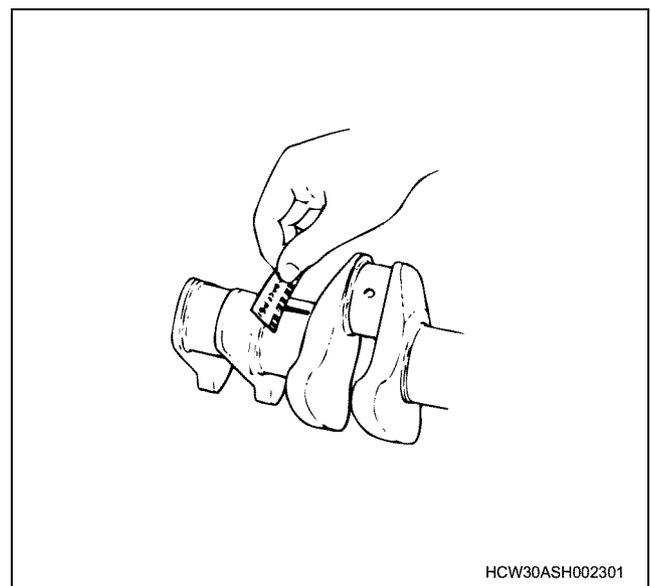
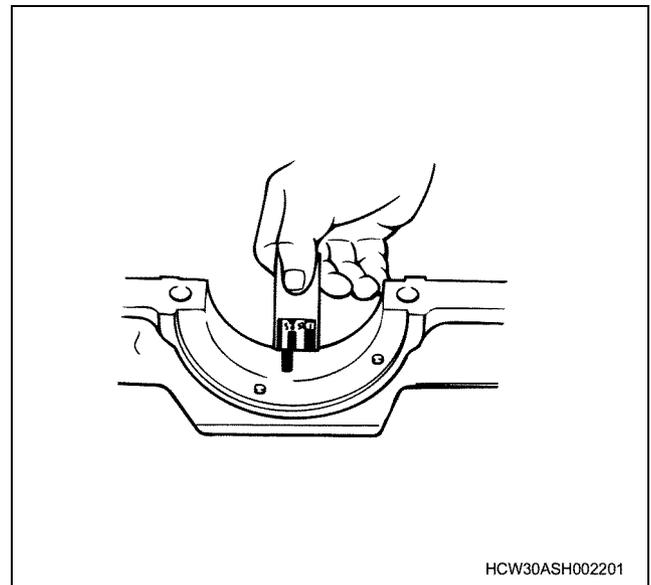
- Clean the clamp face of the cylinder block and crankcase bearing, and also the bearing, and install the cylinder block to the crankcase.
- Gently rest the crankshaft on the cylinder block, and rotate it approximately 30 degree to stabilize it.

- Cut the plastiguage to the same size as the journal width, and while avoiding the oil pore of the journal lay the gauge parallel to the journal.
- Gently rest the crank case on the cylinder block, apply molybdenum disulphide to the thread section and bearing surface of the fastening bolt, and tighten in sequence to the correct torque.

Important:

Do not rotate the crankshaft while using the plastiguage.

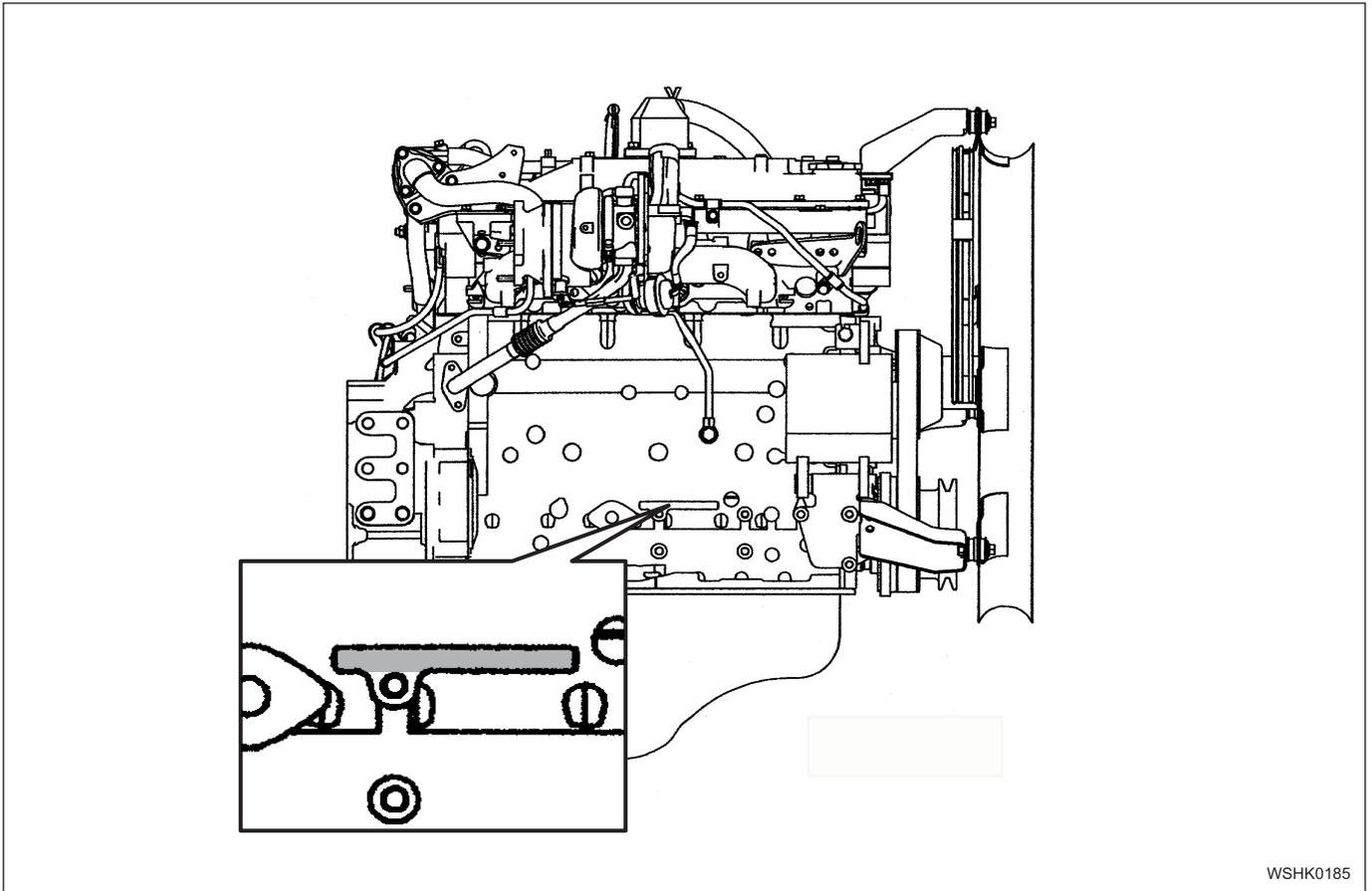
- Gently remove the crankcase, and measure the crushed width of the plastiguage (clearance between bearing and journal) using the scale printed on the bag.



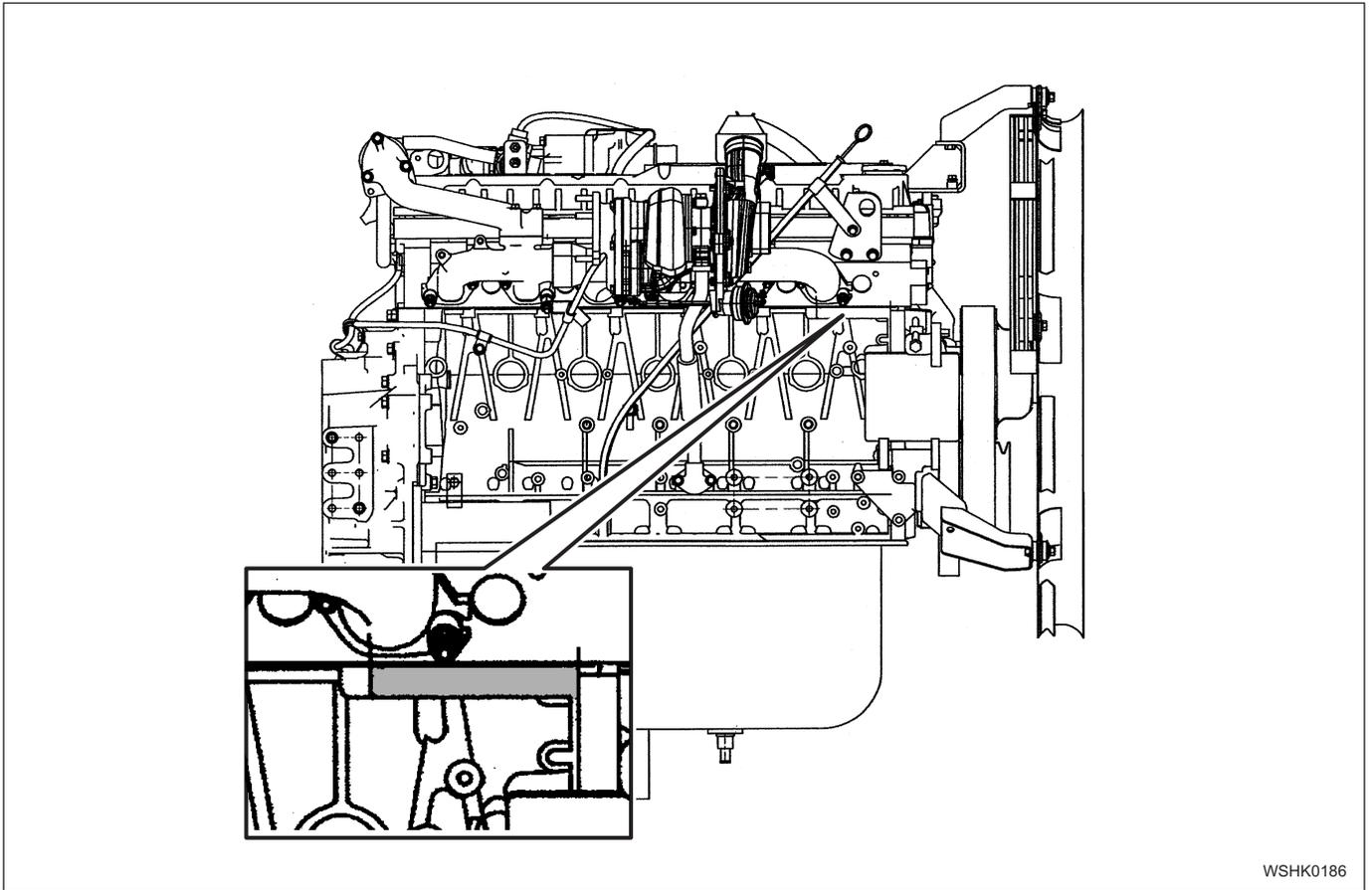
Reading the model

Engine number stamping position

4HK1



6HK1



WSHK0186

General information

Terminology, description of abbreviations

Terminology definitions

Term	Explanation
Maintenance standard	The generic name for reference values required for maintenance, such as nominal dimension, selection of a reference point, and limit.
Nominal dimension	Shows the standard value at the point of manufacture that does not include the common difference.
Selection of a reference point	Shows the standard value after assembling, repairing, or adjusting.
Limit	When this value (dimensions) is reached, it shows that the part has reached its full limit and must be replaced or repaired.
Front · rear, left · right, upper · lower	These show each orientations of parts installed to the vehicle when looking from the vehicle's forward direction.
Unit	Units written to SI conventions (mainly torque, pressure, force) [Example] Length: mm, Torque: N·m {kgf·m}
Warning	Items that carry the warning mark pose a danger to life or threat of serious injury if not strictly observed.
Caution	Items that carry the caution mark may cause injury or lead to accidents if not strictly observed.
Important	Items that carry the important mark may cause the vehicle to break down, or may prevent the guaranteed normal operation of the system or related parts if not strictly observed.

0A-8 General Information

Term	Explanation
Notes	Items that should receive special mention within a work procedure.

Description of abbreviations

Abbreviation	Description
AC	Alternating Current Alternating Current
ACC	Accessory Accessory
ACG	Alternating Current Generator Alternating current generator
API	American Petrol Institute American Petroleum Institute
ASM (Assy)	Assembly Assembly
ATDC	After Top Dead Center After Top Dead Center
BAT, BATT	Battery Battery
BRG, Brg	Bearing Bearing
BKT, BRKT	Bracket Bracket
BTDC	Before Top Dead Center Before Top Dead Center
CO	Carbon Oxide Carbon Monoxide
CONN	Connector Connector
CPU	Central Processing Unit Central processing unit
C/U	Control Unit Control unit
DC	Direct Current Direct current
DI	Direct Injection Direct injection
ECU	Engine Control Unit / Electronic Control Unit Engine control unit / control unit
ECM	Engine Control Module Engine control module
EGR	Exhaust Gas Recirculation Exhaust gas recirculation
Exh, EXH	Exhaust Exhaust
Ft, FRT	Front Front

Abbreviation	Description
FWD	Forward Forward
F/C	Fuel Cut Fuel Cut
GND	Ground Earth
IC	Integrated Circuit Integrated circuit
ID Plate	Identification plate Identification plate, ID plate
IN	Intake, Intake Intake
ISO	International Organization for Standardization International Organization for Standardization
I/PUMP	Injection Pump Injection Pump
JIS	Japanese Industrial Standard Japanese Industrial Standard
L/H, LH	Left Hand Left hand side
M/V	Magnetic Valve Magnetic valve
NOx	Nitrogen Oxide Nitrogen Oxide
N-TDC	Number - Top Dead Center Top dead center rotational frequency
OPT	Option Option
P	Pole(S) Pole
PCV	Pump Control Valve/ Positive Crankcase Ventilation Pump control valve/ Positive crankcase ventilation
PM	Particulate Matter Particulate matter
PS	Pre-Stroke Pre-stroke
PTO	Power Take Off Power take off
QOS	Quick On System Rapid preheating system
Rr, RR	Rear Rear

Abbreviation	Description
R/H, RH	Right Hand Right hand side
R/L	Relay Relay
STD	Standard Standard
SW	Switch Switch
TICS	Timing & Injection rate Control System A type of injection system
VGS Turbo	Variable Geometry turbocharger System Adjustable turbo, VGS turbo
W/L	Warning Lamp Warning lamp

SI (International System of Units)

With regards the conversion to SI (International System of Units)

The introduction of the SI systems aims to internationally unify the metric system and the various units used by different countries (traditional weights and measures, the foot pound method etc.), and to curb the confusion that occurs between the different units (conversion calculations etc.).

The new calculating method which adopted SI units was completely adopted in Japan in 1992, and is standardized by JIS-Z-8203.

All of the units in this manual are written in line with the International System of Units SI units, and conventional units are written in { } brackets.

SI

(French) Abbreviated name of Le Systeme International d'Unites

Connection between main SI units and conventional units

	SI	Conventional Unit	Item, unit conversion
Length	m	m	Same as the conventional unit
Weight (Mass)	kg	kg	Same as the conventional unit
Force	N	* kg, kgf	1 kgf = 9.80665 N
Torque	N·m	* kg·m, gf·m	1 kgf·m = 9.80665 N·m
Pressure	Pa	*kg/cm ² , mmHg	1 kgf/cm ² = 9.80665 kPa, 1 mmHg = 133.3 Pa
Dynamic force, horsepower	W	PS	1 PS = 0.74 kW
Capacity, air volume displacement	m ³	Litre, L, cc	1 Litre = 1 dm ³ , 1 cc = 1mLitre = 1cm ³
Fuel consumption	g/(kW·h)	g/(PS·h)	1 g/(PS·h) = 1.360 g/(kW·h)

*1 Published service data may conveniently use kg for force and mass (weight) instead of kgf.

*2 Some conversion results may be rounded off to 1 or 2 decimal places.

Converting expressions of quantity

When converting, prefixes such as k (kilo) or m (mili) are used.

M	Mega	10 ⁶	1,000,000
k	Kilo	10 ³	1,000
h	Hecto	10 ²	100
d	Deci	10 ⁻¹	0.1
c	Centi	10 ⁻²	0.01
m	Milli	10 ⁻³	0.001
μ	Micro	10 ⁻⁶	0.000001

- 200 kgf/cm² = 19,620 kPa = 19.6 MPa
- 40 mmHg = 5,332 Pa = 5.3 kPa

0A-10 General Information

Table of standard Isuzu tightening torque

The tightening torque values in the table below apply to all situations unless a special tightening torque is specified.

Isuzu standard bolts, nuts

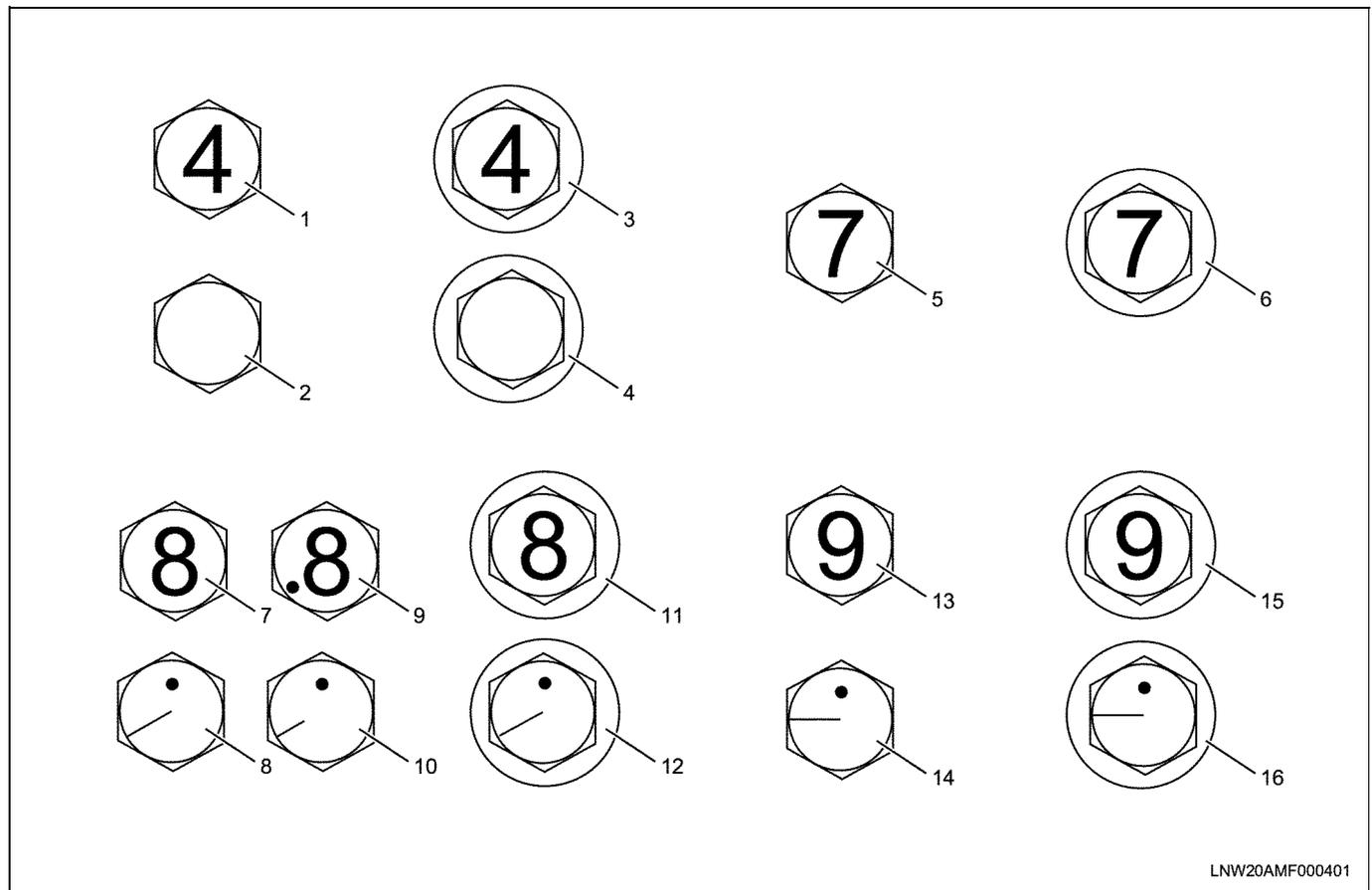
N·m {kgf·m}				
Strength classification	4.8 4T		7T	
Bolt head section shape	Hexagon head bolt	Flange bolt	Hexagon head bolt	Flange bolt
* M10 × 1.5	19.6 ~ 33.3 {2.0 ~ 3.4}	22.3 ~ 37.2 {2.3 ~ 3.8}	27.5 ~ 45.1 {2.8 ~ 4.6}	30.3 ~ 50.4 {3.1 ~ 5.1}
M12 × 1.25	49.0 ~ 73.5 {5.0 ~ 7.5}	54.9 ~ 82.3 {5.6 ~ 8.4}	60.8 ~ 91.2 {6.2 ~ 9.3}	68.1 ~ 102.1 {6.9 ~ 10.4}
* M12 × 1.75	45.1 ~ 68.6 {4.6 ~ 7.0}	51.0 ~ 76.5 {5.2 ~ 7.8}	56.9 ~ 84.3 {5.8 ~ 8.6}	62.7 ~ 94.0 {6.4 ~ 9.6}
M14 × 1.5	76.5 ~ 114.7 {7.8 ~ 11.7}	83.0 ~ 124.5 {8.5 ~ 12.7}	93.2 ~ 139.3 {9.5 ~ 14.2}	100.8 ~ 151.1 {10.3 ~ 15.4}
* M14 × 2	71.6 ~ 106.9 {7.3 ~ 10.9}	77.2 ~ 115.8 {7.9 ~ 11.8}	88.3 ~ 131.4 {9.0 ~ 13.4}	94.9 ~ 142.3 {9.7 ~ 14.5}
M16 × 1.5	104.0 ~ 157.0 {10.6 ~ 16.0}	115.6 ~ 173.3 {11.8 ~ 17.7}	135.3 ~ 204.0 {13.8 ~ 20.8}	150.1 ~ 225.2 {15.3 ~ 23.0}
* M16 × 2	100.0 ~ 149.1 {10.2 ~ 15.2}	109.4 ~ 164.2 {11.2 ~ 16.7}	129.4 ~ 194.2 {13.2 ~ 19.8}	142.5 ~ 213.8 {14.5 ~ 21.8}
M18 × 1.5	151.0 ~ 225.6 {15.4 ~ 23.0}	—	195.2 ~ 293.2 {19.9 ~ 29.9}	—
* M18 × 2.5	151.0 ~ 225.6 {15.4 ~ 23.0}	—	196.1 ~ 294.2 {20.0 ~ 30.0}	—
M20 × 1.5	206.0 ~ 310.0 {21.0 ~ 31.6}	—	269.7 ~ 405.0 {27.5 ~ 41.3}	—
* M20 × 2.5	190.2 ~ 286.4 {19.4 ~ 29.2}	—	249.1 ~ 374.6 {25.4 ~ 38.2}	—
M22 × 1.5	251.1 ~ 413.8 {25.6 ~ 42.2}	—	362.8 ~ 544.3 {37.0 ~ 55.5}	—
* M22 × 2.5	217.7 ~ 327.5 {22.2 ~ 33.4}	—	338.3 ~ 507.0 {34.5 ~ 51.7}	—
M24 × 2	358.9 ~ 539.4 {36.6 ~ 55.0}	—	430.5 ~ 711.0 {43.9 ~ 72.5}	—
* M24 × 3	338.3 ~ 507.0 {34.5 ~ 51.7}	—	406.0 ~ 608.0 {41.4 ~ 62.0}	—

The * mark indicates where soft materials have been used for internal thread sections, such as castings.

N·m {kgf·m}				
Strength classification	8.8		9.8 9T	
Bolt head section shape	Hexagon head bolt	Flange bolt	Hexagon head bolt	Flange bolt
M6 × 1	5.6 ~ 11.2 {0.6 ~ 1.1}	6.6 ~ 12.2 {0.6 ~ 1.2}	—	—
M8 × 1.25	13.4 ~ 25.7 {1.4 ~ 2.6}	15.3 ~ 28.4 {1.6 ~ 2.9}	16.7 ~ 30.4 {1.7 ~ 3.1}	18.1 ~ 33.6 {1.9 ~ 3.4}
M10 × 1.25	31.3 ~ 52.5 {3.2 ~ 5.4}	35.4 ~ 58.9 {3.6 ~ 6.1}	37.3 ~ 62.8 {3.8 ~ 6.4}	42.3 ~ 70.5 {4.3 ~ 7.2}
* M10 × 1.5	31.3 ~ 51.4 {3.2 ~ 5.2}	34.5 ~ 57.5 {3.5 ~ 5.8}	36.3 ~ 59.8 {3.7 ~ 6.1}	40.1 ~ 66.9 {4.1 ~ 6.8}
M12 × 1.25	69.3 ~ 104.0 {7.1 ~ 10.6}	77.7 ~ 116.5 {7.9 ~ 11.9}	75.5 ~ 113.8 {7.7 ~ 11.6}	85.0 ~ 127.5 {8.7 ~ 13.0}
* M12 × 1.75	64.8 ~ 96.1 {6.6 ~ 9.8}	71.4 ~ 107.2 {7.3 ~ 10.9}	71.6 ~ 106.9 {7.3 ~ 10.9}	79.5 ~ 119.2 {8.1 ~ 12.2}
M14 × 1.5	106.2 ~ 158.8 {10.8 ~ 16.2}	114.9 ~ 172.3 {11.7 ~ 17.6}	113.8 ~ 170.6 {11.6 ~ 17.4}	123.4 ~ 185.1 {12.6 ~ 18.9}
* M14 × 2	100.6 ~ 149.8 {10.3 ~ 15.3}	108.2 ~ 162.2 {11.1 ~ 16.6}	106.9 ~ 160.0 {10.9 ~ 16.3}	115.5 ~ 173.3 {11.8 ~ 17.7}
M16 × 1.5	154.3 ~ 232.5 {15.7 ~ 23.7}	171.1 ~ 256.7 {17.4 ~ 26.2}	160.0 ~ 240.3 {16.3 ~ 24.5}	176.9 ~ 265.3 {18.0 ~ 27.1}
* M16 × 2	147.6 ~ 221.4 {15.0 ~ 22.6}	162.5 ~ 243.8 {16.6 ~ 24.9}	153.0 ~ 229.5 {15.6 ~ 23.4}	168.5 ~ 252.7 {17.2 ~ 25.8}
M18 × 1.5	222.5 ~ 334.3 {22.7 ~ 34.1}	—	229.5 ~ 345.2 {23.4 ~ 35.2}	—
* M18 × 2.5	223.6 ~ 335.4 {22.8 ~ 34.2}	—	230.5 ~ 346.2 {23.6 ~ 35.3}	—
M20 × 1.5	307.4 ~ 461.7 {31.4 ~ 47.1}	—	316.8 ~ 475.6 {32.3 ~ 48.5}	—
* M20 × 2.5	284.0 ~ 472.1 {29.0 ~ 43.5}	—	293.2 ~ 440.3 {29.2 ~ 44.9}	—
M22 × 1.5	413.6 ~ 620.5 {42.2 ~ 63.3}	—	424.6 ~ 636.5 {43.3 ~ 64.9}	—
* M22 × 2.5	385.7 ~ 578.0 {39.3 ~ 58.9}	—	394.2 ~ 592.3 {40.0 ~ 60.4}	—
M24 × 2	490.8 ~ 810.5 {50.0 ~ 82.7}	—	554.1 ~ 830.6 {56.5 ~ 84.7}	—
* M24 × 3	462.8 ~ 693.1 {47.2 ~ 70.7}	—	520.7 ~ 781.6 {53.1 ~ 79.7}	—

The * mark indicates where soft materials have been used for internal thread sections, such as castings.

Designations for Isuzu standard bolt heads



LNW20AMF000401

Legend

- | | |
|------------------------------------|---------------------------------------|
| 1. Hexagon head bolt(4.8, 4T) | 9. Hexagon head bolt(Un-refined 8.8) |
| 2. Hexagon head bolt(4.8, 4T) | 10. Hexagon head bolt(Un-refined 8.8) |
| 3. Flange bolt(4.8, 4T) | 11. Flange bolt(8.8) |
| 4. Flange bolt(4.8, 4T) | 12. Flange bolt(8.8) |
| 5. Hexagon head bolt(7T) | 13. Hexagon head bolt(9.8, 9T) |
| 6. Flange bolt(7T) | 14. Hexagon head bolt(9.8, 9T) |
| 7. Hexagon head bolt (refined 8.8) | 15. Flange bolt(9.8, 9T) |
| 8. Hexagon head bolt (refined 8.8) | 16. Flange bolt(9.8, 9T) |

Flare nut

	Pipe diameter	tightening torque (for medium and large size vehicles)	Flare nut 2 side width (mm)	
			Old	New
Flare nut tightening torque (service standard value) N-m {kgf·m}	φ4.76 mm	12.8 ~ 18.6 {1.3 ~ 1.9}	14	14
	φ6.35 mm	23.5 ~ 49 {2.4 ~ 5.0}	17	17
	φ8.0 mm	23.5 ~ 49 {2.4 ~ 5.0}	19	17
	φ10.0 mm	44.1 ~ 93.2 {4.5 ~ 9.5}	22	19
	φ12.0 mm	58.8 ~ 137.3 {6.0 ~ 14.0}	27	24
	φ15.0 mm	78.5 ~ 156.9 {8.0 ~ 16.0}	30	30

Taper screw from connectors (brass)

				N·m {kgf·m}
Screw size	PT(R) 1/8	PT(R) 1/4	PT(R) 3/8	PT(R) 1/12
—	2.0 ~ 14.7 (0.2 ~ 1.5)	4.9 ~ 15.7 (0.5 ~ 1.6)	9.8 ~ 16.7 (1.0 ~ 1.7)	9.8 ~ 17.7 (1.0 ~ 1.8)

ENGINE

ENGINE MECHANICAL (4HK1, 6HK1)

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1A-2 ENGINE MECHANICAL (4HK1, 6HK1)

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ISUZU DIESEL ENGINE (4HK1, 6HK1)

Precautions on Service Work

Matters that require attention in terms of maintenance

To prevent damage to the engine and ensure reliability of its performance, pay attention to the following in maintaining the engine: When taking down the engine on the ground, do not make the bearing surface of the oil pan touch directly the ground. Use a wood frame, for example, to support the engine with the engine foot and the flywheel housing.

Because there is only a small clearance between the oil pan and the oil pump strainer, it can damage the oil pan and the oil strainer.

- When the air duct or air cleaner is removed, cover the air intake opening to prevent foreign matter from getting into the cylinder. If it gets into it, it can considerably damage the cylinder and others while the engine is operating.
- When maintaining the engine, never fail to remove the battery ground cable. If not, it may damage the wire harness or electrical parts. If you need electricity on for the purpose of inspection, for instance, watch out for short circuits and others.
- Apply engine oil to the sliding contact surfaces of the engine before reassembling it. This ensures adequate lubrication when the engine is first started.
- When valve train parts, pistons, piston rings, connecting rods, connecting rod bearings or crankshaft journal bearings are removed, put them in order and keep them.
- When installing them, put them back to the same location as they were removed.
- Gaskets, oil seals, O-rings, etc. must be replaced with new ones when the engine is reassembled.
- As for parts where a liquid gasket is used, remove an old liquid gasket completely and clean it up thoroughly so that no oil, water or dust may be clung to them. Then, apply the designated liquid gasket to each place anew before assembly.
- Surfaces covered with liquid gasket must be assembled within 7 minutes of gasket application. If more than 7 minutes have elapsed, remove the existing liquid gasket and apply new liquid gasket.
- When assembling or installing parts, fasten them with the specified tightening torque so that they may be installed properly.

Matters that require attention in specifically dealing with this engine.

Holes or clearances in the fuel system, which serve as a passage of fuel, including the inside of the injector, are made with extreme precision. For this reason, they are highly sensitive to foreign matter and if it gets in, it can lead to an accident on the road, for instance; thus, make sure that foreign matter will be prevented from getting in.

When servicing the fuel system, every precaution must be taken to prevent the entry of foreign material into the system.

- Before beginning the service procedure, wash the fuel line and the surrounding area.
- Perform the service procedures with clean hands. Do not wear work gloves.
- Immediately after removing the fuel hose and/or fuel pipe, carefully tape vinyl bags over the exposed ends of the hose or pipe.
- If parts are to be replaced (fuel hose, fuel pipe, etc.) do not open the new part packaging until installation.

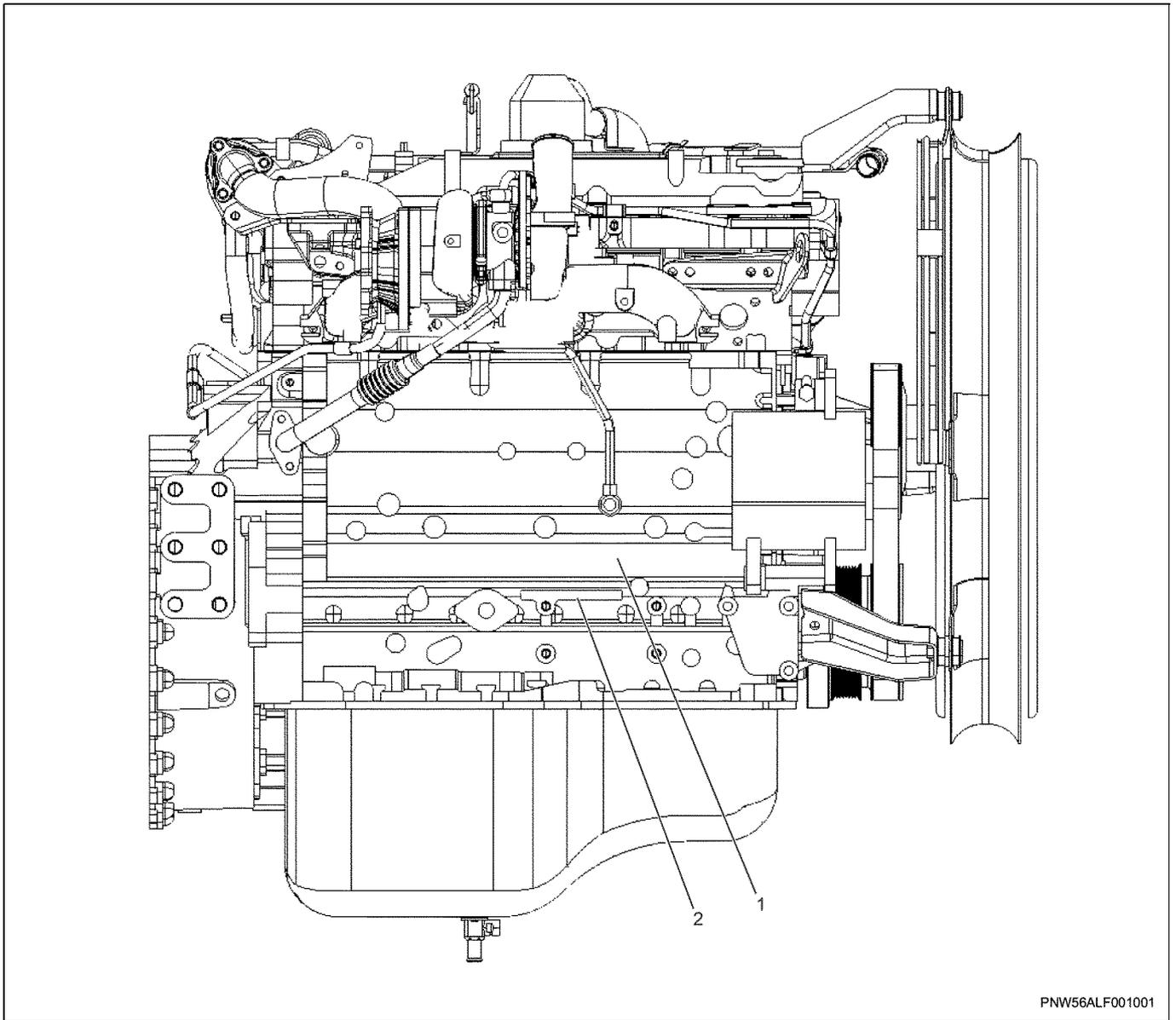
Work procedure

- The fuel opening must be quickly sealed when removing the fuel pipe, injection pipe, fuel injector, fuel supply pump, and common rail.
- The eyebolts and gasket must be stored in a clean parts box with a lid to prevent adhesion of foreign matter.
- Fuel leakage could cause fires. Therefore, after finishing the work, wipe off the fuel that has leaked out and make sure there is no fuel leakage after starting the engine.

1A-4 ENGINE MECHANICAL (4HK1, 6HK1)

How to read the model

4HK1



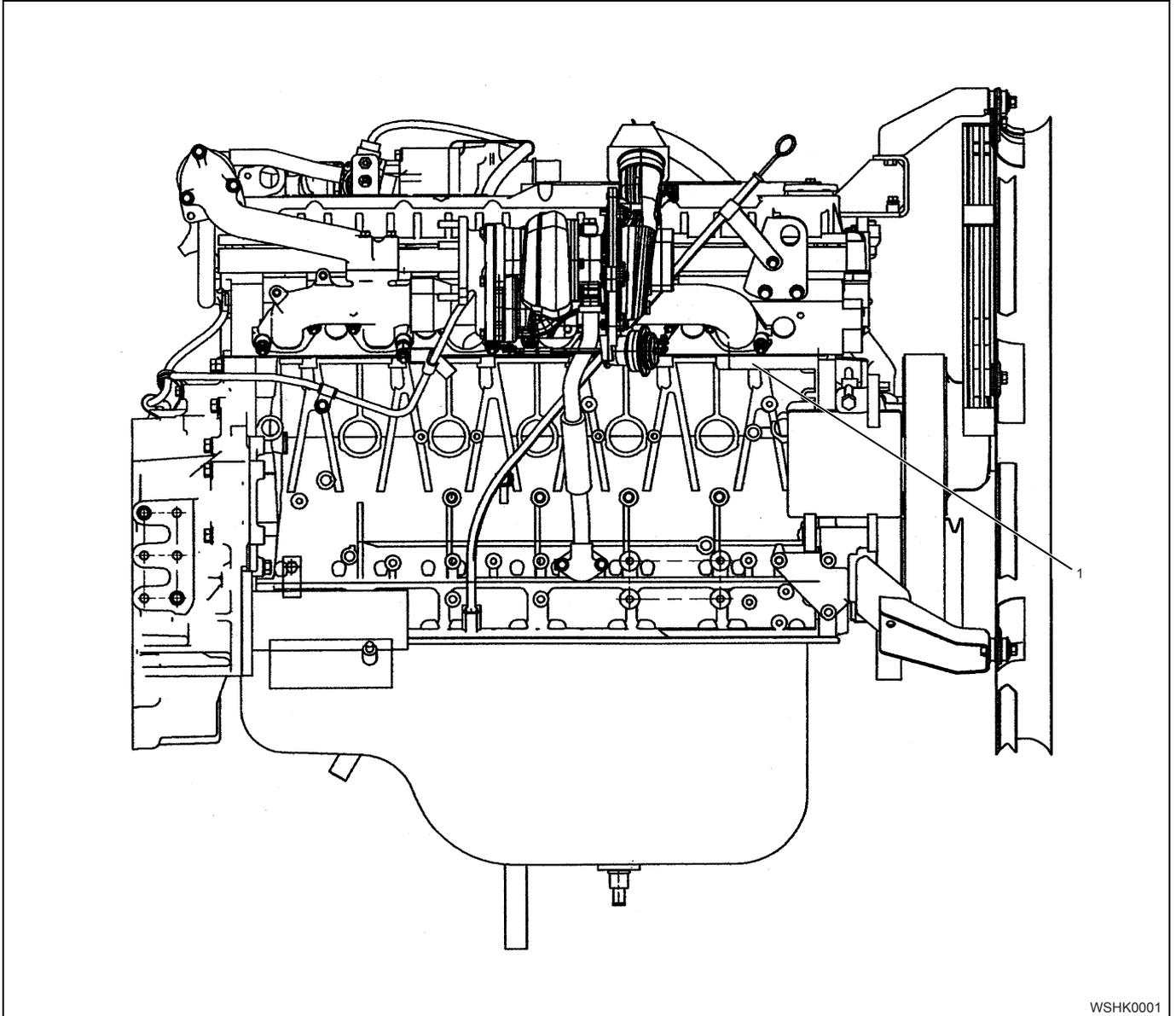
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Name

1. Cast The Engine Model

2. Stamp An Engine Number

6HK1



WSHK0001

Name

1. Stamp An Engine Number

Explanations on functions and operation**Electronic engine control**

With the control unit, the range from injection to air intake/exhaust, including fuel injection quantity, injection timing, intake air restriction, EGR, and idling rpm, is controlled.

Cylinder block

The cylinder block is cast-iron with the center distance of each bore being equal and is of the highly rigid, symmetrical structure with the crankshaft center being the center. The bearing cap is of the ladder frame structure and tightened up under the plastic range rotation angle method.

Crankshaft

Tuffriding is given, while on the No. 1 balance weight

Cylinder liner

The cylinder liner is selected to match an internal diameter of a bore of the cylinder block and built, which is imprinted on the left side of the cylinder.

Piston

The piston is aluminum-alloy and an autothermatic piston with a strut cast, while the combustion chamber is a round reentrant type.

Cylinder head

The cylinder head is cast-iron and there are 4 valves per cylinder. The angular tightening method of the cylinder head bolt further increases reliability and durability.

imprinted is the grade of each journal diameter.

EGR system

Based upon data, including water temperature, engine speeds or engine loads, it is controlled via Engine Control Module (ECM) to purify exhaust by recycling part of it.

Its main components include an EGR valve, an EGR cooler and various sensors.

Connecting rod cap bolt

The angular tightening method of the connecting rod cap bolt further increases reliability and durability.

Common rail-type electronic control injection system

The common rail-type electronic control injection system is composed of a fuel supply pump that sets the target pressure of high-pressure fuel and supply it, a common rail that measures such high-pressure fuel and a fuel injector that turns it into a fine spray and injects it. Each is controlled via ECM based upon various signals, while injection timing or fuel injection quantity is controlled under every possible driving condition.

Fuel injector

The fuel injector is a 7-hole nozzle that adjusts fuel injection quantity or injection timing by opening or closing an electromagnetic valve on the head of the fuel injector.

ECM corrects the dispersion of fuel injection quantity between fuel injectors according to ID code data in memory. At the replacement of fuel injectors, ID code data should be stored in ECM.

Fuel filter with sedimenter

It is a fuel filter with sedimenter that gets rid of water by making use of the difference in specific gravity between light oil and water, which comes with an indicator that notifies you that it is filled with water.

Preheating system

The preheating system consists the ECM, the glow relay, glow plugs and the glow indicator lamp. The preheating system is operated when the engine coolant temperature is low, and make the engine easy to start.

Lubrication system

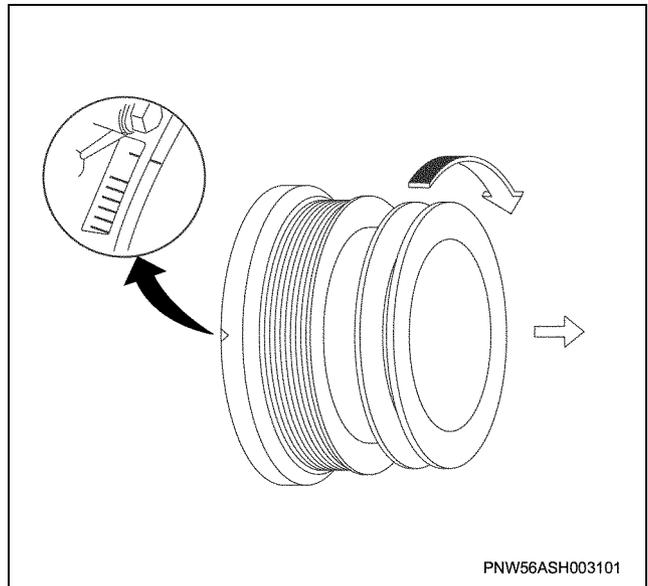
It is an oil filter with full-flow bypass, which uses a water-cool oil cooler and oil jet to cool the piston.

Function check

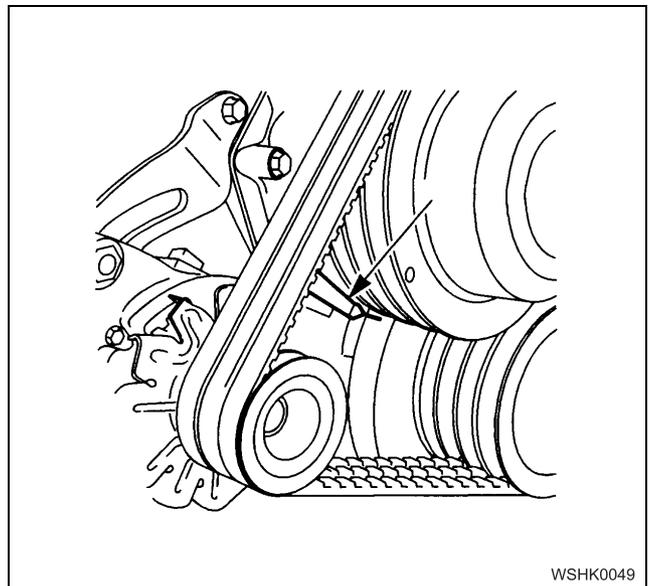
Inspection/adjustment of valve clearance

1. Inspection of valve clearance
 - Remove the cylinder head cover.
 - Remove the fuel injector harness ASM.
 - Loosen the terminal nuts alternately to remove.
 - Remove the leak off pipe.
 - Rotate the crankshaft to make the No.1 cylinder meet the compression top dead center (TDC).

4HK1



6HK1



- Insert a 0.4 mm (0.016 in) thickness gauge into a clearance between the rocker arm and the bridge to check it and adjust it if needed.

Valve clearance	mm (in)
Intake valve	0.4 (0.016)
Exhaust valve	0.4 (0.016)

Caution:

Adjust while being cold.

2. Adjustment of valve clearance

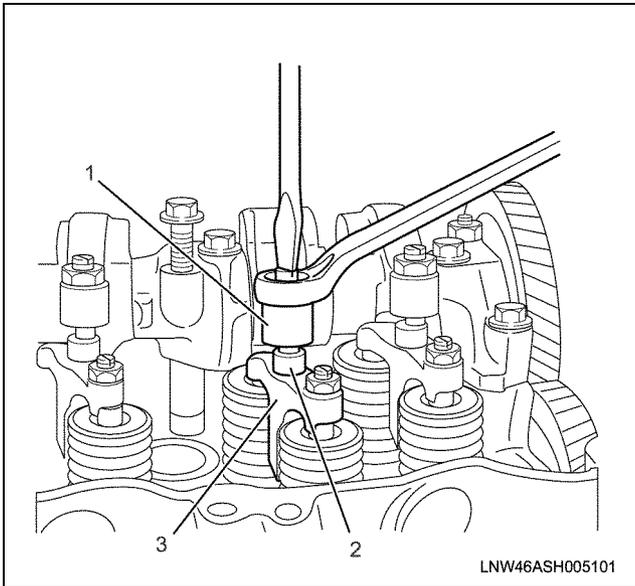
Caution:

Adjust valve clearance carefully so that the bridge may become level (hit the end of the 2 valve axes).

- a. Completely loosen all of the bridge and rocker arm adjusting nuts and adjusting screws (4HK1: 8 nuts and 8 screws, 6HK1: 12 nuts and 12 screws).

- b. Place a 0.4 mm (0.016 in) thickness gauge between the No. 1 cylinder rocker arm end and the bridge cap.
- c. Tighten the rocker arm adjusting screw until the thickness gauge is snug (not tight) between the rocker arm end and the bridge cap.
- d. Tighten the rocker arm lock nut.
- e. Tighten the bridge adjusting screw until the bridge contacts the valve head.
- f. Tighten the bridge lock nut.
- g. Check that the thickness gauge is still held snugly between the rocker arm end and the bridge cap. If it is too tight, slightly loosen the bridge adjusting screw and lock nut to restore snugness.
- h. Remove the thickness gauge.
- i. Repeat Steps 2 through 5 for the remaining cylinders.

Tightening torque: 22 N·m (2.2 kg·m/16 lb ft)



Name

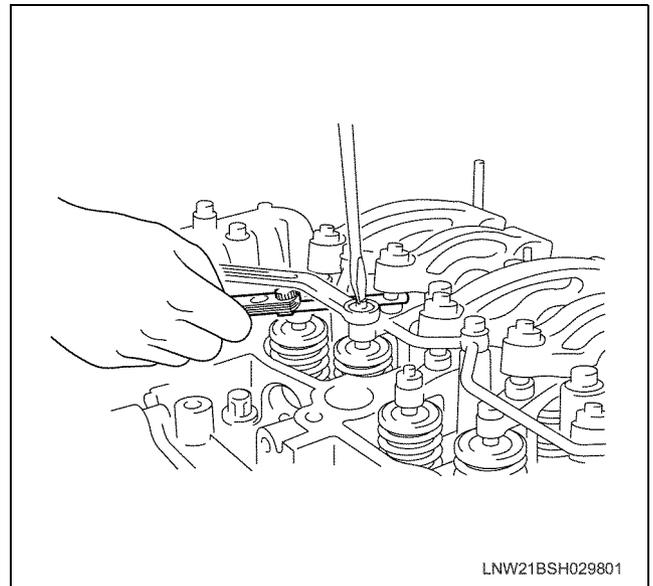
1. Rocker Arm
2. Bridge Cap
3. Bridge

- With a thickness gauge kept inserted, tighten an adjusting screw of the bridge lightly and make sure that the tip of the adjusting screw touches the end of valve axis and the movement of the thickness gauge has become tight.
- Then, check if the end of the valve axis on the opposite side is unstable or hits diagonally. If so, loosen the bridge adjusting screw a little so that the end of the valves on both sides may touch properly.
Valve bridge clearance: ± 0.1 mm (0.0039 in) or less
- After making an adjustment so that the end of the valves on both sides may touch properly, tighten up an adjusting screw nut of the bridge with a flathead screwdriver so that the bridge adjusting screw may not rotate.

Tightening torque: 22 N·m (2.2 kg·m/16 lb ft)

Caution:

If the adjusting screw of the bridge is poorly adjusted, the bridge would tilt and be pushed down and seized, which may damage the bridge guide, for example. Thus, adjust it accurately.



Tightening torque:

Rocker arm adjustment 22 N·m (2.2 kg·m/16 lb ft)
screw nut

Bridge adjustment screw 22 N·m (2.2 kg·m/16 lb ft)
nut

1A-8 ENGINE MECHANICAL (4HK1, 6HK1)

Adjustment table (4HK1)

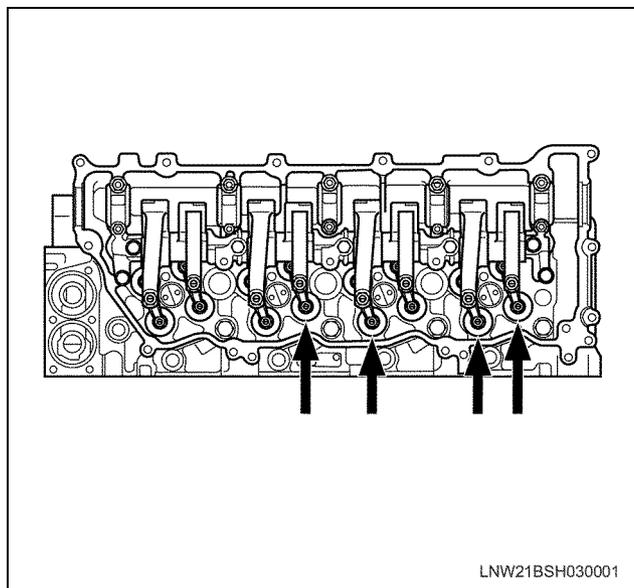
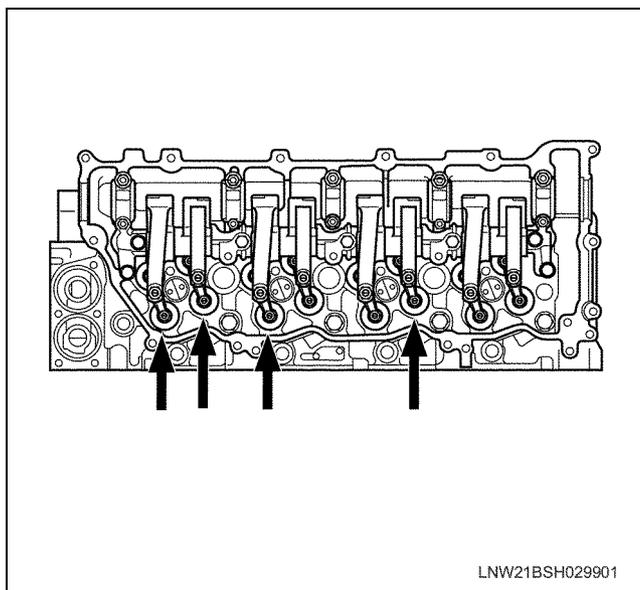
Cylinder No.	1		2		3		4	
	IN	EX	IN	EX	IN	EX	IN	EX
No. 1 cylinder Compression top dead center position	○	○	○			○		
No. 4 cylinder Compression top dead center position				×	×		×	×

Adjustment table (6HK1)

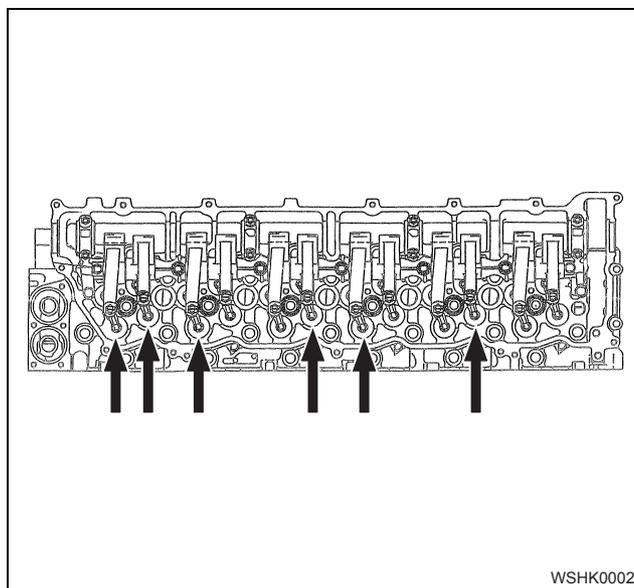
Cylinder No.	1		2		3		4		5		6	
	IN	EX										
No. 1 cylinder Compression top dead center position	○	○	○			○	○			○		
No. 6 cylinder Compression top dead center position				×	×			×	×		×	×

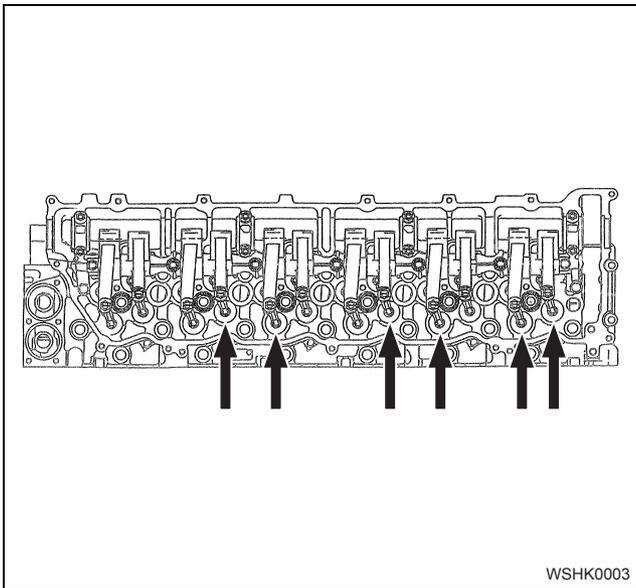
- If the No. 1 cylinder is the compression TDC, adjust a valve clearance with ○ mark given on the table and if the No. 4 (4HK1) or No. 6 (6HK1) cylinder is the compression TDC, that with × mark.

4HK1



6HK1





- Attach the harness ASM to the fuel injector. Tighten the harness bracket with the designated torque.

Tightening torque: 48 N·m (4.9 kg·m/35 lb ft)

- Install the terminal nuts on the fuel injector.

Tightening torque: 2 N·m (0.2 kg·m/18 lb in)

Note:

- Tighten the terminal nuts alternately in order to prevent imbalance in tightening because they are unified.
- Do not tighten the nuts too tightly because it leads to damage to the terminal stud.
 - Install the cylinder head cover. Refer to the "Cylinder Head Cover".

Compression pressure inspection

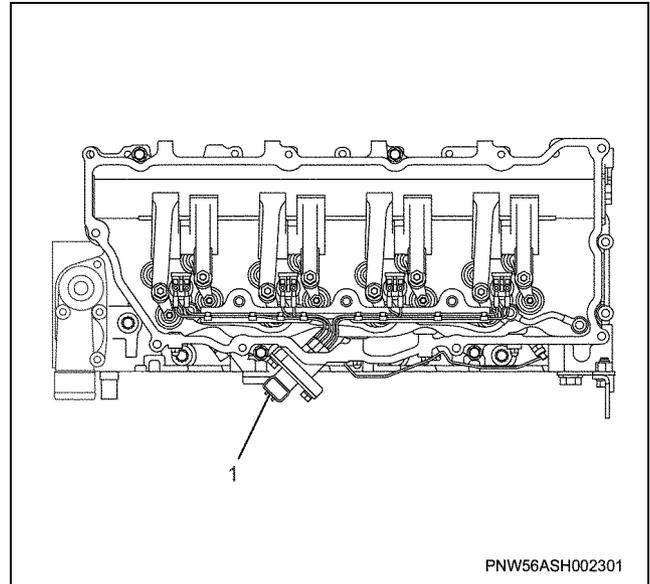
- Warm-up the engine.
- Remove a negative terminal of the battery and remove all the glow plugs.
- Remove the harness connector for the fuel injector built on the lower head cover (no fuel will be injected).

Caution:

When the harness connector is removed, ECM judges that it broke down and DTC is recorded. Upon completion of measurement, never fail to clear memory of ECM.

(For how to clear memory of ECM, refer to the Engine Control System Section)

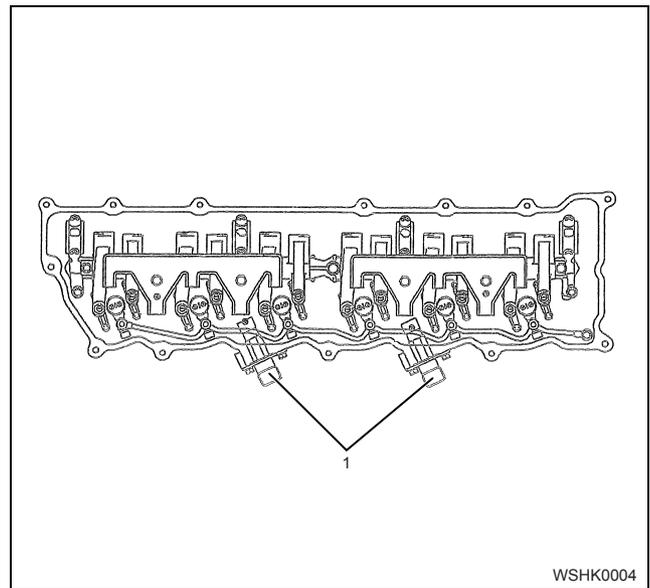
4HK1



Name

1. Fuel Injector Harness Connector

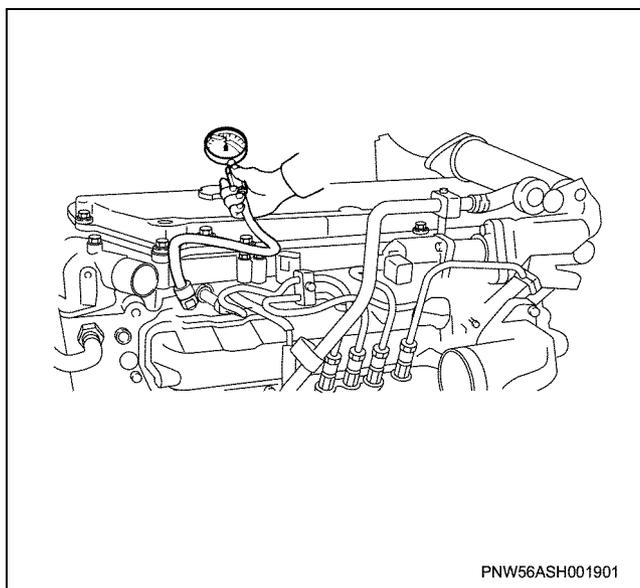
6HK1



Name

1. Fuel Injection Harness Connector

- Install the negative terminal of the battery.
- Turn on the starter to emit foreign matter within the cylinders.
- Install an adapter and a gauge of a compression gauge of the special tool.



Compression gauge: 5-8840-2675-0 (J-26999-12)

Compression gauge adapter

4HK1: EN-46722

6HK1: 380.002.627

- Turn on the starter to inspect compression pressure.

4HK1

Compression pressure	MPa (psi) / 200 rpm
Standard	2.84 – 3.24 (412 – 469)
Limit	1.96 (284)
Differences among the cylinders	294 kPa (43)

6HK1

Compression pressure	MPa (psi) / 200 rpm
Standard	3.24 (469)
Limit	2.26 (327)
Differences among the cylinders	294 kPa (43)

- Measure each cylinder one by one.

Caution:

To keep engine speed at 200 rpm or more, use fully charged batteries.

- Remove a compression gauge of the special tool.
- Remove a negative terminal of the batteries.
- Install a harness connector for the fuel injector built on the lower head cover.
- Install all the glow plugs.

Tightening torque: 20 N·m (2.0 kg·m/15 lb ft)

- Install the negative terminal of the battery.

Main Data and Specifications

Item		Engine model 4HK1
Type		Diesel/4-cycle/water cooled-type, inline four-cylinder OHC
Combustion chamber form		Direct injection type
Cylinder liner type		Dry type
Number of cylinders - cylinder bore × strokes	mm (in)	4-115 (4.53) × 125 (4.92)
Displacement	cc (cu.in)	5193 (317)
Compression ratio		17.5
Compression pressure	MPa (psi)/rpm	3.23 (468)/200
Idle speed	rpm	800
Valve clearance	Intake	0.4 (0.016) (cold)
	Exhaust	0.4 (0.016) (cold)
	mm (in)	
Ignition type		Compressed ignition
Injection order		1 - 3 - 4 - 2
Lubricating system		
Lubricating type		Pressure type
Oil pump type		Gear type
Volume of lubricating oil	L (qts)	13.0 (13.7) — 20.5 (21.7)
Oil filter type		Full flow filter (cartridge type)
Oil cooling type		Built-in, water-cooling
Cooling system		
Cooling type		Water cooling type
Radiator type		Corrugated fin (pressure type)
Water pump type		Centrifugal, belt type
Thermostat type		2 wax-type units
Thermostat valve-opening temperature	°C (°F)	85 (185)
Volume of coolant	L (qts)	14 (14.8) (incl. radiator)
Fuel system		
Injection pump type		Electronic control common rail type
Governor type		Electronic type
Timer type		Electronic type
Injection nozzle type		Multi-hole type 7-hole and ϕ 0.16 mm (0.0063 in) inside diameter
Charging system		
Generator type		AC type
Power output	V/A	24 - 50
Regulator type		IC

1A-12 ENGINE MECHANICAL (4HK1, 6HK1)

Product Case 4HK1-6HK1 ISUZU ENGINES, Service Manual

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Item	Engine model 4HK1
Starting system	
Starter type	Reduction type
Power output	24 - 5.0
Preheat system type	Glow plug
Glow plug standard voltage/electric current	23 - 3.5

Item	Engine model 6HK1
Type	Diesel/4-cycle/water cooled-type, inline four-cylinder OHC
Combustion chamber form	Direct injection type
Cylinder liner type	Dry type
Number of cylinders - cylinder bore × strokes	6-115 (4.53) × 125 (4.92)
Displacement	7790 (475)
Compression ratio	17.5
Compression pressure	3.04 (441)/200
Idle speed	For Hitachi products: 800, For JCB and Sumitomo products: 900
Valve clearance	Intake
	Exhaust
	0.4 (0.016) (cold)
	0.4 (0.016) (cold)
Ignition type	Compressed ignition
Injection order	1 - 5 - 3 - 6 - 2 - 4
Lubricating system	
Lubricating type	Pressure type
Oil pump type	Gear type
Volume of lubricating oil	28 (29.6) — 38 (40.2)
Oil filter type	Full flow filter (cartridge type)
Oil cooling type	Built-in, water-cooling
Cooling system	
Cooling type	Water cooling type
Radiator type	Corrugated fin (pressure type)
Water pump type	Centrifugal, belt type
Thermostat type	2 wax-type units
Thermostat valve-opening temperature	82 (180)
Volume of coolant	14.5 (15.3)
Fuel system	
Injection pump type	Electronic control common rail type
Governor type	Electronic type
Timer type	Electronic type

Sample of manual. Download All 333 pages at:

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