WSM

WORKSHOP MANUAL

DIESEL ENGINE

SM-E4 SERIES

Kubota

KiSC issued 04, 2021 A

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SAFETY FIRST

This symbol, the industry's "Safety Alert Symbol", is used throughout this manual and on labels on the machine itself to warn of the possibility of personal injury. Read these instructions carefully. It is essential that you read the instructions and safety regulations before you attempt to assemble or use this unit.

DANGER
- **Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.**

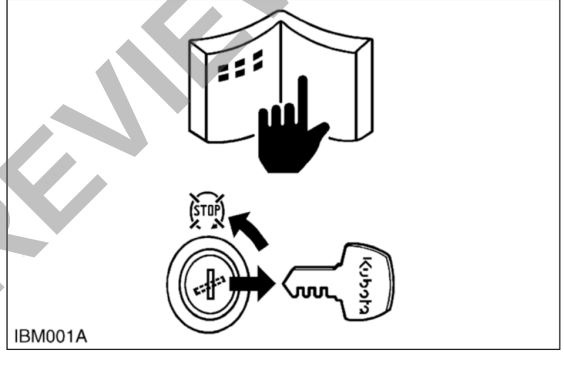
WARNING
- **Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.**

CAUTION
- **Indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury.**

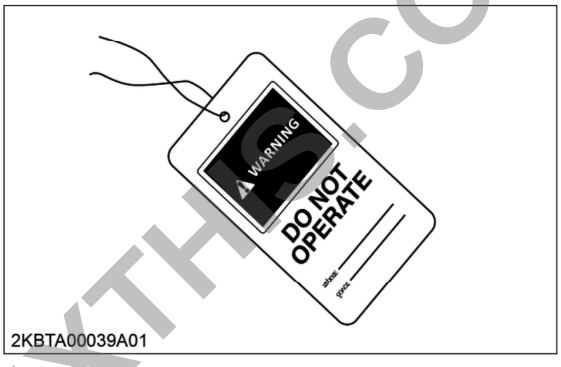
IMPORTANT
- **Indicates that equipment or property damage could result if instructions are not followed.**

NOTE
- **Gives helpful information.**

1. Working precautions

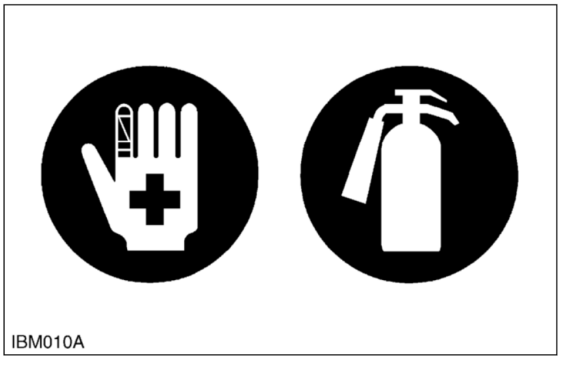


- Understand all safety instructions and safety labels in this manual.
- Park the machine on a stable and level ground then lower the attachment to check the machine safely.
- Stop the engine and remove the key when leaving the operator's seat for cleaning, maintenance, and servicing.



- Hang a DO NOT OPERATE tag near the operator's seat.
- Do not use worn or cracked tools. Use tools in a proper way with enough strength.
- In regards to the facility which is used in the workshop, follow each safety instruction.

2. Preparing for emergencies



- Keep a first aid kit and fire extinguisher ready at all times.
- Keep emergency numbers near your telephone at all times.

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Production year

Alphabet or number	Year
1	2001
2	2002
3	2003
4	2004
5	2005
6	2006
7	2007
8	2008
9	2009
A	2010
B	2011
C	2012
D	2013
E	2014
F	2015
G	2016
H	2017
J	2018
K	2019
L	2020
M	2021
N	2022
P	2023
R	2024
S	2025
T	2026
V	2027

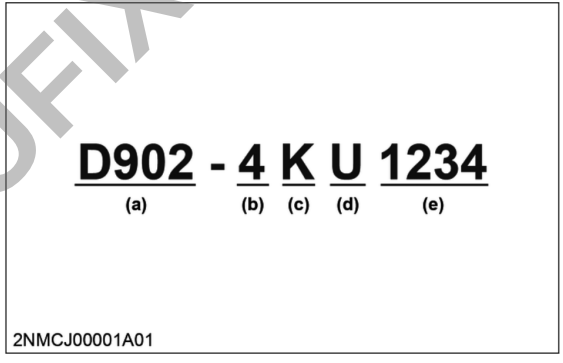
* Alphabetical letters "I" and "O" are not used.

Production month and lot number

Month	Engine lot number	
January	A0001～A9999	B0001～
February	C0001～C9999	D0001～
March	E0001～E9999	F0001～
April	G0001～G9999	H0001～
May	J0001～J9999	K0001～
June	L0001～L9999	M0001～
July	N0001～N9999	P0001～
August	Q0001～Q9999	R0001～
September	S0001～S9999	T0001～
October	U0001～U9999	V0001～
November	W0001～W9999	X0001～
December	Y0001～Y9999	Z0001～

* Alphabetical letters "I" and "O" are not used.

Example of model name and engine serial number



(a) D902: Engine model name
(b) 4: Engine series (SM series)
(c) K: Production year (2019)
(d) U: Production month (October)
(e) 0001: Lot number (0001～9999 or A001～Z999)

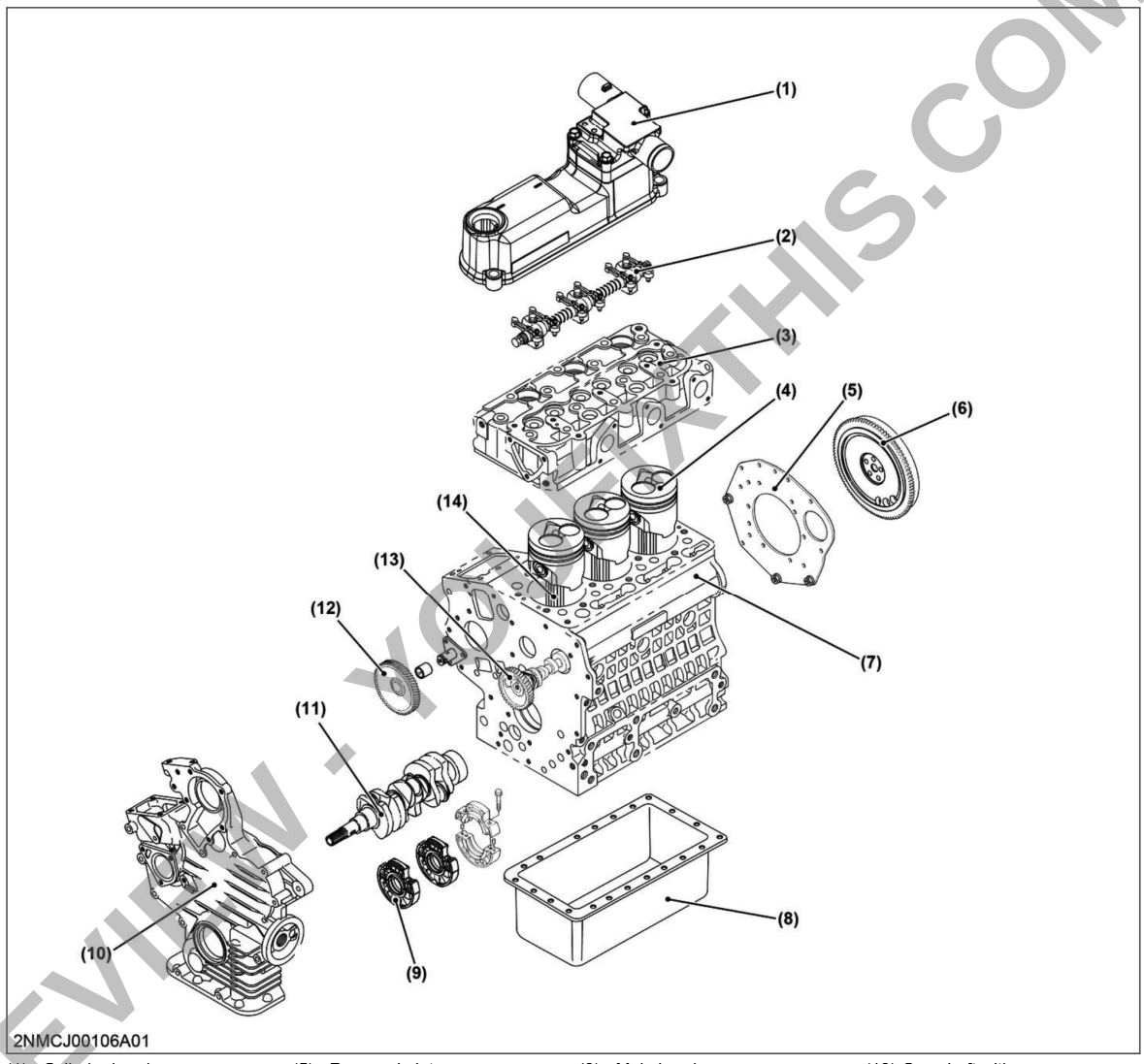
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2. Engine body

2.1 Structure of engine body

The engine body is the main part of the engine.
It is made up of related cylinders, primary motion, and valve train mechanisms.



(1) Cylinder head cover
(2) Rocker arm
(3) Cylinder head
(4) Piston
(5) Rear end plate
(6) Flywheel
(7) Crankcase
(8) Oil pan
(9) Main bearing case
(10) Gear case
(11) Crankshaft
(12) Idle gear
(13) Camshaft with cam gear
(14) Connecting rod

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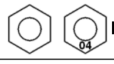
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3. Tightening torques

Refer to the following table if the tightening torques of screws, bolts and nuts are not specified in each part.

3.1 Tightening torques of screws, bolts and nuts for general use

If the tightening torque is not specified, refer to the table below for the none specified torques values.

Indication on top of bolt	 No-grade or 4T			7T		
Indication on top of nut	 No-grade or 4T					
Unit	N·m	kgf·m	lbf·ft	N·m	kgf·m	lbf·ft
M6	7.8 to 9.3	0.80 to 0.94	5.8 to 6.8	9.80 to 11.3	1.00 to 1.15	7.23 to 8.33
M8	17.7 to 20.6	1.81 to 2.10	13.1 to 15.1	23.5 to 27.5	2.40 to 2.80	17.4 to 20.2
M10	39.2 to 45.1	4.00 to 4.59	29.0 to 33.2	49.0 to 55.9	5.00 to 5.70	36.2 to 41.2
M12	62.8 to 72.6	6.41 to 7.40	46.4 to 53.5	77.5 to 90.2	7.91 to 9.19	57.2 to 66.5

3.2 Tightening torques of screws, bolts and nuts for special use

■ NOTE

- **For the screws, bolts and nuts with the mark "*", apply the engine oil to their threads and seats before you tighten.**
- **The alphabet "M" in Dimension × Pitch shows that the screw, bolt or nut dimensions are in the metric system. The dimension is the nominal external diameter in mm of the threads. The pitch is the nominal distance in mm between 2 threads.**

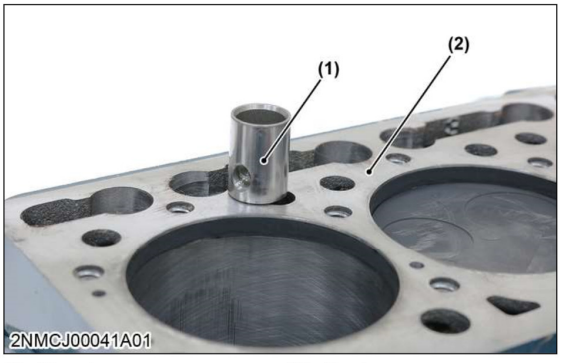
Disassembling and assembling

Item	Dimension × Pitch	N·m	kgf·m	lbf·ft
Drain plug with copper gasket	M12 × 1.25	33.0 to 37.0	3.37 to 3.77	24.4 to 27.2
	M22 × 1.5	64.0 to 73.0	6.53 to 7.44	47.2 to 53.8
Drain plug with rubber coated gasket	M22 × 1.25	45.0 to 53.0	4.59 to 5.40	33.2 to 39.0
Drain plug (D902-TE4)	M22 × 1.5	44.1 to 53.9	4.50 to 5.49	32.6 to 39.7
Dynamo pulley nut	M10 × 1.25	29.4 to 34.3	3.00 to 3.49	21.7 to 25.2
Alternator pulley nut	—	58.4 to 78.9	5.95 to 8.05	43.1 to 58.2
Starter terminal B mounting nut (Electromagnetic drive type)	M8	7.9 to 9.8	0.81 to 0.99	5.9 to 7.2
Starter terminal B mounting nut (Planetary gear reduction type)	M8	5.9 to 11	0.61 to 1.1	4.4 to 8.1
*Main bearing case screw 1	M6 × 1.0	12.7 to 15.7	1.30 to 1.60	9.37 to 11.5
*Main bearing case screw 2	M7 × 1.0	26.5 to 30.4	2.71 to 3.09	19.6 to 22.4
*Flywheel screw	M10 × 1.25	53.9 to 58.8	5.50 to 5.99	39.8 to 43.3

(Continued)

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1. Remove the tappet (1) from the crankcase (2).



(1) Tappet (2) Crankcase

5.14 Removing valve

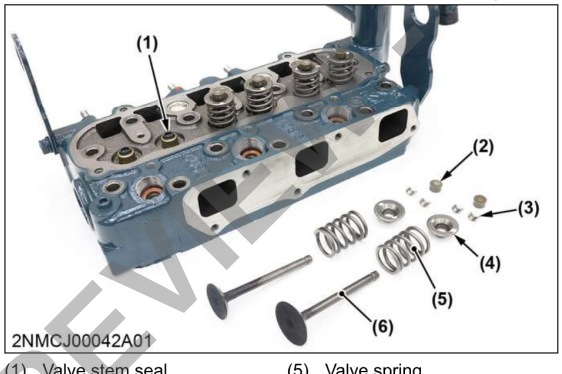
■ NOTE

- **Mark the cylinder number to the valve to prevent interchanging.**

Tools required

- Valve spring compressor

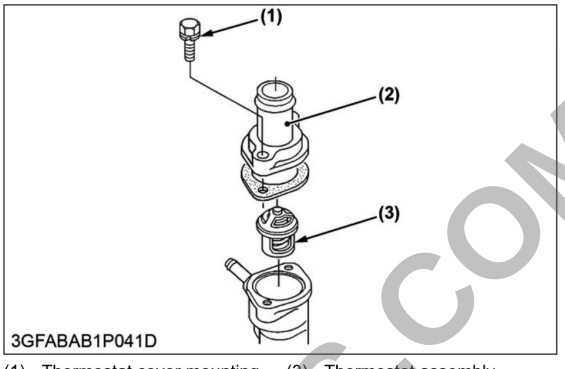
1. Remove the valve cap (2).
2. Push the valve spring (5) with the valve spring retainer (4) by valve spring compressor and remove the valve spring collet (3).
3. Remove the valve spring (5), valve spring retainer (4) and valve (6).
4. Remove the valve stem seal (1).



(1) Valve stem seal
(2) Valve cap
(3) Valve spring collet
(4) Valve spring retainer
(5) Valve spring
(6) Valve

5.15 Removing thermostat assembly

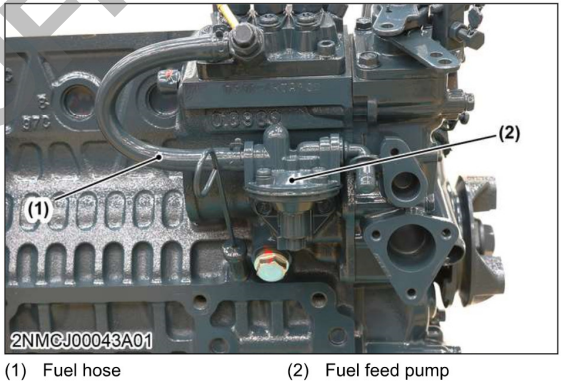
1. Remove the thermostat cover mounting screws (1), and remove the thermostat cover (2).
2. Remove the thermostat assembly (3).



(1) Thermostat cover mounting screw
(2) Thermostat cover
(3) Thermostat assembly

5.16 Removing fuel injection pump (Energized to stop type engine stop solenoid)

1. Remove the fuel hose (1) and the fuel feed pump (2).



(1) Fuel hose (2) Fuel feed pump

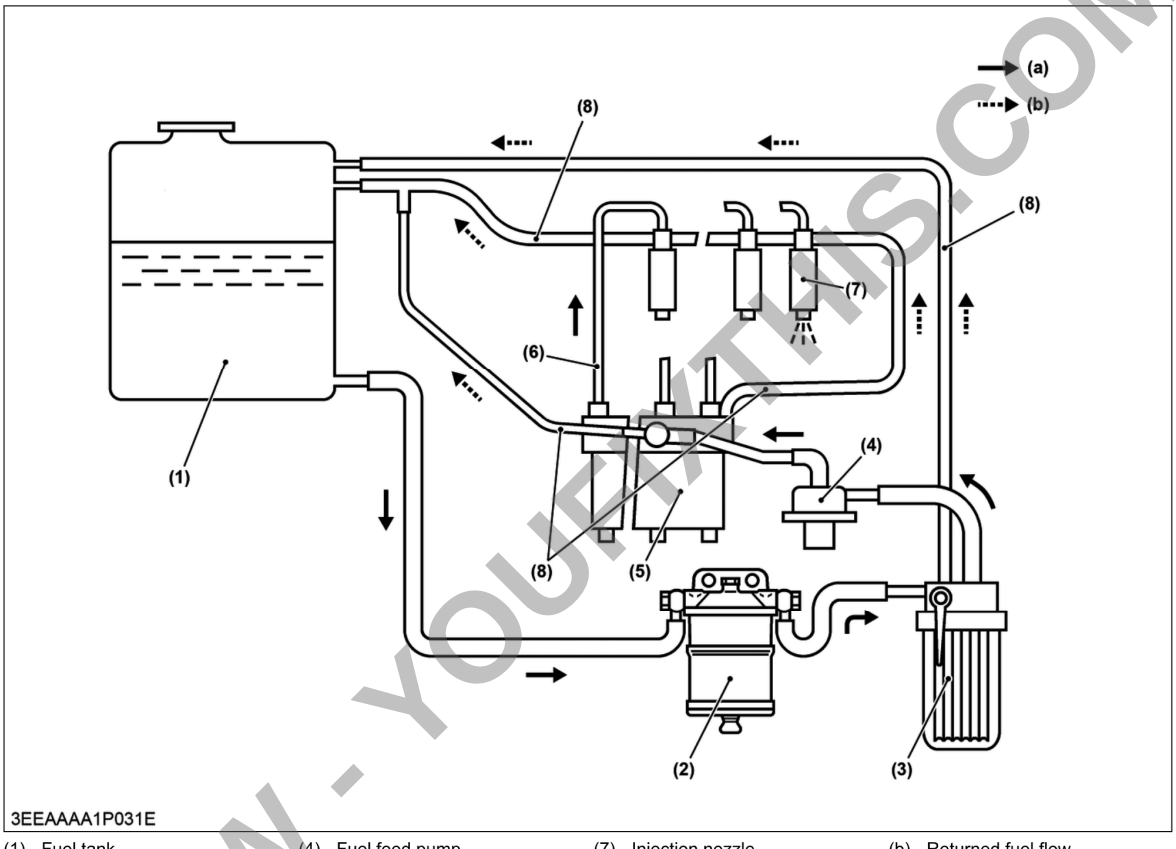
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3. Fuel system

3.1 Structure of fuel system

The fuel system is made up of an injection pump, an injection nozzle, a fuel feed pump, and the like.
(When the position of a fuel tank is high)



(1) Fuel tank
(2) Water separator
(3) Fuel filter
(4) Fuel feed pump
(5) Injection pump
(6) Injection pipe
(7) Injection nozzle
(8) Fuel overflow pipe
(a) Injected fuel flow
(b) Returned fuel flow

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SERVICING

1. Troubleshooting

1.1 Troubleshooting for engine

This "Troubleshooting" shows mechanical failures.

Symptom	Probable cause and checking procedure	Solution	Reference page
The engine does not start	1. No fuel	Fill up the fuel	—
	2. Air in the fuel system	Bleed the air	—
	3. Water in the fuel system	Change the fuel and repair or replace the fuel system	3-9 3-14
	4. The injection pump is damaged	Replace	4-92 4-122
	5. The fuel hose is clogged	Clean or replace	3-9
	6. The fuel filter is clogged	Clean or replace	3-13 3-17
	7. The viscosity of fuel at low temperature is too high	Replace the specified fuel	3-1
	8. The cetane number of fuel is low	Replace the specified fuel	3-1
	9. Fuel leakage because of loose injection pipe retaining nut	Tighten the retaining nut	4-129
	10. The injection timing is incorrect	Adjust	3-23
	11. The fuel camshaft is worn out	Replace	4-98 4-116
	12. The injection nozzle is clogged	Clean or replace	4-89 4-129 4-88 4-129
	13. Seizure of the crankshaft, camshaft, piston or bearing	Repair or replace	4-98 4-117 4-99 4-115 4-102 4-110
	14. Compression leakage from the cylinder	Replace the head gasket Tighten the cylinder head screw	4-91 4-126
	15. Incorrect valve timing	Check the timing gear	4-117

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2. Specifications

2.1 Specification for Z482-E4

Model		Z482-E4
Number of cylinder		2
Type		Vertical, Water-cooled, 4 cycle IDI diesel engine
Bore × stroke		67.0 × 68.0 mm (2.64 × 2.68 in.)
Total displacement		479.0 cm^3 (29.23 cu.in.)
SAE net continuous		8.10 kW/3600 min^{-1} (rpm) (10.9 HP/3600 min^{-1} (rpm))
SAE net intermittent		9.30 kW/3600 min^{-1} (rpm) (12.5 HP/3600 min^{-1} (rpm))
SAE gross intermittent		9.90 kW/3600 min^{-1} (rpm) (13.3 HP/3600 min^{-1} (rpm))
Maximum bare speed		3800 min^{-1} (rpm)
Minimum bare idling speed		1250 to 1350 min^{-1} (rpm)
Combustion chamber		Spherical type (E-TVCS)
Fuel injection pump		Bosch MD type mini pump
Governor		All speed mechanical governor
Direction of rotation		Counter-clockwise (viewed from flywheel side)
Injection nozzle		Bosch "Throttle" type
Injection timing		0.33 rad (19°) before T.D.C.
Firing order		1-2
Injection pressure		13.73 MPa (140.0 kgf/cm^2, 1991 psi)
Compression ratio		23.5 : 1
Lubricating system		Forced lubrication by trochoid pump
Oil pressure indicating		Electrical type switch
Lubricating Filter		Full flow paper filter (Cartridge type)
Cooling system		Pressurized radiator, forced circulation with water pump (not included in the basic engine)
Starting system		Electric starting with starter
Starting motor		12 V, 0.8 kW
Starting support device		By glow plug in combustion chamber
Battery		12 V, 28 AH equivalent
Charging alternator		12 V, 150 W
Fuel		Diesel fuel No. 2-D, see page 3-1.
Lubricating oil		Class CF lubricating oil as per API classification is recommended. For details on recommended lubricating oils, see page 3-1.
Lubricating oil capacity	Oil pan depth 101 mm (3.98 in.)	2.1 L (0.55 U.S.gals)
	Oil pan depth 121 mm (4.76 in.)	2.5 L (0.66 U.S.gals)
Weight (Dry)		53.1 kg (117 lbs)

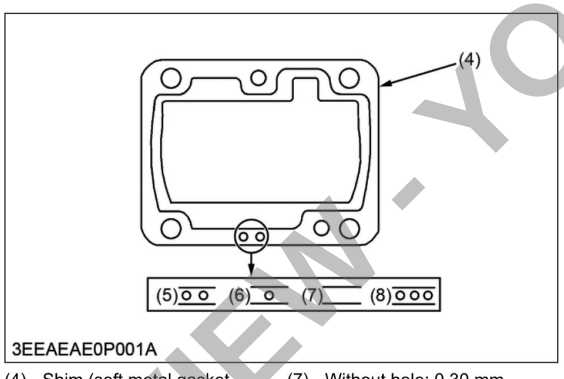
NOTE
- ***The specification described above is of the standard engine of each model.**
- ***Conversion Formula: HP = 0.746 kW, PS = 0.7355 kW**

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7. If injection timing is out of adjustment, readjust the timing with shims.

■ NOTE

- **The liquid gasket is not required for assembling.**
- **Shims are available in thickness of 0.20 mm (0.0079 in.), 0.25 mm (0.0098 in.), 0.30 mm (0.012 in.), 0.35 mm (0.014 in.) and 0.175 mm (0.00689 in.).**
  Combine these shims for adjustments.
- **Addition or reduction of a shim (0.050 mm, 0.0020 in.) delays or advances the injection timing by approx. 0.0087 rad (0.5°).**
- **During disassembling and replacing the injection pump, be sure to use the same number of new shims with the same thickness.**
- **The 0.175 mm (0.00689 in.) thick shim is coated only on the lower face.**
  Therefore, do not use the 0.175 mm (0.00689 in.) thick shim as the top shim of the combination (injection pump side), because this can cause oil leakage.
- **Refer to the figure of the shim to check the thicknesses of the shims.**
- **The injection timing might be changed by the application.**



(4) Shim (soft metal gasket shim)
(5) Two-holes: 0.20 mm (0.0079 in.)
Two-holes: 0.175 mm (0.00689 in.)
(6) One-hole: 0.25 mm (0.0098 in.)
(7) Without hole: 0.30 mm (0.012 in.)
(8) Three-holes: 0.35 mm (0.014 in.)

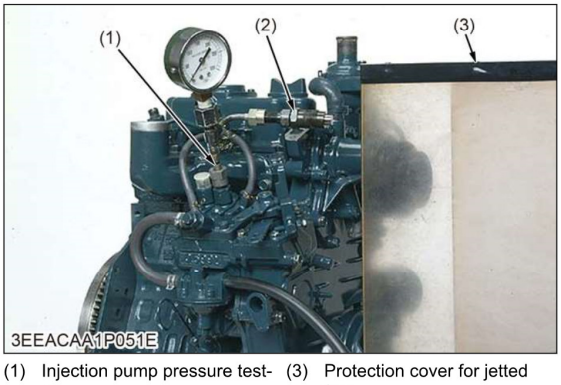
Injection timing		
Engine model	(min^{-1} (rpm))	Service specification
Z482/D602-E4	3600	0.3186 to 0.3447 rad 18.25 to 19.75° before T.D.C
D722-E4	3200	0.3360 to 0.3621 rad 19.25 to 20.75° before T.D.C
D782-E4	3200	0.2837 to 0.3097 rad 16.25 to 17.75° before T.D.C
D902-E4	3600	0.3186 to 0.3447 rad 18.25 to 19.75° before T.D.C
D902-TE4	3200	0.3360 to 0.3621 rad 19.25 to 20.75° before T.D.C

4.19 Checking fuel tightness of pump element

Tools required

- Injection pump pressure tester

1. Remove the injection pipes and glow plugs.
2. Install the injection pump pressure tester (1) to the injection pump.
3. Install the injection nozzle (2) jetted with the proper injection pressure to the injection pump pressure tester (1). (Refer to the photo.)



(1) Injection pump pressure tester
(2) Injection nozzle
(3) Protection cover for jetted fuel

4. Set the speed control lever to the maximum speed position.

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