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)

Special Tool Classification

A; Essential tool

Servicing operation cannot be done with any other tools than the essential tool.

B; Recommended tool

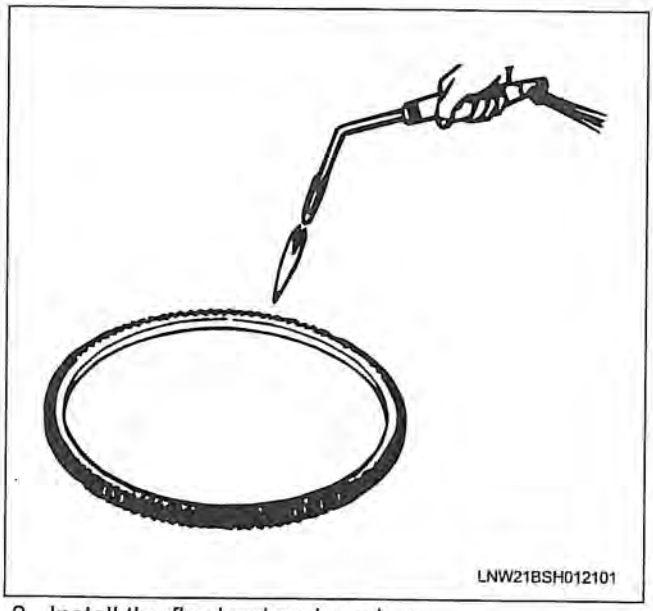
Servicing work can be done with a general-purpose tool commercially available.
However, it is advisable to use the recommended tool as much as possible for a reduced work time and an improved safety in work operations.

C; Available tool

Although it takes a more working time, servicing operations can be made with a tool commercially available as substitute for the available tool.

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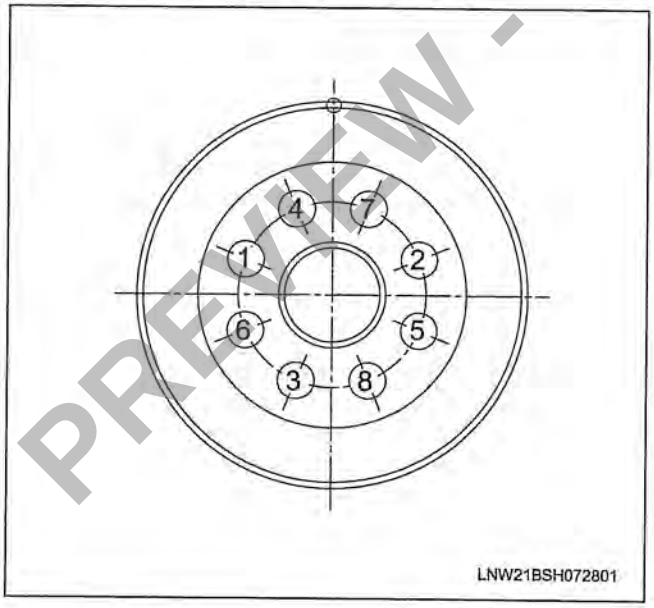
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2. Install the flywheel and washer.
   - Install the flywheel to the crankshaft, and tighten in the order shown in the illustration.
   - Apply engine oil to the threads of the bolt.
   - Install the crankshaft stopper to the starter installing portion of the flywheel housing.

Tightening torque:
1st step=59 N·m (6.0 kg·m/43 lb ft)
2nd step=60° — 90°

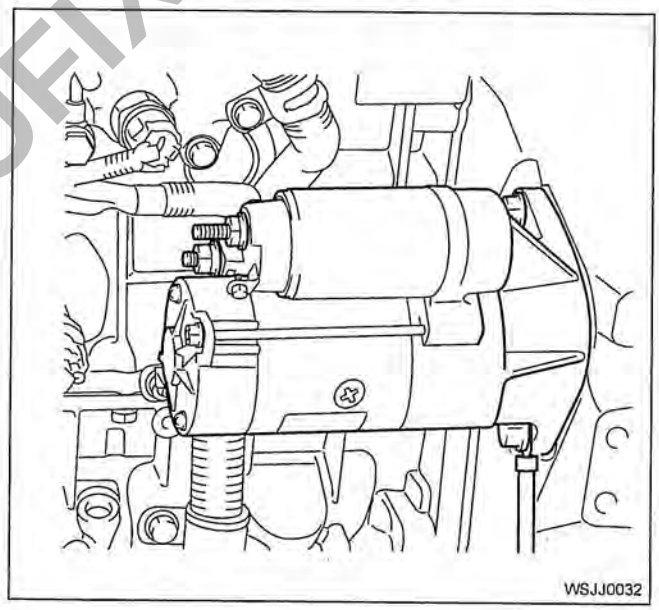
Special tool
Crankshaft stopper
Angle gauge:
5-8840-0266-0 (J-45059, KM470-B)





3. Install the starter motor and ground cable to the flywheel housing and tighten the bolt to the specified torque.

Tightening torque: 97 N·m (9.9 kg·m/72 lb ft)



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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	Litle, L, cc	1 Litle = 1 dm^3, 1 cc = 1mLitle = 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/cm^2 = 19,620 kPa = 19.6 MPa
- 40 mmHg = 5,332 Pa = 5.3 kPa

Conversion formula

Length
- km × 0.6214 = mile
- m × 3.281 = ft
- mm × 0.03937 = in

Pressure
- kPa × 0.0101972 = kg/cm^2
- kPa × 0.145038 = psi
- MPa × 10.197162 = kg/cm^2
- MPa × 145.03774 = psi

Tightening torque
- N·m × 0.101972 = kg·m
- N·m × 0.737562 = lb ft

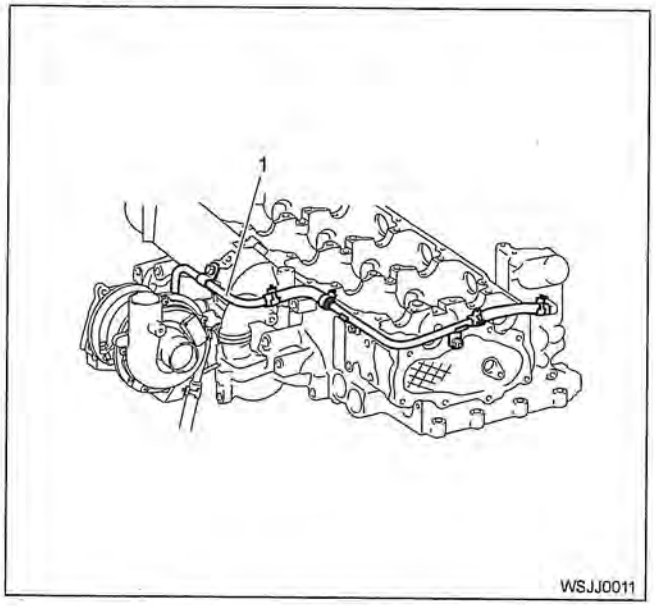
Speed
- kg/h × 0.6214 = MPH

Temperature
- °C × 1.8 + 32 = °F

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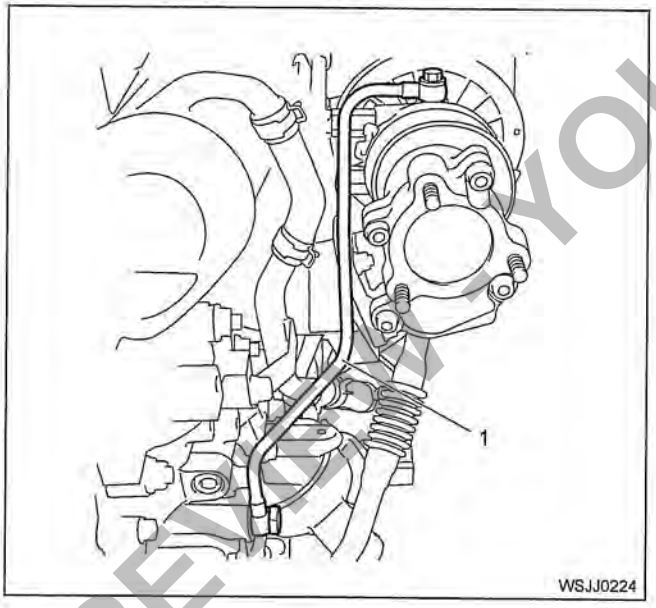
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17. Disconnect the water feed pipe on the turbocharger.



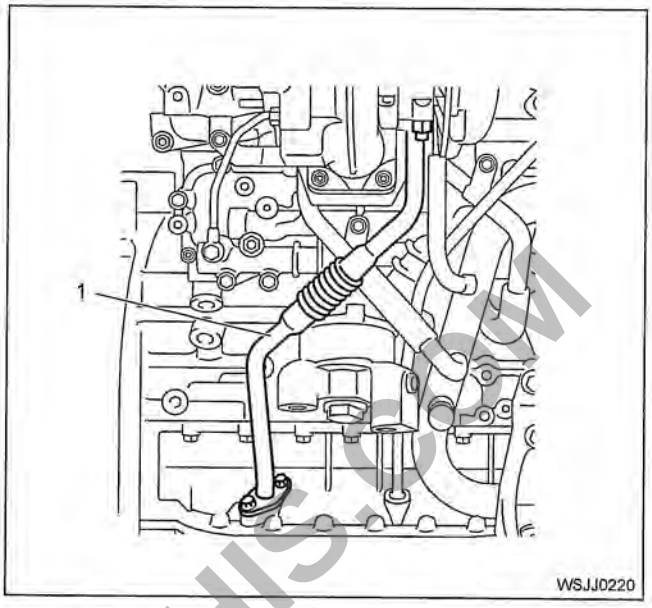
Name
1. Water Feed Pipe

18. Disconnect the oil feed pipe on the turbocharger.



Name
1. Oil Feed Pipe

19. Disconnect the oil return pipe on the turbocharger.



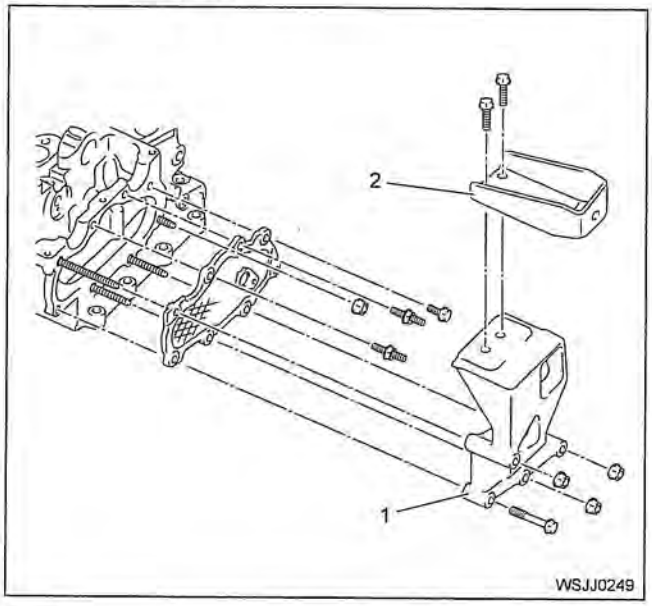
Name
1. Oil Return Pipe

20. Disconnect the fuel injection pipe.

Important:
Do not reuse the high-pressure pipe in fuel system if it has been removed.
Refer to "Fuel Injector" in the Fuel System section.

21. Remove the timing chain cover lower.
Refer to "Fuel Supply Pump" in the Fuel System section.

22. Remove the fan shroud bracket upper and the fan shroud stay upper.



Name
1. Fan Shroud Bracket Upper
2. Fan Shroud Stay Upper

23. Remove the timing chain cover upper.

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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

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Fuel System

Precautions on Service Work

Parts of the fuel system such as the internal part of the fuel injector, holes and clearances that form passages for fuel are finished to a very high degree of accuracy. They are therefore highly sensitive to foreign matter and the entry of foreign matter could cause damage to the fuel passage. Take extreme care not to allow foreign matter to enter.

If water removal agent is used in the fuel then it will absorb moisture in the light oil and may cause rust. Therefore, do not use water removal agent in the fuel tank.

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.
- Always replace the high-pressure pipe in fuel system with new one if it has been removed. Reuse of it causes damage to the seal surface, resulting in fuel leakage.
- If parts are to be replaced (fuel hose, fuel pipe, etc.), do not open the new part packaging until installation.

Discard gaskets and O-rings and replace them with new ones.

Work procedure

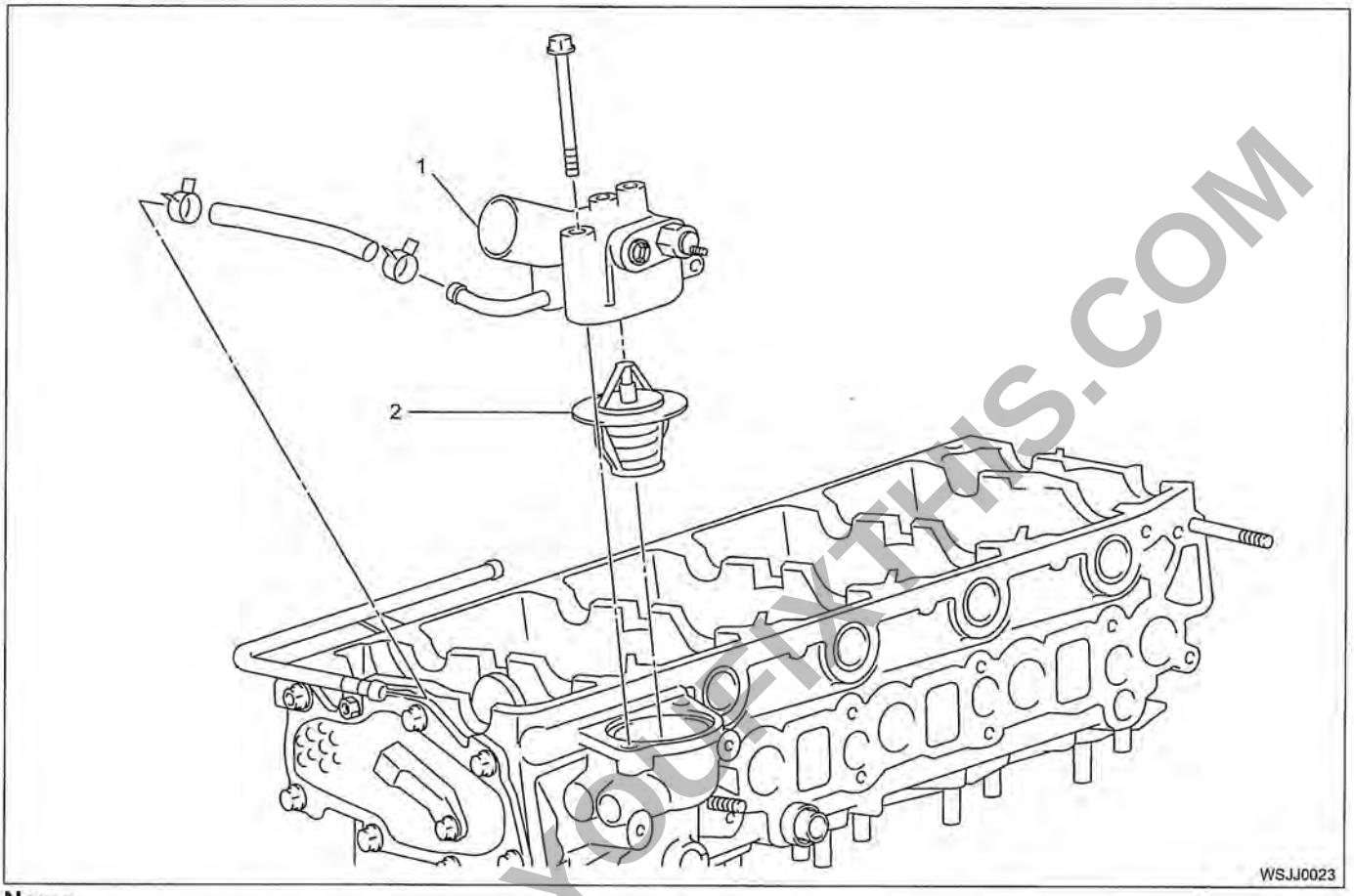
- The fuel opening must be quickly sealed when removing the fuel pipe, injection pipe, fuel injector, fuel supply pump, and common rail.
- The eyebolts and gasket must be stored in a clean parts box with a lid to prevent adhesion of foreign matter.
- Fuel leakage could cause fires. Therefore, after finishing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

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Thermostat

Components

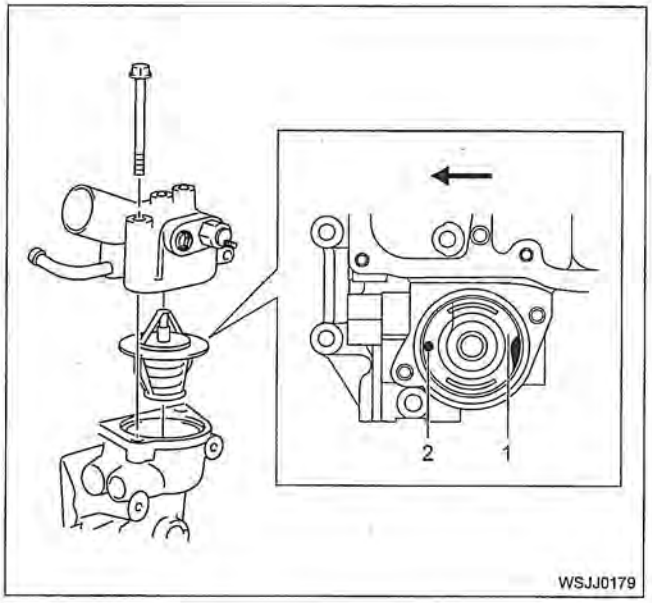


Name

1. Water Outlet Pipe
2. Thermostat

Removal

1. Drain the coolant. Prepare the container for discharging and use it for replenishment when mounting the thermostat. Set the discharge of cooling water such that the water does not flow out of the thermostat housing.
2. Disconnect the radiator upper hose.
3. Remove the engine harness clip.
4. Disconnect the water outlet pipe.
   - Disconnect the turbocharger water feed hose from the water outlet pipe.
5. Remove the thermostat.
   - Be careful not to damage the thermostat.



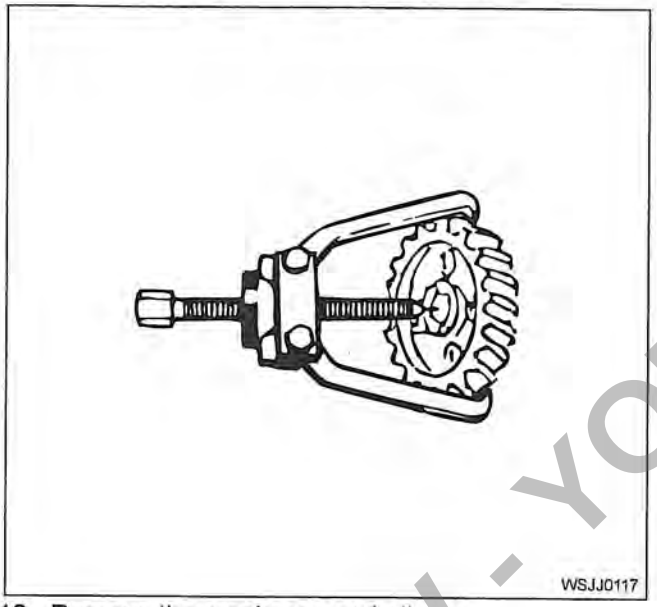
Name

1. Thermostat
2. Jiggle Valve

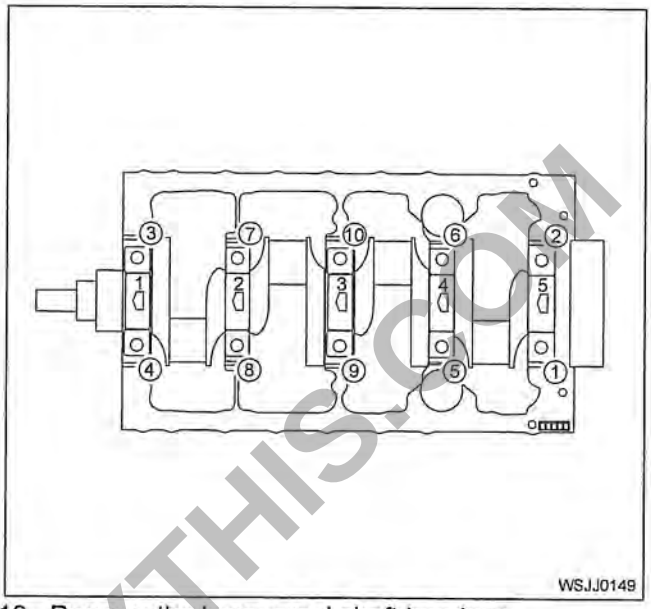
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9. Remove the crankshaft rear oil seal.
   Refer to the "Crankshaft Rear Oil Seal".
10. Remove the water pump.
    Refer to the "Water Pump" in the Cooling System Section.
11. Remove the gear case cover.
    Refer to the "Timing Gear Train".
12. Remove the timing gear train.
    Refer to the "Timing Gear Train".
13. Remove the oil pump.
    Refer to the "Oil Pump".
14. Remove the gear case ASM.
    Refer to "Gear Case ASM".
15. Remove the crankshaft gear.
    - Remove the gear using a gear puller.


WSJJ0117

16. Remove the crankcase and oil pan.
    Refer to "Crankcase, Oil Pan".
17. Remove the piston and connecting rod.
    Refer to the "Piston, Connecting Rod".
18. Remove the bearing cap.
    - Gradually loosen the installation bolts of crankshaft bearing cap in the order shown in the illustration.

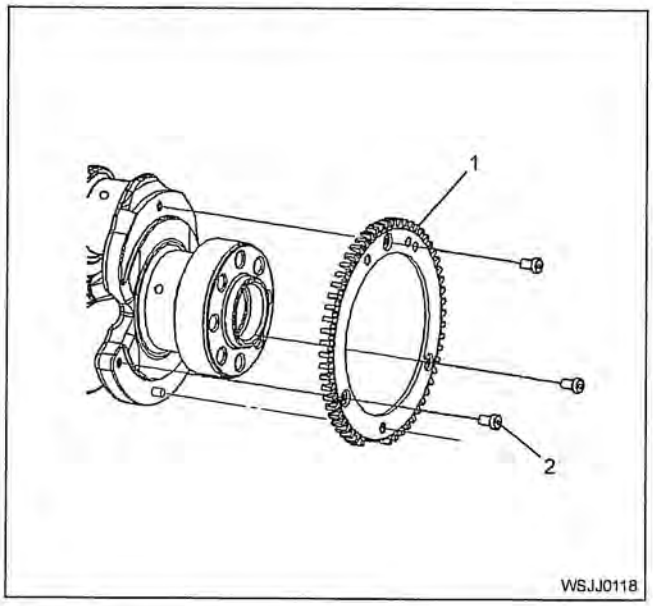


WSJJ0149

19. Remove the lower crankshaft bearings.
20. Remove the crankshaft ASM.
21. Remove the thrust bearing.
22. Remove the upper crankshaft bearings.

Disassembly

1. Remove the CKP sensor rotor.



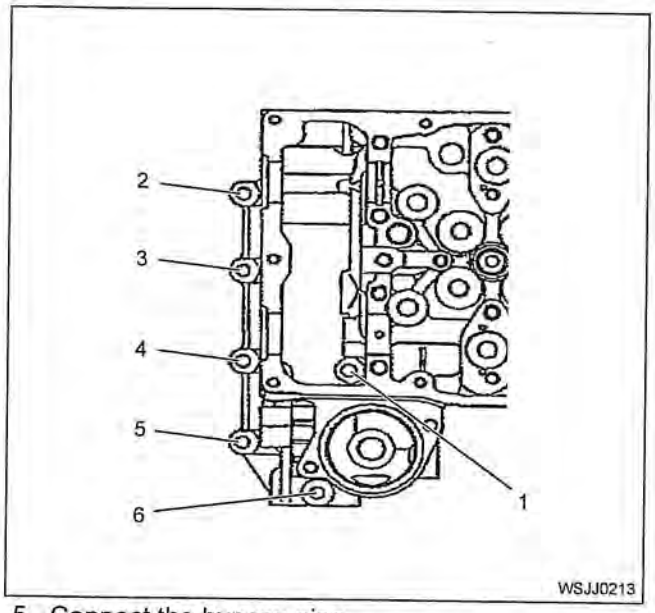
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Name

1. CKP Sensor Rotor
2. Bolt

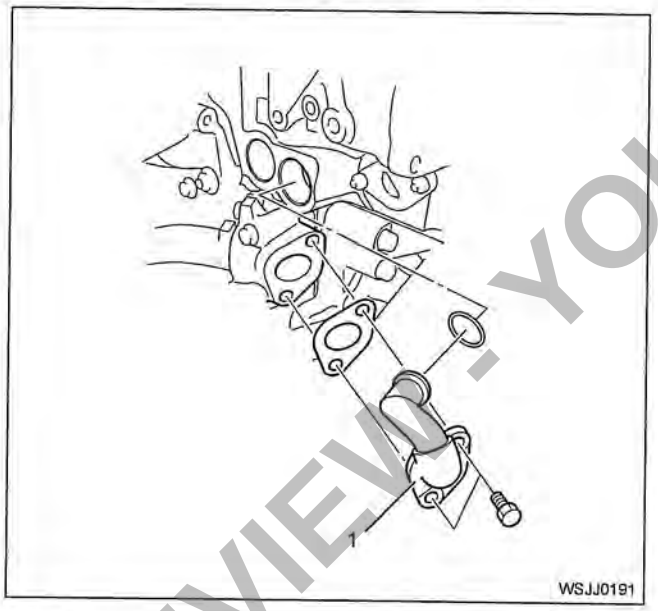
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5. Connect the bypass pipe.
   - Apply soap water to the O-ring.

Tightening torque: 25 N·m (2.5 kg·m/18 lb ft)

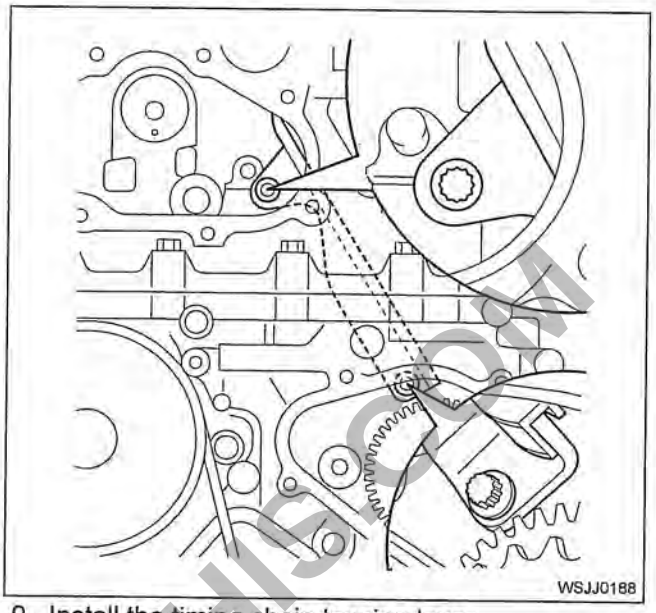


Name

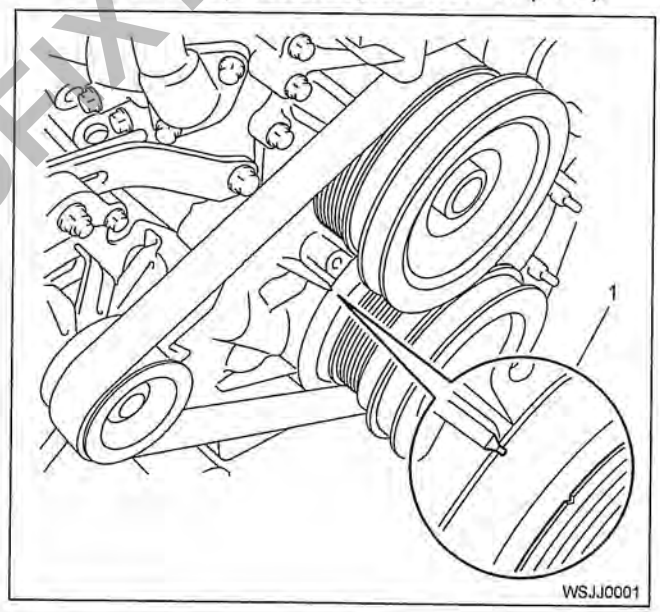
1. Bypass Pipe

6. Install the valve stem end cap.
   - Apply engine oil.
7. Install the rocker arm shaft ASM.
   Refer to "Rocker Arm Shaft ASM".
8. Install the bolt of the chain guide to the cylinder head.

Tightening torque: 25 N·m (2.5 kg·m/18 lb ft)



9. Install the timing chain tension lever.
10. Rotate the crankshaft to make the No.1 cylinder meet the compression top dead center (TDC).



Name

1. TDC

11. Install the timing chain together with the idle gear D.
    - Apply engine oil to the threads and the seating surface of the bolt, and to the part where the gear of the idle gear shaft is to be put together.

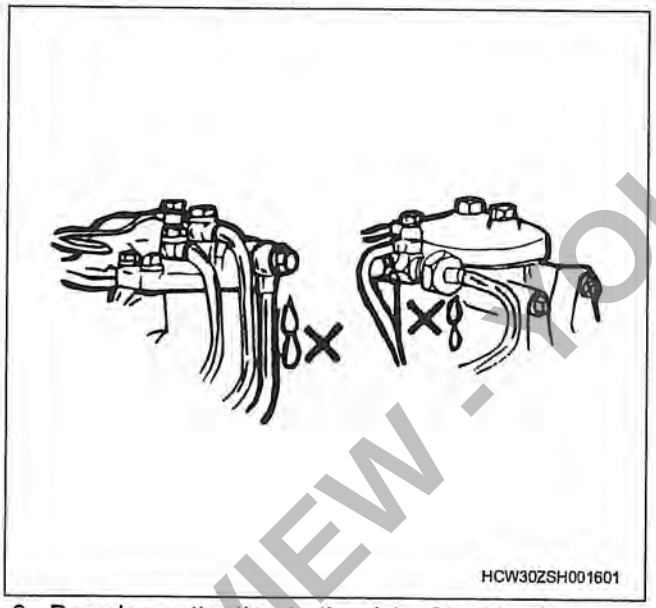
Tightening torque: 59 N·m (6.0 kg·m/43 lb ft)

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WSHK0191

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


HCW30ZSH001601

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


WSHK0192

Replacement parts and part numbers.

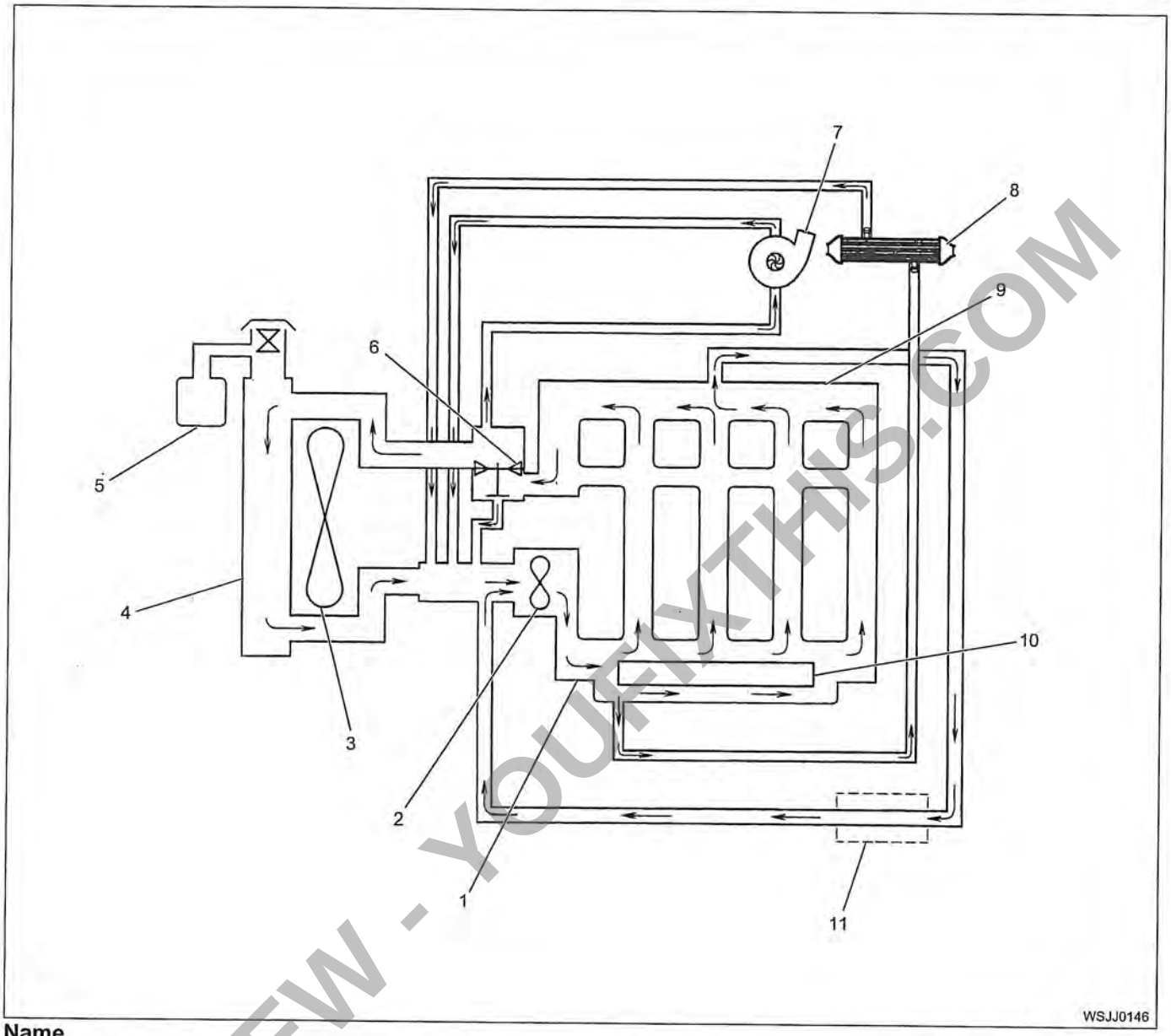
1. Always replace packing, oil seals, o-rings, caulking lock nuts, folding lock plates, split pins and other such parts with brand new parts.
2. The parts numbers contained in this manual may not represent the supply condition of the parts, and the part numbers may be changed due to revisions. Therefore, 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 5 minutes of applying the liquid gasket.

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Name

1. Cylinder Block
2. Water Pump
3. Cooling Fan
4. Radiator
5. Reserve Tank
6. Thermostat
7. Turbocharger
8. EGR Cooler
9. Cylinder Head
10. Oil Cooler
11. Heater

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