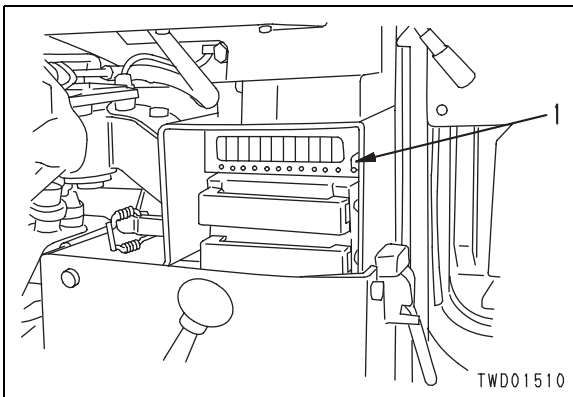


MEASURING ENGINE SPEED

★ Measure the engine speed using the monitoring mode and the adjustment mode of the monitor panel.

For an overall explanation of the monitoring mode and the adjustment mode, see MONITOR PANEL DISPLAY AND SPECIAL FUNCTIONS.

1. Turn the starting switch ON.
2. Turn service switch (1) ON.
 - ★ The service switch is installed inside the fuse box.



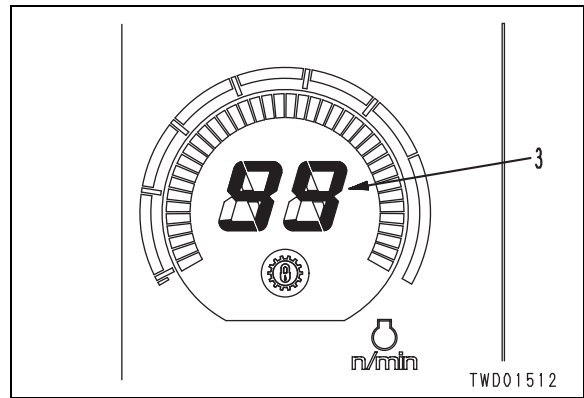
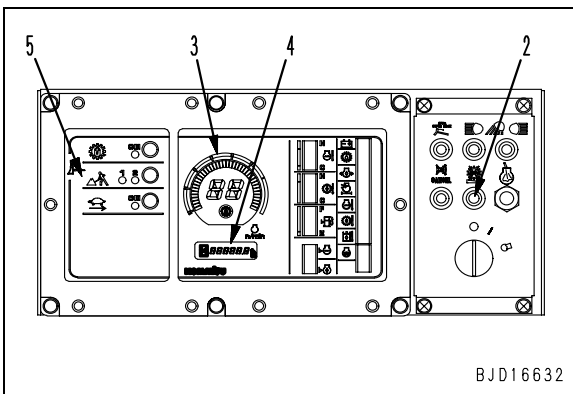
3. Hold buzzer cancel switch (2) for at least 7 seconds at the ON position and switch display (3) at the top of the panel.

★ One of [99], [CH], [01], or [- -] is displayed on the display at the top of the panel.

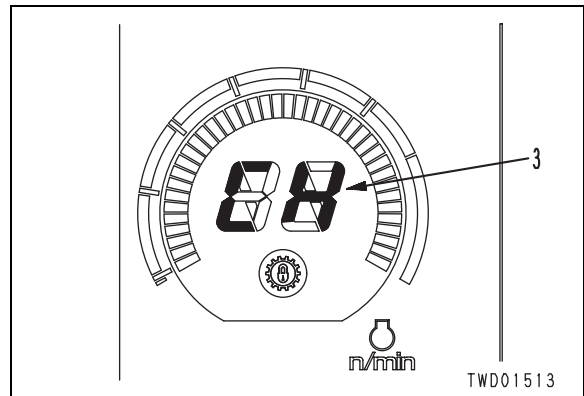
4. Start the engine, and measure the speed with the number displayed on display (4) at the bottom of the panel when the following conditions are set.

★ The engine speed is shown in units of 1 rpm on the display at the bottom of the panel.

- 1) Measuring low idling speed:
 - i) Turn economy mode switch (5) OFF, and display [99] on display (3) at the top of the panel.
 - ii) Set the joystick and blade control lever to the neutral position and set the fuel control dial to the MIN position.



- 2) Measuring engine high idling speed:
 - i) Turn economy mode switch (5) to 1, and display [CH] on display (3) at the top of the panel.
 - ii) Set the joystick and blade control lever to the neutral position and set the fuel control dial to the MAX position.



5. After completing the measurement, turn starting switch (5) OFF and switch the panel to the normal mode.

★ For details of MEASURING TORQUE CONVERTER STALL SPEED and MEASURING TORQUE CONVERTER STALL + HYDRAULIC PUMP RELIEF SPEED, see the separate respective items.

MEASURING AIR SUPPLY PRESSURE (BOOST PRESSURE)

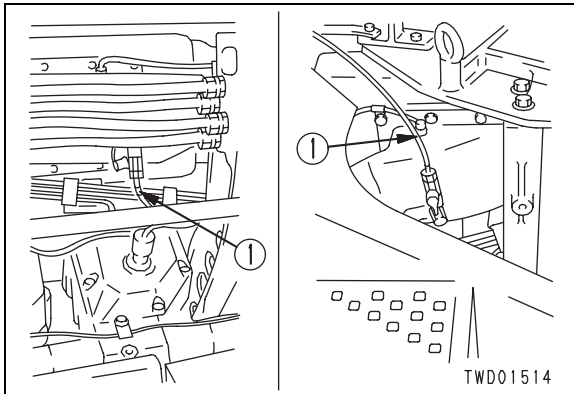
- ★ Measuring instruments for intake air (boost) pressure

Symbol	Part No.	Part Name
H	799-201-2202	Boost gauge kit

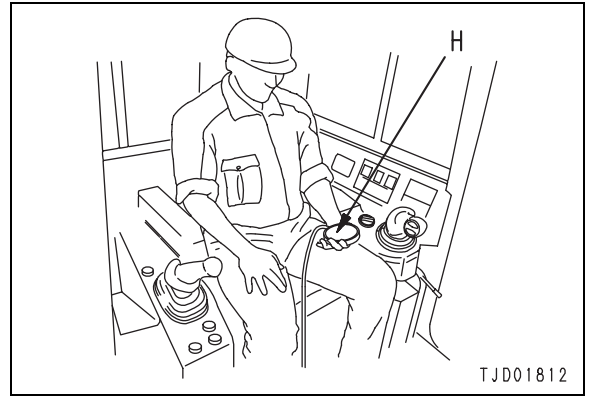
⚠ Be careful not to touch any hot parts when removing or installing the measuring tools.

- ★ Measure the air supply pressure separately for the left and right banks.
- ★ Measure the air supply pressure under the following conditions.
 - Coolant temperature: Within operating range
 - Power train oil temperature: Within operating range
 - Hydraulic temperature: 45 – 55°C

1. Fit hose [1] of pressure gauge kit H, then connect boost gauge H.



2. Run the engine at a mid-range speed or above to bleed the oil from the hose.
 - ★ Insert the connection of the hose and pressure gauge about half way, repeat the action to open the self-seal portion at the hose end, and bleed the oil.
 - ★ If Pm kit A is available, the air bleed coupling (790-261-1130) inside the kit can be used.
 - ★ If there is oil inside the hose, the gauge will not work, so always bleed the oil.



3. Run the engine at high idling to stall the torque converter, and read the air supply pressure (boost pressure).
 - ★ For details of the procedure for stalling the torque converter, see MEASURING TORQUE CONVERTER STALL SPEED.
 - ★ The air supply pressure (boost pressure) should be measured with the engine running at rated output. However, when measuring in the field, a similar value can be obtained at torque converter stall speed.

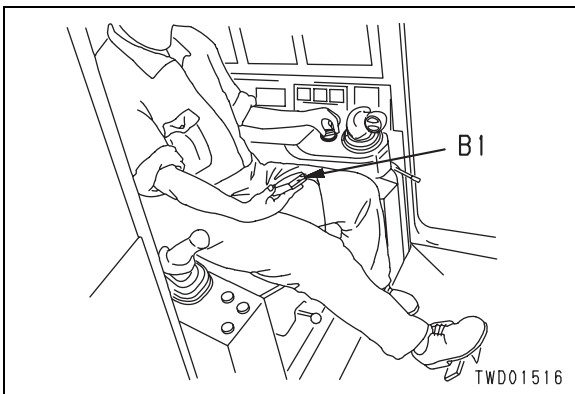
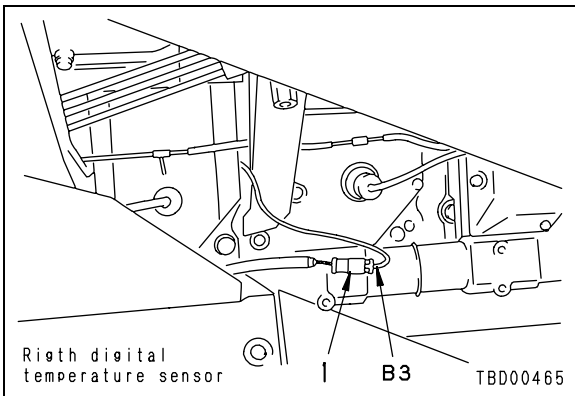
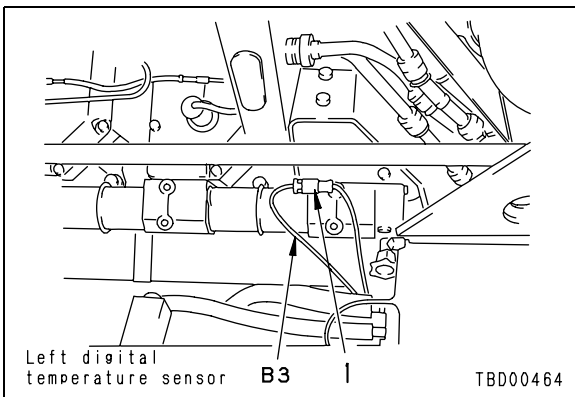
MEASURING EXHAUST TEMPERATURE

★ Measuring instrument for exhaust temperature

Symbol	Part No.	Part Name	
B	1	799-101-6000	Digital temperature gauge
	2	6215-11-8180	Exhaust temperature sensor
	3	799-601-9020	Adapter

★ Raise the coolant temperature to the operating range before measuring.

1. Connect digital temperature gauge **B1** to connector (1) of the exhaust temperature sensor **B2**, with wiring harness **B3**.



Measurement procedure

1. **When measuring in order to adjust the fuel injection amount of the left and right banks**

Measure the exhaust temperature in two ways: with the engine at low idling, and with the engine at high idling with the torque converter stalled.

- When measuring with the torque converter stalled, measure as follows.

- 1) Raise the exhaust temperature by using torque converter stall + hydraulic pump relief (relieved by using PITCH BACK).

★ Approx. 20 seconds

- 2) Stop relieving the hydraulic pump and continue the torque converter stall only.

- 3) The exhaust temperature will drop slightly and become stable, so measure the temperature at this point (left and right at the same time).

★ If only the torque converter is stalled, even if the torque converter overheats, the exhaust temperature will rise but will not become stable.

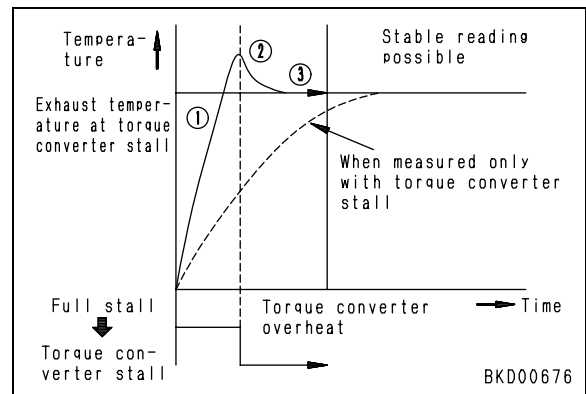
For this reason, always use the above procedure.

2. **When measuring the maximum value for the exhaust temperature**

Carry out actual work and measure the maximum value during operation.

Note:

The exhaust temperature varies greatly according to the ambient temperature (temperature of the engine intake air), so if any abnormal value is obtained, carry out temperature compensation.)



MEASURING EXHAUST COLOR

★ Measuring instruments for exhaust gas color

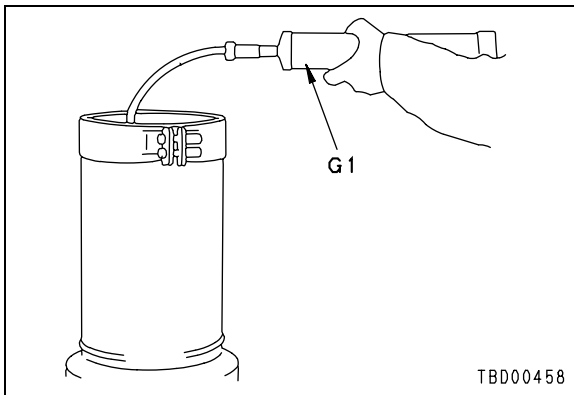
Symbol	Part No.	Part Name
G	1	799-201-9001 Handy smoke checker
	2	Commercially available Smoke meter

- When measuring in the field where there is no air or electric power supply, use **G1**; when recording formal data, use **G2**.
- ★ Raise the coolant temperature to the operating range before measuring.

⚠ When measuring the exhaust color, be careful not to touch the exhaust pipe.

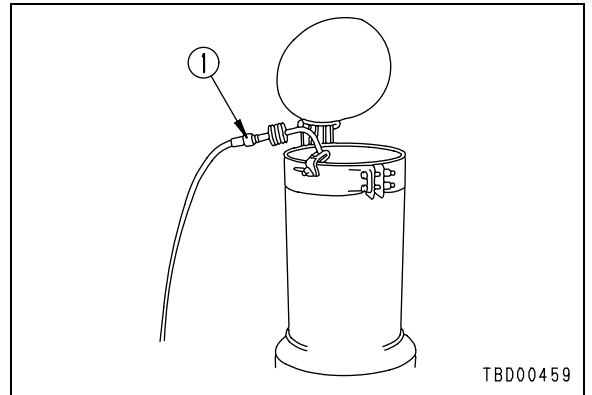
Measuring with G1

- 1) Install filter paper to tool **G1**.
- 2) Insert the exhaust gas suction port into the exhaust pipe, accelerate the engine suddenly, and operate the handle of tool **G1** at the same time to collect the exhaust gas on the filter paper.
- 3) Remove the filter paper and compare it with the scale supplied to judge the condition.

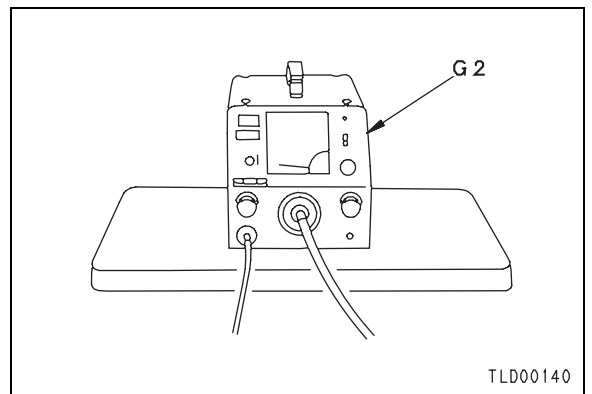


Measuring with G2

- 1) Insert probe [1] into the outlet port of the exhaust pipe, and tighten the clip to secure it to the exhaust pipe.



- 2) Connect the air hose to tool **G2**.
 - ★ Keep the pressure of the air supply below 1.5 MPa {15 kg/cm²}.
- 3) Connect the power cord to the power source socket.
 - ★ When connecting the cord, check that the power switch of tool **G2** is OFF.
- 4) Loosen the cap nut of the suction pump, and fit the filter paper.
 - ★ Fit the filter paper securely so that the exhaust gas cannot leak.
- 5) Turn the power switch of tool **G2** ON.
- 6) Accelerate the engine suddenly, and depress the accelerator pedal of tool **G2** at the same time to collect the exhaust gas color on the filter.
- 7) Place the filter paper used to catch the exhaust gas color on top of at least 10 sheets of unused filter paper inside the filter paper holder, and read the value shown.



ADJUSTING VALVE CLEARANCE

★ Adjusting instrument for valve clearance

Symbol	Part No.	Part Name
F	Commercially available	Clearance gauge

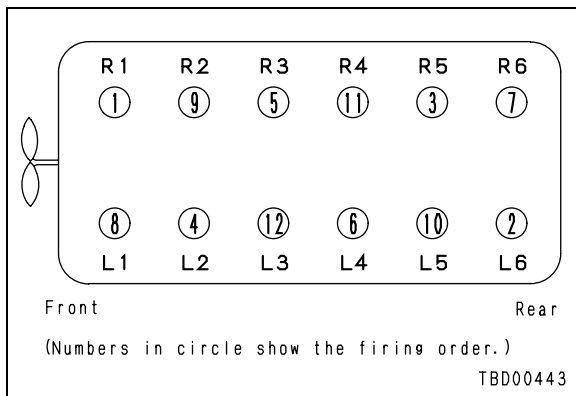
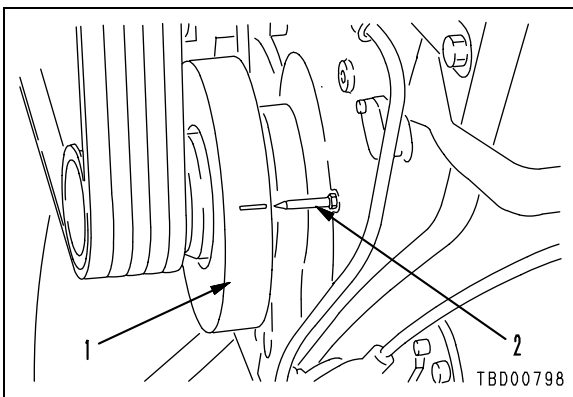
★ Adjust the clearance between the crosshead and rocker arm as follows.

Unit:mm

	Intake valve	Exhaust valve
Both hot and cold	0.4	1.0

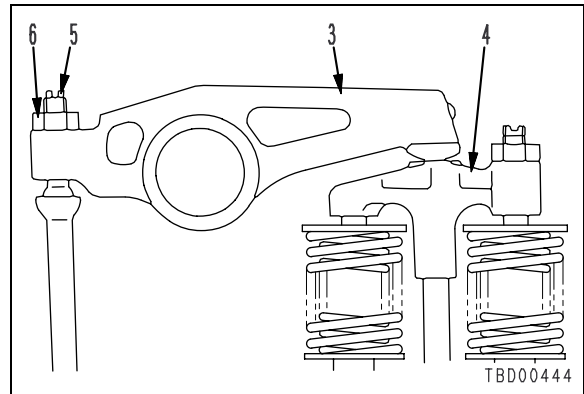
Method of adjusting valve clearance

1. Remove the cylinder head cover.
2. Rotate the crankshaft in the normal direction to align the R1.6 TOP line on vibration damper (1) with pointer (2) to set the right No. 1 cylinder at compression top dead center. When rotating, check the movement of the intake valve of right No. 6 cylinder.
 - ★ When the right No. 1 cylinder is near compression top dead center, the intake valve of right No. 6 cylinder moves (opens).

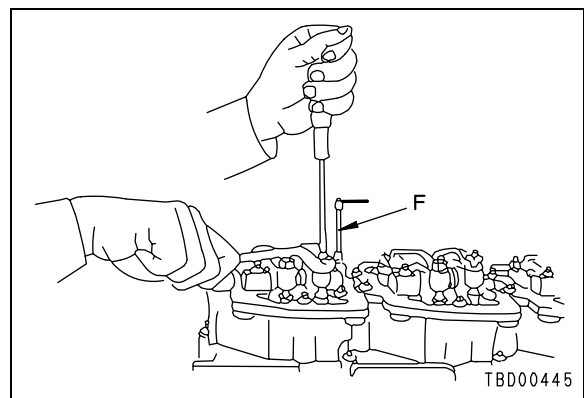


3. Loosen locknut (6) of adjustment screw (5) for right No. 1 cylinder, then insert feeler gauge F of the specified thickness between crosshead (4) and rocker arm (3), and adjust with the adjustment screw until the clearance is a sliding fit.
4. Tighten the locknut (6) to hold the adjustment screw (5) in position.

kgm Locknut: **67.7 ± 9.8 Nm {6.9 ± 1.0 kgm}**



5. Following the firing order of the engine, rotate the crankshaft, align the damper line with the pointer, and adjust the clearance of each cylinder.
 - ★ Firing order
R1 – L6 – R5 – L2 – R3 – L4 – R6 – L1 – R2 – L5 – R4 – L3



MEASURING COMPRESSION PRESSURE

★ Measuring instruments for compression pressure

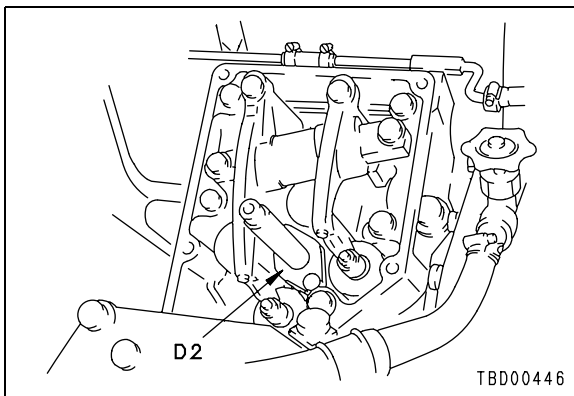
Symbol	Part No.	Part Name
D	1	795-502-1590 Compression gauge
	2	795-502-1500 Adapter assembly
		795-502-1510 • Adapter
		795-502-1520 • Plate

⚠ Be careful not to touch any hot places when installing or removing the measuring tools.

★ Raise the temperature of the cooling water to the operating range before measuring.

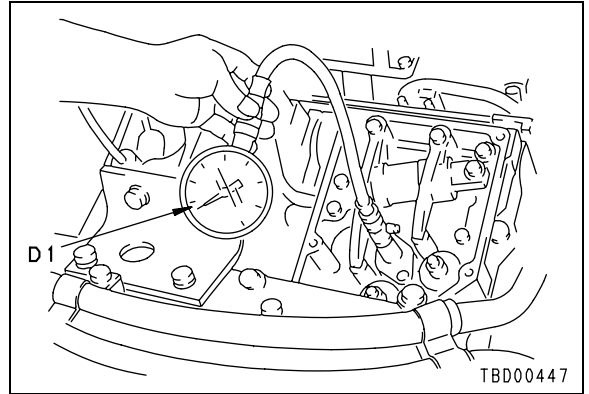
1. Adjust the valve clearance.
 - ★ For details, see ADJUSTING VALVE CLEARANCE.
2. Remove the nozzle holder assembly of the cylinder to be measured.
 - ★ Be careful not to let dirt or dust get inside.
3. Install adapter **D2** in the mount of the nozzle holder assembly.

 Adapter **D2**:
 $26.9 \pm 2.5 \text{ Nm } \{2.75 \pm 0.25 \text{ kgm}\}$



4. Connect compression gauge assembly **D1** to the adapter.

⚠ When measuring the compression pressure, be careful not to touch any hot parts or to get caught in the rotating parts.



5. Place the fuel control lever in the NO INJECTION position. Crank the engine with the starting motor and measure the compression pressure.
 - ★ Measure the compression pressure at the point where the pressure gauge indicator remains steady.

⚠ If the fuel control lever is not placed at the NO INJECTION position, fuel will spurt out.

- ★ If the adapter mount is coated with a small amount of oil, it will reduce the leakage.
 - ★ For details of the standard values for the compression pressure, see TABLE OF STANDARD VALUES FOR TESTING, ADJUSTING, AND TROUBLESHOOTING.
 - ★ When measuring the compression pressure, measure the engine speed to confirm that it is within the specified range.
- ★ For details of installing the nozzle holder assembly after measuring the compression pressure, see INSTALLATION OF NOZZLE HOLDER ASSEMBLY.

MEASURING BLOW-BY PRESSURE

★ Blow-by pressure measurement tools

Symbol	Part No.	Part Name	
E	1	799-201-1504	Blow-by checker
	2	799-201-1590	Gauge
	3	799-201-1511	Nozzle
		799-201-1450	Adapter

! The measuring equipment is installed at a position that cannot be seen from the operator's seat, so take steps to ensure that no one starts the engine during the operation.

★ Raise the coolant temperature to the operating range before measuring.

1. Install the nozzle **E3** of blow-by checker **E1** to the tip of breather hose (3), then connect it to the gauge with the hose.

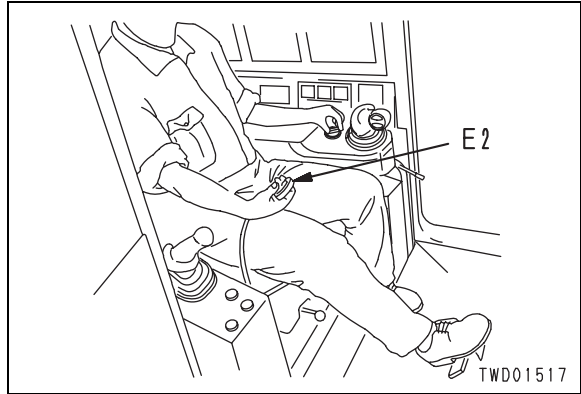
2. Install nozzle **E3** to the tip of the remaining breather hoses (1) and (2).

★ Block the port used to connect the gauge.

! When measuring, be careful not to touch any hot parts or rotating parts.

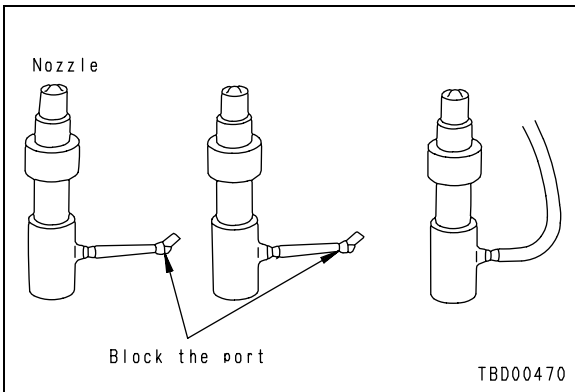
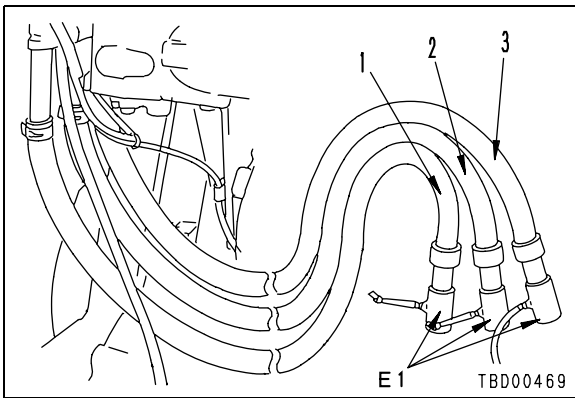
3. Run the engine at high idling with the torque converter continuously stalled, and measure the pressure indicated by the gauge **E2**.

★ Be careful not to overheat the torque converter (the red range of the oil temperature gauge lights up).



Reference:

Blow-by varies greatly according to the condition of the engine. Therefore, if the blow-by value is considered abnormal, check for problems connected with defective blow-by, such as excessive oil consumption, defective exhaust gas color, and prematurely dirty or deteriorated oil.



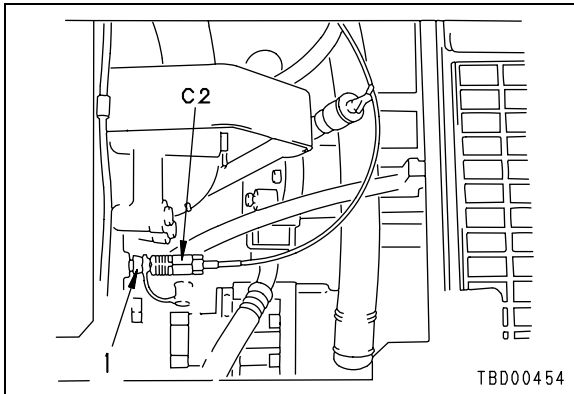
MEASURING ENGINE OIL PRESSURE

★ Engine oil pressure measurement tools

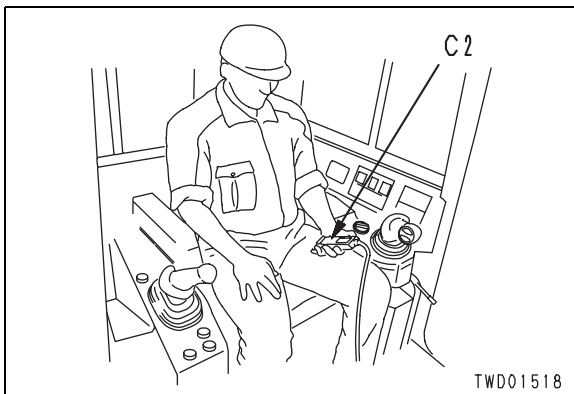
Symbol	Part No.	Part Name
C	1	799-101-5002 Hydraulic tester
		790-261-1204 Digital hydraulic tester
	2	799-401-2320 Hydraulic tester

★ Raise the coolant temperature to the operating range before measuring.

1. Connect the hose of oil pressure gauge **C1** to pressure measurement nipple (1), then install oil pressure gauge **C2** (1.0 MPa {10 kg/cm²}).



2. Start the engine, and measure the oil pressure at low idling and high idling.



TESTING AND ADJUSTING FUEL INJECTION TIMING

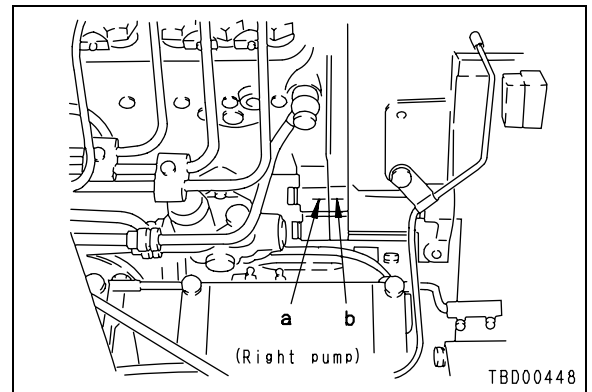
Test and adjust the fuel injection timing of the injection pump as follows.

- If the injection pump has not been repaired, and it is assembled to the original engine, adjust by aligning the match marks.
 - If the injection pump has been repaired or replaced, use the delivery valve method to adjust.
- ★ Set the No. 1 cylinder to the compression top dead center before testing and adjusting.
- ★ For details, see ADJUSTING VALVE CLEARANCE.
- ★ When using the DELIVERY VALVE method, make preparations to replace the delivery valve copper gasket and O-ring with new parts.

TESTING AND ADJUSTING BY ALIGNING MATCH MARKS METHOD

1. Testing

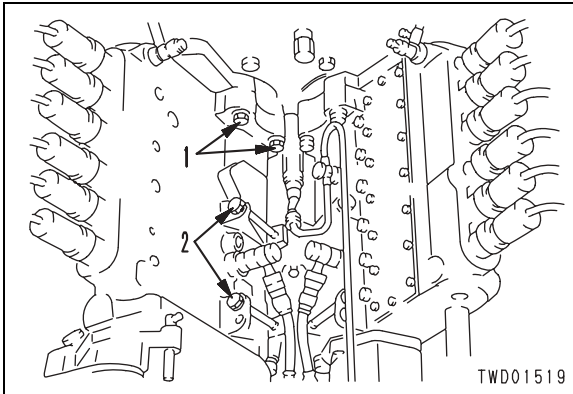
Check that line **a** on the injection pump and line **b** on the case are aligned.



2. Adjusting

If the results of the inspection shows that the lines are not aligned, or if the injection pump has been repalced (or removed and installed), adjust the fuel injection timing as follows.

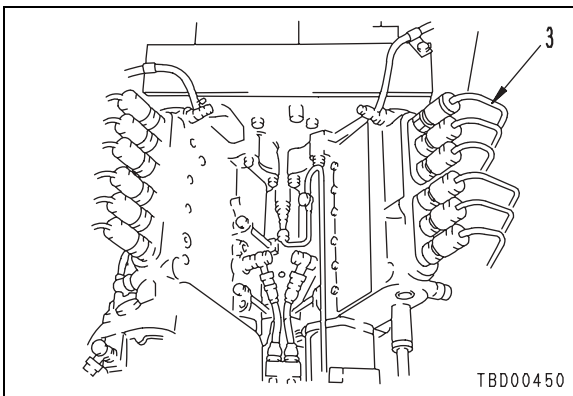
- 1) Loosen 4 mounting bolts (1) and 4 mounting bolts (2) of the injection pump.
- 2) Align line **a** of injection pump with line **b** on the case, then tighten mounting bolts (2) and (1).



★ For details of adjusting the fuel injection amount for the left and right banks, see **ADJUSTING INJECTION PUMP RACK LINKAGE**.

• Testing and adjusting with delivery valve method

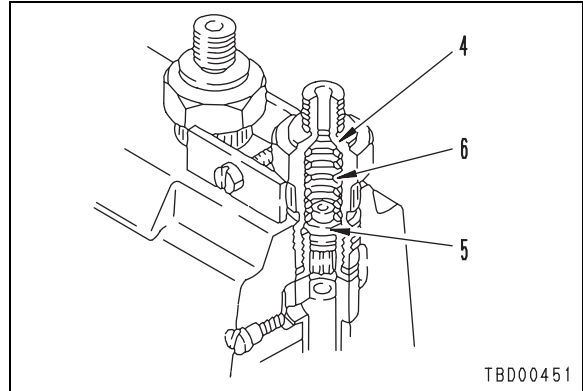
1. Disconnect fuel injection pipe (3) to right No. 1 cylinder.
 - ★ Before disconnecting the pipe, wipe off all the fuel at the top of the fuel injection pump to prevent dust from entering.



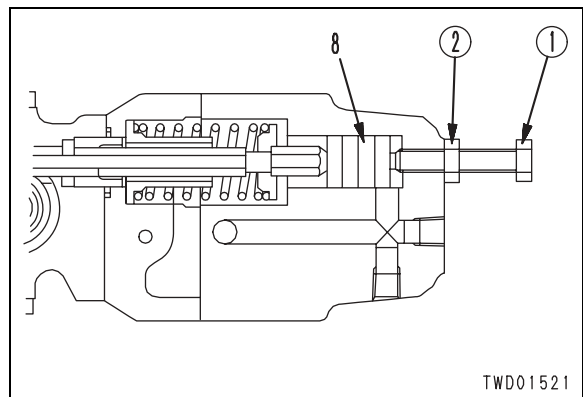
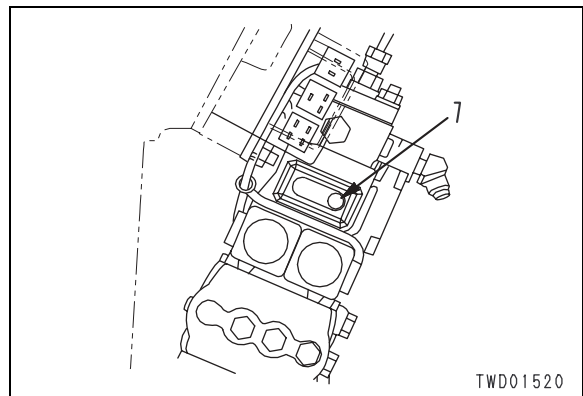
2. Remove delivery valve holder (4).

3. Remove spring (6) and delivery valve (5) from delivery valve holder (4), then assemble delivery valve holder (4) again.

★ When doing this, assemble the same O-ring and copper gasket that were removed. (Replace with new parts after adjusting.)

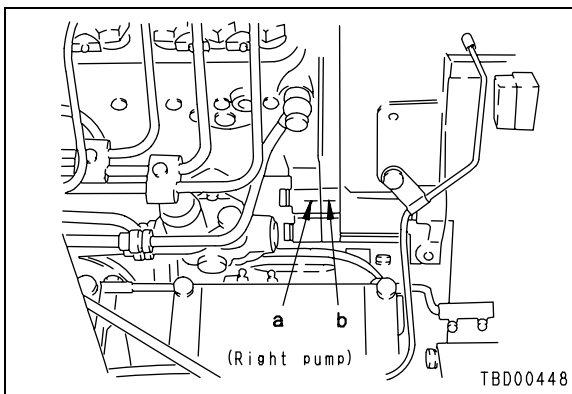


4. Set the fuel control lever at the FULL position.
5. Remove stopper bolt (7), then tighten rack pusher bolt ① to move the rack.
 - ★ Tighten the rack pusher bolt until it contacts the rack piston (8), then tighten it a further 8 turns and tighten locknut ②.
 - ★ Rack pusher bolt part number: 01016-30850

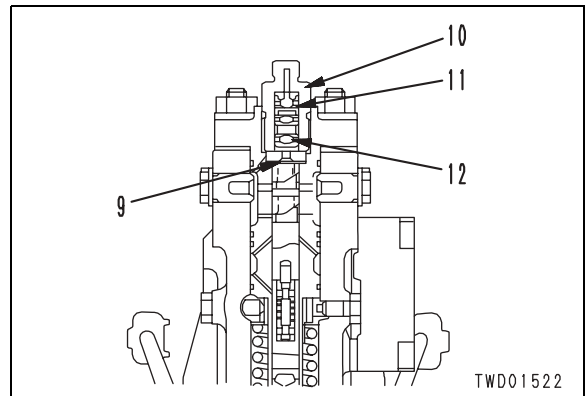


6. Set with the right No. 1 cylinder at the TOP position, then rotate the crankshaft 35 – 40° in the opposite direction.
7. Operate the priming pump and rotate the crankshaft slowly in the normal direction. Check the point where the fuel stops flowing from the delivery valve holder.
8. Check that the fuel injection timing line on the vibration damper and the pointer are aligned at the point where the fuel stops flowing.
 - ★ BEYOND injection timing line:
Timing RETARDED
 - ★ BEFORE injection timing line:
Timing ADVANCED

- If the results of the test show that the fuel injection timing is incorrect, adjust the fuel injection timing as follows.
 - 1) Set with the right No. 1 cylinder at the TOP position, then rotate the crankshaft 35 – 40° in the opposite direction.
 - 2) Rotate the crankshaft slowly in the normal direction, and align the injection timing line on damper and pointer correctly.
 - 3) Loosen bolt (1) in the oblong hole of the injection pump mounting flange, operate the priming pump, and turn the flange at the pump end a little at a time. Stop at the point where fuel stops flowing from the delivery valve holder (10).
 - 4) Tighten the bolt in the oblong hole of the injection pump mounting flange.
 - ★ Check the injection timing again to confirm that the injection timing is correctly adjusted.
 - 5) Align with line **a** on the fuel injection pump, then make line **b** on the coupling.



- ★ After adjusting, remove the delivery valve holder (10), assemble the delivery valve (12) and spring (11), then install the delivery valve holder (10) again.
- ★ Always replace the copper gasket (9) and O-ring of the delivery valve with new parts. If the old parts are used, they may cause fuel leakage. Be careful not to mistake the mounting position of the copper gasket.
- ★ Replace rack pusher bolt ① and rack stopper bolt (7). (If they are not replaced, there is danger that the engine may overrun.)



- Be careful to assemble the copper gasket (9) in the correct mounting position (below the seat).

kgm Order for tightening delivery valve holder

Unit: Nm {kgm}	
1st step	137.3 – 156.9 {14 – 16}
2nd step	Return to 0
3rd step	137.3 – 156.9 {14 – 16}
4th step	Return to 0
5th step	137.3 – 156.9 {14 – 16}