



YANMAR 4TNV, Elec.Control.Governor (Tier III)

ENGINE TRAINING
for R55-7A, R55W-7A, R80-7A
R55-9, R55W-9, R60CR-9, R80CR-9

EDITOR
PIETER EVERAERTS

	<u>PAGE</u>
1] GENERAL	03
2] ELECTRONIC CONTROL SYSTEM (ECO)	06
3] INJECTION PUMP	10
4] EXHAUST GAS RECIRCULATION (EGR)	43
5] COOLANT TEMP SENSOR	45
6] ELECTRICS	47
7] ENGINE VIEW	51
8] ENGINE ERROR CODE SYSTEM	52
9] YANMAR DIAGNOSTIC TOOL	58
10] FUEL PUMP ADJUSTMENT & REPLACEMENT	61

Related manuals:

TNV-ECO-manual.pdf (>Ceres : TNV-SERIES-ECM, part 1)
TNV-ECO-diagnostic tool.pdf (>Ceres : TNV-SERIES-ECM, part 2)
TNV-ECO-troubleshooting.pdf

TNV-INJ-mechanical.pdf (>Ceres: YANMAR FUEL INJECTION)
TNV-service-mechanical.pdf (>Ceres: YANMAR 3TNV, 4TNV)

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1. GENERAL - OVERVIEW

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(All listed engines are Yanmar "NV3-Series engines" >> Range 3000...4000cc: all direct injection)

YANMAR	R55(W)-7	R80-7	R55(W)-7A	R80-7A
Engine model Content / HP (Rated Gross) at rpm Max. Torque at RPM SETTING MAX RPM	4TNV94L # cyl cyl bore (mm) 3054cc / 53HP at 2200 rpm 20.6 kgf at 1400 rpm 2300±50 (R55-7) 2400±50 (R55W-7)	4TNV98 3318cc / 60HP at 2100 rpm 25.2 kgf at 1000 rpm 2250±50	4TNV98-EPHYB derating output eco -eng.) 3319cc / 57HP at 2400 rpm 20.5 kgf at 1550 rpm 2260±50 ("M" mode selected)	4TNV98-ZVHYB standard output eco -eng.) 3319cc / 59.6HP at 2100 rpm 24.5 kgf at 1000 rpm 2250±50 ("H" mode selected)

Explanation of engine model names (-7A/-9)

E or Z	stands for	→ kind of output
P, V		→ rated eng. speed
HY		→ Hyundai
B		→ excavator

-7A → "adapted technologie" to meet Tier III

- ❑ (higher fuel injection pressure)
- ❑ Electric Control of Exhaust Gas Regulation
- ❑ Electric Control of Governor (= "ECO")



-9 Series → same engines

	High idle (M mode)	Low idle	eng. type
R55-9	2200±30	1000±30	4NTV98-EPHYBU
R55W-9	2200±50	1050±100	4NTV98-EPHYBU
R60CR-9	2200±50	1000±50	4NTV98-EPHYBU
R80CR-9	2100±50	1000±50	4NTV98-ZVHYB

"MAX" mode not operated → RPM 1000 ~ 1950

► At full charge, eng. drop is max “150 rpm”

1. GENERAL - SPECIFICATION

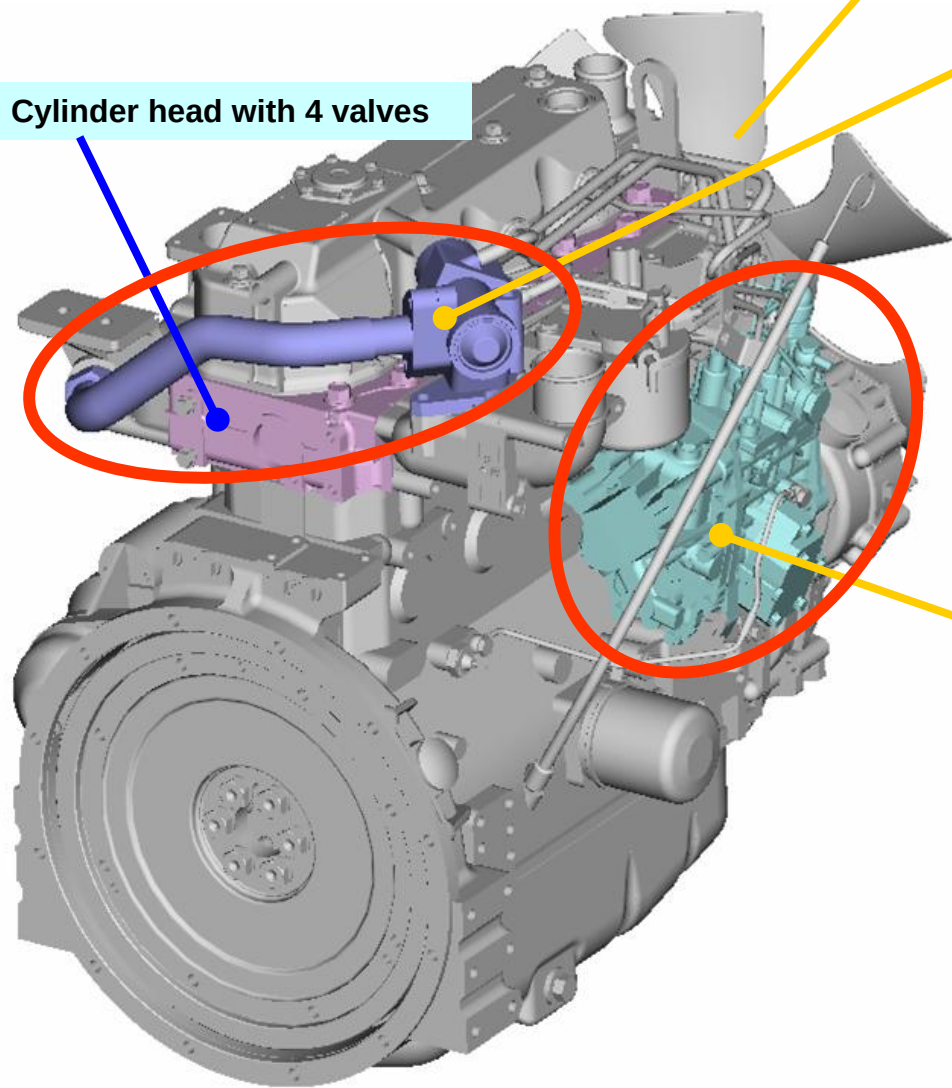
<https://truckmanualshub.com/>

R55(W)-7A

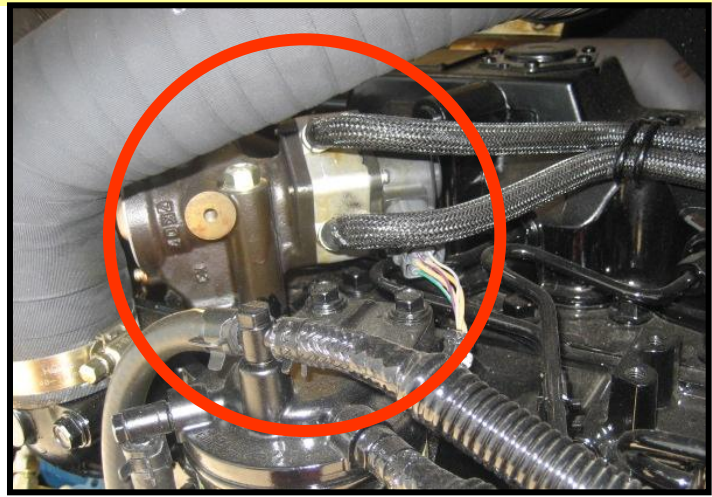
R80-7A

Engine model			4TNV98-E						4TNV98-Z					
Engine classification			VM						VM					
1	Type	—	Vertical, 4-cycle water-cooled diesel engine						Vertical, 4-cycle water-cooled diesel engine					
2	Combustion system	—	Direct injection (DI)						Direct injection (DI)					
3	No. of cylinders - Bore × Stroke	n - mm × mm	4 - 98×110						4 - 98×110					
4	Displacement	ℓ	3.318						3.318					
5	Rated engine speed	min ⁻¹		2100	2200	2300	2400	2500	2000	2100	2200	2300	2400	2500
	Output (Gross) *1	Cont. rating kW												
		Rated output kW		37.4	39.0	40.5	42.4	44.0	42.5	44.4	46.3	48.2	50.2	52.1
	Output (NET)	Cont. rating kW												
		Rated output kW		36.8	38.2	39.7	41.6	43.0	41.9	43.8	45.6	47.4	49.3	51.1
6	Maximum idling speed	min ⁻¹ ±25		2290	2400	2510	2590	2700	2180	2290	2400	2510	2590	2700
7	Specific fuel consumption	g/kWh	≤224			≤231			≤224			≤231		
8	Exhaust gas temp.	°C (°F)		≤610	≤620	≤630	≤640	≤650	≤600	≤610	≤620	≤630	≤640	≤650
9	Compression ratio	—	18.5						18.5					
10	Diesel fuel injection pressure	MPa (kgf/cm ²)	21.6 ^{+1.0} ₀ (220 ⁺¹⁰ ₀)						21.6 ^{+1.0} ₀ (220 ⁺¹⁰ ₀)					
11	Main shaft side	—	Flywheel side						Flywheel side					
12	Rotation direction	—	Counterclockwise (Viewed from flywheel side)						Counterclockwise (Viewed from flywheel side)					
13	Governor	—	Electronic governor (All-speed governor)						Electronic governor (All-speed governor)					
14	Aspiration	—	Natural aspiration						Natural aspiration					
15	Cooling system	—	Liquid-Cooled With Radiator						Liquid-Cooled With Radiator					
16	Lubricating system	—	Forced lubrication with multi-stage trochoid pump						Forced lubrication with multi-stage trochoid pump					
17	Starting system	—	Electric starting						Electric starting					
18	Charging system	—	Alternator (12 VDC/40 A)						Alternator (12 VDC/40 A)					
19	Starting aid device	—	Air heater (12 VDC/500 W)						Air heater (12 VDC/500 W)					
20	Engine oil pressure	Rated speed MPa	0.34±0.05 (3.5±0.5)						0.34±0.05 (3.5±0.5)					
21	Oil pan	Full	ℓ						ℓ					
	capacity	Useful	ℓ						ℓ					
			10.2						10.2					
			4.5						4.5					
22	Engine coolant capacity	ℓ	4.2 (Engine only)						4.2 (Engine only)					
23	Cooling fan type - dia. × No. of blades	mm	Made by resin, Pusher, F Type - φ410(AI)×6						Made by resin, Pusher, F Type - φ410(AI)×6					
24	Crank V-pulley dia./ Fan V-pulley dia.	mm/mm	φ130 / φ130						φ130 / φ130					

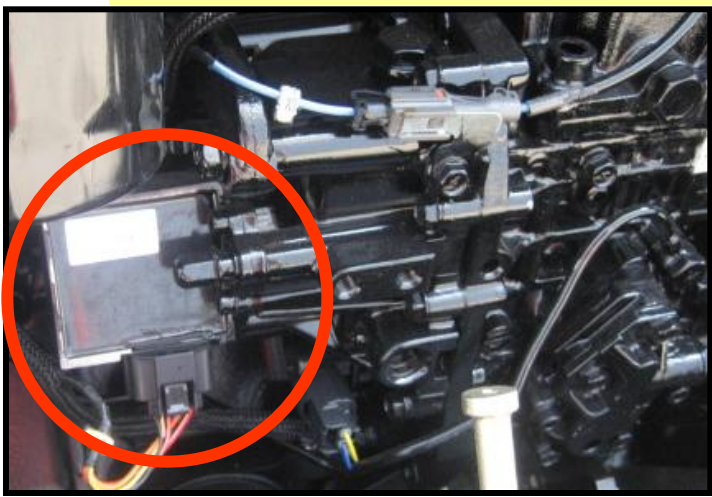
NV3, adapted (tier III)

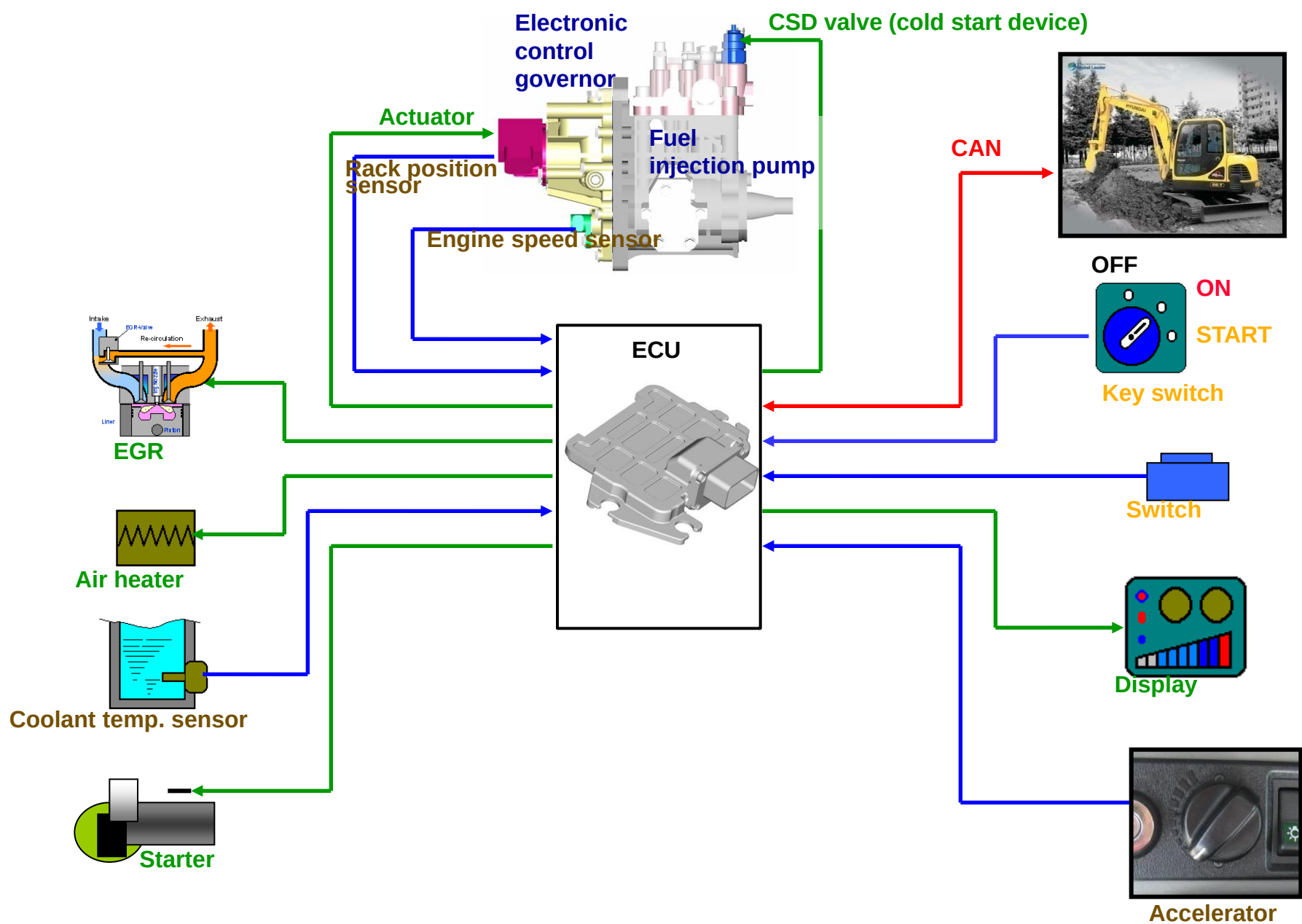


Electronic control of EGR (exhaust gas recirculation)
→ to achieve lower NOx

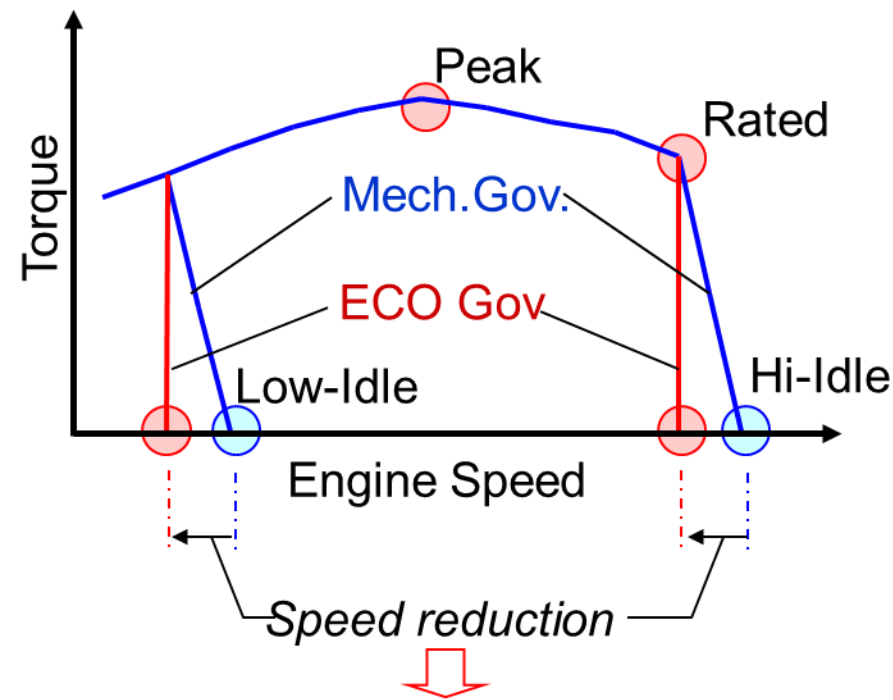
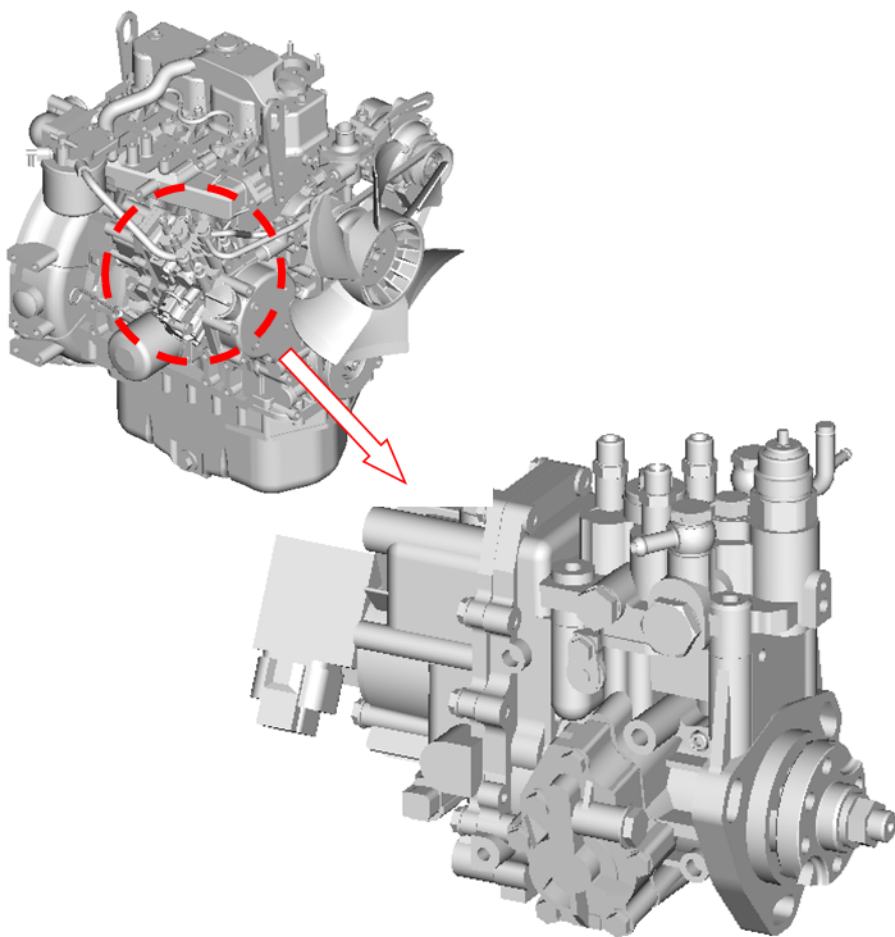


Electronic Control of Governor (ECO)



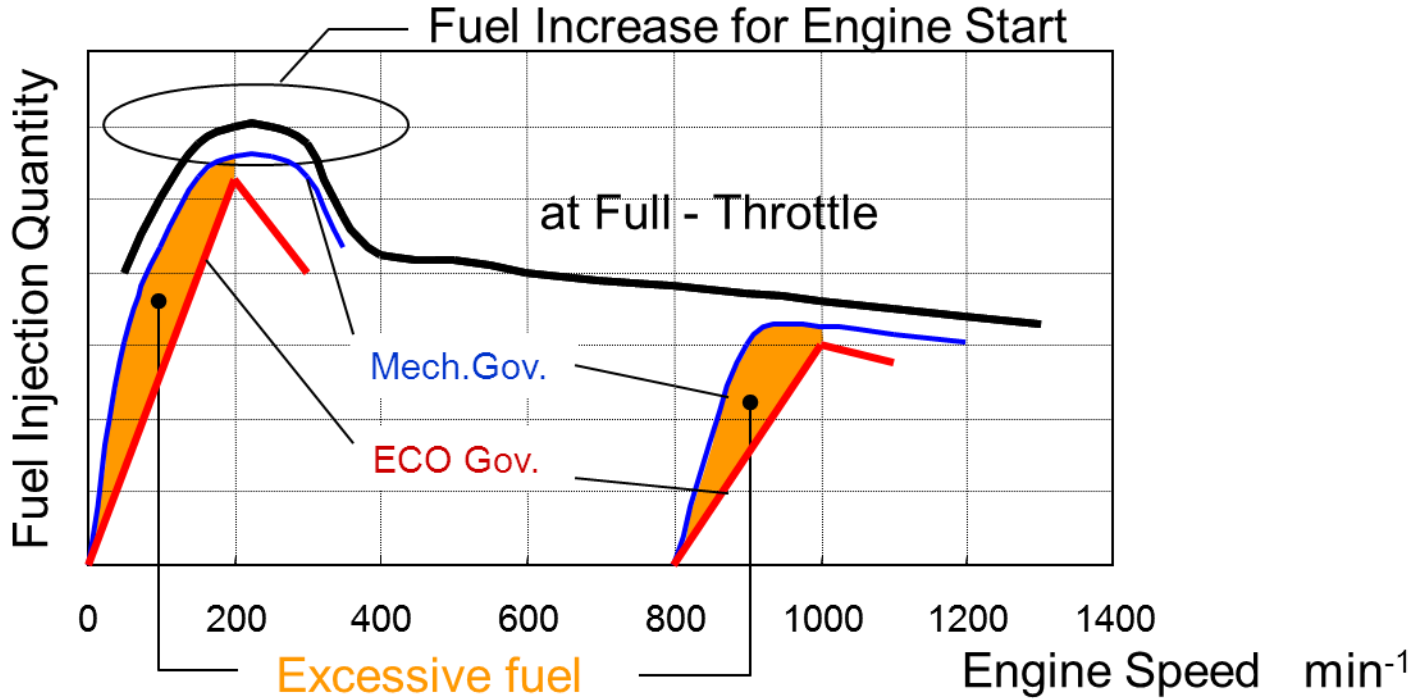


YANMAR-'ECO' governor



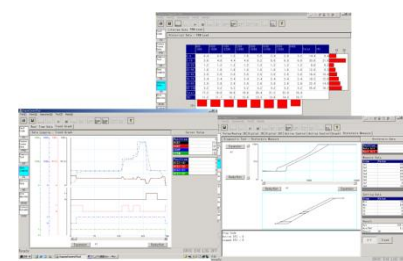
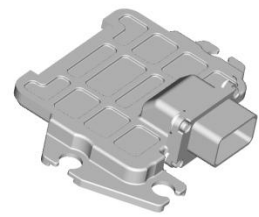
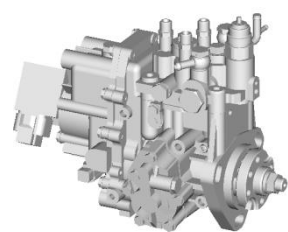
**Noise reduction at idle speed
&
Lower fuel consumption**

YANMAR-'ECO' governor



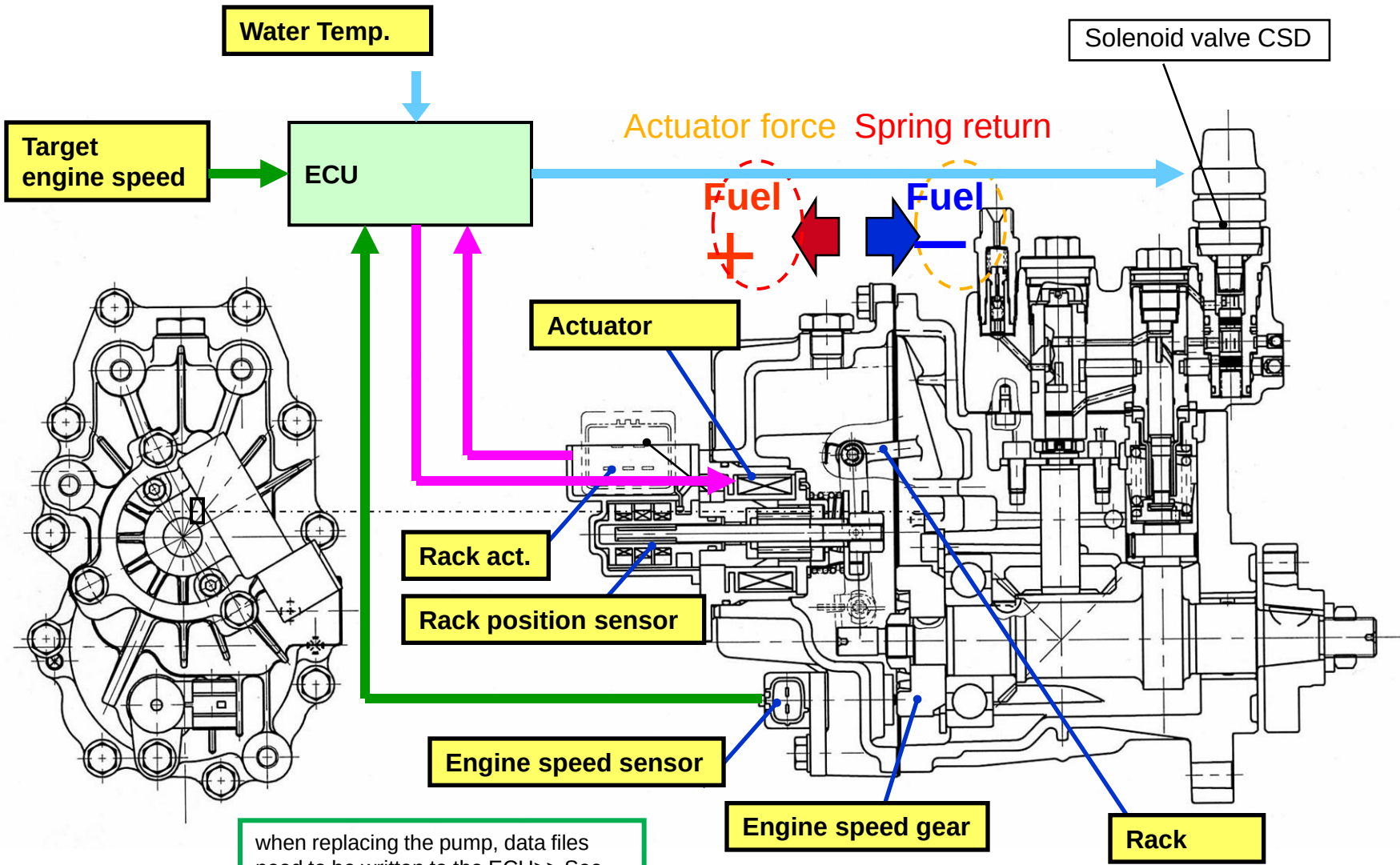
No smoke visible at engine start & acceleration

Eco-Governor is Yanmar’s unique electronics control governor system which has been used for over 10 years mainly on agricultural machines. Yanmar has renewed this system to apply to all equipment and named it “2G Eco-Governor” which means second generation Eco-Governor. In addition an EGR valve is controlled by this system.

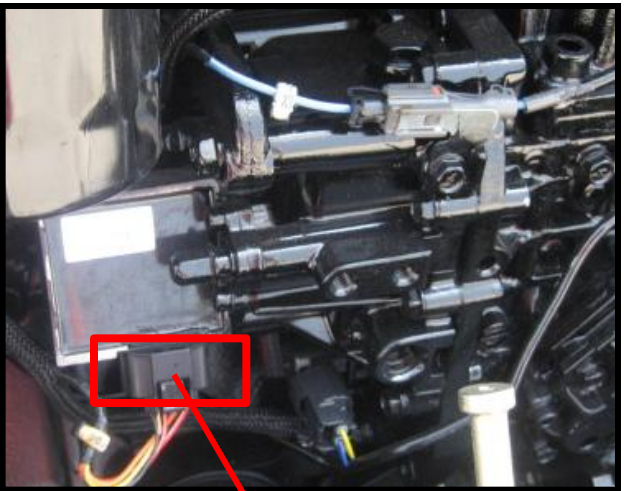


Idling speed control	After heat control	Communication function
Idling speed will be adjusted depending on cooling water temperature	Starting aid devices stay activated after start	Data logging by ECO system Connection for troubleshooting
Engine warm-up time reduced, protection at high idle & less white smoke		Possible to monitor engine performance System diagnosis incl history

Electronically control rack by ECU

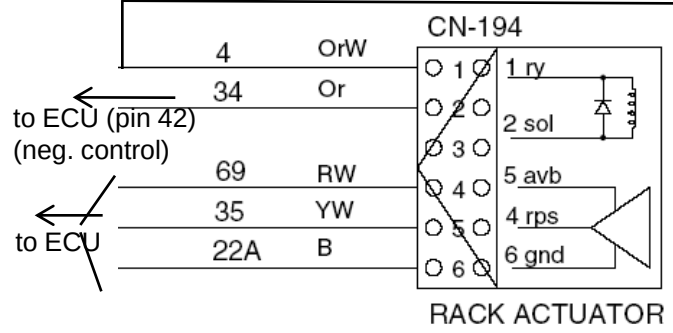
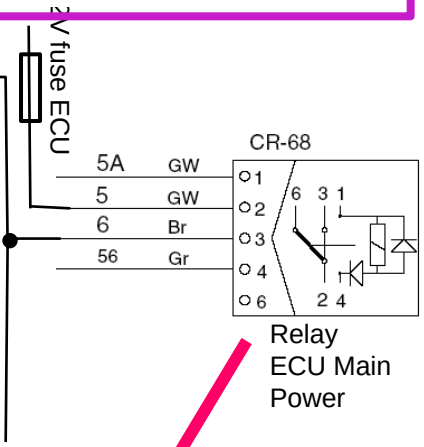
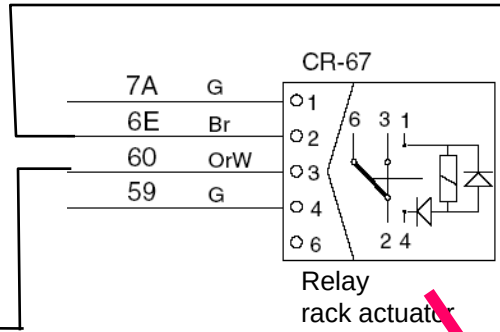
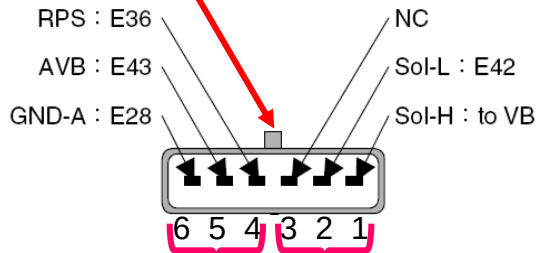
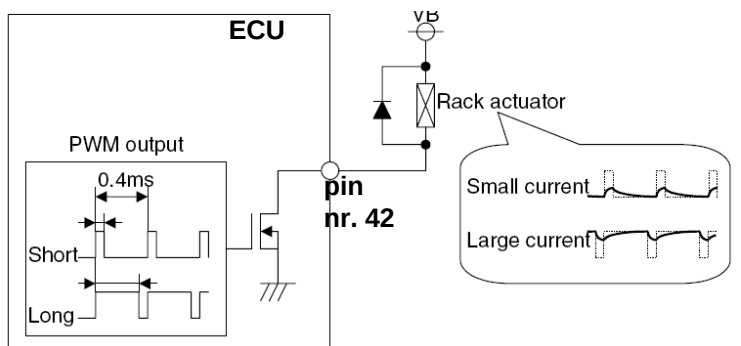


when replacing the pump, data files need to be written to the ECU>> See "TNV-ECO-diagnostic tool.pdf, p51 for more information



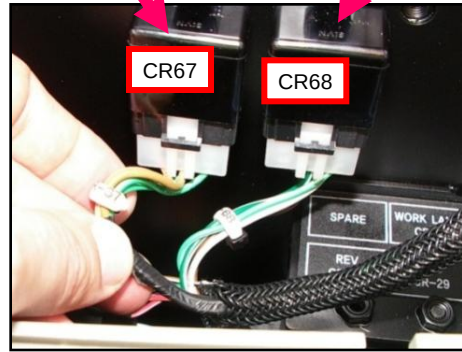
The E-ECU adjust the magnitude of current flowing through the rack actuator solenoid by shortening or lengthening the ON-duration of the output transistor. The rack position of the fuel injection pump varies depending on the magnitude of current flowing through the rack actuator.

This technique where the ON duration of the transistor is changed to provide current control is called PWM (Pulse Width Modulation). The PWM control period of the Eco-governor E-ECU is 0.4 ms.

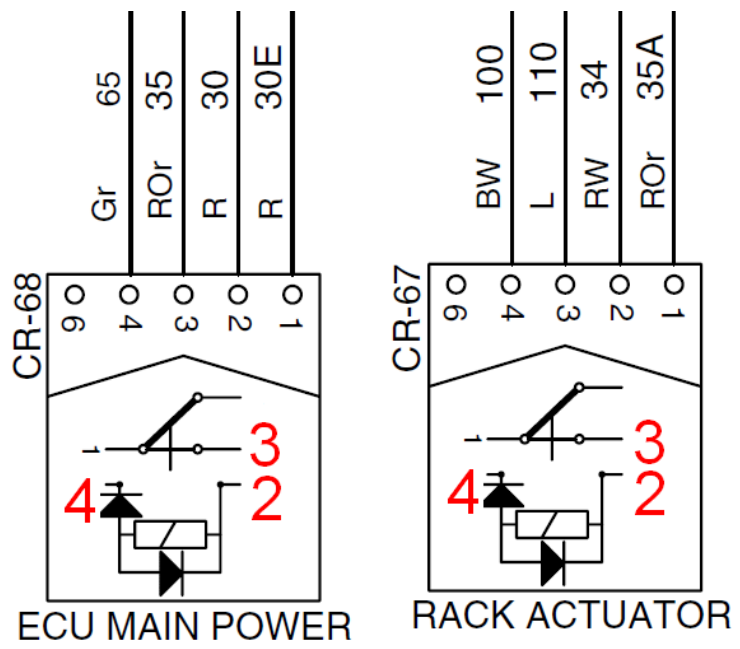


Rack actuator

Rack position sensor



CORRECTED PIN LAY OUT FOR CR-68 (ecu main power) AND CR-67 (rack actuator) ON R80-7A

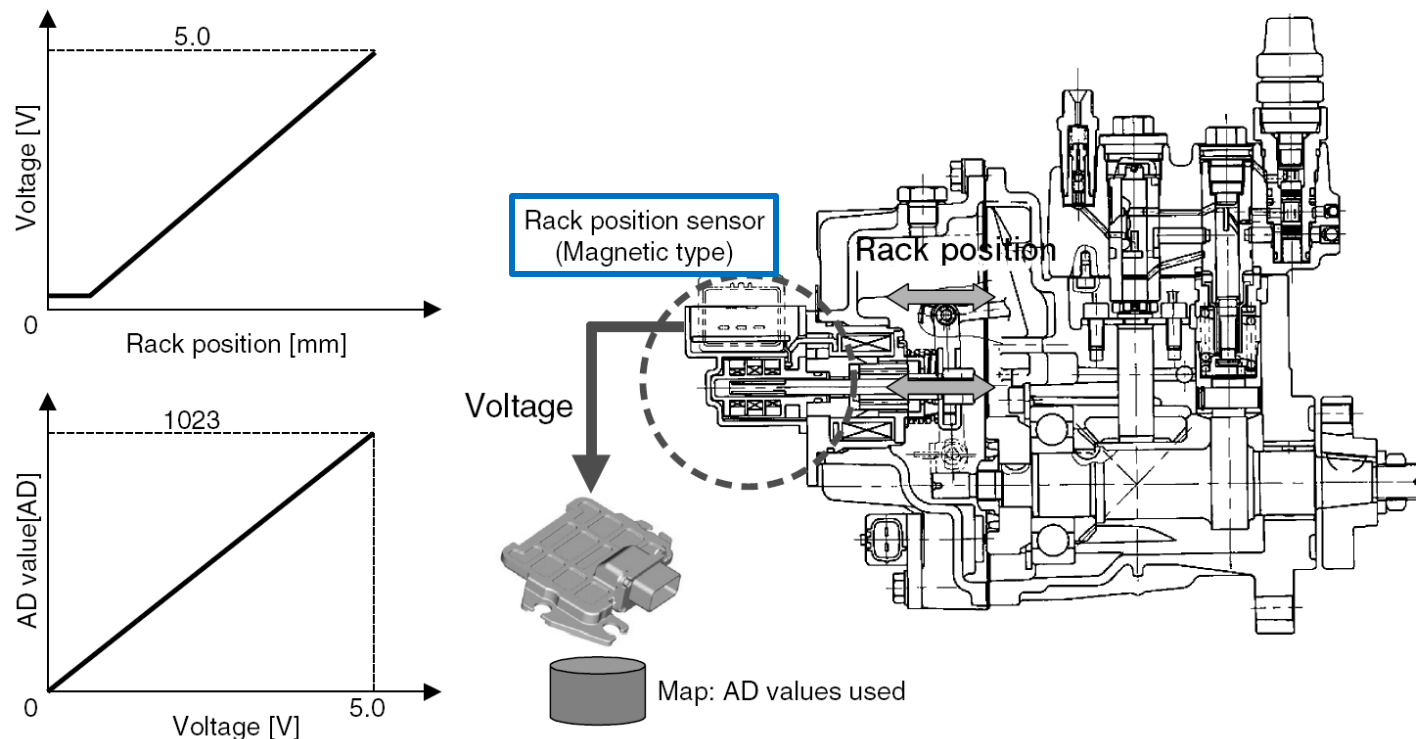


3. INJECTION PUMP - RACK POSITION SENSOR

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The Eco-governor controls the fuel injection quantity by adjusting the rack position of the fuel injection pump. The rack position is converted into voltage by the rack position sensor, and the voltage signal is applied to ECU terminal RPS and sent to an AD converter. The AD converter converts the input voltage of 0 to 5 volt into an AD value of 0 to 1023. See **Figure 2-14**.

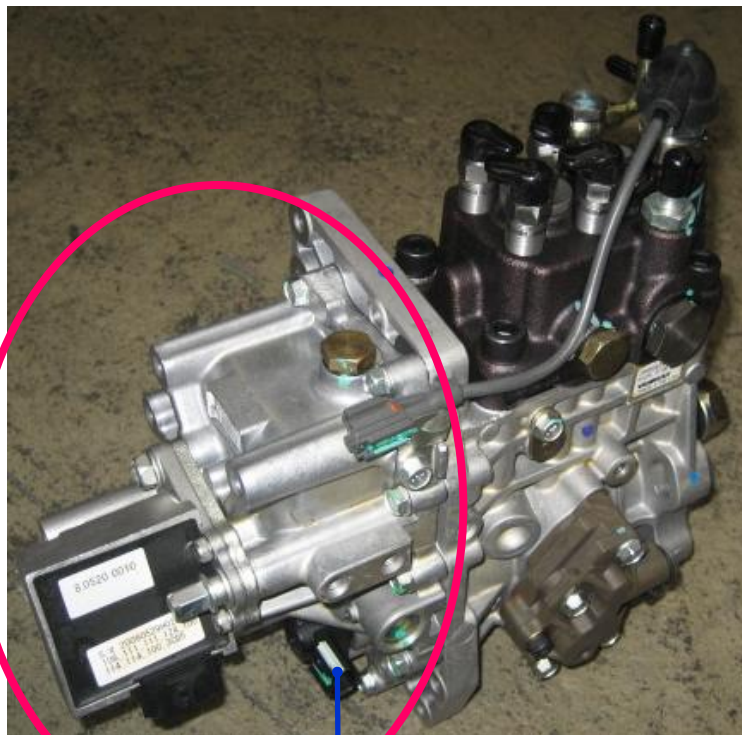
The Eco-governor controls the maximum and minimum rack positions and calculates the load factor on the basis of this AD value.



3. INJECTION PUMP - ECO 2G GOVERNOR VERSUS MECHANICAL GOVERNOR

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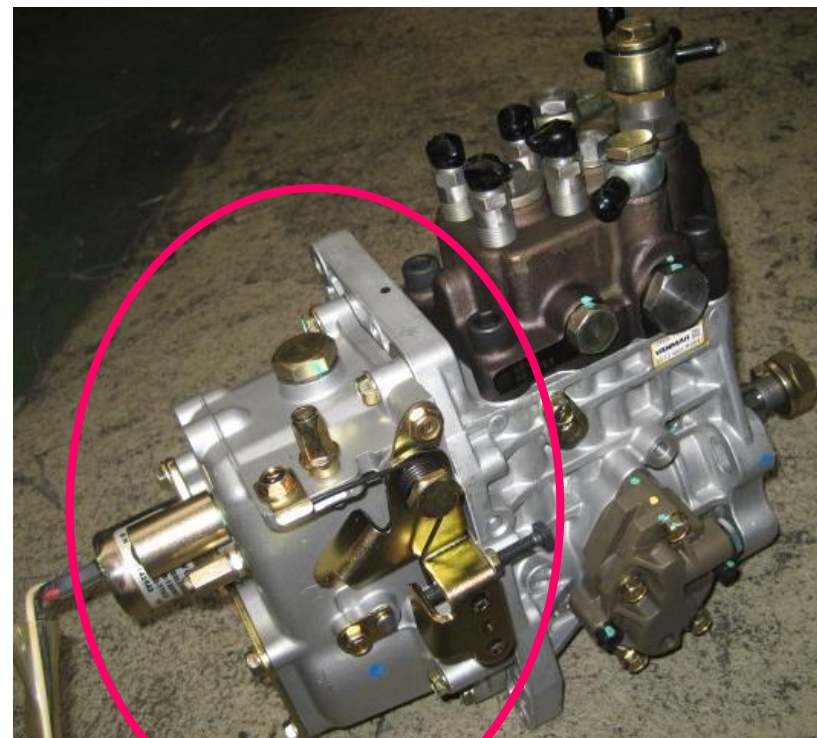
INJ. PUMP WITH EL. GOVERNOR (on -7A & -9)



Engine speed sensor

- magnetic type
- detects eng. speed with 12 pulsers attached to the camshaft

INJ. PUMP WITH MECHANICAL GOVERNOR (on -7)



Contents

1. Condition of trouble
2. Procedure for removing actuator
3. Checking for governor-lever
4. Checking for actuator
(Procedure for checking guide-plate)
5. Procedure for installation actuator

1. Condition of trouble

(1) The following trouble occurred.

- The engine doesn't start.
- The load doesn't hang though the engine starts.
- The rotational speed of the engine doesn't go up though the engine starts.

(2) When you confirm the breakdown lamp

- It blinks seven times.
- It blinks eight times.
- It doesn't light.

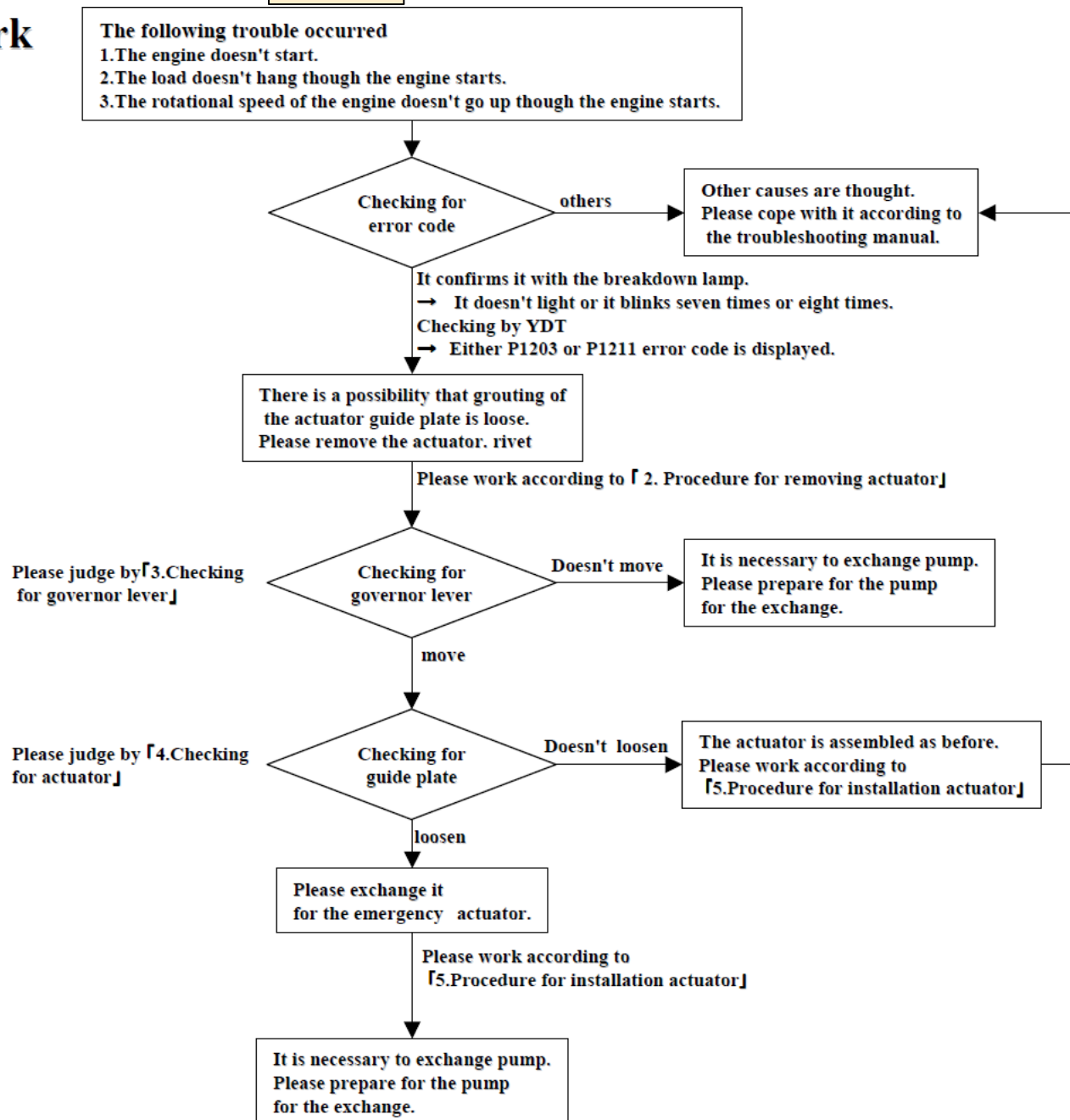
(reference) When you use YDT,
code of DTC , Either P1203 or P1211 error code is displayed.

(3) Execution judgment of confirmation work

The trouble of the actuator thought, when the trouble (1) occurred,
and it applies to either of (2).

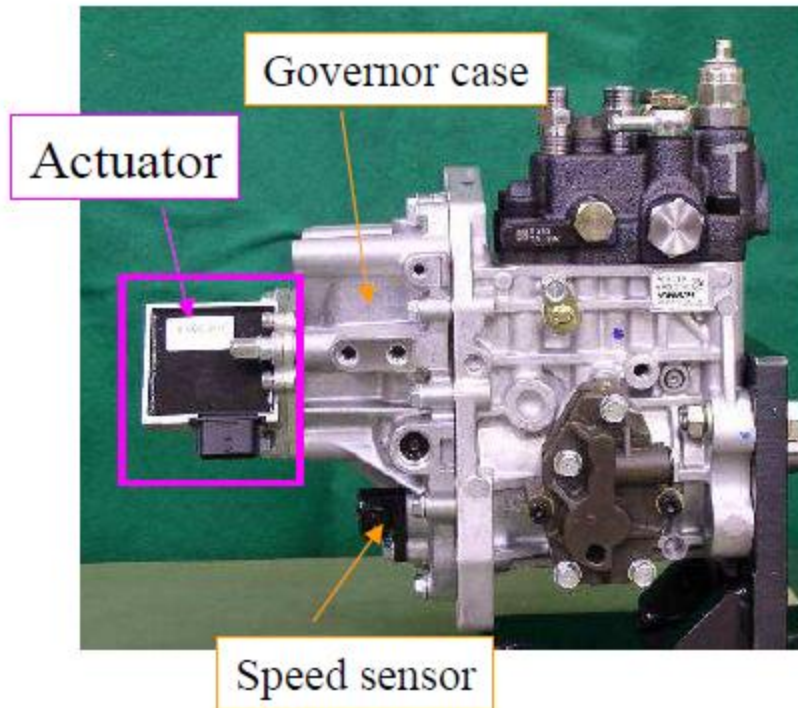
Please remove the actuator according to the following procedures,
and do the confirmation work.

(4) Outline of work

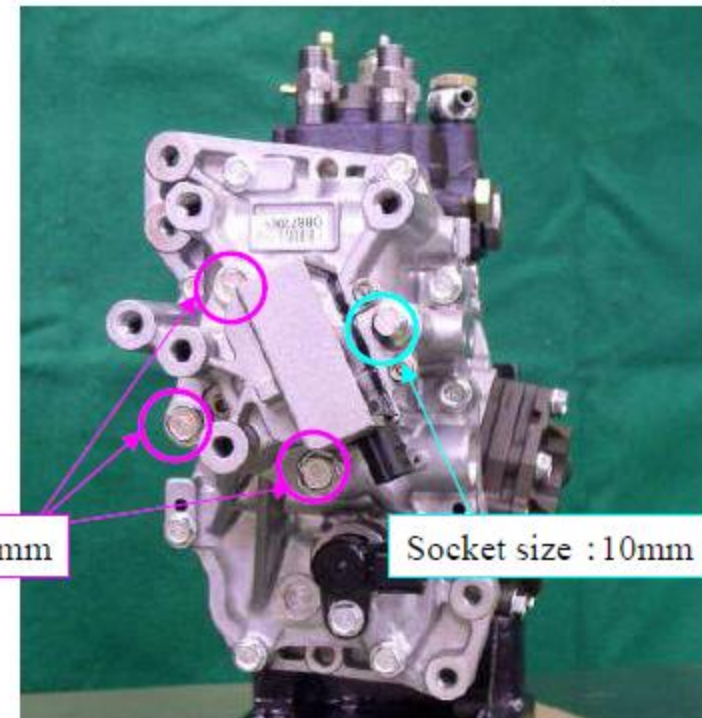


2. Procedure for removing actuator

(1) The look of actuator



The actuator is installed in governor case with four bolts.



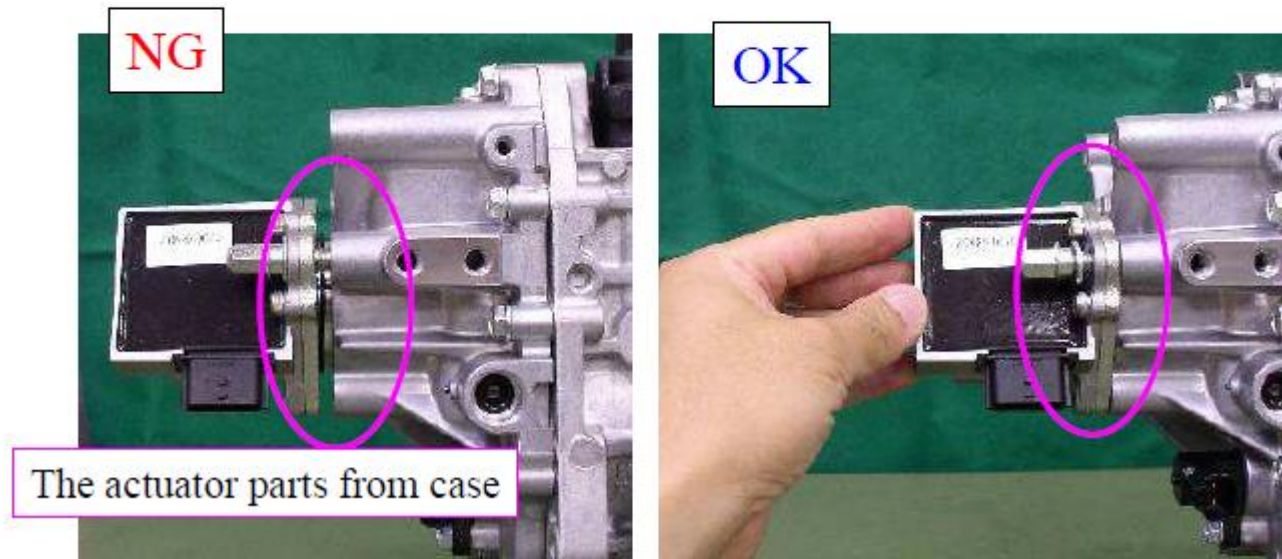
Socket size : 12mm

Socket size : 10mm

2. Procedure for removing actuator

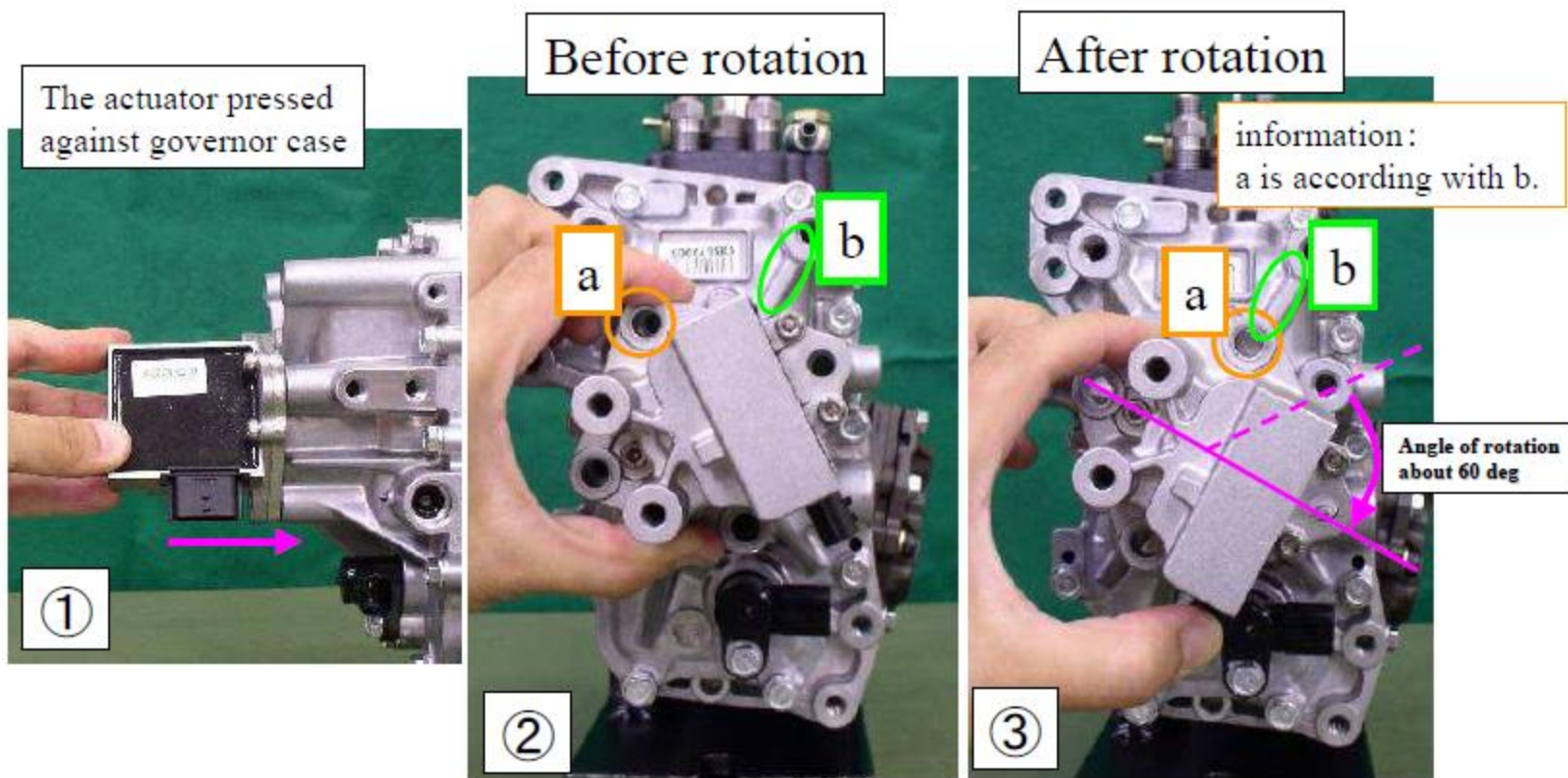
(2) Please remove four bolts.

Because the actuator parts from governor case when loosening a bolt, please hold it by hand while removing it.



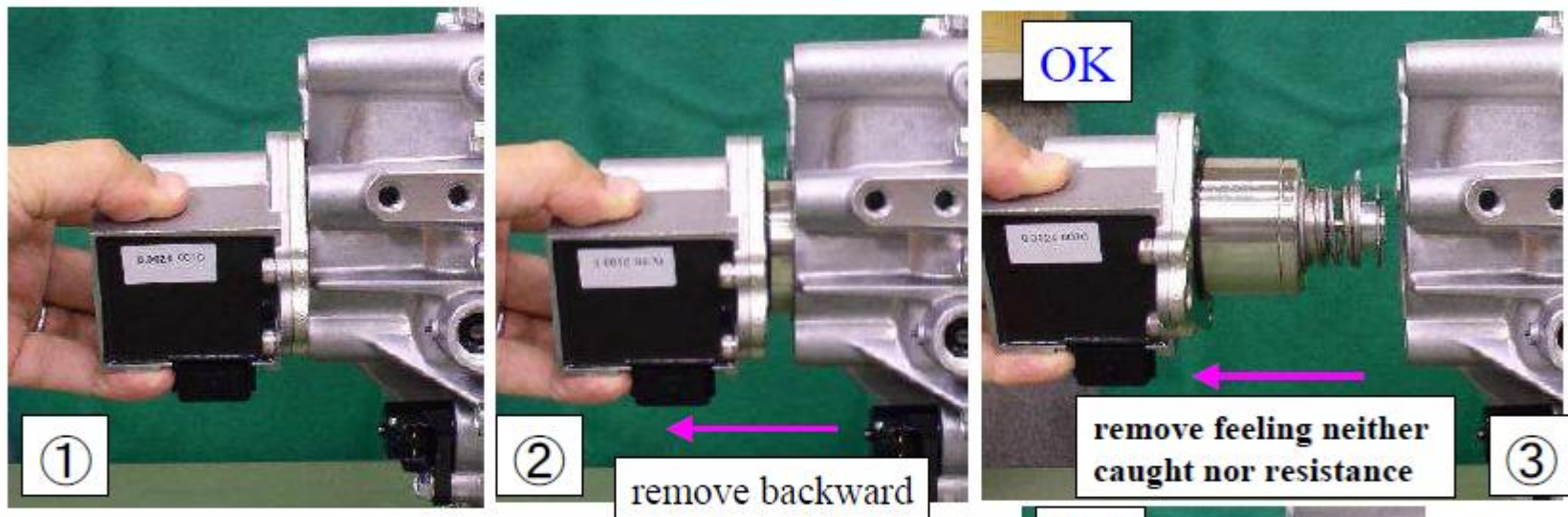
2. Procedure for removing actuator

(3) The actuator is rotated in the direction of the figure below with it pressed against governor case.



2. Procedure for removing actuator

(4) You remove the actuator backward keeping the state of 2-(3).
You will be able to remove feeling neither caught nor resistance on the way. Please do it over again from 2- (3) ,when you feel resistance.

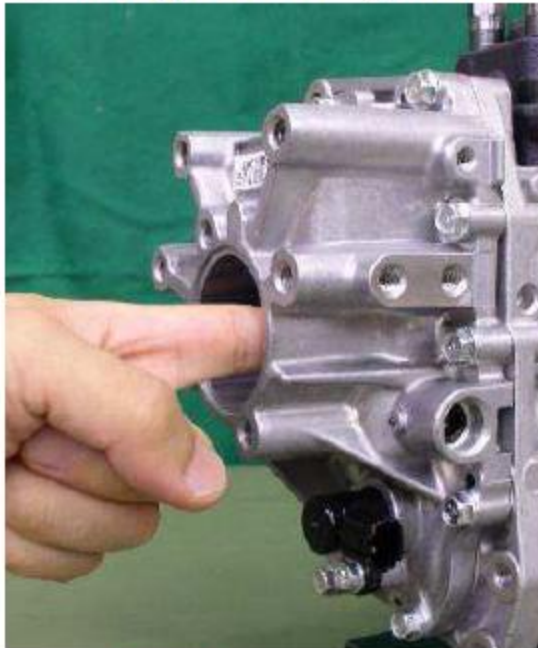


The link has not come off.
Please do it over again from 2-(3).

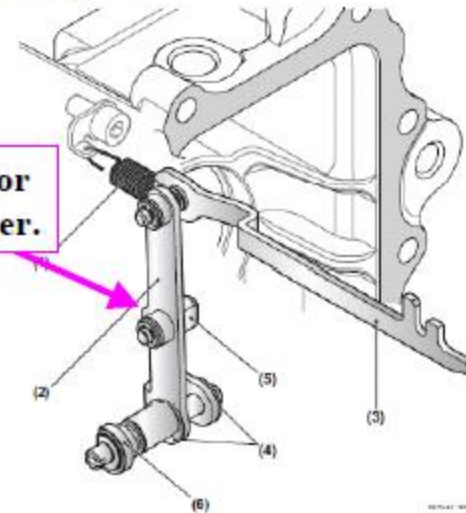


3. Checking for governor-lever

(1) You push the governor lever by the finger.



push the governor lever by the finger.



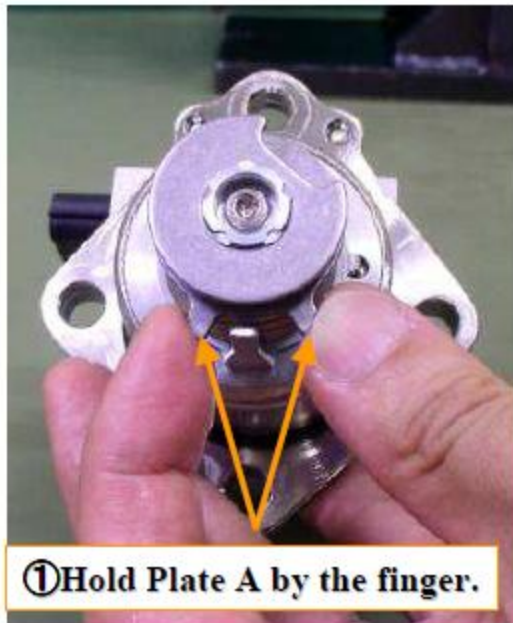
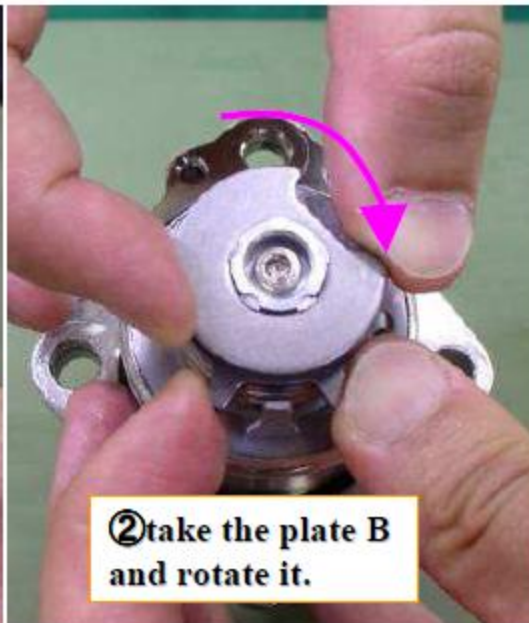
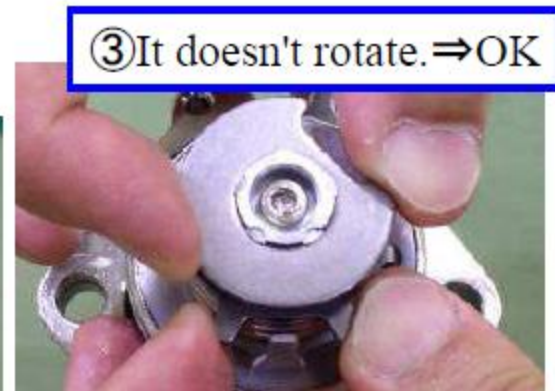
(1)	Rack-restoring assisting spring	(4)	Spacers
(2)	Governor lever	(5)	Governor-lever pin
(3)	Link	(6)	Governor-lever shaft (Eccentric shaft)

When the governor lever doesn't move ⇒ Please exchange pump.

When the governor lever moves (about 5mm)
⇒ Please go to 「4. Checking for actuator」

4. Checking for actuator

(1) Checking for guide plate

**① Hold Plate A by the finger.****② take the plate B and rotate it.****③ It doesn't rotate. => OK****③ It rotates. => NG**

When plate B doesn't rotate

⇒ The grouting of guide plate is OK.

⇒ Please install the detached actuator again.

When plate B rotates

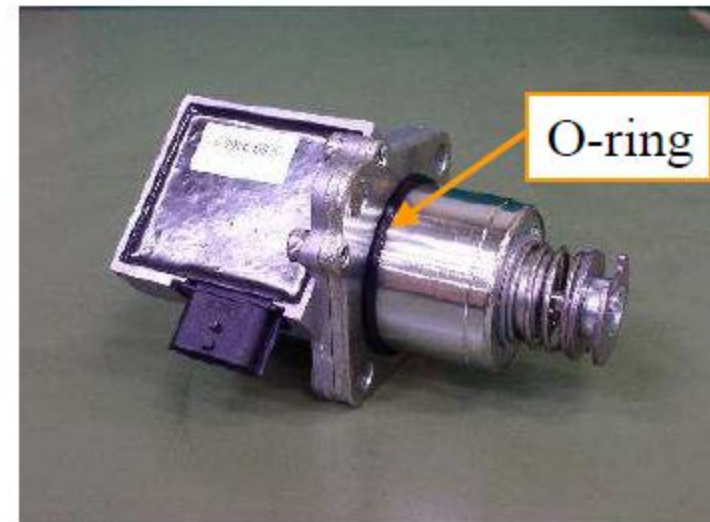
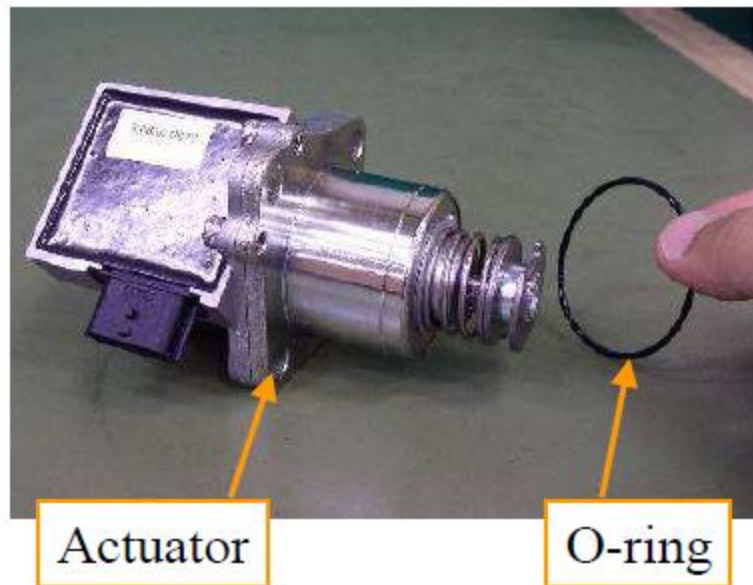
⇒ The grouting of guide plate is loose. (NG)。

⇒ It is necessary to exchange actuator.

Please exchange it for the emergency actuator.

5. Procedure for installation actuator

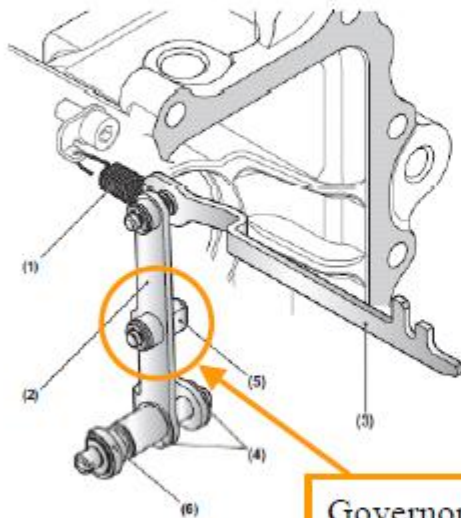
(1) O-ring is inserted.



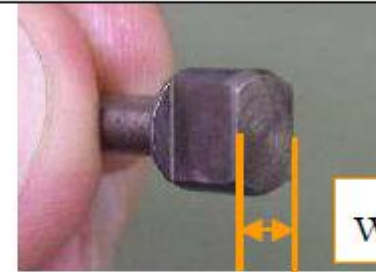
5. Procedure for installation actuator

(2)-1 You make width across flats of governor lever pin the same direction.

The look of governor lever pin



Governor lever pin

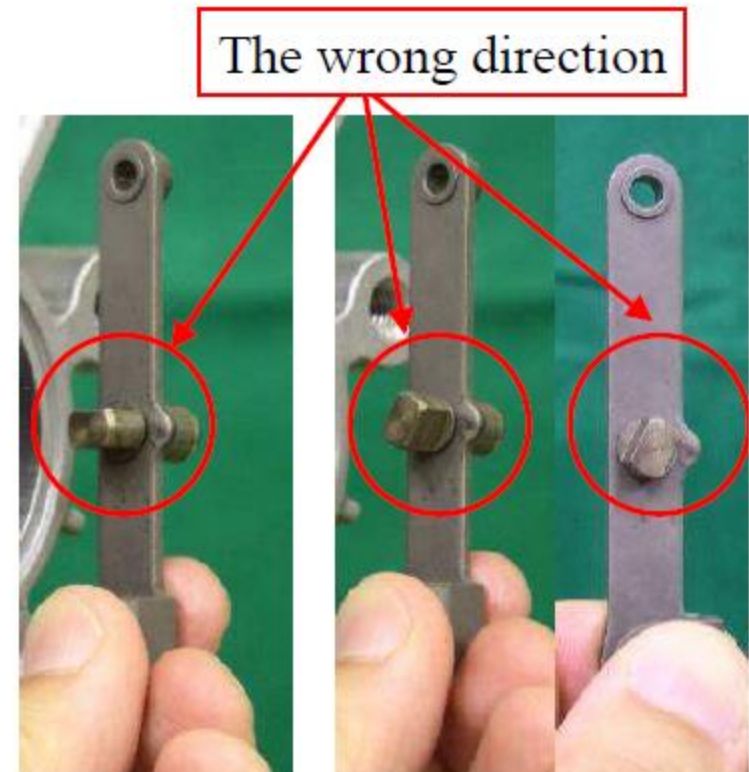
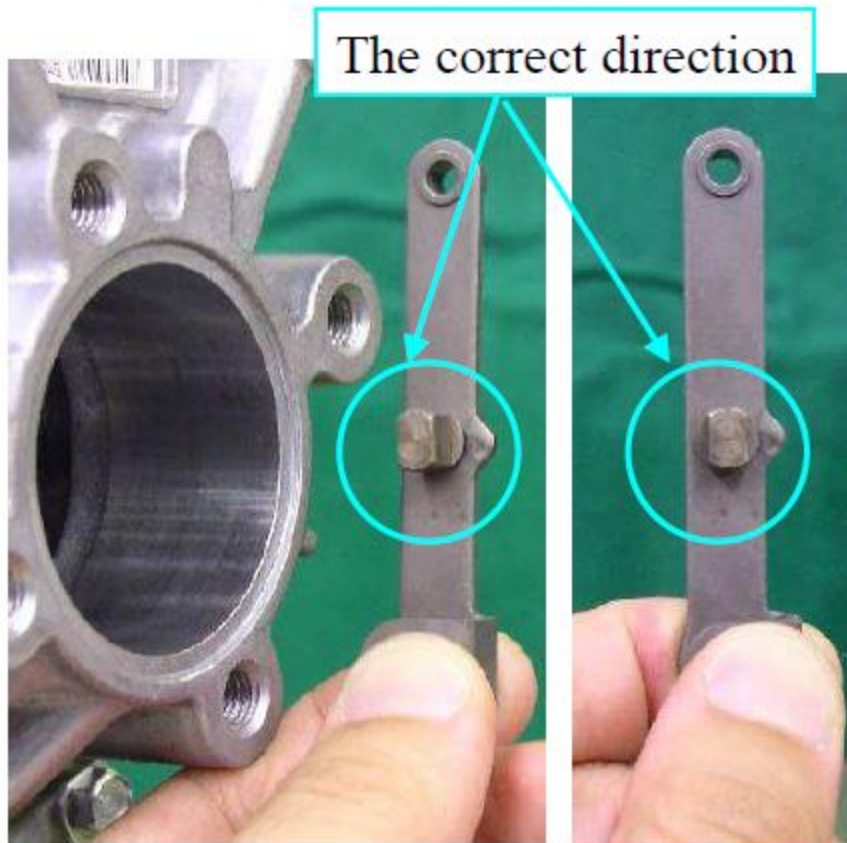


width across flats



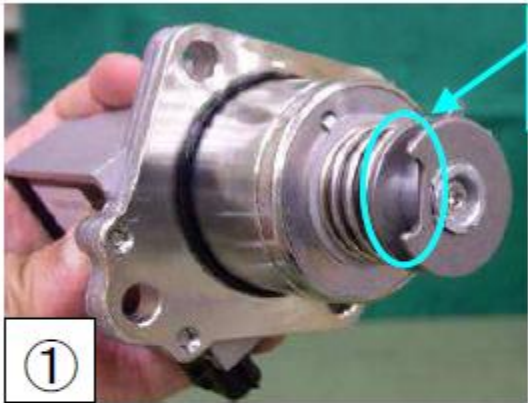
5. Procedure for installation actuator

(2)-2 You make width across flats of governor lever pin the same direction.

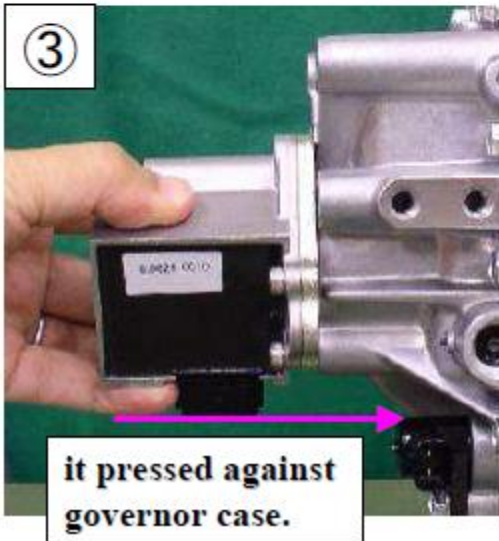
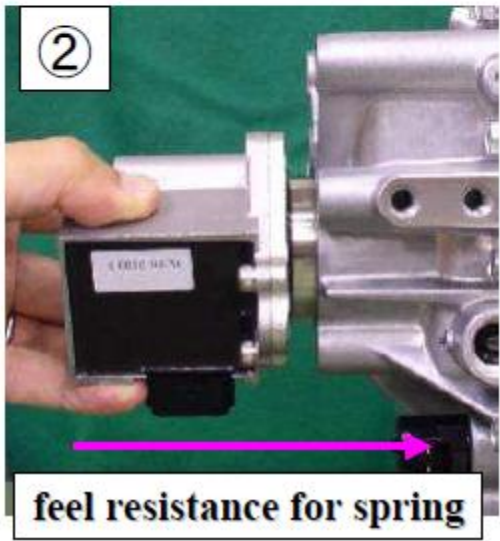
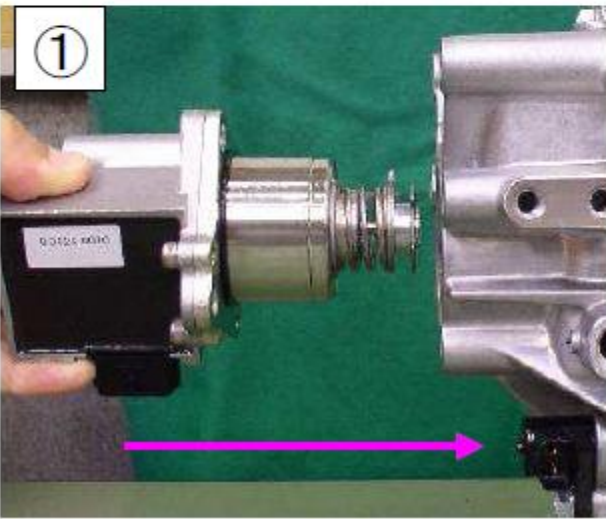
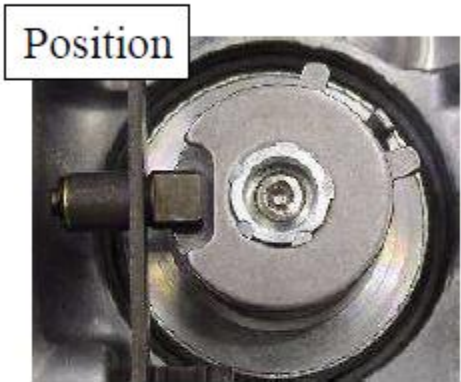


5. Procedure for installation actuator

(3) You insert actuator into governor case.

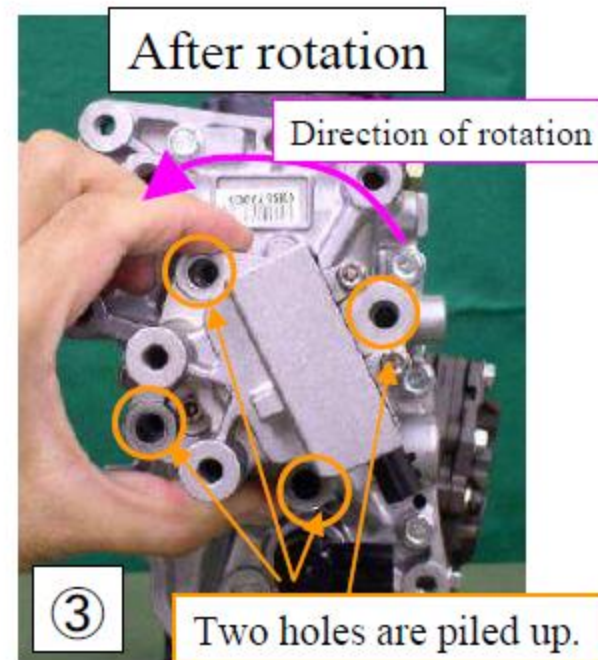
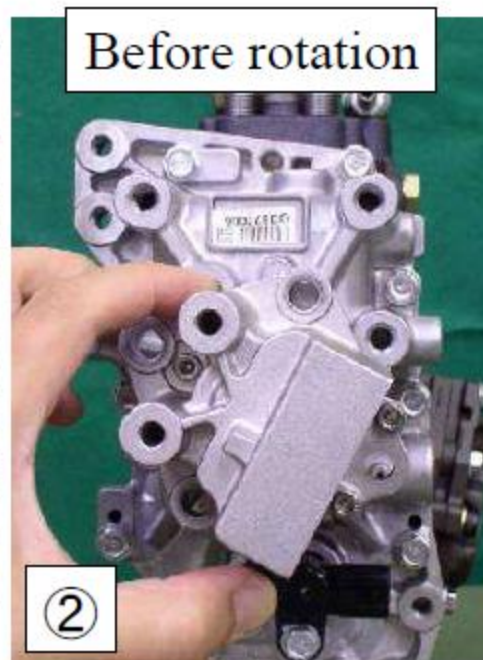
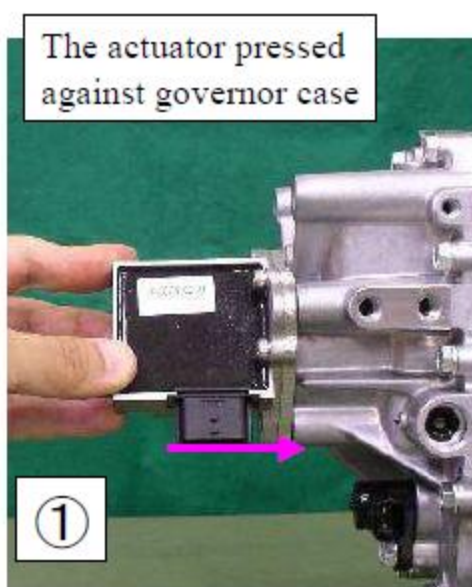


Direction of the notched portion of the guide plate.



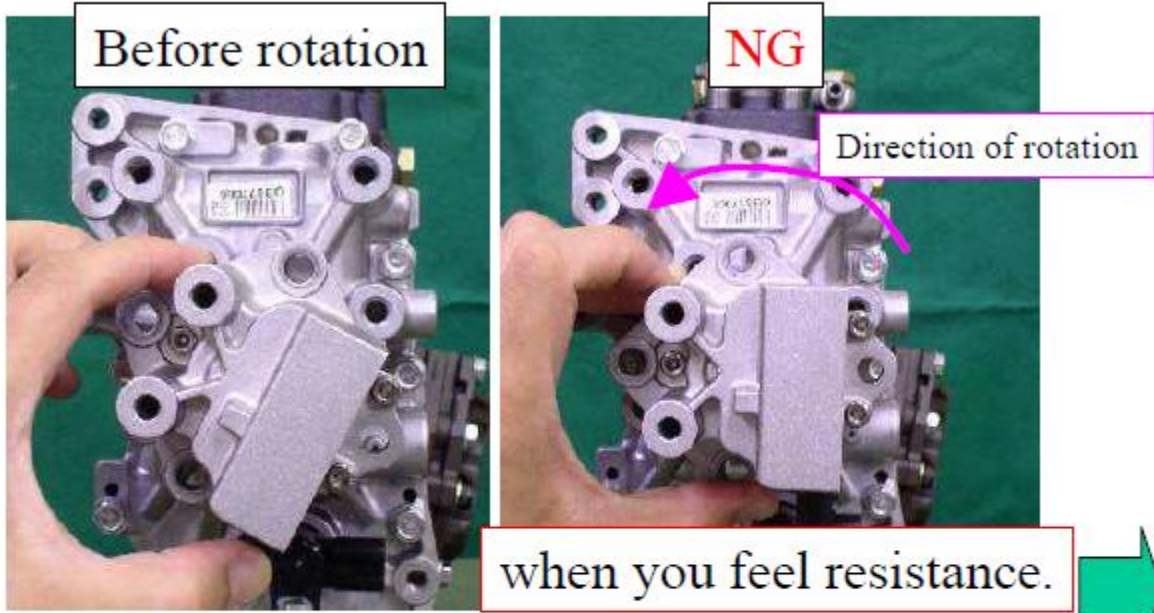
5. Procedure for installation actuator

(4)-1 The actuator is rotated in the direction of the figure below with it pressed against governor case.

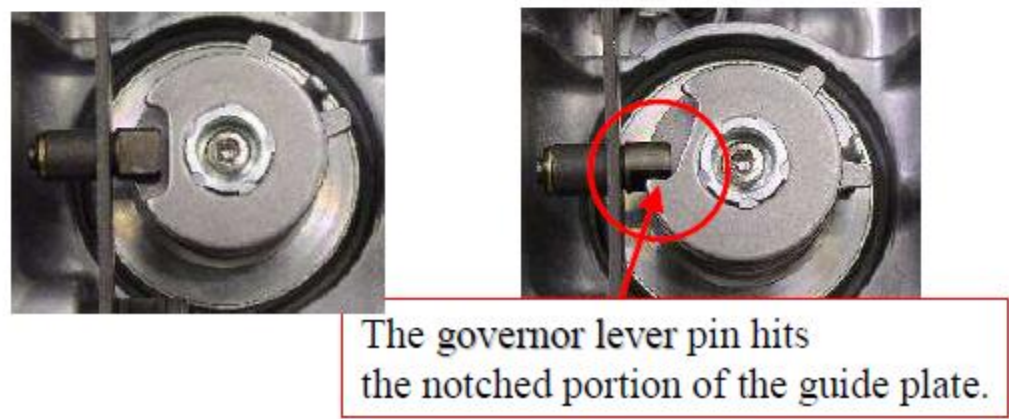


Important: When you feel resistance even a little at the time of rotating.
Please stop it at once.
(The actuator is damaged when keeping rotating. Refer to 5-(4)-2)

5. Procedure for installation actuator
(4)-2 In wrong cases

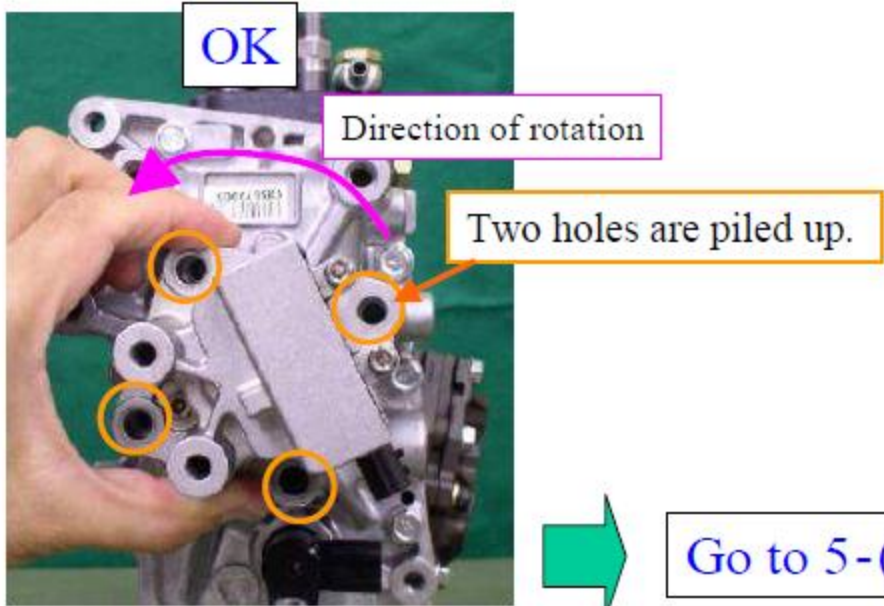
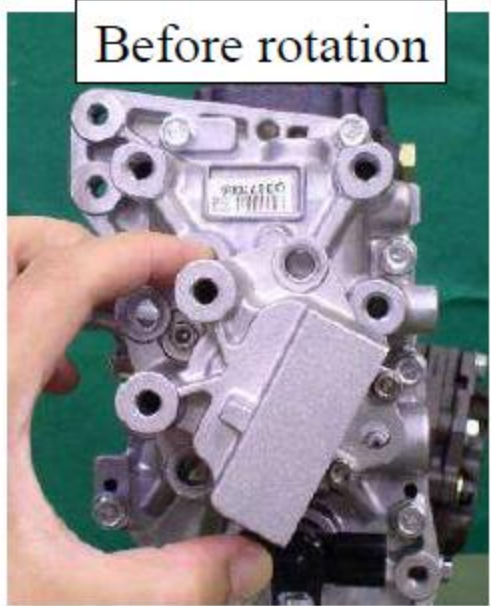


Please do it over again from 5-(2)



5. Procedure for installation actuator

(4)-3 In correct cases (OK)

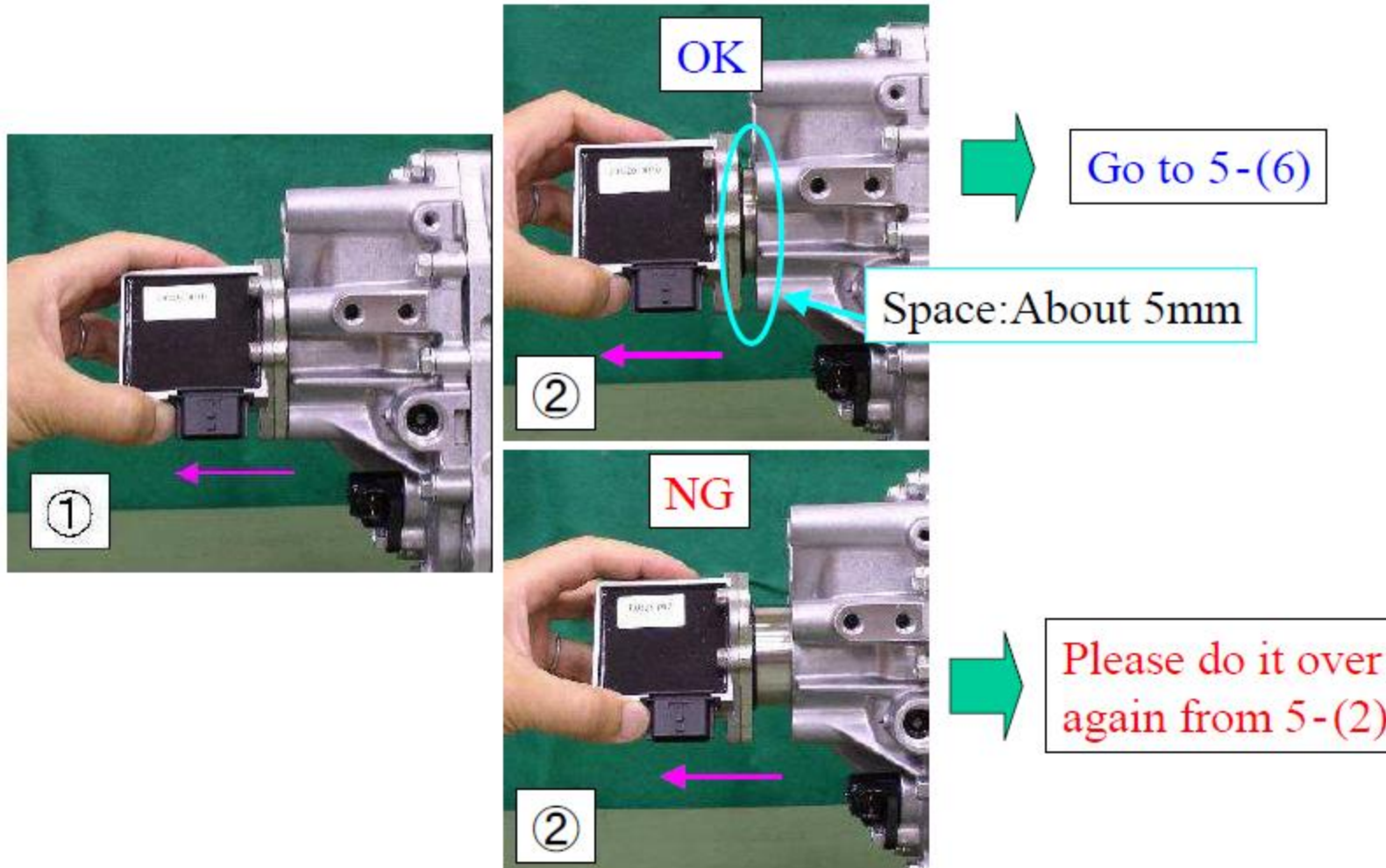


Go to 5-(5)



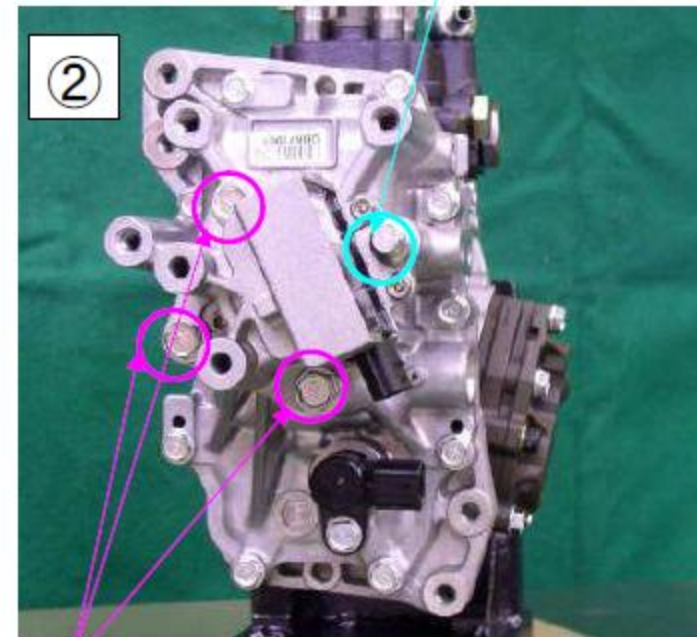
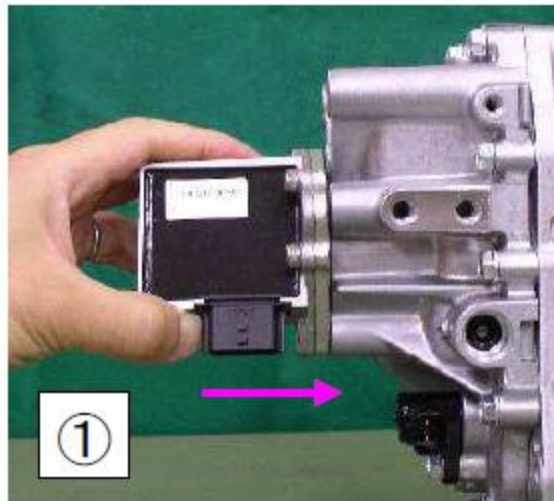
5. Procedure for installation actuator

(5) Please pull the actuator lightly. Please inspect the thing that the actuator cannot be detached from governor case.



5. Procedure for installation actuator

(6) Please fix four bolts.



Socket size: 10mm

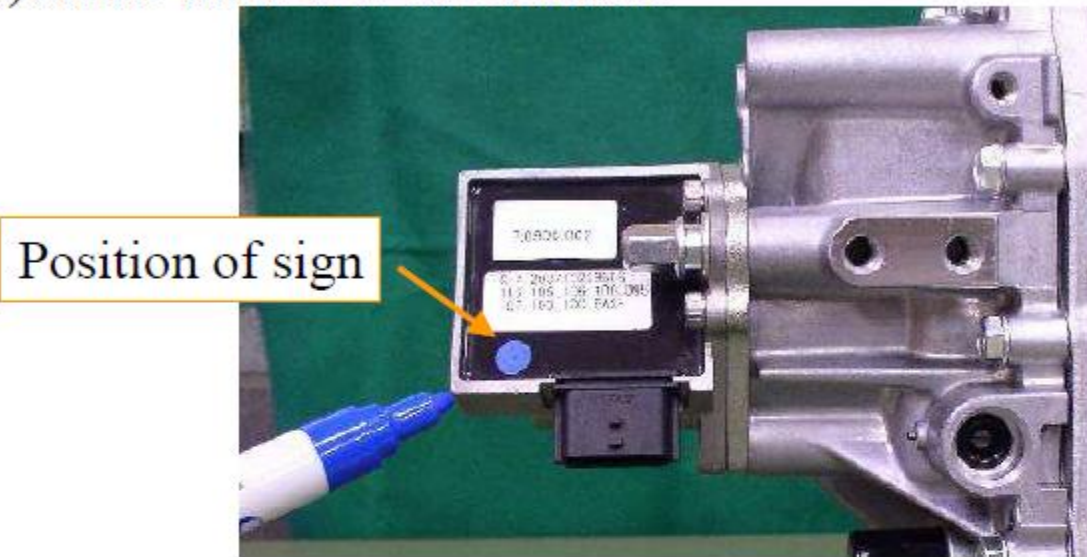
Tightening torque: $16.5 \pm 2.0 \text{ N} \cdot \text{m}$

Socket size: 12mm

Tightening torque: $20 \pm 2.0 \text{ N} \cdot \text{m}$

5. Procedure for installation actuator

(7) Please mark it to the actuator.



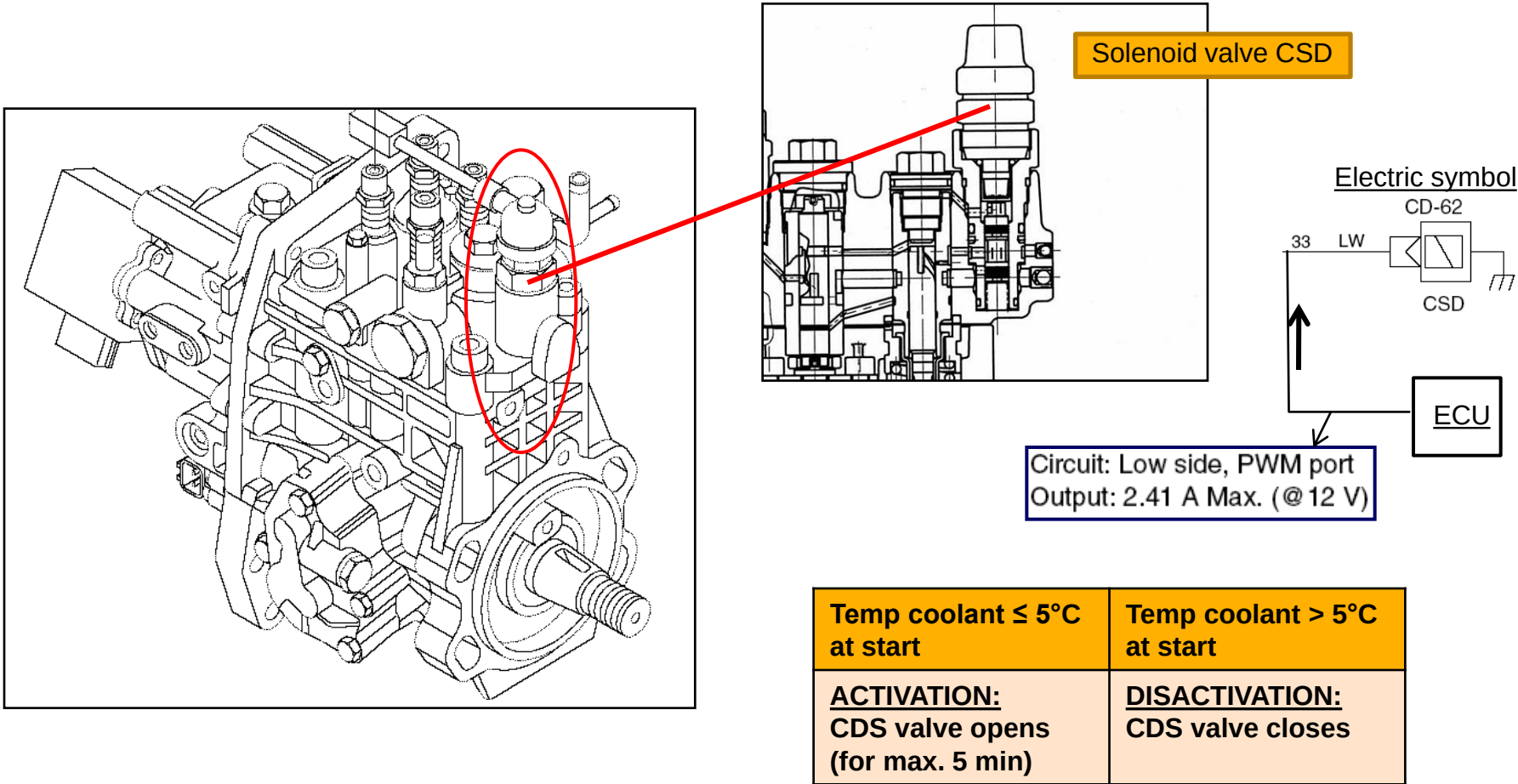
- (8) • Please connect the wire harness.
• Please confirm whether the engine starts

(• When the actuator is normal
⇒ Please cope with it according to the troubleshooting manual.)

Important: When you exchange it for the emergency actuator
⇒ Please exchange the Fuel Injection Pump and ECU later.

The fuel injection pump (MP pump) has a CSD valve mechanism that allows the fuel injection timing to advance and the injection quantity to increase, thereby improving the cold start performance of the engine.

The Eco-governor has a solenoid valve CSD where the CSD can be opened or closed with a valve solenoid. The E-ECU opens the CSD valve when the coolant temperature sensor detects that the coolant temperature is 5°C or lower at cold start. The CSD valve closes when the coolant temperature rises to 5°C or five minutes have elapsed after engine started.

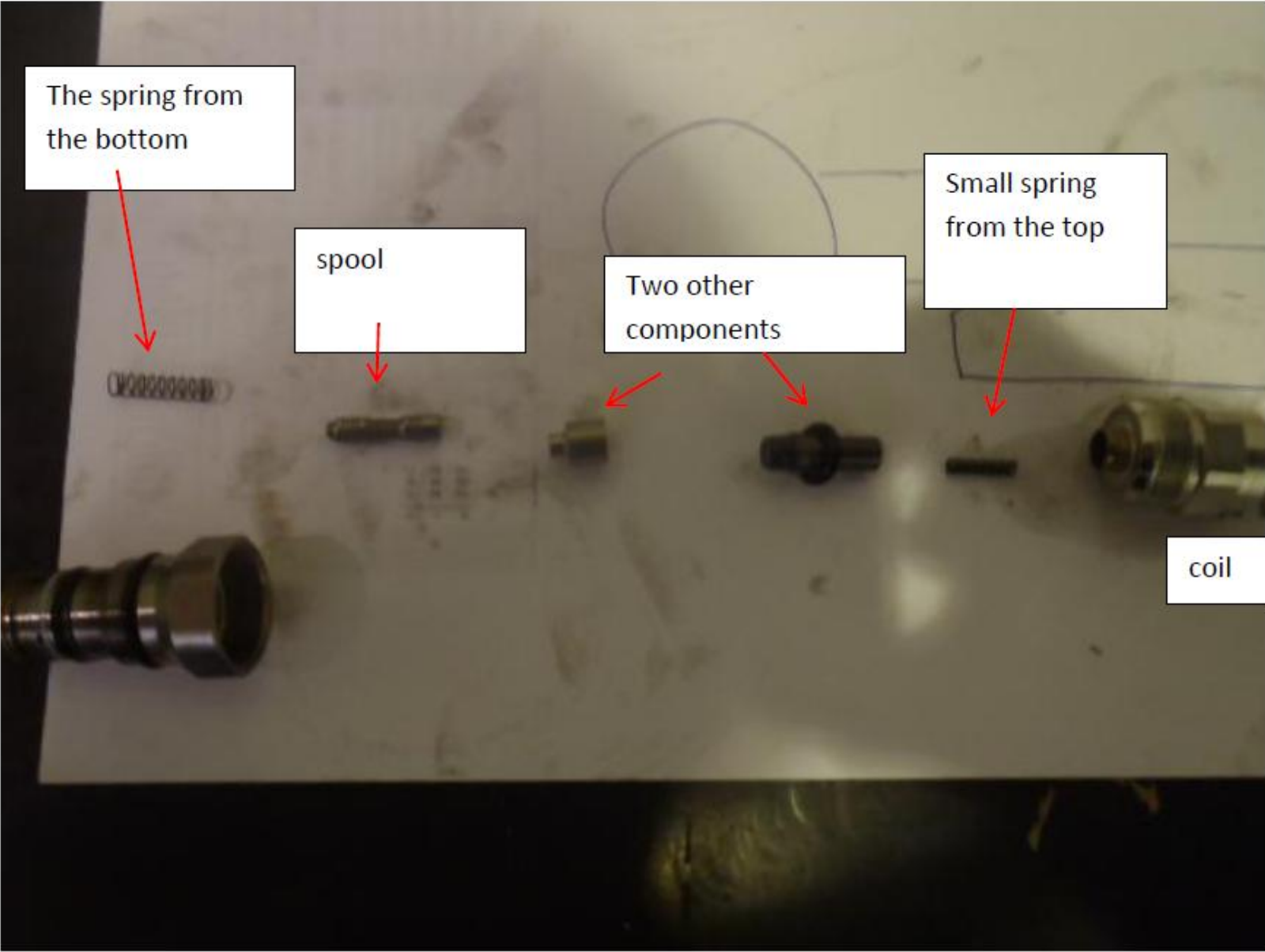




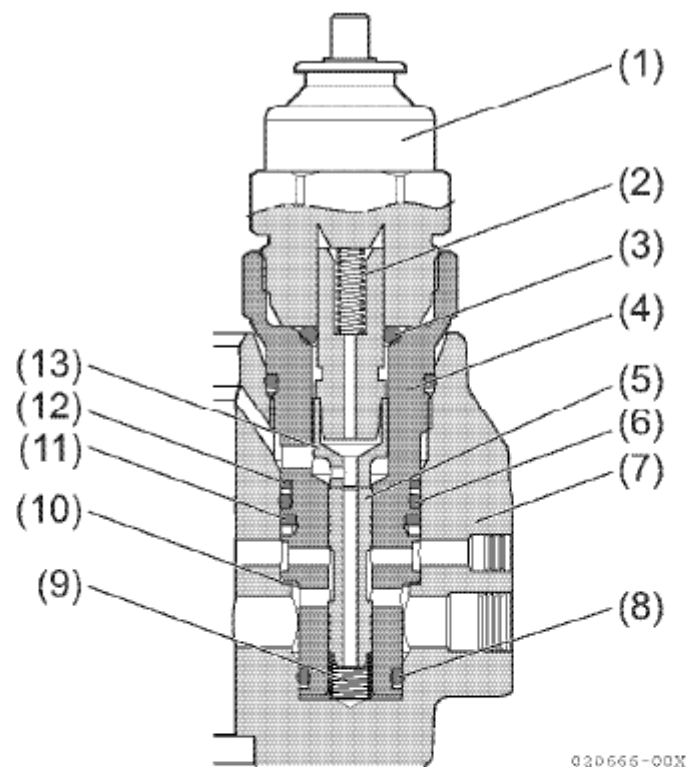
COLD START DEVICE on YANMAR engine R55-7A

If you dismount the solenoid , you will find a loose spring at the bottom of the solenoid. It is not easy to mount it back if the pump is mounted on the engine.





3. INJECTION PUMP - COLD START DEVICE (CSD)

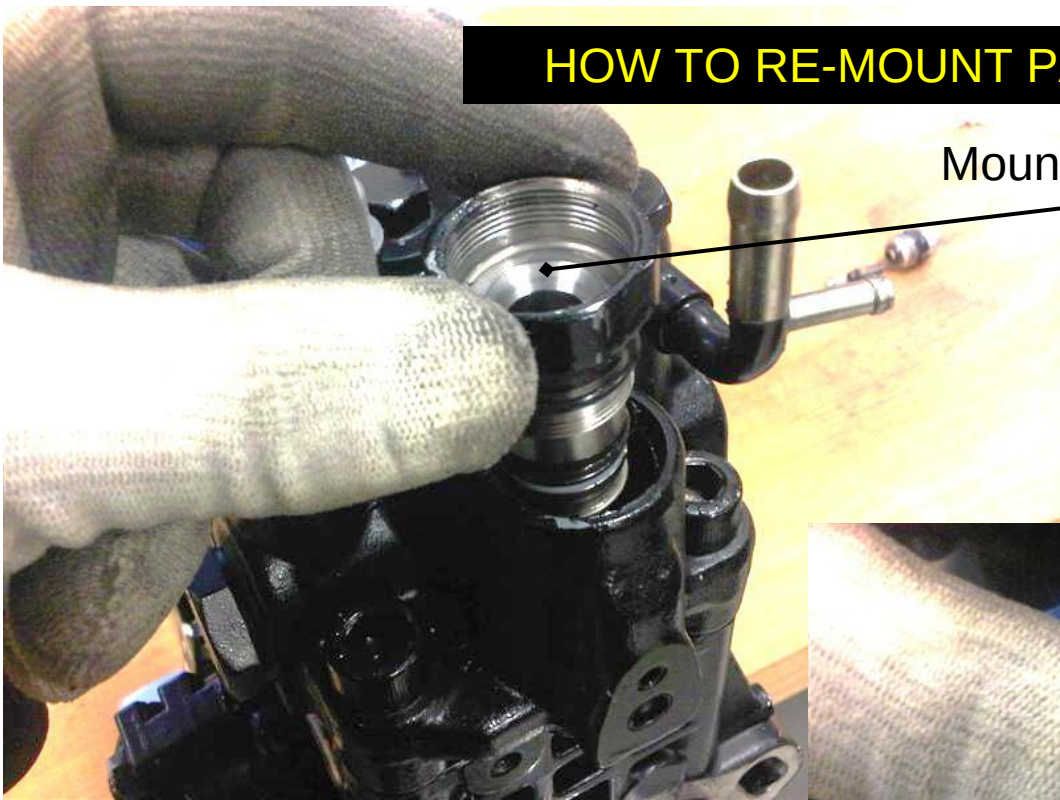
<https://truckmanualshub.com/>

In case of CSD failure, normally only the solenoid valve (1) needs to be exchanged. All other parts can remain in the FIP! If other parts are or need to be removed as well, the easiest way to mount back is shown in the next slides

- | | |
|----------------------------------|-----------------------|
| 1. Solenoid Valve CSD (Solenoid) | 8. O-Ring 1011 |
| 2. Solenoid Spring | 9. Timer Spring |
| 3. O-Ring 4D1020 | 10. Timer Packing |
| 4. Timer Holder | 11. Backup-Ring T2P15 |
| 5. Timer Piston | 12. Backup-Ring |
| 6. O-Ring 1016 | 13. Cap (Timer)) |
| 7. Hydraulic Base | |

HOW TO RE-MOUNT PARTS OF CSD

Mount the timer holder



Insert the timer spring



3. INJECTION PUMP - COLD START DEVICE (CSD)

<https://truckmanualshub.com/>



Insert the timer piston
(with some diesel for
lubrication)



Insert the timer cap



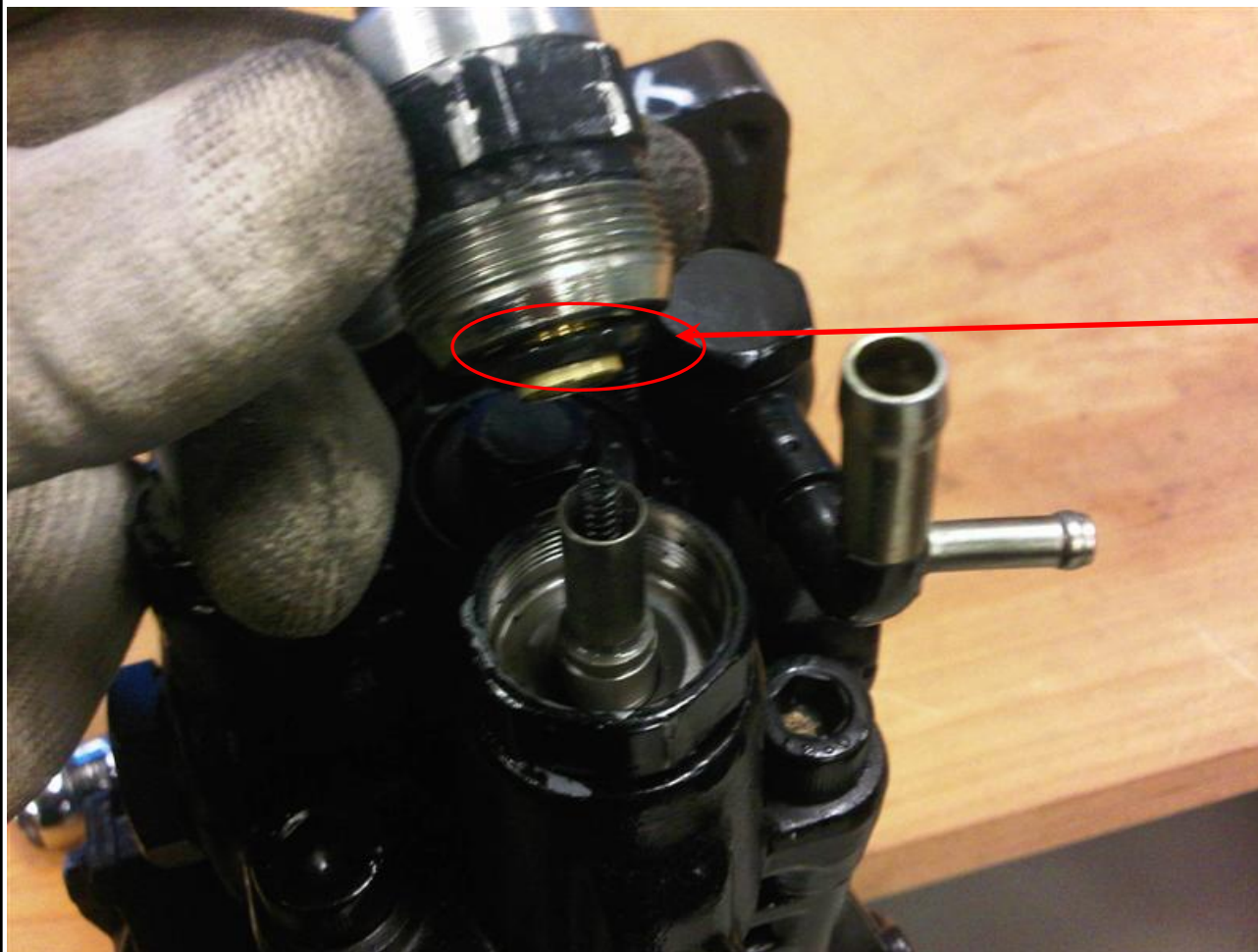
Timer cap installed

3. INJECTION PUMP - COLD START DEVICE (CSD)

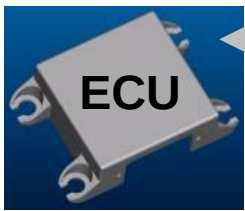
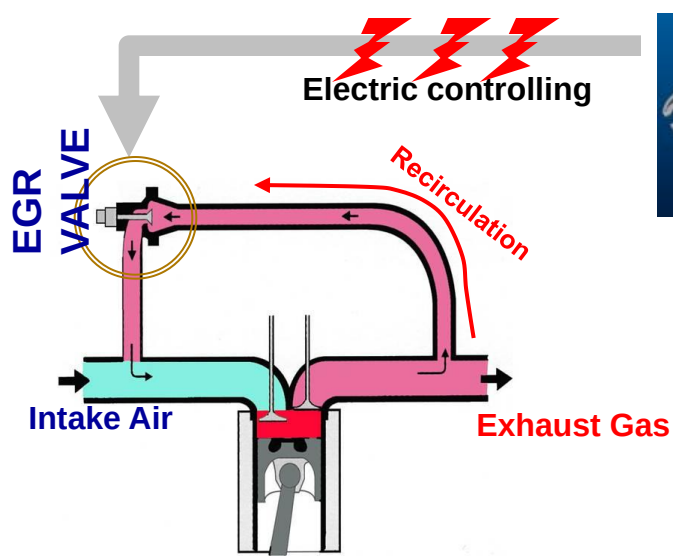
<https://truckmanualshub.com/>

Place the solenoid plunger

And the solenoid spring



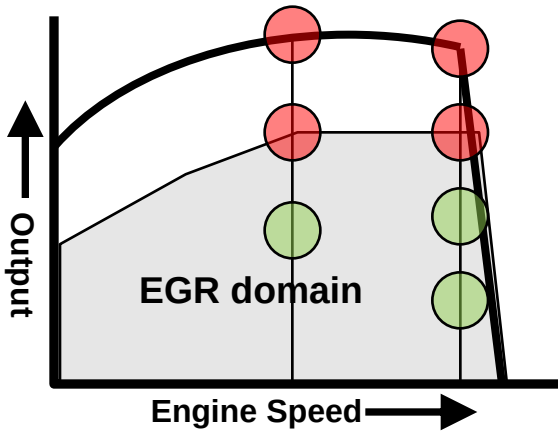
Finally mount the solenoid valve. Make sure that the o-ring is mounted correct as shown here. At disassembly the o-ring can remain seated on the solenoid plunger!



Speed & Load
& temp-coolant

Electronic Control
for EGR valve

goal of EGR valve:
↓
combustion temp. reduction
↓
NOx reduction



EGR principle:

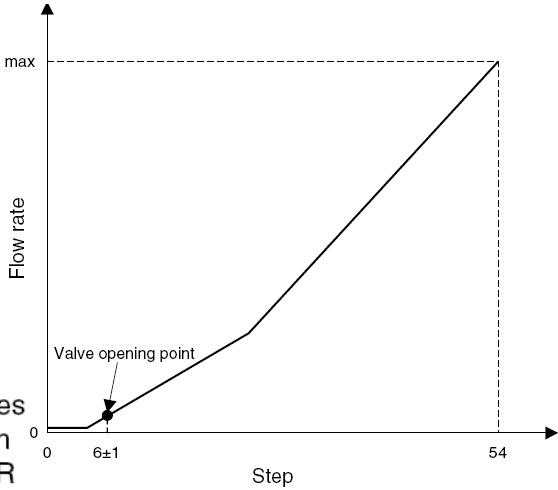
By recirculating exhaust gases in the intake, the available gases to combust will be diminished and that causes slowing down & cooling of the combustion process by several hundred degrees, thus reducing NOx formation.

The Eco-governor uses an electronic-controlled EGR valve to reduce the emission of NOx from 37 kW or more engines.

The EGR valve is driven by a stepping motor. The opening (0 - 54 steps) of the EGR valve is adjusted depending on the engine speed and load factor so as to control recirculation of exhaust gas. **Figure 2-31** outlines the relationship between the number of steps and the flow rate.

The EGR valve does not open when the coolant temperature is lower than 60°C. This is because low temperature corrosion due to condensation of exhaust gas components must be prevented.

The EGR valve is driven by a stepping motor. This stepping motor adopts two-phase excitation and requires holding current to keep the valve stopped. "Two-phase excitation" means that the solenoid is supplied with two-phase current and "holding current" does that the solenoid is always energized. The motor of the EGR valve is consequently approx. 24 watt heated even while the engine is at rest.



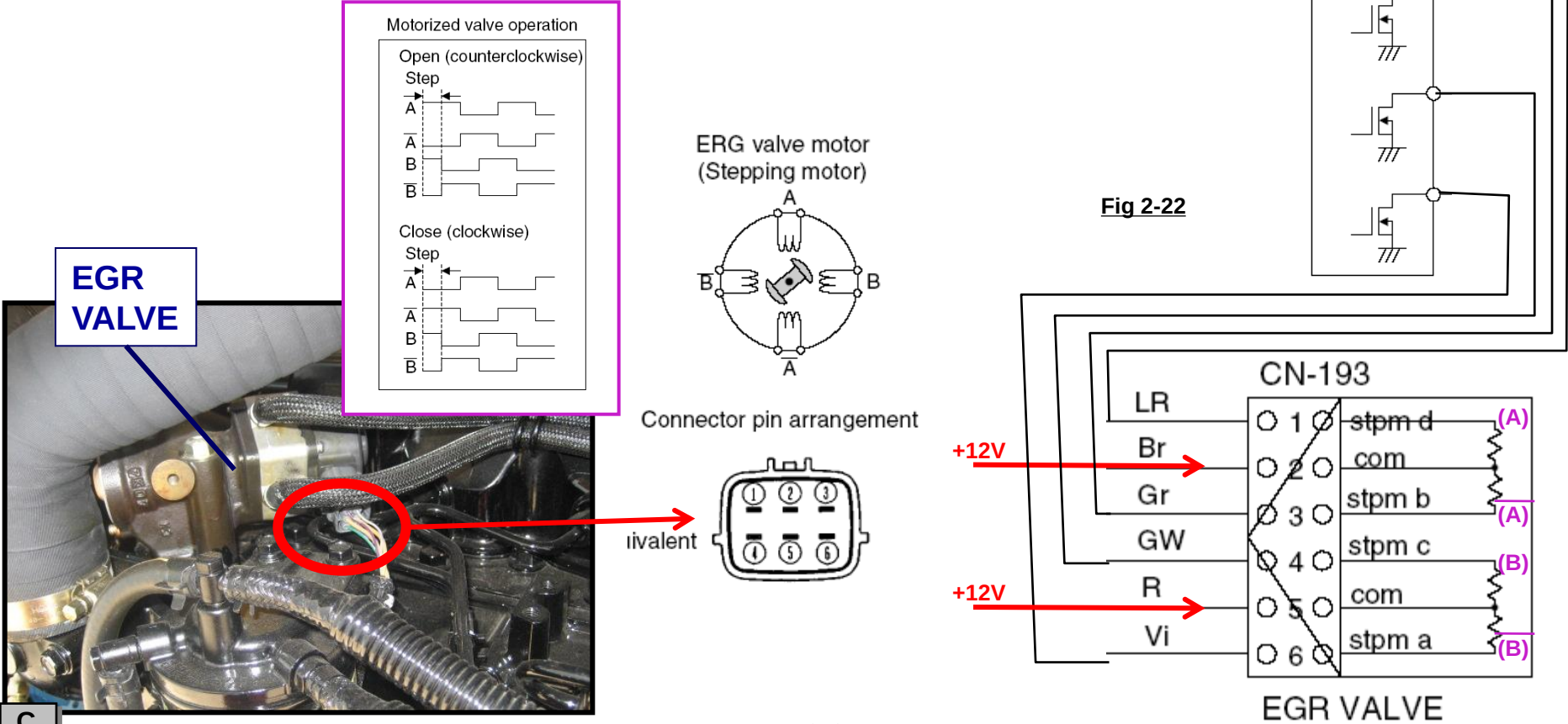
!! For electronically controlled EGR engine, it is necessary to use fuel with max. 1000 ppm of sulfur !!! → In case of too much sulfur parts, sulfuric acid can be formed (due to the presence of recycled sulfur dioxide) and cause corrosion on the cylinder liner and other major components

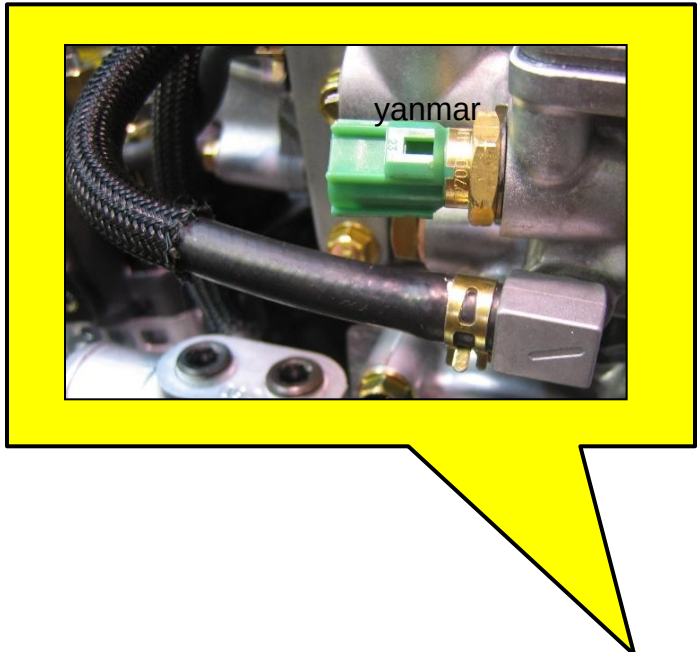
Output from ECU to EGR valve:

The EGR valve output is a high-side output. See **Figure 2-22**.

The EGR valve is driven by a stepping motor. This stepping motor adopts two-phase excitation and requires holding current to keep the valve stopped. "Two-phase excitation" means that the solenoid is supplied with two-phase current and "holding current" does that the solenoid is always energized. The motor of the EGR valve is consequently approx. 24 watt heated even while the engine is at rest.

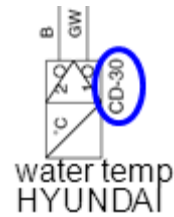
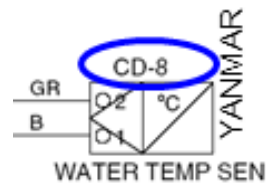
The E-ECU turns on or off the output transistors in the sequence shown in **Figure 2-22**, thereby driving the solenoids for the stepping motor and opening/closing the EGR valve. The speed of the valve open/close operation depends on the on/off speed of the transistors. The EGR valve opens at 125 pps (pulses per second: the number of steps taken per second) and closes at 250 pps (20 pps for 10 steps before full close).





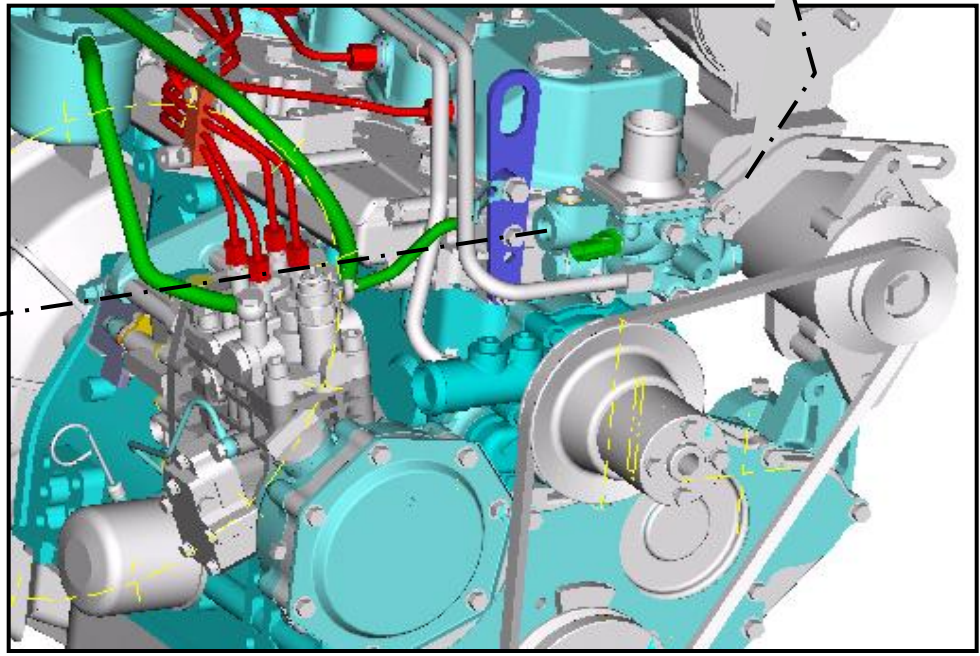
Yanmar
water temp. sensor
CD-8

(XJAU-00896 for R55-7A)



Hyundai
water temp. sensor
CD-30

(21EA-62010 for R55-7A)



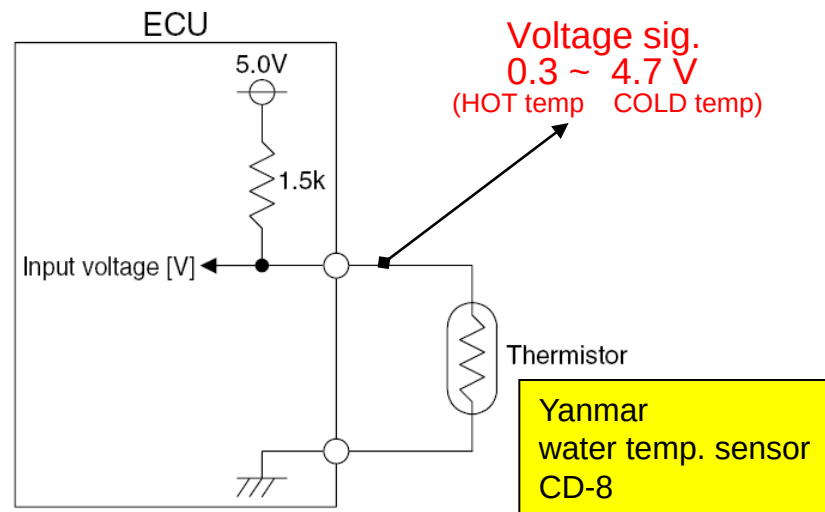
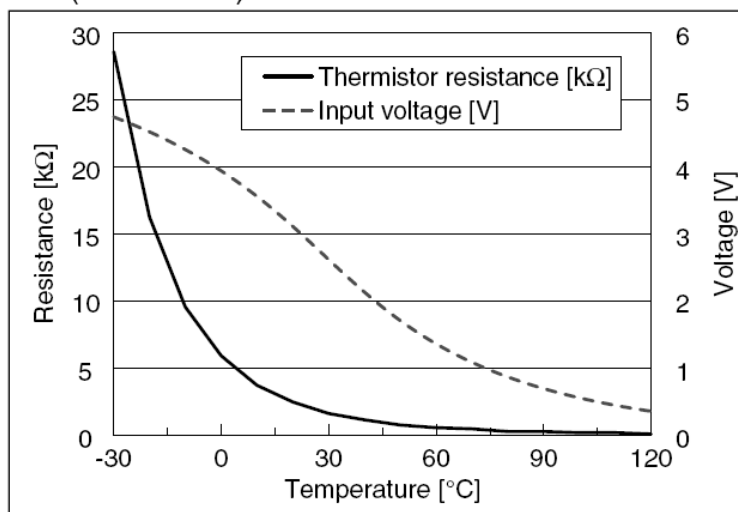
5. COOLANT(WATER) TEMP SENSOR CD-8 (YANMAR)

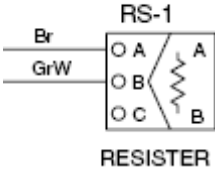
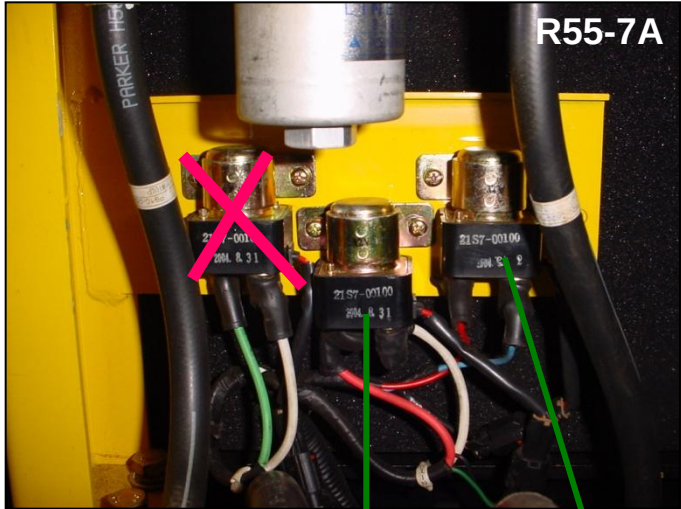
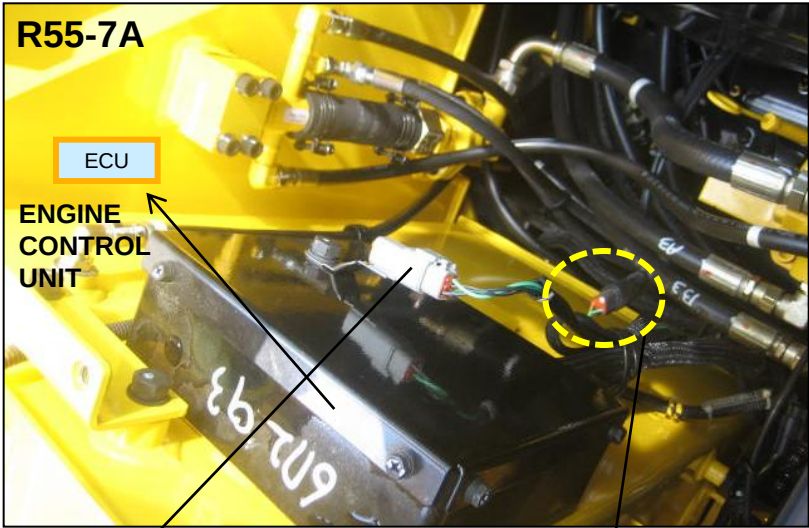
<https://truckmanualshub.com/>

The input characteristics of the coolant temperature sensor are shown in **Figure 2-15**. As in the case of the rack position sensor, the input voltage of 0 to 5 volt is converted into an AD value of 0 to 1023. As is clear from the figure, the thermistor resistance decreases with increasing temperatures.

The measurement error of the coolant temperature sensor is approximately $\pm 3^{\circ}\text{C}$ at 0°C and $\pm 6^{\circ}\text{C}$ at 110°C . The coolant temperature sensor has been designed so that it provides high measurement accuracy at relatively low temperatures to allow low-temperature control of CSD etc.

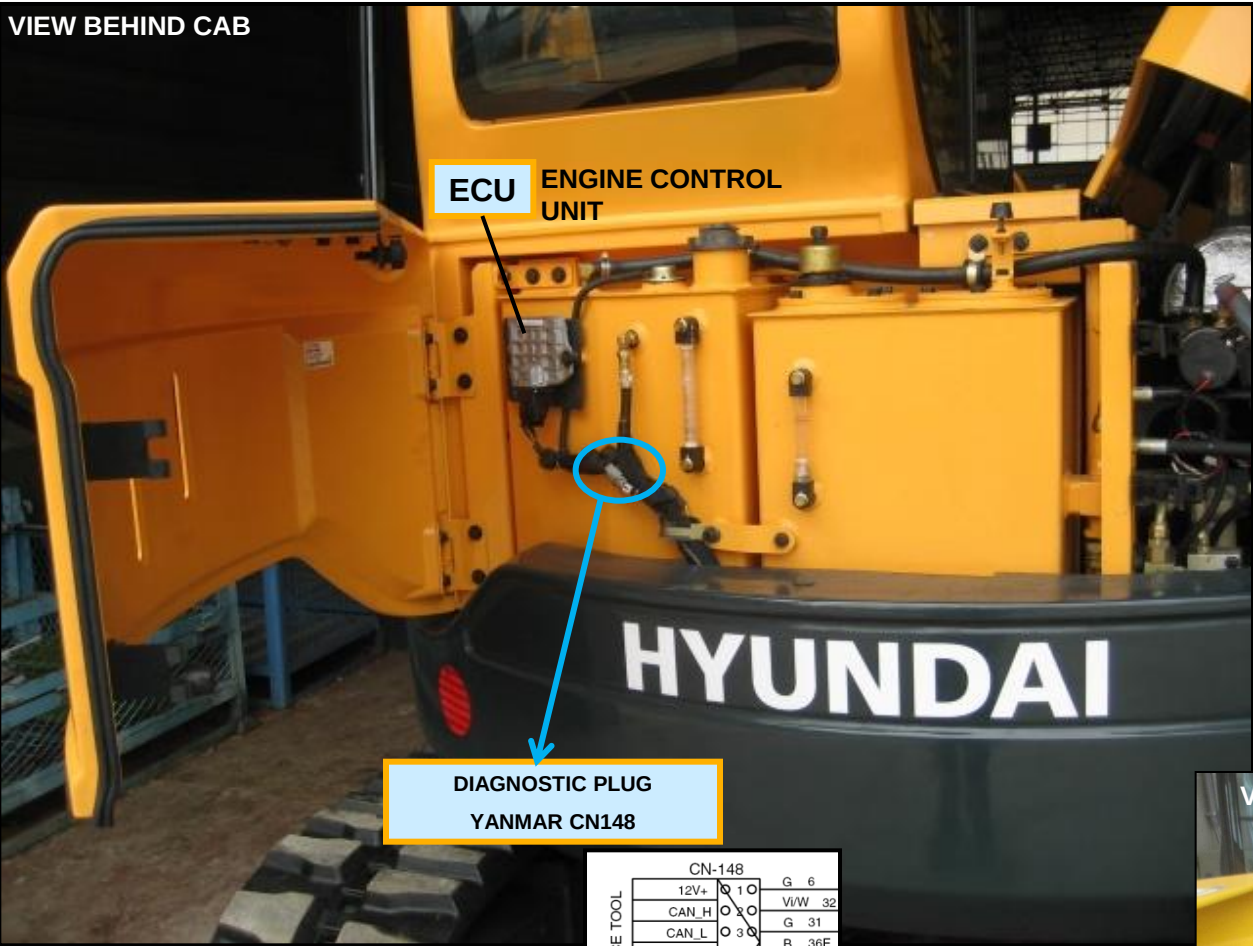
The E-ECU converts the input voltage into temperatures by mapping. Connecting a thermistor with different characteristics to the sensor or connecting an unintended load to the thermistor circuit will affect the relationship between input voltage and temperature, resulting in failure to perform correct temperature measurement. Do not connect a coolant temperature sensor other than the Yanmar genuine sensor to terminal TW (E25 - E28) of the E-ECU.





R80CR-9 (first model)

VIEW BEHIND CAB



ECU

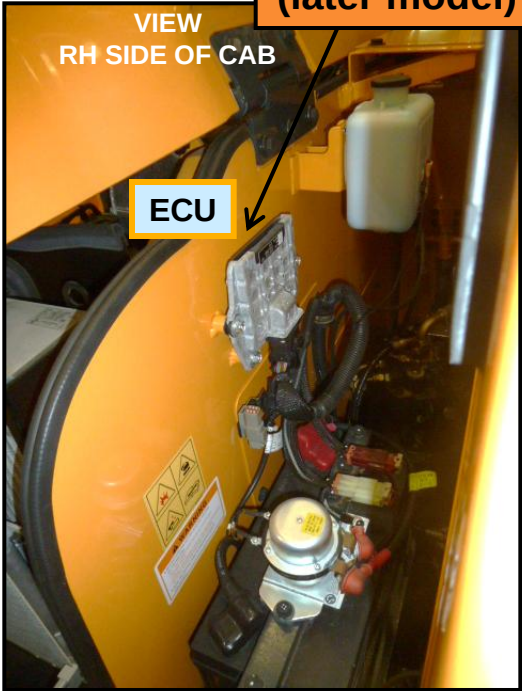
ENGINE CONTROL
UNIT

DIAGNOSTIC PLUG
YANMAR CN148

CN-148			
SERVICE TOOL	12V+	1	G 6
	CAN_H	2	V/W 32
	CAN_L	3	G 31
	GND	4	B 36E
	NC	5	
	NC	6	

R80CR-9
(later model)

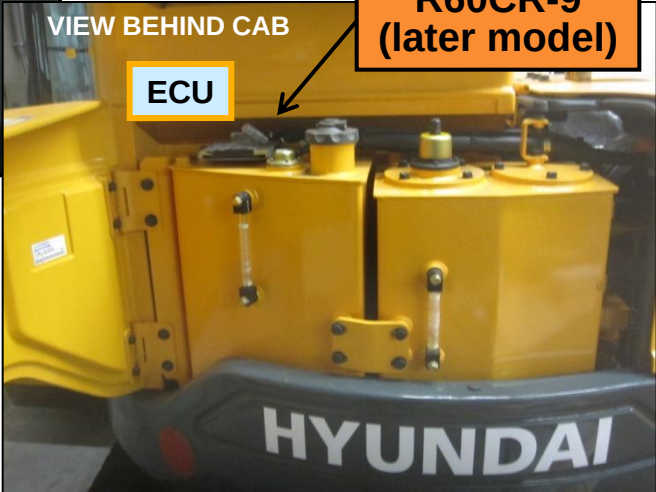
VIEW
RH SIDE OF CAB



ECU

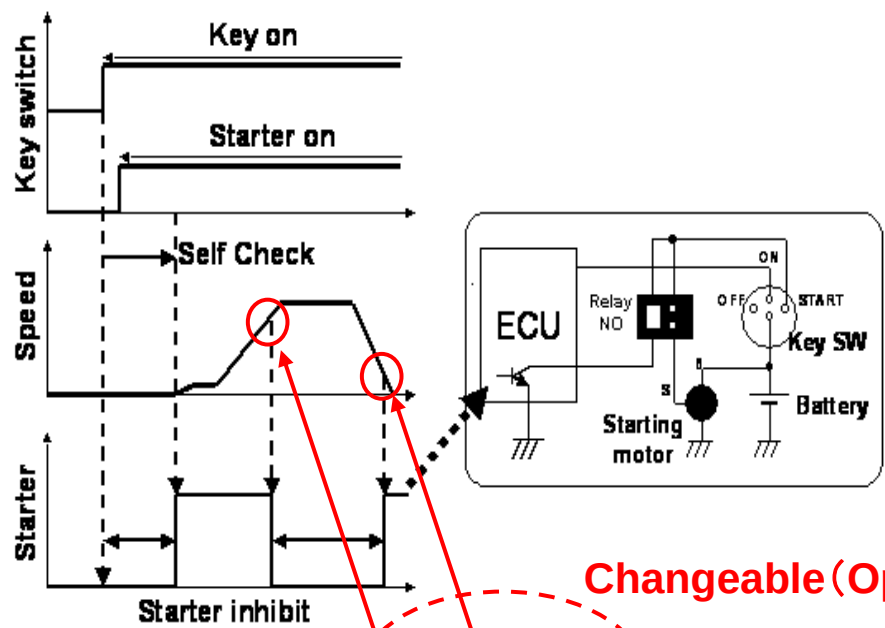
R60CR-9
(later model)

VIEW BEHIND CAB



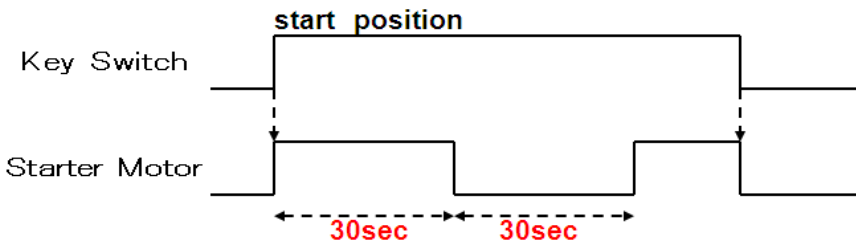
ECU

Starter Control
Starter safety control

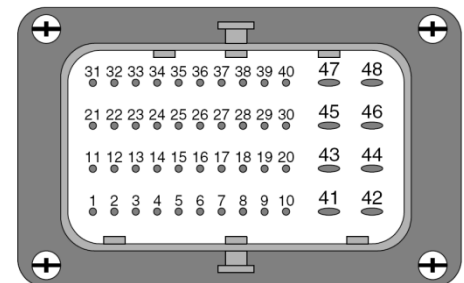
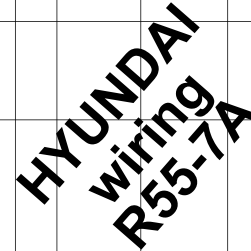


Maximum running time: 30sec.
Rest time for next cycle: 30sec. } **Changeable (Option)**

Changeable (Option)
325 rpm
675 rpm

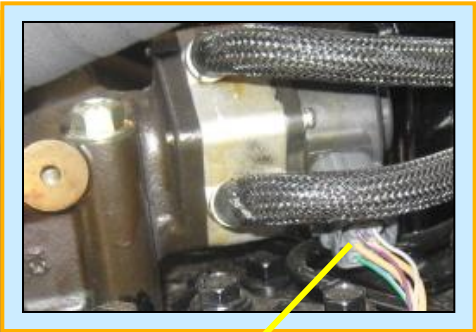


Eng. of b
https://tru



7. ENGINE VIEW

<https://truckmanualshub.com/>



EGR valve (Exhaust Gas Recirculation)
CN 193

RACK
ACTUATOR
CN 194

Eng Oil
press CD 18

Lift pump
CN 145

Pre heater
CN 80

CSD valve (Cold start device)
CD 62

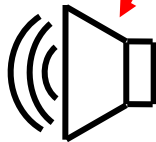
Tacho
(speed)
sensor
CD 17

Air cleaner SW
CD 10

Water Temp
CD 8
(Yanmar)

Water Temp
CD 30
(Hyundai)

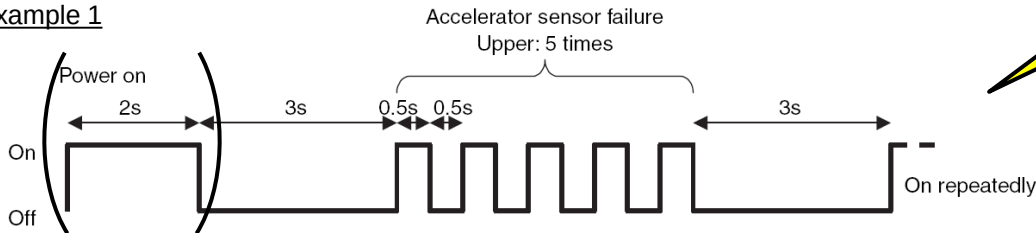
When the ECU (engine control unit) detects an active engine fault, the engine fault warning lamp on the cluster lights up and the beeper inside cluster starts beeping



LISTEN TO LENGTH & FREQUENCE OF BEEPS FOR TROUBLESHOOTING !

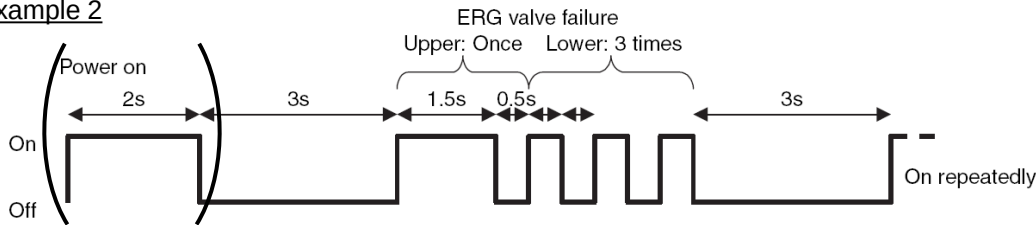
Each engine fault code generates a specified amount of beeps with specified length:

Example 1



“Accelerator engine failure” → BEEPS CODE = “5”
In this case the beeper creates 5 “short” beeps

Example 2



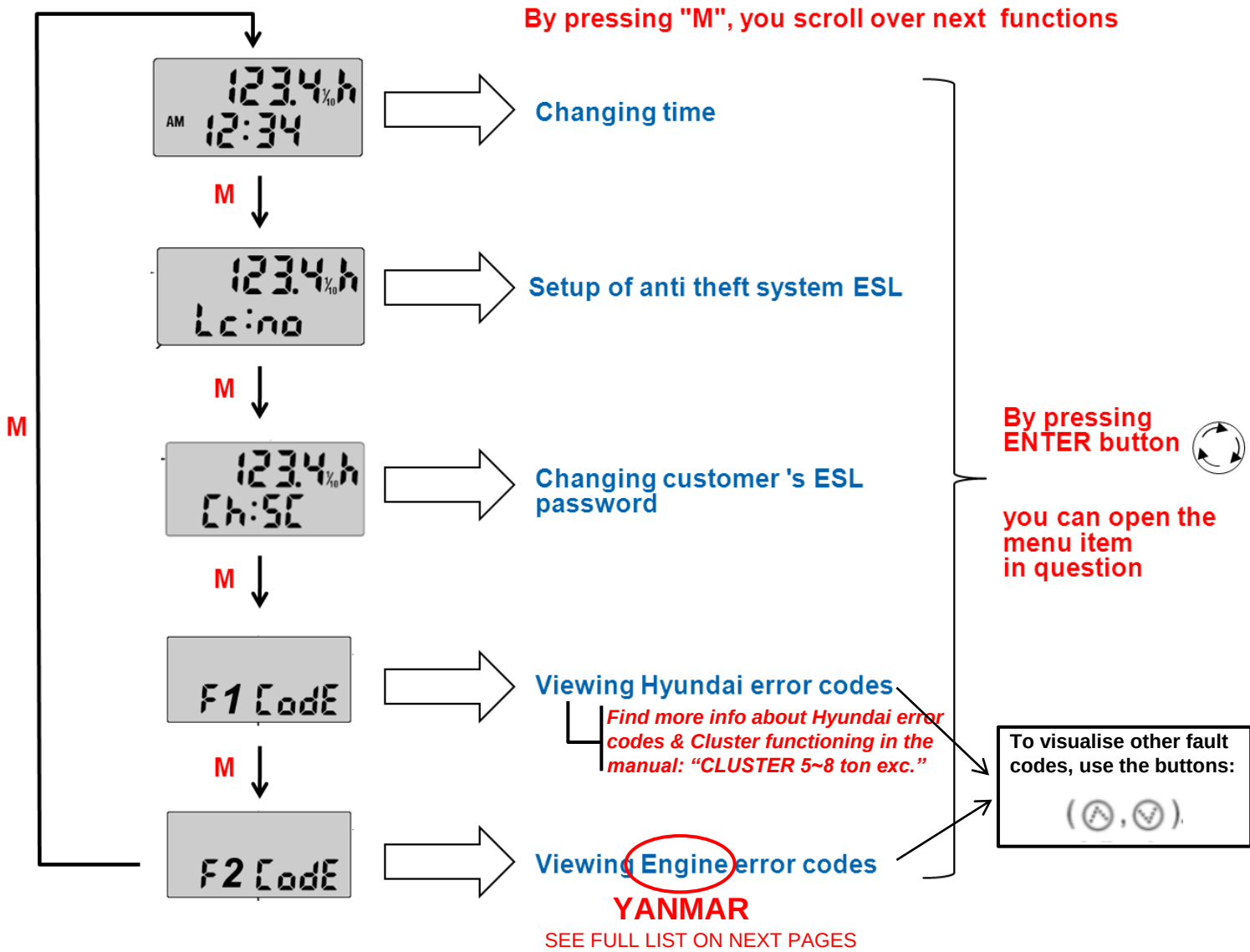
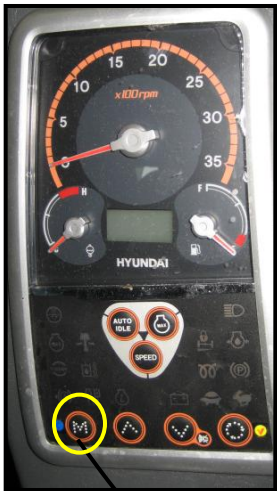
“ERG valve failure” → BEEPS CODE = “1 - 3”
In this case the beeper creates 1 “long” beep, followed by 3 “short” beeps

In case of simultaneous engine faults, the different beep patterns will appear successively, in order of increasing number of beeps. A complete overview of the engine errors list can be found on next pages

No.	Item	Failure detection conditions	Operation when failure occurs	Action/ condition for recovery	Category	Number of beeps
1	Coolant temperature sensor failure	Sensor voltage is 4.8 V or more, or 0.2 V or less.	Engine runs with a coolant temperature of 30°C.	Correct failure.	Always enable	4
2	Accelerator sensor failure	Sensor voltage is 4.6 V or more, or 0.2 V or less.	[Without optional backup accelerator sensor] Engine runs at 1500 min ⁻¹ . (Option can change) [With optional backup accelerator sensor] Select backup accelerator sensor: No limitation Backup accelerator sensor failure: Engine runs at 1500 min ⁻¹ . (Option can change)	Correct failure.	Default to disable	5
3	Speed sensor failure	Engine start signal (E8) is on, but the engine speed is zero. Engine speed decreases by 480 min ⁻¹ or more in 40 ms.	[With optional backup speed sensor] Backup speed sensor becomes active; speed is limited to 1800 min ⁻¹ . (Option can change) Backup speed sensor failed: Engine stops. [Without optional backup speed sensor] Engine stops.	Turn key off.	Always enable	6
4	Rack position sensor failure	Correlation between rack actuator output and rack position exceeds threshold upper limit by 0.32 sec. or more. Correlation between rack actuator output and rack position exceeds threshold lower limit by 0.16 sec. or more.	Engine runs with limited output and speed. (Rack position control is inactive and speed control is active).	Turn key off.	Always enable	7
5	Rack actuator failure	Rack actuator current is too high. Rack actuator current is too low. Engine accelerates with minimum rack actuator output. Engine stalls while rack position sensor is failed.	Engine stops.	Turn key off.	Always enable	8
6	Overspeed	Idling engine speed exceeds high idling speed plus 600 min ⁻¹ .	Engine stops.	Turn key off.	Always enable	9

No.	Item	Failure detection conditions	Operation when failure occurs	Action/ condition for recovery	Category	Number of beeps
7	Backup speed sensor failure	Engine start signal (E8) is on, but the engine speed is zero.	Engine continues to run while main speed sensor is used. Backup speed sensor failed: Engine stops.	Turn key off.	Default to disable	1-1
		Engine speed decreases by 480 min ⁻¹ or more in 40 ms.				
8	CAN communication failure	CAN communication packets cannot be received.	Last value is retained. Backup sensor becomes active.	Correct failure.	Default to enable	1-2
9	EGR valve failure	Low status is detected even through port is off.	Engine runs with limited output(92%) and speed(1800min ⁻¹).	Turn key off.	Default to disable	1-3
		High status is detected even through port is on.				
10	CSD solenoid valve failure	High status is detected even through port is off.	Engine continues to run with port being off.	Turn key off.	Always enable	1-4
11	Air heater relay failure	Low status is detected even through port is on.				
		High status is detected even through port is off.				
			Engine runs with air heater relay being off.	Turn key off.	Default to enable	1-5
12	Main relay failure	Power is not shut off even though main relay is off.				
		Low status is detected even through port is on.				
13	Rack actuator relay failure	Low status is detected even through port is off.	Engine stops.	Turn key off.	Always enable	1-7
		High status is detected even through port is on.				
14	Backup accelerator sensor failure	Sensor voltage is 4.6 V or more, or 0.2 V or less.	Engine continues to run while main accelerator sensor is used. Main accelerator sensor failure: Engine runs at 1500 min ⁻¹ .(Option can change)	Correct failure.	Default to enable	1-8
15	Atmospheric pressure sensor failure		Atmospheric pressure compensation is canceled.	Turn key off.	Default to enable	1-9
16	Oil pressure switch failure	Oil pressure switch fails to turn on when engine is off.	Engine runs normally.(Option can change)	Turn key off.	Default to enable	2-1
17	Charge switch failure	Charge switch fails to turn on when engine is off.	Engine runs normally.	Turn key off.	Default to enable	2-2
18	Power supply voltage abnormal	E-ECU supply voltage exceeds 10.0 V. E-ECU supply voltage exceeds 16.0 V.	Engine runs normally.	Correct failure.	Always enable	2-3

No.	Item	Failure detection conditions	Operation when failure occurs	Action/ condition for recovery	Category	Number of beeps
19	Sensor 5V failure	Monitoring voltage is approx. 0 V.	Engine runs normally.	Turn key off.	Always enable	2-4
		Monitoring voltage is 4.5 V or less.				
		Monitoring voltage is 5.5 V or more.				
20	E-ECU overheat alarm	E-ECU temperature exceeds 105°C. Alarm is canceled when E-ECU temperature decreases to 100°C. (Option can change)	Engine runs normally. (Option can change)	Correct failure.	Default to enable	2-5
21	Oil pressure low	Oil pressure switch fails to turn off when engine is running.	Engine runs normally. (Option can change)	Correct failure.	Default to enable	3-1
22	Charge failure	Charge switch fails to turn off when engine is running.	Engine runs normally.	Turn key off.	Default to enable	3-2
23	Coolant temperature abnormal	Coolant temperature switch turns on.	Engine runs normally. (Option can change)	Turn key off.	Default to enable	3-3
24	Air cleaner blockage alarm	Air cleaner switch turns on.	Engine runs normally. (Option can change)	Turn key off.	Default to enable	3-4
25	Oil/water separator alarm	Oil/water separator switch turns on.	Engine runs normally. (Option can change)	Turn key off.	Default to enable	3-5
26	Coolant temperature high alarm	Coolant temperature is 115°C or higher. Alarm is canceled when Coolant temperature decreases to 110°C. (Option can change)	Engine runs normally.	Correct failure.	Default to enable	3-6
27	E-ECU failure [ROM error]	FlashROM suffers checksum error.	Engine stops.	Turn key off.	Always enable	4-1
28	E-ECU failure [EEPROM error]	Reading/Writing fails.	Engine runs normally.	Turn key off.	Always enable	4-1
		EEPROM suffers checksum error.				
29	E-ECU failure [Sub CPU failure]	E-ECU fails to communicate with sub CPU.	Engine runs normally.	Turn key off.	Always enable	4-1
30	E-ECU failure [Mapping error]	Map format is invalid.	Engine stops.	Turn key off.	Always enable	4-1
31	E-ECU failure [E-ECU temperature sensor failure]	Sensor voltage is 4.6 V or more, or 1.0 V or less.	Engine runs normally.	Correct failure.	Always enable	4-1



8b. ENGINE ERROR CODE SYSTEM -9 Series

<https://truckmanualshub.com/>

Fault code		Description
YANMAR SPN	FMI	
1210	4	Engine fuel rack position sensor : shorted to low source
	3	Engine fuel rack position sensor : shorted to high source
91	4	Accelerator pedal position sensor "A" : shorted to low source
	3	Accelerator pedal position sensor "A" : shorted to high source
	2	Accelerator pedal position sensor "A" : intermittent fault
	1	Accelerator pedal position sensor "A" : below normal operational range (SAE J1843)
	0	Accelerator pedal position sensor "A" : above normal operational range (SAE J1843)
	15	Accelerator pedal position sensor "A" : not available (SAE J1843)
29	4	Accelerator pedal position sensor "B" : shorted to low source
	3	Accelerator pedal position sensor "B" : shorted to high source
	2	Accelerator pedal position sensor "B" : intermittent fault
	1	Accelerator pedal position sensor "B" : below normal operational range (SAE J1843)
	0	Accelerator pedal position sensor "B" : above normal operational range (SAE J1843)
	15	Accelerator pedal position sensor "B" : not available (SAE J1843)
108	4	Barometric pressure sensor : shorted to low source
	3	Barometric pressure sensor : shorted to high source
	2	Barometric pressure sensor : intermittent fault
1136	4	E-ECU internal temperature sensor : shorted to low source
	3	E-ECU internal temperature sensor : shorted to high source
	2	E-ECU internal temperature sensor : intermittent fault
	0	E-ECU internal temperature : too high
110	4	Engine coolant temperature sensor : shorted to low source
	3	Engine coolant temperature sensor : shorted to high source
	2	Engine coolant temperature sensor : intermittent fault
	0	Engine coolant temperature : too high
1079	4	Sensor 5V : shorted to low source
	3	Sensor 5V : shorted to high source
	2	Sensor 5V : intermittent fault
158	1	E-ECU system voltage : too low
	0	E-ECU system voltage : too high
1078	4	Engine fuel injection pump speed sensor : shorted to low source
522402	4	Auxiliary speed sensor : shorted to low source
522241	4	Engine fuel rack actuator relay : open circuit
	3	Engine fuel rack actuator relay : short circuit
	7	Engine fuel rack actuator relay : mechanical malfunction
	2	Engine fuel rack actuator relay : intermittent fault
522243	4	Air heater relay : open circuit
	3	Air heater relay : short circuit
	2	Air heater relay : intermittent fault

Fault code		Description
YANMAR SPN	FMI	
522242	4	Cold start device : open circuit
	3	Cold start device : short circuit
	2	Cold start device : intermittent fault
522251	4	EGR stepping motor "A" : open circuit
	3	EGR stepping motor "A" : short circuit
522252	4	EGR stepping motor "B" : open circuit
	3	EGR stepping motor "B" : short circuit
522253	4	EGR stepping motor "C" : open circuit
	3	EGR stepping motor "C" : short circuit
522254	4	EGR stepping motor "D" : open circuit
	3	EGR stepping motor "D" : short circuit
100	4	Oil pressure switch : shorted to low source
	1	Oil pressure : too low
167	4	Battery charge switch : shorted to low source
	1	Battery charge : charge warning
522314	0	Engine coolant temperature : abnormal temperature
522323	0	Air cleaner : mechanical malfunction
522329	0	Oily water separator : mechanical malfunction
190	0	Engine speed : over speed condition
638	4	Engine fuel rack actuator : shorted to low source
	3	Engine fuel rack actuator : shorted to high source
	7	Engine fuel rack actuator : mechanical malfunction
639	12	High speed CAN communication : communication fault
630	2	E-ECU internal fault : EEPROM check sum error (data set 2)
	12	E-ECU internal fault : EEPROM error
628	12	E-ECU internal fault : flashROM check sum error (main software)
	2	E-ECU internal fault : flashROM check sum error (data set 1)
	2	E-ECU internal fault : flashROM check sum error (data set 2)
1485	4	E-ECU main relay : shorted to low source
522727	12	E-ECU internal fault : cyclic redundancy check of sub-CPU error
	12	E-ECU internal fault : acknowledgement of sub-CPU error
	12	E-ECU internal fault : communication with sub-CPU error
522728	12	E-ECU internal fault : engine map data version error
522730	12	Immobilizer : CAN communication fault
	8	Immobilizer : pulse communication fault
1202	2	Immobilizer : system fault

9. YANMAR ENGINE DIAGNOSTIC TOOL (YEDST)

<https://truckmanualshub.com/>

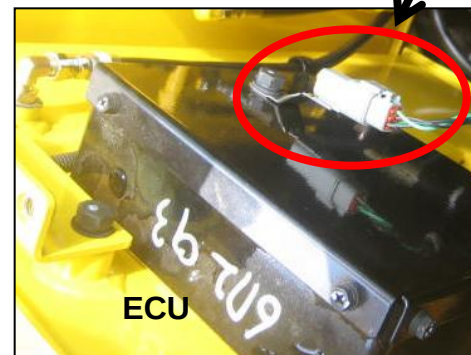
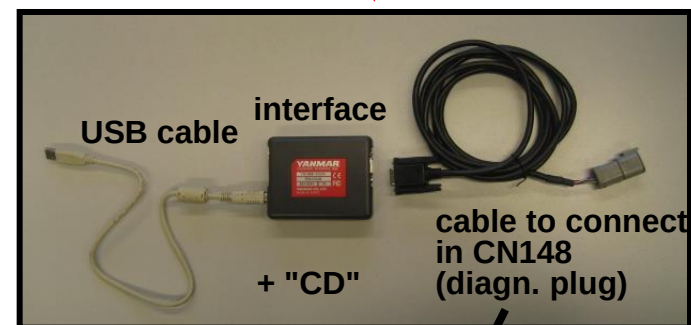
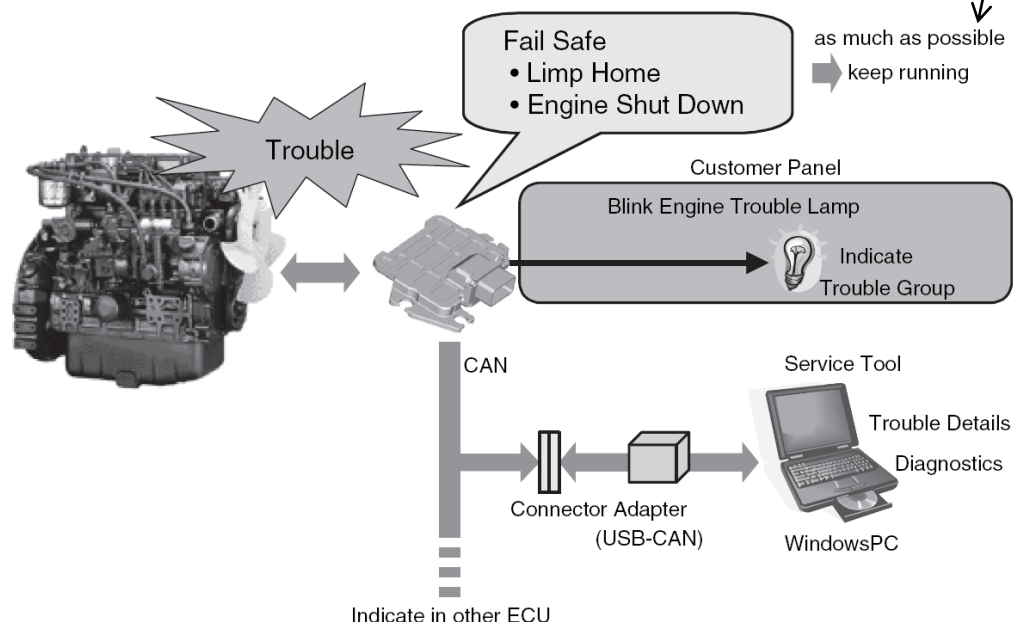
The YANMAR Engine Diagnostic Service Tool (YEDST) for the TNV series is software to support troubleshooting and installation/maintenance services for electronic control engines. It runs on personal computers (PC/AT) running Windows operating system.

Part nr. of Yanmar Engine Diagnostic Tool : XJAU-01062

PC Requirements PC/AT compatible

- Communication port : USB
- Display resolution : 1024 × 768
- OS : Windows 2000 Professional SP1, Windows XP Professional, Windows XP Home, Windows XP Tablet PC Edition

Connecting the Yanmar genuine service tool to the E-ECU as shown in **Figure 2-53** allows status monitoring or diagnostic testing as well as the indication of detailed failure information, failure log and freeze frame data.



Mind that some repair works (or others) can only be done by application of the YEDST tool ! —>

- replacing of pump
- calibrating of ECU
- tuning of engine

>> CONFIGURATION MENU (FOR REPLACE OF ECU, PUMP)

7.8.1.1 ECU Exchange

When you mount a new ECU, you need to copy the data from the injection pump to the ECU: the data per injection pump is "individual " and "engine specific.

FULL INFO → SEE
PAGES 44...48 OF
YEDST MANUAL

○ Information that must be copied when replacing the ECU.

- 1) Correction information: ① Pump injection quantity correction value, ② Engine output correction value ()
- 2) Configuration value
- 3) Calibration value
- 4) Tuning value
- 6) Serial number : ① Engine serial number, ② Pump serial number
- 7) Additional information : ① Calibration date (date inside PC), ② Calibration device number (license key)

7.8.1.1.1 Copy from Old ECU

When the ECU program is running normally and the CAN communication functions normally, you can copy the setting values (correction values, etc) from the current (old) controller to the new controller. Follow these steps. → ...

Pump data controller

7.8.1.1.2 Writing Data Received from the PDM

If the ECU is broken and data cannot be read, you can receive data from the PDM and write the correction values to the ECU using the following procedure. First, you need to receive the pump correction data file (pump_serial.excp) and the engine correction data file (engine_serial.exce) for the model name and serial number of your engine in advance. Note that, in this case, the configuration, calibration, and tuning data are not written. Therefore, you need to reenter each item using the menu. → ...

7.8.1.1.3 Manual Entry

If the ECU is broken, data cannot be read, and you cannot receive data from the PDM, you can manually write the correction values to the ECU. In this case, first, you need to obtain the pump correction data and the engine correction data (eg, paper document) for the model name and serial number of your engine in advance from the PDM. Note that, in this case, the configuration, calibration, and tuning data are not written. Therefore, you need to reenter each item using the menu. → ...

When you mount a new injection pump, the data from this pump needs to be written to the ECU: in that case the ECU is updated according to the settings of the new pump

7.8.1.2 Replacing the Pump

○ Information that must be written when replacing the pump.

- 1) Correction information : ① Pump injection quantity correction value
- 2) Serial number : ① Pump serial number
- 3) Additional information : ① Calibration date (data inside PC), ② Calibration device number (license key)



At page 50
of YEDST
manual

7.8.1.2.1 Writing Data Received from the PDM

When you replace the pump, you need to receive data from the PDM and write the correction values to the ECU using the following procedure. First, you need to receive the pump correction data file (pump_serial.excp) for the model name and serial number of your pump in advance.

7.8.1.2.2 Manual Entry

As with replacing the ECU, you can enter data manually.



At page 51
of YEDST
manual

>> CALIBRATION MENU (YEDST)

This screen provides the function to calibration (correct) the sensor. You can perform the digital calibration of the reference position for the accelerator position sensor, and check the origin calibration value at the time of injection.

(APS)

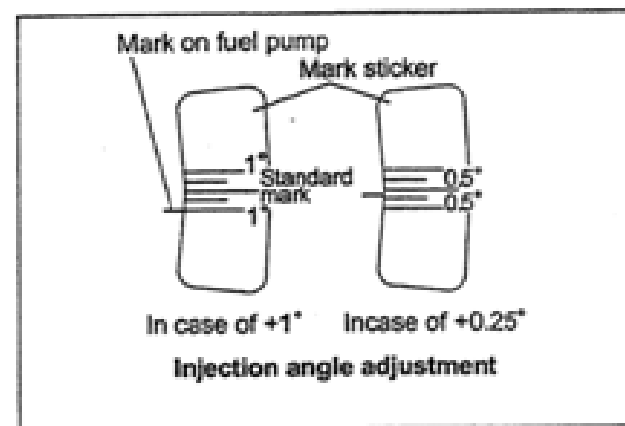


At page 52
of YEDST
manual

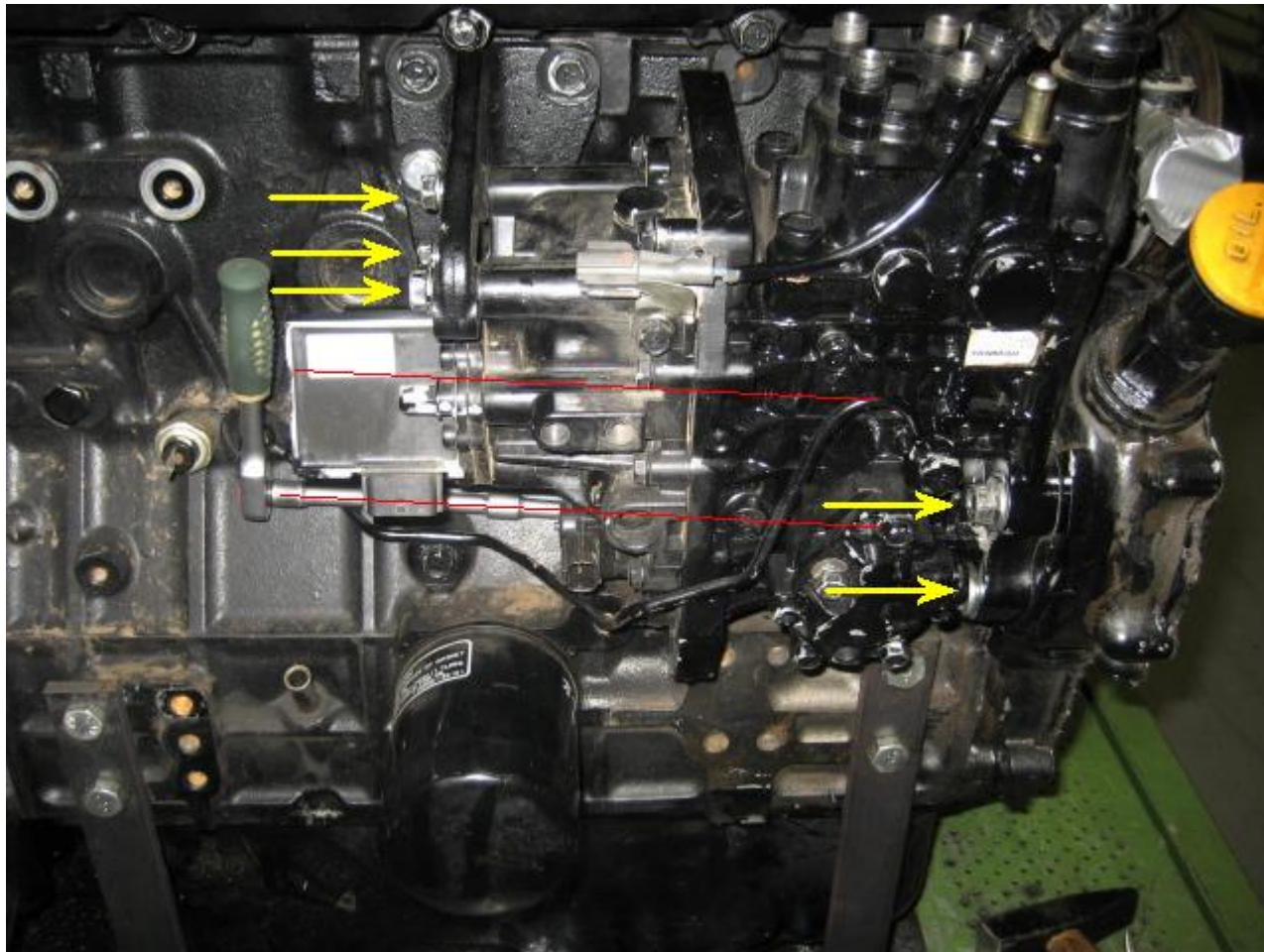
>> TUNING (YEDST)

This screen provides the function to set engine's low idle rotation, select the torque pattern, and fine-tune the speed governing performance. You can make correction within the range according to the emission regulations.

Before you adjust the pump timing make sure to mark the current position! Also attach a mark sticker on the engine next to the mark on the fuel pump so you can measure how far you adjust the fuel pump.



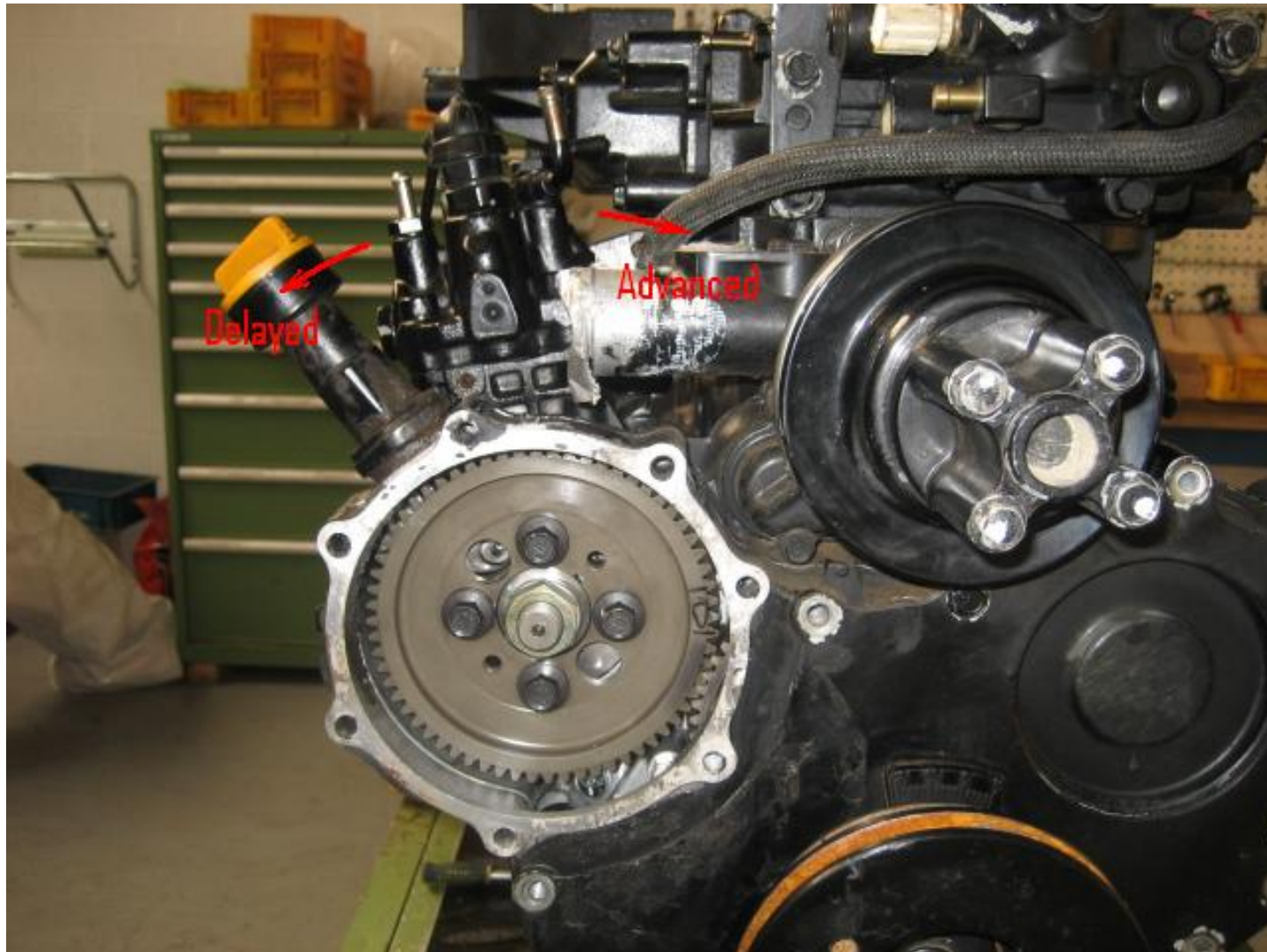
To be able to adjust the fuel pump you first have to loosen 7 bolts. 3 on the rear support and 4 on the flange at the distribution side. In red line you see the position of 2 of them behind the pump house. These can be reached using a $\frac{1}{4}$, 14mm socket and extensions as shown in the picture. The nuts and bolts don't have to be removed just loosened.



The fuel pump can be tilted to advance or retard the fuel injection moment. To make this possible the 7 bolts used to fixate the pump are provided with slotted holes.



To advance the fuel injection you have to turn clockwise when looking to the front of the engine, the delay the fuel injection, turn counter-clockwise.



If you like to replace the fuel pump you have to follow the previous steps but this time completely remove the 7 mounting bolts on the pump and the support on the rear of the pump. You also have to disconnect the fuel, oil & electric lines. Be carefull for high pressure when you are disconnecting the fuel lines!

Proceed by removing the fuel pump drive gear cover. Then remove the **center nut**. NEVER loosen the four **flange bolts**! They connect the fuel pump drive gear to the flange through slotted holes. When they are loosened the fuel pump drive gear can rotate freely and all references of timing will be lost!

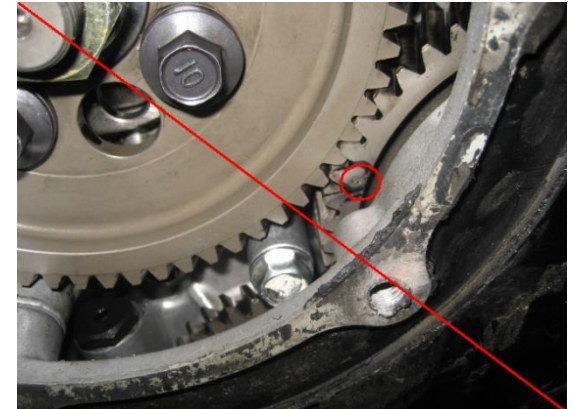
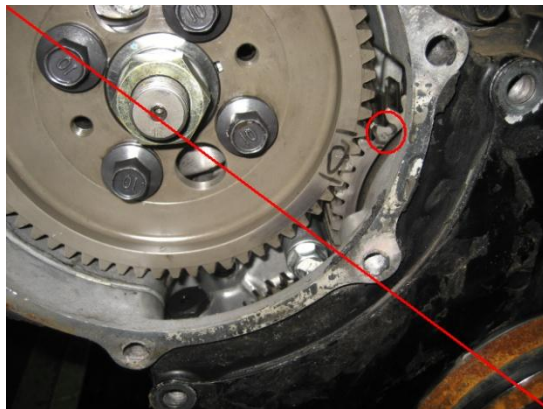




Normally it is enough to put a mark on fuel pump drive gear and idler to be able to reassemble the pump on the correct position after removal. But when the injection pump was mounted in the wrong position or the engine has rotated after removal of the pump there is a more precise way to put everything right on time.

On the crankshaft pulley are 3 timing marks, 2 bulges and 1 notch. You have to align this notch to the 0° mark on the distribution cover (TDC cyl.1), make sure that cyl 1 is not only on his TDC but also on compression AND be able to see the "B" mark on the idler in the **middle (not to high or to low)** of the opening from the fuel pump driver cover. These 3 situations combined appear only once every !50! Crankshaft revolutions so a little patience can be helpful...

When you have the engine in this position you can align the "B" mark on the fuel pump drive gear with the "B" mark of the idler and the gears will be positioned perfectly.



If you replace the pump you have to calculate the injection timing difference between these pumps:

- 1) Remove the old pump and take a note of the timing index recorded in that pump.
- 2) Read the timing on the new pump and calculate the difference between new and old angle.
- 3) Put the pump temporarily on the gear case and install the drive gear accordingly to the ID marks you made earlier. (Tightening torque of installation nut => 113 – 123 Nm)
- 4) Use the marking on the sticker to adjust the calculated (2) injection angle difference.
- 5) If you have calculated a positive angle correction value, push the fuel pump away from the cylinder block to delay the injection timing and vice versa to advance the timing in case of a negative value.

Timing-Index difference
 $\Delta \theta$

=

Timing-Index of New pump
 $\theta 2$

-

Timing-Index of previous pump
 $\theta 1$

Calculation Example

Timing-index $\theta 2$	Timing-index $\theta 1$	Timing-index Difference $\Delta \theta$	Fuel pump installation method
75	70	+5	Advanced injection timing 1 scale to direction of +
60	70	-10	Delayed injection timing 2 scale to direction of -
70	70	0	Install same position



1 scale is equal to Timing-index Difference $\Delta \theta = 5$ and 1 degree at Crank angle.

If there is no timing index on the pump body you can find it in this table buy using the **pump ID** number.



Pump ID	Timing index
XG05	82
XG10	83
XG12	74
XG13	73
XG16	72
XG17	68
XG18	68
XG20	65
XG21	68
XG22	63
XG23	67
XG24	64
XG26	66
XG27	64
XG28	66
XG29	64
XG33	65
XJ01	63
XJ03	77
XJ04	65
XJ09	77
XJ27	81
XJ32	76
XJ33	66
XJ37	75
XJ41	69
XJ42	69
XJ43	62
XJ44	67
XJ46	65
XJ47	79
XJ48	64
XJ49	68
XJ52	78
XJ53	64
XJ54	83
XJ56	70
XJ57	69
XJ59	65
XJ61	69
XJ68	65
XJ71	65
XJ72	82
XJXH	74
XK01	81
XK02	64
XK05	81
XK07	78
XK14	64
XK19	64
XK20	68
XK21	67
XK22	65
XK23	64
XK25	65

Pump ID	Timing index
XK26	67
XK27	68
XK28	71
XK30	71
XK31	79
XK33	66
XK34	64
XK35	67
XK42	78
XKXB	63
XM01	74
XM14	63
XM15	68
XM16	68
XM17	68
XM19	60
XM20	62
XM21	73
XM22	73
XM23	84
XM24	80
XM29	71
XM30	84
XN01	74
XN04	60
XN06	81
XN10	63
XN11	63
XN12	75
XN13	63
XN14	67
XN16	65
XN20	65
XN21	63
XN23	64
XN24	62
XN25	63
XN26	66
XN27	63
XN29	66
XN31	64
XN32	66
XN33	64
XN35	66
XN36	67
XN38	67
XN45	70
XN46	63
XN54	65
XNXB	63
XR01	64

Pump ID	Timing index
BT18	32
BT17	52
BT18	57
BT19	54
BT21	53
BT22	52
BT23	52
BT98	50
BT99	52
TQ87	32
TQ92	53
XS08	48
XS10	46
XS12	49
XS13	46
XS14	49
XS18	51
XS20	45
XS22	57
XS24	50
XS26	52
XSXD	49
XT03	29
XT04	54
XT06	28
XT10	54
XT11	52
XT13	29
XT16	45
XT17	51
XT18	55
XT19	49
XT20	55
XT23	48
XT24	53
XT25	54
XT26	53
XT27	53
XT28	54
XT29	52
XT31	45
XT32	56
XT33	52
XT38	48
XT41	50
XT53	51
XT54	51
XT56	52
XT58	51
XT63	49
XT64	50
XT71	55
XT72	48
XT73	51
XTXB	51
XTXD	50

END