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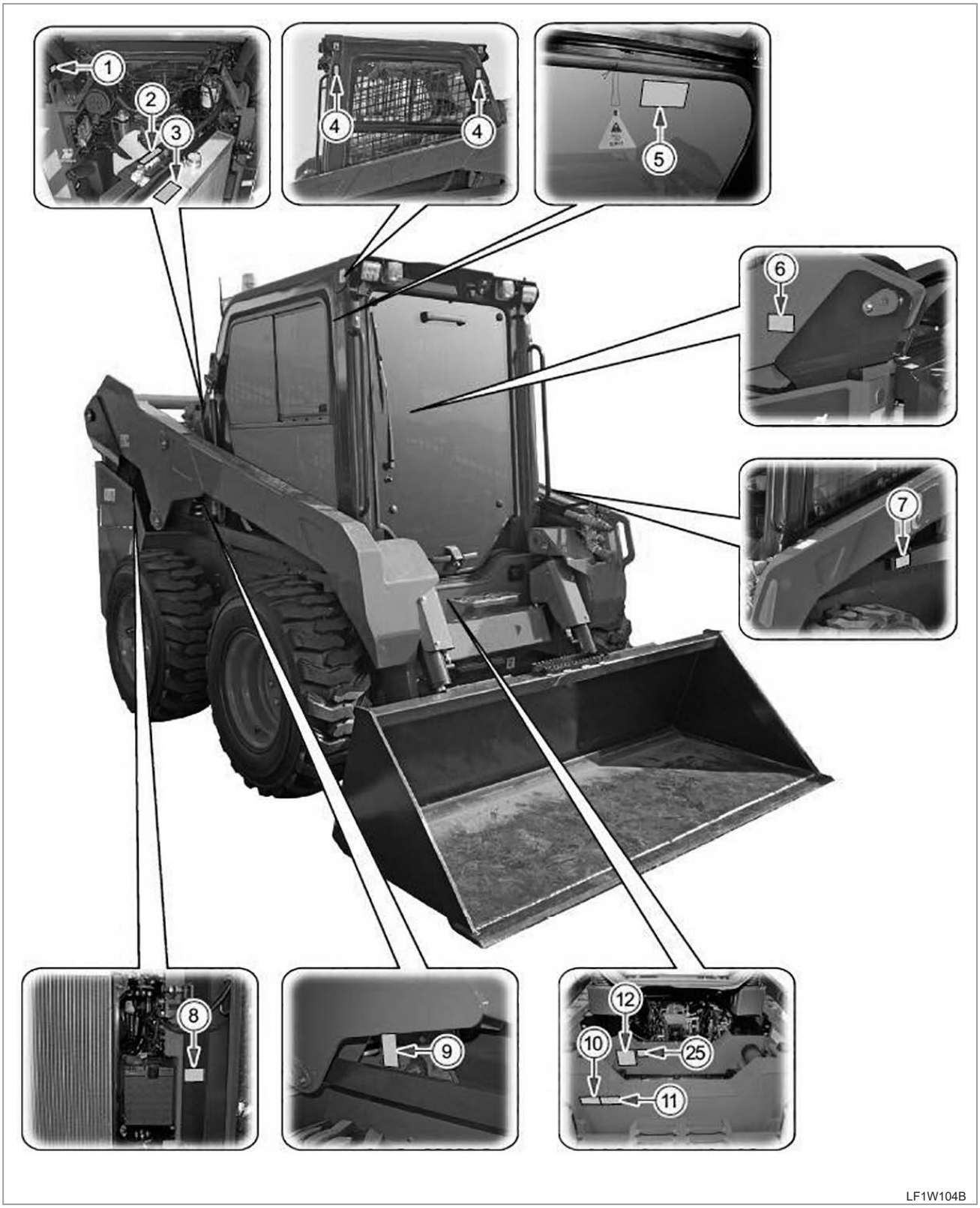
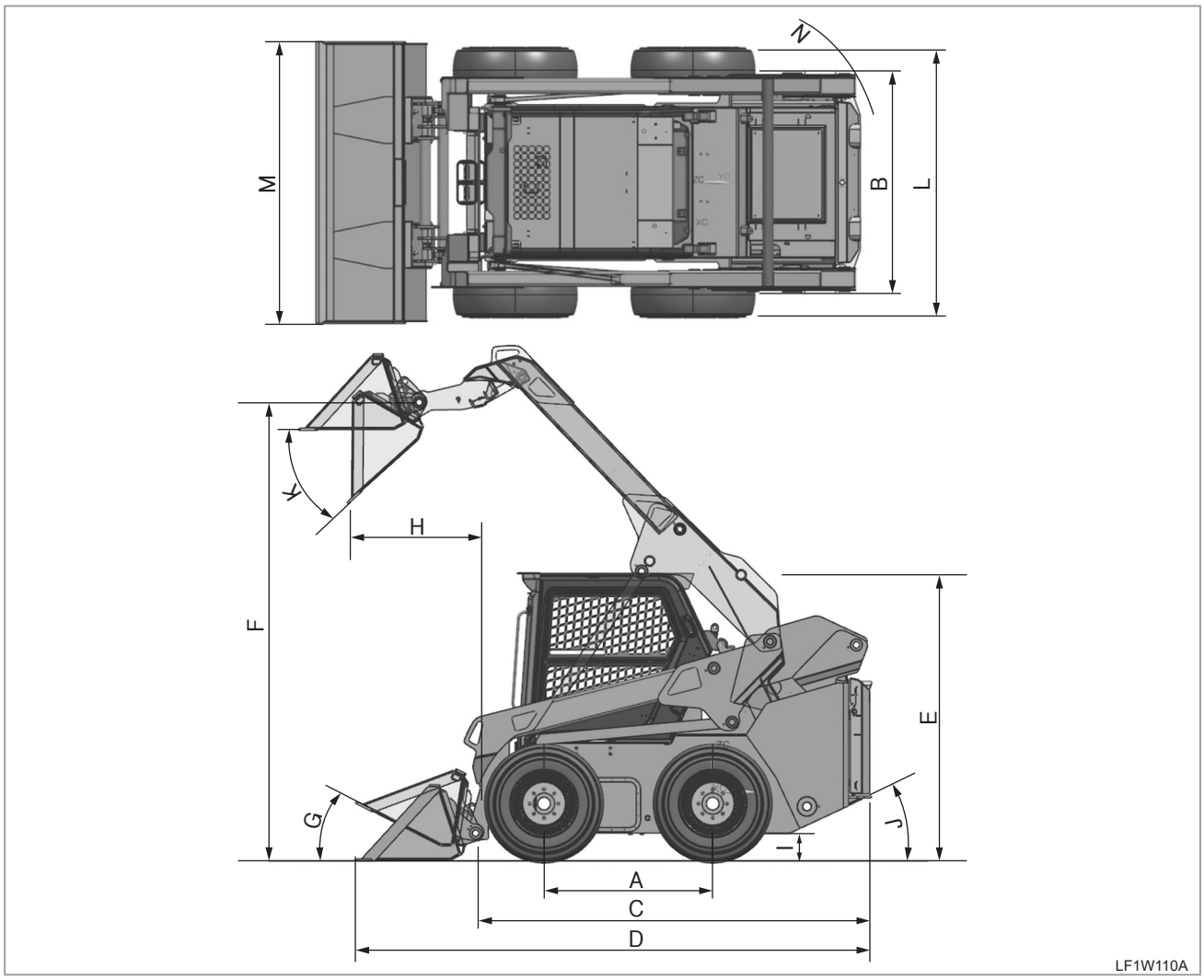
3. SAFETY DECALS

- When replacing parts, be sure to install the appropriate safety decal as well. Otherwise, the customer's safety will be threatened.
- If a decal is damaged or detached, always replace with the appropriate decal.
- The decal and its attaching location are as follows.
- Part numbers appear at the bottom of decals.

3.1 LOCATION OF DECALS



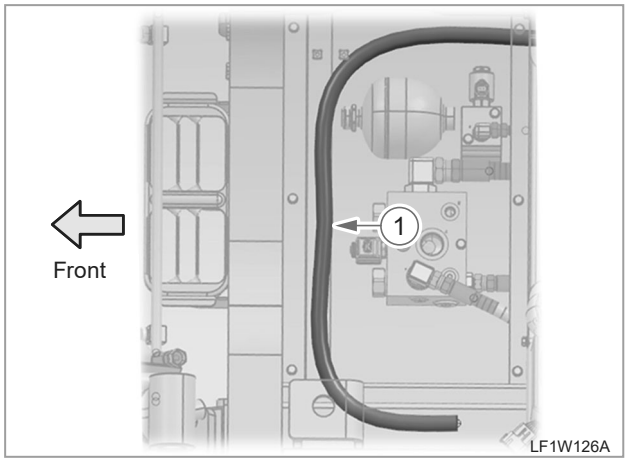
6.3 DIMENSIONS



mm (in.)

ITEM		DIMENSIONS
A	Wheel base	1,200 (47.2)
B	Tread	1,513 (59.6)
C	Overall length (Excluding the bucket)	2,960 (116.5)
D	Overall length (Including the bucket)	3,675 (144.7)
E	Overall height (Cabin upper)	2,161 (85.1)
F	Bucket hinge pin height at max. lift	3,215 (126.6)
G	Rollback angle at carry position	29°
H	Reach at max. lift and dump	949 (37.4)
I	Ground clearance	195 (7.7)
J	Departure angle	25°
K	Maxinum dumping angle	44.3°
L	Overall width	1,820 (71.7)
M	Bucket width	1,890 (74.4)
N	Turning radius from rear	1.850 (72.8)

FLUID OIL CHANGE



1. Place a container under the drain hole on the bottom of the floor to collect oil.
2. Direct the drain hose (1) under the floor to the floor hole, remove the plug from the hose end, and drain the oil through the hole (A).

HYDRAULIC OIL FILTER REPLACEMENT

(1) Hydraulic oil filter

1. The hydraulic oil filter is mounted in the engine compartment.
2. With the engine stopped and the oil having sufficiently cooled down, remove the filter by turning it counterclockwise and replace it with a new one.

10. TIGHTENING TORQUE

10.1 GENERAL USE SCREWS, BOLTS AND NUTS

Screws, bolts and nuts whose tightening torques are not specified in this workshop manual should be tightened according to the table below.

Mark on bolt head	⬡ 4 No-grade or 4T						⬡ 7 7T						⬡ 9 9T		
Bolt material	SS400, S20C						S43C, S48C						SCr435, SCM435		
Material of component part	Steel or cast iron			Aluminum			Steel or cast iron			Aluminum			Steel or cast iron		
Unit / Type	Nm	kgf-m	lb-ft	Nm	kgf-m	lb-ft	Nm	kgf-m	lb-ft	Nm	kgf-m	lb-ft	Nm	kgf-m	lb-ft
M6	7.85 ~ 9.31	0.80 ~ 0.95	5.79 ~ 6.87	7.85 ~ 8.82	0.80 ~ 0.90	5.79 ~ 6.50	9.81 ~ 11.2	1.00 ~ 1.15	7.24 ~ 8.31	7.85 ~ 8.82	0.80 ~ 0.90	5.79 ~ 6.50	12.3 ~ 14.2	1.25 ~ 1.45	9.05 ~ 10.4
M8	17.7 ~ 20.5	1.8 ~ 2.1	13.1 ~ 15.1	16.7 ~ 19.6	1.7 ~ 2.0	12.3 ~ 14.4	23.6 ~ 27.4	2.4 ~ 2.8	17.4 ~ 20.2	17.7 ~ 20.5	1.8 ~ 2.1	13.1 ~ 15.1	29.5 ~ 34.3	3.0 ~ 3.5	21.7 ~ 25.3
M10	39.3 ~ 45.1	4.0 ~ 4.6	29.0 ~ 33.2	31.4 ~ 34.3	3.2 ~ 3.5	23.2 ~ 25.3	48.1 ~ 55.8	4.9 ~ 5.7	35.5 ~ 41.2	39.3 ~ 44.1	4.0 ~ 4.5	29.0 ~ 32.5	60.9 ~ 70.6	6.2 ~ 7.2	44.9 ~ 52.0
M12	62.8 ~ 72.5	6.4 ~ 7.4	46.3 ~ 53.5				77.5 ~ 90.2	7.9 ~ 9.2	57.2 ~ 66.5	62.8 ~ 72.5	6.4 ~ 7.4	46.3 ~ 53.5	103 ~ 117	10.5 ~ 12.0	76.0 ~ 86.7
M14	108 ~ 125	11.0 ~ 12.8	79.6 ~ 92.5				124 ~ 147	12.6 ~ 15.0	91.2 ~ 108				167 ~ 704	17.0 ~ 20.0	123 ~ 144
M16	167 ~ 191	17.0 ~ 19.5	123 ~ 141				197 ~ 225	20.0 ~ 23.0	145 ~ 166				260 ~ 304	26.5 ~ 31.0	192 ~ 224
M18	246 ~ 284	25.0 ~ 29.0	181 ~ 209				275 ~ 318	28.0 ~ 32.5	203 ~ 235				344 ~ 402	35.0 ~ 41.0	254 ~ 296
M20	334 ~ 392	34.0 ~ 40.0	246 ~ 289				368 ~ 431	37.5 ~ 44.0	272 ~ 318				491 ~ 568	50.0 ~ 58.0	362 ~ 419

10.2 STUD BOLTS

Material of component part	Steel or cast iron			Aluminum		
Unit / Diameter	Nm	kgf-m	lb-ft	Nm	kgf-m	lb-ft
M8	11.6 ~ 15.6	1.2 ~ 1.6	8.68 ~ 11.5	8.82 ~ 11.6	0.90 ~ 1.2	6.51 ~ 8.67
M10	24.6 ~ 31.3	2.5 ~ 3.2	18.1 ~ 23.1	19.7 ~ 25.4	2.0 ~ 2.6	14.5 ~ 18.8
M12	34.3 ~ 49.0	3.5 ~ 5.0	25.2 ~ 36.1	31.4	3.2	23.1
M14	61.7 ~ 73.5	6.3 ~ 7.5	45.4 ~ 54.0	-		
M16	98.0 ~ 112.7	10.0 ~ 11.5	72.0 ~ 82.8	-		

2. SPECIFICATIONS

2.1 GENERAL SPECIFICATIONS

Engine model		4HTI4
Bore I.D. X Stroke	(mm)	Ø 87×102.4
Honing		PLATEAU honing
Number of cylinders		4
Ignition sequence		1-3-4-2
Displacement	(ℓ)	2.435
Speed	(rpm)	2,400
Max. gross output	kW(HP)/rpm	54.9 (73.6) / 2,400
Max. torque	Nm/rpm	274/1,500
Compression ratio		17.4:1
Combustion chamber type		Direct injection type Turbo charged
High pressure fuel pump type		Delphi DFP 4.6.18 TP
Injection pressure	bar	Max. 1,800
Engine oil capacity	(ℓ)	9.0 (with filter)
Engine oil specification		SAE 15W 40, API Classification CJ or higher
Coolant capacity	(ℓ)	4.2 (Engine only)
Anti-freeze		Ethylene glycol 50% with anti-corrosive agent

- The engine gross output is measured with the cooling fan removed.
- The cylinder number for ignition sequence is given from the cylinder on the engine cooling fan side.
- If the coolant level drops due to its evaporation, add only water. If the coolant lever drops due to the leakage, add coolant mixed with anti-freeze.
- The freezing point of the 50% coolant mixture is -37°C (-34°F) in a normal condition.
- When replacing the coolant with a different type of coolant, flush the cooling system thoroughly beforehand.

2.6.4 TIGHTENING TORQUES FOR ENGINE

ITEM	SIZE X PITCH	TIGHTENING TORQUE					
		Nm		kgf-m		lb-ft	
Cylinder head bolt	M11×1.25	39.22+90°+70°		4+90°+70°		28.8+90°+70°	
Head cover bolt	M6×1.0	8.8	11.8	0.9	1.2	6.5	8.7
Main bearing bolt	M12×1.25	90.2	93.2	9.2	9.5	66.5	68.7
Ladder frame bolt	M10×1.25	47.1	52	4.8	5.3	34.7	38.3
Piston cooling jet bolt	M12×1.25	29.4	34.3	3	3.5	21.7	25.3
*Flywheel bolt	M12×1.25	98.1	107.9	10	11	72.3	79.6
*Connecting rod bolt	M8×1.0	44.1	49	4.5	5	32.5	36.2
Rocker arm support bolt	M10×1.25	60.8	70.6	6.2	7.2	44.8	52.1
Injector clamp bolt	M8×1.25	27.5	31.4	2.8	3.2	20.3	23.1
Hi-pressure pipe nut (pump side)	M14×1.5	24.5	29.4	2.5	3	18.1	21.7
Hi-pressure pipe nut (rail side)	M14×1.5	27.5	31.4	2.8	3.2	20.3	23.1
Crank shaft bolt	M16×1.5	320.7	343.2	32.7	35	236.5	253.2
Glow plug	M10×1.25	19.6	24.5	2	2.5	14.5	18.1
Eye-bolt (turbo side)	M10×1.25	27.5	31.4	2.8	3.2	20.3	23.1
Eye-bolt (nut side)	M12×1.5	32.4	37.3	3.3	3.8	23.9	27.5
Coolant temp sensor	PT3/8	34.3	44.1	3.5	4.5	25.3	32.5
Oil pressure switch	PT1/8	14.7	19.6	1.5	2	10.8	14.5

⚠ CAUTION

- **For * marked screw, bolts and nuts on the table, apply engine oil to their threads and seats before tightening.**
- **The letter "M" in Size × Pitch means that the screw, bolt or nut dimension stands for metric. The size is the nominal**
- **outside diameter in mm of the threads. The pitch is the nominal distance in mm between two threads.**

❗ IMPOARTANT

- **Tightening torque for cylinder head bolts**

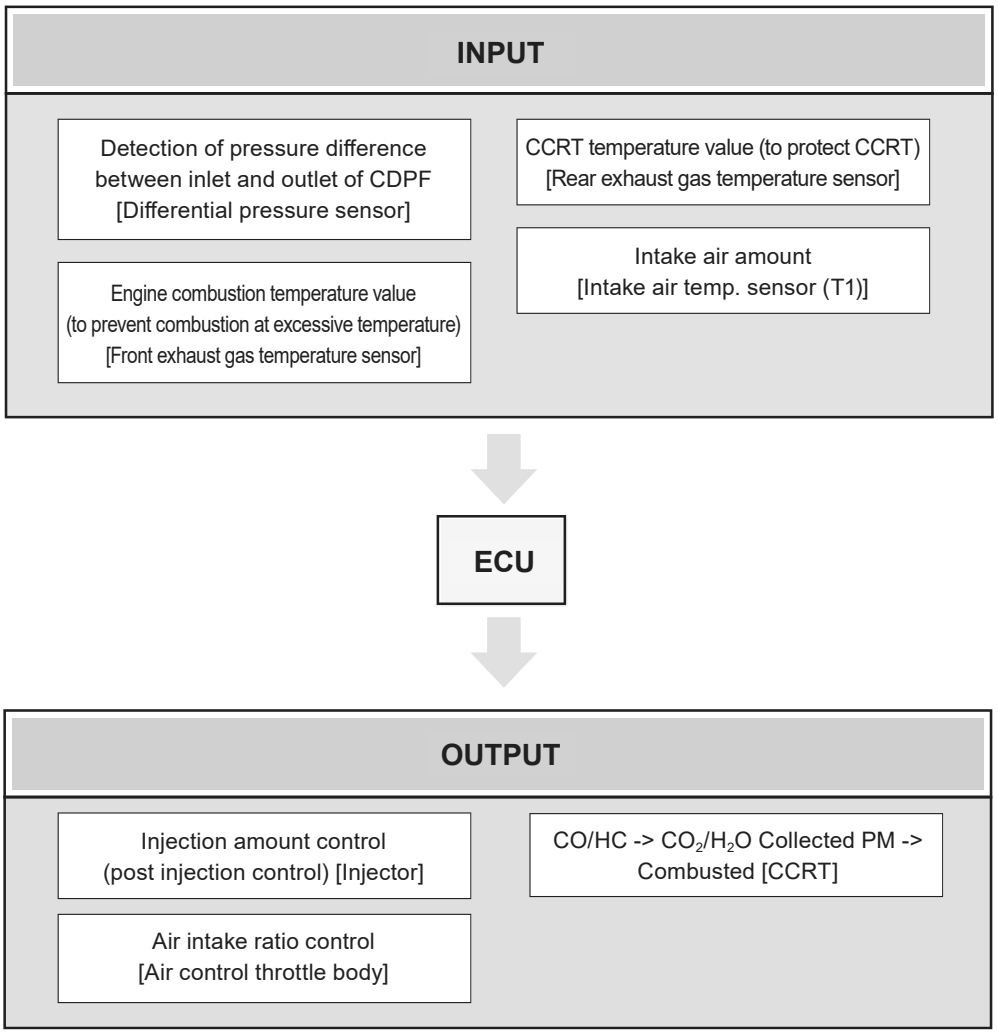
  Tightening order (using the angle controlled tightening method)

  1st step: Tighten the bolts to 4.0 kgf-m (39.2 Nm, 28.8 lb-ft)

  2nd step: Rotate the bolts additional 90°

  3rd step: Rotate the bolts additional 70°
- **For more details, refer to 7.3.4 "Cylinder head removal.**

▶ INPUT/OUTPUT OF CCRT CONTROL



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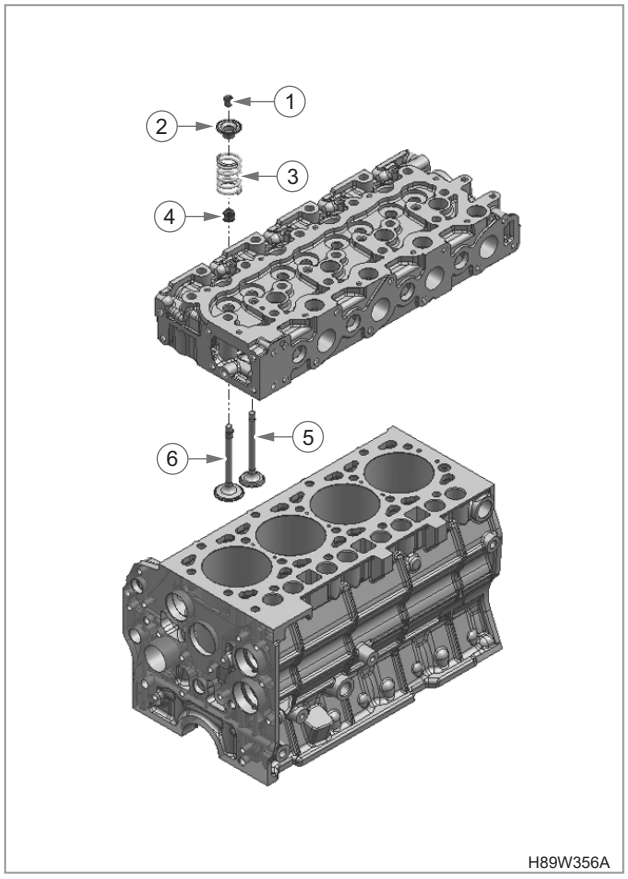
- Front exhaust gas temperature sensor: it is installed to the exhaust manifold to determine whether the DOC can burn (oxidize) injected fuel during the post-injection process.
- Rear exhaust gas temperature sensor: it is installed to the inlet of the DPF to monitor whether the temperature of exhaust gas is maintained at 600˚C.
  - Excessive temperature (over 600˚C), leading to reduction of CCRT life → Decrease in fuel injection amount in post injection process
  - Insufficient temperature (below 600˚C), leading to low efficiency of CCRT regeneration → Increase in fuel injection amount in post injection process
- Differential pressure sensor: it detects the pressure difference between the inlet and outlet of the CCRT to calculate the PM amount.
- Air control throttle valve: it reduces the intake air amount to increase the exhaust gas temperature when the CCRT is activated with the engine idling.

3.2.9 INTAKE AND EXHAUST VALVES

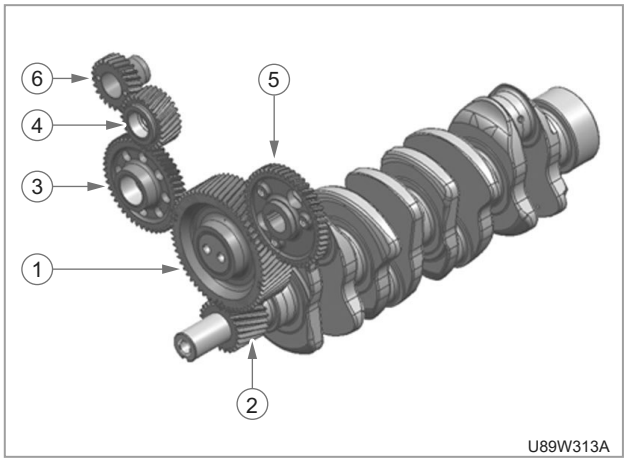


(1) Valve spring collet
(2) Valve spring retainer
(3) Valve spring
(4) Valve stem seal
(5) Exhaust valve
(6) Intake valve

The valve and its guide of the intake are different from those for the exhaust. Other parts, such as the spring, spring retainers, valve spring collets, valve stem seals are the same for both the intake and the exhaust.

The diameter of the intake valve is always larger than the that of the exhaust valve. The intake valve is located prior to exhaust valve when seeing them from the cooling fan side.

3.2.10 TIMING GEAR

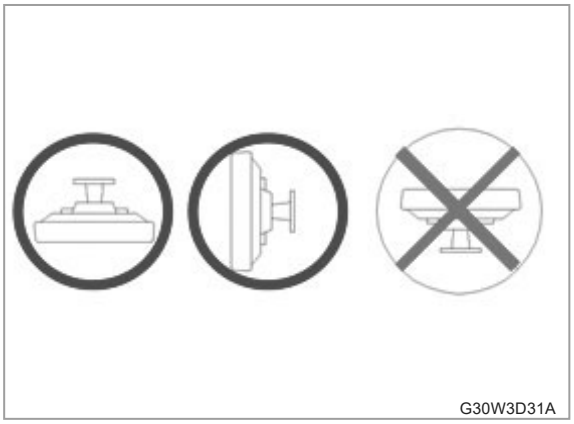


(1) Idle gear 1
(2) Crankshaft gear
(3) Idle gear 3
(4) Idle gear 4
(5) Camshaft gear
(6) High pressure fuel pump gear

The crankshaft drives the camshaft, idle gear, hydraulic pump drive gear and high pressure fuel pump gear. The timings for opening and closing the valves is extremely important to achieve the effective air intake and sufficient gas exhaust. When assembling, the appropriate timing can be obtained by aligning the mark on the crankshaft gear (2) with idle gear 1 (1), idle gear 1 with camshaft gear (5). Valve can be opened and closed at the correct timing when the idle gear 1 is aligned with the idle gear 3 (3), the idle gear 3 is aligned with the idle gear 4 (4) and the idle gear 4 is aligned with the high-pressure fuel pump gear (6) properly.

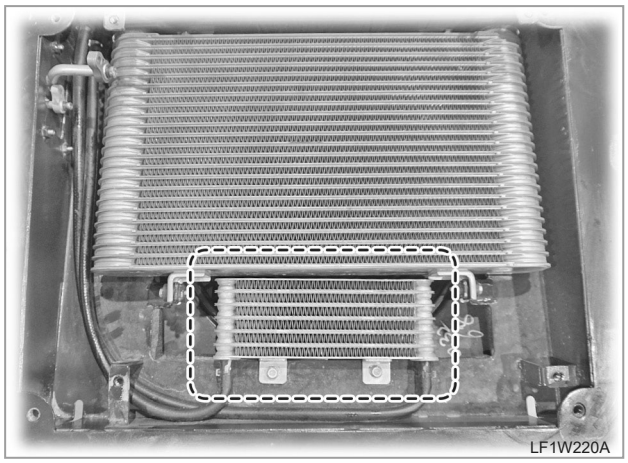
⚠ CAUTION

- **When the clutch fan is placed in storage, silicone may leak if the part with the shaft mounted is facing downwards, so make sure to store it either facing the opposite direction or upright.**



(If the fan is not used for a prolonged period of time, the rpm may temporarily appear higher than the disengaged rpm due to silicone in the storage chamber in low temperature conditions.)

FUEL COOLER


LF1W220A

In the CRDI (Common Rail Direct Injection) engine, the temperature of returning fuel is increased high due to high pressure and multiple injection of the injectors.

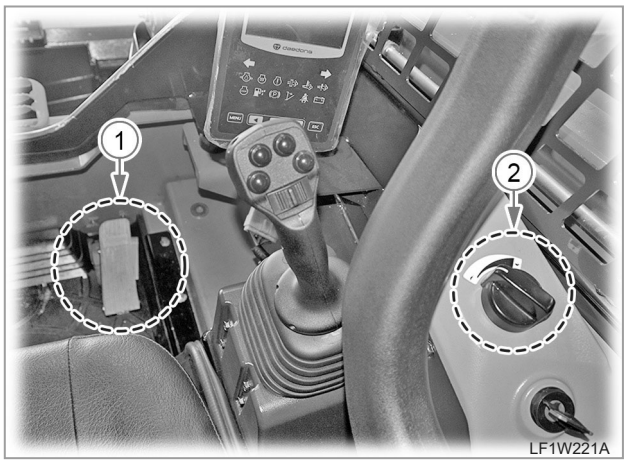
If the temperature of diesel fuel becomes excessively high, its lubrication film breaks and its elements are transmuted. Then, some components using fuel as lubricant, such as the high-pressure pump, can be damaged easily.

Therefore, fuel returned from the injector to the high-pressure fuel pump through the return pipe is passed through the fuel cooler to be cooled before returning back to the fuel tank.

▶ SPECIFICATION

- Air flow: 8 m/s
- Fuel flow: 2.6 LPM
- Fuel inlet temperature: 95°C (203°F)
- Fuel capacity: Approx. 0.15 L

3.6 ACCELERATION SYSTEM



LF1W221A

When depressing the accelerator pedal (1) or moving the engine throttle dial (2) to select a high speed, detects the amount of movement of the acceleration position sensor and sends this information to the ECU which then permits combustion in the chamber to increase the engine RPM and power.

⚠ **CAUTION**

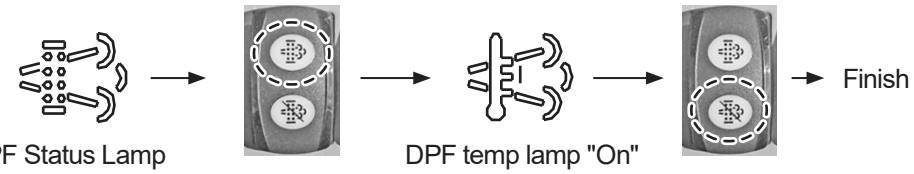
PRECAUTIONS FOR MAINTENANCE OF CATALYTIC FILTER

- **Make sure to use the genuine fuel.**
- **Keep the engine oil change schedule.**
- **Check and service the engine oil amount frequently.**
- **Avoid unnecessary idling of the engine.**
- **Never stop the engine during driving.**
- **Never place the shift lever in the neutral position on a a downhill.**
- **Do not use any kind of additive for engine oil and fuel.**
- **Avoid prolonged driving with the warning lamp illuminated.**
- **Make sure that any flammable material, such as dry grass or paper, gets to the catalytic filter while parked.**

REGENERATION STRATEGY

- Passive Regeneration: PM is burnt naturally when the exhaust temperature is high or NOx is abundant.
- Active Regeneration
  - Automatic Regeneration: ECU controls the exhaust temperature when regeneration is needed.
  - Manual Regeneration: Operator should push the manual regeneration button when signal is "on"

In case of Passive Regen & Automatic Regen are impossible

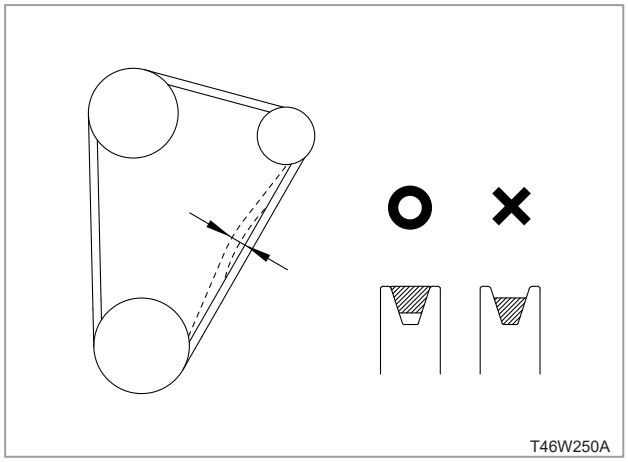


DPF Status Lamp "On" or "Flashing" → Push the manual regen. button → DPF temp lamp "On" → Push inhibit Switch → Finish

* Ash Service Interval: 3000 Hours

5. MEASUREMENT AND ADJUSTMENT

5.1 FAN BELT



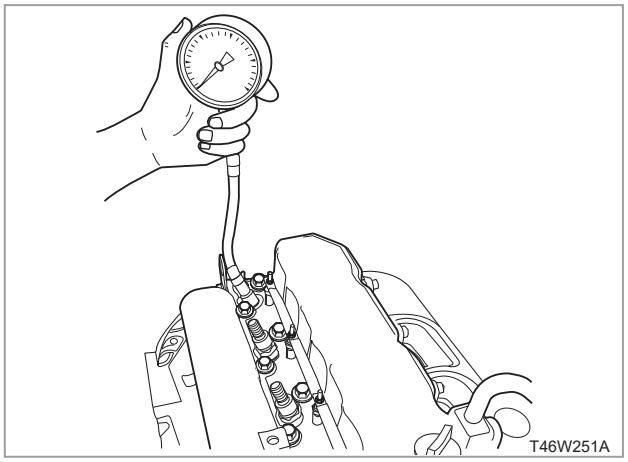
Measure the deflection by depressing the center of the belt between the fan drive pulley and the alternator pulley at 98 N (10 kgf, 22 lbs) of force.

If the deflection is out of the specified value, loosen the bolts and nuts and adjust the location of the alternator.

If the belt is damaged or worn (see figure), replace the belt.

Fan belt deflection..... 7 ~ 9 mm
(0.28 ~ 0.35 in.)

5.2 PISTON COMPRESSION PRESSURE MEASUREMENT



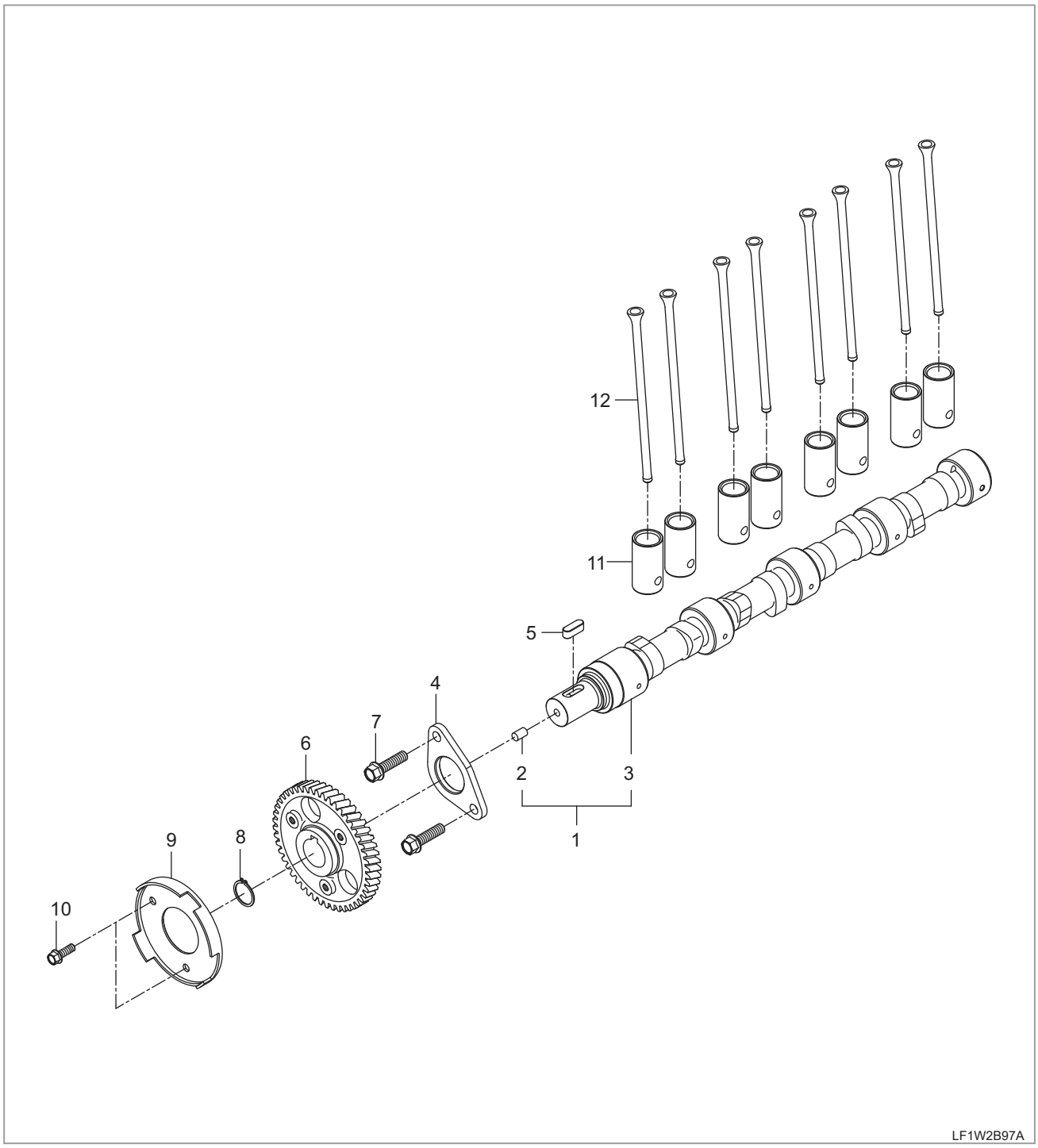
1. Run the engine until it is warmed up.
2. Stop the engine and remove the air cleaner, the muffler and all nozzle holders.
3. Connect a compression tester to the nozzle holder hole.
4. Pull the stop lever or close the fuel filter with the cock to cut the fuel and crank the engine with the starter motor for 5 to 10 seconds.
5. Measure the maximum pressure several times while engine running.
6. If the pressure does not reach the allowable limit, apply few drops of oil to the cylinder wall through the nozzle holder hole and check the pressure again.
7. If the pressure rises after applying the oil, check the cylinder wall and piston ring for wear.
8. If the pressure is still low, check the top clearance, valve clearance and cylinder head.

Compression pressure	Specified value	3.24 ~ 3.73 MPa 33 ~ 38 kgf/cm² 469 ~ 540 psi
	Allowable lower limit	2.55 MPa 26 kgf/cm² 370 psi
Pressure difference between two cylinders	Allowable limit	10 %

⚠ CAUTION

- **Check the compression pressure and adjust the valve clearance to the specified value.**

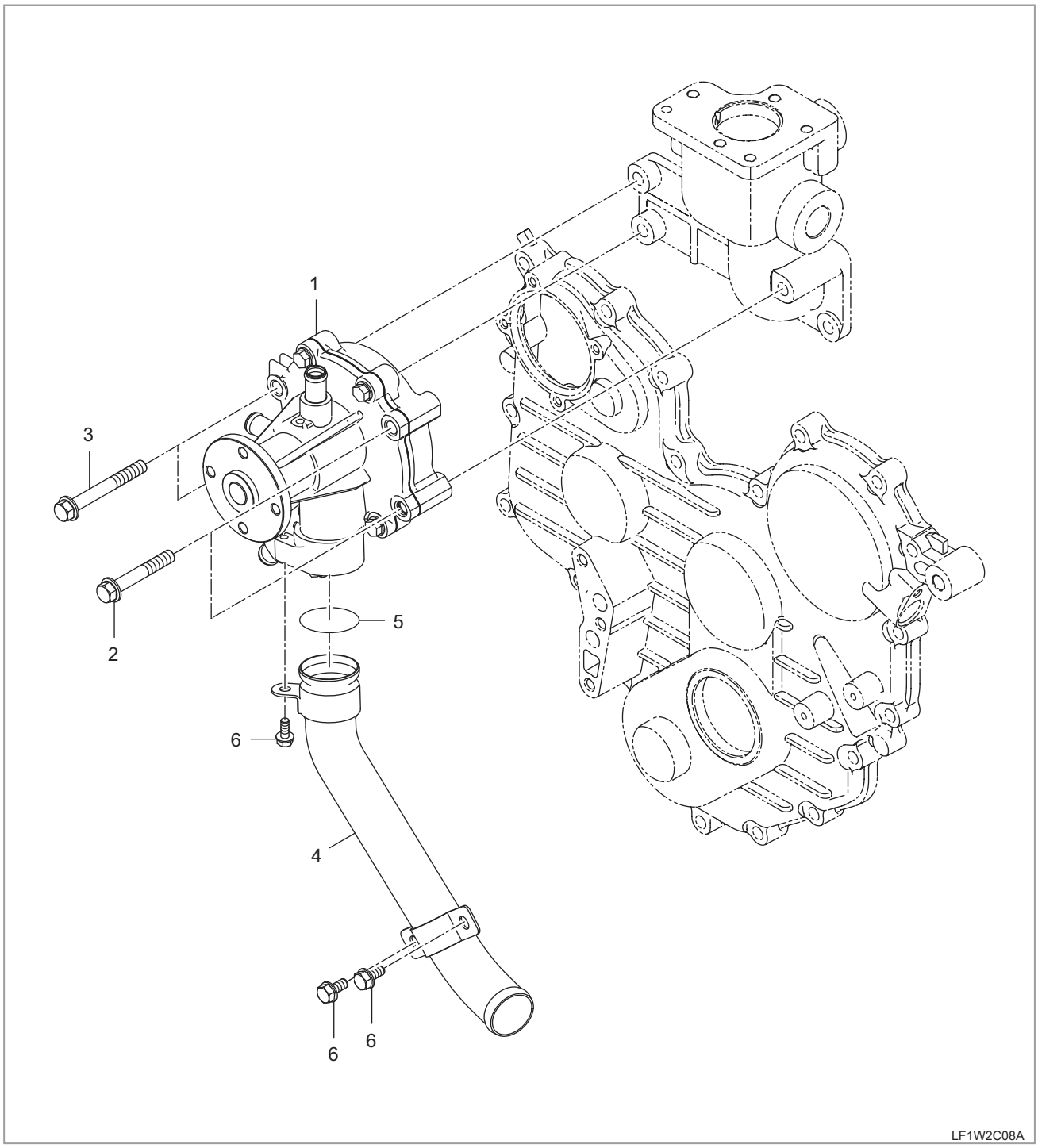
6.6 EH5-G123001 CAMSHAFT GROUP



COMPONENTS

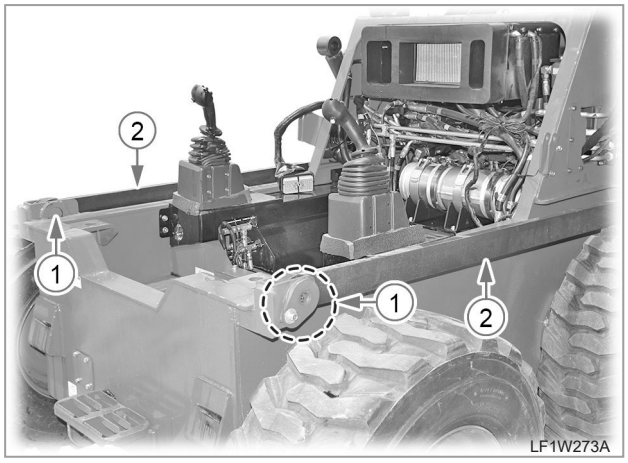
(1) Assy Camshaft
(2) Plug, Set
(3) Camshaft
(4) Stopper, Camshaft
(5) Feather Key
(6) Gear, Camshaft
(7) Flange Bolt
(8) Ring, Snap
(9) Wheel, Camshaft Sensor
(10) Flaner Bolt
(11) Tappet
(12) Rod, Push

6.16 EH5-G163003 WATER PUMP GROUP

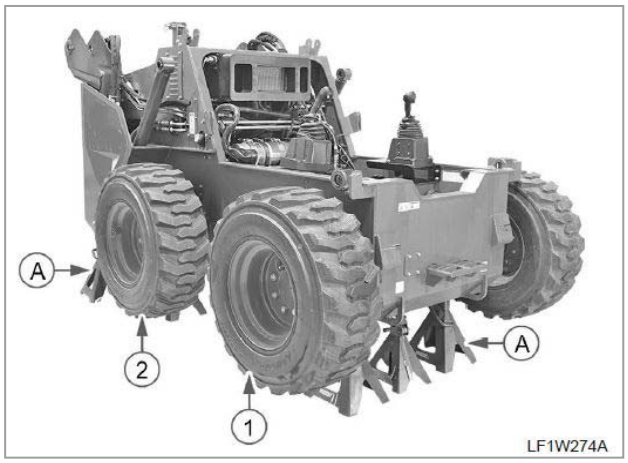


COMPONENTS

(1) Assy Pump, Water
(2) Hex Head Bolt With Washer
(3) With Washer Bolt
(4) Assy Pipe, Water Pump
(5) O Ring
(6) Flange Bolt

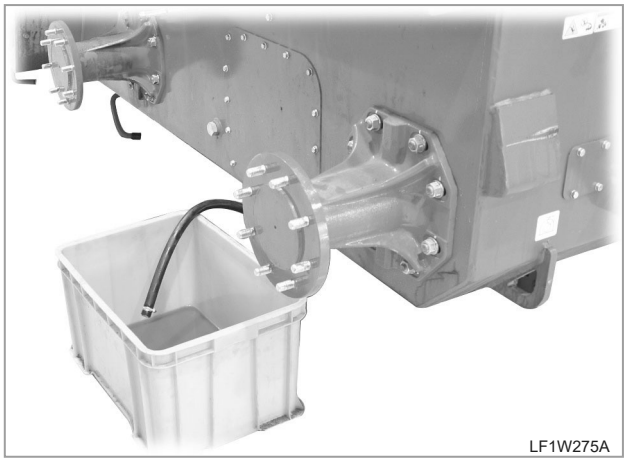


10. Pull out the boom support bar mounting pins (1) to remove the left-hand and right-hand boom support bars (2).

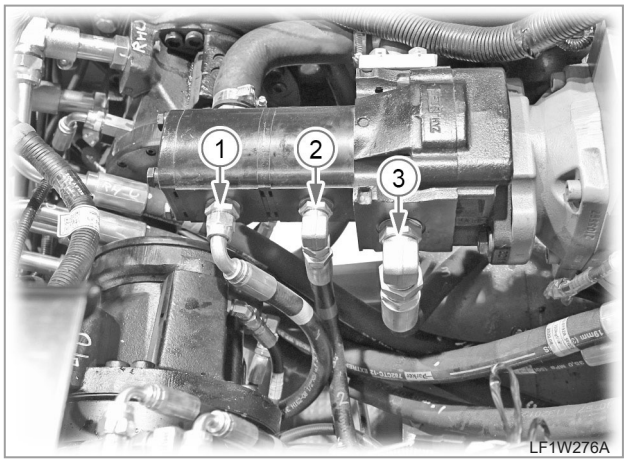


11. Place safety jacks (A) under the main frame firmly and remove the front and rear wheels.

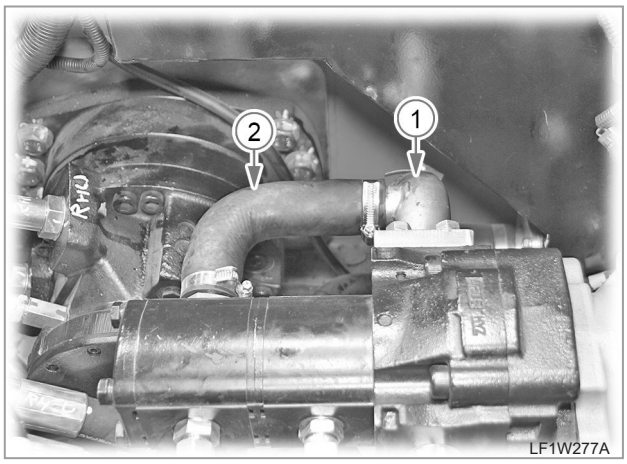
DISASSEMBLING THE MAIN PUMP



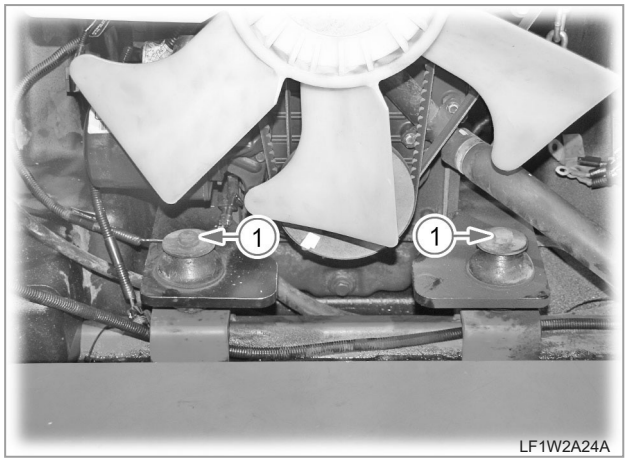
12. Drain the hydraulic oil from the oil tank.

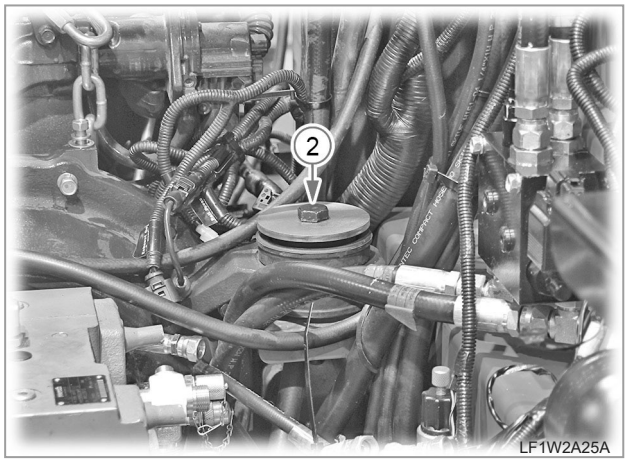


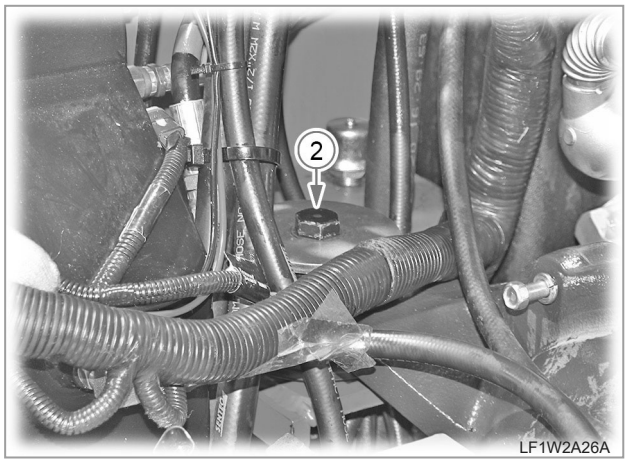
13. Disconnect the high-flow pump hydraulic hose (1), charge pump hydraulic hose (2) and main pump hydraulic hose (3).



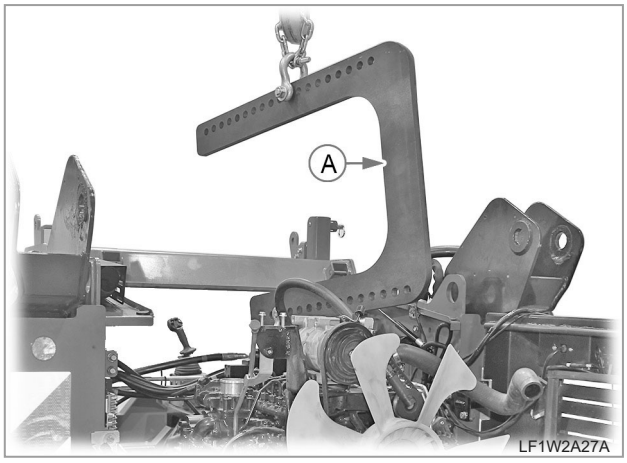
14. Disconnect the suction hose (1) from the main pump and the suction hose (2) from the high-flow pump.

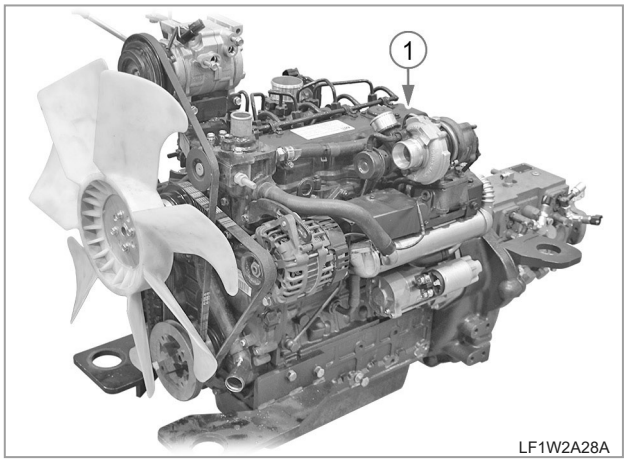




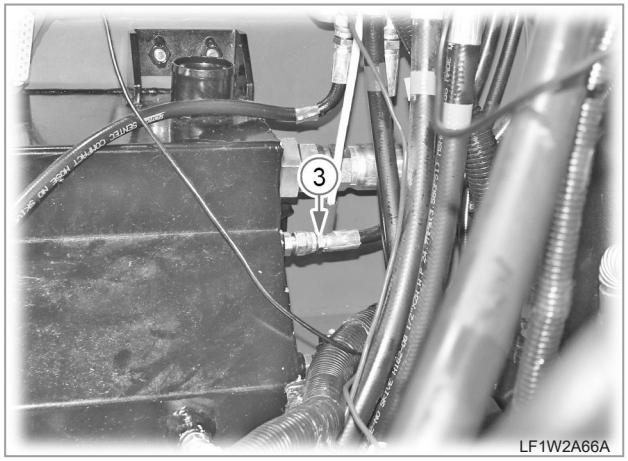


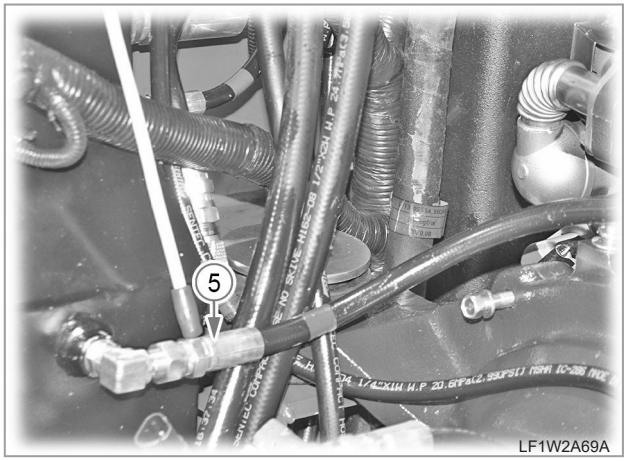
49. Loosen the two front engine mounting bolts (1) and two rear engine mounting bolts (2).

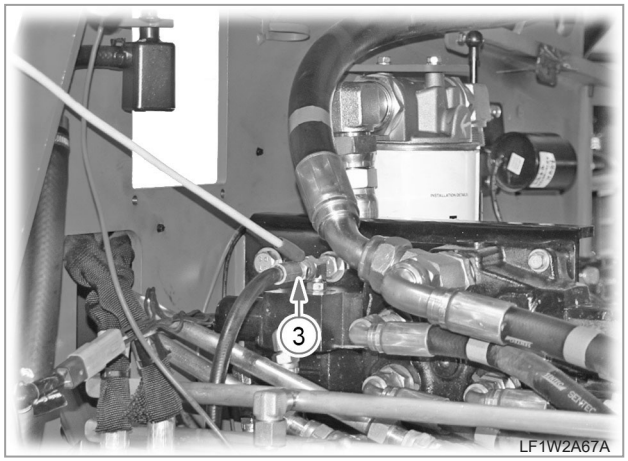




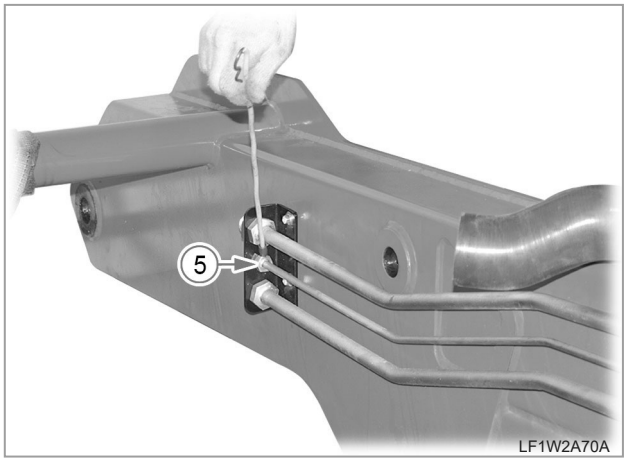
50. Install a disassembly jig (A) on the engine and use a hoist to pull out and put aside the engine/ HST pump assembly (1) safely.



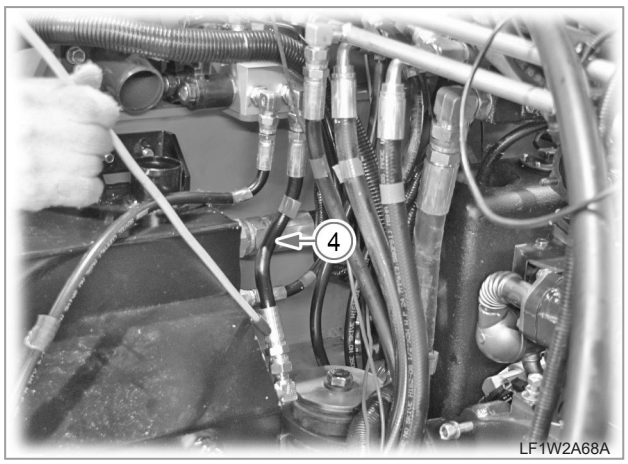




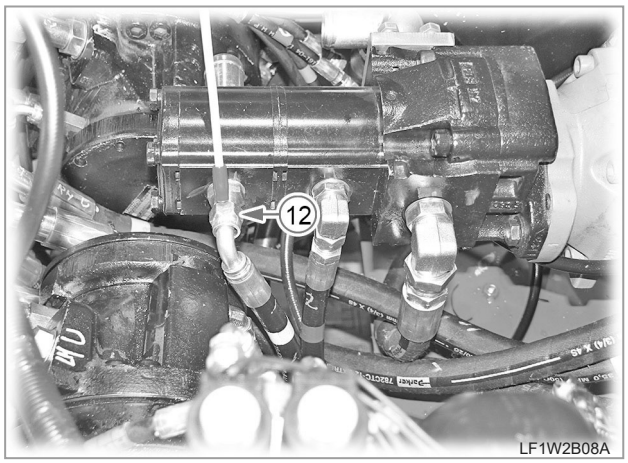
17. Install the return hose (3) between the main control valve and the oil tank.

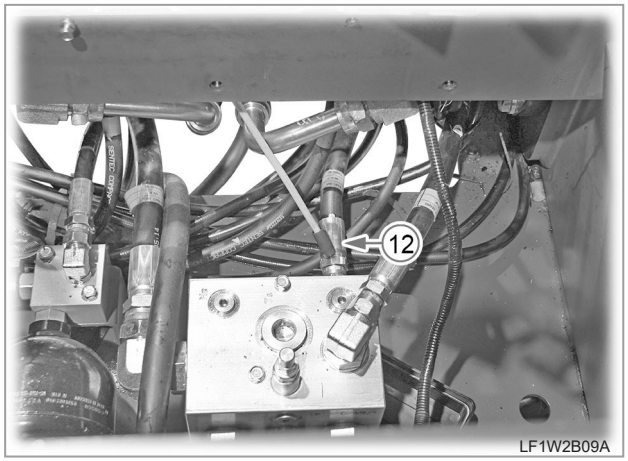


19. Install the external hydraulic oil return hose (5) on the oil tank.



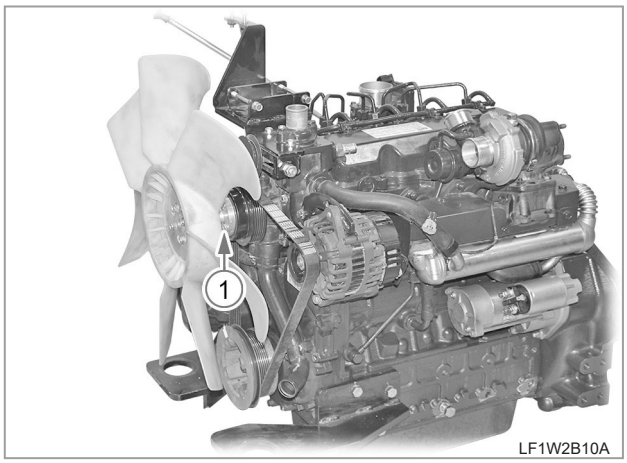
18. Connect the return hose (4) between the quick-attachment valve and the oil tank.



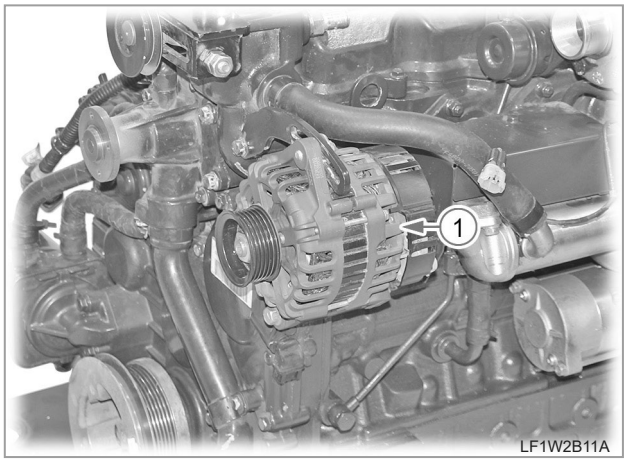


38. Connect the hydraulic hose (12) from the high-flow pump to the high-flow valve.

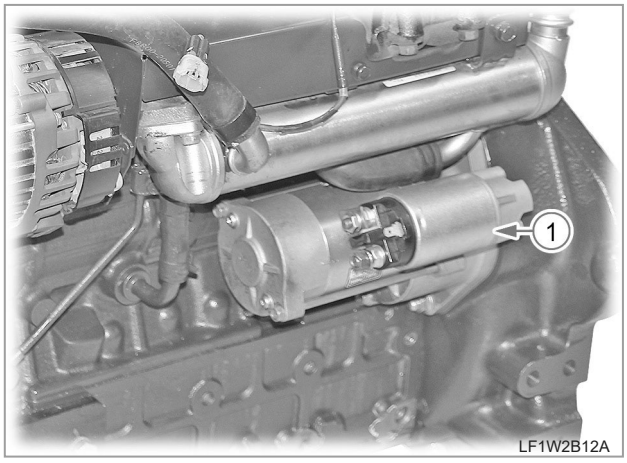
7.3 ENGINE COMPONENT REMOVAL



1. Unscrew the cooling fan mounting bolts (1) and then remove the cooling fan, fan collar, fan pulley, and fan belt in order.



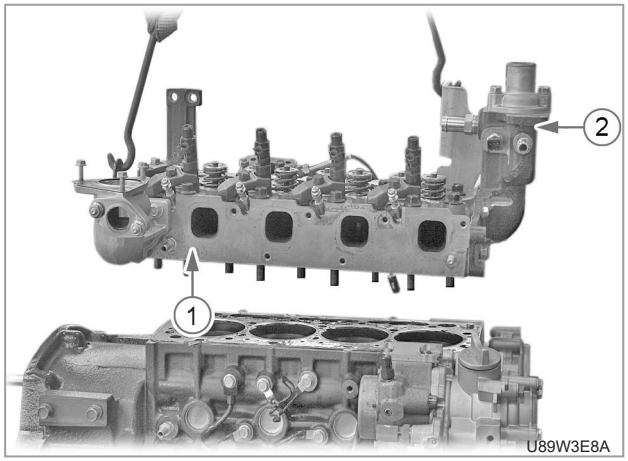
2. Remove the alternator (1).

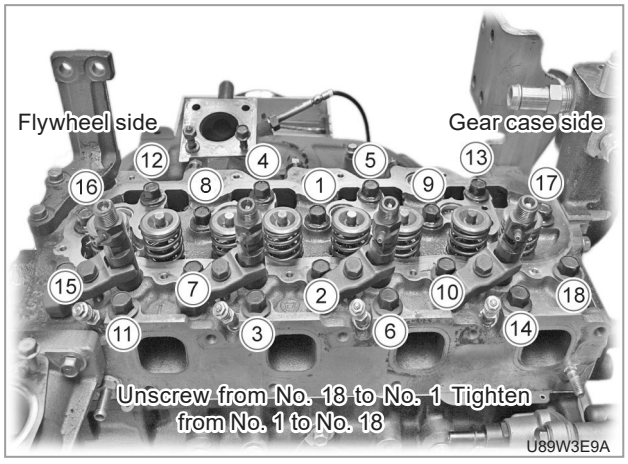


3. Remove the starter motor (1).

7.4.4 CYLINDER HEAD

CYLINDER HEAD REMOVAL





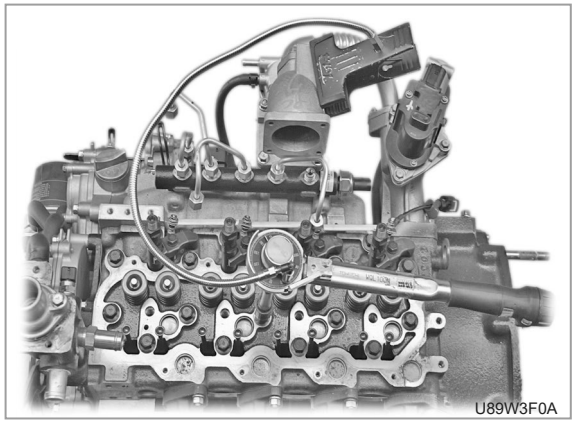
1. Loosen the head bolts in the reverse sequence as shown in the figure. (Follow the sequence in the figure when tightening them.)
2. Lift the head (1) slightly with a hoist by using the hook.
3. Remove the coolant flange (2) if necessary.
4. Remove the tappets from the cylinder block.

⚠ CAUTION

- **Mark the cylinder number to the tappets to prevent them from interchanging.**

IMPOARTANT

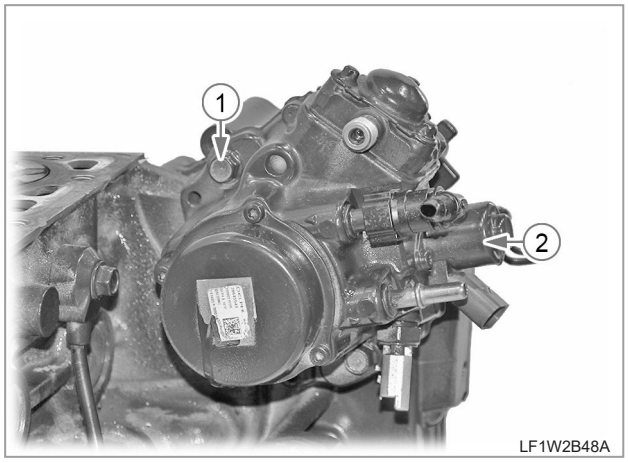
CYLINDER HEAD BOLT TIGHTENING METHOD

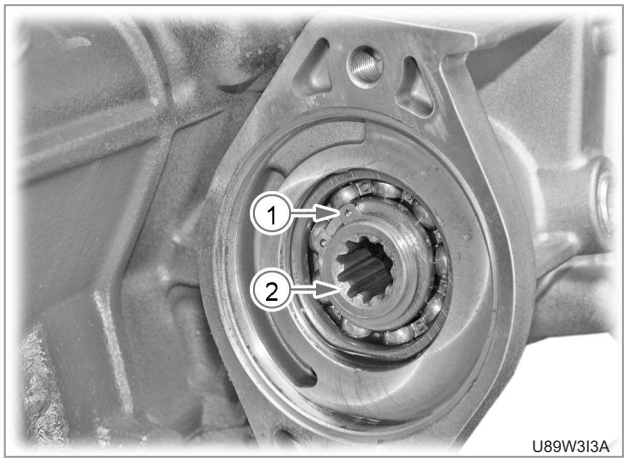


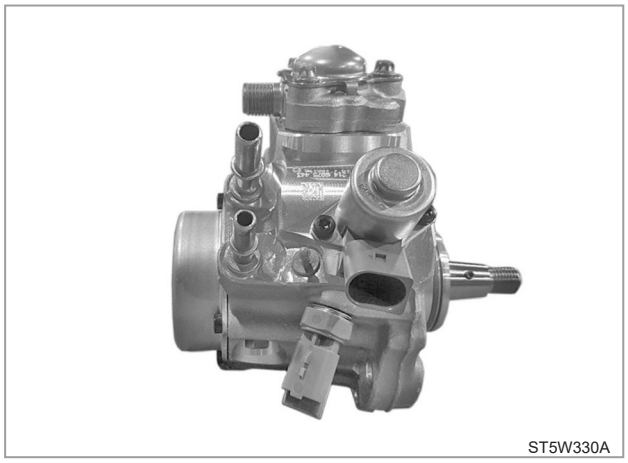
1. **Add a little engine oil to the thread and bottom face of bolt head.**
2. **Tighten the head bolt to 4 kgf-m in accordance with head bolt tightening order.**
3. **Tighten every bolts 90° with angle torque wrench in accordance with tightening order.**
4. **Tighten bolts 70° more in accordance with tightening order.**
5. **Do not re-use old head bolts.**

REMARKS

- **A, B seires engine: 4 kgf-m + 90° + 80°**
- **F, H seires engine : 4 kgf-m + 90° + 70°**

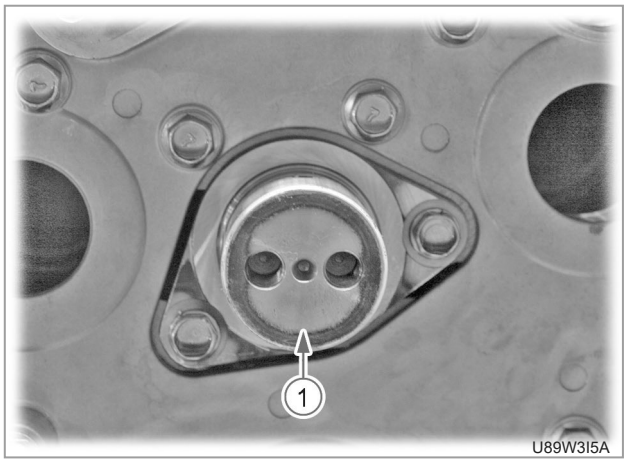






10. Unscrew the high-pressure fuel pump mounting bolts (1) to remove the high-pressure fuel pump assembly (2).

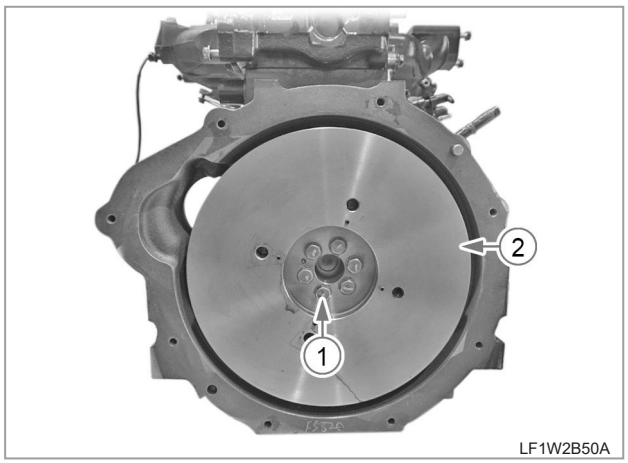
11. Pull out the hydraulic pump drive gear mounting snap ring (1) to remove the hydraulic pump drive gear (2).



12. Remove the idle gear 1 shaft (1).

7.4.10 FLYWHEEL AND CRANKSHAFT

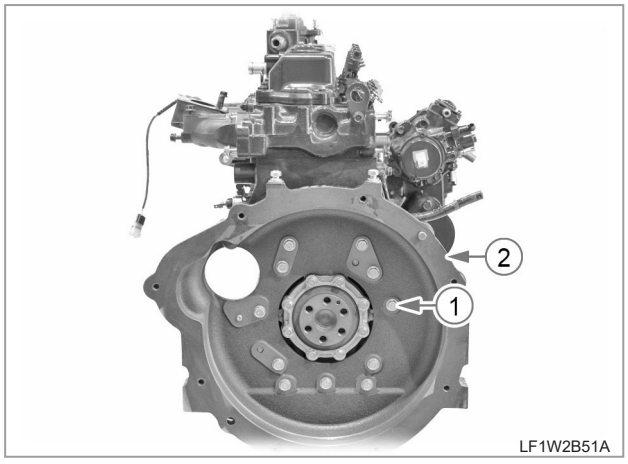
REMOVAL



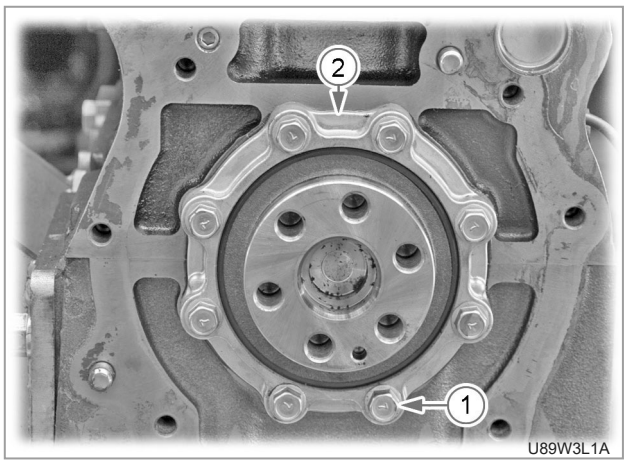
1. Unscrew the flywheel mounting bolts (1) to remove the flywheel (2).

REMARKS

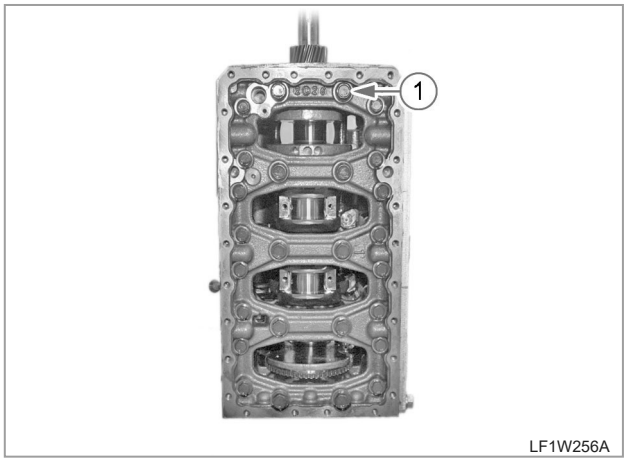
- **Use a crankshaft wrench or flywheel ring gear as a stopper to prevent the flywheel from rotating.**



2. Unscrew the flywheel housing mounting bolts (1) (13 EA) to remove the flywheel housing (2).



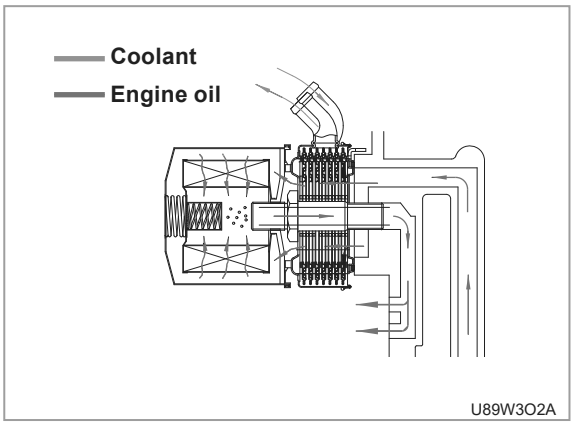
3. Unscrew the oil seal case mounting bolts (1) to remove the oil seal case (2).



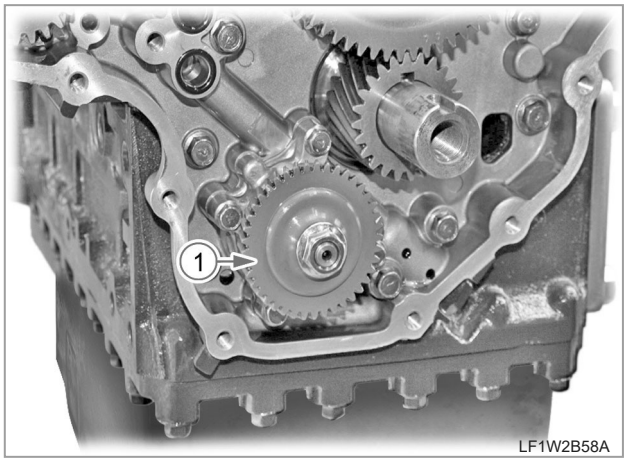
4. Unscrew the main bearing bolts (1) (10 EA) from the bottom of the cylinder block.

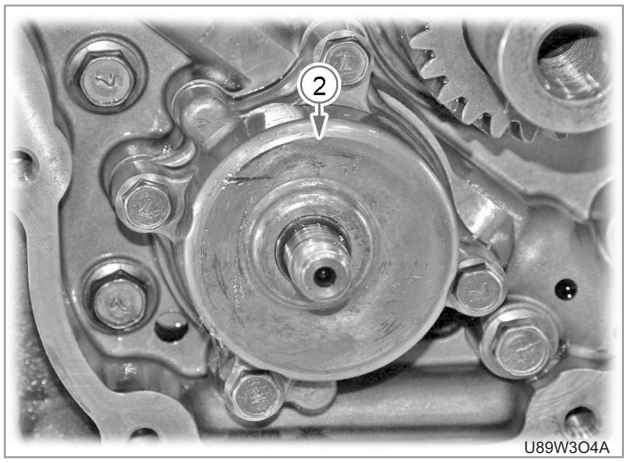
REMARKS

OIL FILTER FLOW AND OIL COOLER COOLANT FLOW



7.4.12 OIL PUMP





(1) Oil pump gear (2) Oil pump ass'y

1. Remove the oil pump gear (1) from the lower section of the gear case. Then, remove the oil pump assembly (2).

INSTALL PROGRAM

▶ INSTALL MICROSOFT VISUAL C++ 2008 SP1 REDISTRIBUTABLE PACKAGE

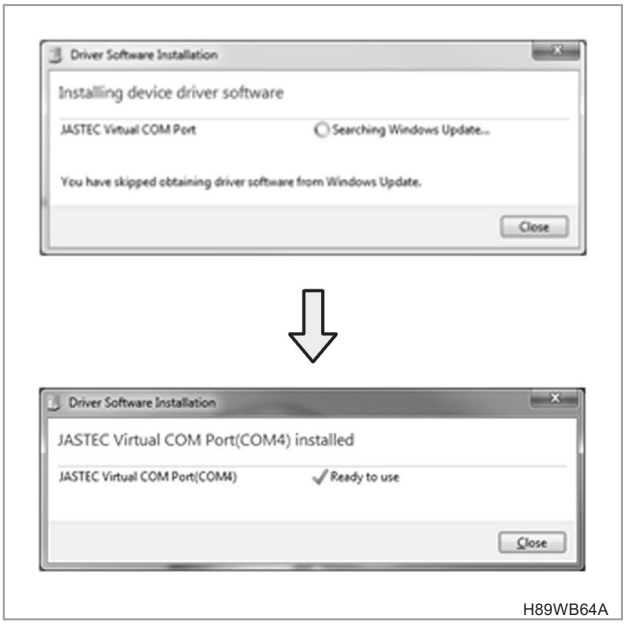
1. Copy vcredist_x64_eng.exe and vcredist_x86_eng.exe on laptop's wallpaper.
2. If you use 32bit's OS, Install vcredist_x86_eng.exe.
3. If you use 64bit's OS, Install vcredist_x64_eng.exe.
4. If you don't know OS type, Install vcredist_x86_eng.exe. If it doesn't install, Install vcredist_x64_eng.exe

▶ INSTALL FT4 DIAGNOSTIC PROGRAM

1. Copy Installation Program on laptop's wallpaper.
2. Run Installation Program.
3. Install Program.
4. Installation completed.
5. Icon will be shown on wallpaper.

UVIM USB DRIVER RECOGNITION

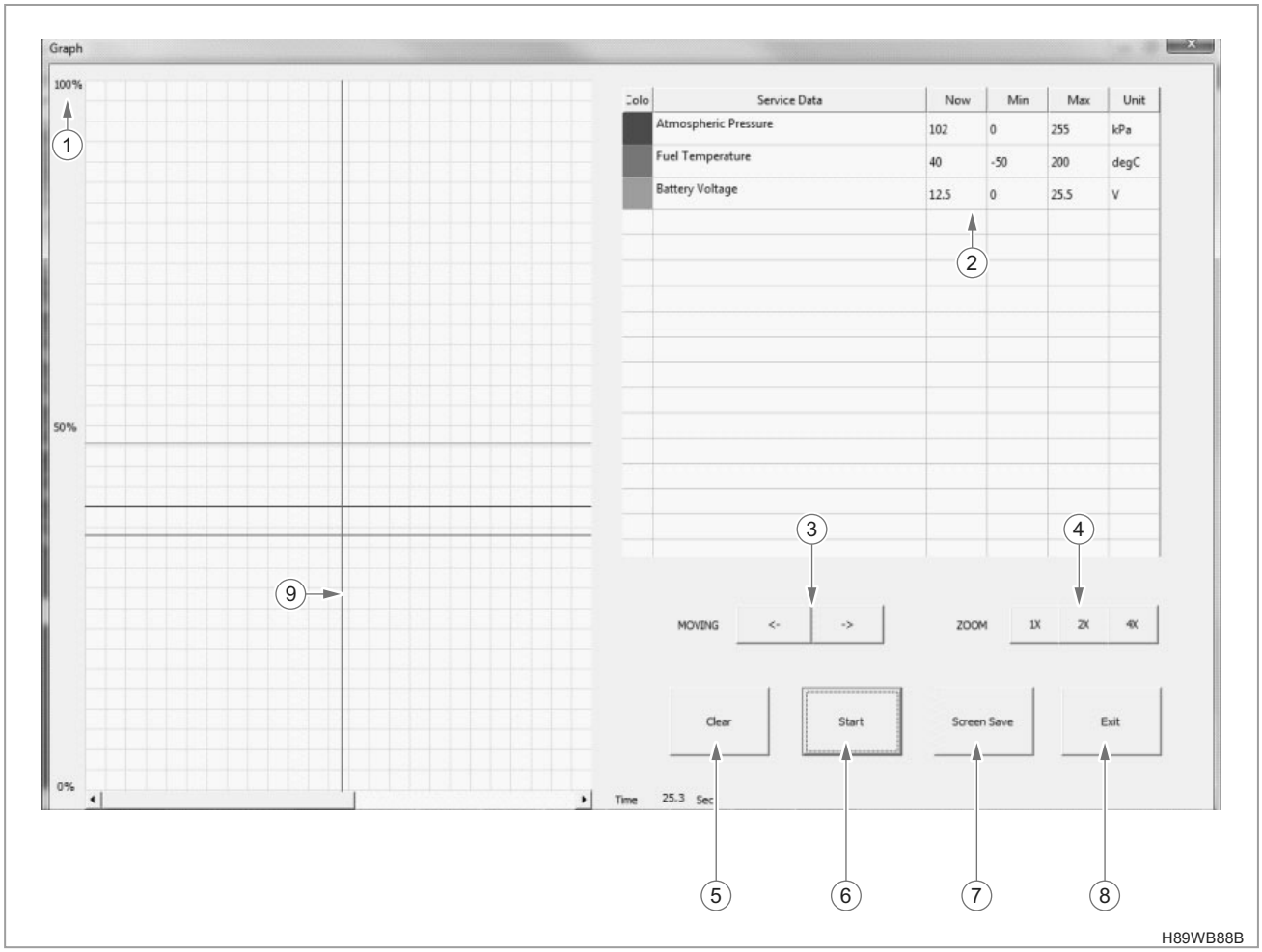
▶ WINDOWS 7 - AUTOMATICALLY INSTALLED



H89WB64A

D. GRAPH

- After progress until "C" of C-3, click graph button and selected item value can be seen as Graph



H89WB88B

(1) Indicating min/max standard of sensor value as 0~100%. Sensor will be separated by color.

(2) Indicate sensor value. Click min/max value and can change standard value.

(3) When graph stops, move standard line no.(9) as left/right.

(4) Can magnify no.1 screen double/ quadruple to Time axis.

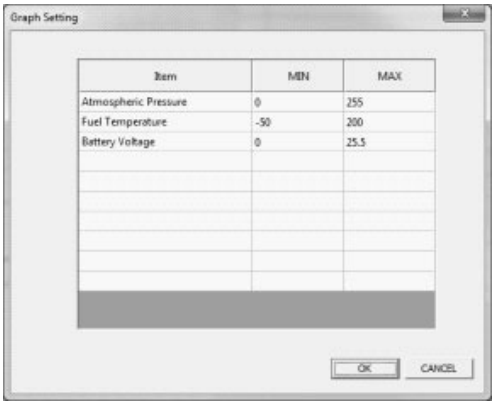
(5) Delete graph screen.

(6) Start/Stop : Start or stop indicating graph.

(7) Save graph screen as image file.

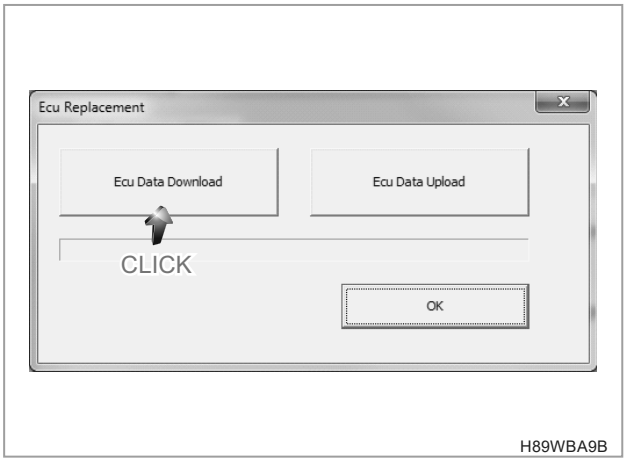
(8) Exit graph screen.

INDICATE SENSOR VALUE

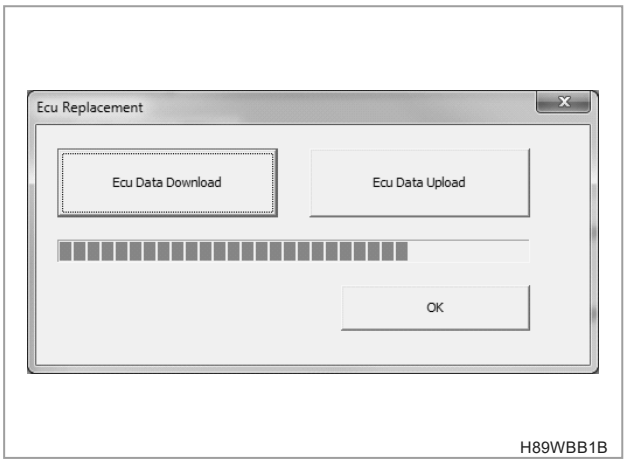


H89WB89B

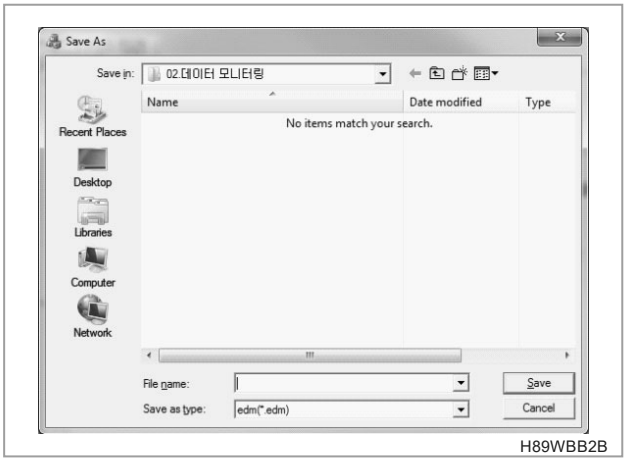
A. ECU CHANGE



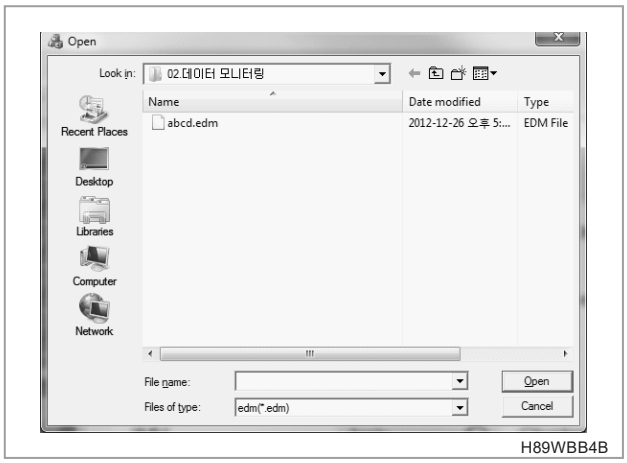
1. Click ECU Data Download Button.



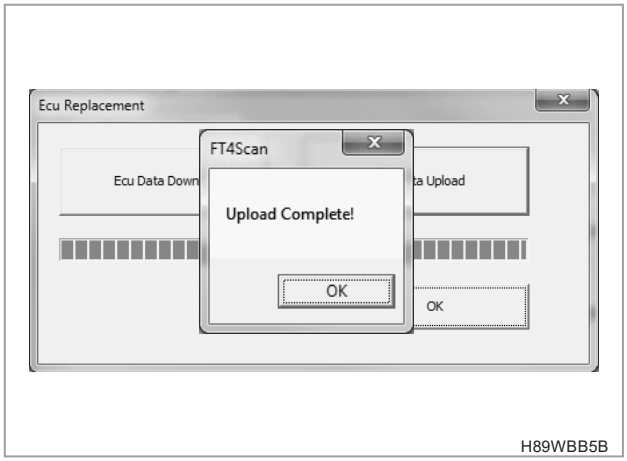
2. Download ECU Data.



3. Save Download data as file.



5. Select data file.



6. Upload Complete message will be shown.

REMARK

- **In case of replace ECU, download ECU Data on PC first. After the replacing ECU, please upload downloaded ECU Data.**

FAULT CODE						FAULT NAME	DESCRIPTION	ACTION							EGR Inducement		
DTC CODE		J1939		LAMP CODE	CLUSTER CODE			CEL"ON"	DELAYED ENGINE STOP (20s)	CCRT (DPF) REGEN DISABLE OR STOP	INCRE-ASED IDLE (1300 rpm)	DISABLE EACH INJECTOR	LIMP HOME (1400 rpm)	TORQUE REDUCTION (2200 rpm)	EMISSION FAILURE LAMP "ON"	SPEED REDUCTION Warn : N/A Low Level: N/A Severe Level : 60%	TORQUE REDUCTION Warn : N/A Low Level: 25% Severe Level : 50%
HMB	LB	SPN	FMI														
P02A2	00	674	6	172		INJECTOR 1 MDP TRIM HIGH FAULT	1. Injector 1 MDP trim high fault. 2. Injector 1 MDP trim exceeds the maximum calibrated threshold limit. * 4CYL Engine: Cylinder No.3// 3CYL Engine: Cylinder No.2	O			O						
P02A2	00	674	6	172	E-ECU-071	INJECTOR 1 MDP TRIM HIGH FAULT	1. Injector 1 MDP trim high fault. 2. Injector 1 MDP trim exceeds the maximum calibrated threshold limit. * 4CYL Engine: Cylinder No.3// 3CYL Engine: Cylinder No.2	O			O						
P02A2	00	674	6	172		INJECTOR 1 MDP TRIM HIGH FAULT	1. Injector 1 MDP trim high fault. 2. Injector 1 MDP trim exceeds the maximum calibrated threshold limit. * 4CYL Engine: Cylinder No.3// 3CYL Engine: Cylinder No.2	O			O						
P02A3	00	675	30	172	E-ECU-072	INJECTOR 1 LEARNING FAULT	1. Injector 2 absolute MDP value is below a calibrated threshold. 2. Injector 2 MDP trim low fault. * 4CYL Engine: Cylinder No.4// 3CYL Engine: Cylinder No.3	O		O	O						
P02A3	00	675	5	172		INJECTOR 1 LEARNING FAULT	1. Injector 2 absolute MDP value is below a calibrated threshold. 2. Injector 2 MDP trim low fault. * 4CYL Engine: Cylinder No.4// 3CYL Engine: Cylinder No.3	O									
P02A3	00	675	5	172	E-ECU-073	INJECTOR 1 LEARNING FAULT	1. Injector 2 absolute MDP value is below a calibrated threshold. 2. Injector 2 MDP trim low fault. * 4CYL Engine: Cylinder No.4// 3CYL Engine: Cylinder No.3	O									
P02A3	00	675	5	172		INJECTOR 1 LEARNING FAUL	1. Injector 2 absolute MDP value is below a calibrated threshold. 2. Injector 2 MDP trim low fault. * 4CYL Engine: Cylinder No.4// 3CYL Engine: Cylinder No.3	O									
P02A6	00	678	6	173		INJECTOR 2 MDP TRIM HIGH FAULT	1. Injector 3 MDP trim high fault. 2. Injector 3 MDP trim exceeds the maximum calibrated threshold limit. * 4CYL Engine: Cylinder No.2	O			O						
P02A6	00	678	6	173	E-ECU-074	INJECTOR 2 MDP TRIM HIGH FAULT	1. Injector 3 MDP trim high fault. 2. Injector 3 MDP trim exceeds the maximum calibrated threshold limit. * 4CYL Engine: Cylinder No.2	O			O						
P02A6	00	678	6	173		INJECTOR 2 MDP TRIM HIGH FAULT	1. Injector 3 MDP trim high fault. 2. Injector 3 MDP trim exceeds the maximum calibrated threshold limit. * 4CYL Engine: Cylinder No.2	O			O						
P02A7	00	679	30	173	E-ECU-075	INJECTOR 2 LEARNING FAULT	1. Injector 3 absolute MDP value is below a calibrated threshold. 2. Injector 3 MDP trim low fault. * 4CYL Engine: Cylinder No.2	O		O	O						
P02A7	00	679	5	173		INJECTOR 2 LEARNING FAULT	1. Injector 3 absolute MDP value is below a calibrated threshold. 2. Injector 3 MDP trim low fault. * 4CYL Engine: Cylinder No.2	O									
P02A7	00	679	5	173	E-ECU-076	INJECTOR 2 LEARNING FAULT	1. Injector 3 absolute MDP value is below a calibrated threshold. 2. Injector 3 MDP trim low fault. * 4CYL Engine: Cylinder No.2	O									
P02A7	00	679	5	173		INJECTOR 2 LEARNING FAULT	1. Injector 3 absolute MDP value is below a calibrated threshold. 2. Injector 3 MDP trim low fault. * 4CYL Engine: Cylinder No.2	O									
P0325	00	805	1	121	E-ECU-077	KNOCK SENSOR 1 FAULT	1. Knock sensor 1 signal or noise ratio is too low in idle.	O									
P0330	00	816	1	122	E-ECU-078	KNOCK SENSOR 2 FAULT	1. Knock sensor 2 signal or noise ratio is too low in idle.	O									
P0335	85	821	27	424	E-ECU-079	CRANK SENSOR SIGNAL OVER SPEED FAULT	1. Crank signal over speed fault. 2. Crank signal gap lost fault.	O			O			O			
P0335	31	821	2	425	E-ECU-080	CRANK SENSOR SIGNAL GAP MISSED FAULT	1. Crank signal over speed fault. 2. Crank signal gap lost fault.	O			O			O			
P0340	54	832	30	415	E-ECU-081	CAM SENSOR SIGNAL LEARNING FAULT	1. Cam signal learning fault. 2. Cam signal erratic fault.	O			O			O			
P0340	2F	832	29	414	E-ECU-082	CAM SENSOR SIGNAL ERRATIC FAULT	1. Cam signal learning fault. 2. Cam signal erratic fault.	O			O			O			

8.2.3 FAULT DIAGNOSIS CODE DESCRIPTION

CHECK DEVICE

CHECK POINT	REMARK
1. CHECK DTC CODE	1. Read diagnostic trouble code.
2. DEVICE HARDWARE CHECK	1. Visually check device hardware.
3. CHECK VEXT (Supply Voltage) Fault	1. Disconnect sensor one by one checking if disappear to find which one is faulty. (Problem with one of the sensors causing loss of supply voltage) 2. If none is found faulty, check short circuit or isolation of Vext lines of harness.
4. CHECK DEVICE CONNECTION	1. Pin to Pin check (Device Connector, ECU Connector, Wire Harness) (*) See the Attached Wire Harness Drawing

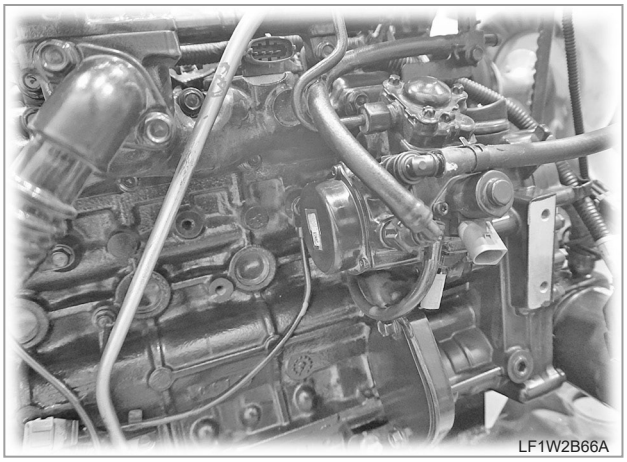
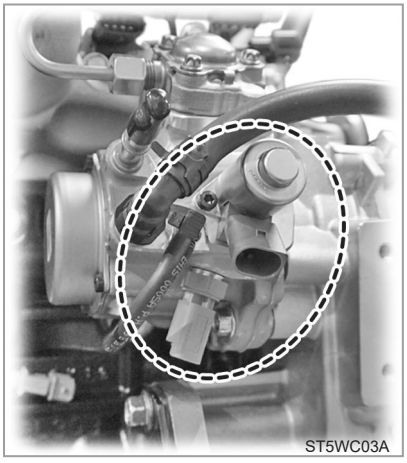
RELAY

CHECK POINT	REMARK
1. RELAY CHECK	1. Relay shortage check. 2. Pin to Pin Check (Sensor Connector, ECU Connector, Wire Harness) (*) See the Attached Wire Harness Drawings.

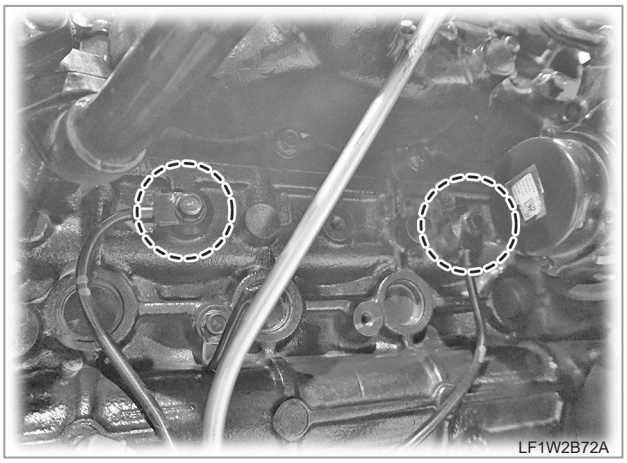
SWITCH

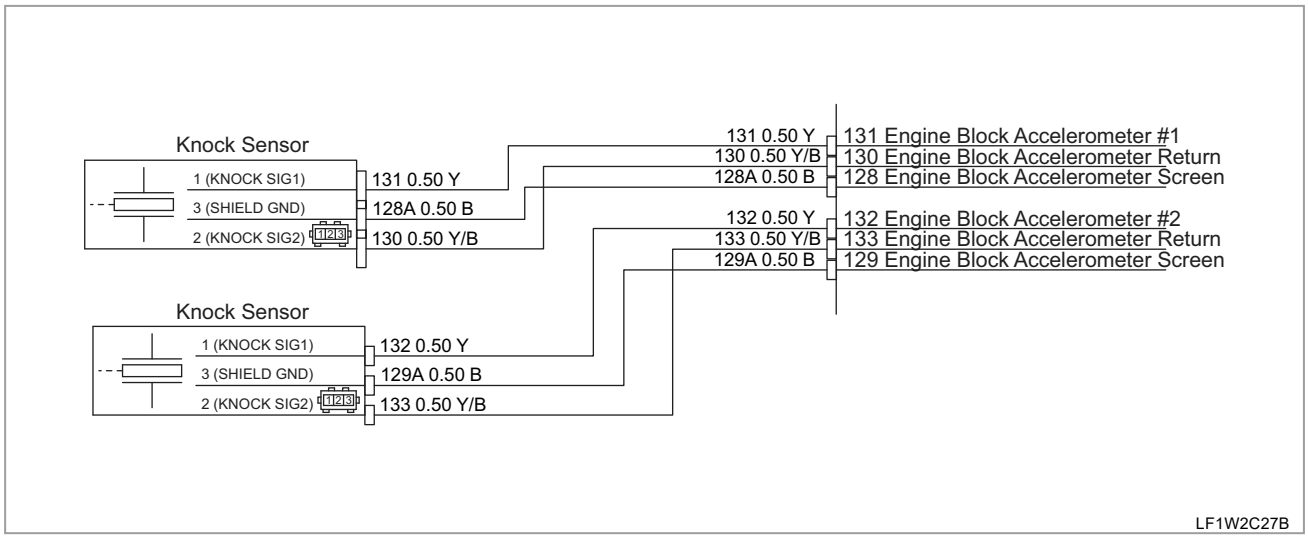
CHECK POINT	REMARK
1. SWITCH CHECK	1. Check 12V supply from the battery. 2. Pin to Pin Check (Sensor Connector, ECU Connector, Wire Harness) (*) See the Attached Wire Harness Drawings.
2. REPLACE THE SWITCH	1. Replace the switch.

RAIL PRESSURE CONTROL ERROR

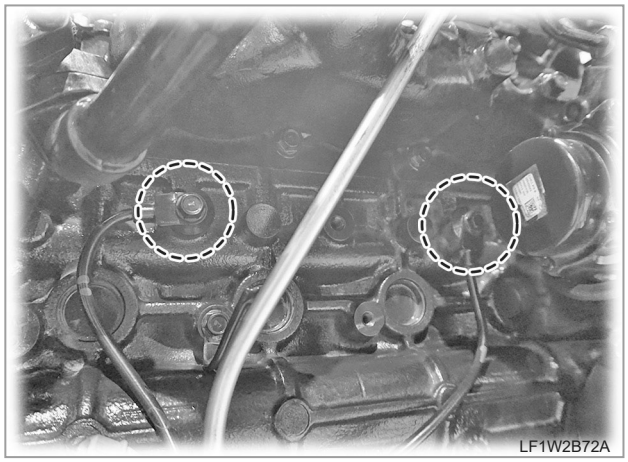
CHECK POINT	REMARK
1. FUEL, AIR AND CIRCUIT CHECK	 LF1W2B66A 1. Check the fuel feed circuit is in good condition. 2. Check diesel is in the system 3. Check any air in the system (Should be no air and no bubble) 4. Check the enough fuel pressure in the inlet pump. 5. Check leak on the high pressure pump. 6. Check diesel fuel of the correct quality and type.
2. IMV CONNECTOR/WARE HARNESS CHECK	 ST5WC03A 1. Pin to Pin Check (Sensor Connector, ECU Connector, Wire Harness) 2. Check electrical isolation. (*) See the Attached Wire Harness Drawings.
3. MEASURE IMV ELECTRICAL RESISTANCE	1. Check IMV electrical resistance. (Around 5.3Ω at 20° C) 2. If there is resistance problem, replace the IMV.

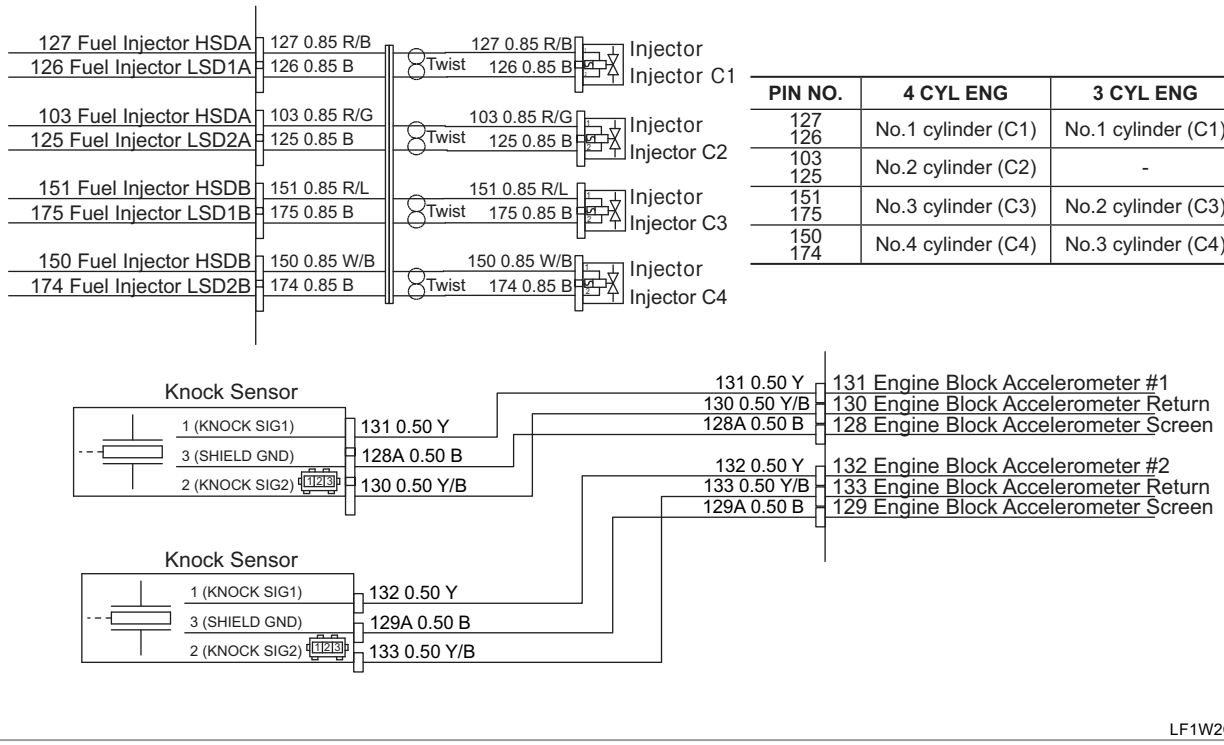
KNOCK SENSOR

CHECK POINT	REMARK
1. KNOCK SENSOR CHECK	 LF1W2B72A 1. Check the individual knock sensor. (Installation and connection) (*) See the Attached Wire Harness Drawings.



INJECTOR BALANCING

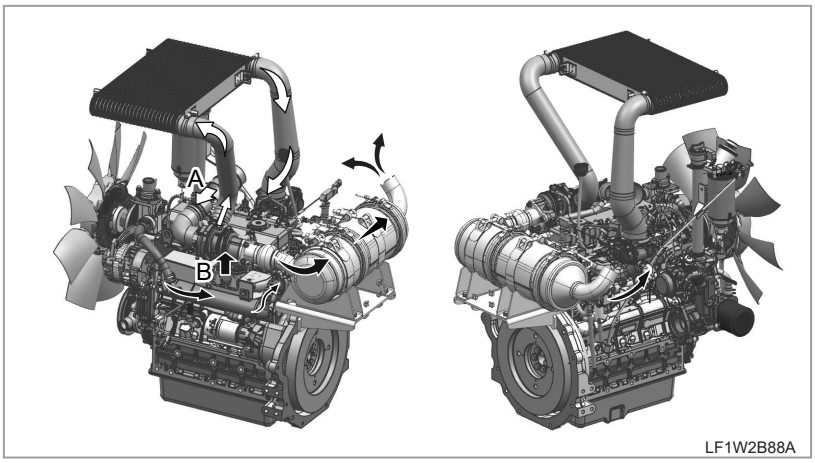
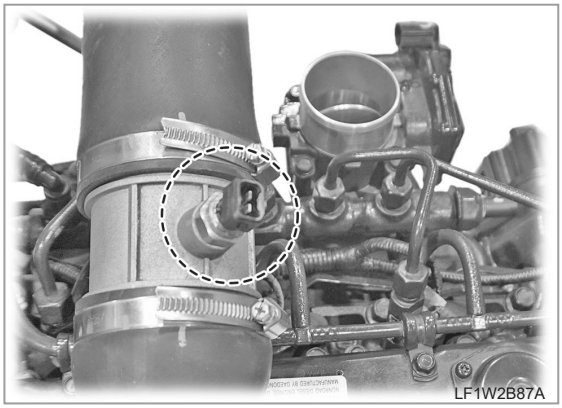
CHECK POINT	REMARK
1. CHECK DTC CODE	1. Read diagnostic code (DTC) in the scan tool.
2. REWRITE INJECTOR CODE (C3I)	2. Rewrite injector code (C3I)
3. INDIVIDUAL INJECTOR CHECK	1. Check the individual injector. (Shut up test or Run up test using scan tool.)  LF1W2B72A 2. Check the knock sensor for installation and connection. (*) See the Attached Wire Harness Drawings.
4. CHECK AIR CIRCUIT & AIR LEAK	1. Read diagnostic code (DTC) in the scan tool.

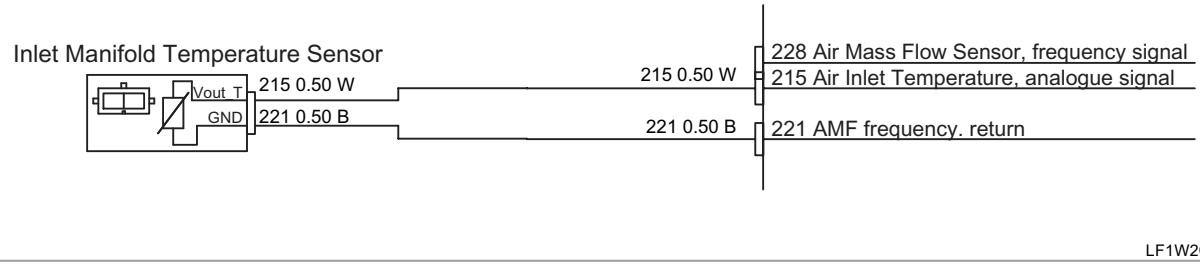


PIN NO.	4 CYL ENG	3 CYL ENG
127 126	No.1 cylinder (C1)	No.1 cylinder (C1)
103 125	No.2 cylinder (C2)	-
151 175	No.3 cylinder (C3)	No.2 cylinder (C3)
150 174	No.4 cylinder (C4)	No.3 cylinder (C4)

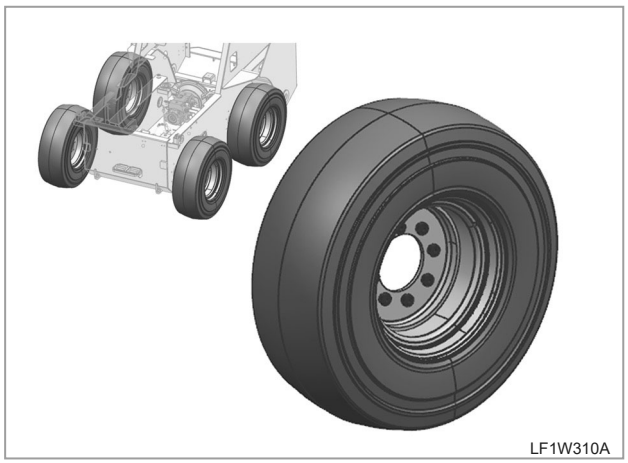
LF1W2C35B

INTAKE AIR TEMPERATURE SENSOR (T1)

CHECK POINT	REMARK
1. CHECK AIR INLET CIRCUIT	 1. Check air inlet leak in air intake system. (A) 2. If yes, repair it.
1. CHECK AIR INLET CIRCUIT	1. Read diagnostic trouble code.
3. CHECK VEXT (Supply Voltage) Fault	1. Disconnect sensor one by one checking if disappear to find which one is faulty. (Problem with one of the sensors causing loss of supply voltage) 2. If none is found faulty, check short circuit or isolation of Vext lines of harness.
4. ECU CONNECTOR / WIRE HARNESS CHECK	 1. Pin to Pin Check (Sensor Connector, ECU Connector, Wire Harness) 2. Check electrical isolation. (*) See the Attached Wire Harness Drawings.



TIRE GROUP



Tire : 12 × 16.5 - 12PR

- 12 → Section Width
- 16.5 → Rim Diameter
- 12PR → Ply Rating

Rim : 9.75 × 16.5

- 9.75 → Width
- 16.5 → Rim Diameter

- Tire OD : 845 mm
- Rolling Circumference: 2496 mm

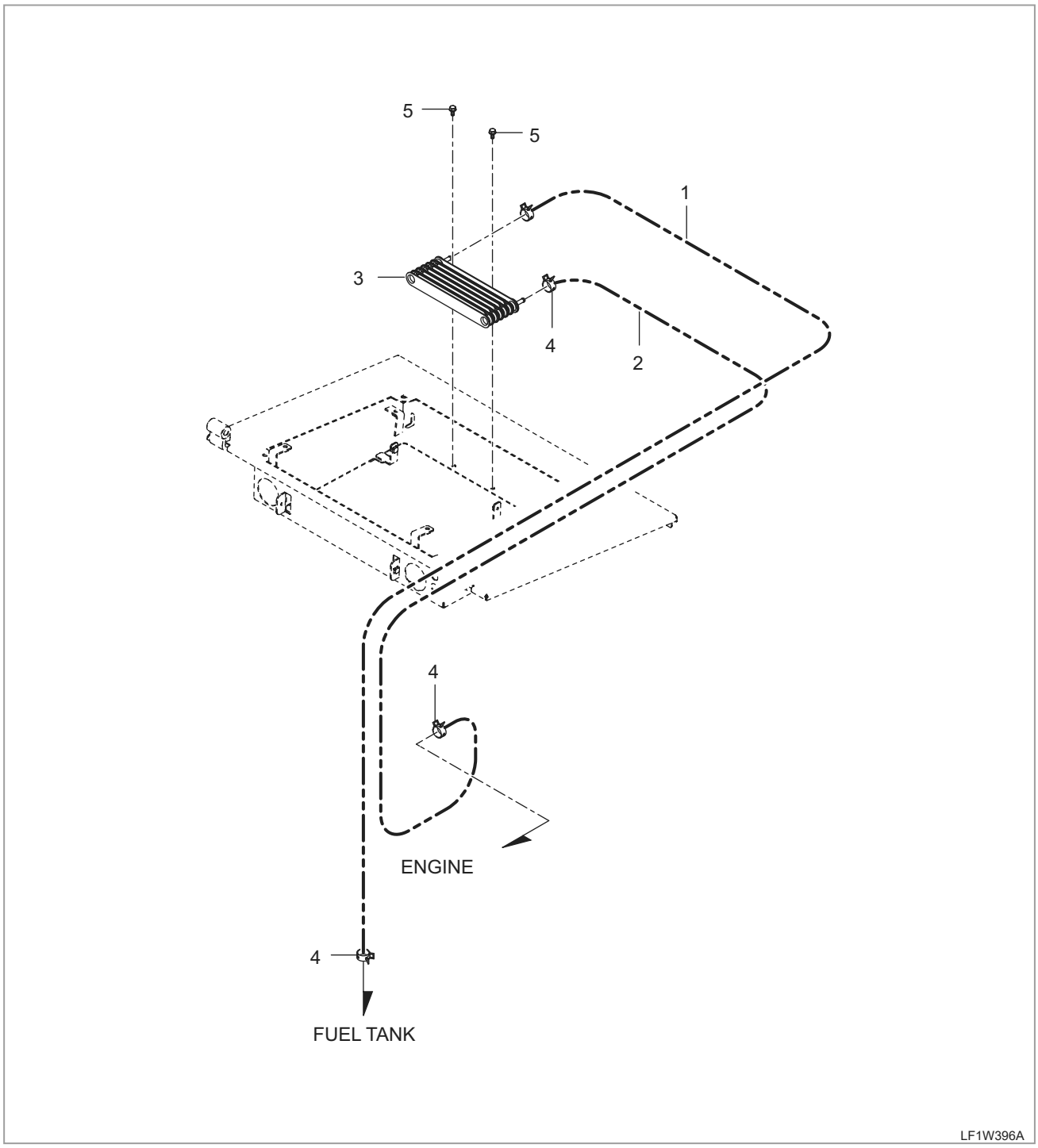
Axle rpm : 78 rpm , 131 rpm

speed[km/h] = (60 × 10^{-6}) × Rolling Circumference × Axle rpm

- Speed : 11.7 km/h , 19.6 km/h

SYMPTOM	CAUSE	SOLUTION
Insufficient output torque or draft force	Insufficient pressure built in the pump	• Apply the full load on the motor and check the maximum pressure according to the equipment specification. If the measurement is excessively low, plug the lines A & B and measure the maximum pressure at the blocked line. If the measurement is still too low, adjust, repair, or replace the pump, pump adjuster, or system pressure relief valve as necessary.
	Excessive oil leakage from the motor and impossible to build full pressure	• Apply the full load on the motor and check the maximum pressure according to the equipment specification. If the measurement is excessively low, plug the lines A & B and measure the maximum pressure at the blocked line. If the measurement is proper, remove and inspect the motor. Replace any faulty part. If necessary, replace the whole motor.
	Insufficient break-in of the motor	• Operate the motor for 24-48 hours continuously (under load) to achieve its maximum efficiency. If the output torque increases continuously, this symptom may appear during this period.
	2-Speed spool partially or fully moved unintentionally due to high 2-speed shift pressure (if equipped)	• If the spool does not move properly according to the equipment specification, check the 2-speed shift pressure. If the pressure is excessively high, adjust, repair, or replace the control valve. If necessary, check if the line is clogged.
	2-Speed spool partially or fully moved and stuck in place (if equipped)	• Remove the 2-speed valve and check all the components, including the bore of the motor housing. Remove any foreign material. If necessary, replace any necessary component or the motor housing.
	Brake not released fully, due to excessively low brake release pressure (if equipped)	• Check the brake release pressure according to the equipment specification. If necessary, adjust, repair, or replace the source of the pressure. If the source of the pressure is normal, remove the brake and replace the brake seal as necessary.
	Internal damage to the motor	• Apply the full load on the motor and check the maximum pressure according to the equipment specification. If the measured pressure is normal and there is no apparent defect, other than the one described above, remove and check the motor. Replace any defective part. If necessary, replace the whole motor.

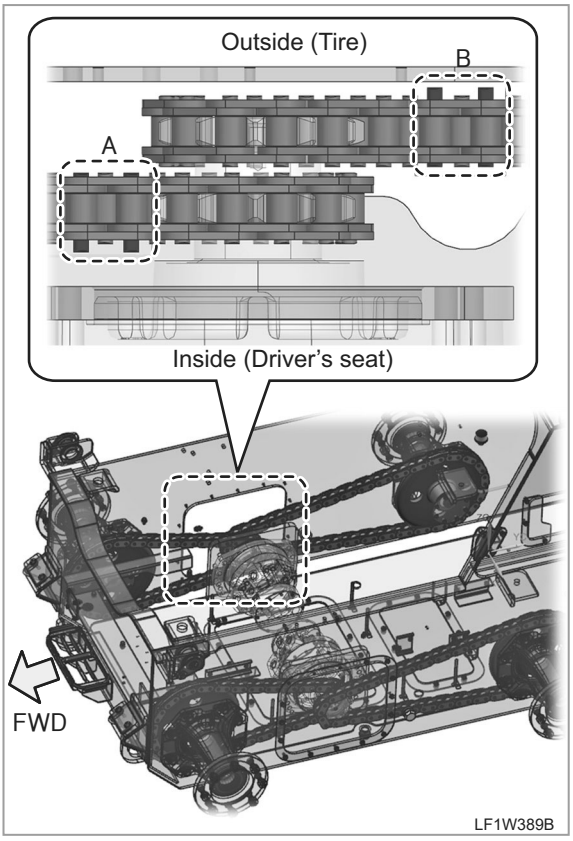
5.6 LF1-G432001 FUEL COOLER GROUP



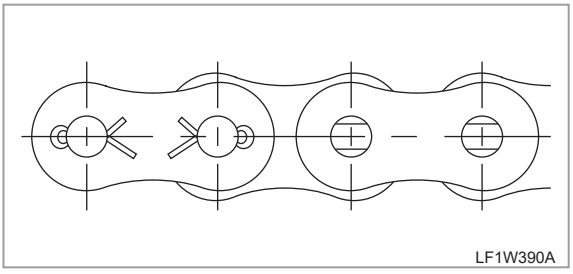
COMPONENTS

(1) Hose, Fuel 3
(2) Hose, Fuel 4
(3) Fuel Cooler
(4) Clmap, Hose
(5) Hex Head Cap Screw

⚠ CAUTION

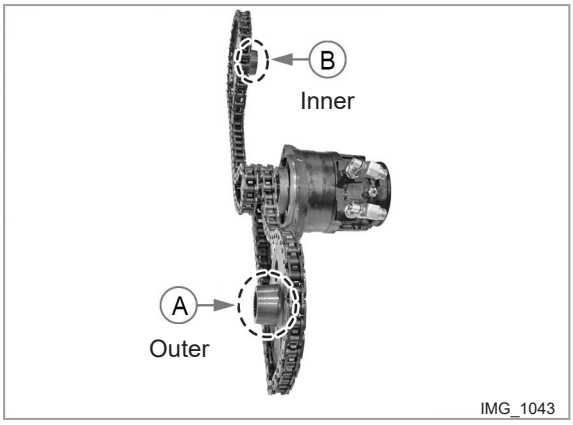


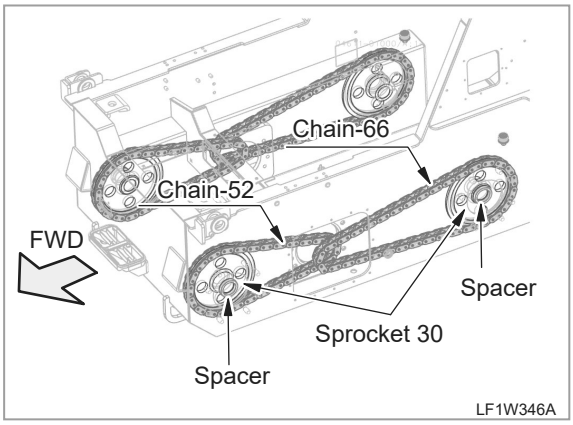
- **When installing the drive chain, check the direction of the connecting link and install it using a jig as shown in the figure.**
- **Chain-52 (A Section) : The split pin direction should face inward.**
- **Chain-66 (B Section) : The split pin direction should face outward.**



- **When installing the drive chain connecting link, make sure to install the split pin in the correct direction. (Refer to the figure)**

⚠ CAUTION





- **When installing the sprockets, ensure that the front (A) and rear (B) boss sections are facing the correct direction.**
- **Refer to "1.5.1 Drive chain tension adjustment" for chain tension adjustment.**

HS120V

HYDRAULIC SYSTEM

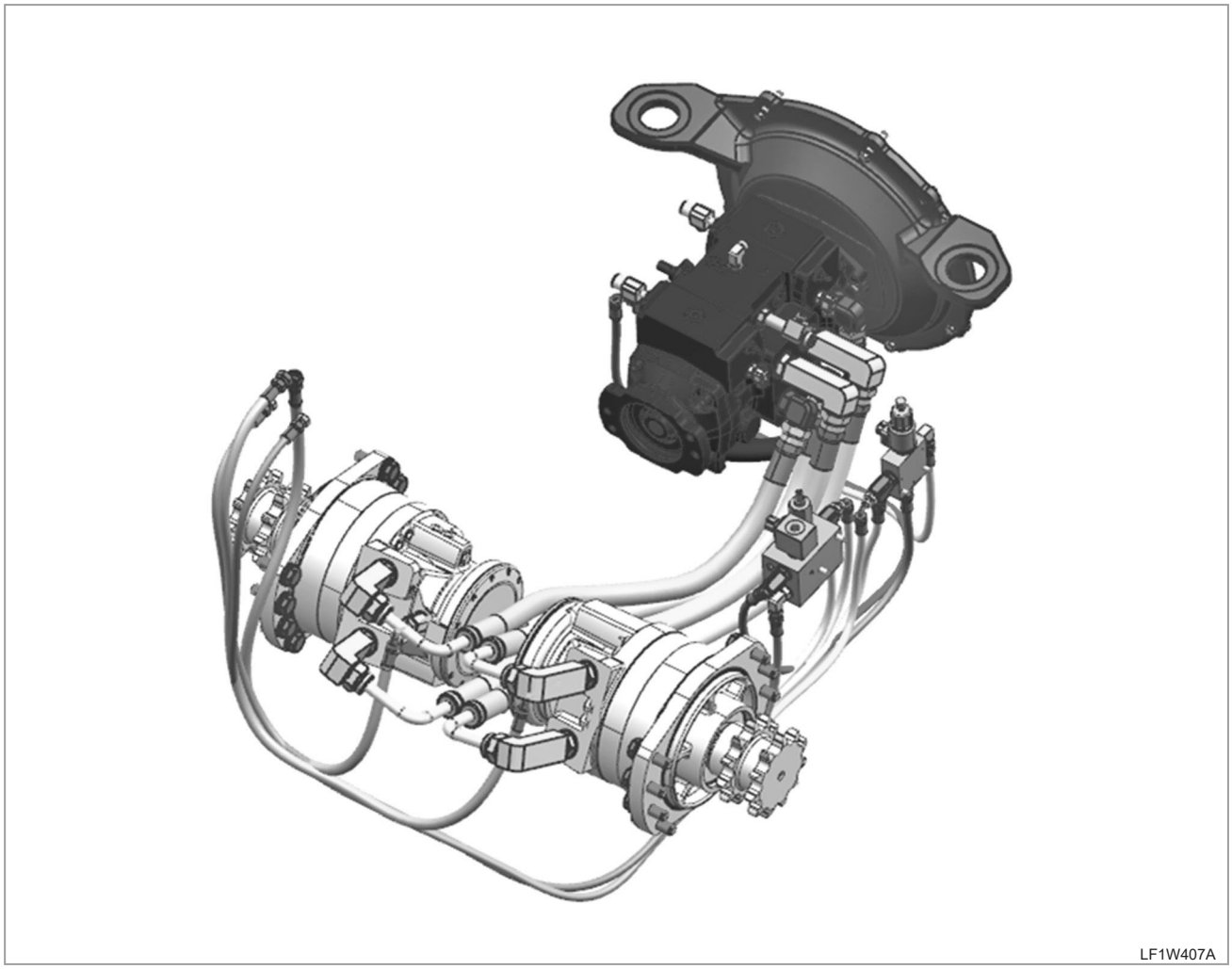
CHAPTER 4

HYDRAULIC SYSTEM

TABLE OF CONTENTS

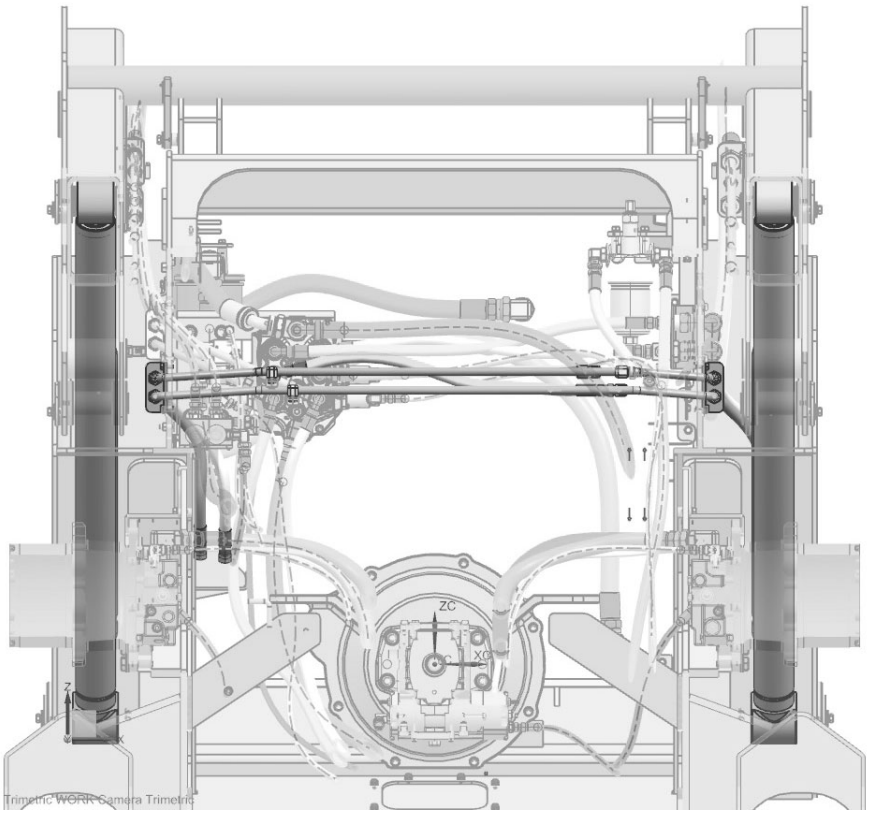
2.3 CONNECTING LINES BY HYDRAULIC SYSTEM GROUPS

2.3.1 HST GROUP

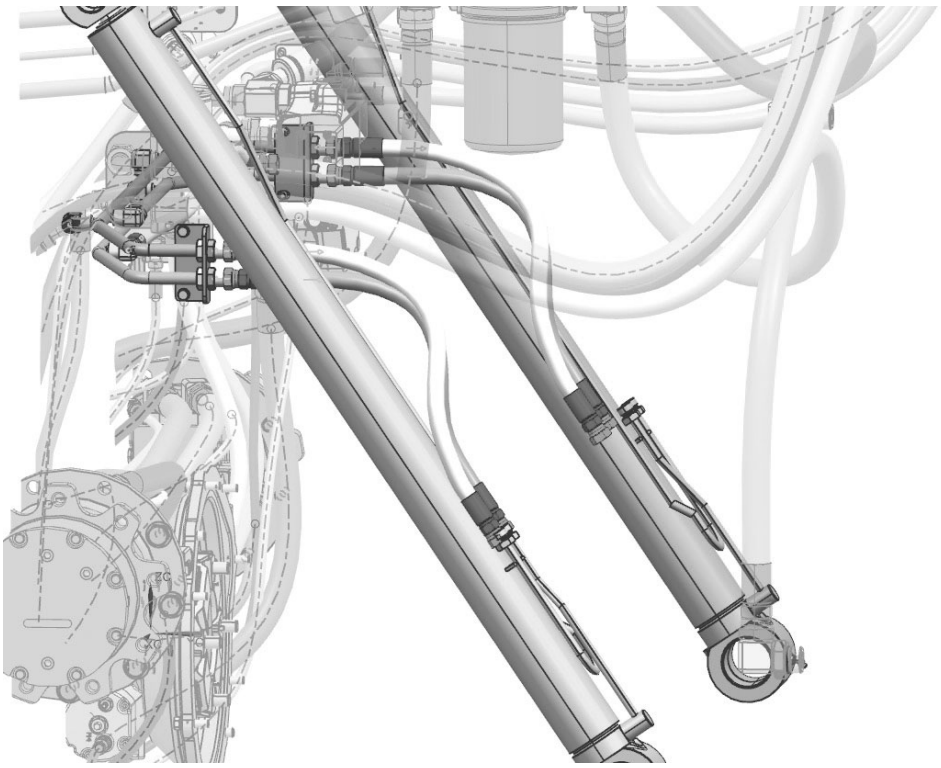


LF1W407A

2.3.7 LIFT CYLINDER GROUP

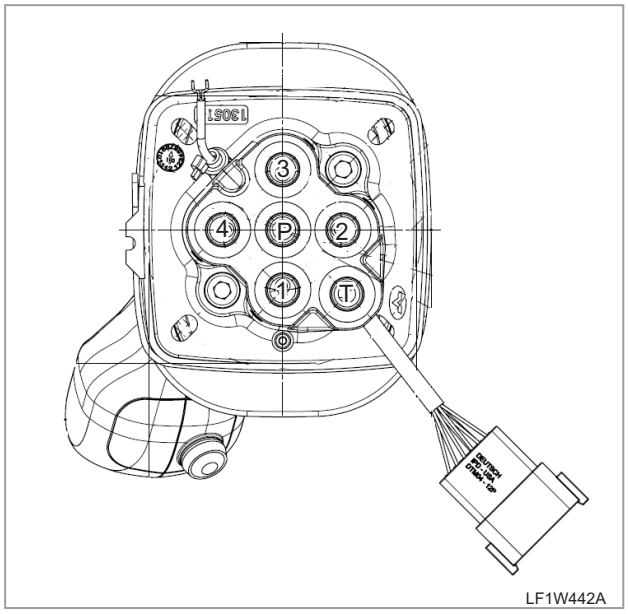


LF1W428A



LF1W429A

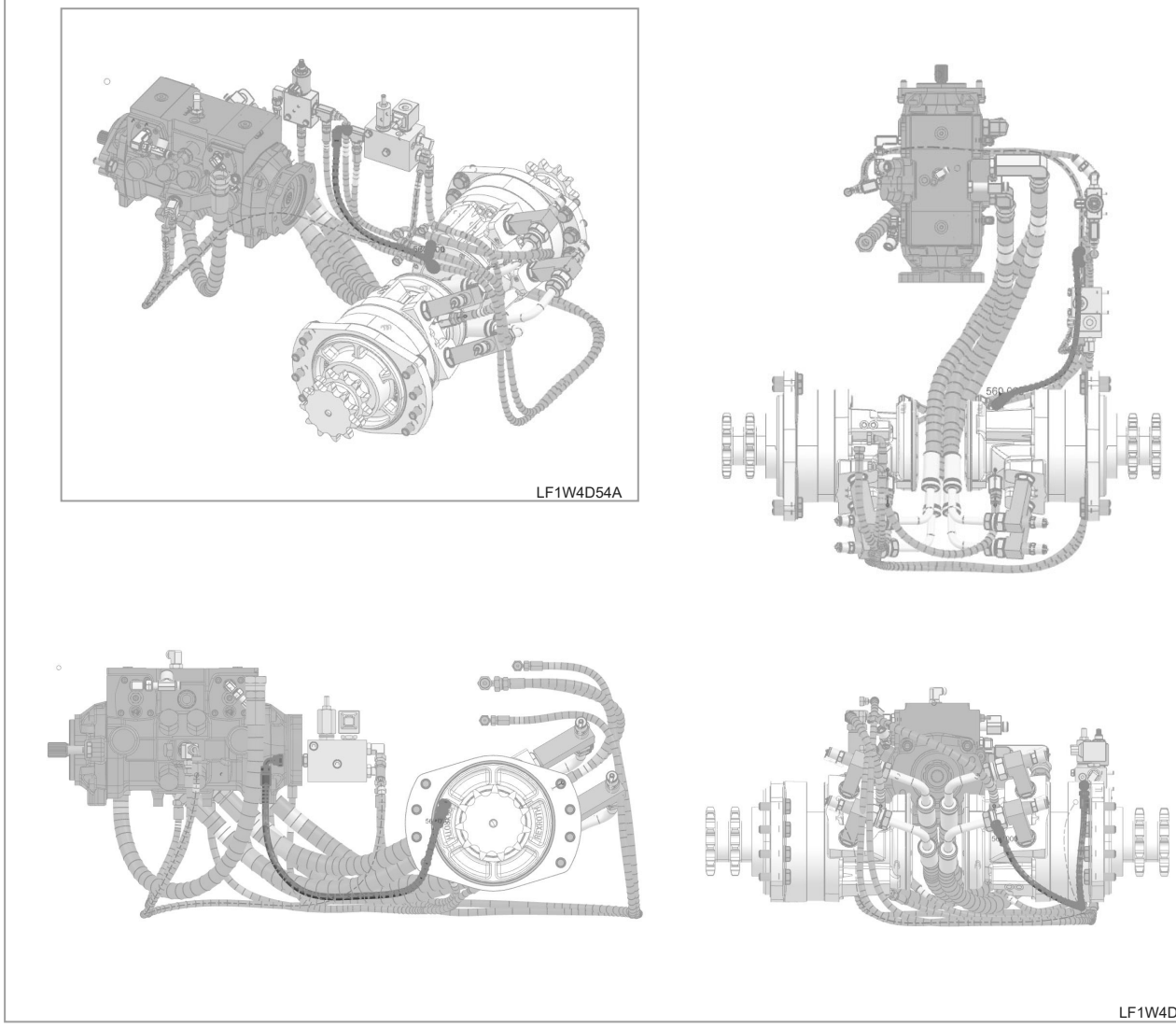
2.4.7 RCV ASSEMBLY (RH) (LF13-0056)



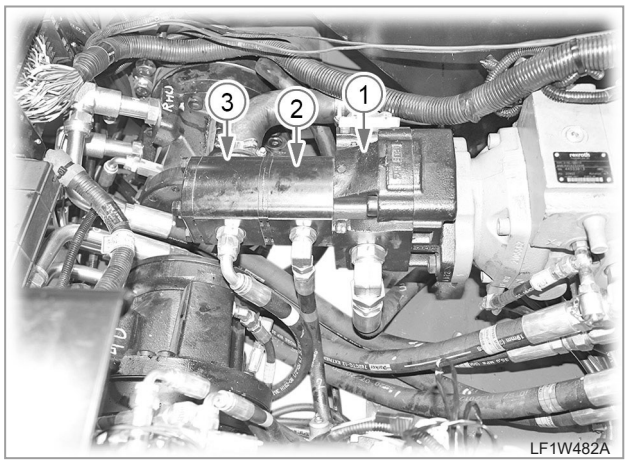
LF1W442A

PORT	LINE	FITTING	HOSE	
			CTL	SSL
1	MCV (Boom down)	Short LF13-0070	LF13-0067	LF13-0561
2	MCV (Dump)	Short LF13-0070	LF13-0062	LF13-0560
3	MCV(Boom up)	Short LF13-0070	LF13-0068	LF13-0559
4	MCV (Roll back)	Short LF13-0070	LF13-0069	LF13-0558
P	Pilot lock valve	Long LF13-0057	LF13-0060	LF13-0557
T	Oil tank	Long LF13-0057	LF13-0053	LF13-0566

2.5.9 HYDRAULIC HOSE - SHIFT MOTOR(LH) (LF13-0397B)



3.2 GEAR PUMP (MAIN+CHARGE+HIGH FLOW PUMP)



The gear pumps are connected to the HST pump in a row and receives the rotating power from the engine through the HST pump. The main pump (1), charge pump (2), and high-flow pump (3) are mounted in order when seen from the HST pump side.

SPECIFICATIONS

ITEM	MAIN PUMP (1)	CHARGE PUMP (2)	HIGH FLOW PUMP (3)
Capacity (cm³ / rev)	34.555	19.091	19.091
Maximum continuous pressure (bar)	280	200	200
Maximum peak pressure (bar)	320	240	240
Speed (rpm)	500 ~ 3,000		
Temperature (°C)	-25 ~ 80 (Continuous / 100 (Peak)		
Rotation driction	Clockwise (View from drive shaft)		

3.5 PILOT LOCK VALVE

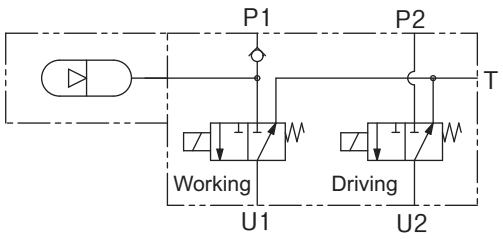

LF1W492A

The pilot lock valve is mounted on the left middle section of the main frame. When the seat bar is raised, this valve blocks the main oil gallery in order to stop the whole hydraulic operation. When the seat bar is lowered and the reset switch is turned on, the main oil gallery is restored for normal operation.

SPECIFICATIONS

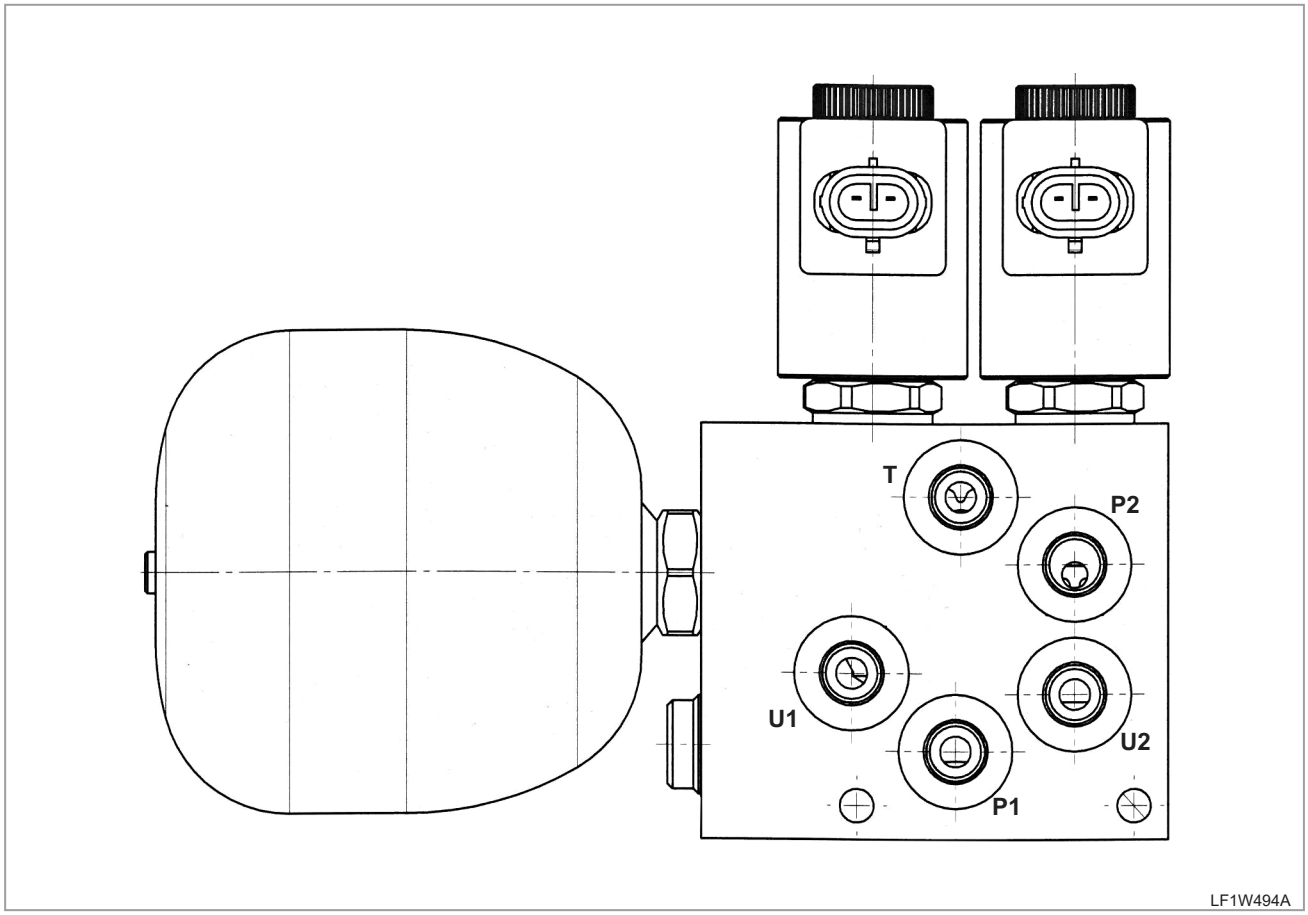
ITEM	SPECIFICATION
Max. flow	10 ℓ/min
Max. pressure	40 bar
Accumulator capacity	0.32 ℓ
Free charge pressure	11 bar

CIRCUIT DIAGRAM



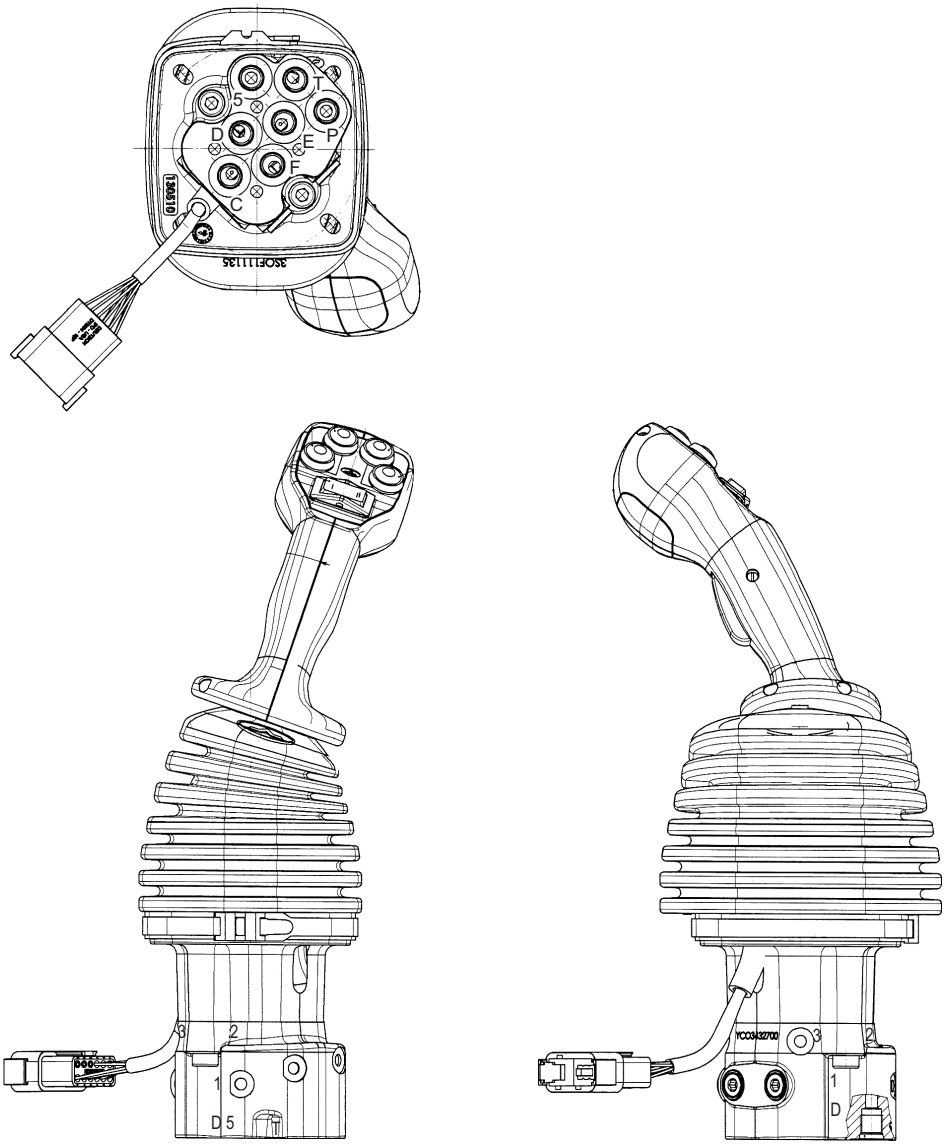
LF1W493C

EXTERIOR

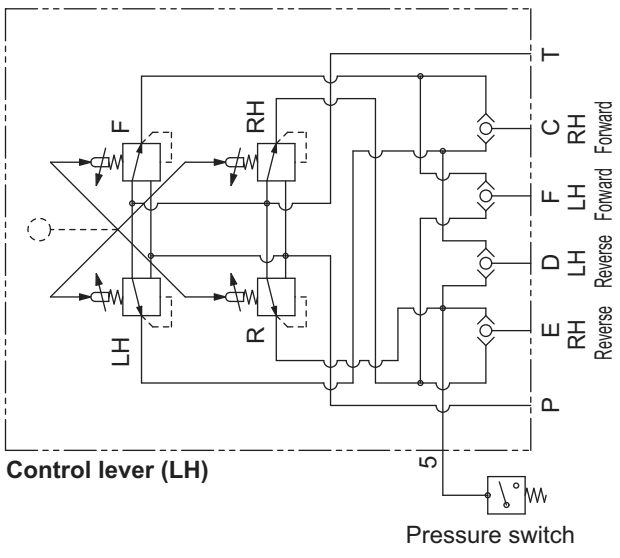


LF1W494A

EXTERIOR & CIRCUIT DIAGRAM

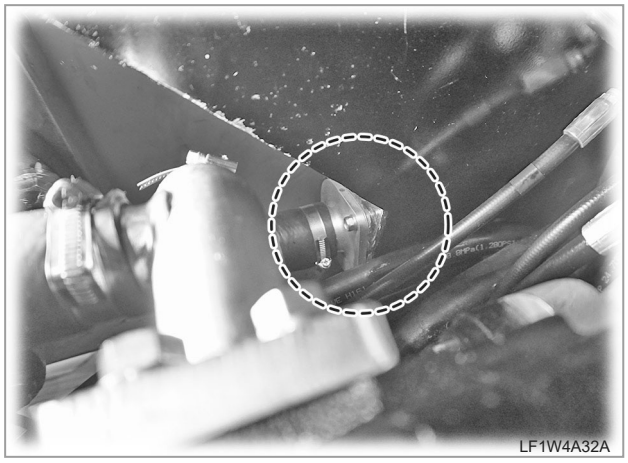


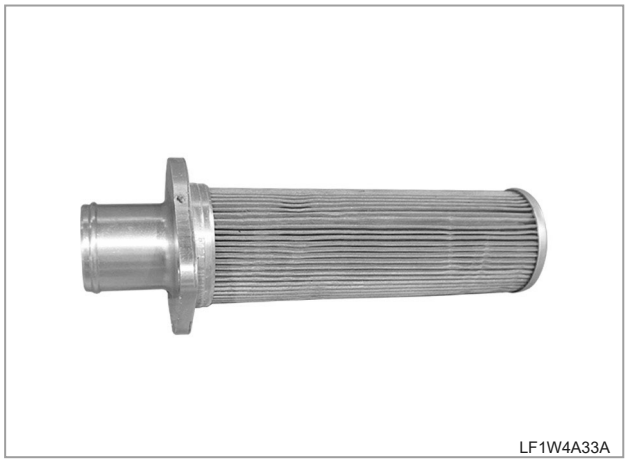
LF1W4A15A

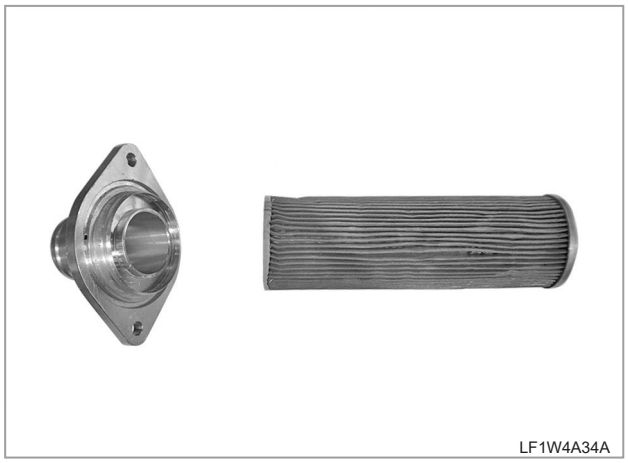


LF1W4A16B

3.15.3 OIL STRAINER


LF1W4A32A


LF1W4A33A

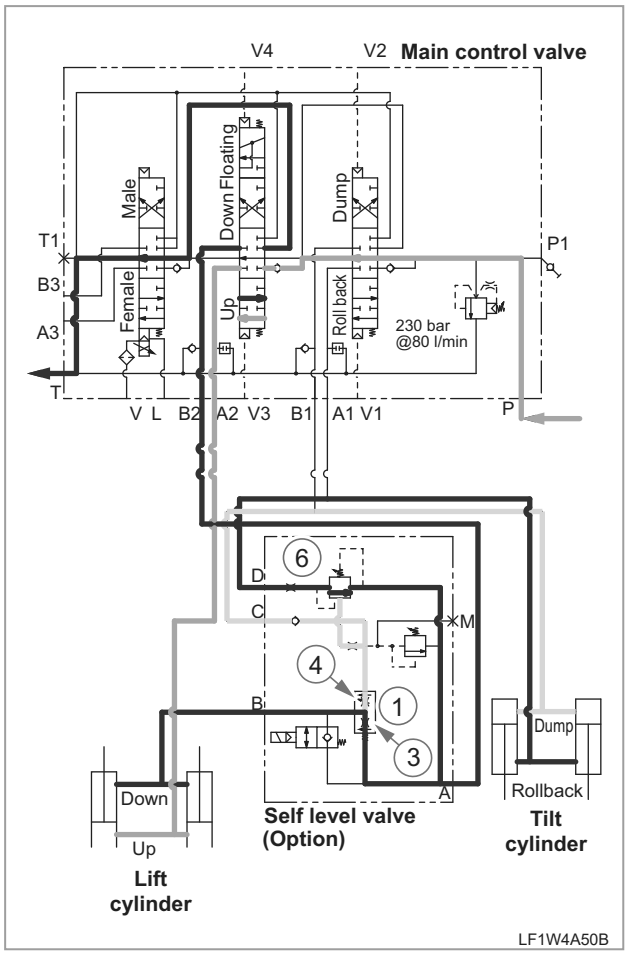

LF1W4A34A

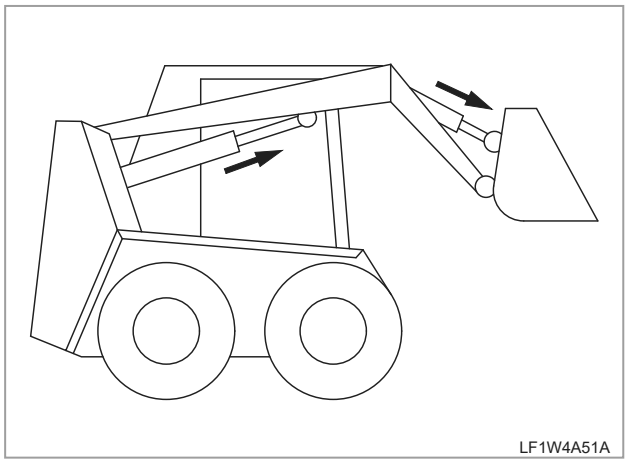
The oil strainer is a suction filter located on the inlet on the front bottom section of the oil tank. It filters the oil before it is delivered to the main pump and high-flow pump.

SPECIFICATIONS

ITEM	SPECIFICATION
Number of folds	57
Effective filtering dimension	0.157 m^2

SELF LEVELING





To activate this function, press the self-leveling switch first.

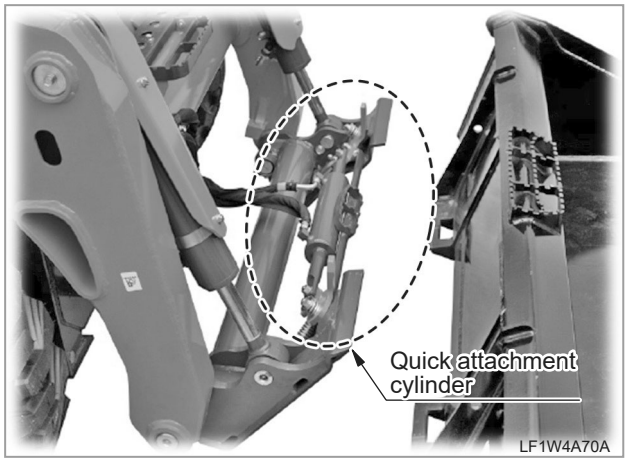
When the boom spool is pulled, the hydraulic oil from the control valve is led into the head port of the lift cylinder.

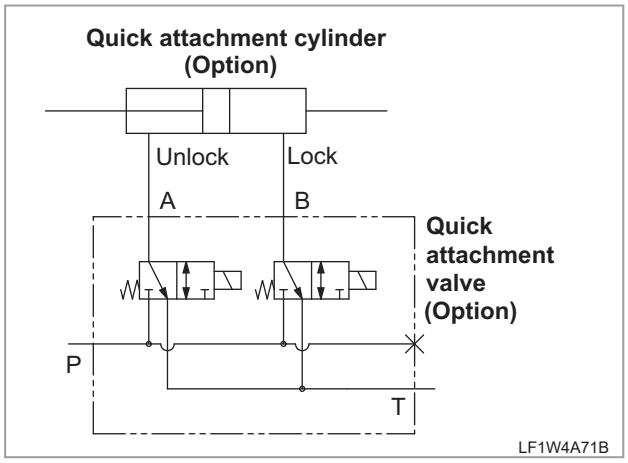
As the lift cylinder expands, the oil from the rod port flows directly to port B of the self-leveling valve. The oil entering port B passes through the fixing orifice (3) and adjusting orifice (4) in the flow divider spool (1).

The split ratio of the hydraulic oil is determined by the setting of the adjusting orifice (4). The remaining oil is returned to the tank after it is returned to the control valve through the fixing orifice (3) and out port A. The oil passing through the adjusting orifice (4) flows to out port C, and then it is led to the head port of the tilt cylinder in a T form in order to extend the tilt cylinder.

The resistance from the tilt cylinder operation builds enough pressure to open the cylinder lock valve (6) of the self-leveling valve. When the tilt cylinder is extended, the oil from the rod port of the tilt cylinder flows to port D and passes through the cylinder lock valve (6) that is open. Then, it is returned to the control valve through out port A before it is finally returned to the tank.

4.3.7 QUICK ATTACHMENT





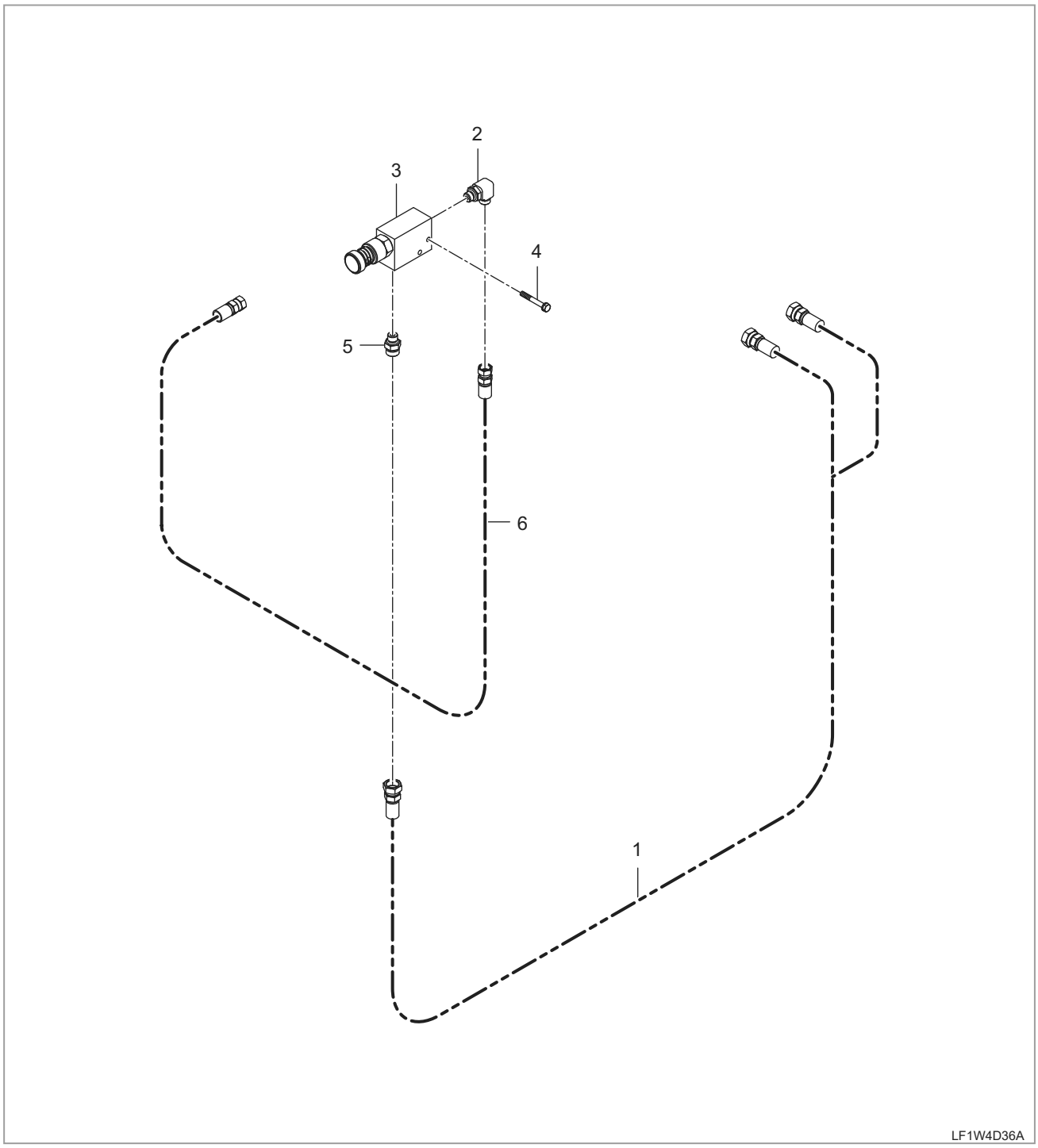
▶ QUICK ATTACHMENT FUNCTIONS

Previously, in order to mount the bucket on the skid loader, the attachment lever had to be locked manually. As a result, there was the inconvenience of having to leave the machine in order to mount the bucket. As shown in the figure above, the quick attach cylinder and valve enable the operator to mount the bucket with a single button without having to leave the machine itself.

6. TROUBLESHOOTING

SYMPTOM	CAUSES	REMEDY
The hydraulic oil pressure is weak. (The oil does not flow in the charge and main pumps.)	• Insufficient oil in the tank	• Check for leakage and add the oil to the tank.
	• Damaged coupling between the engine and pump	• Check for any damaged part and replace it as necessary. Check for proper alignment.
	• Malfunctioning main pump	• Check for any damaged part, and replace it as necessary.
	• Defective main pump shaft	• Check for any damaged part, and replace it as necessary.
	• Faulty spline coupling between front/rear pumps	• Check for any damaged part, and replace it as necessary.
The hydraulic oil pressure is weak. (The oil flows in the charge and main pumps.)	• Locked auxiliary valve spool	• Unlock it.
	• Disconnected or stuck component linkage	• Check and adjust or repair it.
	• Defective relief valve and repair impossible	• Check the pressure and repair as necessary.
The hydraulic operation is not smooth, but intermittent.	• Insufficient oil in the tank	• Check for leakage and add oil to the tank.
	• Worn or loose component linkage	• Check and adjust or replace any damaged part.
	• Air in the hydraulic system	• Check for oil leakage between the oil tank and pump. Operate the lift cylinder several times to bleed the system.
	• Rod check valve inoperable	• Check and replace any damaged part.
	• The control valve spool spring won't return	• Check and replace any damaged part.
The boom rises slowly.	• Insufficient oil in the tank	• Check for leakage and add the oil to the tank.
	• Defective component linkage	• Check and adjust it.
	• Locked auxiliary switch	• Unlock the auxiliary switch.
	• Exceeding rated capacity	• Reduce the load.
	• Excessively low engine RPM	• Check and readjust the engine RPM.
The boom rises slowly at the maximum RPM.	• Defective or incorrectly adjusted relief valve	• Check the pressure and adjust or repair it.
	• Leakage from the lift cylinder piston seal	• Check for leakage of the piston seal and repair it as necessary.
	• Internal leakage from the main pump	• Test and repair the main pump.
	• Internal leakage from the control valve	• Check and repair the control valve.
The boom and bucket cylinder cannot overcome the load.	• External oil leakage between the control valve and cylinder	• Check and repair it.
	• Incorrectly centered control valve spool	• Check if the control lever is stuck and repair it.
		• Check if the spring return device of the control valve spool is damaged.
	• Oil leakage from one or both lift cylinder piston seal(s)	• Check for leakage of the piston seal and repair it as necessary.
	• Internal leakage from the control valve	• Check and repair the control valve.
The hydraulic oil warning lamp is turned on. The hydraulic oil is overheated.	• Insufficient oil in the tank	• Check for leakage and add the oil.
	• Clogged or contaminated oil cooler or engine radiator	• Clean the oil cooler fins.
	• Locked auxiliary switch	• Unlock the auxiliary switch.
	• Excessively low engine RPM	• Check and readjust the engine RPM.
	• Engine cooling fan rotating in the opposite direction	• Check and reinstall the fan.
	• Defective or incorrectly adjusted relief valve	• Check and adjust the pressure.
	• Defective temperature sensor switch	• Replace
	• Faulty hydraulic oil	• Replace

7.10 LF1-G226002 DRAIN VAVLE GROUP

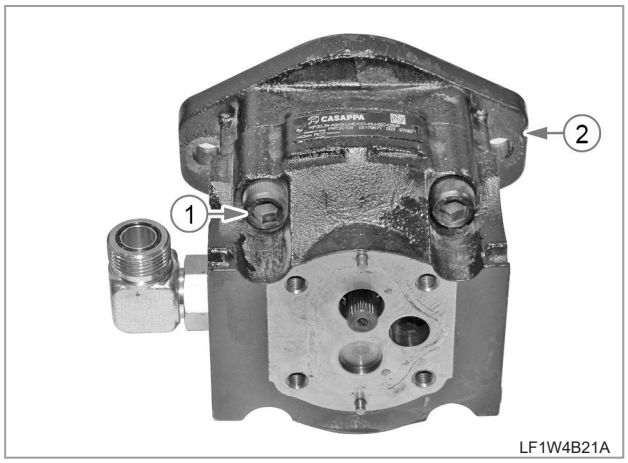


COMPONENTS

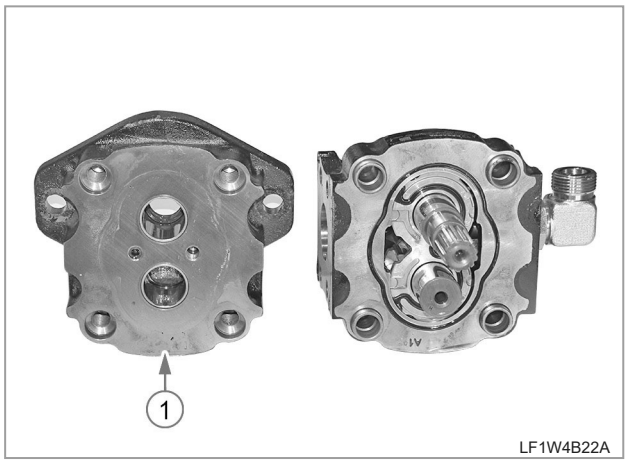
(1) Hose, HYD -DV A
(2) Elbow
(3) Valve, Drain
(4) Bolt
(5) Connector
(6) Hose, HYD -DV B

▶ MAIN PUMP DISASSEMBLY


LF1W4B20A

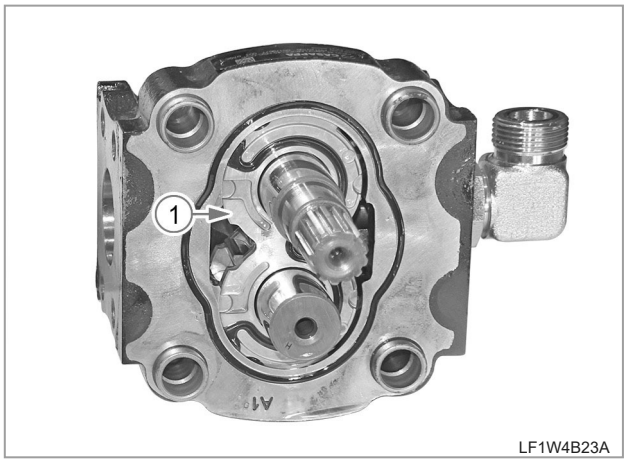


LF1W4B21A

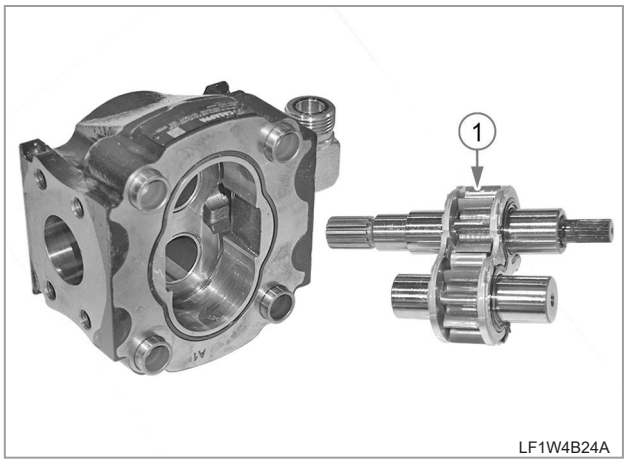


LF1W4B22A

1. Unscrew the hex wrench bolts (1)(4EA) and then remove the front cover (2).

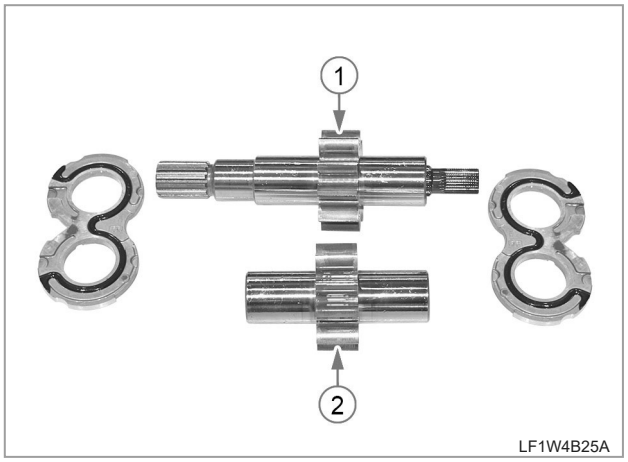


LF1W4B23A



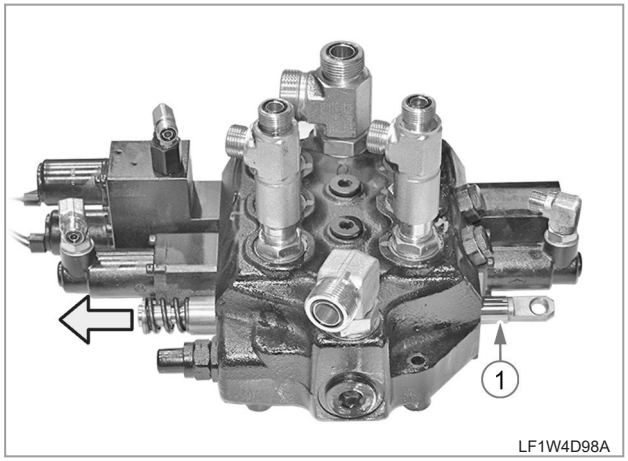
LF1W4B24A

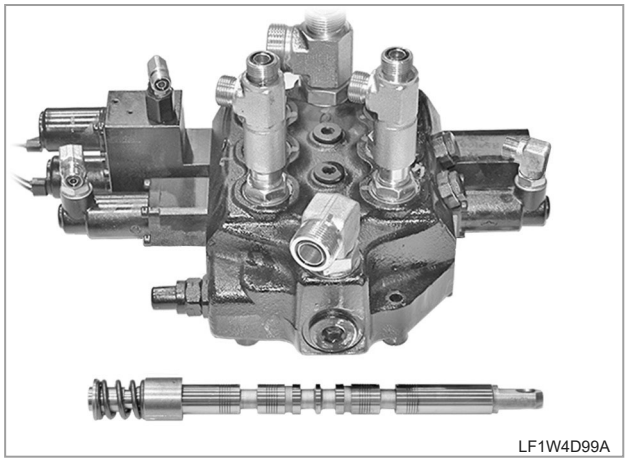
2. Remove the thrust plate assembly (1) from the main pump body.



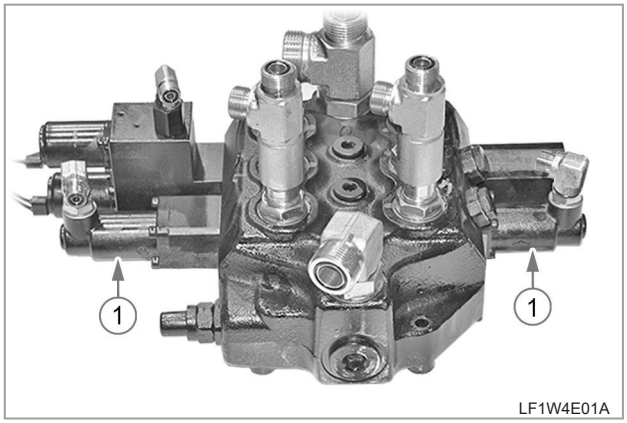
LF1W4B25A

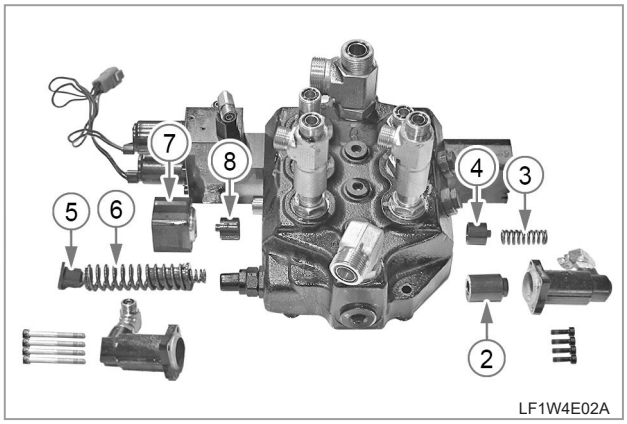
3. Remove the drive gear (2) and driven gear (3) from the thrust plate.

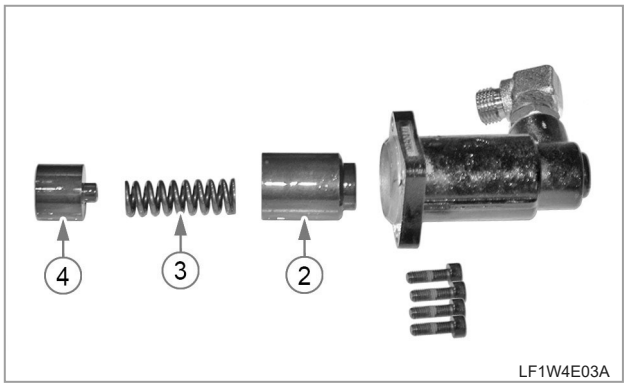


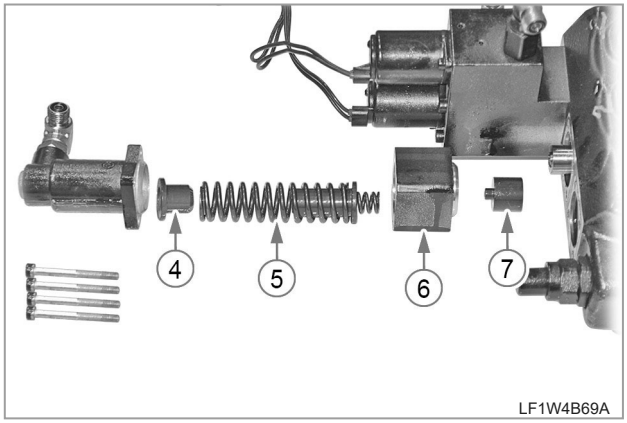


2. Pull out the bucket spools (1).





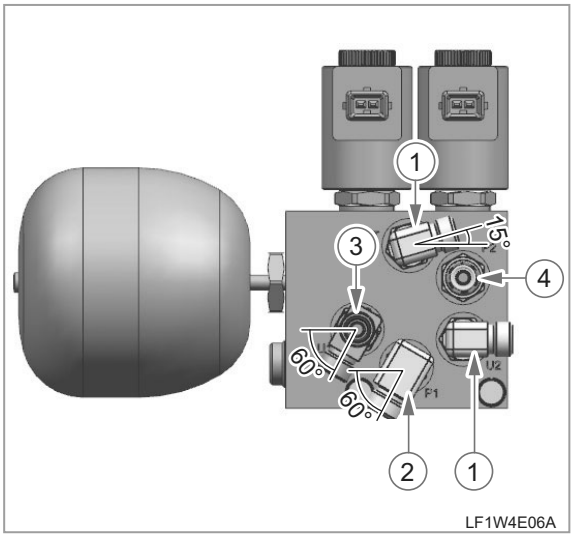




3. After removing the boom spool covers (1), remove the components (2, 3, & 4) from the left side as well as the components (5, 6, 7, & 8) from the right side.

REMARKS

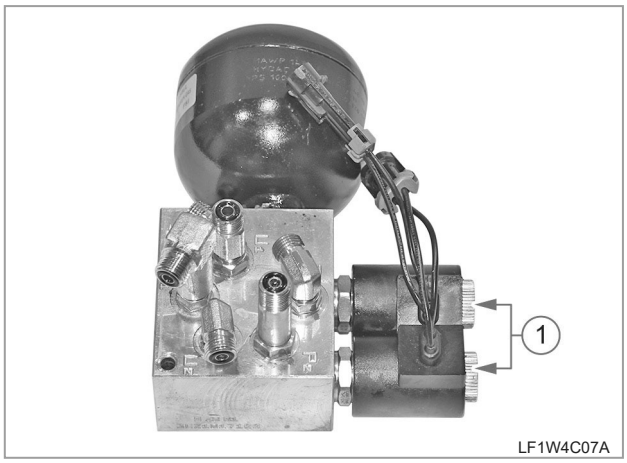
ELBOE ASSEMBLY

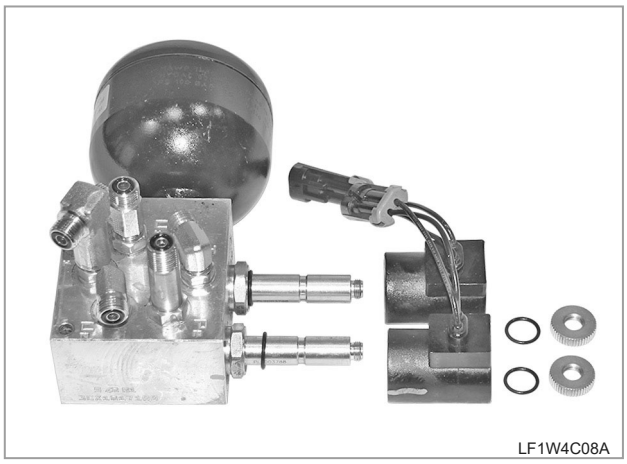


- **When installing the elbow, install it according to the direction and specified torque**

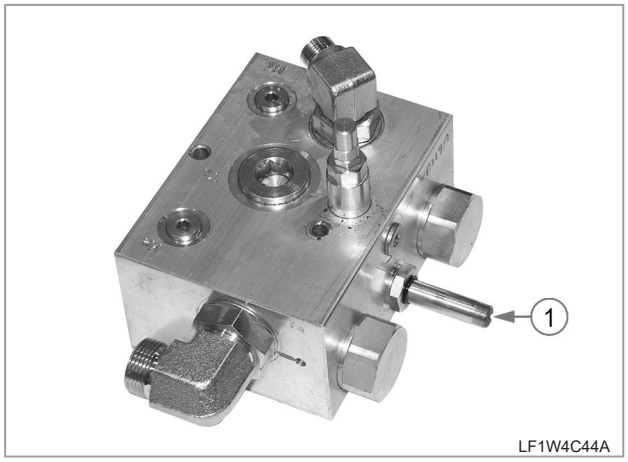
  ①, ②, ③, ④ :
  Mounting section (7/16-20 UNF)
  tightening torque .....2.0 ~ 2.2 kgf.m
  Hose section (9/16-18 UNF)
  tightening torque .....2.5 ~ 3.0 kgf.m

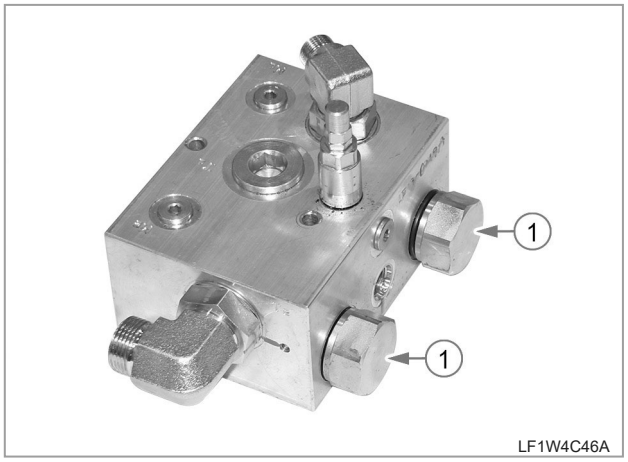
DISASSEMBLY

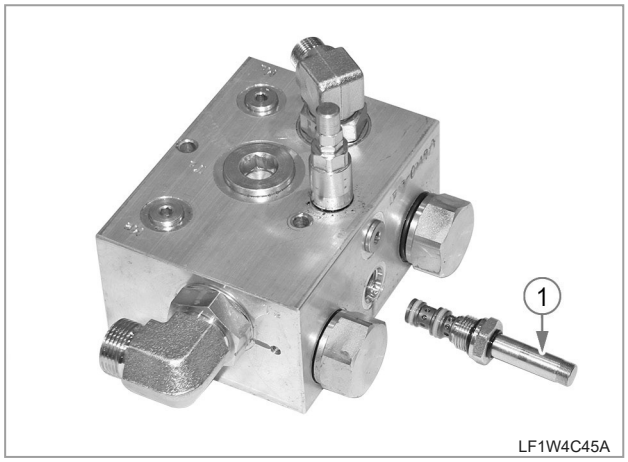


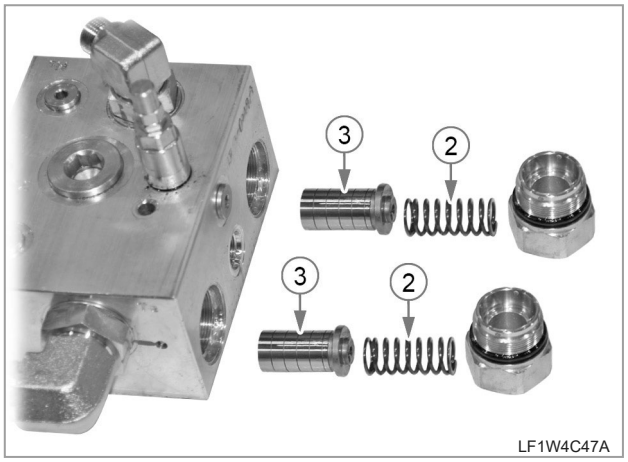


1. Remove the solenoid magnets (1) from the pilot lock valve body.









2. Remove the solenoid valve (1).

3. Unscrew the plugs (1) and remove the springs (2) and spools (3).

8.14 RETURN FILTER REPLACEMENT

LF1W4C79A

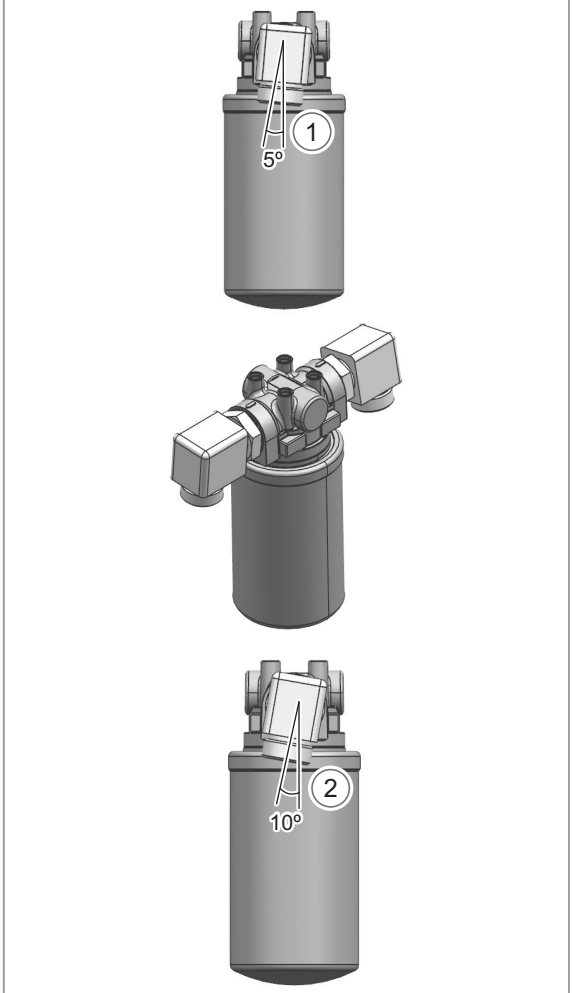
LF1W4C80A

LF1W4C81A

1. With a filter wrench completely engaged with the filter, turn the wrench counterclockwise to remove the return filter (1). After inspection, replace it with a new one as necessary.

REMARKS

ASSEMBLY ANGLE AND TIGHTENING TORQUE WHEN INSTALLING THE ELBOW



LF1W4E11A

- ①, ② **Elbow Mounting section (PF1) : 18.5 ~ 19.5 kgf.m**
- **Hydraulic hose tightening (1·5/16-12 UN) : 18.5 ~ 19.5 kgf.m**

HS120V

ELECTRIC SYSTEM

CHAPTER 5

ELECTRIC SYSTEM

TABLE OF CONTENTS

4. ELECTRIC COMPONENTS

4.1 ENGINE ROOM

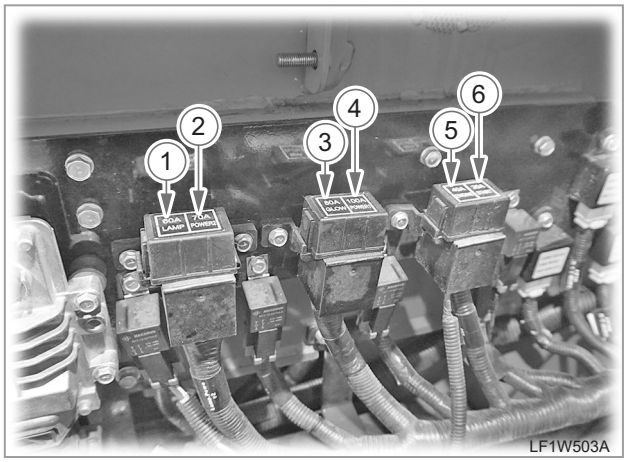
4.1.1 BATTERY

Open the rear cover, the battery is installed on the right hand side. A lead-acid battery is used, which is rechargeable by supplying electricity from outside.

- Capacity : 12V 110Ah

4.1.2 FUSE BOX

SLOW-BLOW FUSE

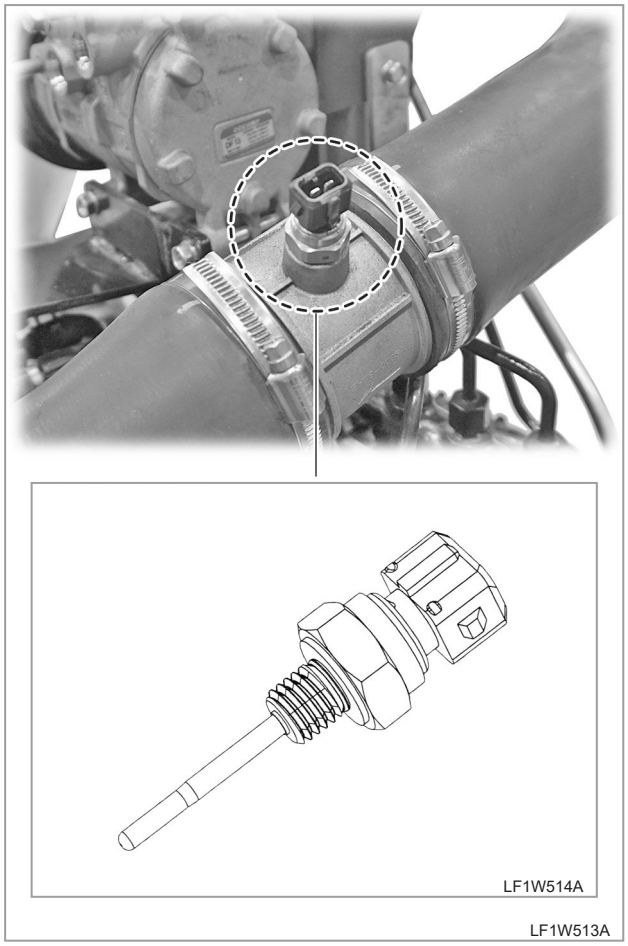


(1) Lamp power fuse (60A)
(2) Power 2 fuse (70A)
(3) Preheat power fuse (80A)
(4) Power 1 fuse (100A)
(5) Engine power fuse (40A)
(6) Ignition power fuse (30A)

Six slow-blow fuses are installed on the frame in the left side of the engine compartment and they are connected to the main wiring. If any electric system does not operate while the battery operates properly, the slow-blow fuse should be checked. If the replaced fuse is blown again, there is a short circuit between the direct B line (power from the battery) and the chassis.

FUSE	COMPONENT TO DIAGNOSE
Lamp	RCV (LH), Horn relay, Flasher unit, Room lamp, Power relay 2
Power 2	Power relay 4, Power socket, 14-pin
Preheat	Power relay 1, Glow plug
Power 1	Alternator, Ignition switch, A/C, Cabin, Fuel heater
Engine	ECU relay, ECU
Ignition	Starter relay

INTAKE AIR TEMPERATURE SENSOR (T1)



The intake air temperature sensor is installed on the intake hose which is connected the turbo charger.

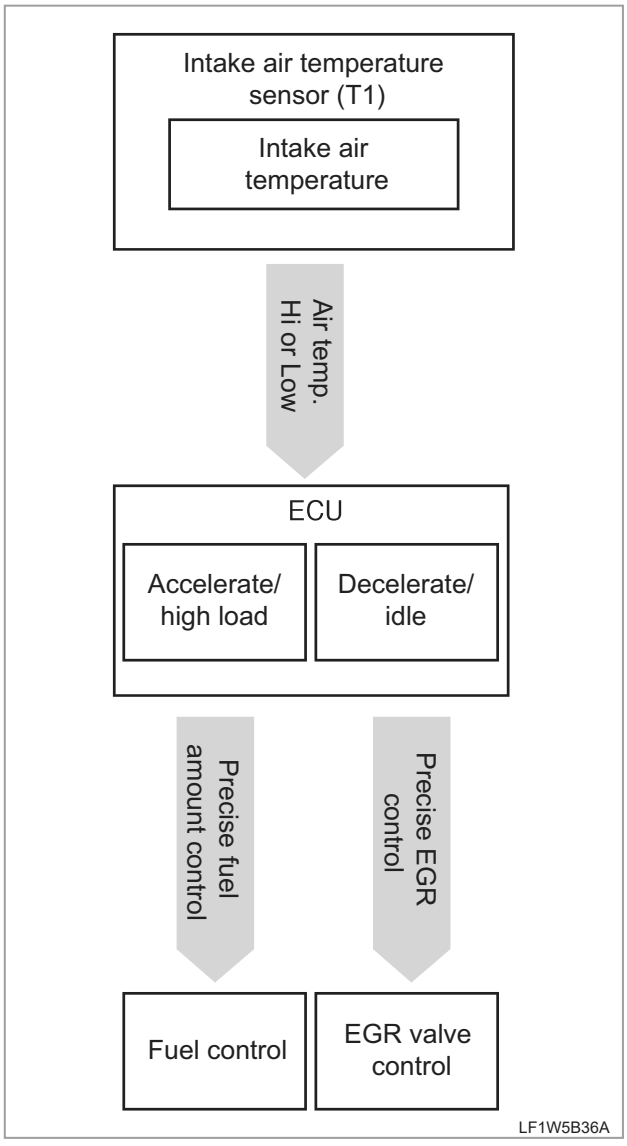
It measures the amount and temperature of the intake air and sends these information to the ECU which then uses these information to set the injection amount and timing. The intake air amount information is also used as a primary condition for the EGR control.

- It measures the amount and temperature of the air drawn into the engine.
- Its measurement is used as an important information to determine the fuel injection amount for theoretical air-fuel ratio control.
- Its measurement is also used as a feedback signal for EGR valve control.
- Intake air temperature - output as digital/analogue
- Temperature detection range of the element : -40°C ~ 250°C

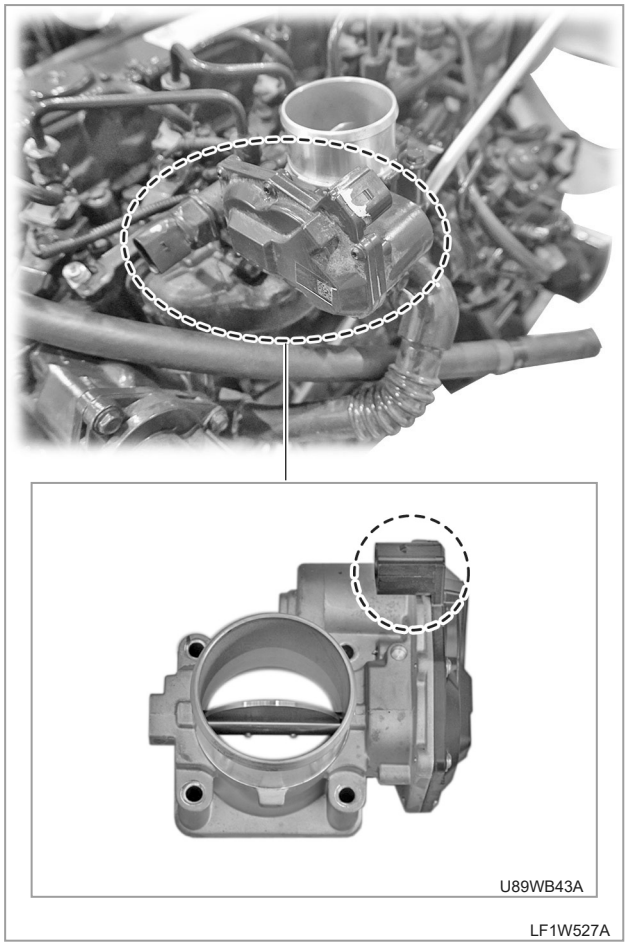
▶ RESISTANCE BY TEMPERATURE

Temp [°C]	R min [kΩ]	R cent [kΩ]	R max [kΩ]
-40	192.11	204.12	216.68
0	26.500	27.598	28.716
25	9.7000	10.000	10.300
85	1.3810	1.4510	1.5240
100	0.9165	0.9672	1.0200
150	0.2741	0.2927	0.3123
200	0.1022	0.1102	0.1187
250	0.0451	0.0490	0.0532

▶ INPUT/OUTPUT DIAGRAM



AIR CONTROL VALVE SENSOR

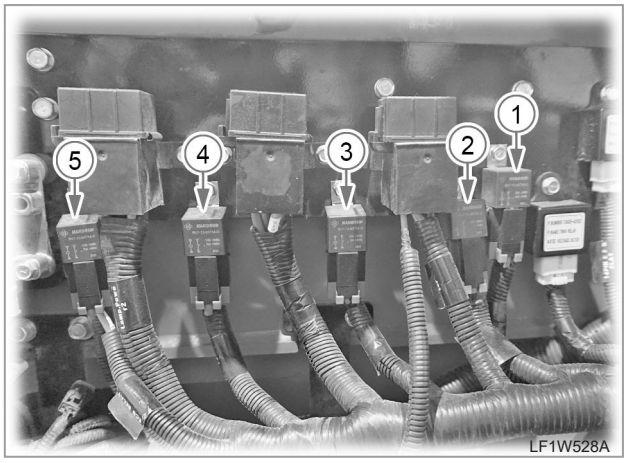


The air control valve sensor is installed to the air control valve between the turbocharger intake hose and intake manifold flange.

The air control valve adjusts the amount of air entering the intake manifold. The operating angle of the blade at its inlet is changed according to the depressed amount of the accelerator pedal to control the intake air amount into the engine.

Therefore, this sensor detects the opening angle of the blade and sends this information to the ECU which then adjust the fuel injection amount accordingly.

RELAY (70A)

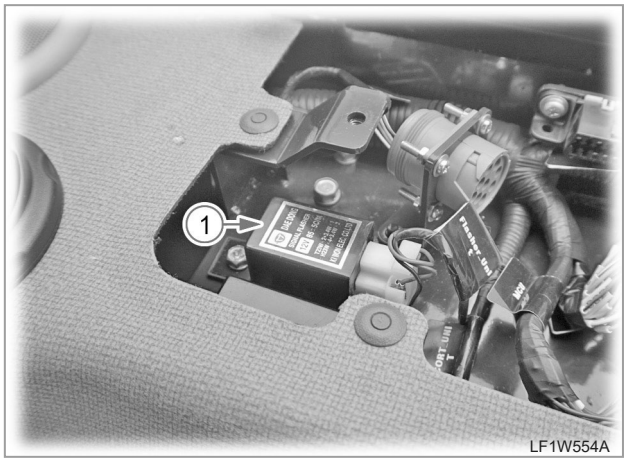


(1) Power relay 5
(2) Power relay 1
(3) Power relay 2
(4) Power relay 4
(5) Power relay 3

Relays (70A) are installed side by side on the panel at the left side of the engine compartment and supply power to individual elements.

Power relay 1	Glow plug
Power relay 2	Reverse buzzer, Air suspension seat, Beacon lamp
Power relay 3	Wiper motor
Power relay 4	14-pin, Power socket, Motor fan
Power relay 5	Air conditioner

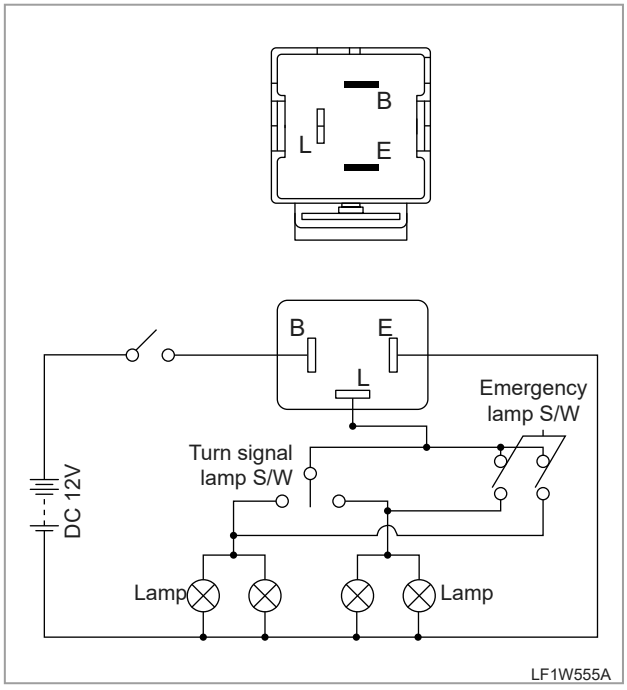
4.2.3 FLASHER



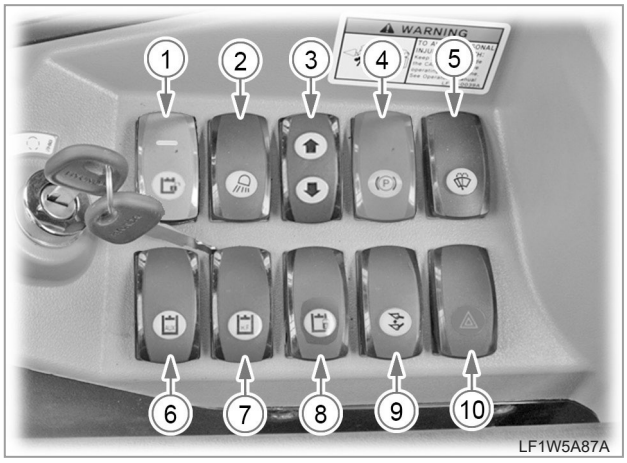
The flasher unit (1) is installed under the top cover behind the driver's seat; this flickers the lamps when the hazard warning flasher switch or turn signal lamp switch is operated.

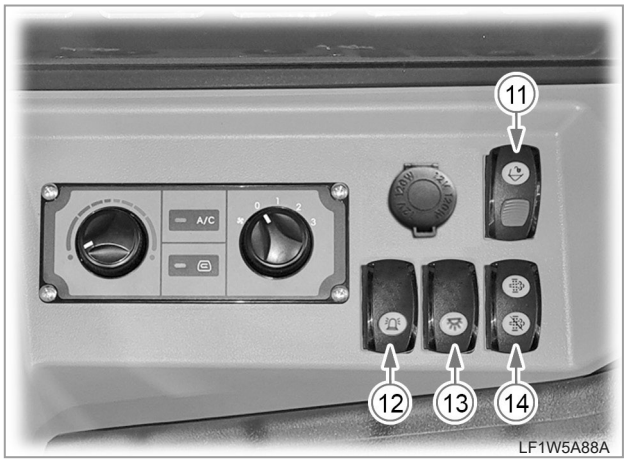
As the flasher unit is directly connected to the battery, it can operate without the key in the ignition switch. It is designed to flash the lamp faster to inform a driver if a bulb of any turn signal lamp is blown.

CONNECTOR & CIRCUIT



4.2.4 SWITCH PANEL





No	Switch	Function
1	Reset (Green)	Driving system release
2	Main light	Front, Rear work lamp ON, OFF
3	Turn signal lamp	Turn signal lamp operation
4	Parking (Red)	Parking brake emgagement
5	Wiper/Washer	Wiper, washerr operation
6	AUX	External implement flow rate / power supply
7	High flow (Option)	Supplying additional flow to equipment when needed
8	Hydraulic lock	Blocking operating hydraulic line
9	Self leveling (Option)	Maintaining balance when lifting or lowering the bucket
10	Hazard lamp	Emergency lamp operation
11	Quick attachment	Loader removal, installation
12	Beacon lamp	Beacon lamp operation
13	Room lamp	Room lamp ON, OFF
14	DPF regeneration	DPF regeneration and stop

▶ STRUCTURE

Main menu	Sub menu	Description
Diagnosis function	Machine condition	Displaying coolant temperature, hour meter, RPM, etc.
	Machine information	Displaying instrument panel & MCU version, model name, etc.
	Current fault	Displaying current fault status list of the engine and machine
Maintenance function	Engine start inhibition setting	Engine start inhibition setting, password change or password display
	Consumables management	Changing oil/filters replacement intervals and checking elapsed time
	A/S contact	Displaying and changing A/S telephone number
	Administrator menu	Displaying fault history and mode change
Configuration	Brightness settings	Brightness manual/automatic (day, night) settings
	Time settings	Current time settings
	Unit settings	Temperature (°F/°C)
	Language settings	Korean, English
	Camera settings	Reverse gear-linked function ON/OFF

※Press the menu button to activate the sub-menu.

LF1O4C7U

5. Press the Enter button (↵) to select the "Machine fault".

LF1O4C8U

6. Check the DTC code and press the Enter button (↵).

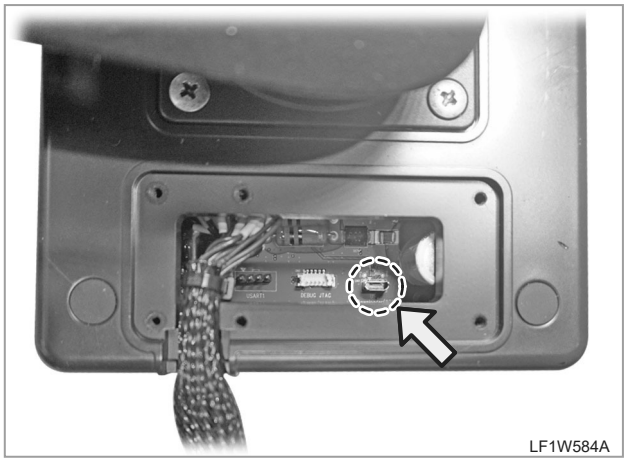
LF1O4C9U

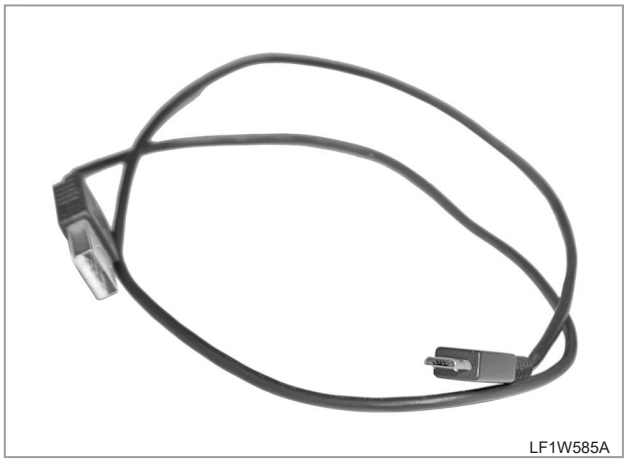
7. Verify and check the diagnosis details.

UPDATE

LF1W583A

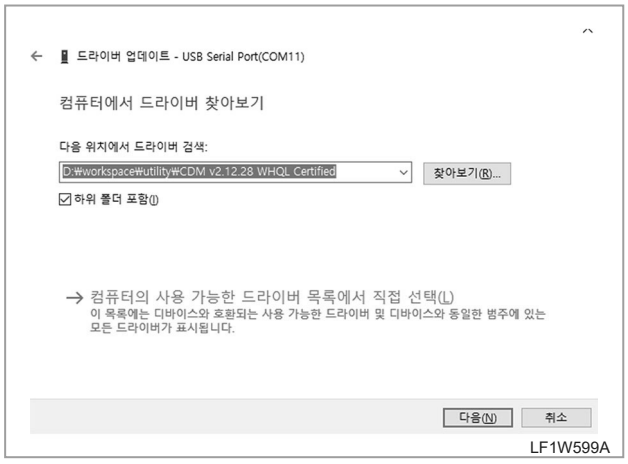
1. Unscrew the cover mounting screws (1) at the lower back of the dashboard to remove the cover (2).


LF1W584A


LF1W585A

2. Insert a micro 5-pin USB cable to the USB port at the lower back of the dashboard, and then connect the cable to the PC.

1-2) INSTALLING RS232 TO USB DRIVER (DRIVER UPDATE)



LF1W599A

If a COM port is recognized, this step can be omitted.

1-3) CONFIRMING INSTALLATION OF RS232 TO USB DRIVER (DEVICE MANAGER)

The USB serial port should be displayed under the port (COM & LPT) in the Device Manager of the Windows system. Otherwise, firmware update cannot proceed.

If this doesn't appear on the Device Manager, re-install the USB driver.

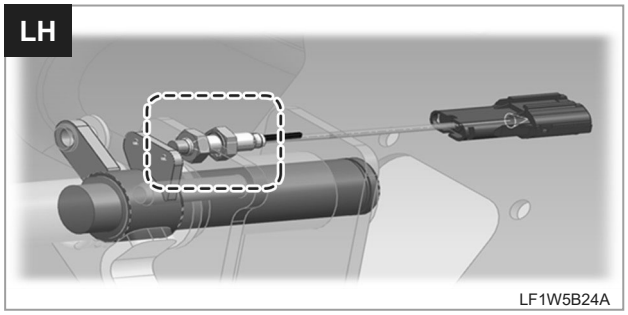
LF1W5A02A

※Here, the COM Port is port no.11 on the Device Manager.

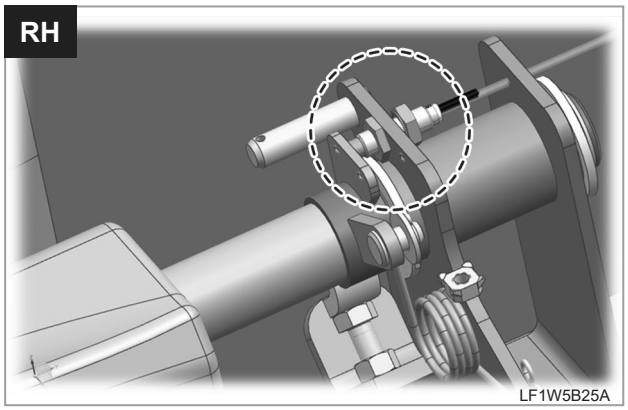
4.2.12 SAFETY SENSOR (SAFETY BAR)


LF1W5B23A

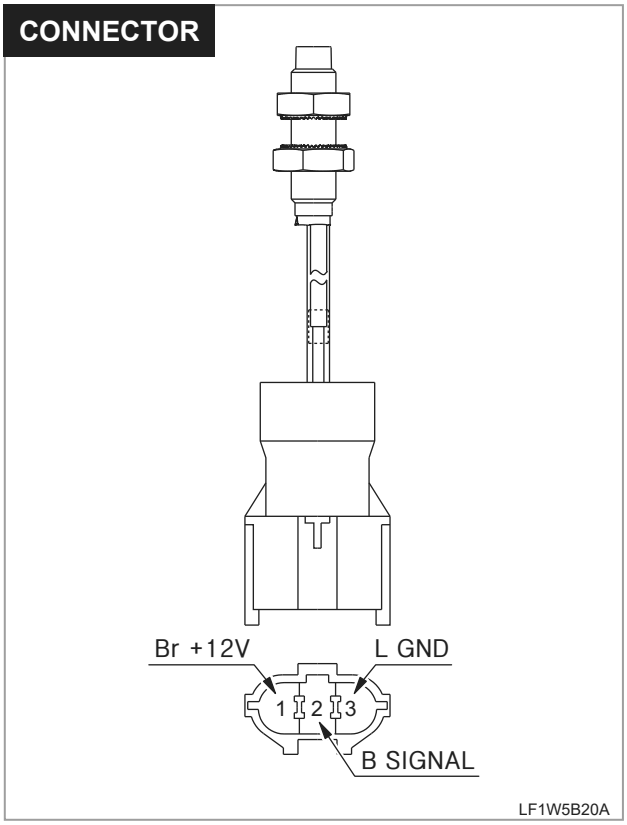
LH


LF1W5B24A

RH


LF1W5B25A

CONNECTOR



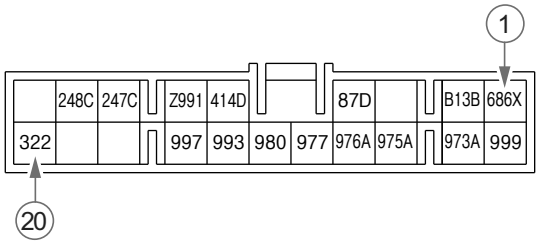
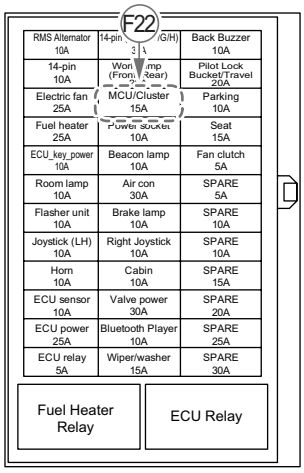
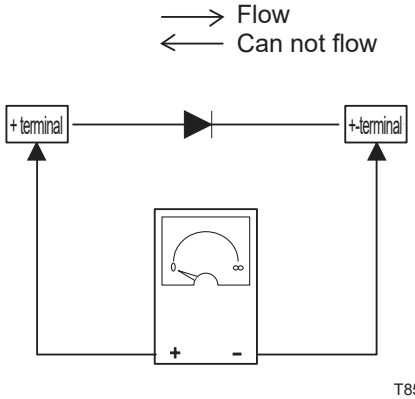
LF1W5B20A

The safety sensors are mounted on both ends of the safety bar of the driver's seat. The output of the parking valve and hydraulic lock valve is turned ON or OFF according to the raising or lowering state of the safety bar.

When the safety bar is raised, the parking brake is applied and the hydraulic line is locked to prevent unexpected accidents from operation of the machine.

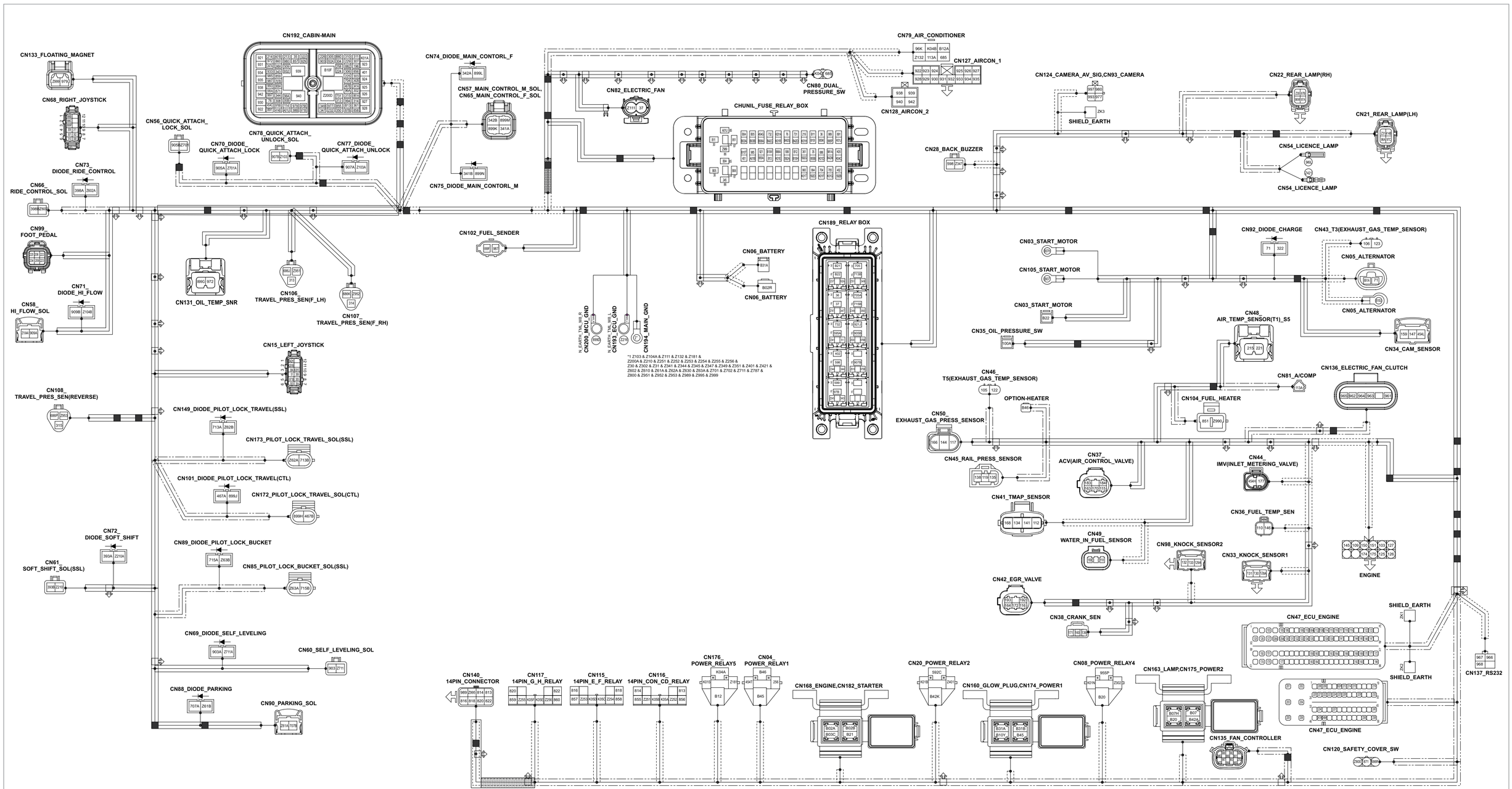
NORMAL OPERATING CONDITION

- Before starting the engine (ignition switch in "ON" position): Charge warning lamp ON
- After starting the engine: Charge warning lamp OFF

Check point	Check method	Remarks
1. Charge warning lamp .(on cluster)	1. Check the voltage. - Voltage between the terminal No. 1 of the A connector (cluster) and terminal 20 of the A connector with the key "ON" Voltage: It should be 12 V.	 LF1W5A54A
2. Charge warning lamp	1. Visual check	 LF1W5A55A
3. Check the fuse.	1. Check the F22 fuse : 15 A for MCU/Cluster	 LF1W5B29A
4. Diode	1. Check the diode. Check if current flows from the positive pole to the negative pole of the diode.	 T85WBF0A

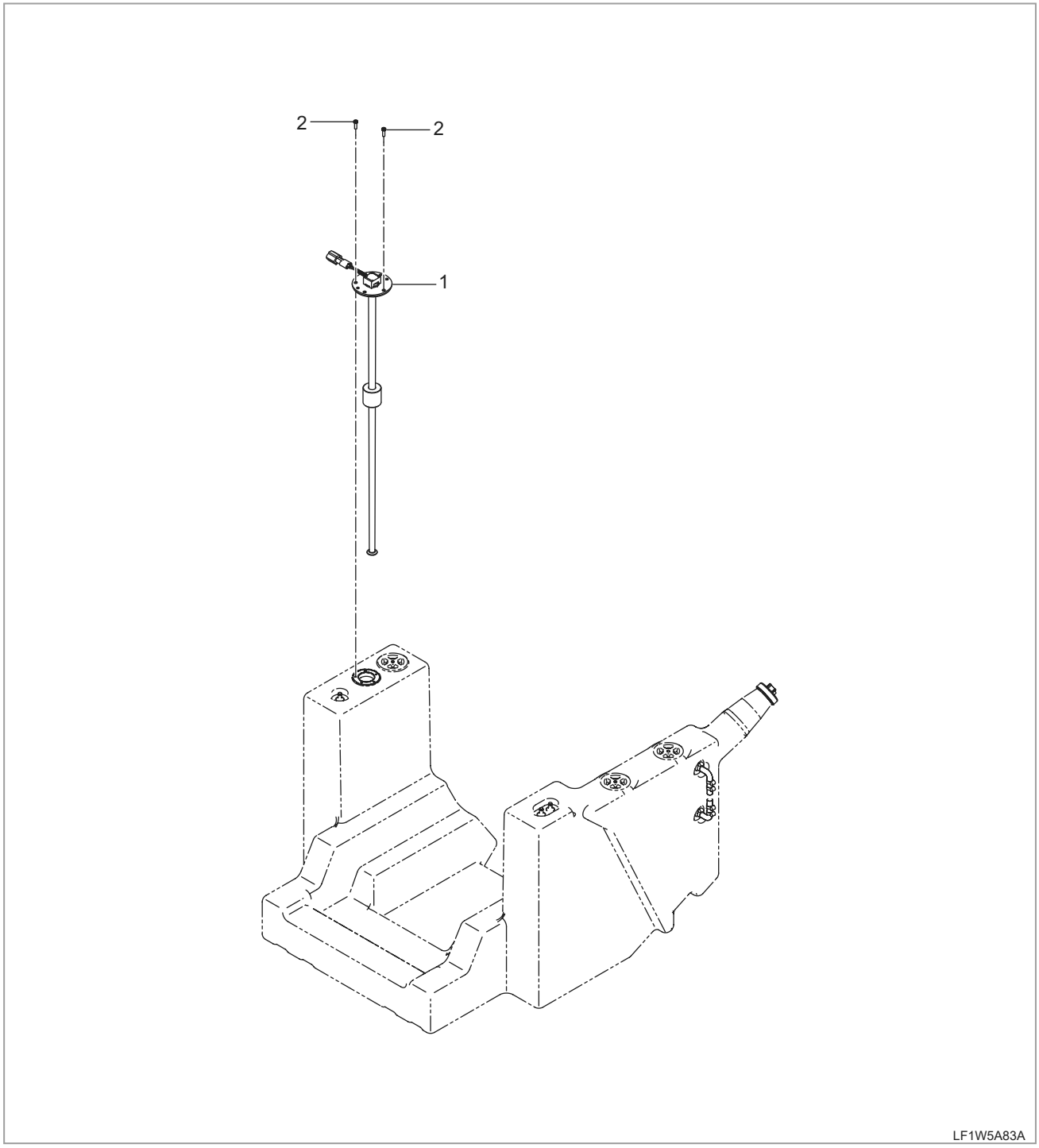
6. WIRING DIAGRAM

6.1 MAIN



LF1W5B32A

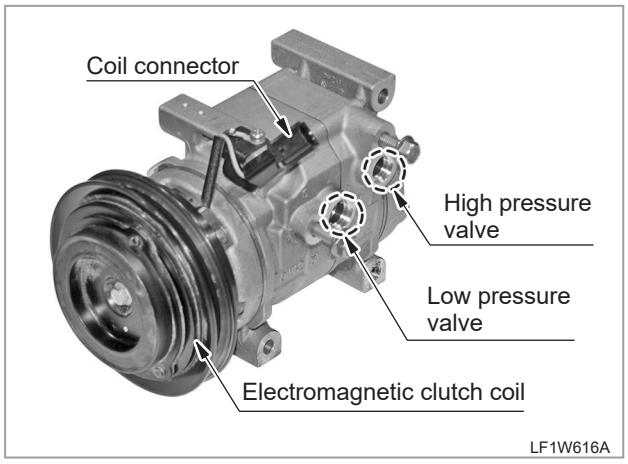
7.6 LF1-G332501 FUEL SENDER GROUP



COMPONENTS

(1) Sender, Fuel
(2) Screw with washer

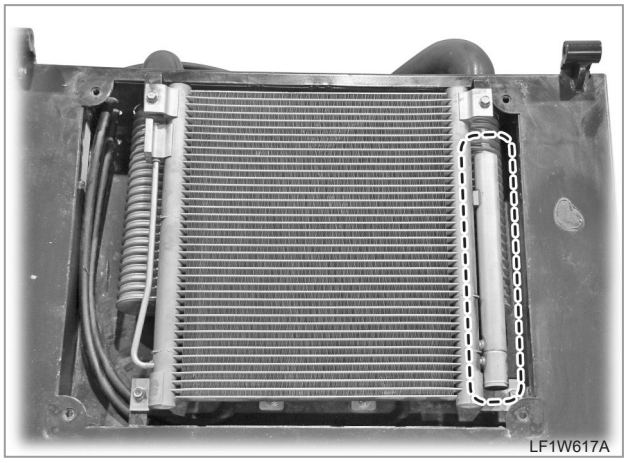
INSPECTION



It is possible to check if the amount of refrigerant is proper by comparing the temperature and the pressure. If the refrigerant loss is excessive, the oil level in the system should be checked.

1. The malfunction of the compressor can be divided into four categories; noise, seizure, leakage and poor compression. If irregular or vibrating noise is heard, apart from sympathetic sound, it could be because of excessive clearance due to a broken part or wear.
2. To check if the compressor is seized, cut off power supply to the clutch and check if the clutch driving plate rotates freely. If it does not rotate, it means that the compressor is seized.
3. Poor compression is due to the damaged seal in the compressor or clogged compressor. Also, its cause can be insufficient refrigerant or clogged circuit. Therefore, these should be checked before servicing the compressor.
4. If the compressor itself operates correctly and is not seized, check if the current going to the electronic clutch coil meets the specified value.
5. When checking oil level of the compressor, remove the check plug first.
6. If the oil is too dirty, change it with new oil.
7. To check the amount of oil for each part, turn on the air conditioner and set the fan speed to the maximum level. Run the engine at 1,000 rpm for over 20 minutes to set the system in normal operating condition. In this condition, the amount of oil for each component is as follows: (Compressor: approx. 60 cc, evaporator: 40 cc, condenser: approx. 20 cc, receiver-drier: approx. 20 cc)

2.3.2 RECEIVER-DRIER



STORING FUNCTION

It stores the liquid refrigerant which is sent to the evaporator depending on heat load.

BUBBLE SEPARATION FUNCTION

As there are some bubbles in the liquid refrigerant coming from the condenser, the bubbles keep gas refrigerant in.

The bubbles are separated from the liquid refrigerant and only the liquid refrigerant is sent to the expansion valve.

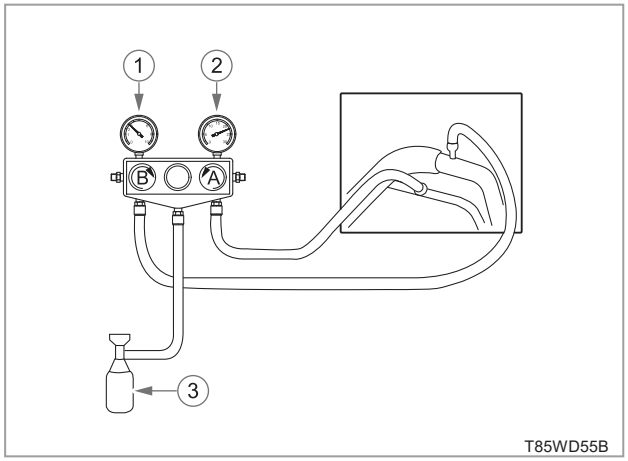
WATER SEPARATION FUNCTION

It removes moisture and foreign material from the refrigerant.

▶ SPECIFICATIONS

ITEM		UNIT	PERFORMANCE SPECIFICATION (12V)
Fan type		-	PULLER
Fan speed control method		-	ON - OFF
Fan & Motor only	Wind volume	CMH	3,400 -8% MIN
	Number of rotations	RPM	2,120 ±8%
	Consumption current	A	14.5 +10% MAX

CHARGING



(1) Low pressure gauge (A) High pressure (open)
(2) High pressure gauge (B) Low pressure (close)
(3) Refrigerant

IMPOARTANT

- **Refill the gas after gas has been released and vacuuming has been performed.**
- **When refilling gas, do not start the engine and perform from the high pressure end first, and then start the engine and put in the prescribed amount.**

WARNING

- **When refilling gas on the high pressure end, do not start the engine. This could cause rupture from the back flow and as there are no refrigerants it could cause damage to the compressor.**

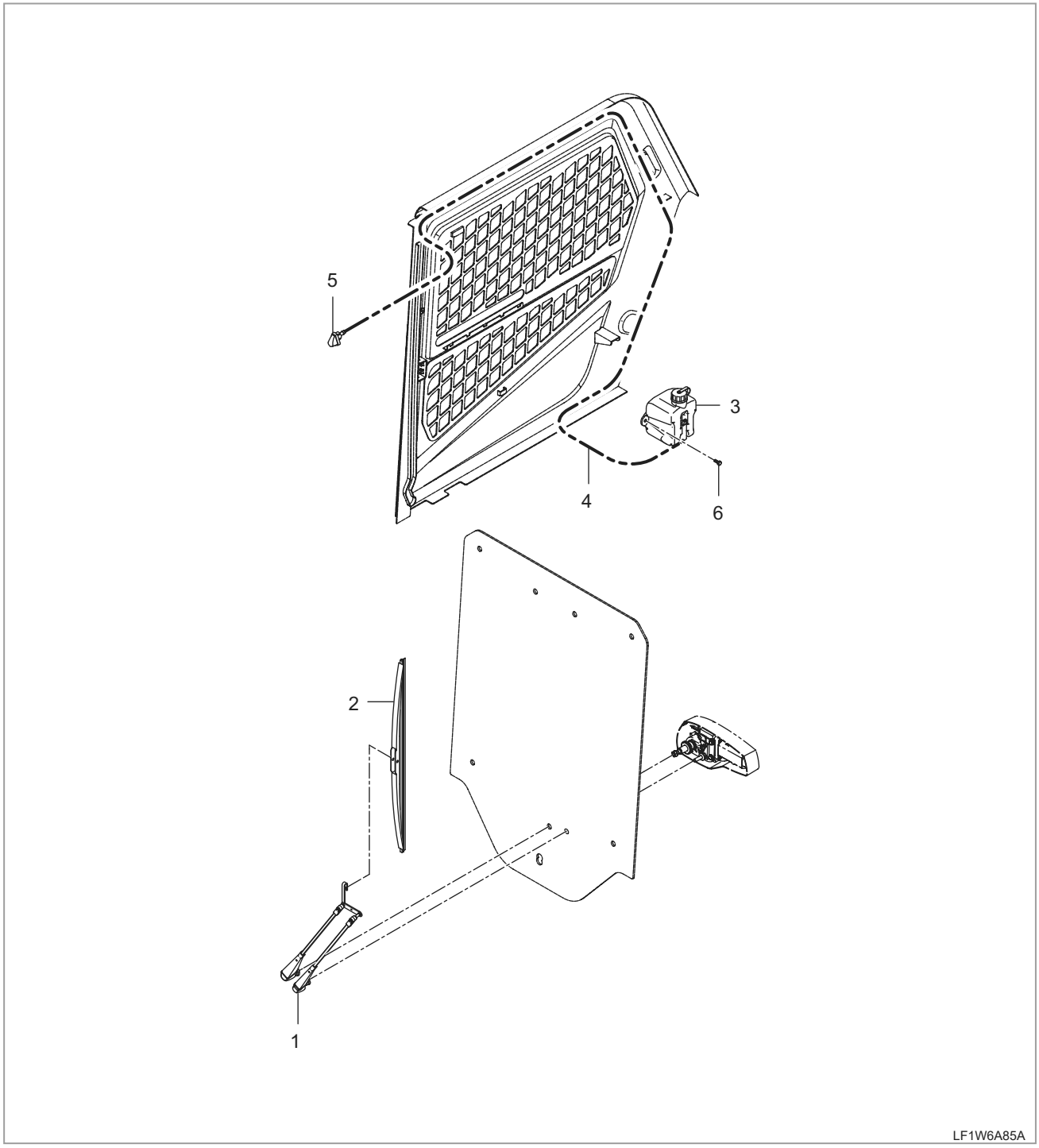
1. Open the high pressure valve and put in about 600g of refrigerant.
2. Close the high pressure valve and check for any gas leakages.

WARNING

When replacing the service can, release the air from the charging hose (green).

3. After checking that the high pressure valve is closed, start the engine and take it to about 2,000rpm.
4. Open the interior door and adjust the temperature control lever to cool, and the fan switch to high.
5. Open the low pressure valve and add refrigerant.
6. When the refrigerant has been filled, close the low pressure valve and stop the engine.
7. Perform refrigerant leakage tests.
   - Refrigerant replenishment quantity: 600 g (1.32 lbs)
   - Manifold gauge pressure {when the exterior temperature in 30 degrees (86°F)}
   - High pressure: 14.5 ~ 15 kgf/cm^2 (1.42 ~ 1.47 Mpa, 206.2 ~ 213.3 psi)
   - Low pressure: 1.5 ~ 2.0 kgf/cm^2 (0.15 ~ 0.19 Mpa, 21.3 ~ 28.4 psi)

6.4 LF1-G4E1001 WIPER GROUP



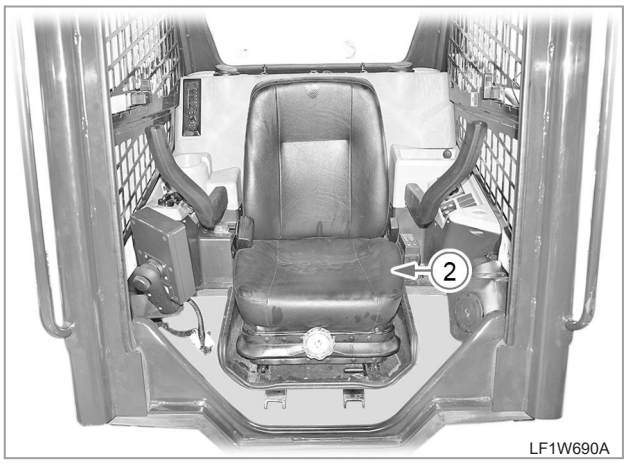
COMPONENTS

(1) Wiper,Arm
(2) Blade, Wiperfront 16 In Dk55/45s
(3) Tank, Washer
(4) Hose, Wiper
(5) Nozzle, Wiper-Mist
(6) With Washer Bolt

7.3 CABIN COMPONENTS DISASSEMBLY & ASSEMBLY


LF1W689A

1. Remove the cabin assembly.



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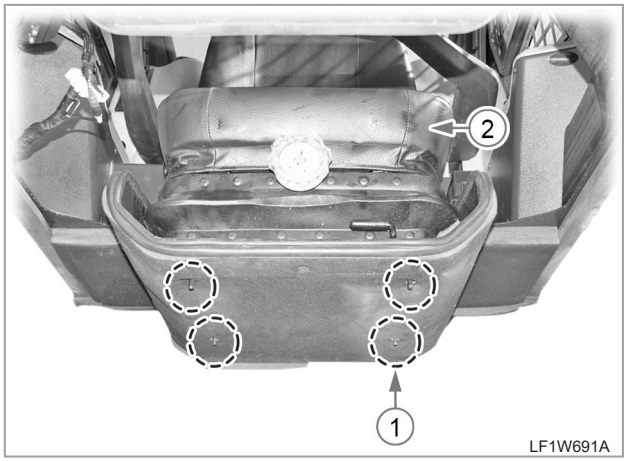
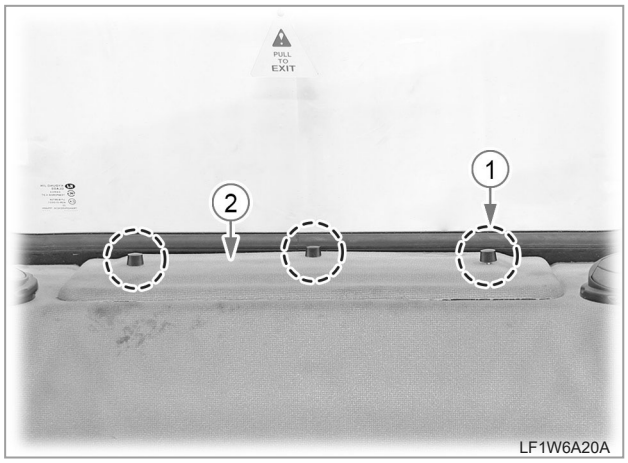


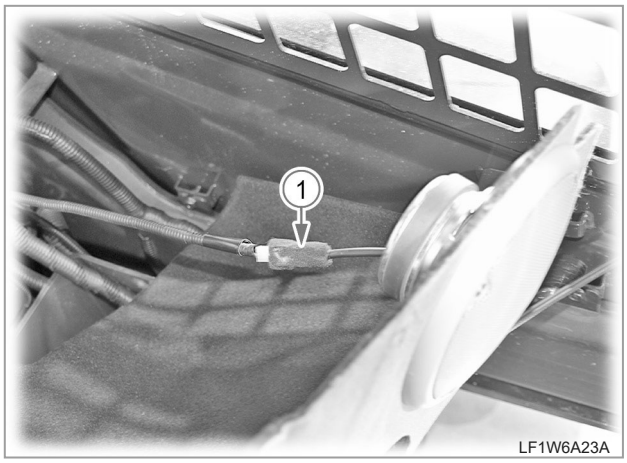
LF1W691A

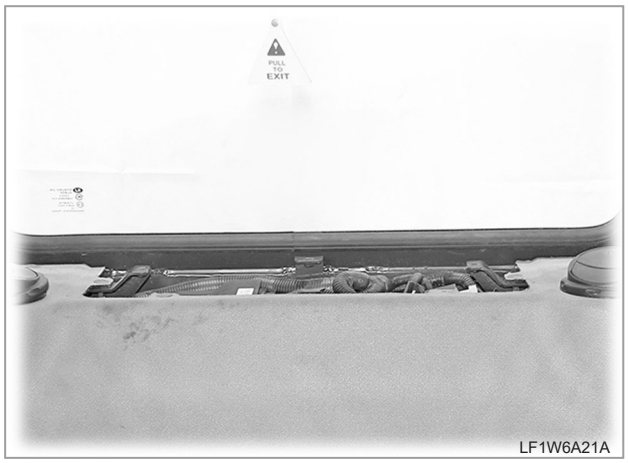

LF1W692A

2. After opening the door, unscrew seat mounting nuts (1)(4EA) at the bottom of the cabin to remove the seat assembly (2).

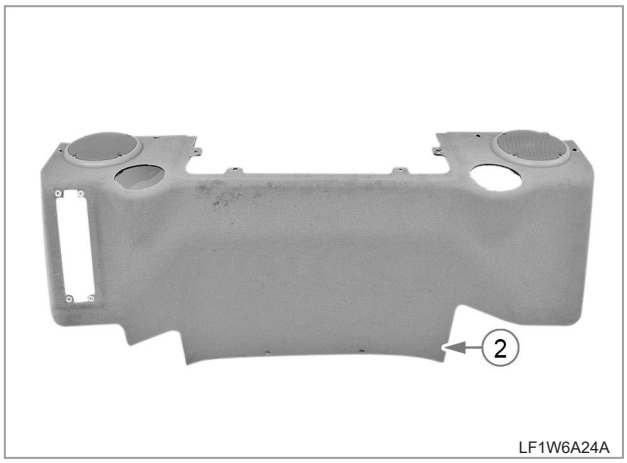
▶ SEAT REAR COVER REMOVAL



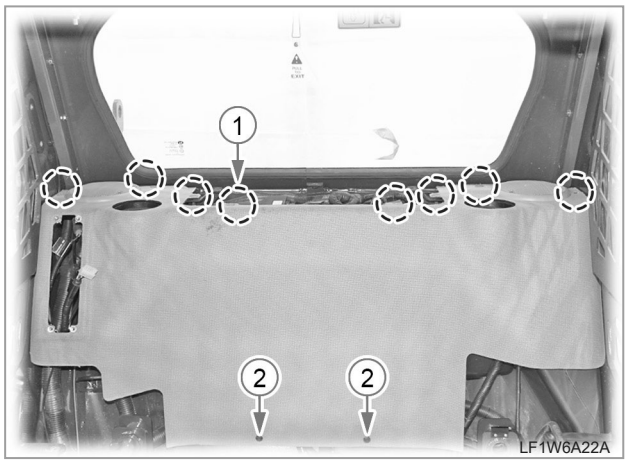




33. Unscrew knob bolts (1)(3EA) on the cover at the back of the seat to remove the upper cover (2).

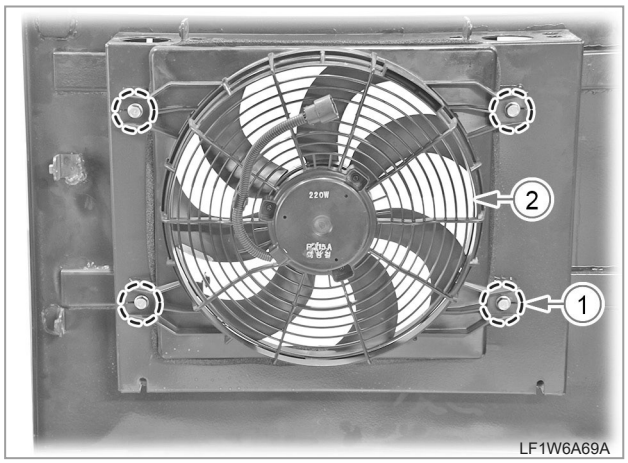


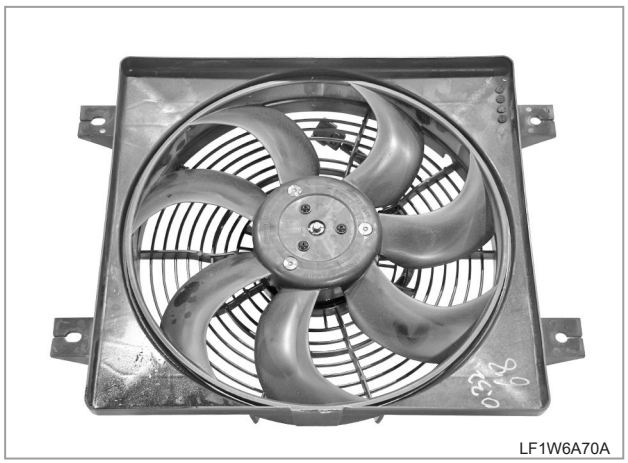
35. Disconnect connectors (1) from the left-hand and right-hand speakers and remove the cover (2) at the back of the seat.

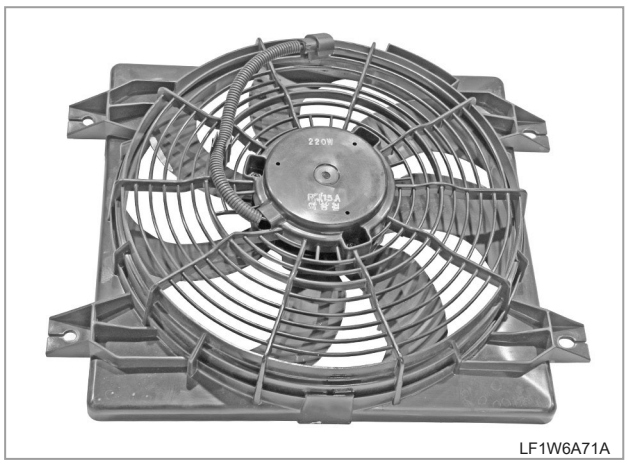


34. Unscrew mounting rivets (1)(8EA) and bolts (2)(2EA) on the cover at the back of the seat.

7.6 FAN MOTOR DISASSEMBLY



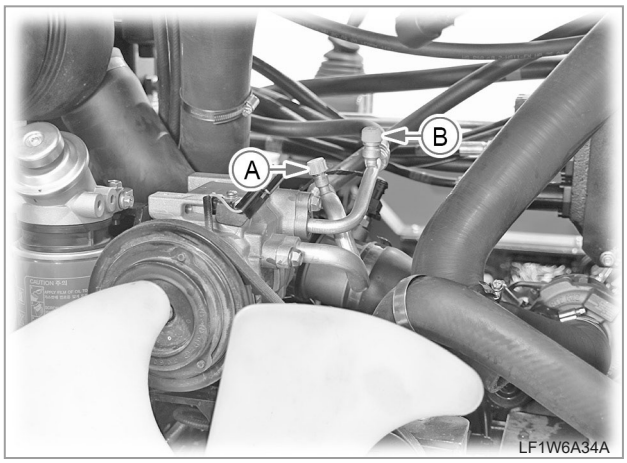




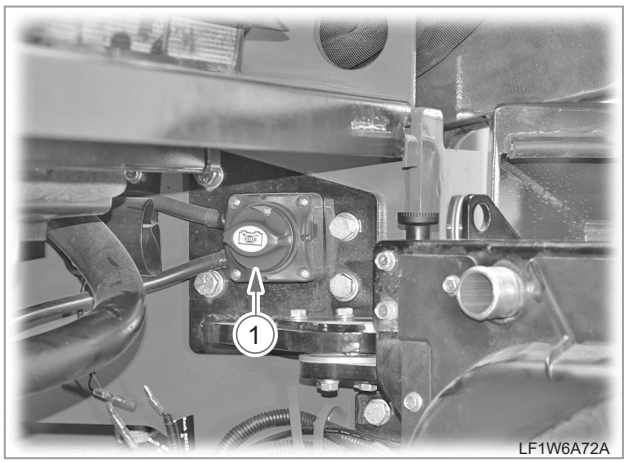
1. Unscrew fan motor mounting bolts (1)(4EA) to remove the fan motor (2).

7.7 COMPRESSOR DISASSEMBLY

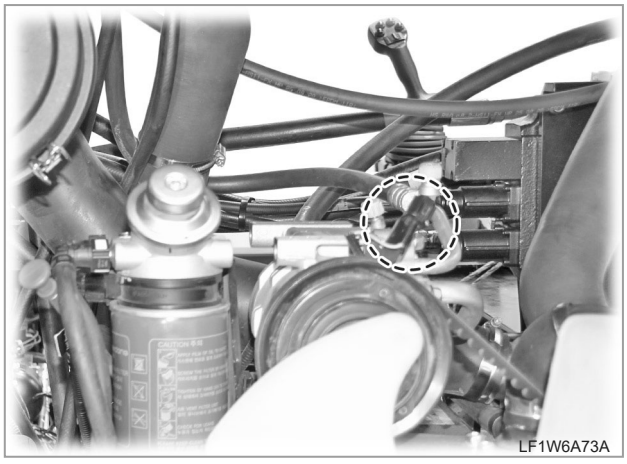
1. Open the rear cover and radiator of the engine compartment.



2. Install a collector to be connected to the compressor A/C hose (A & B) to collect the refrigerant.



3. Turn off the battery power cut-off switch (1).



4. Remove the compressor connector (1).