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MASTERS OF COMPACTION

SW994 Diagnostic Information

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Please See Operators and Service Manual for additional information.

ALL Work Must be performed by a factory trained technician to prevent injury. This manual is not intended to replace the service manual but to assist with additional information.

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⚠ WARNING

Unexpected machine movement may cause a serious accident. When inspecting the machine while the engine is running, always follow the instructions below.

- **Park the machine on level, flat ground.**
- **Apply the parking brake.**
- **Set chocks in front and behind each drum or tire.**
- **Make sure that service personnel are given the appropriate information at the appropriate time.**
- **Make sure that no one can enter any hazardous area.**

⚠ CAUTION

Do not work on the hydraulic system while the engine is running and the system is hot and under pressure. Do not disconnect hydraulic hoses or fittings until the system has cooled and pressure has been properly relieved.

Before removing any plugs from the pressure measurement ports, always release any residual pressure from the piping and open the cap of the fluid tank to release and pressure.

⚠ WARNING

Inadvertent starting the engine may cause a serious accident.

When inspecting the engine, make sure to exchange the appropriate cues and hand signal with the person at the operator station to avoid any accidents.

⚠ CAUTION

Before inspecting inside of the engine compartment, always stop the engine.

Contact with the fan, V-belt or exhaust system parts while the engine is running may cause serious injury.

SW994

SW994 Operators Manual
Scan QR Code to View

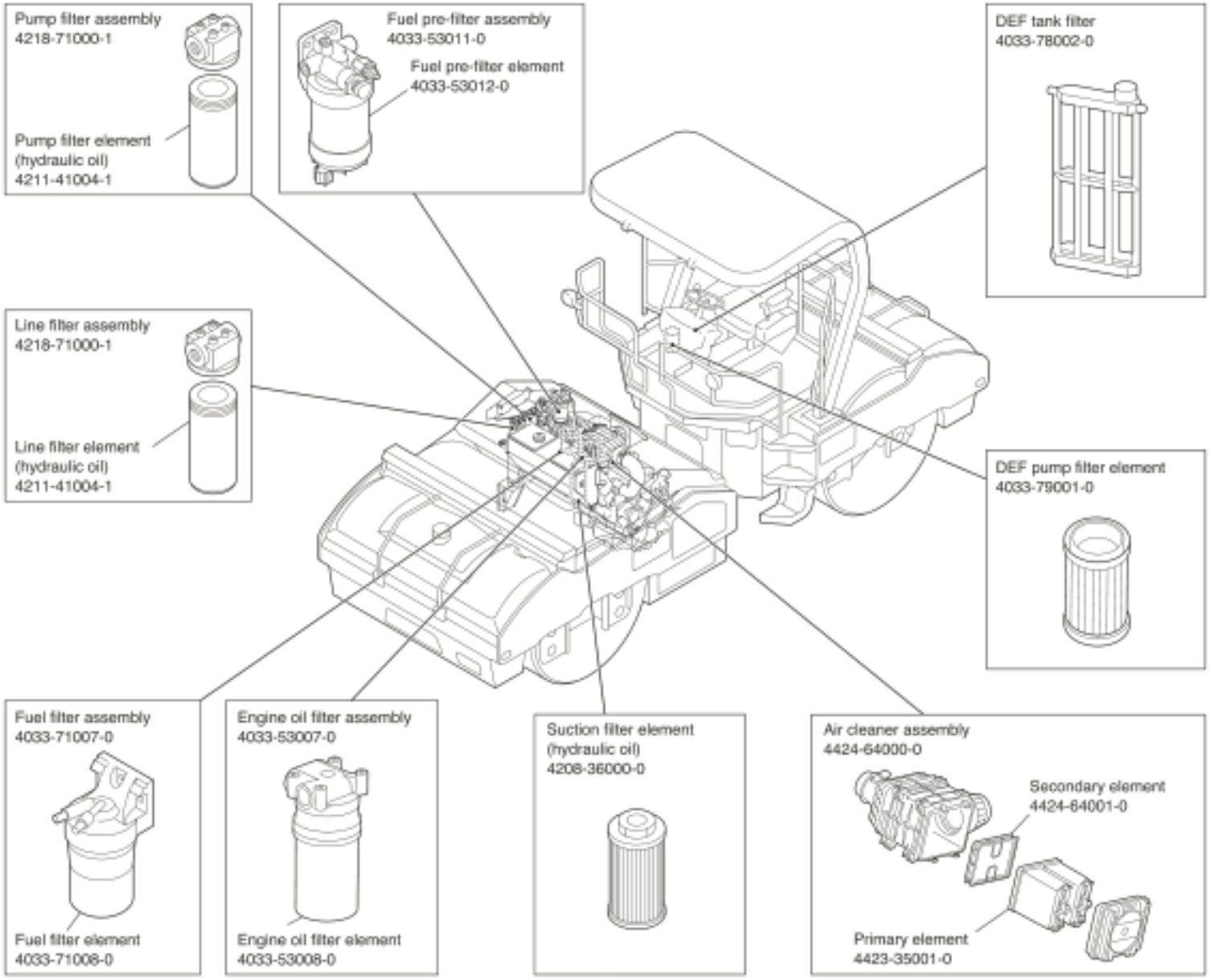
SW994

Engine	Name		CUMMINS QSF3.8 (Diesel, EPA-Tier 4)
	Model		4-cycle, Water-cooled, 4-cylinder in-line, overhead valve, direct injection type, with turbo charger
	Bore × Stroke		102 mm × 115 mm (4.02 in. × 4.53 in.)
	Displacement		3.800 L (229.0 cu.in)
	Performance	Rated speed	2,200 min⁻¹
		Rated output	97.0 kW (130 HP)
		Max. torque	488 N·m (360 lbf·ft) at 1,600 min⁻¹
		Fuel consumption rate	234 g/kW·h (0.385 lb/HP·h) at 2,200 min⁻¹
		Fuel consumption	27 L/h with full load (7.1 gal with full load)
	Fuel system	Fuel	Diesel (ASTM D975-2D)
		Fuel injection pump	Inline injection pump
		Fuel injection time regulator	All speed governor
	Lubrication system	Lubrication type	Full forced pressure feed
		Oil filter type	Full flow
		Oil cooler type	Integrated water cooled
	Air intake system	Air cleaner type	Dry
	Cooling system	Cooling type	Pressurized water forced circulation
		Cooling fan type	Inhale
	Electrical system	Alternator	12 V 135 A
		Starter	12 V 4.8 kW
		Battery	12 V (CCA1000) × 1 pcs. (12 V)
	Dry weight		348 kg (767 lbs.)

Lubricant	Service classification	Ambient temp. and applicable viscosity rating			Applicable standards
		–15 – 30°C (5 – 86°F) Cold	0 – 40°C (32 – 104°F) Moderate	15 – 55°C (59 – 131°F) Tropical	
Engine oil	API grade CJ-4	SAE 5W-40	SAE 5W-40	SAE 5W-40	MIL-L-2104B
Gear oil	API grade GL5	SAE 80W-90	SAE 90	SAE 140	MIL-L-2105
Hydraulic oil	Anti wear	ISO-VG32 over VI 140	ISO-VG46 over VI 140	ISO-VG68 over VI 110	ISO-3448
Grease	Lithium type extreme pressure				NLGI-2
Fuel	Diesel oil				ASTM D975-2D
DEF	ISO22241-1 or AUS32				

Compartment	Type of fluid	Capacity in liters (gal.)
Fuel tank	Diesel oil	292 (77.1)
Engine oil pan	Engine oil	11 (2.9)
Radiator	Coolant	22 (5.8)
Hydraulic oil tank	Hydraulic oil	65 (17.2)
Gear case (Wheel motor)	Gear oil	3.6 (0.95) × 2
Vibrator (SW884,SW994)	Gear oil	22 (5.8) × 2
Vibrator (SW884ND)	Gear oil	75 (19.8) × 2
Water tank	Water	600 (158.5) × 2
DEF tank	DEF	19 (5.0)

SW994


Pump filter assembly
4218-71000-1
Pump filter element
(hydraulic oil)
4211-41004-1
Fuel pre-filter assembly
4033-53011-0
Fuel pre-filter element
4033-53012-0
DEF tank filter
4033-78002-0
Line filter assembly
4218-71000-1
Line filter element
(hydraulic oil)
4211-41004-1
DEF pump filter element
4033-79001-0
Fuel filter assembly
4033-71007-0
Fuel filter element
4033-71008-0
Engine oil filter assembly
4033-53007-0
Engine oil filter element
4033-53008-0
Suction filter element
(hydraulic oil)
4208-36000-0
Air cleaner assembly
4424-64000-0
Secondary element
4424-64001-0
Primary element
4423-35001-0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SW994
4000 VPM

SW994


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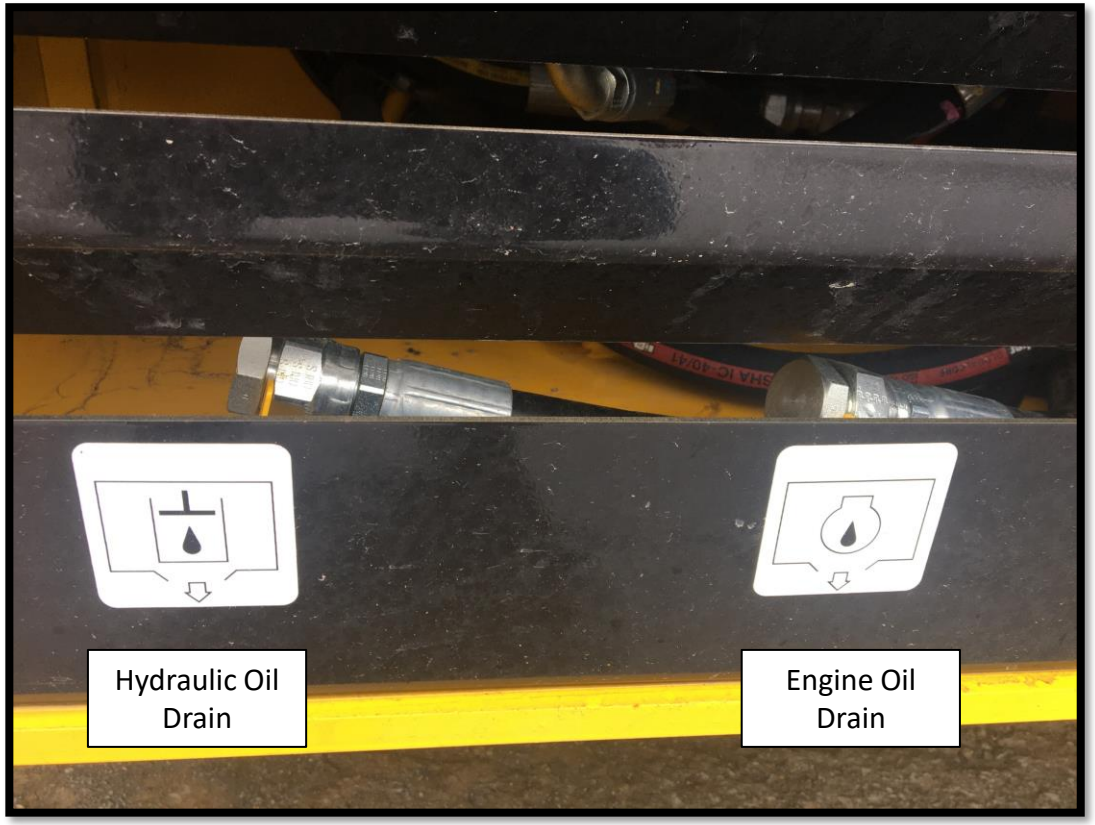
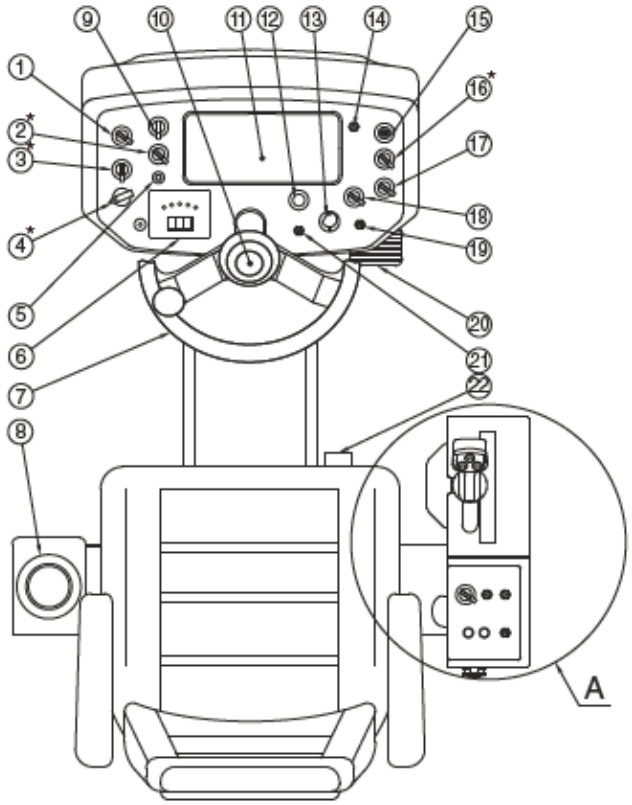
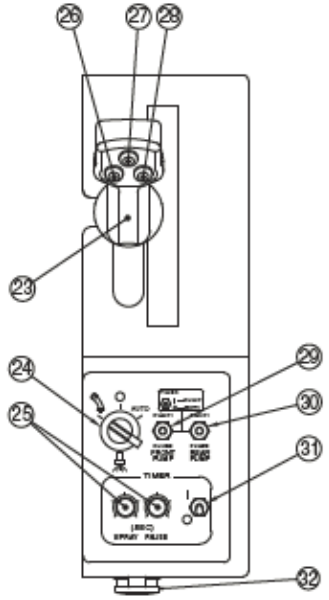
Oscillation/
Vibration


Hydraulic Oil
Drain
Engine Oil
Drain

SW994

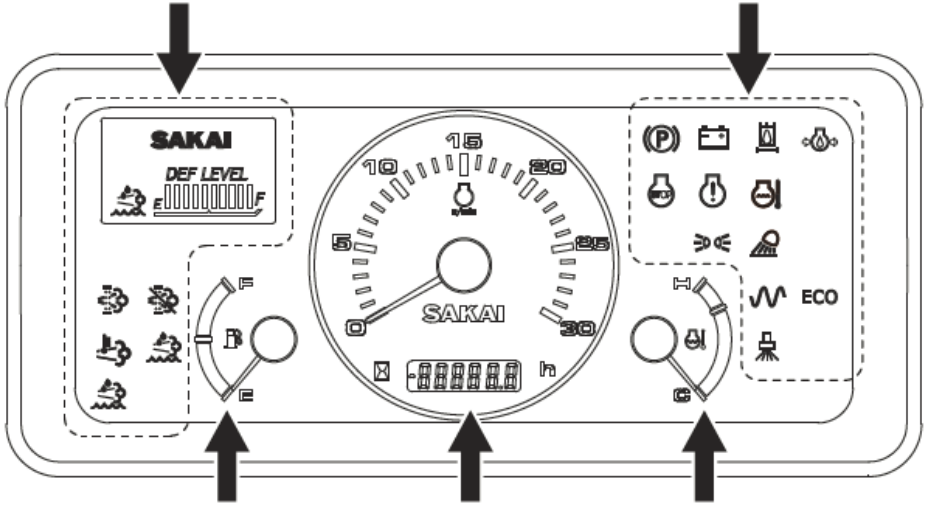




① Vibration drum selector switch
② Vibration amplitude selector switch (SW884, SW994)
Vibration type selector switch (SW884ND)
③ Vibration frequency selector switch (SW884, SW994)
④ IPF selector switch
⑤ AUTO SPEED lamp
⑥ EXACT COMPACT METER
⑦ Steering wheel
⑧ Drink holder
⑨ Vibration mode selector switch (Manual or Auto control)
⑩ Horn switch button
⑪ Combination meter
⑫ Parked manual regeneration switch
⑬ Starter switch
⑭ Emergency propel switch
⑮ Parking brake switch
⑯ Travel mode selector switch
⑰ Engine speed selector switch
⑱ Lamp switch
⑲ Engine diagnostic switch
⑳ Brake pedal
㉑ Disable regeneration switch
㉒ Swivel release pedal
㉓ Forward-Neutral-Reverse lever(F-N-R lever)
㉔ Spray mode selector switch (Manual or Auto control)
㉙ Spray timer dial
㉖ Vibration switch
㉗ AUTO SPEED set switch
㉘ Spray switch
㉙ Front spray pump selector switch
㉚ Rear spray pump selector switch
㉛ Spray timer switch
㉜ Accessory socket

Aftertreatment monitor display(part)

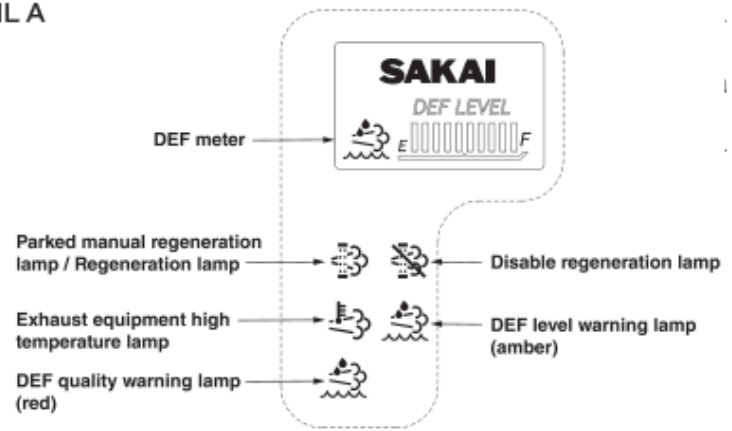
OK monitor display (part)

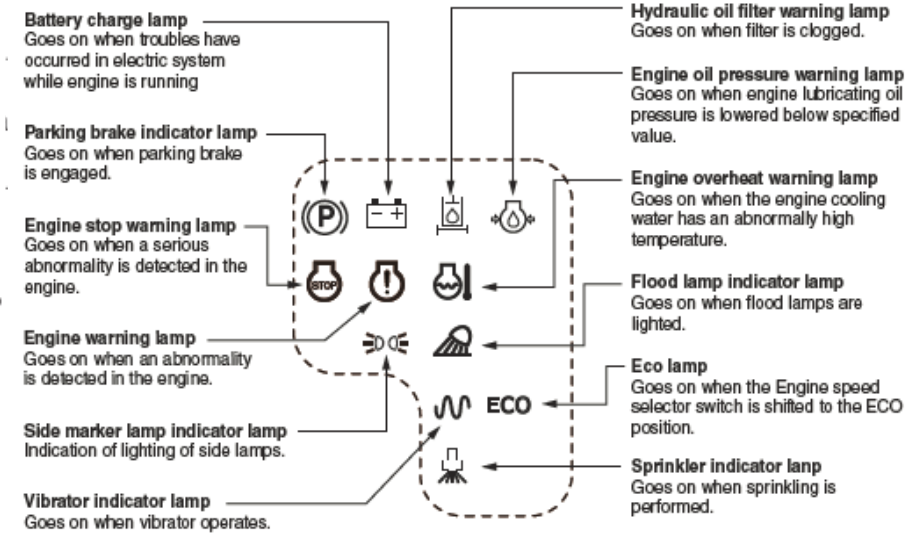


Fuel gauge

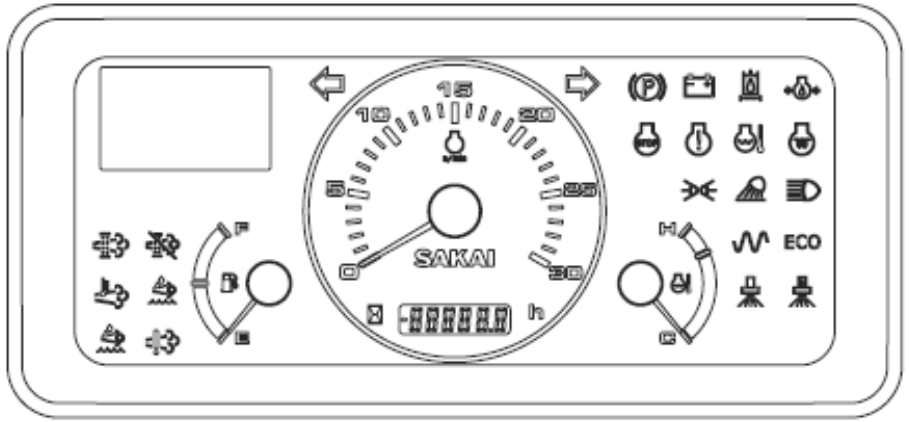
Tachometer / Hour meter

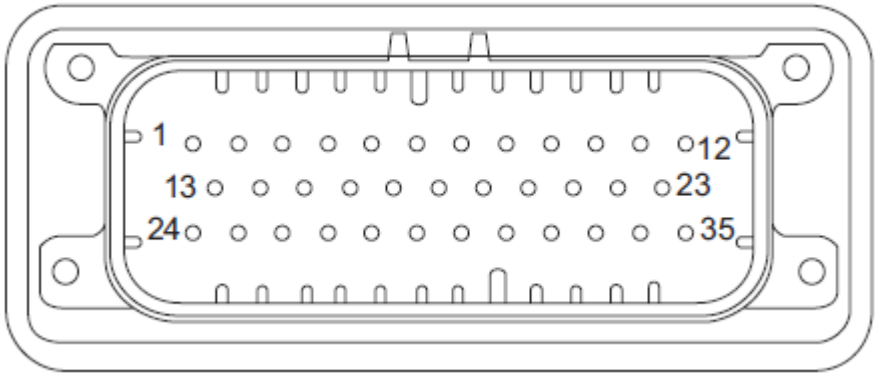
Temperature gauge

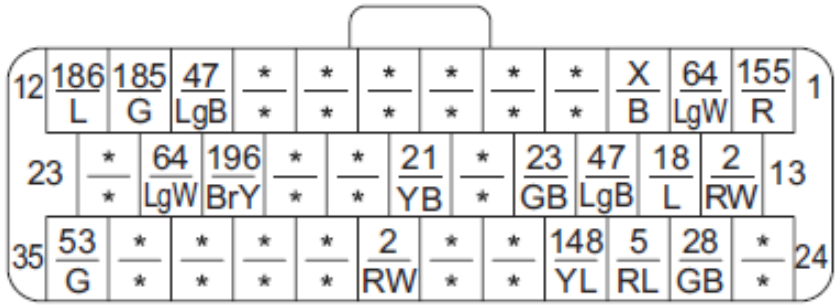




SW994







PIN	DESCRIPTION	NO.
1	Battery 24V (+)	(155)
2	Starter switch (ACC)	(64)
3	Ground	(X)
4	Turn signal (R)	
5	Engine stop	
6	Over heat	
7	REV. ratio SEL.1	
8	REV. ratio SEL.3	
9	Buzzer	
10	Lamp check	(47)
11	CAN(+)	(185)
12	CAN(-)	(186)
13	Head lamp	(2)
14	Parking brake	(18)
15	Charge warning	(47)
16	HYD. oil filter warning	(23)
17	Engine warning	
18	Fuel meter	(21)
19	REV. ratio SEL.2	
20	REV. ratio SEL.4	
21	DTC display	(196)
22	Hour meter	(64)
23	Turn signal (L)	
24	Preheating	
25	Water splay	(28)
26	Flood lamp	(5)
27	Vibrator	(148)
28	Liquid spray	
29	High beam	
30	COMBI. meter ILLUMI.	(2)
31	Exhaust system high temperature	
32	DEF low level	
33	Manual regeneration	
34	LYS pin	
35	ECO mode	(53)

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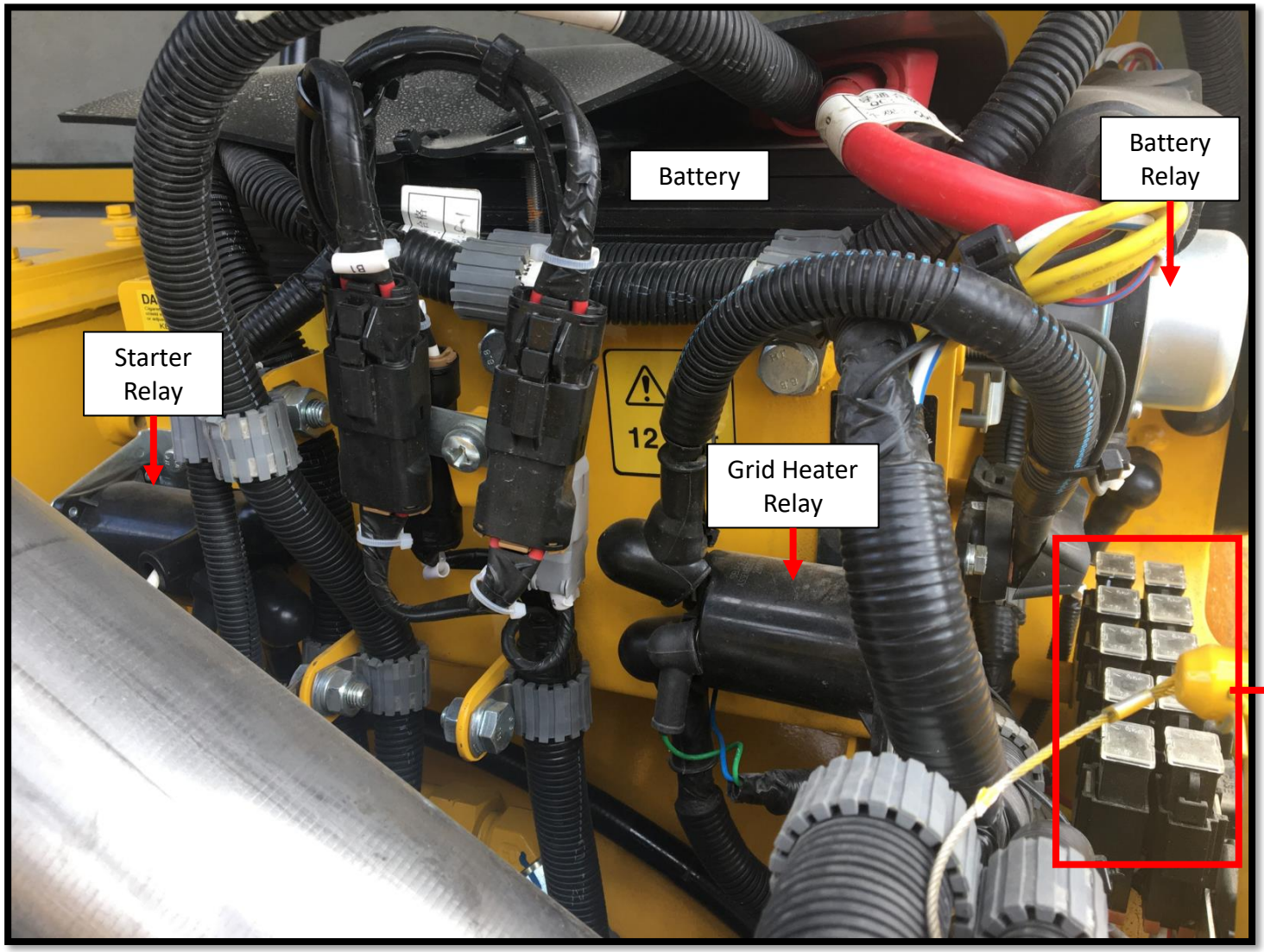
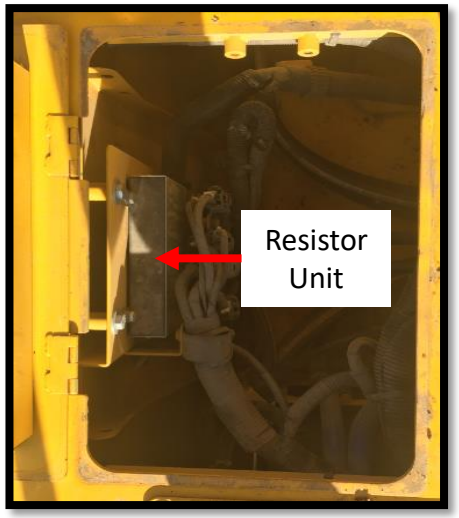
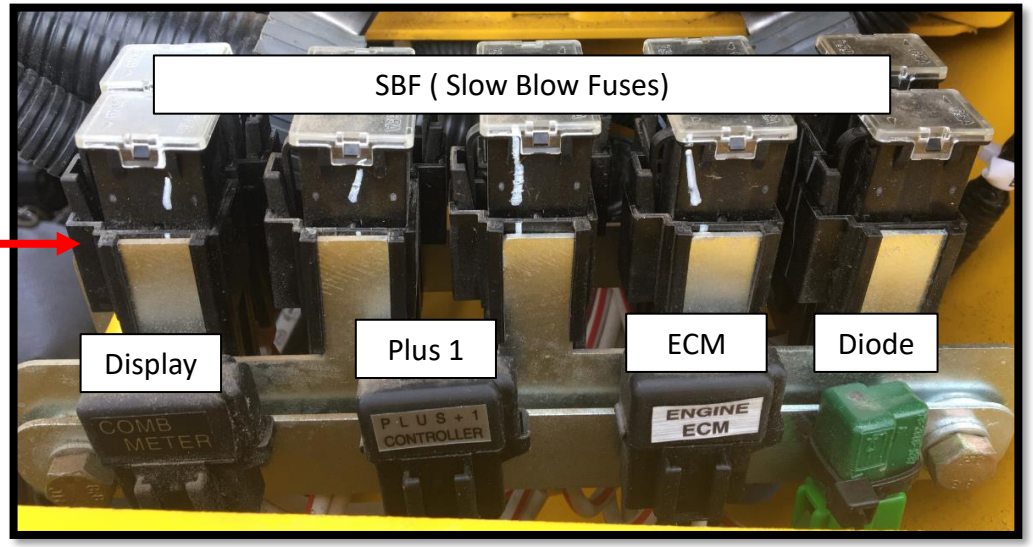

Battery
Battery Relay
Starter Relay
Grid Heater Relay


ECM


Resistor Unit


SBF (Slow Blow Fuses)
Display
Plus 1
ECM
Diode
COMB METER
PLUS+1 CONTROLLER
ENGINE ECM

SW994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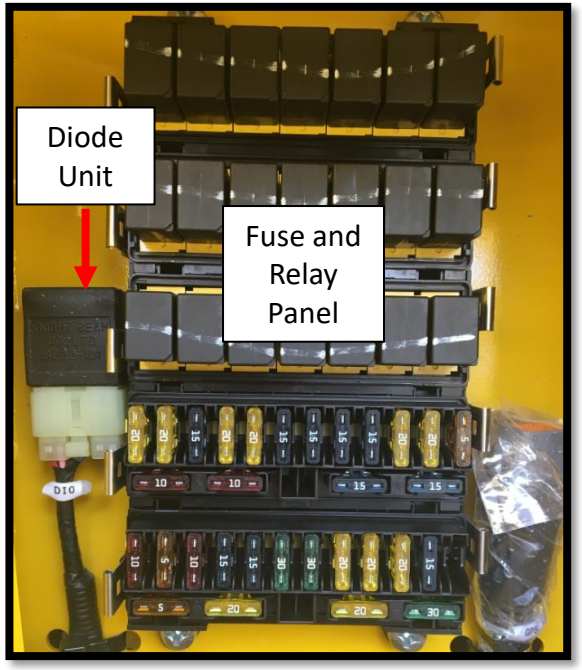
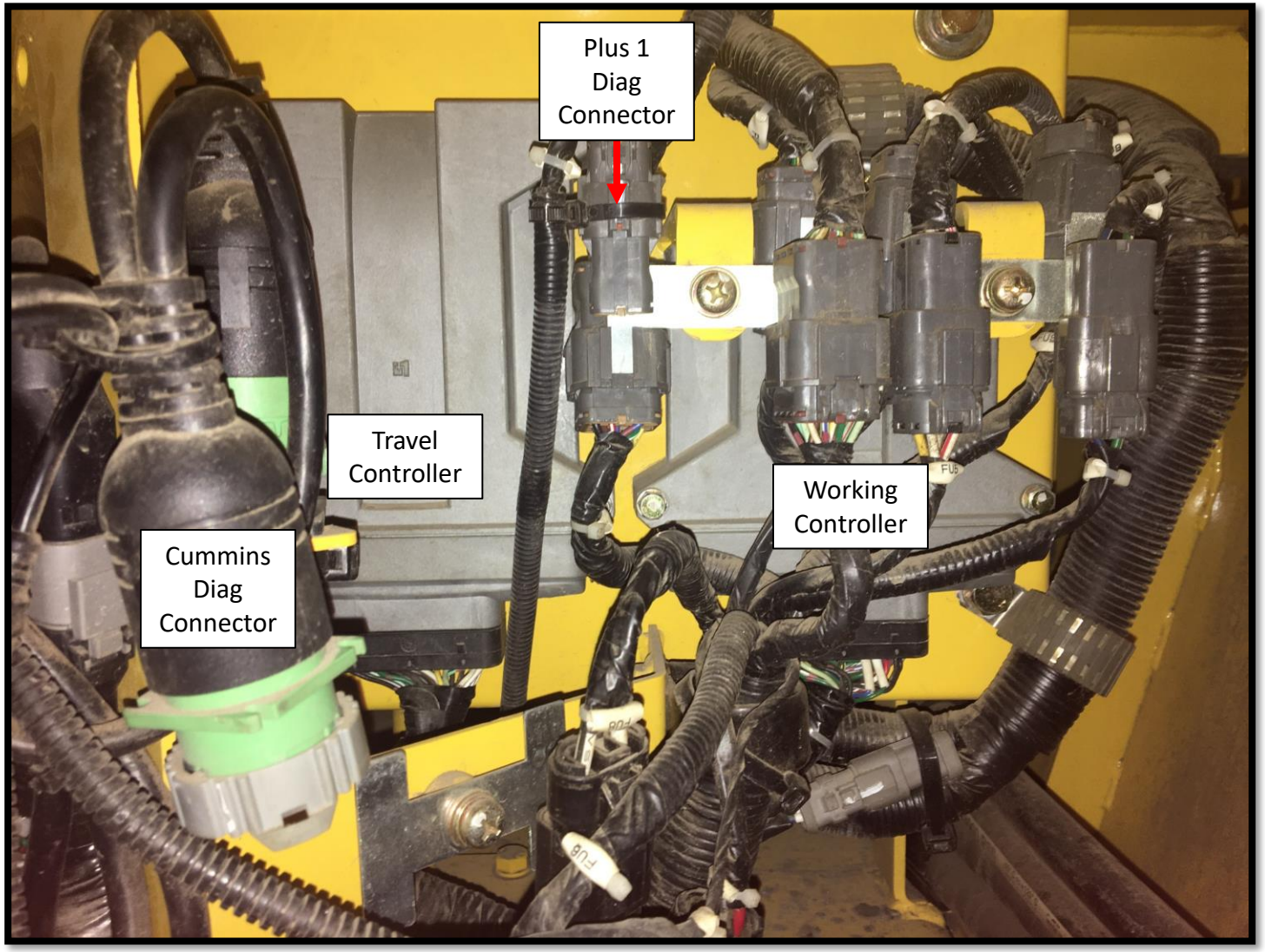
SW994
4000 VPM


Diode Unit
Fuse and Relay Panel


Plus 1 Diag Connector
Travel Controller
Working Controller
Cummins Diag Connector

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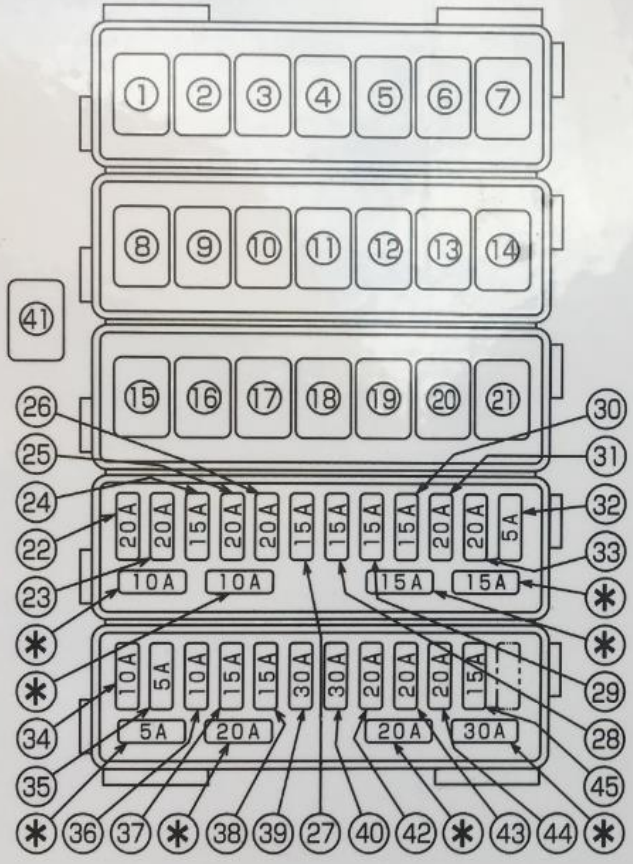
SW994

FUSE & RELAY BOX



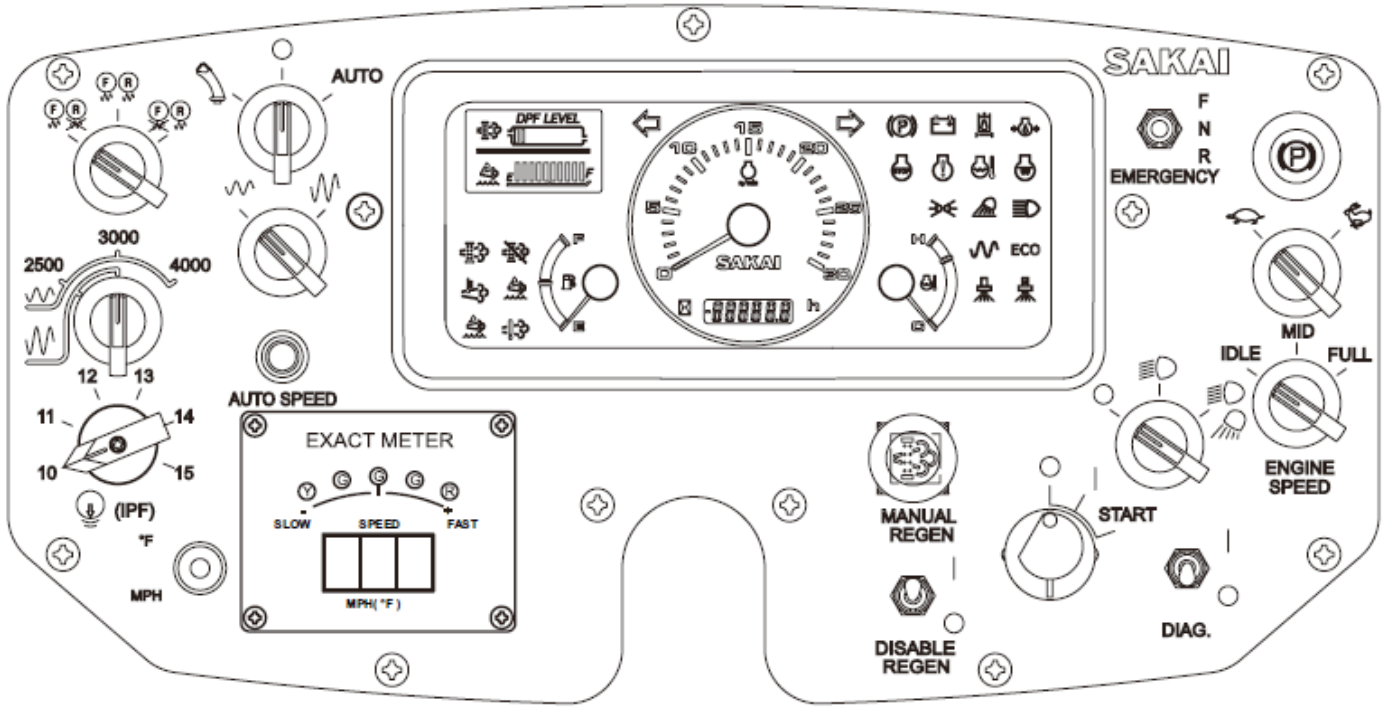
42	OPT.ROPS CAB FRONT WIPER
43	OPT.ROPS CAB FRONT WIPER
44	OPT.ROPS CAB REAR WIPER
45	OPT.ROPS CAB ACC.

1	STARTER SWITCH RELAY
2	EXACT METER RELAY
3	MID SPEED CONTROL RELAY
4	HORN RELAY
5	THROTTLE STOP RELAY
6	DEF SUPPLY MODULE RELAY
7	STARTER LOCKOUT RELAY
8	PROPELLING PUMP NEUTRAL RELAY (1)
9	PROPELLING PUMP NEUTRAL RELAY (2)
10	PROPELLING PUMP NEUTRAL HOLDING RELAY
11	AFTERTREATMENT RELAY
12	PARKING INTERLOCK RELAY
13	STARTER MOTOR RELAY
14	INTERLOCK RELAY
15	WATER SPRAY RELAY (PUMP1)
16	WATER SPRAY RELAY (PUMP2)
17	FRONT WATER PUMP2 RELAY
18	REAR WATER PUMP2 RELAY
19	PRESSURE OUTLET LINE HEATER RELAY
20	BACKFLOW LINE HEATER RELAY
21	SUCTION LINE HEATER RELAY
22	FRONT, REAR WATER SPRAY (PUMP2)
23	FRONT, REAR WATER SPRAY (PUMP1)
24	POWER OUTLET
25	HEAD LAMP
26	FLOOD LAMP
27	HORN,BACK BUZZER, REVERS SW. , OPTION (CIS)
28	FORWARD SWITCH, NEUTRAL SOL, VALVE
29	ENGINE ECM, BRAKE SOL, VALVE
30	PANEL SWITCH, F-R LEVER SWITCH
31	ROLL LIGHTING OPT.,POWER SUPPLY OPT.
32	ENGINE START
33	ENGINE ECM
34	ENGINE DIAGNOSIS
35	NOx SENSOR, SCR SENSOR, DEF TANK SENSOR
36	NOx SENSOR, SCR SENSOR, DEF TANK SENSOR
37	DEF SUPPLY MODULE PUMP
38	SUCTION/PRESS./BACKFLOW LINE HEATER
39	ROPS CAB, AIR CON UNIT
40	ROPS CAB, AIR CON UNIT
41	DIODE UNIT
*	SPARE (5A/10A/15A/20A/30A)

SW994

Plus 1 Controller Errors

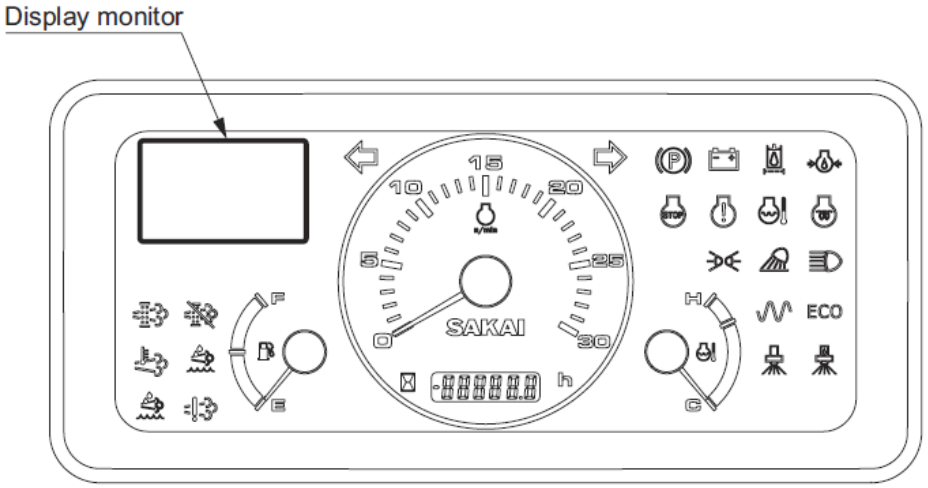
The traveling/working controller constantly monitors the input and output status to control each system. The traveling/working controller performs the system diagnostics function. When any system problem is detected, it displays the corresponding error code like as “E01” on the EXACT METER.



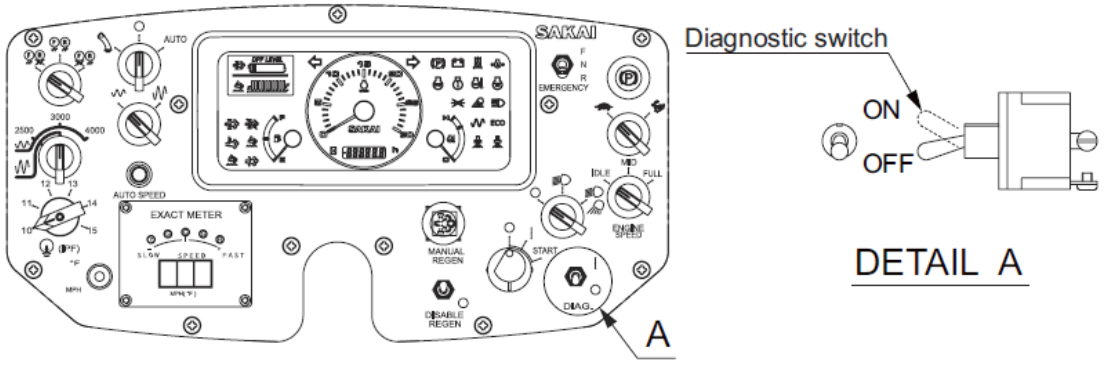
Error code	Function / Component	Error	Engine stop
E01	Potentio meter	Out voltage to machine controller is grounded	Yes
E02	Potentio meter	Output voltage to machine controller is power supply voltage	Yes
E03	Forward switch / F-N-R lever	Short circuit to machine controller	Yes
E04	Forward switch / F-N-R lever	Broken wire	Yes
E05	Reverse switch / F-N-R lever	Short circuit to machine controller	Yes
E06	Reverse switch / F-N-R lever	Broken wire	Yes
E11	Speed sensor	Broken wire	Yes(*)
E15(Lo)	Rolling surface temperature sensor (OPT)	Broken wire or low temperature	No
E21	Vibration selector switch	Broken wire / Short circuit to machine controller	No
E22	IPF selector switch	Broken wire / Short circuit to machine controller	No
E31	Current control / Propel pump solenoid for forward	Current outside the nominal range	Yes
E32	Current control / Propel pump solenoid for reverse	Current outside the nominal range	Yes
E33	Current control / Vibration pump solenoid for front Hi	Current outside the nominal range	No
E34	Current control / Vibration pump solenoid for front Lo	Current outside the nominal range	No
E35	Current control / Vibration pump solenoid for rear Hi	Current outside the nominal range	No
E36	Current control / Vibration pump solenoid for rear Lo	Current outside the nominal range	No
E41	CAN BUS / ECU	Signal defect to machine controller	Yes(*)
E42	Traveling controller	Signal defect to machine controller	Yes
E43	Exact meter	Signal defect to exact meter	Yes
E44	Working controller	Signal defect to machine controller	Yes
E45	Working controller	Parameter error	Yes
E88	Traveling controller / Working controller	Parameter mismatch	Yes
E00	Forward switch / Parking brake switch	Broken wire / Short circuit to machine controller	Yes

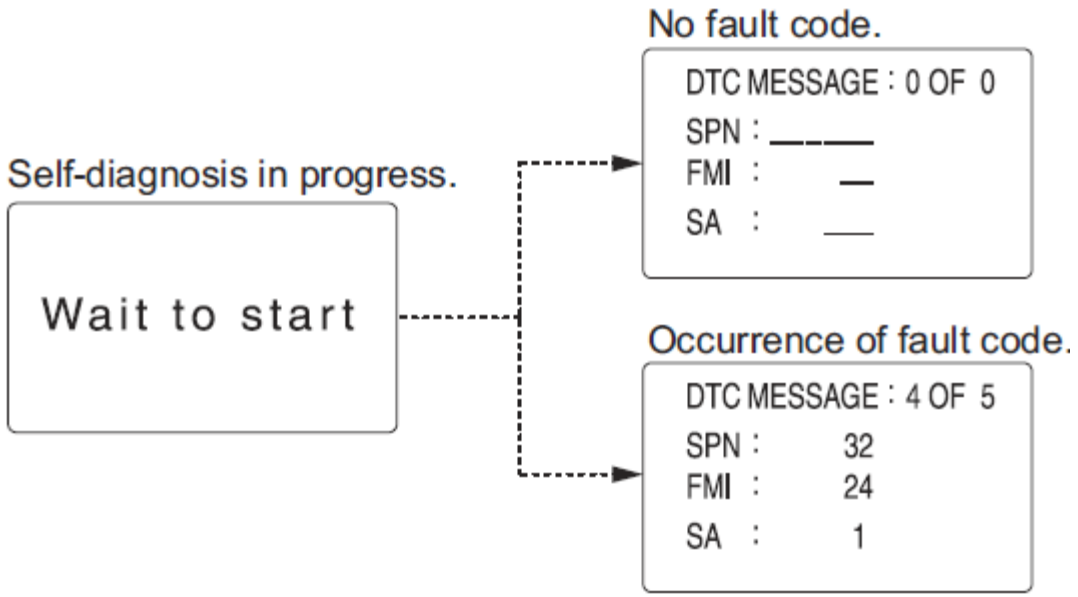
SW994

When a fault code (SPN,FMI) occurs, display a fault code on the display monitor in the combination meter.



Fault codes can be accessed in at least two different ways; using the electronic service tool or a method of displaying it on a display monitor in a combination meter.
To check the fault code occurring in the electronic fuel system / protection system of the engine on the display monitor, set the diagnostic switch to “ON” and set the start switch to “ON”.
After the diagnosis is ended, set the diagnostic switch to “OFF”.



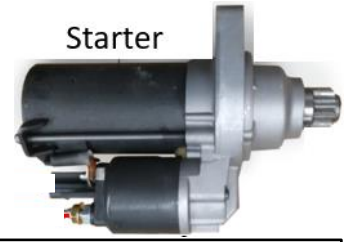


NOTE:

Complete list of codes can be found in the Service Manual in the Troubleshooting Section.

SW994

No Crank, No Start



Does the display come on when key is turned on?

- Yes, Is machine in “Neutral” drive position
  - Yes, Is the park brake “ON”?
    - Yes, Is there power at Terminal 50 Black/White wire on the Starter when turned to “Crank” position?
      - Yes, Repair connections or replace starter as needed.
      - No, Is there power at the Starter Black/White wire on the Starter when turned to “Crank” position?
        - Yes, Repair connections or replace starter as needed.
        - No, Check continuity across the Park Brake switch and Neutral Switch? Does the switches test good?
          - No, Repair or replace defective switch.
          - Yes, Inspect fuses F7, F8 and F11. Is there power across the fuses?
            - No, Repair or replace defective fuse.
            - Yes, Test Starter Lockout and Starter relay and replace as needed.
    - No, Engage Park Brake. Does engine crank?
      - Yes, End diagnosis.
      - No, Is there power at the Starter Black/White wire on the Starter when turned to “Crank” position?
        - Yes, Repair connections or replace starter as needed.
        - No, Check continuity across the Park Brake switch and Neutral Switch? Does the switches test good?
          - No, Repair or replace defective switch.
          - Yes, Inspect fuses F7, F8 and F11. Is there power across the fuses?
            - No, Repair or replace defective fuse.
            - Yes, Test Starter Lockout and Starter relay and replace as needed.
  - No, Shift drive lever to “Neutral”. Does engine crank?
    - Yes, End diagnosis.
    - No, Is the park brake “ON”?
      - No, Engage Park Brake. Does engine crank?
        - Yes, End diagnosis.
        - No, Is there power at the Starter Black/White wire on the Starter when turned to “Crank” position?
          - Yes, Repair connections or replace starter as needed.
          - No, Check continuity across the Park Brake switch and Neutral Switch? Does the switches test good?
            - No, Repair or replace defective switch.
            - Yes, Inspect fuses F7, F8 and F11. Is there power across the fuses?
              - No, Repair or replace defective fuse.
              - Yes, Test Starter Lockout and Starter relay and replace as needed.
- No, Test Battery, is there 12v present?
  - No, Replace or Charge Battery as needed.
  - Yes, Does Battery Relay, engage when key switch is turned to “ON” position?
    - Yes, Check connections and replace Battery Relay as needed.
    - No, Is there 12V power from key switch (Black/Red stripe) at Battery Relay?.
      - Yes, Repair Connection or Replace Battery Relay as needed.
      - No, Repair Wiring from Key Switch.

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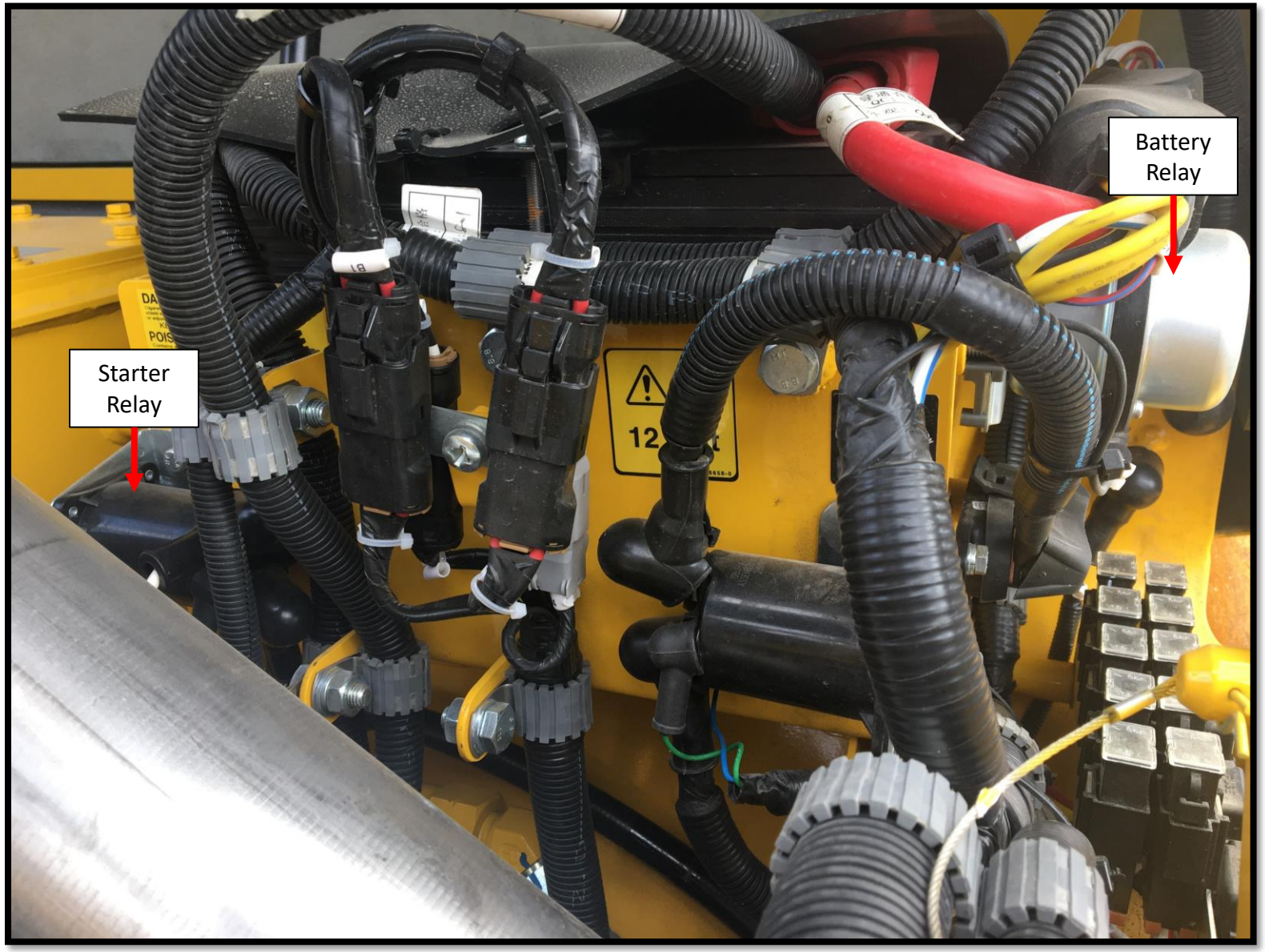
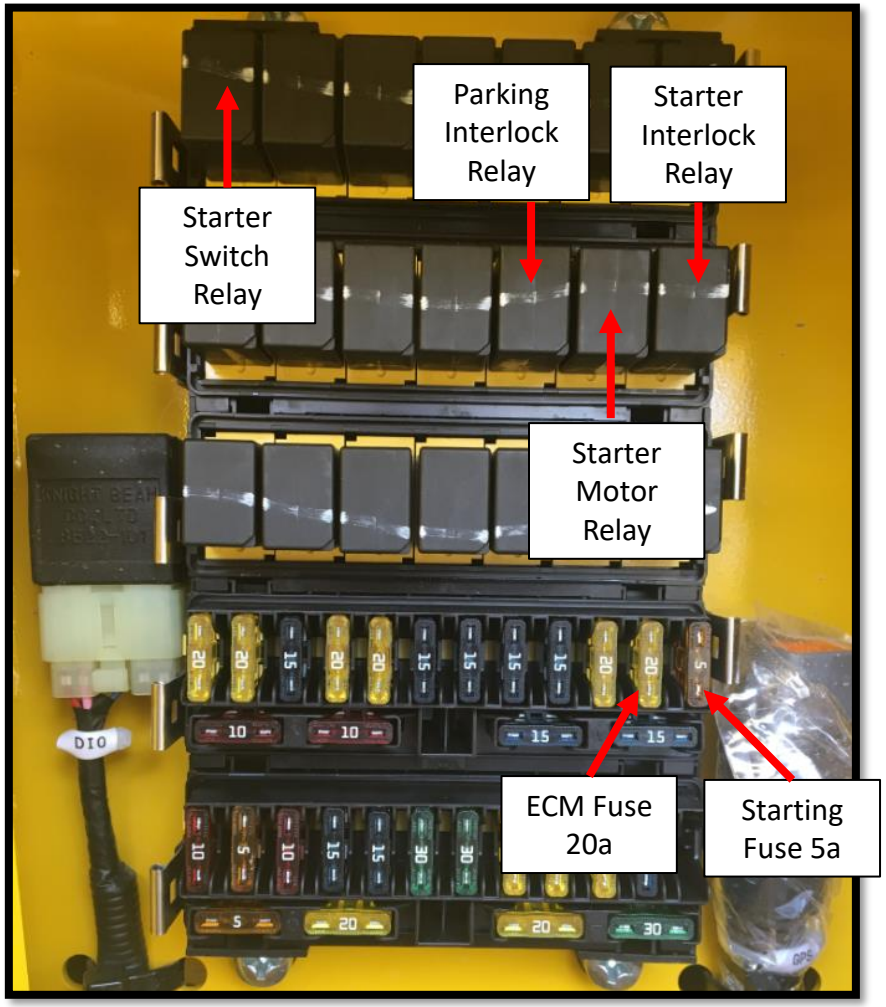

Battery Relay
Starter Relay


Starter Switch Relay
Parking Interlock Relay
Starter Interlock Relay
Starter Motor Relay
ECM Fuse 20a
Starting Fuse 5a

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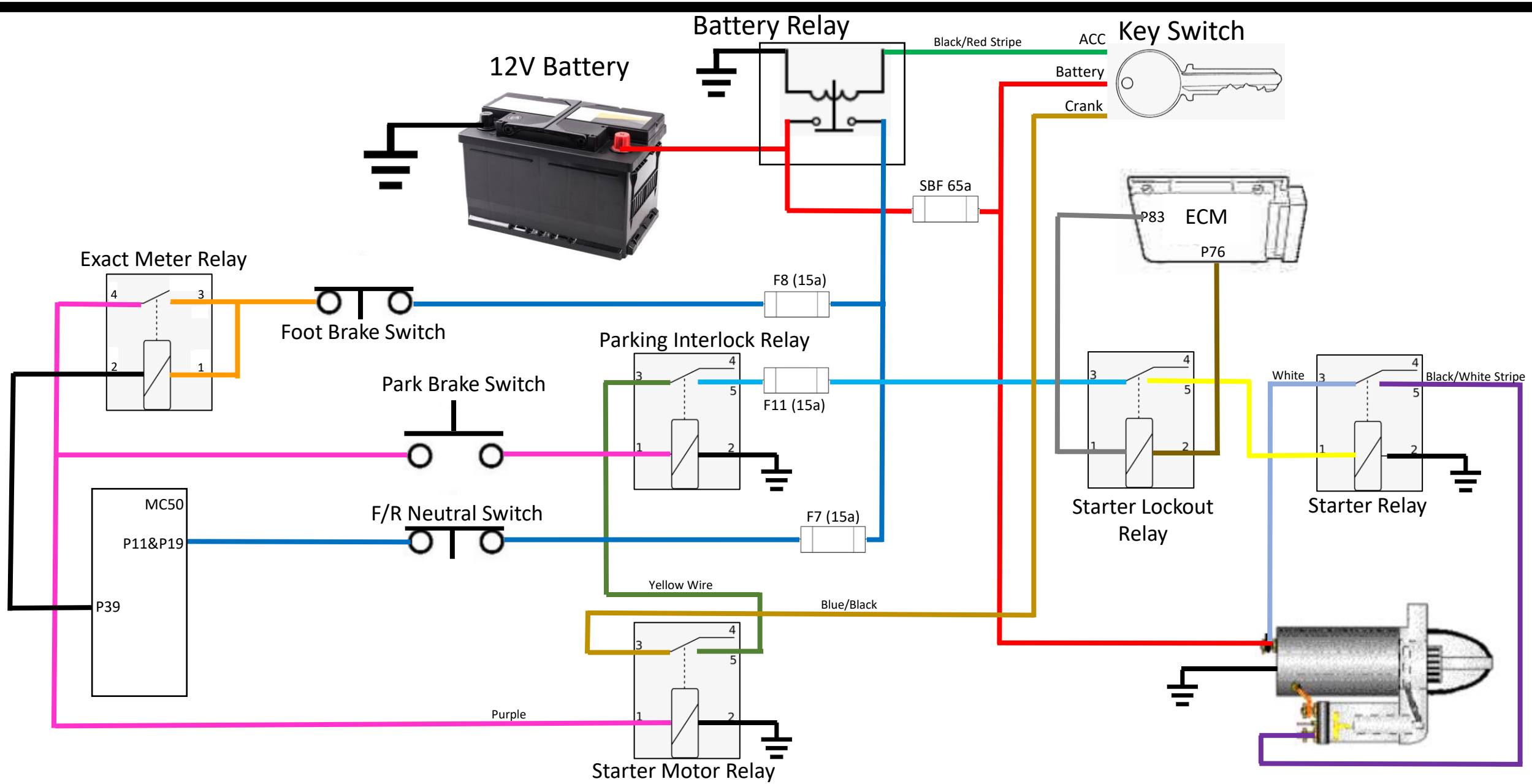

Battery Relay
12V Battery
Black/Red Stripe
ACC
Key Switch
Battery
Crank
SBF 65a
P83
ECM
P76
Exact Meter Relay
F8 (15a)
Foot Brake Switch
Parking Interlock Relay
Park Brake Switch
F11 (15a)
White
Black/White Stripe
Starter Lockout Relay
Starter Relay
MC50
P11&P19
P39
F/R Neutral Switch
F7 (15a)
Yellow Wire
Blue/Black
Purple
Starter Motor Relay

SW994

Crank, No Start

Are there any Engine Codes present?

No, Is there fuel in the machine?

Yes, Please consult local Cummins Dealer

No, Add Fuel and Prime using hand pump.

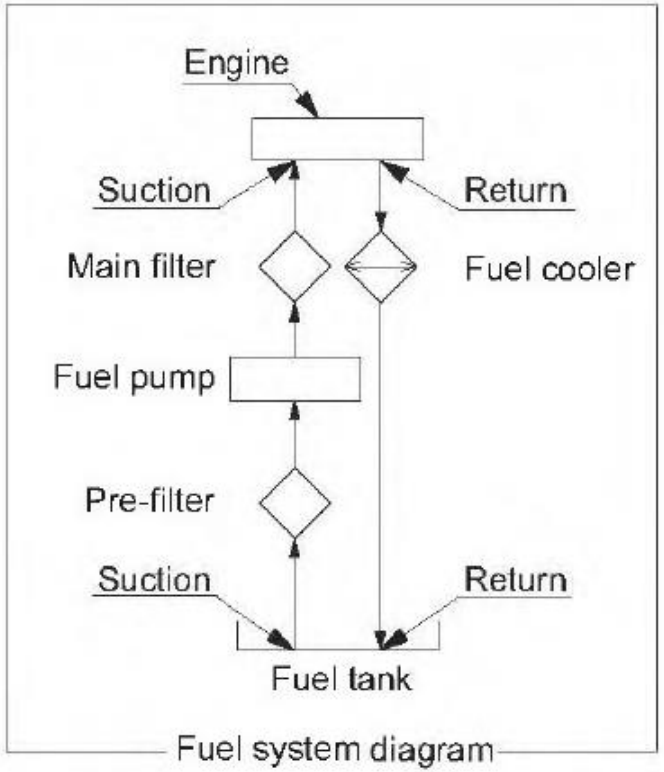
Yes, Is there fuel present at filters?

No, Replace filters as needed or remove fuel restriction, repair as needed.

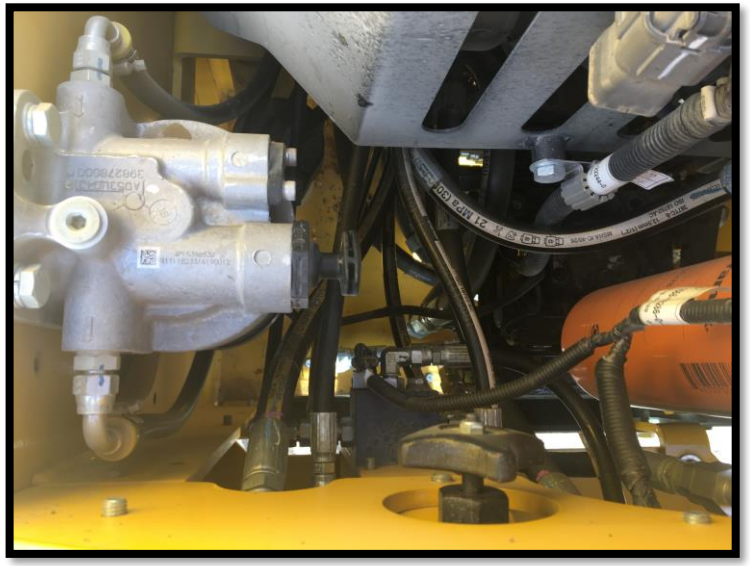
Yes, There fuel present at Fuel Pump ?

No, Replace filters as needed or remove fuel restriction, repair as needed.

Yes, Please consult your local Cummins Dealer.



Fuel system diagram



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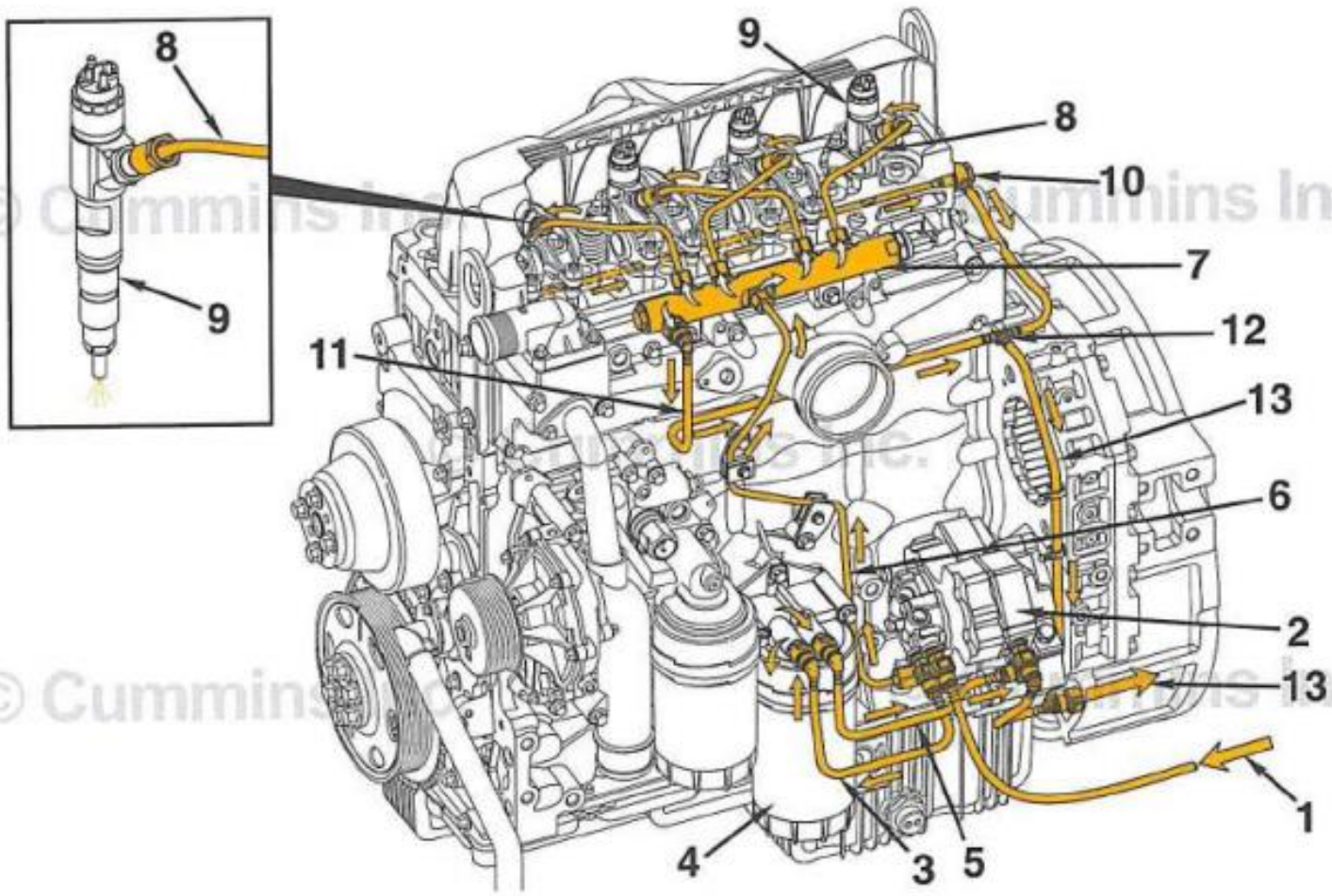
Flow Diagram, Fuel System



1 Fuel supply from tank
2 Fuel pump
3 Fuel supply to filter
4 Fuel filter (spin-on)
5 Fuel flow out of fuel pump
6 Fuel supply to common fuel rail
7 Common fuel rail
8 High pressure fuel to injector
9 Injector
10 Fuel return from cylinder head
11 Fuel return from common rail
12 Fuel return junction
13 Fuel return to tank.

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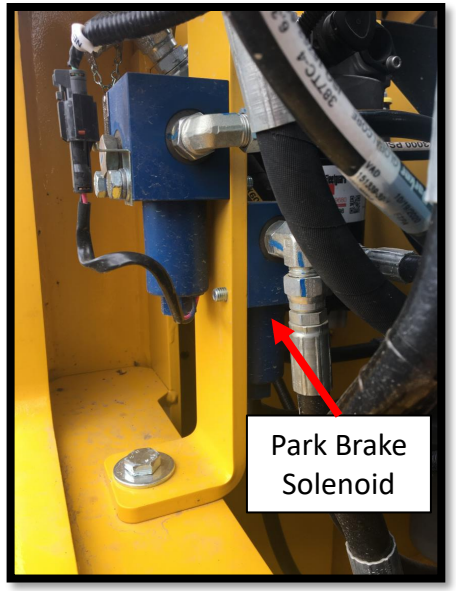
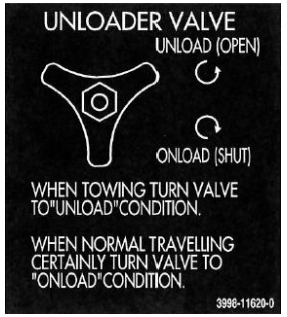


Will not drive, Parking Brake Inop

Is the Unloader valve open? Will not drive with valve open

Yes, Close valve to drive.

No, Is the Parking brake engaged?



Yes, Disengage park brake.

No, With Parking Brake in the "OFF" position, is there power at the switch on the Yellow wire?

No, With Parking Brake in the "OFF" position, is there power at the switch on the Light Green/Yellow?

Yes, Repair or Replace Parking Brake Switch.

No, Is there power on the Light Green/Red wire at the Exact Meter Relay?

Yes, Repair broken Light Green/Red wire.

No, Is there Power at the Exact Meter relay on the Light Green/Yellow wire?

No, Inspect F8 and Foot Break switch and wiring, and repair or replace as needed.

Yes, Inspect exact meter relay and replace as needed.

Yes, Is the Parking Brake "OFF" Does the Parking Brake Solenoid have power at the Yellow Wire?

No, Repair broken Yellow wire from Switch to Solenoid.

Yes, Remove coil, is the coil magnetizing?

No, Repair Ground or Replace defective Coil.

Yes, Test Solenoid and Brake Pressure. Repair as needed.

Note: If all checks out electrically. Test Charge Pressure at **350-400** PSI. And Drive Pump at **6236** PSI.

MEASUREMENT OF PARKING BRAKE RELEASE PRESSURE

- Oil temperature during measurement : 50 ±5°C (122 ±9°F)

① Disconnect hose (1) from propulsion motor. Attach pressure gauge through adapter ⓦ .
- Adapter ⓦ : 4-4LOHL6G5TP (Parker part number)
- Pressure gauge : 0 to 5 MPa (0 to 725 psi)

② Confirm that F-R lever is "N".

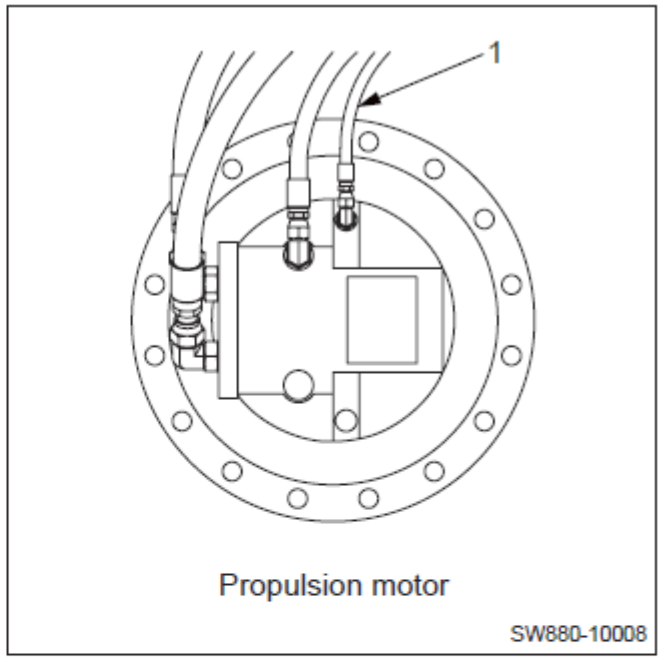
③ Apply parking brake by pressing parking brake switch button.

④ Start the engine and set throttle switch to "Full".

⑤ Release parking brake by pressing parking brake switch button.

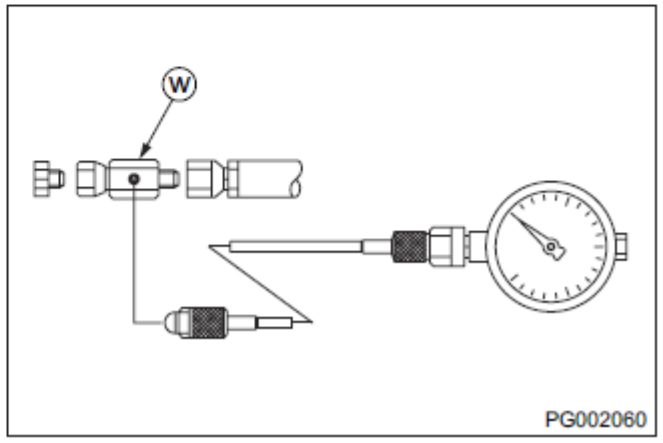
⑥ Read brake release pressure indicated by pressure gauge.

★ Brake release pressure : More than 1.5 MPa (218 psi)



Propulsion motor

SW880-10008



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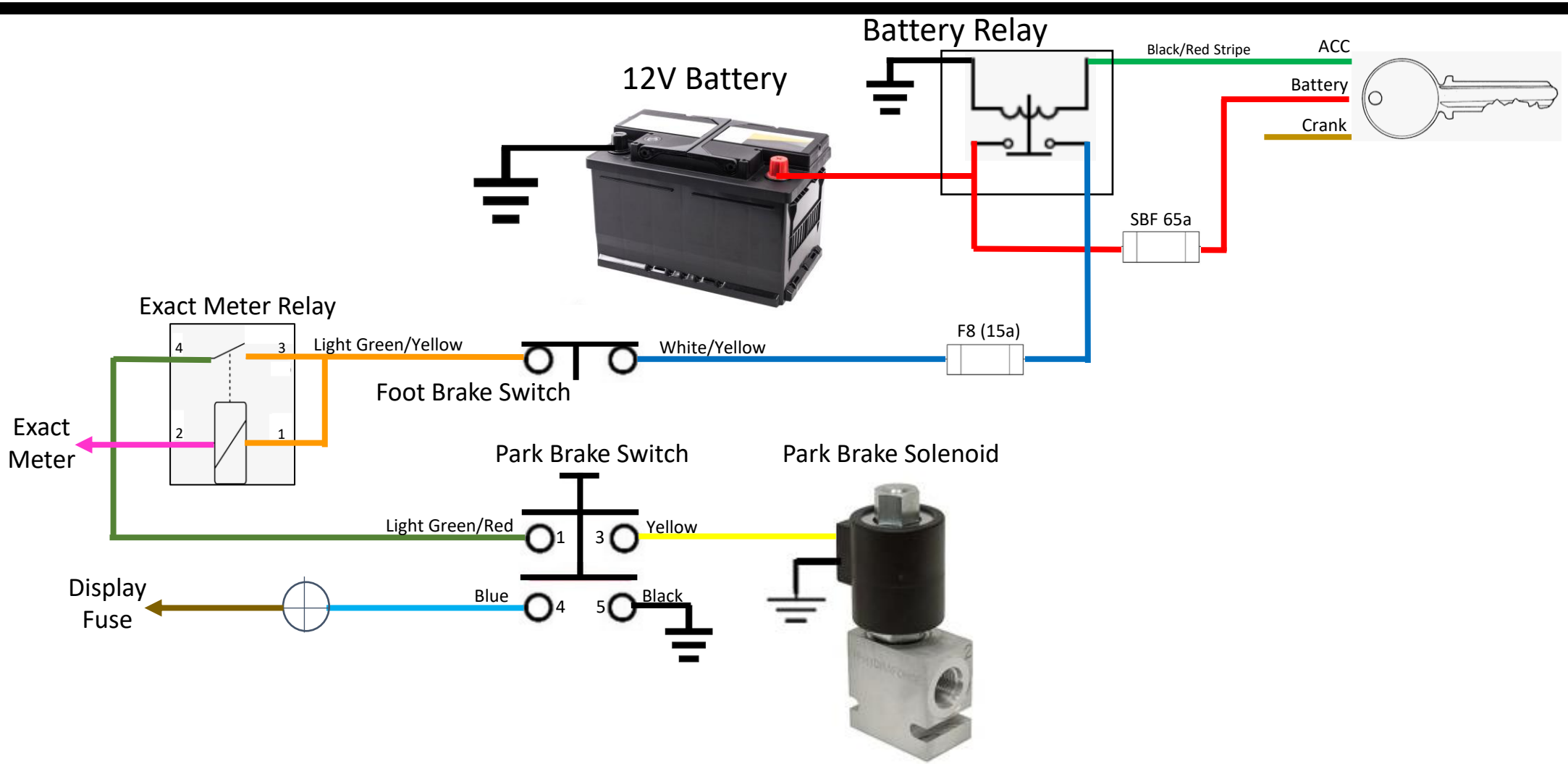

Battery Relay
12V Battery
Black/Red Stripe
ACC
Battery
Crank
SBF 65a
Exact Meter Relay
4
3
2
1
Light Green/Yellow
White/Yellow
F8 (15a)
Foot Brake Switch
Exact
Meter
Park Brake Switch
Park Brake Solenoid
Light Green/Red
1
3
Yellow
Display
Fuse
Blue
4
5
Black

SW994

Will not drive Forward

Is the Unloader valve open? Will not drive with valve open

Yes, Close valve to drive.

No, Is the Parking brake engaged?

Yes, Disengage park brake.

No, With Parking Brake in the “OFF” position, is there power at the Forward Solenoid (Green wire) when lever goes to Forward?

No, Test for power at the Travel Controller on Pin 40 White/Blue wire?

Yes, Repair connection or wires from coil to controller.

No, Is there power at the Travel Controller on Pin 2(White/Black)?

Yes, Test Plus 1 Fuse 15a. Is there power across the fuse?

Yes, Repair broken wire(White/Black) from Fuse 15a to Travel Controller.

No, Replace defective fuse.

Yes, Is the Ground good on Pin 1 of the Travel Controller?

No, Repair Ground wire.

Yes, is there between .5v – 4.9v on Pins 47 & 48 when F/R Lever is moved?

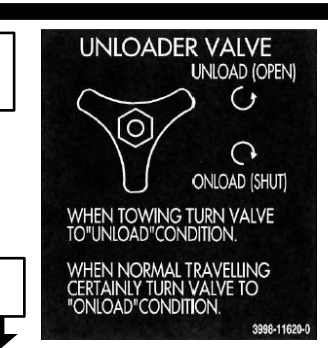
No, Repair connection or replace defective Pot.

Yes, Test Controller and repair or replace as needed.

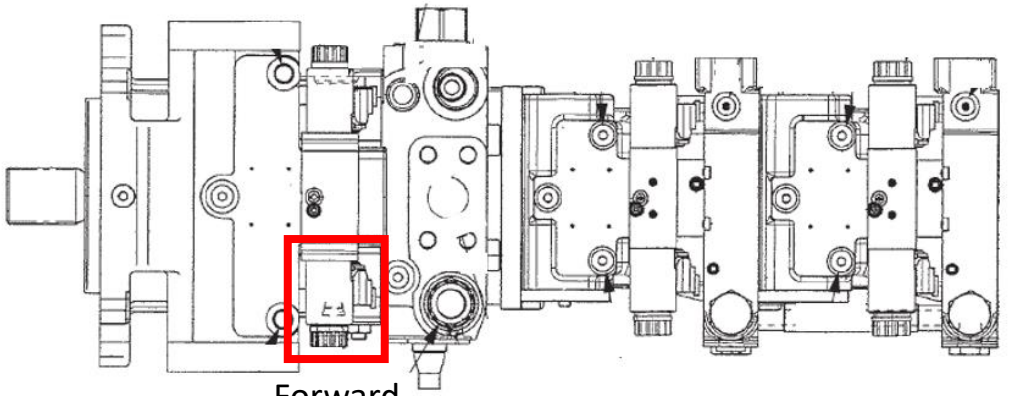
Yes, Remove coil and activate again. Does coil magnetize?

No, Repair connection or replace defective coil.

Yes, Test Drive Pump, Drive Motor and Solenoid and repair or replace as needed.



Note: If all checks out electrically. Test Charge Pressure at **350-400** PSI. And Drive Pump at **6236** PSI.



Forward Solenoid

SW994

Will not drive Reverse

Is the Unloader valve open? Will not drive with valve open

Yes, Close valve to drive.

No, Is the Parking brake engaged?

Yes, Disengage park brake.

No, With Parking Brake in the “OFF” position, is there power at the Reverse Solenoid (Blue wire) when lever goes to Reverse?

No, Test for power at the Travel Controller on Pin 50 Blue wire?

Yes, Repair connection or wires from coil to controller.

No, Is there power at the Travel Controller on Pin 2(White/Black)?

Yes, Test Plus 1 Fuse 15a. Is there power across the fuse?

Yes, Repair broken wire(White/Black) from Fuse 15a to Travel Controller.

No, Replace defective fuse.

Yes, Is the Ground good on Pin 1 of the Travel Controller?

No, Repair Ground wire.

Yes, is there between .5v – 4.9v on Pins 47 & 48 when F/R Lever is moved?

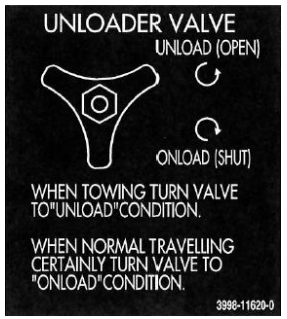
No, Repair connection or replace defective Pot.

Yes, Test Controller and repair or replace as needed.

Yes, Remove coil and activate again. Does coil magnetize?

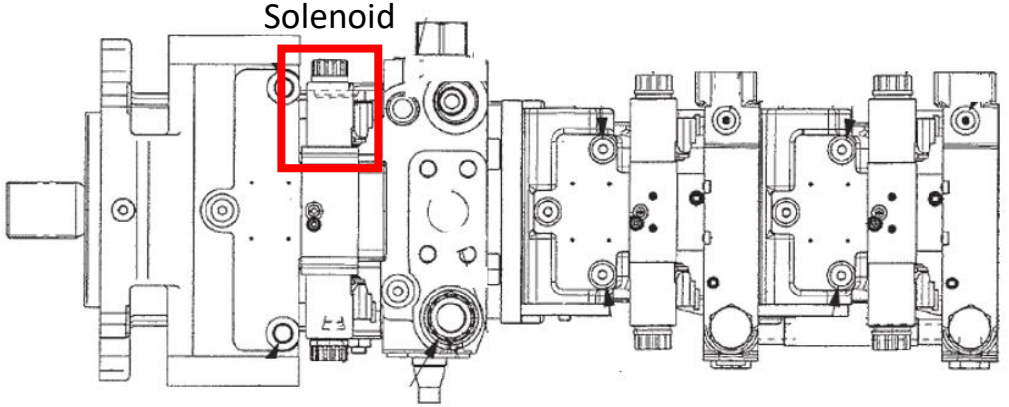
No, Repair connection or replace defective coil.

Yes, Test Drive Pump, Drive Motor and Solenoid and repair or replace as needed.



Note: If all checks out electrically. Test Charge Pressure at **350-400** PSI. And Drive Pump at **6236** PSI.

Reverse Solenoid



SW994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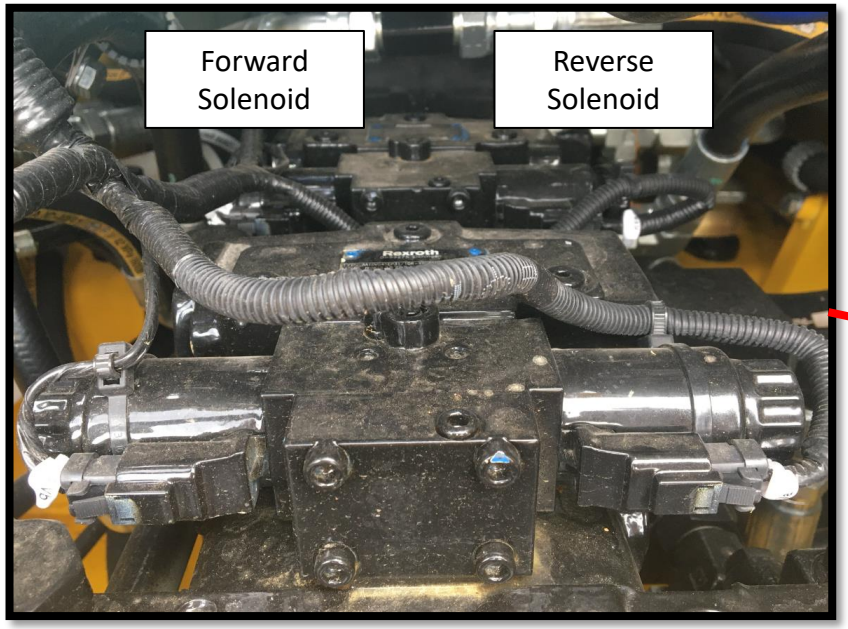
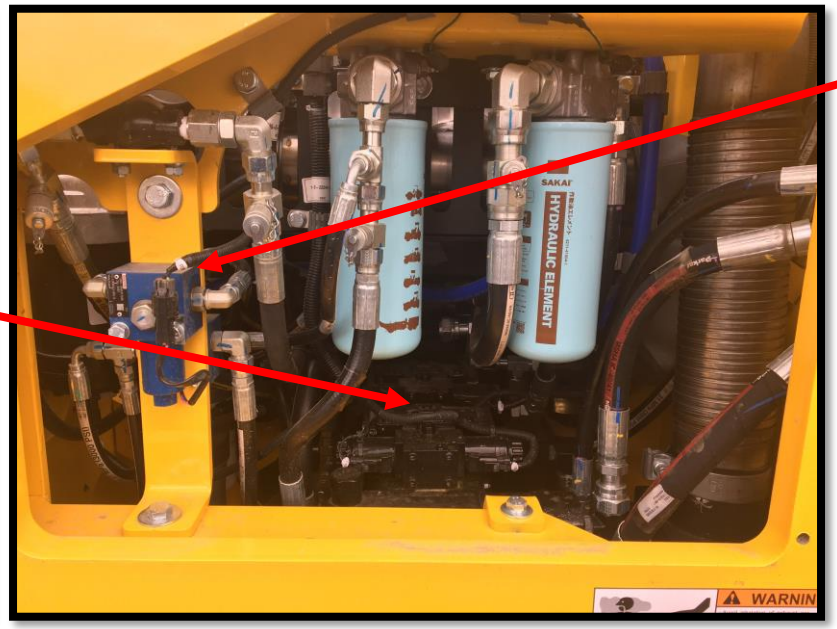
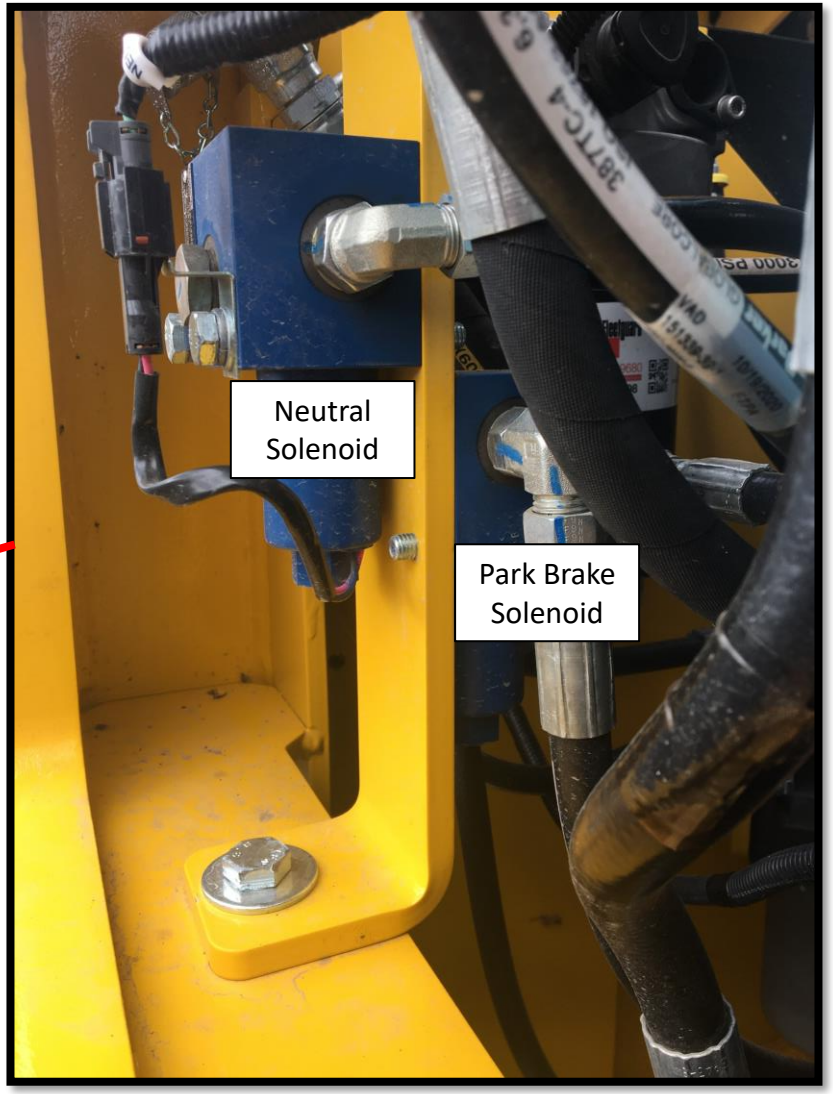
SW994

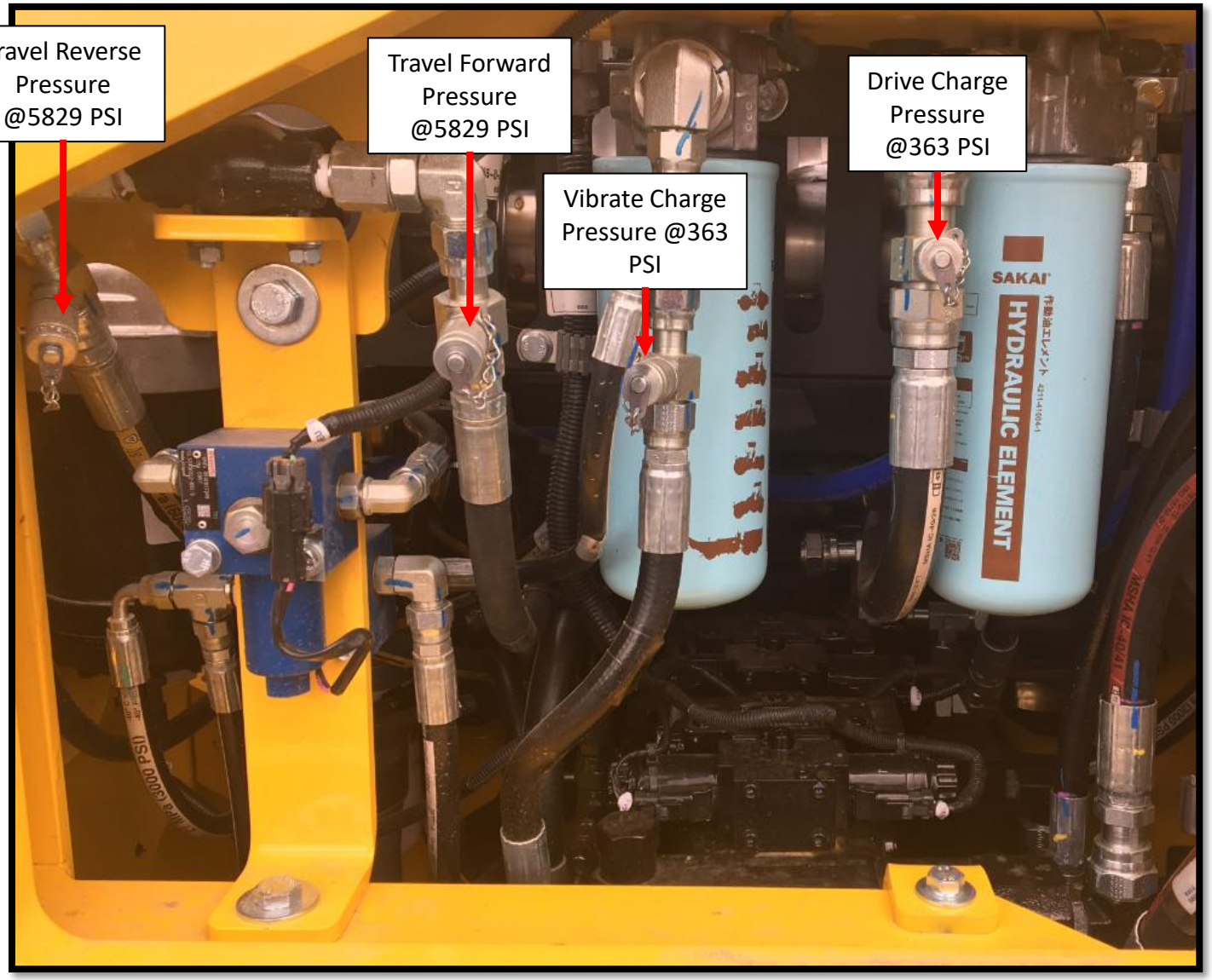

Forward Solenoid
Reverse Solenoid


SAKAI
HYDRAULIC ELEMENT


Neutral Solenoid
Park Brake Solenoid

SW994

Oil temperature during measurement : 50 ± 5°C (122 ± 9°F)



MEASUREMENT OF PROPULSION SERVO CIRCUIT PRESSURE

Oil temperature during measurement : 50 ±5°C (122 ±9°F)

① Disconnect hoses (1) and (3) from propulsion pump (2). Attach pressure gauge through adapter ⓦ.
- Adapter ⓦ : 4-4LOHL6G5TP (Parker part number)
- Pressure gauge : 0 to 5 MPa (0 to 725 psi)

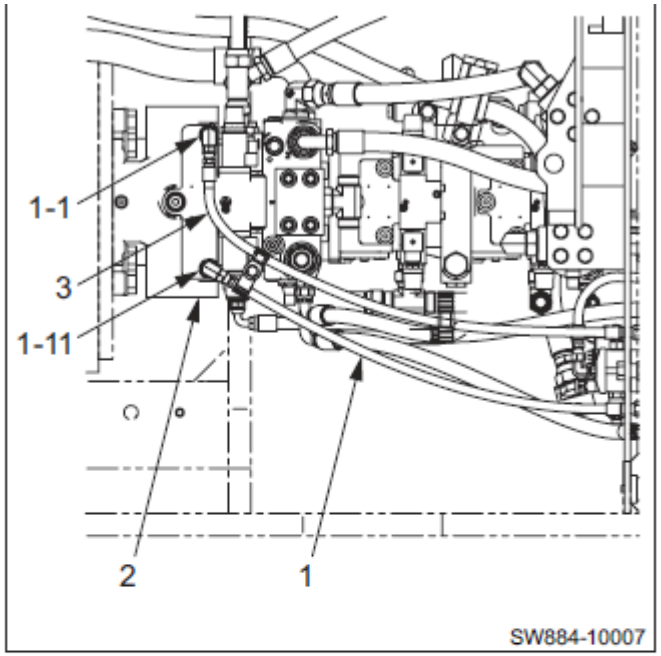
② Confirm that F-R lever is "N".

③ Apply parking brake by pressing parking brake switch button.

④ Start the engine and set throttle switch to "Full".

⑤ Operate F-R lever and then read pressure indicated by pressure gauge.
- With parking brake applied (ON), measured pressures of (1-1) and (1-11) are same.
- With parking brake released (OFF), measured pressures of (1-1) and (1-11) are different.

★ Standard charge relief pressure setting
: 2.5 ±0.2 MPa (362 ±29 psi)



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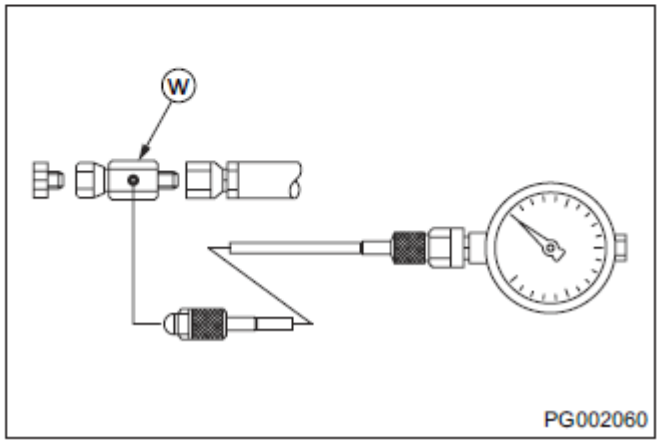


PG002060

MEASUREMENT AND ADJUSTMENT OF PROPULSION CHARGE CIRCUIT PRESSURE

Oil temperature during measurement : 50 ±5°C (122 ±9°F)

① Remove plug from coupling (1). Attach pressure gauge with hose ⓢ and connector ⓤ.
- Coupling : 7/16-20UNF×M16
- Adapter for hose ⓢ : M16 P=2.0
- Pressure gauge connector ⓤ : M16×G3/8
- Pressure gauge : 0 to 25 MPa (0 to 3,625 psi)

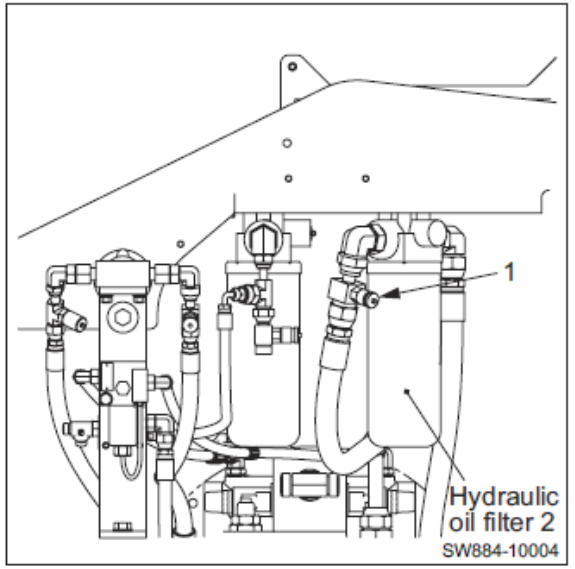
② Confirm that F-R lever is "N".

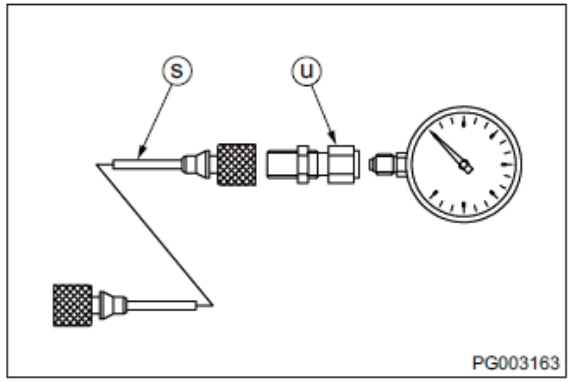
③ Apply parking brake by pressing parking brake switch button.

④ Start the engine and set throttle switch to "Full".

⑤ Read pressure indicated by pressure gauge.

★ Standard charge relief valve setting
: 2.5 ±0.2 MPa (363 ±29 psi)





① Check nut (1) of charge relief valve (1-15) for evidence of having loosened.

② If there is evidence of nut having loosened, adjust charge relief valve so that pressure becomes within standard charge relief valve setting range while watching pressure gauge.
- To adjust pressure, loosen nut and turn adjustment screw (2).

  Adjustment screw turned clockwise : Pressure rise
  Adjustment screw turned counterclockwise : Pressure drop
  Pressure change rate : 0.4 MPa/turn (58 psi/turn)

③ If there is no evidence of nut having loosened, remove it.

④ Check removed charge relief valve for trapped dirt and scratches on its seat.

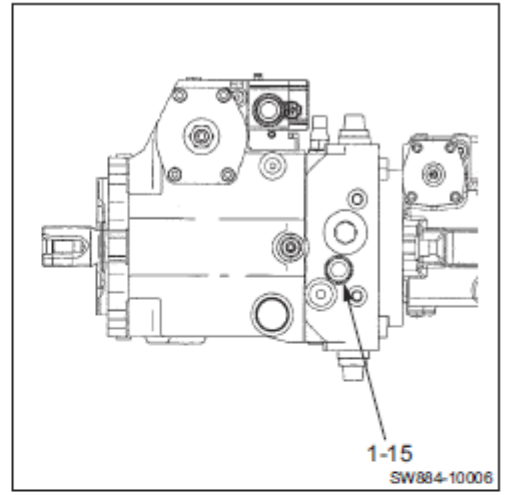
⑤ If trapped dirt is present, disassemble and clean charge relief valve.

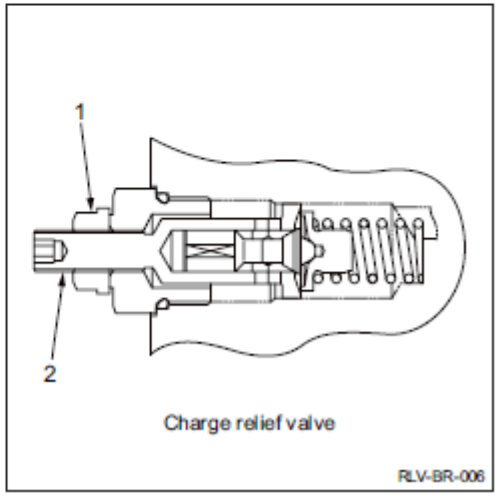
⑥ If a scratch is found on seat, replace charge relief valve.

⑦ After adjustment, measure pressure again and check that pressure reaches standard charge relief valve setting range.

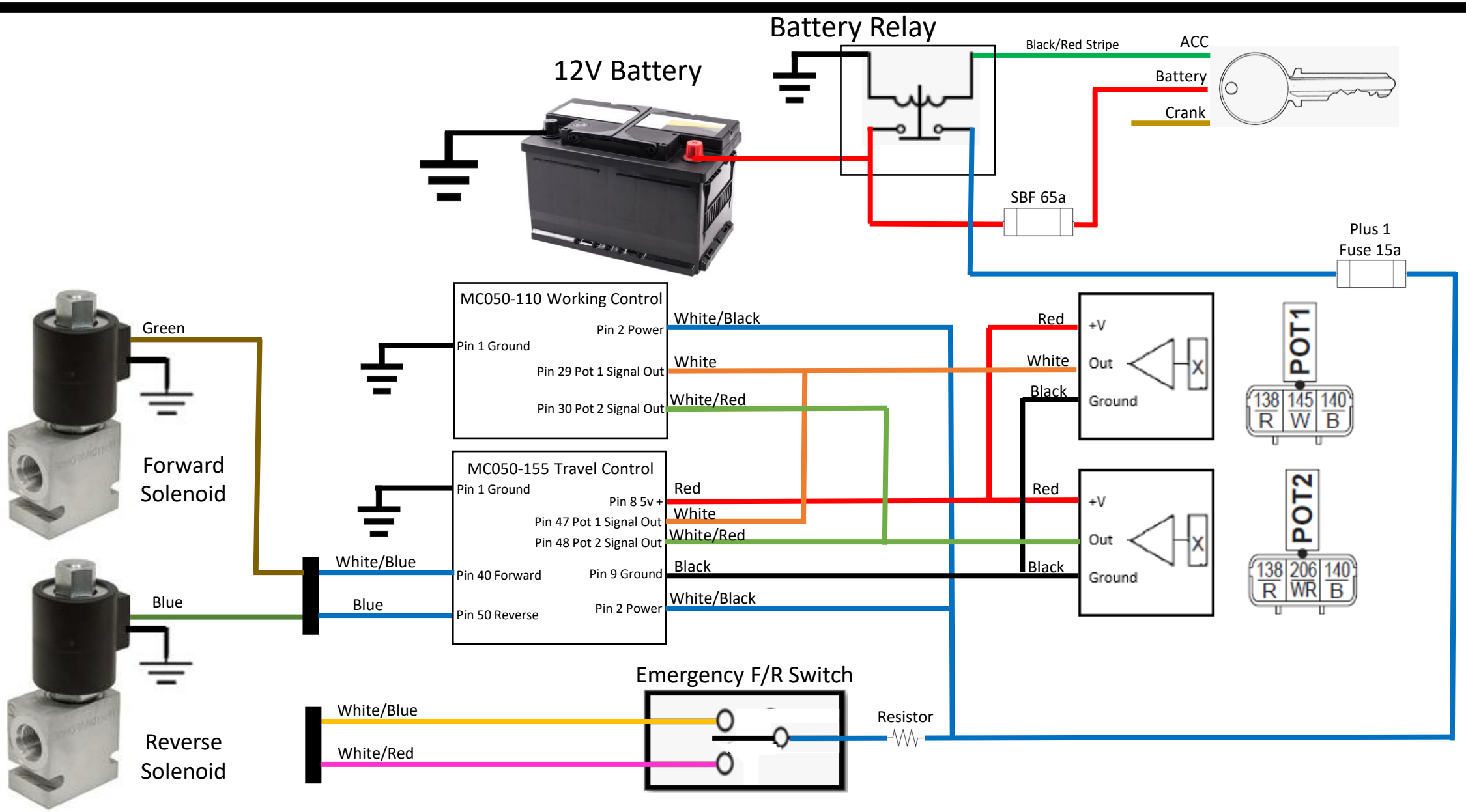
N·m (1) Nut : 44 N·m (32 lbf·ft)
(1-15) Charge relief valve : 70 N·m (52 lbf·ft)

(NOTICE)
- **Carefully disassemble and reassemble after taking steps to prevent foreign material from getting in.**





SW994


Battery Relay
12V Battery
Black/Red Stripe
ACC
Battery
Crank
SBF 65a
Plus 1
Fuse 15a
MC050-110 Working Control
Pin 1 Ground
Pin 2 Power
Pin 29 Pot 1 Signal Out
Pin 30 Pot 2 Signal Out
White/Black
White
White/Red
MC050-155 Travel Control
Pin 1 Ground
Pin 8 5v +
Pin 47 Pot 1 Signal Out
Pin 48 Pot 2 Signal Out
Pin 40 Forward
Pin 50 Reverse
Pin 9 Ground
Pin 2 Power
Red
White
White/Red
Black
White/Black
Green
Forward Solenoid
Blue
Reverse Solenoid
White/Blue
Blue
+V
Out
Ground
X
Red
White
Black
POT1
138 R
145 W
140 B
POT2
138 R
206 WR
140 B
Emergency F/R Switch
White/Blue
White/Red
Resistor

SW994

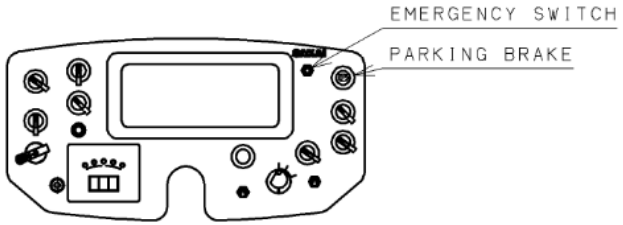
EMERGENCY SWITCH

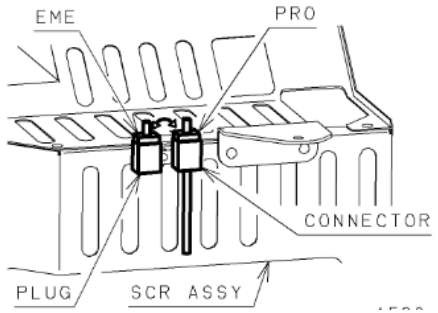
If the vehicle doesn't move when you operate the forward and reverse control lever while the engine is running, there maybe a problem with the control system.
In this case, you may bypass the controller to drive the vehicle temporary by following procedure shown below.

1. Push on the parking brake, stop the engine then make sure the emergency switch is in neutral position.
2. Identify the connectors "PRO" & "EME" on the SCR ASSY on the right side of the vehicle.
3. Remove the plugs from connector "EME" then exchange the connectors "PRO" to "EME".
4. Make sure the connectors are properly connected, close the hood but do not start the engine until you have checked the sorrounding area for obstacles.
   Also, make sure that the emergency switch and traveling direction of the vehicle are the same. Now it will be safe to move the machine to a safe area.
5. Contact your service dealer to maintain the vehicle, after the vehicle is transported to a safe place.

If the vehicle will not move at this point there are other problems, you will have to tow the vehicle to safe area.
When you exchange connectors again, follow below procedure.

- Push on the parking brake.
- Stop the engine running.
- Be sure the emergency switch is in neutral.
- Contact your servicing dealer.



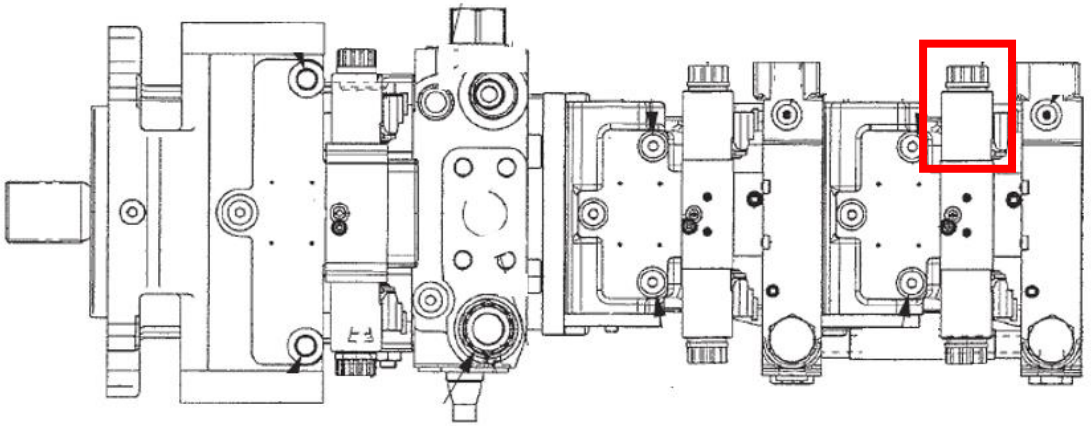


SW994

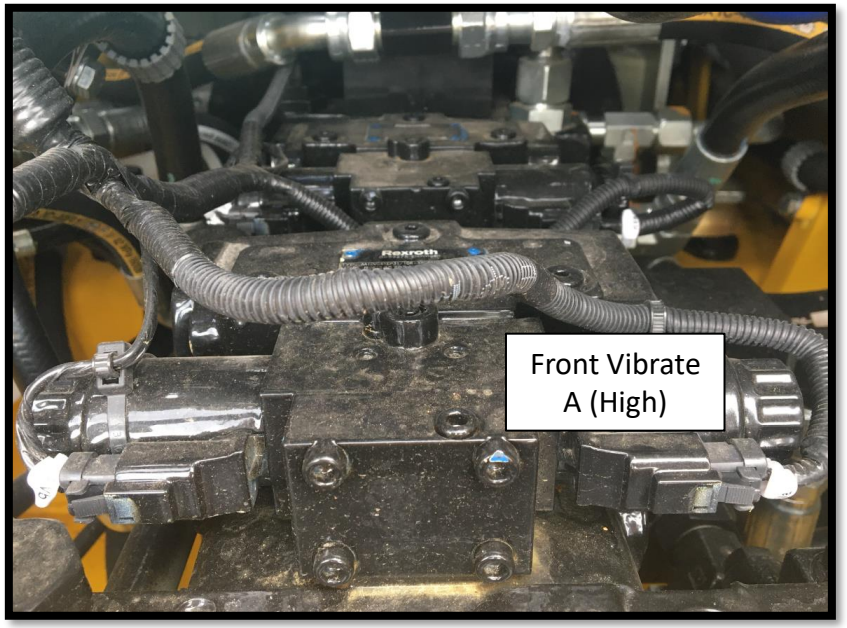
Will not Vibrate Front Drum High

Is there power at the Front Vibrate High Solenoid(Light Green)?

- No, Is there power at the Working Controller pin 43(Light Green wire)?
  - No, Are switches set to correctly?
    - No, See Ops Manual for proper setup.
    - Yes, The Ground on Pin 1 and Power on Pin 2?
      - No, Repair connection or inspect 15a Plus 1 Fuse.
      - Test Power across switch, Inspect Resistor unit and test Plus 1 controller.
  - Yes, Repair broken Light Green Wire.
- Yes, Test the ground wire on the coil, is the ground wire good?
  - Yes, Remove coil. Activate Front High Vibrate. Does coil magnetize?
    - Yes, Test coil for proper operation and test Vibrate Pressure.
    - No, replace defective coil.
  - No, repair ground wire and test.



Working Controller



SW994

Will not Vibrate Front Drum Low

Is there power at the Front Vibrate Low Solenoid(Brown Wire)?

No, Is there power at the Working Controller pin 42(Brown wire)?

No, Are switches set to correctly?

No, See Ops Manual for proper setup.

Yes, The Ground on Pin 1 and Power on Pin 2?

No, Repair connection or inspect 15a Plus 1 Fuse.

Test Power across switch, Inspect Resistor unit and test Plus 1 controller.

Yes, Repair broken Brown Wire.

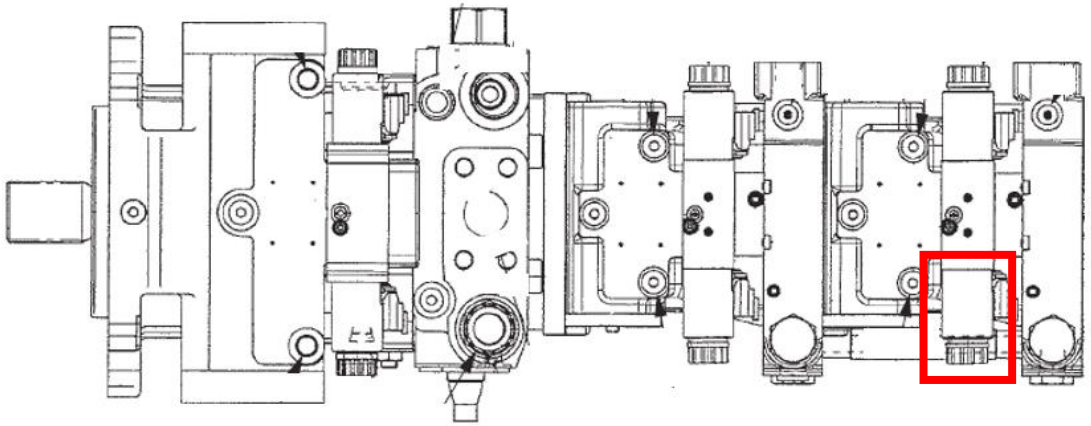
Yes, Test the ground wire on the coil, is the ground wire good?

Yes, Remove coil. Activate Front High Vibrate. Does coil magnetize?

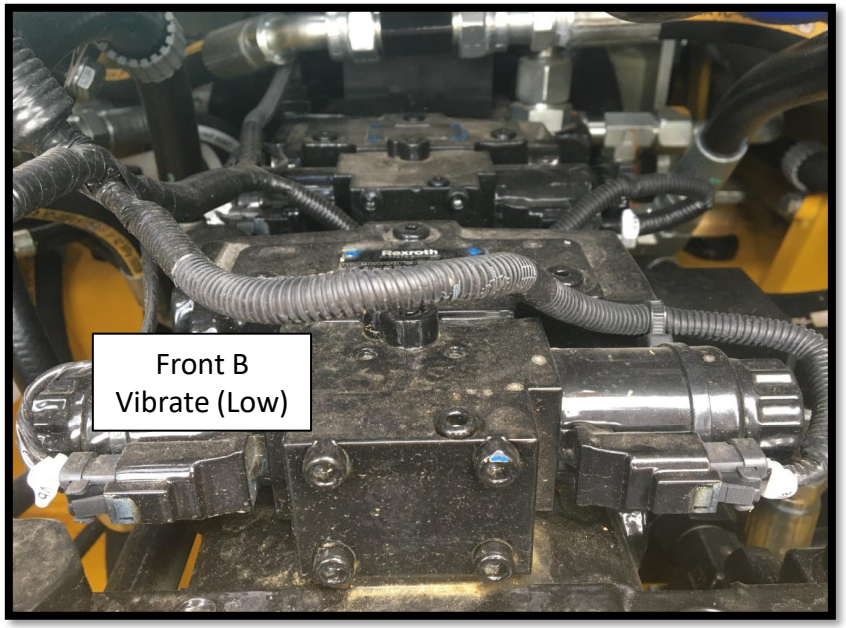
Yes, Test coil for proper operation and test Vibrate Pressure.

No, replace defective coil.

No, repair ground wire and test.



Working Controller

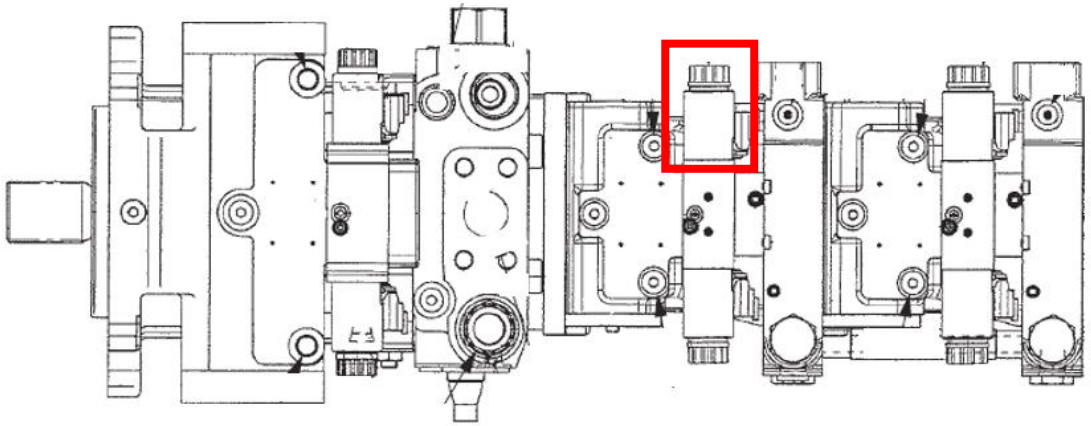


SW994

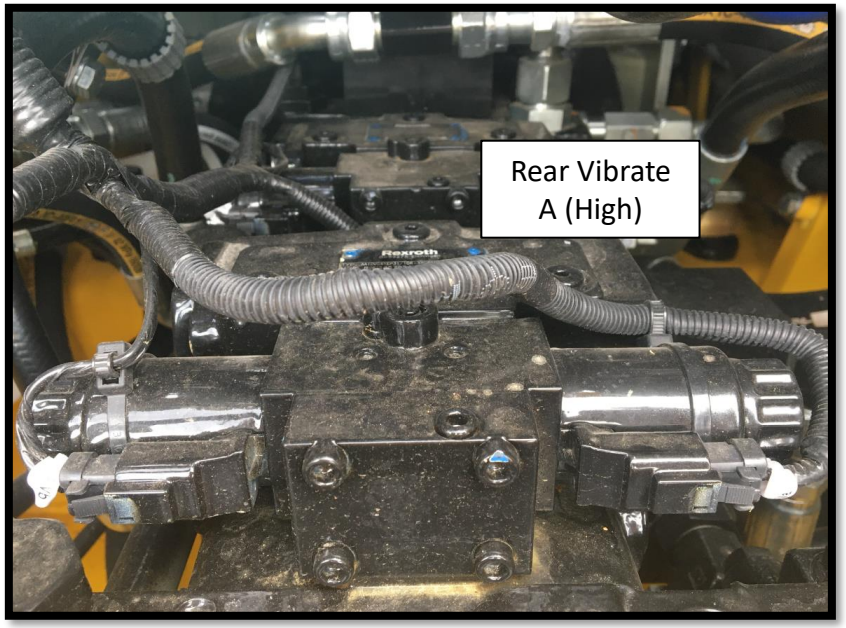
Will not Vibrate Rear Drum High

Is there power at the Rear Vibrate High Solenoid(Light Green/Black)?

- **No**, Is there power at the Working Controller pin 45(Light Green/Black wire)?
  - **No**, Are switches set to correctly?
    - **No**, See Ops Manual for proper setup.
    - **Yes**, The Ground on Pin 1 and Power on Pin 2?
      - **No**, Repair connection or inspect 15a Plus 1 Fuse.
      - Test Power across switch, Inspect Resistor unit and test Plus 1 controller.
  - **Yes**, Repair broken Light Green/Black Wire.
- **Yes**, Test the ground wire on the coil, is the ground wire good?
  - **Yes**, Remove coil. Activate Front High Vibrate. Does coil magnetize?
    - **Yes**, Test coil for proper operation and test Vibrate Pressure.
    - **No**, replace defective coil.
  - **No**, repair ground wire and test.



Working Controller

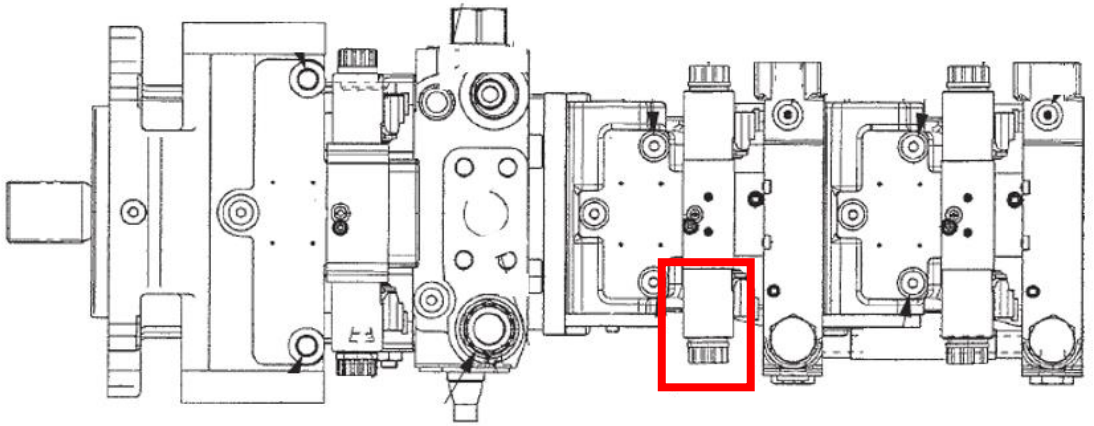


SW994

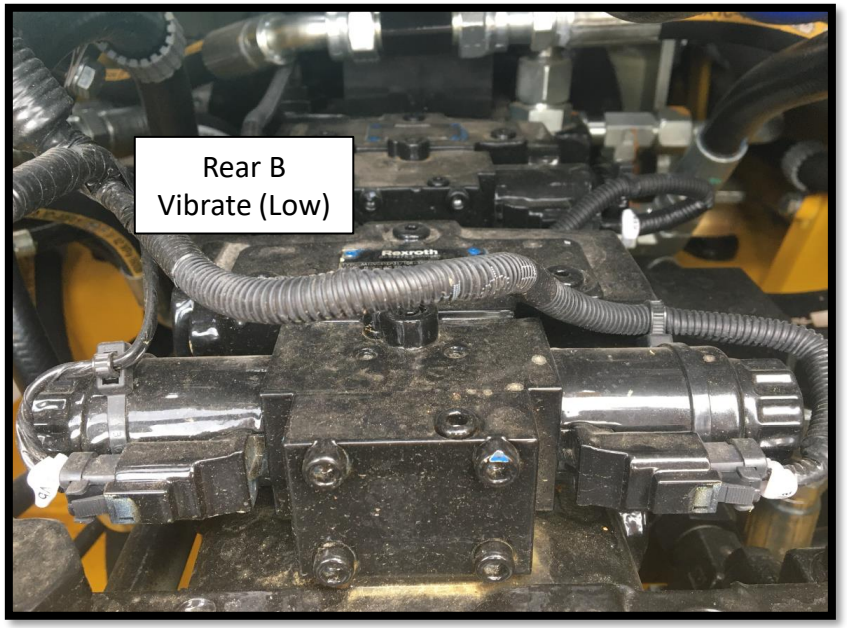
Will not Vibrate Rear Drum Low

Is there power at the Rear Vibrate Low Solenoid(Brown/White)?

- No, Is there power at the Working Controller pin 44(Brown/White)?
  - No, Are switches set to correctly?
    - No, See Ops Manual for proper setup.
    - Yes, The Ground on Pin 1 and Power on Pin 2?
      - No, Repair connection or inspect 15a Plus 1 Fuse.
      - Test Power across switch, Inspect Resistor unit and test Plus 1 controller.
  - Yes, Repair broken Brown/White.
- Yes, Test the ground wire on the coil, is the ground wire good?
  - Yes, Remove coil. Activate Front High Vibrate. Does coil magnetize?
    - Yes, Test coil for proper operation and test Vibrate Pressure.
    - No, replace defective coil.
  - No, repair ground wire and test.



Working Controller



MEASUREMENT AND ADJUSTMENT OF VIBRATOR CIRCUIT PRESSURE

- Oil temperature during measurement : 50 ± 5°C (122 ± 9°F)

① Remove plugs from high pressure gauge port (2-3),(2-11),(3-3) and (3-11) of vibrator pump (F),(R). Attach pressure gauge with adapter ⓨ .
- Adapter ⓨ : 7/16-20UNF
- High pressure gauge port : (2-3),(3-3) (Low amplitude/Oscillation)
- High pressure gauge port : (2-11),(3-11) (High amplitude/Normal)
- Pressure gauge : 0 to 50 MPa (0 to 7,250 psi)

② Confirm that F-R lever is "N".

③ Apply parking brake by pressing parking brake switch button.

④ Set vibratory drum select switch to " Ⓕ Ⓡ ".

⑤ Set vibration mode change switch to " ".

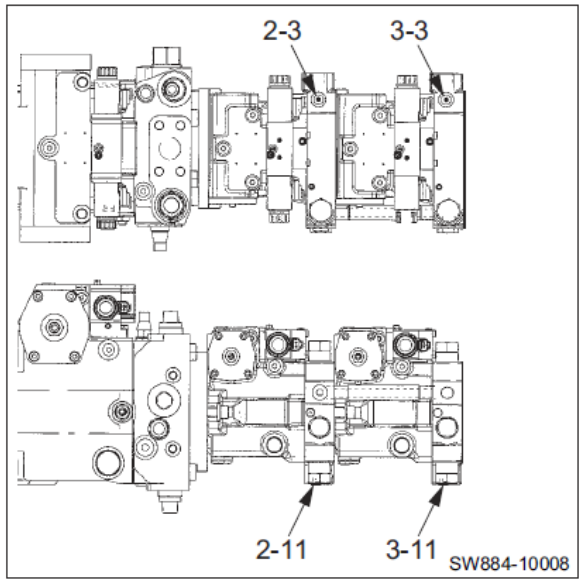
⑥ Start the engine and set throttle switch to "Full".

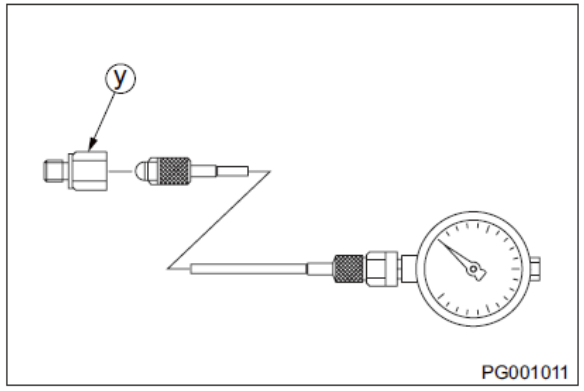
⑦ Press F-R lever vibration switch ON.

⑧ Read pressure gauge for maximum value of vibrator circuit pressure.

⑨ Press F-R lever vibration switch OFF as soon as measurement is finished.

★ Maximum circuit pressure (cut off valve setting)
: 31.5 ± 1.0 MPa (4,568 ± 145 psi)





① Check high pressure relief valve (2-7), (2-10), (3-7), or (3-10) for evidence of having loosened.
- High pressure relief valve : (2-7),(3-7) (High amplitude/Normal)
- High pressure relief valve : (2-10),(3-10) (Low amplitude/Oscillation)

② If there is evidence of high pressure relief valve having loosened, adjust it so that pressure becomes within maximum circuit pressure range while watching pressure gauge.

③ Remove high pressure relief valve.

④ Remove lock screw (3).

⑤ Turn adjustment screw (4) to adjust pressure.
Adjustment screw turned clockwise : Pressure rise
Adjustment screw turned counterclockwise : Pressure drop
Pressure change rate : 4.5 MPa/turn (653 psi/turn)

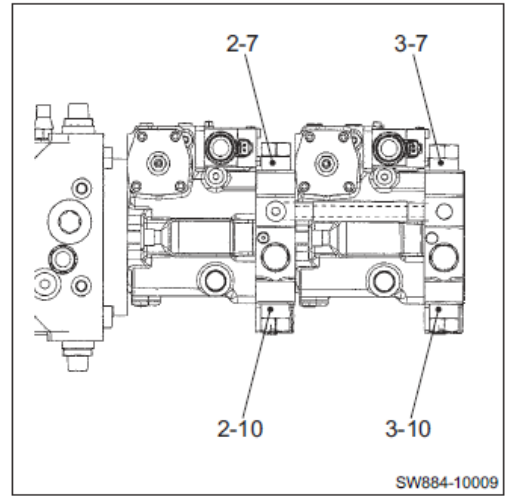
⑥ If there is no evidence of high pressure relief valve having loosened, remove it.

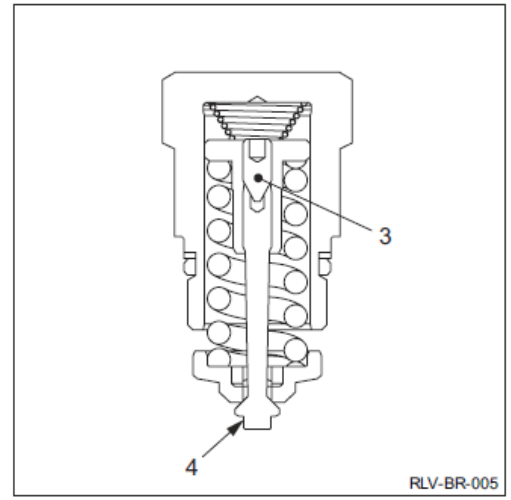
⑦ Check removed high pressure relief valve for trapped dirt and scratches on its seat.

⑧ If trapped dirt is present, disassemble and clean high pressure relief valve.

⑨ If a scratch is found on seat, replace high pressure relief valve.

⑩ After adjustment, measure pressure again and check that pressure reaches maximum circuit pressure range.





MEASUREMENT AND ADJUSTMENT OF VIBRATOR CHARGE CIRCUIT PRESSURE

- Oil temperature during measurement : 50 ±5°C (122 ±9°F)

① Remove plug from coupling (1). Attach pressure gauge with hose ⓢ and connector ⓤ.

- Coupling : 9/16-18UNF×M16
- Adapter for hose ⓢ : M16 P=2.0
- Pressure gauge connector ⓤ : M16×G3/8
- Pressure gauge : 0 to 25 MPa (0 to 3,625 psi)

② Confirm that F-R lever is "N".

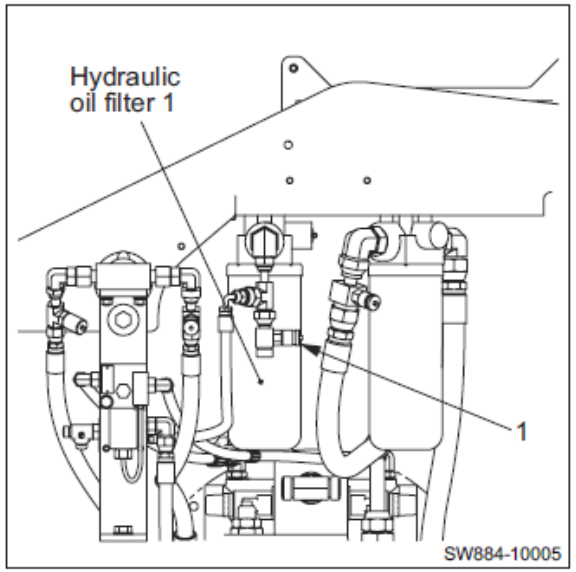
③ Apply parking brake by pressing parking brake switch button.

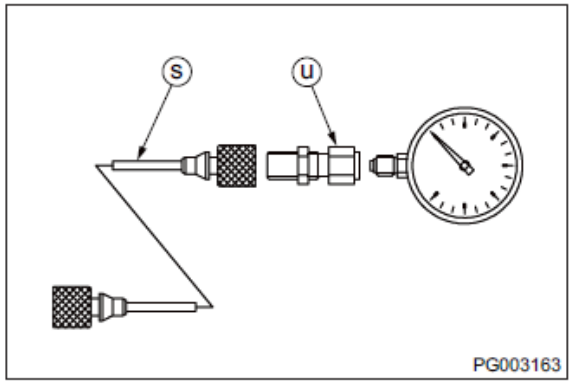
④ Start the engine and set throttle switch to "Full".

⑤ Read pressure indicated by pressure gauge.

★ Standard charge relief valve setting

: 2.5 ±0.2 MPa (363 ±29 psi)





① Remove charge relief valve (2-9).

② Check removed charge relief valve for trapped dirt and other abnormalities.

③ If trapped dirt is present, disassemble and clean charge relief valve.

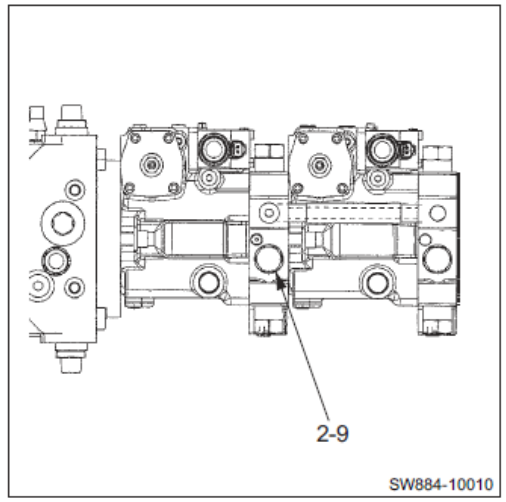
④ If pressure still deviates from standard charge pressure setting range after valve is disassembled and cleaned, replace charge relief valve.

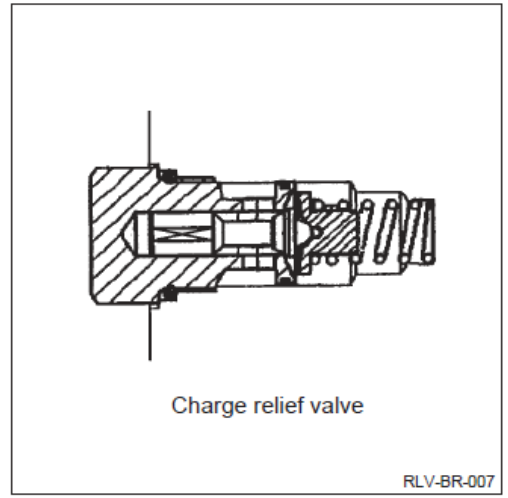
⑤ After adjustment, measure pressure again and check that pressure reaches standard charge relief valve setting range.

N·m (2-9) Charge relief valve : 90 N·m (66 lbf·ft)

(NOTICE)

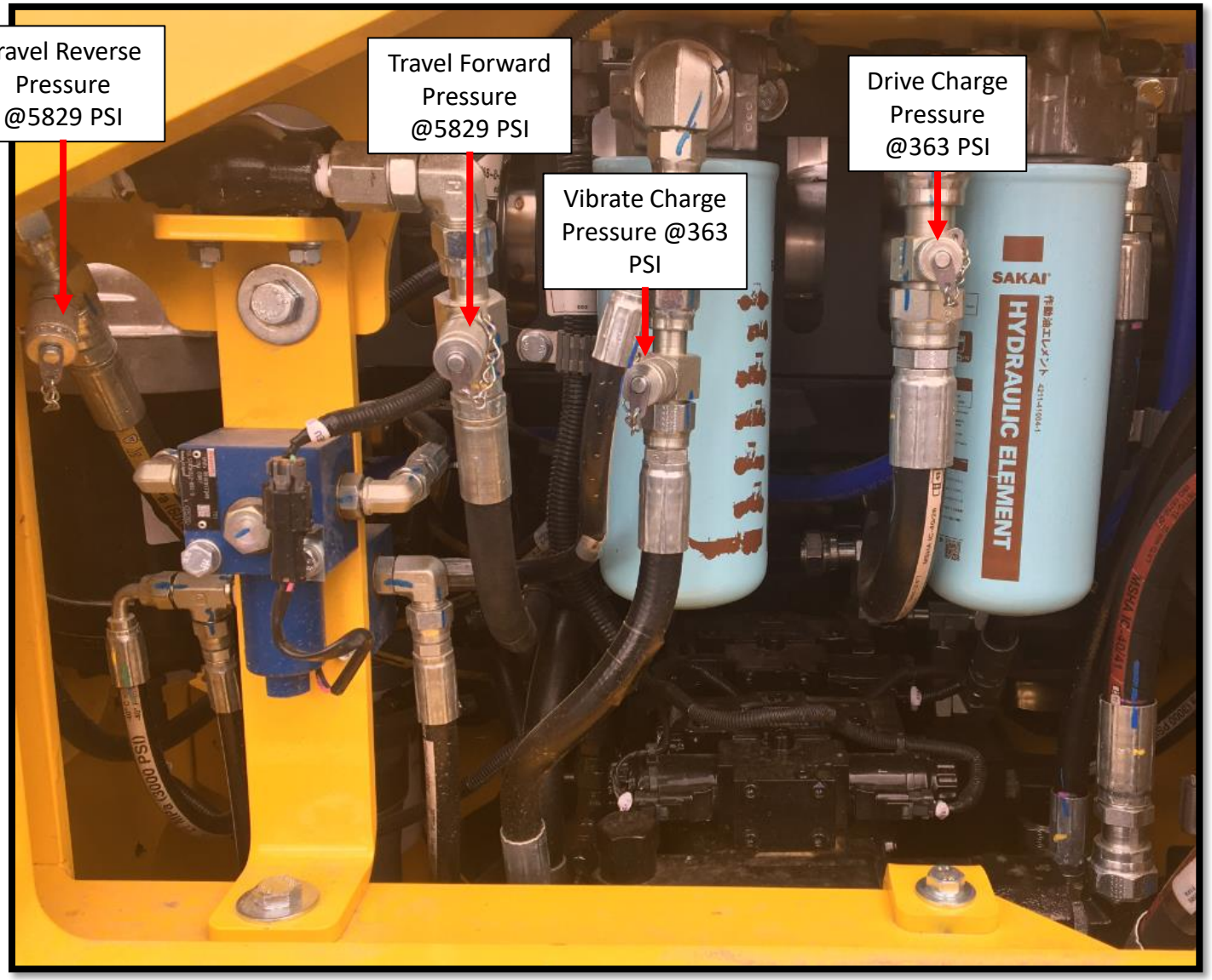
- **Carefully disassemble and reassemble after taking steps to prevent foreign material from getting in.**





SW994

Oil temperature during measurement : 50 ± 5°C (122 ± 9°F)



SW994

Light Green

Front
Vibrate High
Solenoid

Brown

Front
Vibrate Low
Solenoid

Light Green/Black

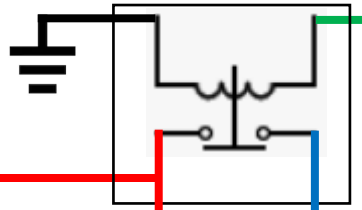
Rear Vibrate
High
Solenoid

Brown/White

Rear Vibrate
Low
Solenoid

12V Battery

Battery Relay

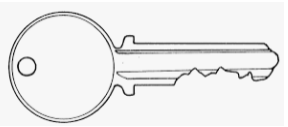


Black/Red Stripe

ACC

Battery

Crank



SBF 65a

F9
15a

Frequency
Vibrate Switch

POSITION	CONNECTION
2500	1-2,4-6
3000	1-3,4-6
4000	1-3,4-5

MC050-110
Working Control

Pin 43 Front
Vibrate High

Pin 42 Front
Vibrate Low

Pin 45 Rear
Vibrate High

Pin 44 Rear
Vibrate Low

Pin 31 Freq

Pin 32 Freq

Pin 33 Freq

Pin 14
Front Vibrate

Pin 15
Rear Vibrate

Green

Blue

Brown

Yellow/White

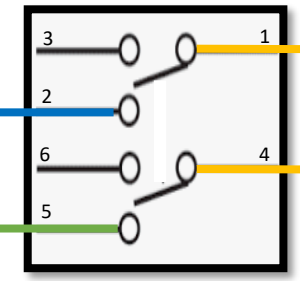
Yellow/White

Resistor Unit

Blue

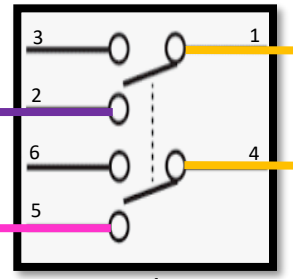
Green

Brown



Yellow/White

POSITION	CONNECTION
F R	1-2,4-6
F R	1-3,4-6
F R	1-3,4-5



Front/Rear
Vibrate Switch

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General Engine

Specifications

Listed below are the general specifications for this engine.

Horsepower	Refer to engine dataplate
Bore and Stroke	102 mm [4.02 in] x 115 mm [4.53 in]
Firing Order	1-3-4-2
Engine Weight (with standard accessories):	
Dry Weight for 3.8 liter engine [231 C.I.D.]	348 kg [767 lb]
Crankshaft Rotation (viewed from the front of the engine)	**Clockwise**
Valve Clearance:	
Intake	0.330 mm [0.013 in]
Exhaust	0.584 mm [0.023 in]
Maximum Overspeed Capability (15 seconds maximum)	3750 rpm
Minimum Ambient Air Temperature for Unaided Cold Start	- 12.2°C [10°F]
Minimum Engine Cranking Speed	120 rpm
Engine Idle Speed	700 rpm
Altitude Maximum Before Derate Occurs	
3.8 liter engine	1676 m [5500 ft]
Oil Carryover:	
Open crankcase ventilation system	Less than 2 grams/hour [0.07 oz/hr]
Engine Blowby (with orifice size 5.61 mm [0.221 in]):	
New	101.6 mm H_2O [4.0 in H_2O]
Used	431.8 mm H_2O [17.0 in H_2O]

Lubricating Oil System

Specifications

Oil Pressure	
Low idle (minimum allowed)	69 kPa [10 psi]
At rated speed (minimum allowed)	275 kPa [40 psi]
Oil-regulating valve-opening pressure range	525 kPa to 600 kPa [76 psi to 87 psi]
Oil filter differential pressure to open bypass	345 kPa [50 psi]
Lubricating oil filter capacity	0.85 liters [0.9 qt]
Oil Temperature	
Maximum oil temperature	135°C [275°F]
Oil Capacity of Standard Engine	
Option 1 - Low Capacity Rear Sump Oil Pan	
Pan **only**	8 liters [8.4 qt]
Total system	10.6 liters [11.2 qt]
High to low (on dipstick)	1.5 liters [1.6 qt]
Option 2 - High Capacity Rear Sump Oil Pan	
Pan **only**	12 liters [12.8 qt]
Total system	14.6 liters [15.4 qt]
High to low (on dipstick)	2 liters [2.1 qt]

Fuel System

Specifications

For performance and fuel rate values, see the Engine Data Sheet.

Maximum Fuel Inlet Restriction - With gear pump **only** (at gear pump inlet)	41 kPa [12 in-Hg]
Rail Pressure	250 to 2,000 bar [3,626 to 29,008 psi]
Maximum Fuel Pressure Range at Fuel Filter Outlet (engine cranking) - With gear pump **only**	207 to 750 kPa [30 to 109 psi] Maximum
Fuel Pressure Range at Fuel Filter Inlet (engine running) - With gear pump **only**	450 to 750 kPa [65 to 109 psi]
Maximum Fuel Drain Line Restriction	20 kPa [5.9 in-Hg]
Maximum Fuel Inlet Temperature	70°C [158°F]

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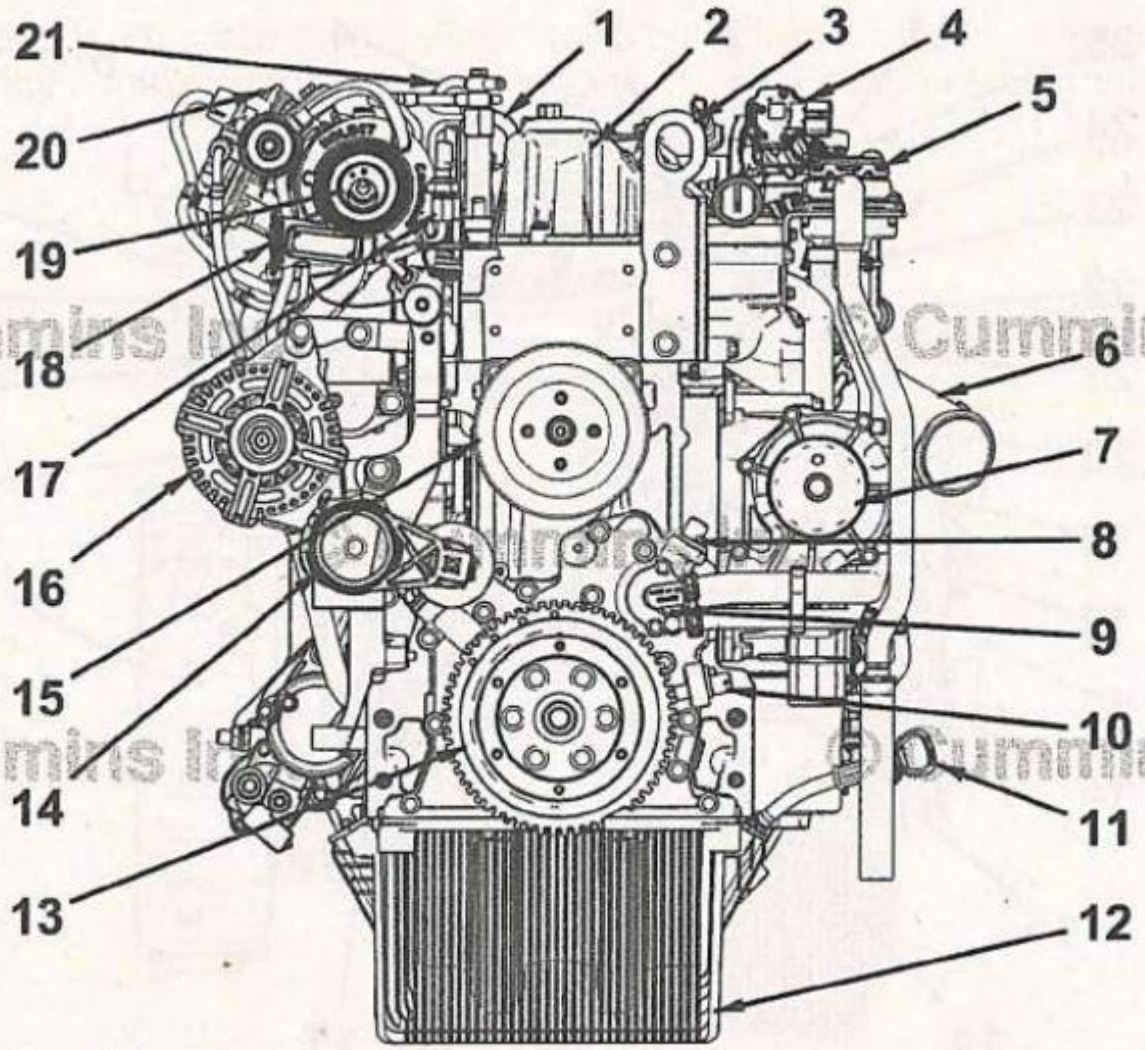

Front View

1 Rear engine lifting bracket
2 Rocker lever cover
3 Front engine lifting bracket
4 Exhaust gas recirculation (EGR) valve
5 Open crankcase ventilation valve
6 Air intake connection
7 Water pump pulley
8 Camshaft speed/position sensor
9 Crankcase breather adapter
10 Crankshaft speed/position sensor
11 Lubricating oil dipstick tube
12 Lubricating oil pan
13 Crankshaft pulley
14 Automatic belt tensioner
15 Fan drive pulley
16 Alternator
17 Exhaust pressure sensor
18 Wastegate turbocharger compressor outlet
19 Wastegate turbocharger compressor inlet
20 Exhaust pressure regulator
21 EGR coolant vent tube.

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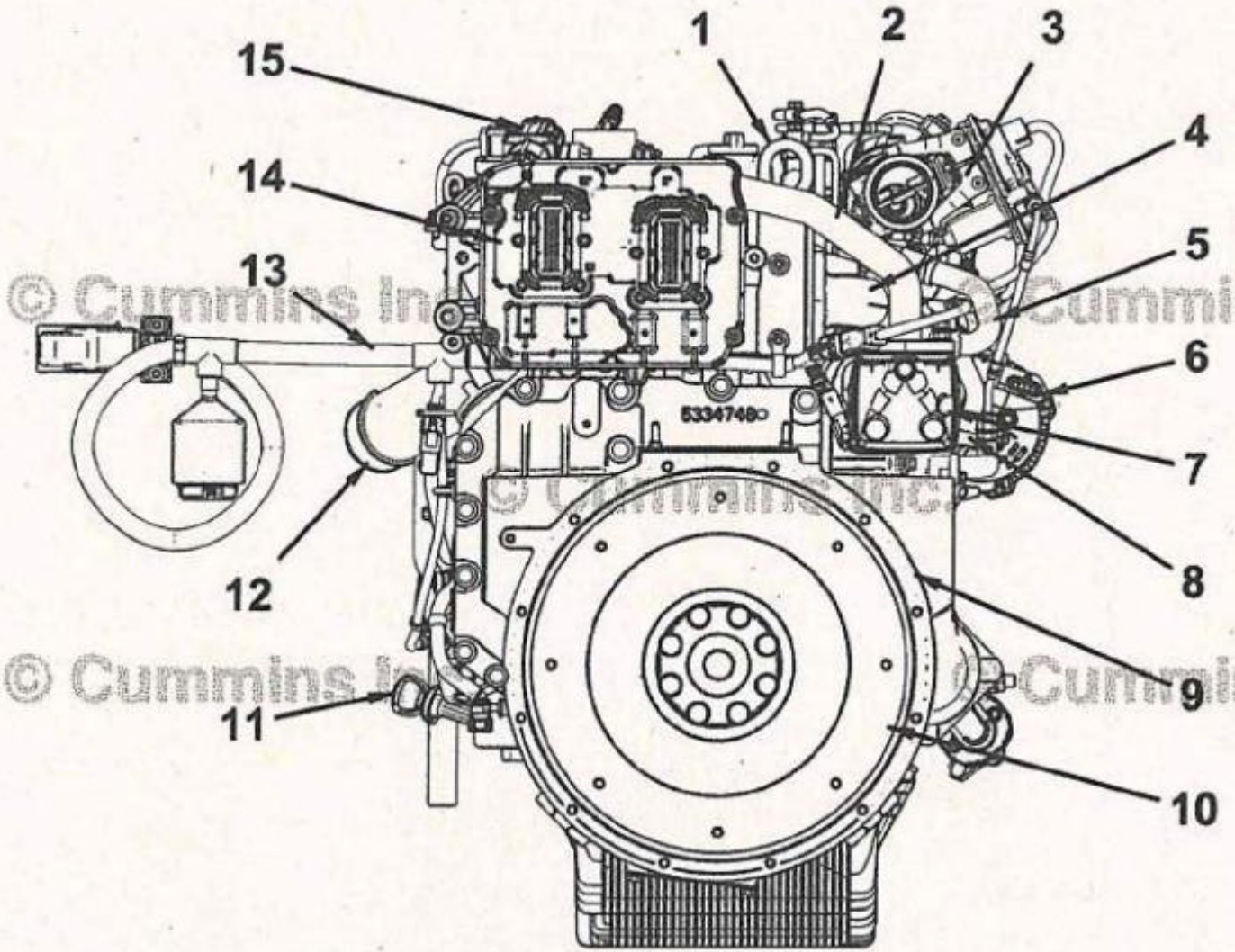

Rear View

1 Rear engine lifting bracket
2 EGR crossover tube
3 Exhaust pressure regulator
4 Exhaust manifold
5 EGR coolant outlet tube
6 Alternator
7 EGR cooler
8 EGR coolant inlet tube
9 Flywheel housing
10 Flywheel
11 Lubricating oil dipstick
12 Intake air connection
13 Wiring harness
14 ECM
15 EGR valve.

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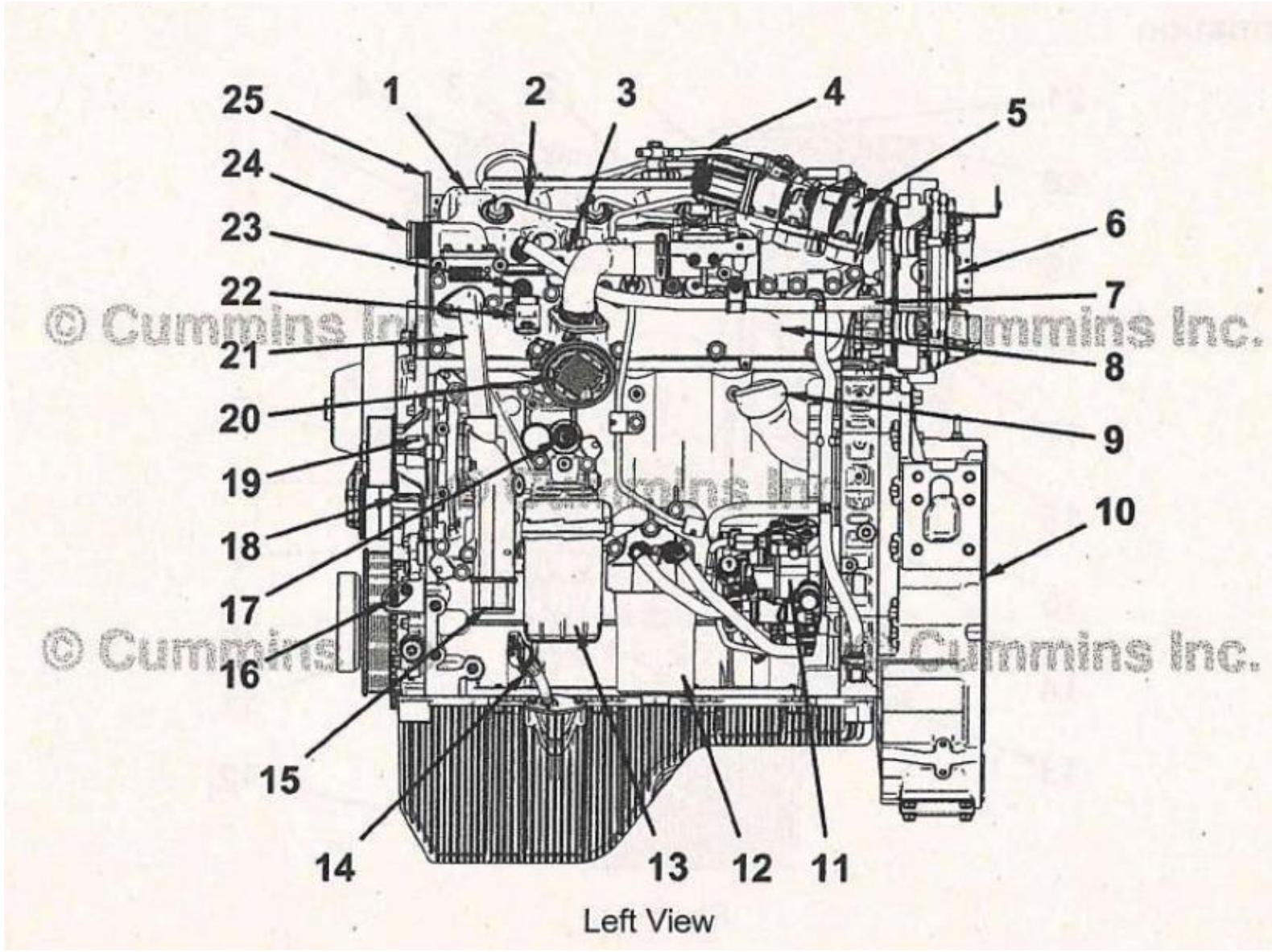

1 Rocker lever cover
2 Injector fuel supply line
3 Common rail fuel manifold
4 EGR coolant vent tube
5 EGR valve
6 Engine control module (ECM)
7 Fuel return line
8 Intake manifold
9 Lubricating oil fill cap
10 Flywheel housing
11 Fuel pump
12 Fuel filter
13 Lubricating oil filter
14 Lubricating oil dipstick
15 Water inlet connection
16 Crankshaft speed/position sensor
17 Oil pressure sensor
18 Camshaft speed/position sensor
19 Water pump
20 Intake air heater
21 Water bypass tube
22 Intake manifold pressure/temperature sensor
23 Engine coolant temperature sensor
24 Water outlet connection

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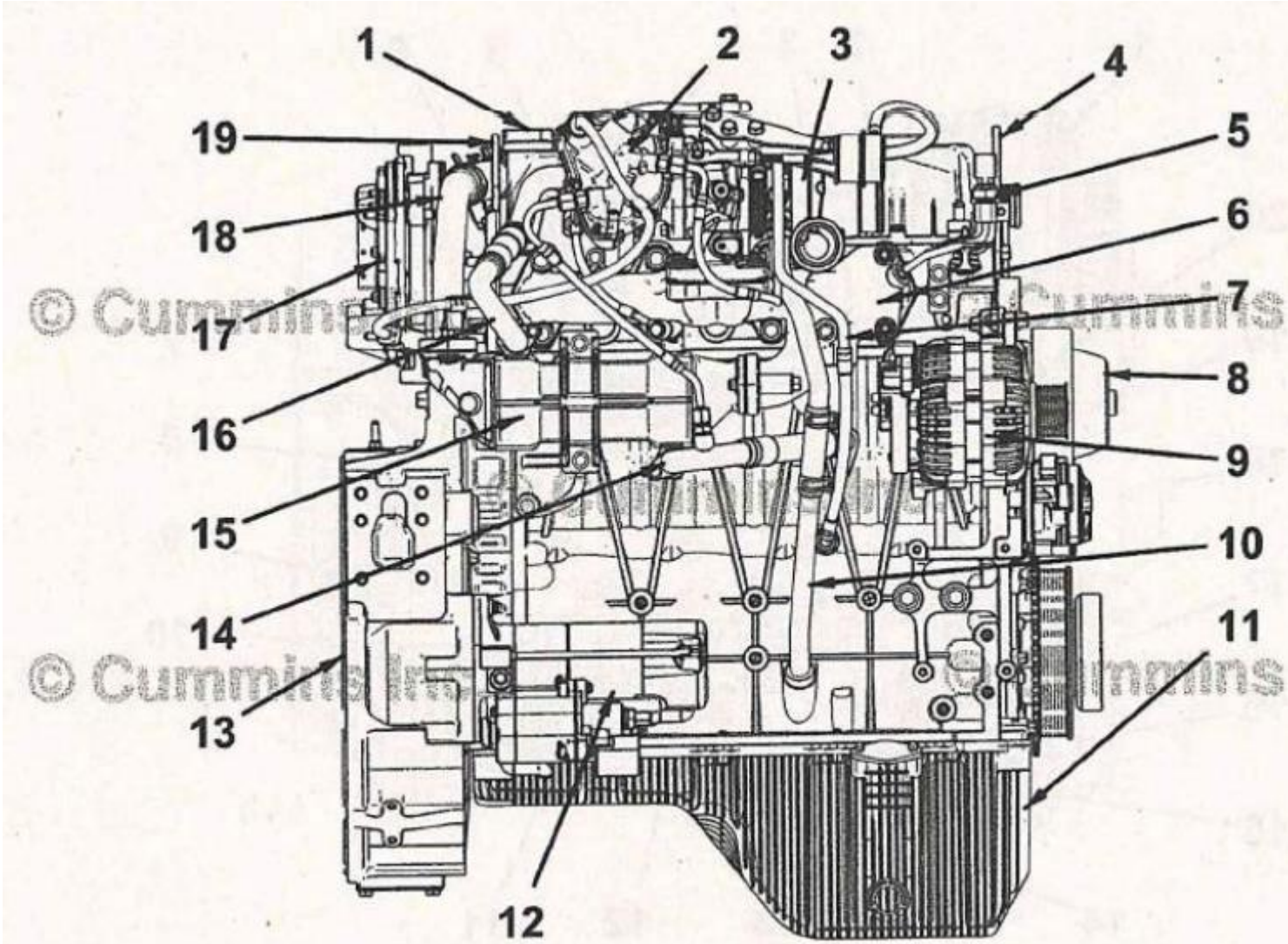
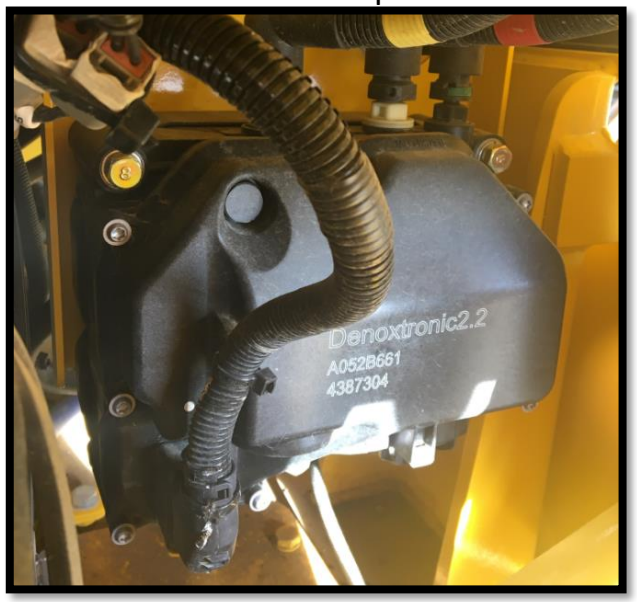


Right View

1 Lubricating oil fill cap
2 Exhaust pressure regulator
3 Wastegate turbocharger
4 Front engine lifting bracket
5 Exhaust pressure sensor
6 Exhaust manifold
7 Turbocharger lubricating oil supply tube
8 Fan hub
9 Alternator
10 Turbocharger lubricating oil drain tube
11 Lubricating oil pan
12 Starting motor
13 Flywheel housing
14 EGR cooler coolant inlet tube
15 EGR cooler
16 EGR cooler coolant outlet tube
17 ECM
18 EGR crossover tube
19 Rear engine lifting bracket.

SW994

DEF Pump



DEF Header

Aftertreatment Components

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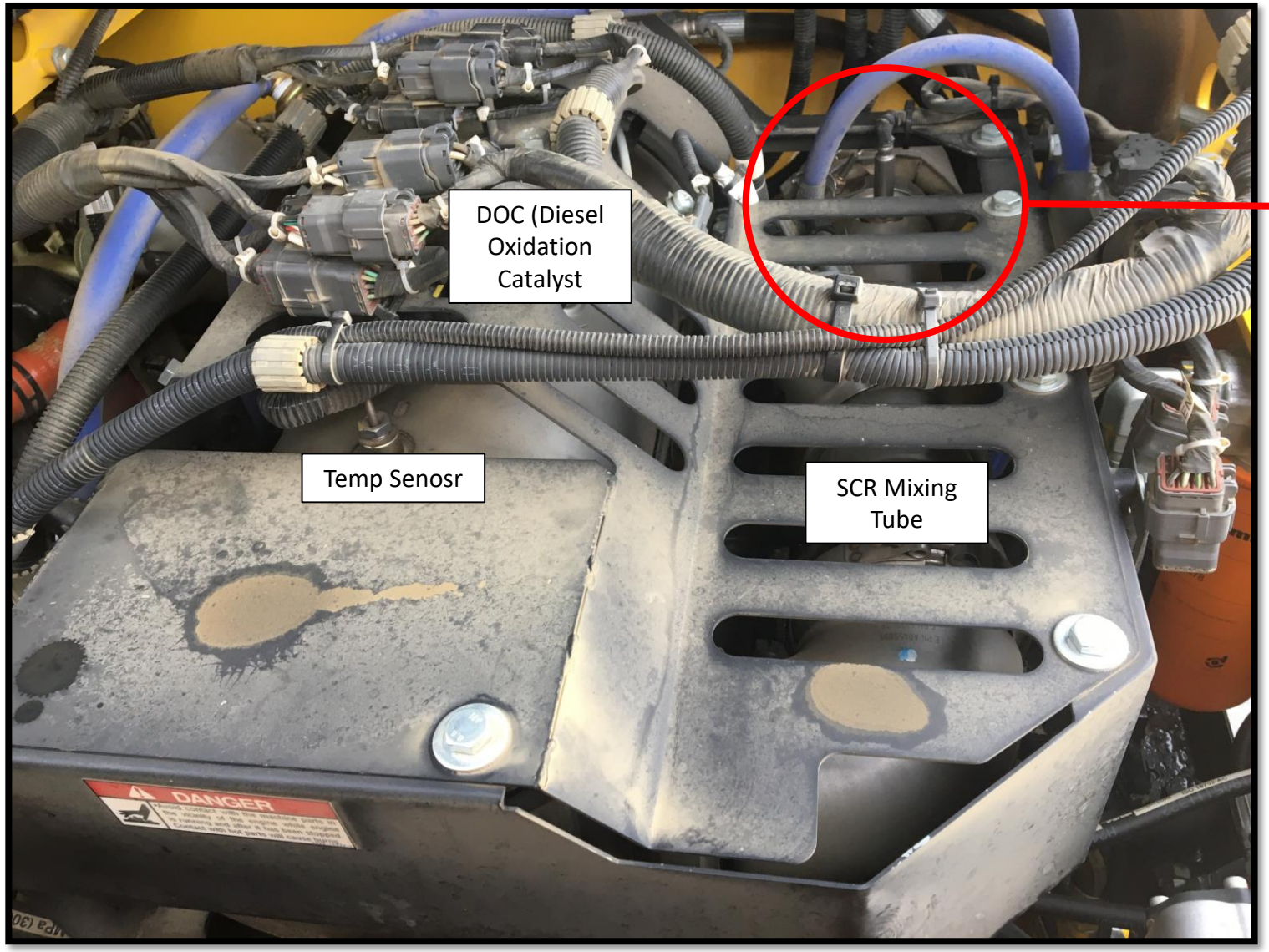
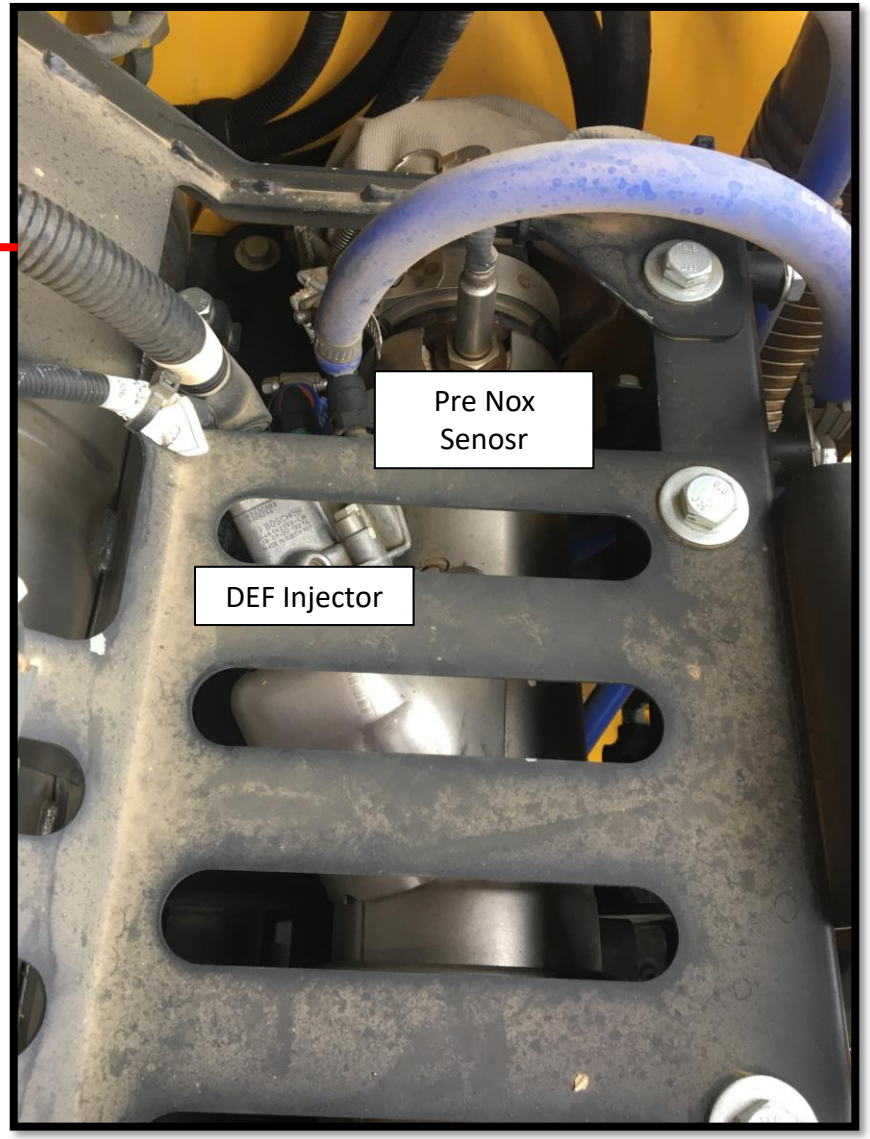
Aftertreatment Components





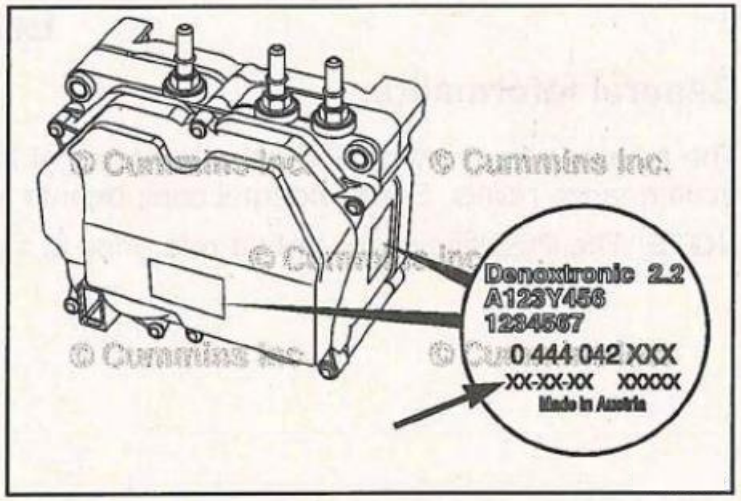
SW994

The aftertreatment DEF dosing unit identification is located on the side of the unit and contains the following information to assist in servicing or replacement.

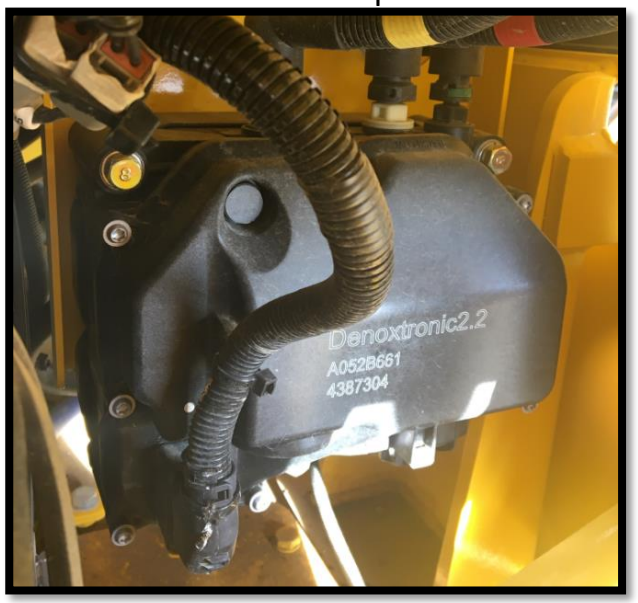
1 Cummins Emission Solutions™ partnumber
2 Cummins® part number
3 Bosch™ part number
4 Bosch™ production data (data code, serial number).

Example:

- A123Y456 is the Cummins EmissionSolutions™ part number
- 1234567 is the Cummins® part number
- 0 444 042 XXX is the Bosch™ partnumber
- XX-XX-XX is the date code
- XXXX is the serial number

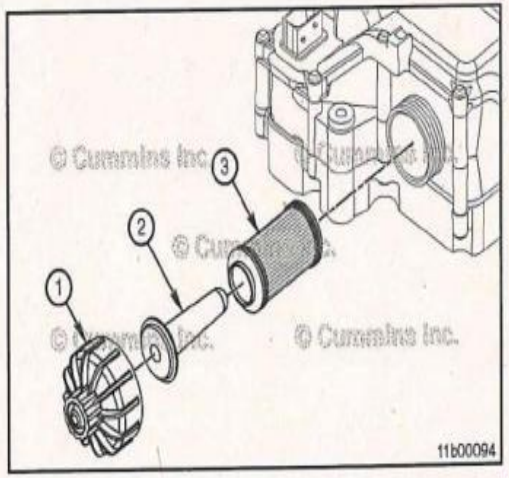


DEF Pump



The aftertreatment DEF dosing unit filter consists of the following components:

1 Aftertreatment DEF dosing unit filter cap
2 Aftertreatment DEF dosing unit filter equalizing element
3 Aftertreatment DEF dosing unit filter element.



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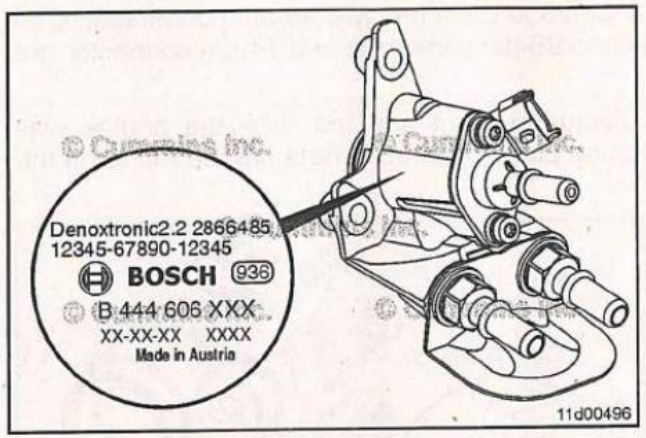
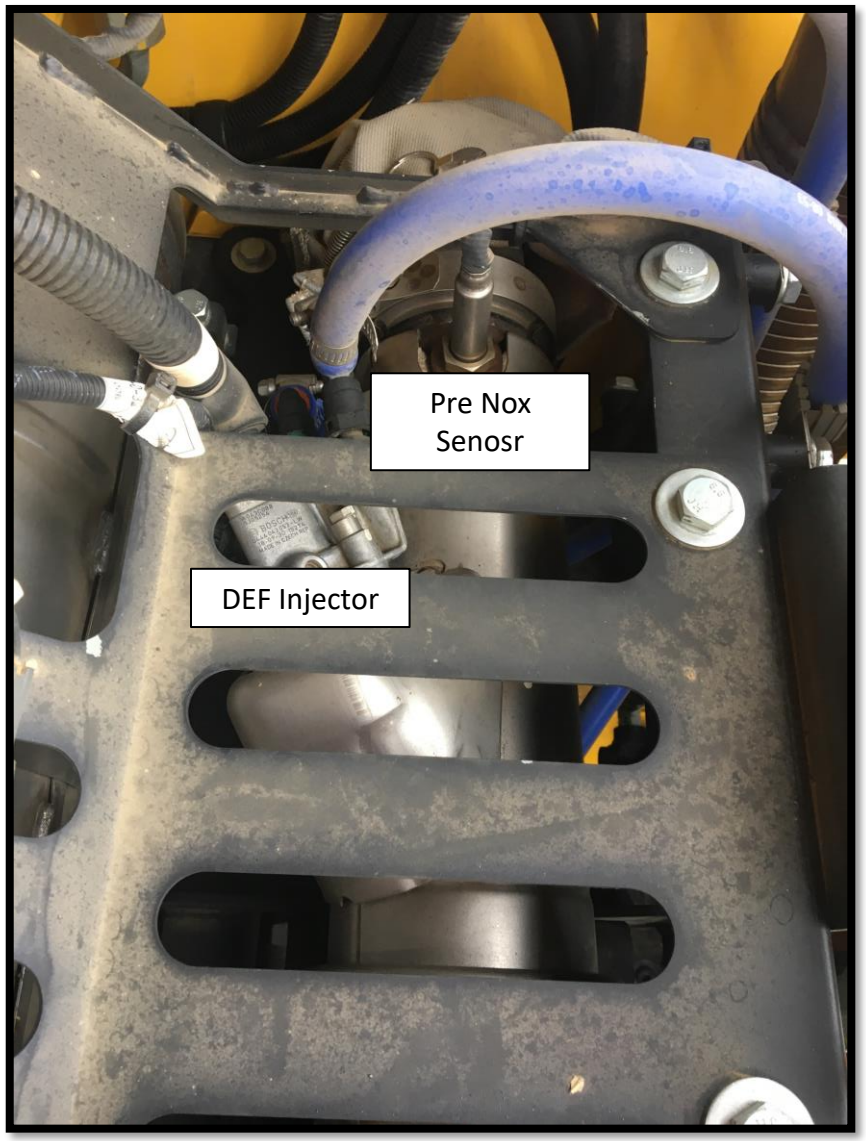


The aftertreatment diesel exhaust fluid dosing (DEF) valve identification is located on the side of the valve and contains the following information to assist in servicing or replacement.

1 Cummins® part number
2 Cummins Emission Solutions™ partnumber
3 Bosch™ part number
4 Bosch™ production data (data code,serial number).

Example:

- 2866485 is the Cummins® part number
- 12345-67890-12345 is the location for the Cummins Emission Solutions™ part number
- B 444 606 XXX is the Bosch™ part number
- XX-XX-XX is the date code
- XXXX is the serial number.



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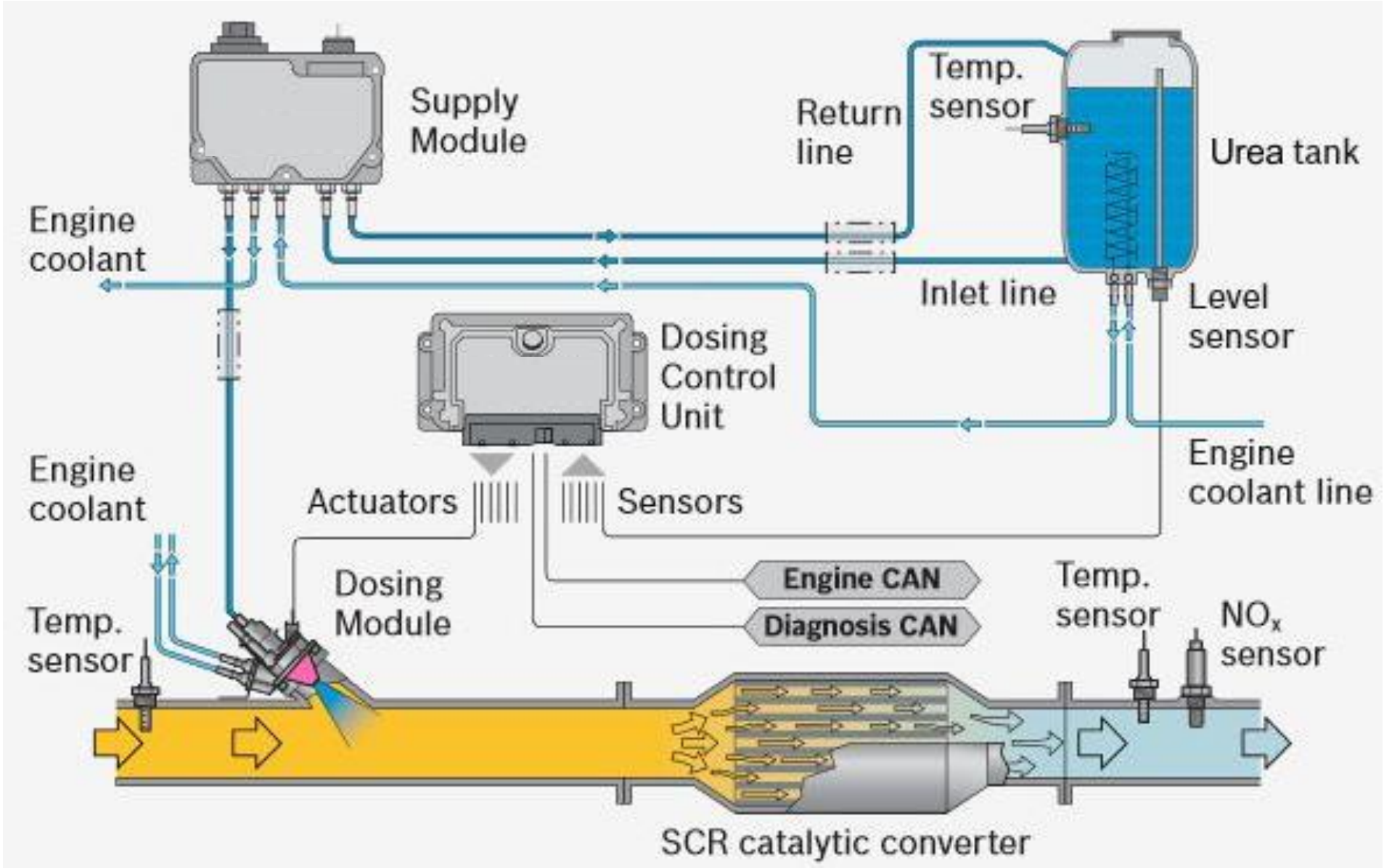
Supply Module
Return line
Temp. sensor
Urea tank
Engine coolant
Inlet line
Level sensor
Dosing Control Unit
Engine coolant line
Engine coolant
Actuators
Sensors
Engine CAN
Diagnosis CAN
Dosing Module
Temp. sensor
Temp. sensor
NO_x sensor
SCR catalytic converter

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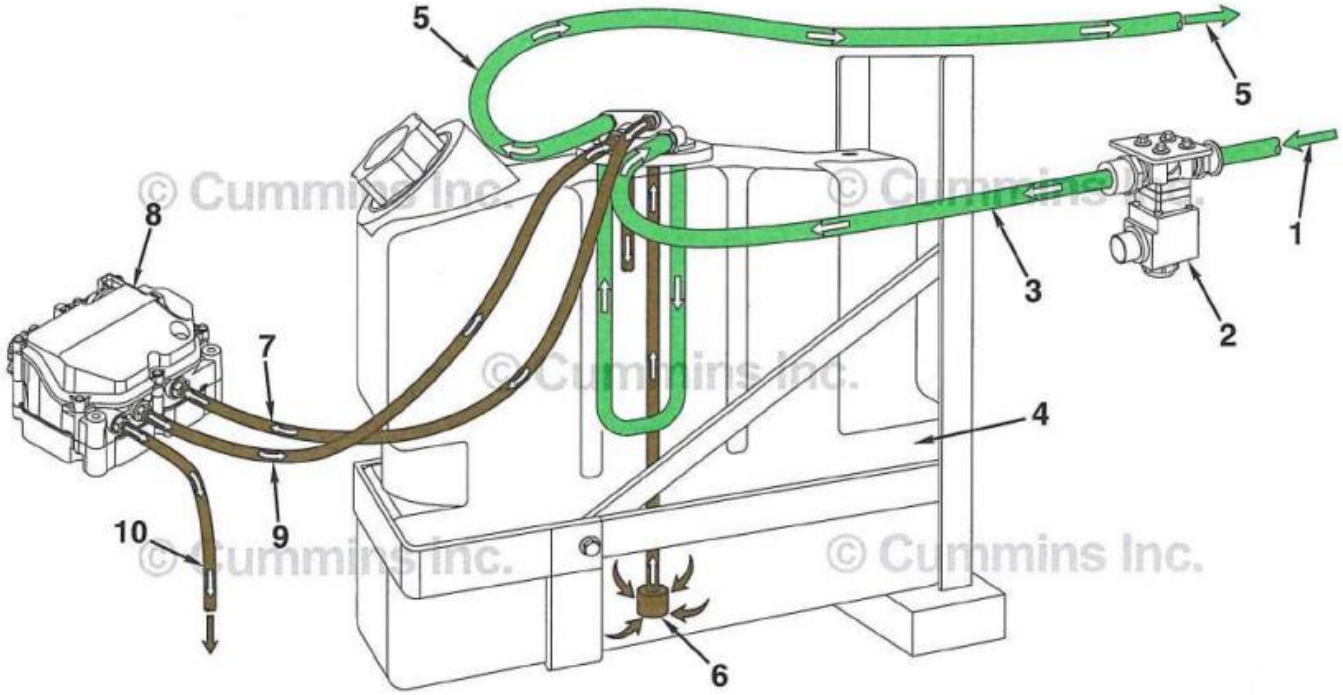

1 Coolant flow from engine
2 Aftertreatment DEF tank coolant valve
3 Coolant flow to aftertreatment DEF tank (only when aftertreatment DEF tank coolant valve is open)
4 Aftertreatment DEF tank
5 Coolant flow to engine
6 Aftertreatment DEF supply from aftertreatment DEF tank
7 Aftertreatment DEF flow to aftertreatment DEF dosing control valve
8 Aftertreatment DEF control valve
9 Aftertreatment DEF flow to aftertreatment DEF tank
10 Aftertreatment DEF flow to aftertreatment DEF dosing valve.

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