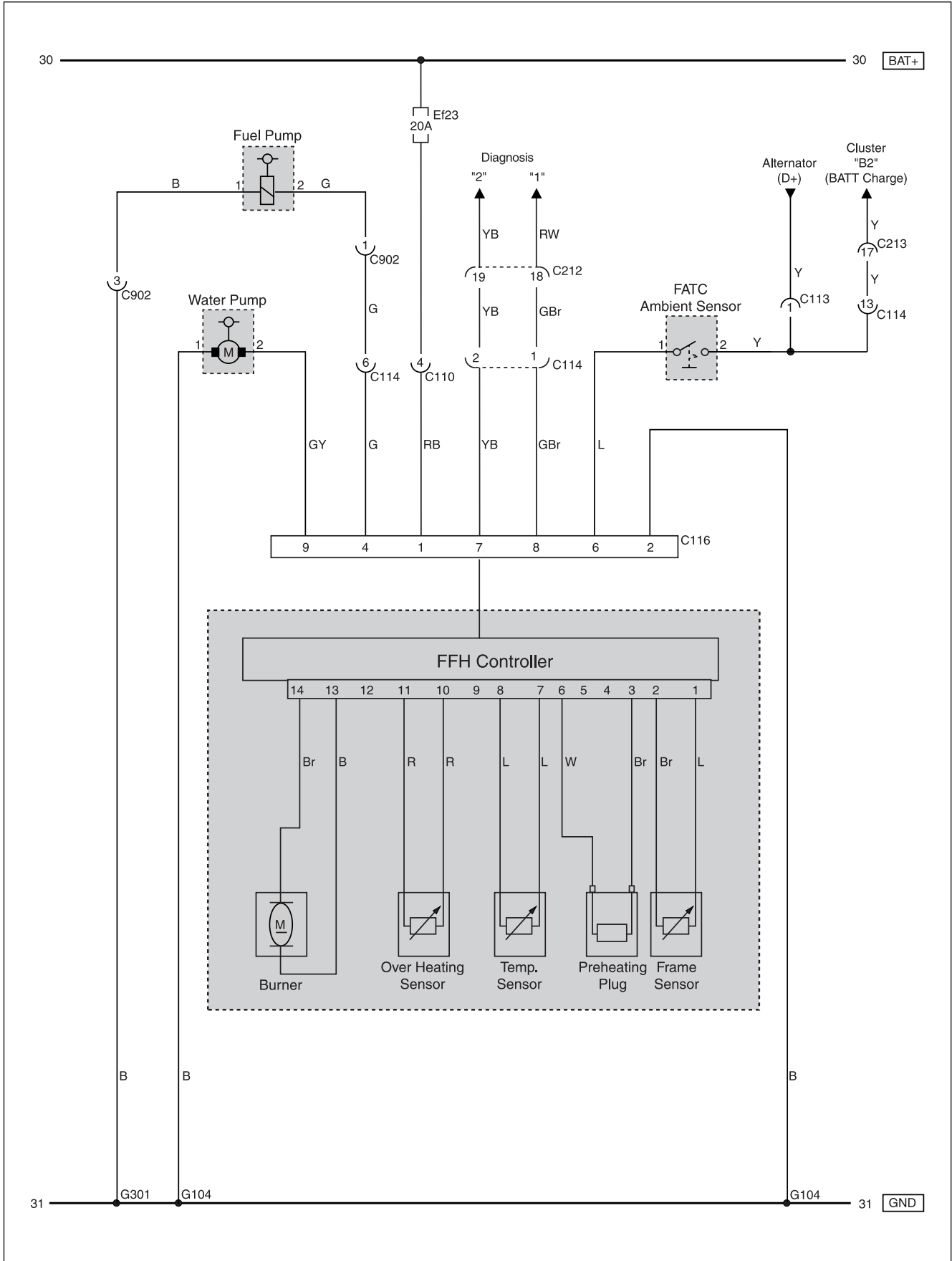


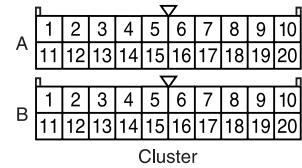
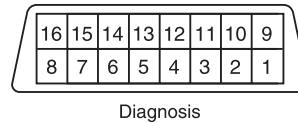
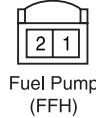
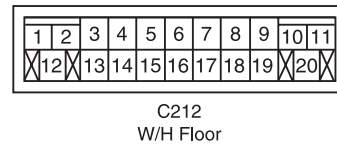
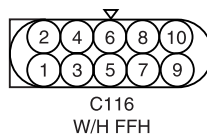
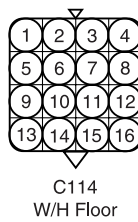
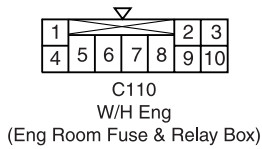
### 34. FFH (FUEL FIRED HEATER) 6910



**A. CONNECTOR INFORMATION**

Connector Number (Pin Number, Color)	Connecting Wiring Harness	Connector Position	Remark
C110 (18Pin, White)	W/H Eng - Eng Room Fuse & Relay Box	Eng Room Fuse & Relay Box	
C113 (2Pin, Black)	W/H Eng - W/H Alternator	Backside RH Head Lamp	
C114 (16Pin, Black)	W/H Eng - W/H Floor	Inside RH Fender PNL	
C116 (10Pin, Black)	W/H Eng - W/H FFH	Right Eng Room Dash PNL	FFH
C212 (20Pin, L/Green)	W/H Main - W/H Floor	Passenger Cowl Side C/Holder	
C213 (20Pin, Red)	W/H Main - W/H Floor	Passenger Cowl Side C/Holder	
C902 (4Pin, Black)	W/H Floor - W/H Fuel Sender	Upper the T/M	
G104	W/H Eng Room	Behind RH Head Lamp	
G301	W/H Floor	Under the Driver Seat	

**B. CONNECTOR IDENTIFICATION SYMBOL & PIN NUMBER POSITION**



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## C. CIRCUIT DESCRIPTION

### FFH (FUEL FIRED HEATER) SYSTEM

The system is to increase the coolant temperature quickly by firing diesel fuel in the burner that is installed in engine cooling system when in winter time the ambient temperature and engine coolant temperature is low. (Option)

FFH System consists of independent fuel lines, fuel pump, coolant circuit, coolant circulation pump, electrical glow plug and exhaust system by driver's intention because FFH system is automatically.

Operated according to the coolant temperature and the ambient temperature.

FFH system operates up to more than 2 minutes to burn the residual fuel inside the system when driver stop the engine during its operation. Therefore, a certain period of FFH operation after stopping the engine is not a malfunction.

### CONTROL AND SAFETY MODE

#### Heater operations and safety mode

1. If the fuel pump fails to ignite within 90 seconds after fuel pumping starts, the start procedure is repeated as described. If after a further 90 seconds fuel pumping the fuel pump still fails to ignite, the heater is switched off in fault mode.

The controller is locked after a certain number of failed starts.

2. If the flame does out by itself during operation, firstly a new start is activated. If the fuel pump fails to ignite within 90 seconds after fuel pumping has started again, the heater is switched off.
3. If the heater is overheated (lack of water, poorly vented cooling circuit), the overheating sensor triggers, the fuel supply is interrupted and the heater is switched off.
4. The heater is switched off if the lower or upper voltage limit is reached.
5. The fuel pump does not start when the glow plug is defect or electrical lead to the dosing pump is interrupted.
6. The fan motor speed is monitored continuously.  
If the fan motor does not start up, is blocked or if the speed falls below 40% of the nominal speed, the heater is switched off in fault mode after 60 seconds.
7. It is possible to diagnose the system by connecting the diagnostic device to controller. For details, refer to the "Diagnosis Procedures" section.

#### [Emergency shutdown]

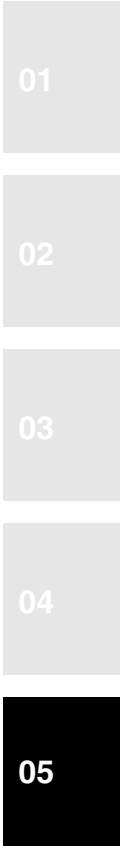
If an emergency shutdown -EMERGENCY OFF- is necessary during operation, proceed as follows;

- Pull the fuse (Ef6: 20A) out.
- Disconnect the heater from the battery.



**DTC (DIAGNOSIS TROUBLE CODE)**

Trouble Code	Trouble Description	Remedies
0	No faults	<ul style="list-style-type: none"> <li>• Measure battery voltage (must be &lt; 15.9V)</li> </ul>
10	Shutdown for overvoltage	<ul style="list-style-type: none"> <li>• Check alternator</li> <li>• Check alternator over voltage</li> </ul>
11	Shutdown for undervoltage	<ul style="list-style-type: none"> <li>• Measure battery voltage (must be &gt; 10.2V under load)</li> <li>• Check alternator</li> <li>• Check lead</li> </ul>
12	Overheating (software threshold)	<p>Temperature at overheating sensor &gt;125°C</p> <ul style="list-style-type: none"> <li>• Check cooling system:</li> <li>• Check the temperature sensor and overheating sensor, replace if necessary</li> </ul>
14	Overheating (difference evaluation)	<p>Difference in temperature values between surface sensor and control overheating sensor is too large. (Prerequisite for this trouble code display is that the heater is in operation and the water temperature at the overheating sensor has reached min. 80°C)</p> <ul style="list-style-type: none"> <li>• Check cooling system</li> <li>• Check the temperature sensor and overheating sensor, replace if necessary</li> </ul>
15	Overheating (operating block)	<p>The controller is locked.</p> <ul style="list-style-type: none"> <li>• Delete the fault memory to release the controller</li> <li>• Check cooling system</li> <li>• Check the temperature sensor and overheating sensor, replace if necessary</li> </ul>
16	Difference evaluation 2	<p>If the surface sensor has a far higher temperature value than the control overheating sensor, then the system proceeds with a fault shutdown.</p>
17	Overheating (hardware, device)	<p>Temperature at control overheating sensor &gt; 125°C</p> <ul style="list-style-type: none"> <li>• Check cooling system</li> <li>• Check the temperature sensor and overheating sensor, replace if necessary</li> </ul>
20	Glow plug interruption	<ul style="list-style-type: none"> <li>• Check cable harness for this component for damage and through current and replace component if necessary</li> <li>• Check plug-in connection, replace component if necessary</li> </ul>
21	Overload, short-circuit or ground contact, glow plug output	<ul style="list-style-type: none"> <li>• Check cable harness for this component for damage, replace component if necessary</li> </ul>
22	Glow plug output defect	<ul style="list-style-type: none"> <li>• Check cable harness for this component for damage, replace component if necessary</li> </ul>
25	Comunication line short	<ul style="list-style-type: none"> <li>• Check the line</li> </ul>



Trouble Code	Trouble Description	Remedies
30	Speed of combustion fan motor outside tolerable range	<p>Fan wheel or combustion air fan motor blocked (frozen, contaminated, stiff, cable harness scrapes on shaft end, ...)</p> <ul style="list-style-type: none"> <li>Eliminate blockage</li> <li>Measure speed of combustion air fan motor: <ul style="list-style-type: none"> <li>- dismantle combustion air fan</li> <li>- check with 8.2 V + 0.2 V, to do so, unclip the cable 0.75<sup>2</sup> black from chamber 13 of the 14-pin connector and the cable 0.75<sup>2</sup> brown from chamber 14. Apply marking (white paint) to the fan wheel and measure speed with contactless speed meter.</li> </ul> </li> </ul> <p>If the measured speed is outside a range of 8,800 rpm to 10,400 rpm, then replace the combustion fan. If the measured speed is within a range of 8800 rpm to 10400 rpm, then replace the controller.</p>
31	Burner motor interruption	<ul style="list-style-type: none"> <li>Check cable harness for this component for damage and through current</li> <li>Check plug-in connection, replace component if necessary</li> </ul>
32	Overload, short-circuit or ground contact, burner motor	<ul style="list-style-type: none"> <li>Fan wheel or combustion air fan motor blocked (contaminated, stiff)</li> <li>Check cable harness of this component for damage, if necessary replace component</li> </ul>
34	Burner motor output defect	<ul style="list-style-type: none"> <li>Check whether the lead to this component has a short-circuit to GND, if not, check component for ground contact, if necessary replace controller</li> </ul>
47	Overload, short-circuit or ground contact, fuel pump	<ul style="list-style-type: none"> <li>Check cable harness to the external component for damage and through current and replace external component if necessary</li> </ul>
48	Fuel pump interruption	<ul style="list-style-type: none"> <li>Check cable harness to the external component for damage and through current</li> <li>Check plug-in connection, replace external component if necessary</li> </ul>
49	Fuel pump output defect	<ul style="list-style-type: none"> <li>Check whether lead to this component has short-circuit to +Ub, if not, check component for ground contact, replace controller if necessary</li> </ul>
50	Operating block because too many start attempts in vain (10 start attempts, also one start repeat for every start attempt)	<p>Too many start attempts, the controller is locked</p> <ul style="list-style-type: none"> <li>Delete the fault memory to release the controller</li> <li>Check fuel quantity and fuel supply</li> </ul>
51	Time exceeded for cold blowing	<ul style="list-style-type: none"> <li>During start (no flame formed yet), the flame sensor reports temperature value too high for too long</li> <li>Check exhaust and combustion air</li> <li>Check flame sensor</li> </ul>



Trouble Code	Trouble Description	Remedies
52	Safety time exceeded	<ul style="list-style-type: none"> <li>• Check exhaust and combustion air system</li> <li>• Check fuel quantity and fuel supply</li> <li>• Clean or replace sieve used in fitting of fuel pump</li> </ul>
53 54 56	Flame aborted from “power” stage Flame aborted from “large” stage Flame aborted from “small” stage	<p><b>Warning</b> <i>In the case of flame aborted in “power”, “large” and “small” stage and with still tolerable start attempts, the heater proceeds with a new start or with subsequent start repeat. If the new start or start repeat is successful, the trouble code display goes off.</i></p> <p>Fault(because no more start attempt allowed )</p> <ul style="list-style-type: none"> <li>• Check exhaust and combustion air system</li> <li>• Check fuel quantity and fuel supply</li> <li>• Check flame sensor - see trouble code 64 and 65</li> </ul>
60	Control overheating sensor interruption	<ul style="list-style-type: none"> <li>• Check cable harness to this component for damage and through current</li> <li>• Check plug-in connection</li> <li>• Check sensor resistance value, replace component if necessary</li> </ul>
61	Short circuit or ground contact control overheating sensor	<ul style="list-style-type: none"> <li>• Check cable harness to this component for damage</li> <li>• Check sensor resistance value, replace external component if necessary</li> </ul>
64	Flame sensor interruption	<ul style="list-style-type: none"> <li>• Check cable harness to this component for damage and through current</li> <li>• Check plug-in connection</li> <li>• Check sensor resistance value, replace component if necessary</li> </ul>
65	Short circuit flame sensor	<ul style="list-style-type: none"> <li>• Check cable harness to this component for damage</li> <li>• Check sensor resistance value, replace external component if necessary</li> </ul>
71	Surface sensor interruption	<ul style="list-style-type: none"> <li>• Check cable harness to this component for damage and through current</li> <li>• Check plug-in connection</li> <li>• Check sensor resistance value, replace component if necessary</li> </ul>
72	Short circuit surface sensor	<ul style="list-style-type: none"> <li>• Check cable harness to this component for damage</li> <li>• Check sensor resistance value, replace external component if necessary</li> </ul>
74	Overheating hardware defect, operating block	<ul style="list-style-type: none"> <li>• Replace controller</li> </ul>
87	Internal temperature sensor short-circuit	<ul style="list-style-type: none"> <li>• Replace controller</li> </ul>
88	Internal temperature sensor interruption	<ul style="list-style-type: none"> <li>• Replace controller</li> </ul>
89	CAN error	<ul style="list-style-type: none"> <li>• Check CAN interface</li> </ul>
90	Watch dog reset	<ul style="list-style-type: none"> <li>• Replace controller</li> </ul>

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Trouble Code	Trouble Description	Remedies
91	Too many resets	<ul style="list-style-type: none"><li>• Replace controller</li></ul>
92	ROM error	<ul style="list-style-type: none"><li>• Replace controller</li></ul>
93	RAM error	<ul style="list-style-type: none"><li>• Replace controller</li></ul>
94	Transistor fault occurs too frequently - operation block	<ul style="list-style-type: none"><li>• Remedy short-circuit of the component to +Ub to GND, replace controller if necessary</li></ul>
95	Software stack overflow	<ul style="list-style-type: none"><li>• Replace controller</li></ul>
96	No valid process, operation lock	<ul style="list-style-type: none"><li>• Replace controller</li></ul>
97	Resonator/quartz faulty, wrong processor cycle	<ul style="list-style-type: none"><li>• Replace controller</li></ul>
98	Main relay faulty	<ul style="list-style-type: none"><li>• Replace controller</li></ul>
99	EEPROM error	<ul style="list-style-type: none"><li>• Replace controller</li></ul>

**GENERAL TROUBLE CAUSES AND REMEDIES**

Condition	Causes	Remedies
Low coolant level	Coolant leakage	Change the radiator
	Leakage in coolant auxiliary tank	Change the coolant auxiliary tank
	Leakage in heater core	Change heater core
	Leakage in joint junction of coolant hose	Check the condition of hose and changing clamp
	Leakage in defective coolant hose	Change the hose
	Leakage in water pump gasket	Change the gasket
	Leakage in water pump sealing	Change the water pump
	Leakage in water inlet cap	Change the water inlet cap gasket
	Leakage in thermostat housing	Change the thermostat sealing
	Insufficient tightening torque of cylinder head bolt	Fasten the bolt to specified torque
Damaged cylinder head gasket	Change the head gasket	
Abnormally high coolant temperature	The coolant leakage (Check the coolant level) excessive anti-freezer	Add coolant Check the density coolant (Anti-freezer)
	Bad coolant hose condition	Check the bent area of hose or change if needed
	Defective thermostat	Change thermostat
	Defective water pump	Change water pump
	Defective radiator	Change radiator
	Defective coolant auxiliary tank or tank cap	Change coolant auxiliary tank or tank cap
	Crack in cylinder head or in cylinder block	Change cylinder head or cylinder block
	Clogged water flow in cylinder head or block	Clean the coolant flow line
	Clogged water flow in radiator core	Clean the radiator core
	Defective cooling fan	Change or check the cooling fan
Defective temp.sensor, wiring, and lamp cluster	Change the sensor and related area	
Abnormally low coolant temperature	Defective thermostat	Change the thermostat
	Defective cooling fan	Change or check the cooling fan
	Defective tem.sensor, wiring, and lamp cluster	Change the sensor and related area

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