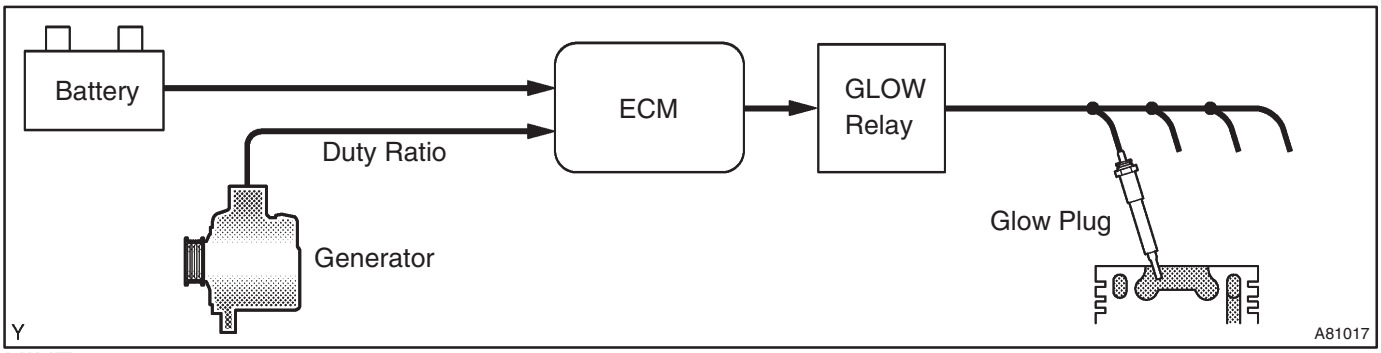
PRE–HEATING CONTROL CIRCUIT

HINT:
These troubleshooting procedures are for: 1) difficult starting engine in cold weather, and 2) difficulty driving/ vehicle malfunctions in cold weather immediately after engine is started.

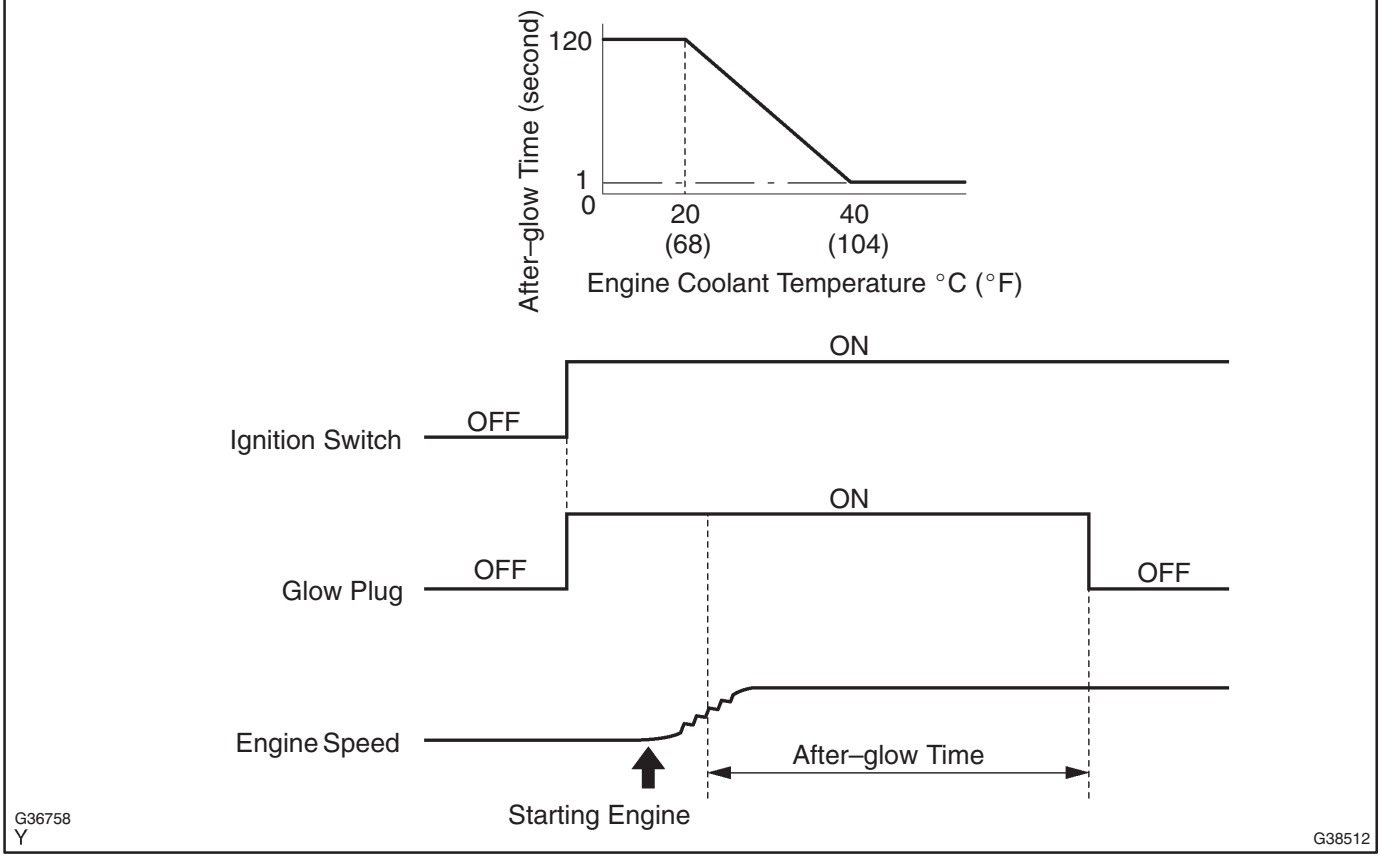
CIRCUIT DESCRIPTION

The glow plug is mounted inside the engine combustion chamber. To ensure efficient engine starting with a cold engine, the ECM calculates a time interval of the current that needs to flow through the glow plug depending on the starting engine coolant temperature when the ignition switch is turned ON. The ECM then turns on the GLOW relay and permits the current to flow through the glow plug based on the ECM's calculated time. The GLOW is then heated, and enhances fuel combustion with a cold engine.
This DTC will be set if there is open in glow plug itself or the circuit.

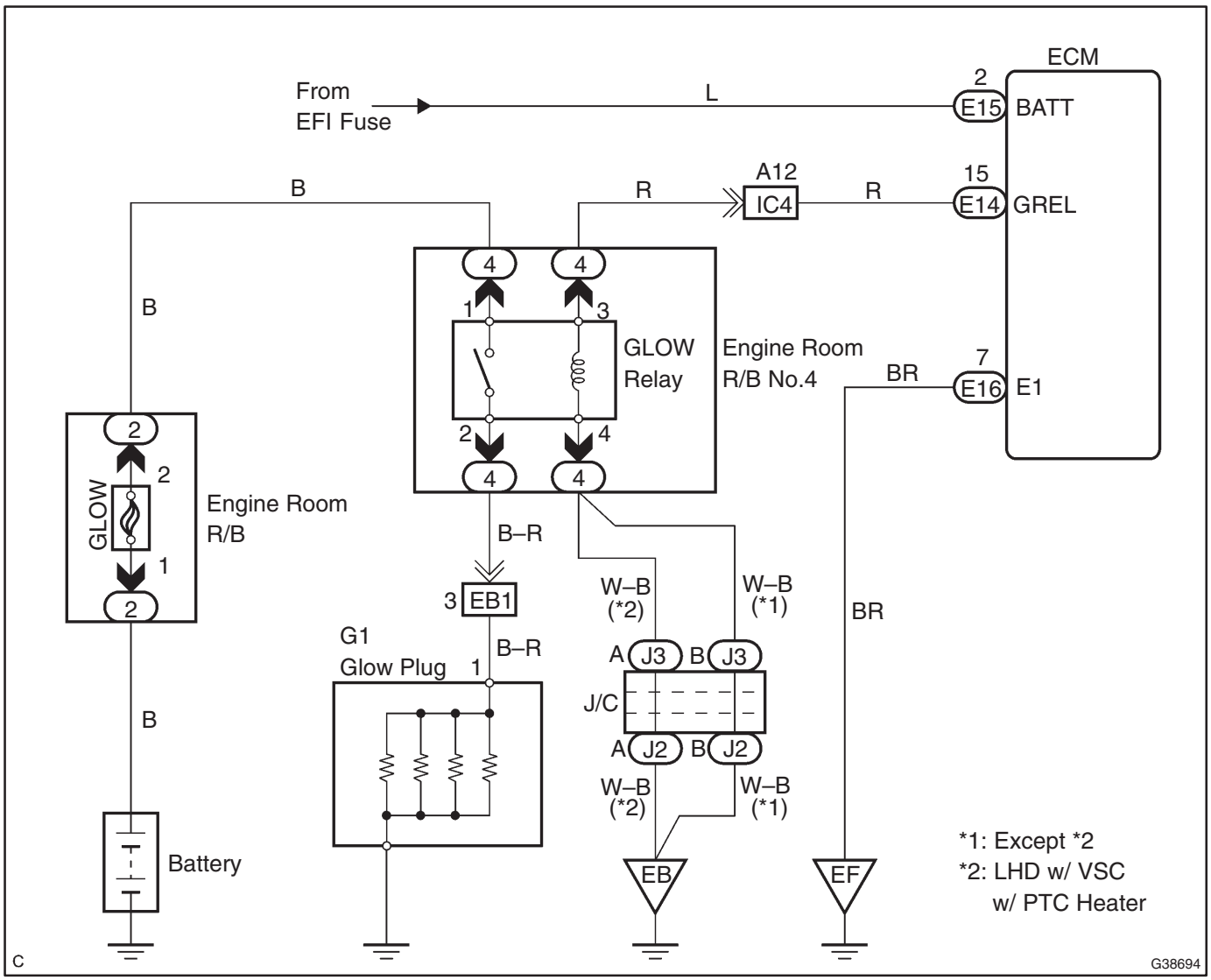


HINT:
After the engine is started, the ECM performs an "after–glow" for a certain period of time. In proportion to the actual engine coolant temperature, the time period varies. The after–glow reduces diesel engine knocking, white smoke emissions and engine noises when the engine is cold.

After–glow System

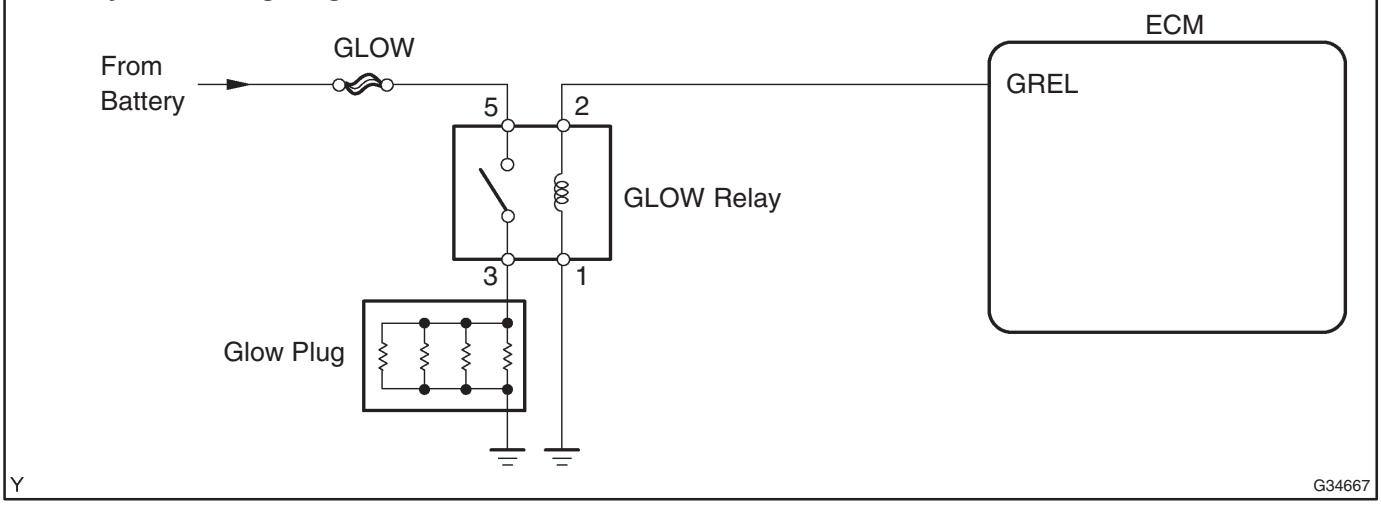


WIRING DIAGRAM

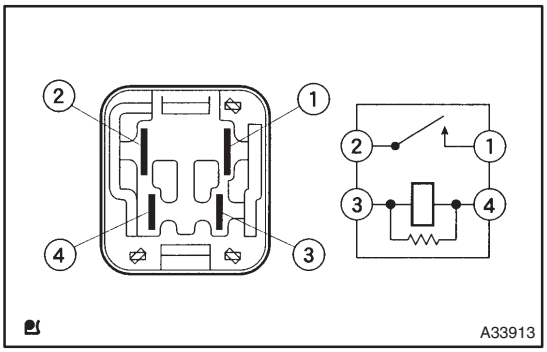


INSPECTION PROCEDURE

Glow System Wiring Diagram



1 INSPECT RELAY (Marking: GLOW)



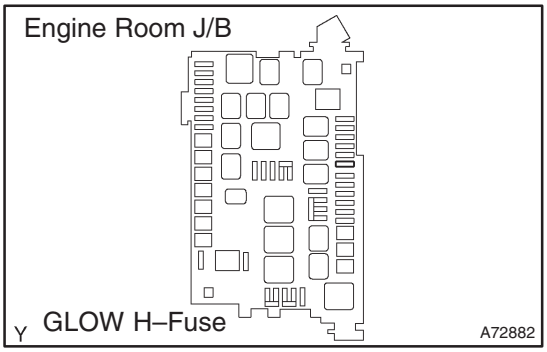
(a) Remove the GLOW relay from the engine room R/B.
(b) Measure the resistance of the relay.
Standard:

Tester Connection	Specified Condition
1 – 2	10 kΩ or higher
1 – 2	Below 1 Ω (when battery voltage is applied to terminals 3 and 4)

NG → **REPLACE RELAY**

OK

2 INSPECT FUSE (GLOW)

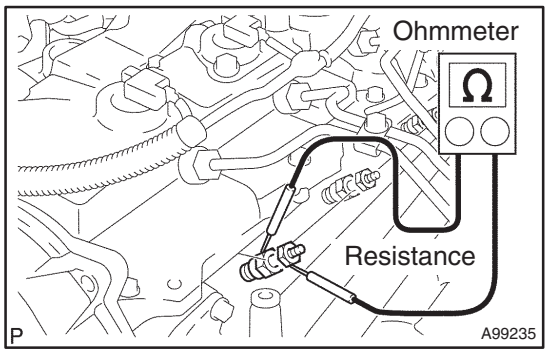


(a) Remove the GLOW H–fuse from the engine room R/B.
(b) Measure the resistance of the H–fuse.
Standard: Below 1 Ω

NG → **CHECK FOR SHORT IN ALL HARNESS AND COMPONENTS CONNECTED TO FUSE, AND REPLACE FUSE**

OK

3 INSPECT GLOW PLUG ASSY



(a) Disconnect the glow plug wire.
(b) Measure the resistance of the glow plug.
Standard:

Tester Connection	Condition	Specified Condition
Glow plug terminal – Body ground	20°C (68°F)	Approximately 0.95 Ω

HINT:
If any one of the glow plugs has an open malfunction, the engine power is insufficient only when the engine is cold.
NOTICE:

- **Exercise extreme care not to damage the glow plug pipes. Damaging them could cause an open circuit, or shorten the life of the glow plugs.**
- **Keep the glow plug free of oil and fuel while cleaning.**
- **Wipe any oil off the terminal and Bakelite washer with a clean–dry cloth during inspection.**
- **Do not apply more than 11 V to the glow plug as it could cause an open circuit.**

NG → **REPLACE GLOW PLUG ASSY (See Pub. No. RM990E, page 19–45)**

OK

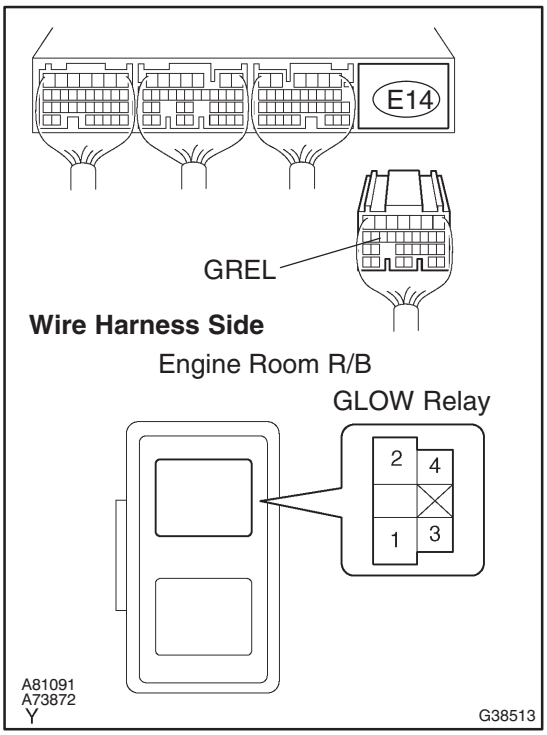
4 CHECK GLOW PLUG ASSY (INSTALLATION)

OK: The glow plug has been installed securely.

NG → **TIGHTEN GLOW PLUG**

OK

5 CHECK WIRE HARNESS (GLOW RELAY – ECM AND BODY GROUND)



(a) Disconnect the E14 ECM connector.
(b) Remove the GLOW relay from the engine room R/B.
(c) Measure the resistance of the wire harness side connectors.

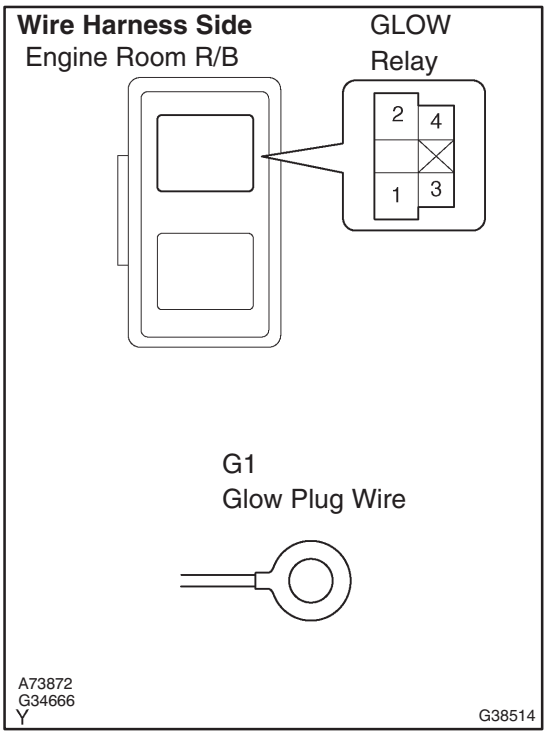
Standard:

Tester Connection	Specified Condition
E14–15 (GREL) – R/B GLOW relay terminal 3	Below 1 Ω
R/B GLOW relay terminal 4 – Body ground	Below 1 Ω
E14–15 (GREL) – Body ground	10 kΩ or higher

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

6 CHECK WIRE HARNESS (GLOW RELAY – GLOW PLUG AND BATTERY)



(a) Remove the GLOW relay from the engine room R/B.
(b) Disconnect the G1 glow plug connector.
(c) Measure the resistance of the wire harness side connectors.

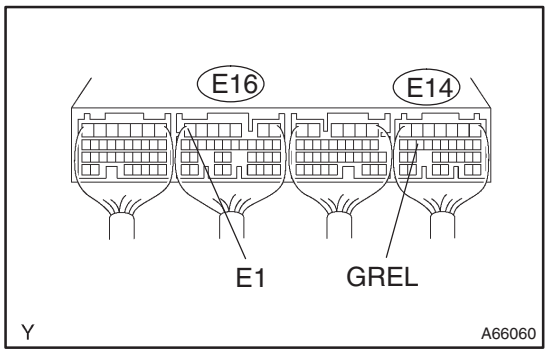
Standard:

Tester Connection	Specified Condition
R/B GLOW relay terminal 2 – Glow plug wire connector	Below 1 Ω
R/B GLOW relay terminal 1 – Positive battery terminal (+) cable	Below 1 Ω

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

7 CHECK ECM (GREL VOLTAGE)



(a) Start the engine.
(b) Measure the voltage of the ECM connectors.
Standard:

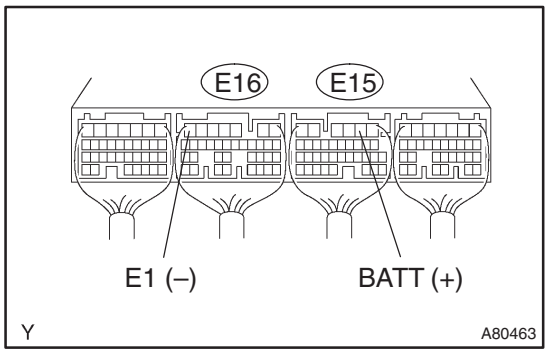
Tester Connection	Condition	Specified Condition
E14–15 (GREL) – E16–7 (E1)	Engine coolant temperature 40°C (104°F) or less	9 to 14 V

NG → **REPLACE ECM (See Pub. No. RM990E, page 10–34)**

NOTICE:
After replacing the ECM, allow for ECM learning start the engine and idle it until it is fully warmed up.

OK

8 CHECK ECM (BATT VOLTAGE)



(a) Measure the voltage of the ECM connectors.
Standard:

Tester Connection	Specified Condition
E15–2 (BATT) – E16–7 (E1)	9 to 14 V

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

CHECK FOR INTERMITTENT PROBLEMS (See page 05–439)