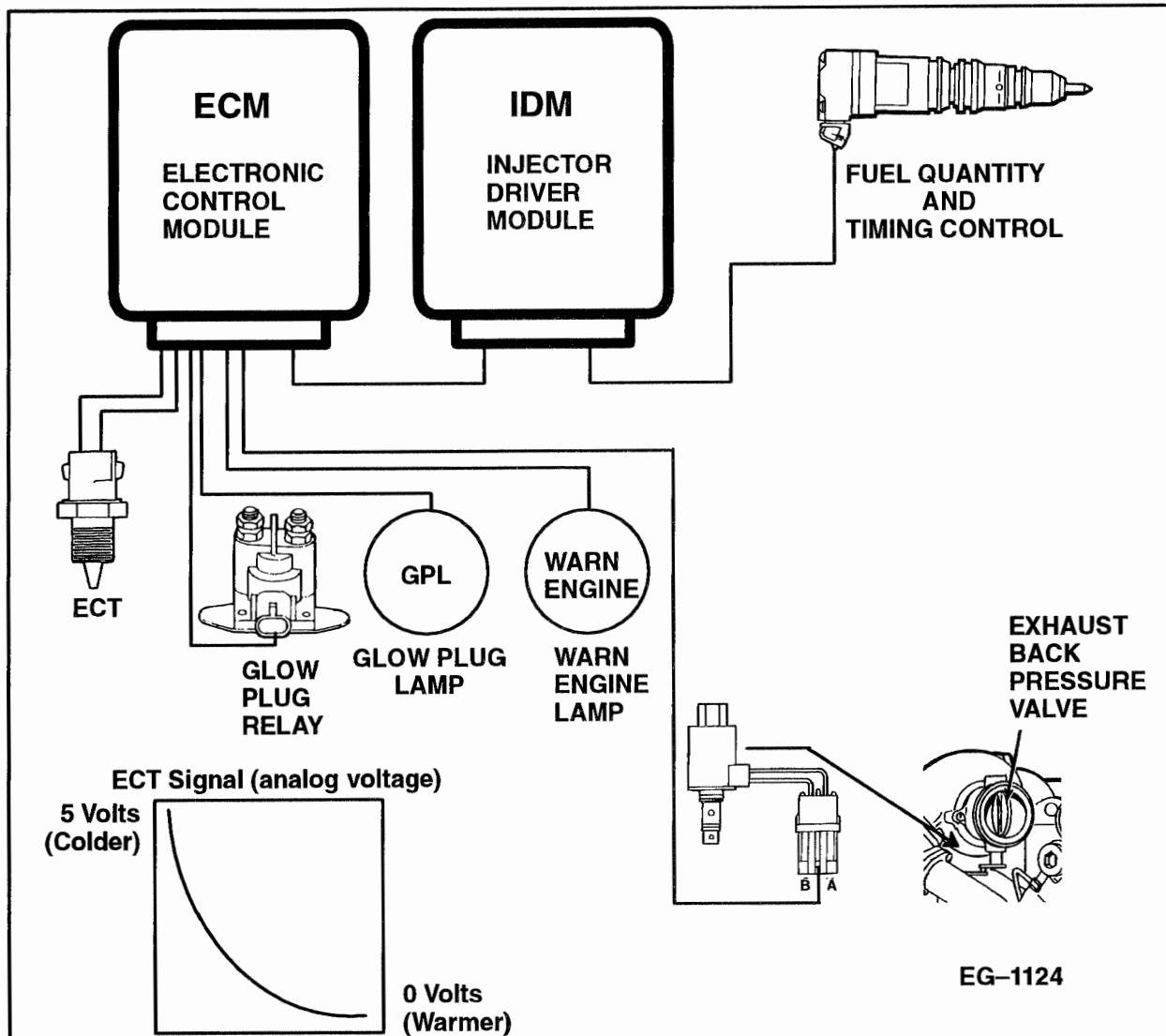


ELECTRONIC CONTROL SYSTEM DIAGNOSTICS

ENGINE COOLANT TEMPERATURE SENSOR (ECT)

ENGINE COOLANT TEMPERATURE (ECT) SENSOR



SIGNAL FUNCTIONS

The Engine Coolant Temperature (ECT) sensor is a thermistor type sensor that has a variable resistance that changes when exposed to different temperatures. When interfaced with the ECM it produces a 0 to 5 volt analog signal that will measure temperature.

Coolant Temperature Compensation – At coolant temperatures greater than 214°F (101° C) fuel quantity is reduced by 6% for each degree of temperature (°C), until engine temperature reaches 218° F (103°C) . Above 218° F (103°C) fuel is reduced by 3% for each °C increase in temperature.

Idle Speed – At temperatures below 158° F, (70° C) low idle is incrementally increased to a maximum of 875 RPM.

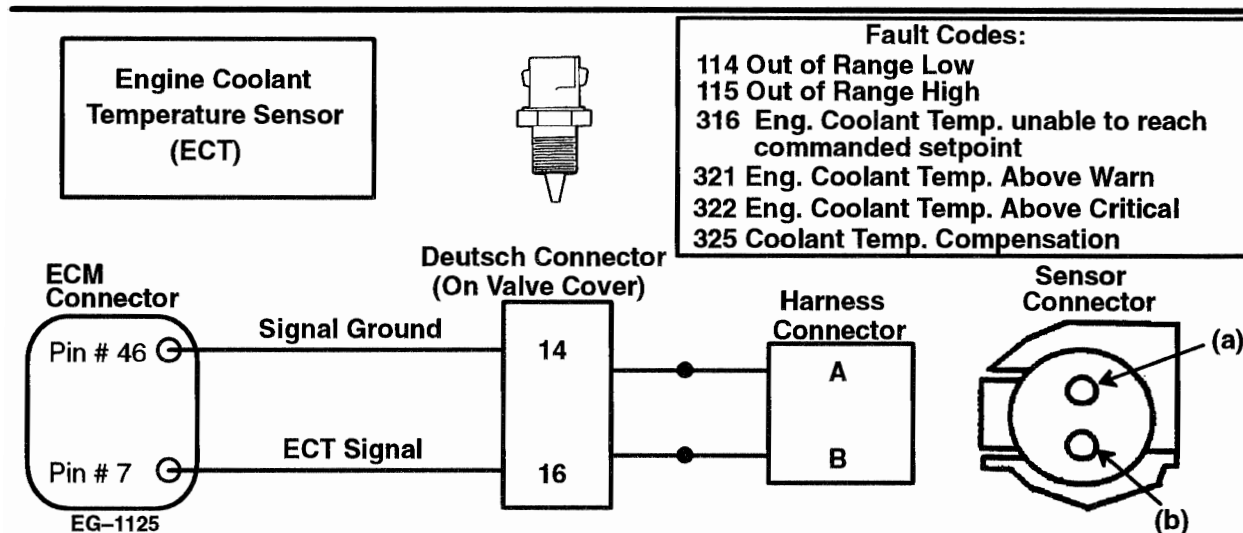
Glow Plug Control – Glow plug relay and lamp on

times are directly affected by engine coolant temperature.

Engine Warning and Protection – Optional feature when enabled will warn driver of overheat condition and can be programmed to shut the engine down.

FAULT DETECTION/MANAGEMENT

An ECT signal that is detected out of range high or low by the ECM will cause the ECM to ignore the ECT signal and assume an engine coolant temperature of -29°F (-20°C) for starting and a temperature of 180° F (82° C) for engine running conditions. The WARN lamp will also be illuminated as long as the fault condition exists.



After removing connectors always check for damaged pins, corrosion, loose terminals etc.

Connector Checks to Chassis Ground

(Check with Sensor Connector Disconnected and Ignition key off, all accessories off)

| Test Points | Spec. | Comments |
|-------------|-------------|--|
| A to Grd. | < 5 ohms | Resistance to chassis ground, check with key OFF, if > 5 ohms the harness is open. |
| B to Grd. | > 1000 ohms | Resistance less than 1000 ohms indicates a short to ground. |

Connector Voltage Checks

(Check with sensor Connector Disconnected and Ignition Key On)

| Test Points | Spec. | Comments |
|-------------|-------------|---|
| B to Grd. | 4.6 – 5.0 v | Pull up voltage, if no or low voltage, circuit has open or high resistance or short to Grd. |
| A to Grd. | 0 – .25 v | If greater than .25 volts, wire is shorted to V Ref. or battery |

Harness Resistance Checks

(Check with breakout box installed on engine harness only)

| Test Points | Spec. | Comments |
|-------------|----------|---|
| #46 to A | < 5 ohms | Resistance from harness connector to 60 pin connector – Signal ground |
| #7 to B | < 5 ohms | Resistance from harness connector to 60 pin connector – ECT Signal |

| Test Points (+) #7 to (–) #46 | | Operational Signal Checks (Check with breakout box installed in line with the ECM) | | |
|----------------------------------|-----------|---|--------------|----------|
| Voltage | Temp. ° F | Temp. ° C | Resistance | Comments |
| 0.53 v | 248 | 120 | 1.19 K ohms | |
| 0.96 v | 212 | 100 | 2 K ohms | |
| 1.37 v | 176 | 80 | 3.84 K ohms | |
| 4.37 v | 32 | 0 | 69.2 K ohms | |
| 4.60 v | –5 | –20 | 131.0 K ohms | |

Fault Code Descriptions

Circuit Faults:

114 = Signal was less than .127 volts for more than 0.1 seconds. (Probable short to ground.)

115 = Signal voltage was greater than 4.8 volts for more than 0.1 seconds. (Probable open circuit.)

Cooling System Faults:

316 = Coolant temp. has not reached 41° F

321 = Engine Coolant Temperature above WARN level 225° F (107° C)

322 = Engine Coolant Temperature above Critical level 234° F (112.5° C)

325 = Coolant Temperature Compensation enabled,
 (Reduces fuel quantity 6% for each degree °C above 214° F (101° C))

ENGINE COOLANT TEMPERATURE SENSOR (ECT)

ENGINE COOLANT TEMPERATURE SENSOR EXTENDED SYSTEM DESCRIPTION

FUNCTION

The Navistar engine control system includes an Engine Coolant Temperature sensor. The ECM measures the Engine Coolant Temperature signal and uses this information for Coolant Temperature Compensation and optional high temperature warning and shut down systems.

Coolant temperature Compensation is used to protect the engine if the coolant temperature is too high. The ECM monitors the ECT signal to determine the coolant temperature. If the coolant reaches 214°F (101°C), the ECM will reduce the fuel delivery by 6% for each Celsius degree of temperature increase. If the coolant temperature increases to 218°F (104°C), fuel quantity will be reduced 3% for each Celsius degree of temperature increase. Coolant Temperature Compensation can be programmed to be inoperative in certain applications where full engine performance is required over the protection of the engine.

On engines equipped with an engine warning system, the ECM will activate the audible warning alarm and illuminate the red Oil/Water warning light when the engine coolant temperature reaches 225°F (107°C).

On engines equipped with an engine shut down system, the ECM will shut the engine off when the coolant temperature reaches 235°F (112.5°C). The vehicle operator may restart the engine by turning the ignition key "OFF" and then restarting it. Upon restart, the ECM will allow the engine to run for an additional 30 seconds, before shutting off the engine again.

OPERATION

The Engine Coolant temperature sensor is a thermistor type sensor which changes resistance when exposed to different temperatures.

When the temperature of the coolant is decreased, the resistance of the thermistor increases which causes the signal voltage to increase. As the temperature of the coolant is increased the resistance of the thermistor decreases, which causes the signal voltage to decrease.

The ECT sensor is supplied a regulated 5 volt reference voltage from ECM terminal 7. The sensor is

grounded at terminal A through the signal return, terminal 46, at the ECM. As the coolant temperature increases or decreases, the sensor changes resistance and provides the ECM with the coolant temperature signal voltage at terminal 7 of the ECM. This signal voltage is then read by the ECM to determine the temperature of the coolant.

ECM DIAGNOSTICS

With the ignition key "ON", the ECM continuously monitors the ECT circuit for expected voltages. If the signal voltage is less than or more than expected the ECM will set a fault code.

If the ECM detects a fault in the ECT signal, the ECM will disregard the signal and default to a temperature of 180°F (82°C) for engine running operation and -4°F (-20°C) for starting the engine. If the fault is no longer present, the ECM will once again return to normal operation using the ECT signal for processing.

Faults in the ECT signal can be retrieved using the Self Test Input Switch (STI) or the Electronic Service Tool. If the fault is no longer present, it will be stored as an Inactive Code.

FLASH CODE 114 ATA CODE PID 110 FMI 4 ECT: *OUT OF RANGE LOW*

An out of range low code will be set if the ECM detects a voltage less than .127 volts for more than 0.1 seconds. If this fault is Active, the ECM will use the default value of 180°F (82°C).

Code 114 may be caused by a short to ground or a shorted or biased sensor.

FLASH CODE 115 ATA CODE PID 110 FMI 3 ECT: *OUT OF RANGE HIGH*

An out of range high code will be set if the ECM detects a voltage greater than 4.6 volts for more than 0.1 seconds. If this fault is Active, the ECM will use the a default value of 180°F (82°C).

Code 115 may be caused by an open circuit, an open sensor, or a short to another voltage source.

**ENGINE COOLANT TEMPERATURE SENSOR
EXTENDED SYSTEM DESCRIPTION (Continued)****FLASH CODE 316****ATA CODE PID 110 FMI 1*****ENGINE COOLANT TEMPERATURE UNABLE
TO REACH COMMANDED SETPOINT***

Code 316 will only be set with engines that have the Cold Ambient Protection (CAP) System enabled. This code will be set after the engine has run for greater than 120 minutes and has not exceeded 147°F (75°C) for vehicles with manual transmissions and 140°F (60°C) for vehicles with automatic transmissions.

NOTE: THIS CODE ONLY INDICATES THAT THE ENGINE HAS NOT BEEN ABLE TO REACH OPERATING TEMPERATURE. IT DOES NOT INDICATE AN ELECTRONIC FAULT.

Possible causes of code 316: Extended idle time, cold ambient temperatures, (may require use of winter front), thermostat stuck open, mis-plumbed cooling system (thermostat bypass bypassed), auxiliary heater cores cooling off engine (school bus applications or fan clutch locked on).

FLASH CODE 321**ATA CODE PID 110 FMI 0*****ENGINE COOLANT TEMPERATURE
ABOVE WARNING LEVEL***

Code 321 will be set if the ECM detects engine coolant temperature above 225°F (107°C). When this occurs, the ECM illuminates the OIL/WATER warning light and sounds the audible alarm (if equipped), alerting the operator that a potential for engine damage exists.

If the temperature drops below 225°F (107°C), the code will become inactive and the ECM will return to normal operation.

FLASH CODE 322**ATA CODE PID 110 FMI 7*****ENGINE COOLANT TEMPERATURE ABOVE
CRITICAL LEVEL***

Code 322 will be set if the ECM detects engine coolant temperature above 235°F (112.5°C). When this occurs, the OIL/WATER warning light illuminates and the audible alarm sounds (if equipped) will alert the operator that the temperature is increasing (having set code 321) indicating a potential for engine damage. With code 322 active, the engine will shut down. At the same time the code and current engine hours will be recorded in the VPM as an Engine Event.

If the temperature drops below 235°F (112.5°C), the code will become inactive and the ECM will return to normal operation. Should the engine shut down, it can be restarted to move the vehicle to a safe place.

FLASH CODE 325**ATA CODE PID 110 FMI 14*****POWER REDUCED, MATCHED TO COOLING
SYSTEM PERFORMANCE***

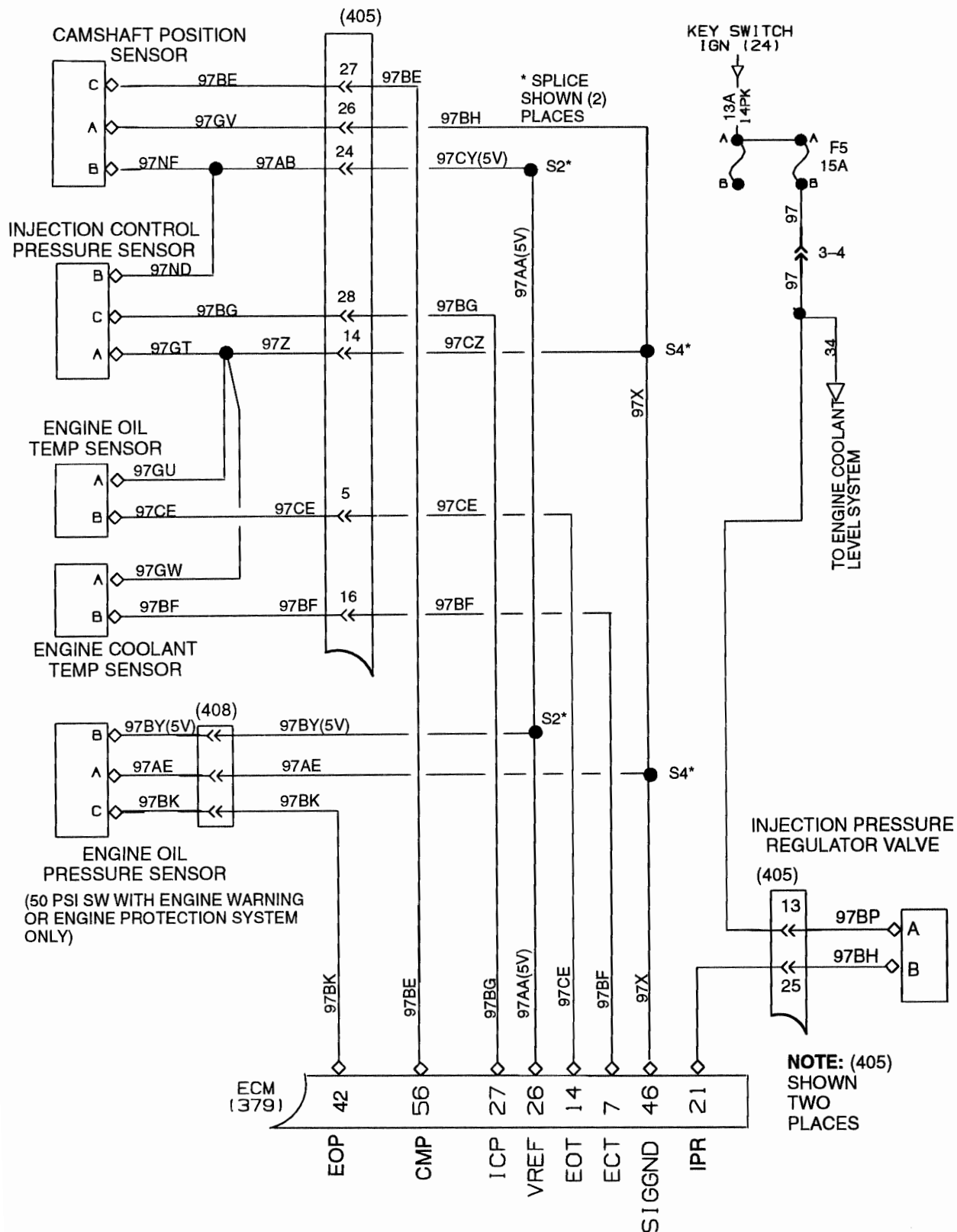
Code 325 will be set if the cooling system temperature exceeds 214°F (101°C). At this temperature the ECM will reduce the fuel delivered to the engine at or near the maximum demand level. For each one Celsius degree of temperature the fuel will be reduced 6%. This reduces the heat produced by the engine thereby reducing the burden on the engine cooling system. It will also slow the vehicle speed encouraging the operator to downshift, thus increasing the efficiency of the cooling system.

As the temperature is reduced the compensation level is reduced until the temperature drops below 214°F (101°C) at which normal operation is resumed.

ELECTRONIC CONTROL SYSTEM DIAGNOSTICS

ENGINE COOLANT TEMPERATURE SENSOR (ECT)

SENSOR CIRCUIT DIAGRAM



ENGINE COOLANT TEMPERATURE (ECT) SENSOR DIAGNOSTICS

Refer to circuit diagram
on page 106.

