SERVICE MANUAL SECTION

INSTRUMENTS (Data Link Driven Instrument Cluster)

Model: RE 200
Start Date: 03/01/2004

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Start Date: 03/01/2004

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DESCRIPTION

This manual covers operation and troubleshooting for the medium duty instrument cluster installed in RE Bus models built from March 2004 to the current model year.

1. DESCRIPTION

1.1. GENERAL

All instruments are located on the instrument panel in a demountable instrument cluster (Figure 1) directly in front of the driver. Gauges and panel lights of the cluster are connected to the vehicle electrical system by two connectors mounted to the back side of the cluster.

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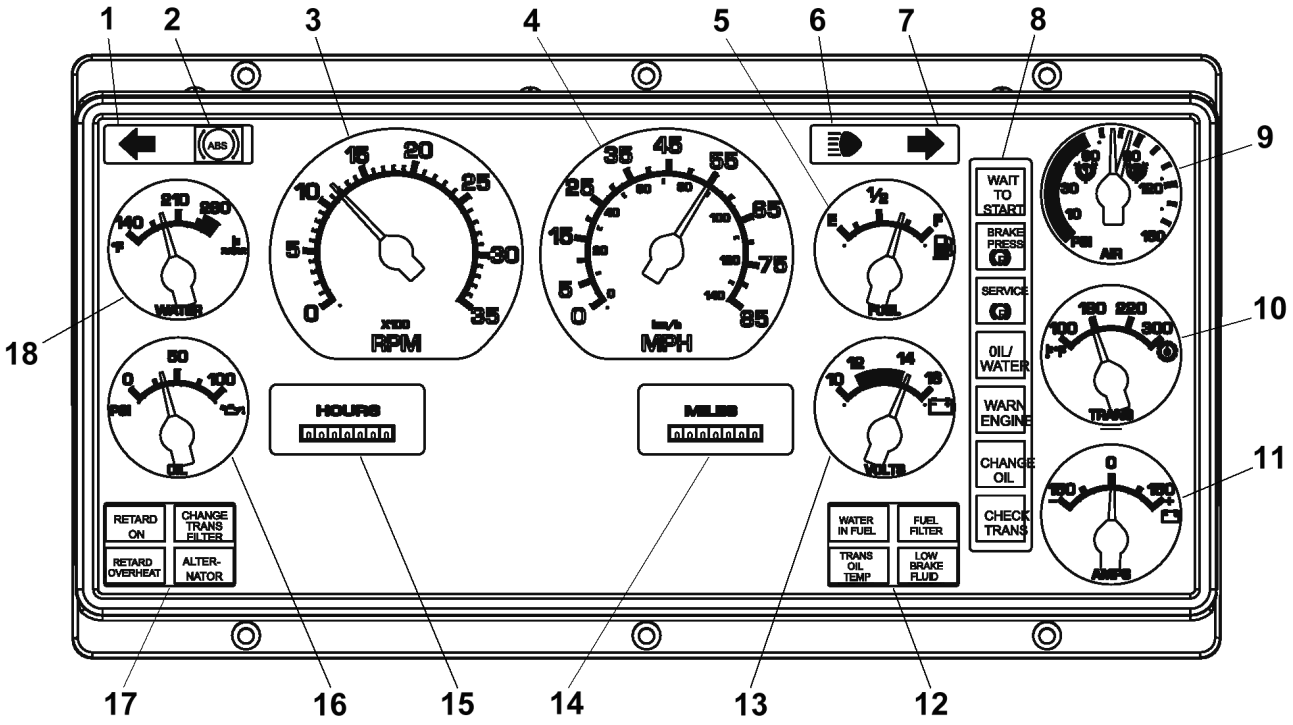

Figure 1 Instrument Cluster

Table 1 Figure 1 Callouts

1. LEFT TURN INDICATOR	10. TRANSMISSION OIL TEMPERATURE GAUGE
2. (ABS) ANTI-LOCK BRAKE WARNING LIGHT	11. AMMETER GAUGE
3. TACHOMETER GAUGE	12. RIGHT PACK WARNING LIGHTS:
4. SPEEDOMETER GAUGE	A. WATER-IN-FUEL
5. FUEL LEVEL GAUGE	B. FUEL FILTER
6. HIGH BEAM INDICATOR	C. TRANS OIL TEMP
7. RIGHT TURN INDICATOR	D. LOW BRAKE FLUID
8. RIGHT WARNING LIGHTS	D. TRAC CTRL
A. WAIT-TO-START	13. VOLTMETER GAUGE
B. BRAKE PRESS	14. ODOMETER
C. ((P)) LOW AIR	15. HOURMETER
C. ((P)) PARK BRAKE	16. ENGINE OIL PRESSURE GAUGE
D. OIL/WATER	17. LEFT PACK WARNING LIGHTS:
E. WARN ENGINE	A. RETARD ON
F. CHANGE OIL	B. CHANGE TRANS FILTER
G. CHECK TRANS	C. RETARD OVER HEAT
9. DUAL AIR PRESSURE GAUGE (WITH AIR BRAKES ONLY)	D. ALTERNATOR
9. AUX AIR PRESSURE GAUGE	18. ENGINE WATER TEMPERATURE GAUGE

The speedometer, odometer, tachometer, hour-meter, voltmeter, oil pressure gauge, and water temperature gauge are microprocessor driven. All other gauges are directly driven by either a sensor or mechanical connection. Gauges and meters are free floating at power off (key switch turned off) and may not return to a "zero" position when electrical power is removed.

1.2. SPEEDOMETER GAUGE

An electronic speedometer gauge (Figure 2) is located in the instrument cluster and it indicates miles and kilometers per hour. The electronic speedometer system consists of the dash mounted air core gauge, microprocessor, transmission mounted vehicle speed sensor (VSS), engine ECM2, data link and circuits that connect the units.

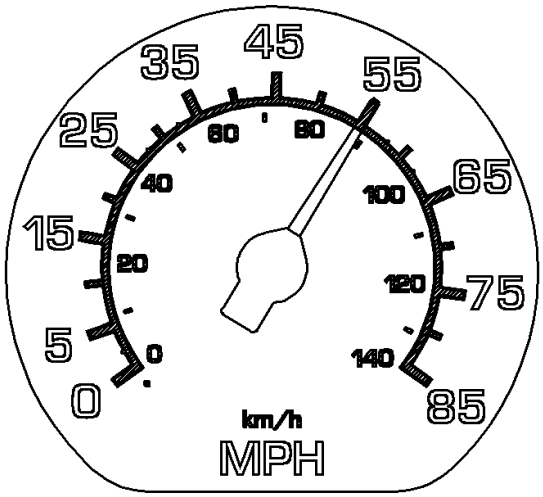

Figure 2 Speedometer Gauge

1.3. ODOMETER

The odometer (Figure 3) is a solenoid activated mechanical counter unit driven by the cluster microprocessor to log mileage traveled by the vehicle.

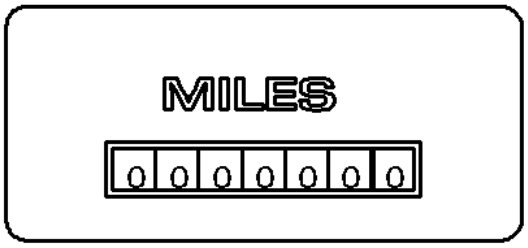

Figure 3 Odometer

1.4. TACHOMETER GAUGE

The electronic tachometer gauge (Figure 4) is located in the instrument cluster to record engine RPM (Revolutions Per Minute). The instrument enables drivers to keep engine speed within an efficient operating range. The electronic tachometer system consists of a dash mounted air core gauge and microprocessor, engine mounted camshaft position sensor, engine ECM2, data link and circuits that connect the units.

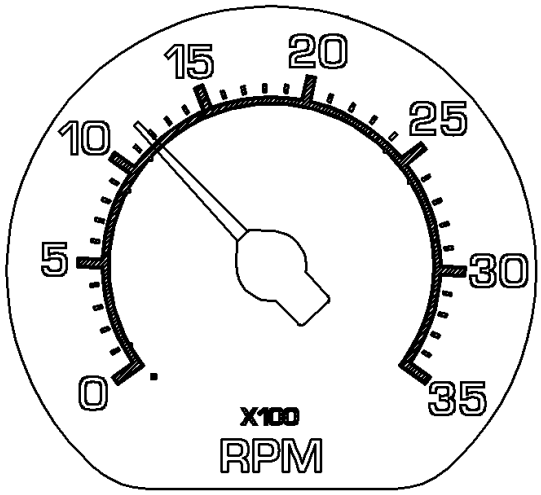

Figure 4 Tachometer Gauge

1.5. HOUR-METER

The hour-meter (Figure 5) is a solenoid activated mechanical counter type unit driven by the cluster microprocessor.

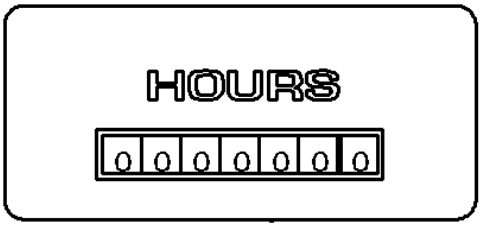

Figure 5 Hour-meter

1.6. VOLTMETER GAUGE

An electronic voltmeter gauge (Figure 6) is located in the instrument cluster. It is used to indicate the battery voltage available for the vehicle systems.

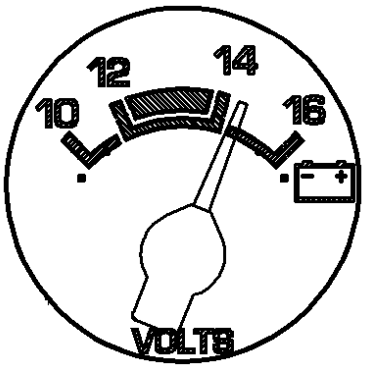

Figure 6 Voltmeter Gauge

1.7. ENGINE OIL PRESSURE GAUGE

An electronic engine oil pressure gauge (Figure 7) is located in the instrument cluster. It is used to indicate the engine oil pressure.

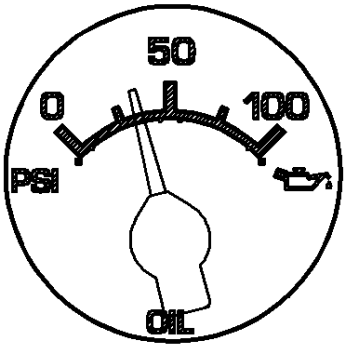

Figure 7 Engine Oil Pressure Gauge

1.8. DUAL AIR PRESSURE GAUGE

A dual readout pressure gauge (Figure 8) is located in the instrument cluster. It is used to indicate the air pressure in both the primary and secondary systems.

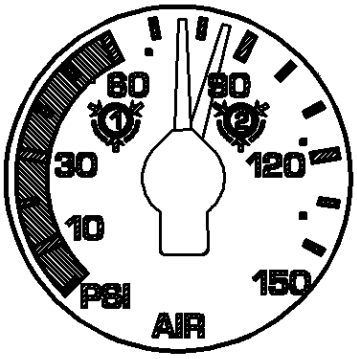

Figure 8 Dual Air Pressure Gauge

1.9. FUEL LEVEL GAUGE

An electric fuel level gauge (Figure 9) is located in the instrument cluster. It is used to indicate the amount of fuel contained in the vehicle's fuel tank(s).

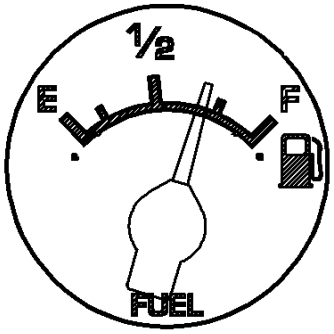

Figure 9 Fuel Level Gauge

1.10. ENGINE WATER TEMPERATURE GAUGE

An electronic engine water temperature gauge (Figure 10) is located in the instrument cluster. It is used to indicate the operating temperature of the engine.

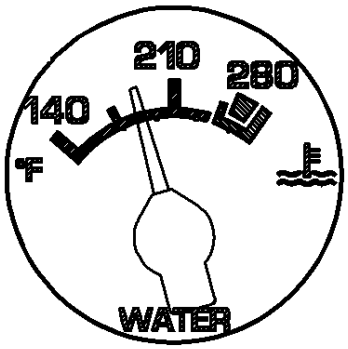

Figure 10 Engine Water Temperature Gauge

1.11. TRANSMISSION OIL TEMPERATURE GAUGE

An electronic transmission oil temperature gauge (Figure 11) is located in the instrument cluster. It is used to indicate the operating transmission oil temperature of the transmission.

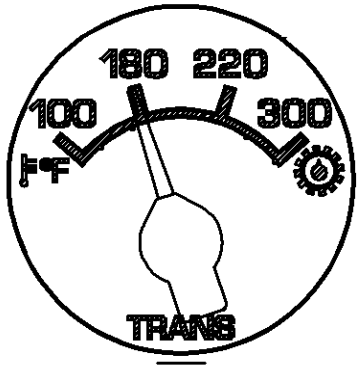

Figure 11 Transmission Oil Temperature Gauge

1.12. AMMETER GAUGE

The ammeter gauge (150 AMP) (Figure 12) is connected between the batteries ("B" terminal of cranking motor solenoid) and the alternator "B" terminal which has connected to it the vehicle loads (less the cranking motor). Thus when the alternator is charging the batteries, current flows through the ammeter and registers a positive reading. When the vehicle loads are greater than the output of the alternator, power flows from the batteries through the ammeter in the opposite direction, registering a negative reading.

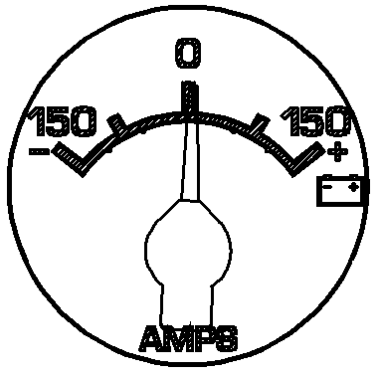

Figure 12 Ammeter Gauge

1.13. INDICATOR AND WARNING LIGHTS

LEFT TURN

The left turn arrow indicator light (Figure 1, Item 1) and green lens provide an indication, to the driver of the vehicle, that the turn signal switch is in the left turn position by blinking in unison with the turn signal lights.

(ABS) ANTI-LOCK BRAKE

The "ABS" indicator light (Figure 1, Item 2) and yellow lens provide an indication, to the driver of the vehicle, that the anti-lock brake system is activating and overriding the engine retarder. The light will also illuminate when a fault in the ABS system is detected by the ABS controller.

HIGH BEAM

The high beam indicator light (Figure 1, Item 6) and blue lens provide an indication, to the driver of the vehicle, that the headlights are on and switched to the bright position.

RIGHT TURN

The right turn arrow indicator light (Figure 1, Item 7) and green lens provide an indication, to the driver of the vehicle, that the turn signal switch is in the right turn position by blinking in unison with the turn signal lights.

WAIT-TO-START

The "WAIT-TO-START" warning light (Figure 1, Item 8.A) and yellow lens signals the driver to hold off on cranking over the engine until the glow plugs have heated up.

BRAKE PRESS

The "BRAKE PRESS" warning light (Figure 1, Item 8.B) and red lens provide a warning, to the driver of the vehicle, that one of the following conditions is present: the air pressure has dropped below an acceptable level to keep the brakes fully released with an air brake system, or that there is an abnormal condition detected by the hydraulic brake monitor module.

((P)) LOW AIR

The "((P)) LOW AIR" warning light (Figure 1, Item 8.B) and red lens warns the driver that the air brake system has either not yet pumped up to a pressure that will reliably for the brake or that the system is losing air pressure to apply the brakes.

SERVICE

The "SERVICE" warning light (Figure 1, Item 8.C) and red lens were used with mechanical engines to provide a warning, to the driver of the vehicle, that the level of the engine coolant is down to a minimum level for safe operation. With electronic engines, the coolant level is monitored by the engine ECM2. The red Oil/Water warning lamp is used to warn of a low coolant condition.

((P)) PARK BRAKE

The "((P)) PARK BRAKE" warning light (Figure 1, Item 8.C) and red lens provide an indication, to the driver of the vehicle, that the parking brake is applied. This light is utilized with both air and hydraulic brake systems.

OIL/WATER

The "OIL/WATER" warning light (Figure 1, Item 8.D) and red lens provide a warning, to driver of the vehicle, that the engine's oil pressure is running low, that its coolant temperature is running high, or the coolant level is low (with electronic engines). Thus the driver can take the necessary actions to protect the engine. This light is also used with International engines to signal that the engine is going to shut down in 30 seconds due to either idle shutdown counter or engine protection system.

WARN ENGINE

The "WARN ENGINE" warning light (Figure 1, Item 8.E) and yellow lens provide a warning, to the driver of the vehicle, that a sensor or system of the engine is not performing as it should. This condition could be affecting performance and or emissions, and indicates that the driver should get the vehicle into a shop for servicing. This light is also used in conjunction with the (STI) Self Test Initialization switch and "STOP ENGINE" light to display active and inactive engine fault codes.

CHANGE OIL

The "CHANGE OIL" warning light (Figure 1, Item 8.F) and yellow lens provide an indication, to the driver of the vehicle, that it is time to get the vehicle in for an oil change. This feature, available on vehicles with the International consolidated engine controller (CEC), keeps track of mileage and engine hours by using a programmed service interval counter to determine that it is time to change the engine oil and turn on the warning light.

CHECK TRANS

The "CHECK TRANS" warning light (Figure 1, Item 8.G) and red lens provide a warning, to the driver of the vehicle, that the transmission is overheating (with Allison nonelectronic transmissions), or that the transmission is overheating, or the ECU senses a problem with the Allison WTEC III electronic transmissions or with the Allison 2000 (LCT) transmissions.

WATER-IN-FUEL

The "WATER-IN-FUEL" warning (Figure 1, Item 12.A) light and yellow lens provide an indication, to the driver of the vehicle, that there is water up to the probe in the fuel filter. Thus the driver knows that the filter must be drained or changed to prevent water from getting into the engine.

FUEL FILTER

The "FUEL FILTER" warning light (Figure 1, Item 12.B) and yellow lens provide an indication, to the driver of the vehicle, that the fuel filter is becoming excessively plugged or restricted. Thus the filter should be changed to prevent hard starting, power limiting, or stalling.

TRANS OIL TEMP

The "TRANS OIL TEMP" warning light (Figure 1, Item 12.C) and red lens provide a warning, to the driver of the vehicle, that the transmission is overheating (with Allison nonelectronic transmissions), or that the transmission is overheating, or the ECU senses a problem with the Allison WTEC III electronic transmissions or with the Allison 2000 (LCT) transmissions.

LOW BRAKE FLUID

A "LOW BRAKE FLUID" warning light (Figure 1, Item 12.D) and red lens is used to warn the driver of the vehicle that the brake master cylinder is low on fluid.

TRAC CTRL

The "TRAC CTRL" warning light (Figure 1, Item 12.D) and yellow lens provide a warning, to the driver of the vehicle, that the optional traction control circuitry has been engaged, and that the anti-lock braking has been switched off.

RETARD ON

The "RETARD ON" indicator light (Figure 1, Item 17.A) and yellow lens provide an indication, to the driver of the vehicle, that the transmission retarder has been enabled. Thus the driver will be reminded to turn off the retarder when road surfaces are slippery.

CHANGE TRANS FILTER

The "CHANGE TRANS FILTER" warning light (Figure 1, Item 17.B) and yellow lens provide a warning, to the driver of the vehicle, that the transmission fluid filter has become restricted.

RETARD OVER HEAT

The "RETARD OVER HEAT" warning light (Figure 1, Item 17.C) and red lens provide an indication, to the driver of the vehicle, that the transmission retarder has reached an unsafe operating temperature. At this point the driver should switch off the retarder and allow it to cool before turning it back on.

ALTERNATOR

The "ALTERNATOR" warning light (Figure 1, Item 17.D) and yellow lens provide an indication, to the driver of the vehicle, that the charging voltage to the battery is low.

2. OPERATION

2.1. SPEEDOMETER GAUGE

The sensor (Figure 13) is a magnetic pickup which senses the rotation of the speedometer gear mounted in the transmission. A permanent magnet located in the sensor establishes a magnetic field at the tip of the sensor. The field is repeatedly interrupted by the teeth of the speedometer gear in the transmission, creating voltage impulses from the vehicle speed sensor (VSS). When Fuller manual transmission, these are transmitted through connector (303), on circuits K47 and K47A, to connector (6021) on the ECM2. When Allison WTEC automatic transmission, these are transmitted from connector (7983), on circuits K139 and K148, to connector (7203) on the ECU, and these are transmitted from the control module connector (7204), on circuits K157, to connector (6021) on the ECM2. Or, Allison 2000 (LCT) automatic transmission, these are transmitted from connector (7600), on circuits K215 and K216, to connector (7304) on the TCM, and these are transmitted from the control module connector (7305), on circuits K126/K126W, to connector (6021) on the ECM2. The ECM2 converts the sensor signal to a digital data signal. This signal is transferred over the data link on circuits A98E(+) and A98F(-) to pins 7 and 9 of connector (11), into the instrument cluster. The instrument cluster's microprocessor drives the speedometer.

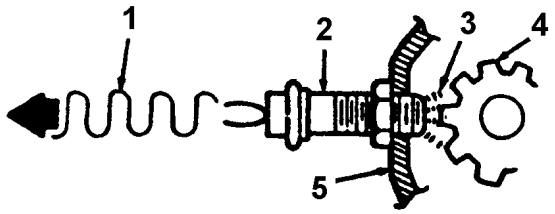

Figure 13 Speedometer Operation

1. SENSOR OUTPUT VOLTAGE
2. SENSOR
3. MAGNETIC FIELD
4. SPEEDOMETER GEAR
5. TRANSMISSION

NOTE – The greatest variable in determining speedometer accuracy is tire revolutions per mile. Factors which can affect tire revolutions per mile are tire manufacturing tolerances, tire load, tire pressure, vehicle speed and tire wear.

2.2. ODOMETER

The electronic odometer system consists of a dash mounted, solenoid activated, mechanical counter and microprocessor. The microprocessor's internal counter advances the odometer 1/10 mile after counting the appropriate distance based on vehicle speed sensor information. In addition, the microprocessor's internal

counter advances 1/20 mile every time the ignition is turned on to minimize odometer error by replacing the accumulated mileage that is less than 1/10 mile (lost when key switch is turned off) with an average value of 1/2 of 1/10 mile or 1/20 mile. This provides for a very accurate odometer.

NOTE – Tire revolutions per mile are the greatest variable in determining speedometer accuracy. Factors which can affect tire revolutions per mile are tire manufacturing tolerances, tire load, tire pressure, vehicle speed and tire wear.

2.3. TACHOMETER GAUGE

The camshaft position sensor is a magnetic pickup that senses the rotation of the engine's camshaft timing disk. The sensor's permanent magnet establishes a magnetic field at the tip of the sensor. This magnetic field is interrupted regularly by the windows in the camshaft timing disk. This interruption creates voltage impulses that are transmitted to the engine ECM2. The ECM2 converts the sensor signal to a digital data signal. This signal is transferred over the data link on circuits A98E(+) and A98F(-) to pins 7 and 9 of connector (11), into the instrument cluster. The instrument cluster's microprocessor drives the tachometer. Refer to the appropriate engine service manual for camshaft position sensor operation, adjustment and repair.

2.4. HOUR-METER

The electronic hour-meter system consists of a dash mounted, solenoid activated, mechanical counter and microprocessor. The microprocessor internal timer advances the hour-meter 1/10 hour for every 6 minutes that the engine is running (above 300 rpm). In addition, the microprocessor's internal timer advances its counter 3 minutes every time the ignition is turned on to minimize hour-meter error by replacing the accumulated time that is less than 1/10 hour (lost when key switch is turned off) with an average value of 1/2 of 1/10 hour or 3 minutes. This provides for a very accurate engine hour-meter.

2.5. VOLTMETER GAUGE

The battery voltage is measured by the engine ECM2, converted to a data signal, and transferred over the data link to the instrument cluster's microprocessor. This signal is transferred over the data link on circuits A98E(+) and A98F(-) to pins 7 and 9 of connector (11), into the instrument cluster. The instrument cluster's processor then drives the voltmeter display gauge.

2.6. ENGINE OIL PRESSURE GAUGE

The engine oil pressure is measured by an electrical sending unit, and fed to the engine ECM2. The ECM2 converts the electrical voltage into a data signal, and transfers it over the data link to the instrument cluster's microprocessor. This signal is transferred over the data link on circuits A98E(+) and A98F(-) to pins 7 and 9 of connector (11), into the instrument cluster. The instrument cluster's processor then drives the oil pressure display gauge.

2.7. DUAL AIR PRESSURE GAUGE

The dual read out pressure gauge is plumbed, with air lines, to both the primary and secondary air systems of the vehicle, thus displaying the pressure in PSI of both systems (a pointer for each system) at the same time.

2.8. FUEL LEVEL GAUGE

The battery voltage is through the ignition switch relay (1711), circuit A13/A13F, fuse F22, circuit A28/A28B, the green instrument cluster (11), pin 10 to the fuel gauge. The level of fuel in the vehicle fuel tank is sensed by the fuel sending unit (37). The sending unit feeds an electrical voltage through circuit 36, pin A of connector (37), circuit N36, pin C6 of connector (2) and circuit A36, pin 3 of connector (11) to the fuel gauge, which

displays the fuel level. The fuel sender (37) pin B is grounded through circuits N36–G/N11–GA/W11–GG to the (9000A) platform ground. The fuel gauge is grounded through pin 2 of connector (11) circuits A28–G/A11–GA to the (IPG) platform ground.

2.9. ENGINE WATER TEMPERATURE GAUGE

The engine water temperature is measured by an electrical sending unit and is fed to the engine ECM2. The ECM2 converts the electrical voltage into a data signal, and transfers it over the data link to the instrument cluster's microprocessor. This signal is transferred over the data link on circuits A98E(+) and A98F(-) to pins 7 and 9 of connector (11), into the instrument cluster. The instrument cluster's processor then drives the water temperature display gauge.

2.10. TRANSMISSION OIL TEMPERATURE GAUGE

The battery voltage is through the ignition switch relay (1711), circuit A13/A13F, fuse F22, circuit A28/A28B, the green instrument cluster connector (11), pin 10 to the transmission oil temperature gauge. The transmission temperature is sensed by the transmission temperature sending unit (6741). The sending unit feeds an electrical voltage through pin A of connector (6741), circuit K31A, pin 6 of connector (9850), circuit N31A, pin F4 of connector (2) and circuit A31A, pin 2 of the natural instrument cluster connector (12) to the transmission oil temperature gauge, which displays the transmission oil temperature. The transmission temperature sending unit (6741) pin B is grounded through circuits N31–G/11–GJ to the (7104) control box ground. The transmission oil temperature gauge is grounded through pin 2 of connector (11) circuits A28–G/A11–G to the (IPG) platform ground.

2.11. AMMETER GAUGE

The battery voltage is through the ignition relay (6309), circuit V13P, fuse 1B, circuit V39, pin F2 of connector (6000), circuit K39/K28B, pin A of connector (6120), circuit 26A, connector (643), pin 1 to the ammeter sensor. The ammeter gauge current is sensed by the ammeter sensor (643). The ammeter sensor (643) pin 2, circuit 26, feeds an electrical voltage through pin C of connector (6120), circuit K26, pin 8 of connector (9850), circuit N26, pin F5 of connector (2) and circuit A26, pin 12 of the natural instrument cluster connector (12) to the ammeter gauge, which displays the positive or negative current flow. The ammeter gauge is grounded through pin 2 of connector (11) circuits A28–G/A11–GA to the (IPG) platform ground. The ammeter sensor (643) is grounded through pin 3, circuit 26–G, pin B of connector (6120), circuits K26–G/K11–GJ to the engine ground.

2.12. INDICATOR AND WARNING LIGHTS

LEFT TURN: RE 200/RE 300 With International Turn Signal Switch (Stationary Column)

When the turn signal switch is placed in the left turn position, power flows through the turn signal switch and violet wire, connector (13)/pin D, circuits A56 and A56B to the left turn indicator connector (11)/pin 6. This will cause the left turn indicator, grounded through connector (11)/pin 2 and circuits A28-G and A11-G to (1PG) platform ground, to illuminate as the turn signal flasher blinks the turn signal lights.

LEFT TURN: RE 200/RE 300 With Douglas Turn Signal Switch (Tilt Column)

When the turn signal switch is placed in the left turn position, power flows through the turn signal switch and yellow wire, connector (13)/pin E, circuits A56 and A56B to the left turn indicator connector (11)/pin 6. This will cause the left turn indicator, grounded through connector (11)/pin 2 and circuits A28-G and A11-G to (1PG) platform ground, to illuminate as the turn signal flasher blinks the turn signal lights.

(ABS) ANTI-LOCK BRAKE: RE 200/RE 300 With WTEC or Allison 2000 ICT Air Brakes

When the air anti-lock brake control module performs a bulb check or logs a fault code, it will set connector (288)/pin E3, low (to ground). The battery voltage is through the ignition switch relay (1711), circuits A13/A13F, fuse F22, circuits A28 and A13N, the coil of the warning light relay (284), circuit A94H, connector (2), circuit N94H, and a gray wire to the ABS module (288)/pin E3. This energizes the warning light relay (284), and allows power to flow through fuse (F22), circuits A28, A94B, the anti-lock brake warning light (297), circuit A94E, the warning light relay (284). This will cause the warning light (297), which is grounded through circuit A94E, normally open contacts of the warning light relay (284), circuits A94-GA and A11-GB to platform ground (4PG), to illuminate.

(ABS) ANTI-LOCK BRAKE: RE 200/RE 300 With Hydraulic Brakes GEN 4

When the hydraulic anti-lock brake control module performs a bulb check or logs a fault code, it will set connector (279)/pin 1, low (to ground). The battery voltage is through the ignition switch relay (1711), circuits A13/A13F, fuse F22, circuits A28 and A13N, the coil of the warning light relay (R2), circuit A94K, connector (2), circuit N94K, and a gray wire to the ABS module (279)/pin 1. This energizes the warning light relay (R2), and allows power to flow through fuse (F22), circuits A28, A94B, the anti-lock brake warning light (297), circuit A94E, the warning light relay (R2), circuit A94K, connector (2), circuit N94K, to the hydraulic ABS module (279)/pin 1. This will cause the warning light (297), which is grounded through circuit A94E, normally open contacts of the warning light relay (R2), circuits A94-GA and A11-GB to platform ground (4PG), to illuminate.

HI BEAM: RE 200/RE 300 With Douglas Turn Signal Switch (Tilt Column)

When the headlight switch (23) is moved to the on position and the dimmer switch (4) is placed in the high beam position, power will flow through circuit A51, dimmer switch connector (4), a green wire, the switch contacts, a brown wire, connector (4), circuits A52 and A52A, and the high beam indicator lamp and connector (11)/pin 4. Thus the lamp, grounded through connector (11)/pin 2 and circuits A28-G and A11-G to platform ground (1PG), will illuminate, indicating that the headlights are on and the dimmer switch is in the high beam position.

HI BEAM: RE 200/RE 300 With International Turn Signal Switch (Stationary Column)

When the headlight switch (23) is moved to the on position and the dimmer switch (6) is placed in the high beam position, power will flow through circuit A51, circuit A51A, the normally closed contacts of lift-to-dim headlight relay (100), circuits A52C and A52A, and the high beam indicator lamp and connector (11)/pin 4. Thus the lamp, grounded through connector (11)/pin 2 and circuits A28-G and A11-G to platform ground (1PG), will illuminate, indicating that the headlights are on and the dimmer switch is in the high beam position.

RIGHT TURN: RE 200/RE 300 With International Turn Signal Switch (Stationary Column)

When the turn signal switch is placed in the right turn position, power flows through the turn signal switch and orange/red wire, connector (13)/pin F, circuits A57 and A57B to the right turn indicator connector (11)/pin 12. This will cause the right turn indicator, grounded through connector (11)/pin 2 and circuits A28-G and A11-G to (1PG) platform ground, to illuminate as the turn signal flasher blinks the turn signal lights.

RIGHT TURN: RE 200/RE 300 With Douglas Turn Signal Switch (Tilt Column)

When the turn signal switch is placed in the right turn position, power flows through the turn signal switch and light blue wire, connector (13)/pin F, circuits A57 and A57B to the right turn indicator connector (11)/pin 12. This will cause the right turn indicator, grounded through connector (11)/pin 2 and circuits A28-G and A11-G to (1PG) platform ground, to illuminate as the turn signal flasher blinks the turn signal lights.

WAIT-TO-START: RE 200/RE 300

When the key switch is initially moved to the ignition position, the engine controller ECM2 (6020) will activate the glow plugs and the “WAIT-TO-START" indicator. The battery voltage is through the ignition switch relay

(1711), circuits A13/A13F, fuse F22, circuits A28/A28B, green instrument cluster connector (11), pin 10 to the “WAIT-TO-START" indicator. The “WAIT-TO-START" indicator is controlled by the ECM2 (6020). The control from ECM2 connector (6020), pins 12 and 13, is transferred over the data link on circuits K5AA(+) and K5AA(-) through pins 14 and 15 of connector (9850), to the MSM1 connector (3114) pins 5 and 6. A ground is sent from the MSM1 connector (3114) through pin 10, circuit A18–G, to pin 5 of the natural instrument cluster connector (12). This causes the indicator to illuminate.

BRAKE PRESS: RE 200/RE 300 With Hydraulic Brakes

When the hydraulic brake pressure system monitor module (86) detects a problem with the brake system, it applies a ground to circuit A90M, connector and blocking diode (25), and circuit A90NA to the alarm (211). Power will then flow from fuse F24 through circuit A13B and alarm connector (211), causing the alarm to sound at a fast rate. When a problem is detected, a ground is also applied by circuit A90M, connector (25), circuit A90N, and natural instrument cluster connector (12), pin 9 to the brake warning light, causing it to illuminate. The brake warning light, the battery voltage is through the ignition switch relay (1711), circuits A13/A13F, fuse F22, circuits A28 and A28C, and natural instrument cluster connector (12), pin 8.

BRAKE PRESS: RE 200/RE 300 With Air Brakes

The brake press warning light, the battery voltage is through the ignition switch relay (1711), circuits A13/A13F, fuse F22, circuits A28 and A28D, and natural instrument cluster connector (12), pin 4. When the air pressure drops below 60 psi, the pressure switch will close, and power will flow through the warning light, natural instrument cluster connector (12), pin 9, circuits A40A and A40, connector (2), pin A4, circuit N40, connector (9850), pin 9, circuit K40 and the low air pressure switch (6740) to ground (1LA). This will cause the brake press warning light to illuminate, and the warning alarm (211) to sound at a fast rate. The warning alarm receives power from fuse F24 over circuit A13B.

((P)) LOW AIR: RE 200/RE 300 With Low Air Suspension

The "((P)) LOW AIR" suspension warning light, the battery voltage is through the ignition switch relay (1711), circuits A13/A13F, fuse F22, circuits A28 and A28D, and natural instrument cluster connector (12), pin 4. When the air pressure drops below 60 psi, the pressure switch will close, and power will flow through the warning light, natural instrument cluster connector (12), pin 9, circuits A40A and A40, connector (2), pin A4, circuit N40, connector (9850), pin 9, circuit K40 and the low air pressure switch (6740) to ground (1LA).

SERVICE: RE 200/RE 300 With Hydraulic Brakes

The battery voltage is through the green instrument cluster connector (11), pin 17 to the “SERVICE" indicator. The “SERVICE" indicator is controlled by the ECM2 (6020). When the coolant level is low in the coolant surge tank, the coolant level probe (400) closes its contacts to the start motor ground, circuit 34–G/K11–GJ, through circuit K34A, to ECM2 connector (6020), pin 4. This causes the “SERVICE" indicator to illuminate.

SERVICE: RE 200/RE 300 With Air Brakes

The battery voltage is through the green instrument cluster connector (11), pin 17 to the “SERVICE" indicator. The “SERVICE" indicator is controlled by the ECM2 (6020). When the coolant level is low in the coolant surge tank, the coolant level probe (6400) closes its contacts to the control box ground (7104), circuit K34–G/K11–GG, through circuit K34A, to ECM2 connector (6020), pin 4. This causes the “SERVICE" indicator to illuminate.

((P)) PARK BRAKE: RE 200/RE 300 With Hydraulic Brakes

Power is fed by the battery voltage is through the ignition switch relay (1711), circuits A13/A13F, fuse F22 to circuits A28 and A28C and the “((P)) PARK BRAKE” warning light and connector (12)/pin 8. When the parking brake is applied, power will flow through the warning light and connector (12)/pin 17, circuits A44 and A44A, the park brake switch (218), and circuits A44-GA, A11-GB, and A11-G to platform ground. This will cause the park brake warning light to illuminate, indicating that the parking brake is applied. The lamp will also illuminate

when the key switch (20) is moved to the start position, and a ground is applied through circuit A44, a brake diode (82), and circuit A44-G, performing a bulb check.

((P)) PARK BRAKE: RE 200/RE 300 With Air Brakes

Power is applied by fuse F22 to circuits A28 and A28C and the park brake warning light and connector (12), pin 8. When the parking brake is applied, power will flow through the warning light and connector (12), pin 17, circuits A44 and A66K, the park brake switch (168) and circuit A66-G to cab ground. This will cause the park brake warning light to illuminate, indicating that the park brake is applied. The lamp will also illuminate when the key switch is moved to the start position, and a ground is applied through circuit A66H, performing a bulb check.

OIL/WATER: RE 200/RE 300 With Air Brakes

The alarm receives power from fuse F24 over circuit A13B, and the oil/water warning light receives power from fuse F22, circuits A28 and A28A, and natural instrument cluster connector (12), pin 13. The warning light illuminates when a ground path is applied to natural instrument cluster connector (12), pin 14 by circuits A29A/35 and A97AF by the MSM1 (3114), pin 1. The alarm will also sound at a slow rate when a ground path is applied by the MSM1 in response to low oil pressure, high water temperature, or low coolant level.

The battery voltage is through the ignition switch relay (1711), circuits A13/A13F, fuse F22, circuits A28/A28A, natural instrument cluster connector (12), pin 13 to the “OIL/WATER" indicator. The “OIL/WATER" indicator is controlled by the ECM2 (6020). The control from ECM2 connector (6020), pins 12 and 13, is transferred over the data link on circuits K5AA(+) and K5AA(-) through pins 14 and 15 of connector (9850), to the MSM1, circuits A5DD(+) and A5DD(-) to connector (3114) pins 5 and 6. A ground is sent from the MSM1 connector (3114) through pin 1, circuit A97AF, to pin 1 of the audible alarm connector (211). This causes the indicator to illuminate.

OIL/WATER: RE 200/RE 300 With Hydraulic Brakes

The alarm receives power from fuse F24 over circuit A13B, and the oil/water warning light receives power from fuse F22, circuits A28 and A28D, and natural instrument cluster connector (12), pin 4. The warning light illuminates when a ground path is applied to natural instrument cluster connector (12), pin 14 by circuits A29/35 and A97AF by the MSM1 (3114), pin 1. The alarm will also sound at a slow rate when a ground path is applied by the MSM1 in response to low oil pressure, high water temperature, or low coolant level.

The battery voltage is through the ignition switch relay (1711), circuits A13/A13F, fuse F22, circuits A28/A28D, natural instrument cluster connector (12), pin 4 to the “OIL/WATER" indicator. The “OIL/WATER" indicator is controlled by the ECM2 (6020). The control from ECM2 connector (6020), pins 12 and 13, is transferred over the data link on circuits K5AA(+) and K5AA(-) through pins 14 and 15 of connector (9850), to the MSM1, circuits A5DD(+) and A5DD(-) to connector (3114) pins 5 and 6. A ground is sent from the MSM1 connector (3114) through pin 1, circuit A97AF, to pin 1 of the audible alarm connector (211). This causes the indicator to illuminate.

WARN ENGINE: RE 200/RE 300

When the ECM2 detects a faulty sensor or circuit, it will set a fault code and turn on the “WARN ENGINE" indicator. The battery voltage is through the ignition switch relay (1711), circuits A13/A13F, fuse F22, circuits A28/A28D, natural instrument cluster connector (12), pin 4 to the “WARN ENGINE" indicator. The “WARN ENGINE" indicator is controlled by the ECM2 (6020). The control from ECM2 connector (6020), pins 12 and 13, is transferred over the data link on circuits K5AA(+) and K5AA(-) through pins 14 and 15 of connector (9850), to the MSM1 connector (3114) pins 5 and 6. A ground is sent from the MSM1 connector (3114) through pin 9, circuit A97T, to pin 15 of the natural instrument cluster connector (12). This causes the indicator to illuminate.

CHANGE OIL: RE 200/RE 300

The engine ECM2 is programmed to track engine hours and vehicle miles, and when the programmed values are achieved, the ECM2 will turn on the “CHANGE OIL" indicator. The battery voltage is through the ignition switch relay (1711), circuits A13/A13F, fuse F22, circuits A28/A28B, green instrument cluster connector (11), pin 10 to the “CHANGE OIL" indicator. The “CHANGE OIL" indicator is controlled by the ECM2 (6020). The control from ECM2 connector (6020), pins 12 and 13, is transferred over the data link on circuits K5AA(+) and K5AA(-) through pins 14 and 15 of connector (9850), to the MSM1 connector (3114) pins 5 and 6. A ground is sent from the MSM2 connector (3115) through pin 2, circuit A97AA, to pin 6 of the natural instrument cluster connector (12). This causes the indicator to illuminate.

NOTE – The Change Oil/Service interval light default setting is off. The customer can use the service tool to activate the light and enter their own parameters into the ECM2 memory. The STI button (diagnostics flash button) is used to reset the service interval reminder light.

CHECK TRANS: RE 200/RE 300 With Allison WTEC III With Hydraulic Brakes

When the Allison ECU detects that the transmission is overheating or that there is a problem with the WTEC III system, it will apply a ground to circuit K#115 at connector (7204), pin 31. The battery voltage is through the ignition switch relay (1711), circuits A13/A13F, fuse F22, circuits A28 and A28C, and natural instrument cluster connector (12), pin 8, the “CHECK TRANS” warning light, connector (12), pin 7, circuit A125, connector (377), circuit A115, connector (644), circuit N125, connector (523), circuit K#115, and ECU connector (7204), pin 31, to ground. This will cause the “CHECK TRANS” warning light to illuminate.

CHECK TRANS: RE 200/RE 300 With Allison WTEC III GEN 4 With Hydraulic Brakes

When the Allison ECU detects that the transmission is overheating or that there is a problem with the WTEC III GEN 4 system, it will apply a ground to circuit K#129 at connector (7150), pin 29. The battery voltage is through the ignition switch relay (1711), circuits A13/A13F, fuse F22, circuits A28 and A28C, and natural instrument cluster connector (12), pin 8, the “CHECK TRANS” warning light, connector (12), pin 7, circuit A125, connector (377), circuit A115, connector (644), circuit N129, connector (523), circuit K#129, and ECU connector (7150), pin 29, to ground. This will cause the “CHECK TRANS” warning light to illuminate.

CHECK TRANS: RE 200/RE 300 With Allison WTEC III With Air Brakes

When the Allison ECU detects that the transmission is overheating or that there is a problem with the WTEC III system, it will apply a ground to circuit K#115 at connector (7204), pin 31. The battery voltage is through the ignition switch relay (1711), circuits A13/A13F, fuse F22, circuits A28 and A28C, and natural instrument cluster connector (12), pin 8, the “CHECK TRANS” warning light, connector (12), pin 7, circuit A125, connector (377), circuit A125, connector (644), circuit N125, connector (523), circuit K#115, and ECU connector (7204), pin 31, to ground. This will cause the “CHECK TRANS” warning light to illuminate.

CHECK TRANS: RE 200/RE 300 With Allison WTEC III GEN 4 With Air Brakes

When the Allison ECU detects that the transmission is overheating or that there is a problem with the WTEC III GEN 4 system, it will apply a ground to K#129 at connector (7150), pin 29. The battery voltage is through the ignition switch relay (1711), circuits A13/A13F, fuse F22, circuits A28 and A28C, and natural instrument cluster connector (12), pin 8, the “CHECK TRANS” warning light, connector (12), pin 7, circuit A125, connector (377), circuit A125, connector (644), circuit N129, connector (523), circuit K#129, and ECU connector (7150), pin 29, to ground. This will cause the “CHECK TRANS” warning light to illuminate.

CHECK TRANS: RE 200/RE 300 With Allison 2000 (LCT)

When the Allison ECU detects that the transmission is overheating or that there is a problem with the 2000 (LCT) system, it will apply a ground to circuit K#125 at connector (7305), pin 25. The battery voltage is through the ignition switch relay (1711), circuits A13/A13F, fuse F22, circuits A28 and A28C, and natural instrument

cluster connector (12), pin 8, the “CHECK TRANS” warning light, connector (12), pin 7, circuit A125, connector (377), circuit A125, connector (644), circuit N125, connector (9875), circuit K#125, and ECU connector (7305), pin 25, to ground. This will cause the “CHECK TRANS” warning light to illuminate.

CHECK TRANS: RE 200/RE 300 With Allison 1000/2000 GEN 4

When the Allison ECU detects that the transmission is overheating or that there is a problem with the 1000/2000 GEN 4 system, it will apply a ground to circuit K#129 at connector (7150), pin 29. The battery voltage is through the ignition switch relay (1711), circuits A13/A13F, fuse F22, circuits A28 and A28C, and natural instrument cluster connector (12), pin 8, the “CHECK TRANS” warning light, connector (12), pin 7, circuit A125, connector (377), circuit A125, connector (644), circuit N129, connector (9875), circuit K#129, and ECU connector (7150), pin 29, to ground. This will cause the “CHECK TRANS” warning light to illuminate.

WATER-IN-FUEL: RE 200 (V8 ENGINE)

The battery voltage is through the ignition switch relay (1711), circuits A13/A13A, fuse F20, circuits A19D, to the fuel heater relay (R5). With the key switch (20) in the on or start position, the water-in-fuel module (16) receives power at WIF connector (3116), pin A, from fuel heater relay (R5) and circuit A19E. When the key switch is moved to the start position, the key switch (20) ground is applied to circuit A19-GB going to the water-in-fuel module (16), pin C, to the WIF connector (3116), pin E. This initiates a bulb check by causing the module to apply power to connector (16), pin B, circuit A19F, to the WIF connector (3116), pin B, and the water-in-fuel module warning light (9). This causes the warning light, grounded through connector (9), circuit A19-G, to the WIF connector (3116), pin C, circuit A19-G, to the WIF connector (3116), pin D, circuits A19-GC/A11–G, to platform ground (1PG), to illuminate. When water is detected in the fuel filter by the water probe, a ground path is completed to the water-in-fuel module (16), pin D, circuit A19C, to the WIF connector (3116), pin F, circuit A19C, to connector (2), pin H6, circuit N19C, connector (9851), pin F, circuit K19C, fuel filter connector (6704), pin 2, and water probe (1WP), thus causing the “WATER-IN-FUEL” warning light to illuminate.

WATER-IN-FUEL: RE 300 (I6 ENGINE)

The I6 engine ECM2 will turn on the “WATER-IN-FUEL” warning light. The battery voltage is through the ignition switch relay (1711), circuits A13/A13A, fuse F20, circuits A97AC/A97AB, to the MSM1 connector (3114) pin 7 and to the WIF connector (3116), pin G, circuit A19K, to the WIF connector (3116), pin C, circuit A19–G, to the “WATER-IN-FUEL” warning light (9), pin B. The “WATER-IN-FUEL” indicator is controlled by the ECM2 (6020). The control from ECM2 connector (6020), pins 12 and 13, is transferred over the data link on circuits K5AA(+) and K5AA(-) through pins 14 and 15 of connector (9850), to the MSM1 connector (3114) pins 5 and 6. A ground is sent from the MSM2 connector (3115) through pin 3, circuit A19–GD, to the WIF connector (3116), pin H, circuit A19F, to the WIF connector (3116), pin B, to the “WATER-IN-FUEL” warning light (9), pin A, thus causing the “WATER-IN-FUEL” warning light to illuminate.

FUEL FILTER: RE 200/RE 300

When the fuel filter becomes restricted, the contacts of the fuel filter vacuum switch will close and the ECM2 will turn on the “FUEL FILTER" indicator. The battery voltage is through the ignition switch relay (1711), circuits A13/A13H, fuse F25, circuits A19J, to the “FUEL FILTER" warning light (69), pin A, in the instrument cluster. The “FUEL FILTER" indicator is controlled by the ECM2 (6020). The control from ECM2 connector (6020), pins 12 and 13, is transferred over the data link on circuits K5AA(+) and K5AA(-) through pins 14 and 15 of connector (9850), to the MSM1 connector (3114) pins 5 and 6. A ground is sent from the MSM2 connector (3115) through pin 1, circuit A19B, to the “FUEL FILTER" warning light (69), pin B, in the instrument cluster. This causes the indicator to illuminate.

TRANS OIL TEMP: RE 200/RE 300 With Allison WTEC III

When the transmission temperature sensor senses that the transmission temperature is above 305 degrees F, its contacts close. The battery voltage is through the ignition switch relay (1711), circuits A13/A13F, fuse F22,

circuits A28 and A28B, green connector (11), pin 10, the “TRANS OIL TEMP” warning light, green connector (11), pin 6, circuit A31, connector (2), circuit A31A, connector (9850), circuit N31A, and the closed contacts of the temperature sensor to ground. This will cause the “TRANS OIL TEMP” warning light to illuminate.

LOW BRAKE FLUID: RE 200/RE 300 With Hydraulic Brakes

With the key switch in the on or start position, battery voltage is through the ignition switch relay (1711), circuits A13/A13F, fuse F22, circuits A28 and A90R to the “LOW BRAKE FLUID” warning light (89–A). With the key switch held in the start position, the low brake fluid warning light will illuminate (bulb check is performed) as a ground is applied through circuits A90V and A90W, brake diode assy (82), and circuit A44-G (also A31-GD with pall transmission filter) to the key switch ground.

TRAC CTRL: RE 200/RE 300 With Anti-lock Brake System (ABS) — Hydraulic Brakes

The battery voltage is through the ignition switch relay (1711), circuits A13/A13F, fuse F22, circuits A28 and A94T, to the “TRAC CTRL” warning light, connector (1500), pin A, connector (1500), pin B, circuit A94U, connector (2), pin F6, circuit N94U, to the full power HCV connector (9808), pin 13. When the traction control switch (1101) is placed (on) position, the “TRAC CTRL” warning light to grounded through the full power HCV connector (9808), pin 8, circuit N94W, connector (2), pin A2, circuit A94W, the traction control switch (1101), circuits A94-GT and A11-G to the platform ground (1PG). The ABS module (ECU) (279) will enable the traction control mode and when the wheel sensors sense wheel slip, the module will apply 12 volts to the modulator valve for the brake to apply to the wheel that is slipping.

TRAC CTRL: RE 200/RE 300 With WTEC or Allison 2000 ICT Anti-lock Brake System (ABS) — Air Brakes

The battery voltage is through the ignition switch relay (1711), circuits A13/A13C, fuse F27, circuits A13M and A94BT/A94DT, to the traction control switch (1101) and is placed (on) position, circuit N94FT, connector (2), pin A7, circuit N94FT, to the ABS module (ECU) connector (288), pin F2. Also, the battery voltage is to circuits A94BT/A94GT, to the “TRAC CTRL” warning light, connector (3127), pin B, connector (3127), pin A, circuit A94CT, connector (2), pin A5, circuit N94CT, to the ABS module (ECU) connector (288), pin C2. The “TRAC CTRL” warning light and the traction control switch are grounded through the coil of the ABS power relay (283), circuits A94–GB and A11-GB to the platform ground (4PG). The ABS module (ECU) (288) will enable the traction control mode and when the wheel sensors sense wheel slip, the module will apply 12 volts to the modulator valve for the brake to apply to the wheel that is slipping.

RETARD ON: RE 200/RE 300 With Allison WTEC III XMSN GEN 4

When the key switch is in the ignition or start position, power from fuse F1C–1 flows through circuit V146A, connector (7101), pin U, circuit K#146A, to the ECU “S” connector (7204), pin 4, and the spliced circuit V146A/V146D, to the retard on warning light relay connector (7807), pin 1. When the retard on on/off switch (919) is moved to the on position, the switch (919), pin 1, circuit A163A, connector (644), pin F, circuit N163A, connector (523), pin L, circuit K#163A, spliced circuit K#163, to the ECU “S” connector (7204), pin 27, and through the switch (919), pin 2, circuit A143H, connector (644), pin H, circuit N143H, spliced circuit N143A, connector (523), pin J, circuit K#143A, to the ECU “S” connector (7204), pin 32, and the retarder enable function is completed. The retarder warning light relay circuit V146B to its coil and circuit V146D to its contacts, will become de-energized when the ECU removes its ground to circuit K#125 at connector (7202), pin 18, through spliced circuit K#125A, connector (7101), pin Q, circuit V125A, relay (7807), pin 5. This will allow power to flow through the contacts of the de-energized warning light relay (7807), circuit V92H, connector (7100), pin L, circuit K92H, connector (523), pin V, circuit N92H, connector (1601), pin A and circuit A92H to the “RETARD ON” warning light (926), pin A. This will cause the warning light (926), pin B, which is grounded through circuits A92-GA/A186, connector (377), pin A, circuits A186/A11-G to the platform ground (1PG), to illuminate.

CHANGE TRANS FILTER: RE 200/RE 300 With Allison WTEC III XMSN GEN 4

For vehicles equipped with the automatic transmission filter warning light, power is supplied to fuse F10, circuit A31D, and the filter warning light (94). When the key switch (20) is held in the start position, power will flow through the filter warning light (94), circuit A31-GA, connector (344), a blue wire, and the pigtail of the filter pressure differential switch. This power will flow through the normally closed contacts of the pressure switch and its connector, a green wire, connector (344), circuit A31-GB, blocking diode (64), circuits A31-GC and A31-GD, and the key switch ground, thus causing the warning light to illuminate for a bulb check. When the transmission filter becomes restricted, the pressure differential switch's normally open contacts will close and power will flow through the warning light to the switch as above, but the power will flow through the normally open contacts of the switch and its connector, a brown wire, connector (344) and circuit A11-GE to platform ground, thus illuminating the change trans filter warning light.

RETARD OVER HEAT: RE 200/RE 300 With Allison WTEC III XMSN

The battery voltage is through the ignition switch relay (1711), circuits A13/A13F, fuse F22, circuits A28 and A13J, connector (377), pin F, circuit A13J, to the "RETARD OVER HEAT" warning light, connector (925), pin B, connector (925), pin A, circuit A105B, connector (1601), pin B, circuit N105B, connector (523), pin U, circuit K#105B/K#105, to the ECU connector (7202), pin 19. When the transmission ECU detects that the transmission retarder is overheating, it will apply a ground (switch to low state) to illuminate the "RETARD OVER HEAT" warning light.

RETARD OVER HEAT: RE 200/RE 300 With Allison WTEC III XMSN GEN 4

The battery voltage is through the ignition switch relay (1711), circuits A13/A13F, fuse F22, circuits A28 and A13J, connector (377), pin F, circuit A13J, to the "RETARD OVER HEAT" warning light, connector (925), pin B, connector (925), pin A, circuit A164B, connector (1601), pin B, circuit N164B, connector (523), pin U, circuit K#164B/K#164, to the TCM connector (7150), pin 64. When the transmission TCM detects that the transmission retarder is overheating, it will apply a ground (switch to low state) to illuminate the "RETARD OVER HEAT" warning light.

ALTERNATOR: RE 200/RE 300

When the voltage output of the alternator is low, a ground will be provided on terminal (G) of the alternator, and through the VT365 or I6 circuit filters. This ground will be present on circuit 1C to pin 16, of the natural instrument cluster connector (12) and will cause the "ALTERNATOR" warning light, to illuminate. The battery voltage is through the ignition switch relay (1711), circuit A13/A13F, fuse F22, circuit A28/A28B, the green instrument cluster (11), pin 10 to the alternator warning light.

3. REMOVE AND INSTALL

3.1. INSTRUMENT CLUSTER

The cluster is a reliable, quick-disconnect package for the most commonly used instruments. Should the need arise, the cluster body can be quickly detached from the RE drivers instrument console for quick access to any of its components. Either the complete cluster assembly or any of its components can be replaced.

Always place the ignition in the OFF position (not ACC) prior to working on the cluster, due to potential shorting between the ground and ignition pins, which will damage the circuit board and gauges.

CAUTION – Static electricity can cause permanent damage to the cluster. Before working on the cluster, be sure you have removed all static electricity from your body by touching metal that is grounded. Do not wear clothing that causes static build up (such as nylon). Do not touch any pin connectors during removal and installation of gauges. Work on the cluster in a clean environment to avoid dust.

Remove

1. Remove the nine (9) gray vinyl button fasteners (Item 4, Figure 14) located on the instrument console.
2. Remove the nine (9) instrument console screws (Item 3, Figure 14) located on the instrument console.
3. Remove the two (2) instrument console screws (Item 1, Figure 14) located on the side wall of the bus below the defroster duct.
4. Remove the vinyl instrument console (Item 2, Figure 14) located on the drivers instrument console. Protect the vinyl instrument console during removal by placing a soft cloth on the forward side of the steering column.

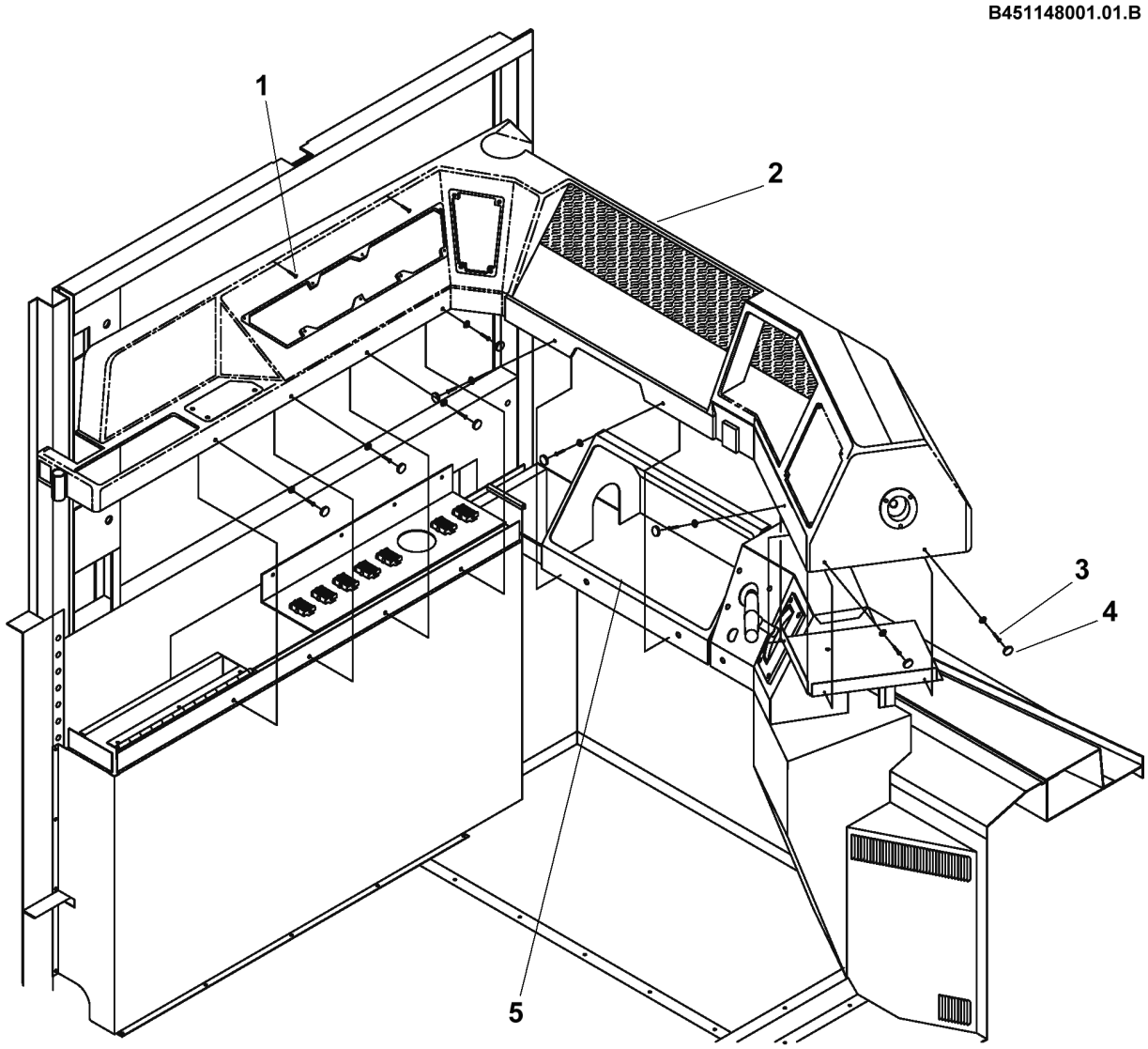

Figure 14 RE Driver Instrument Console

1. TWO (2) INSTRUMENT CONSOLE SCREWS
2. DRIVER VINYL DASH CONSOLE
3. NINE (9) INSTRUMENT CONSOLE SCREWS
4. NINE (9) GRAY VINYL BUTTON FASTENERS
5. DASH PANEL

5. Protect the bezel during removal by placing a soft cloth on the forward side of the steering column.

6. Remove the six (6) cluster mounting screws (Item 1, Figure 15) located on the upper and lower front face of the cluster.

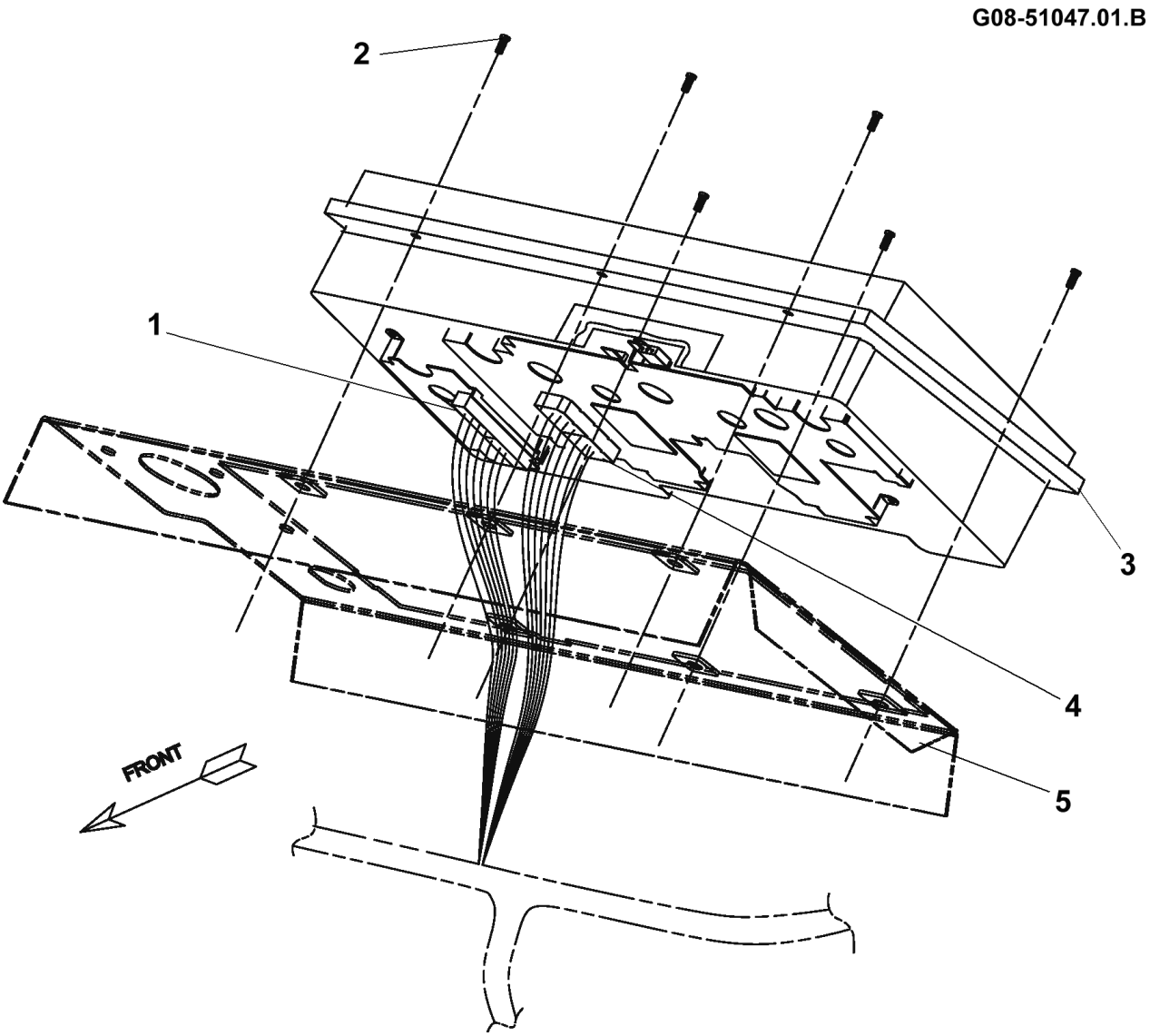

Figure 15 Instrument Cluster Assembly

1. WIRING HARNESS NATURAL CONNECTOR (12)
2. SIX (6) CLUSTER MOUNTING SCREWS
3. CLUSTER
4. WIRING HARNESS GREEN CONNECTOR (11)
5. DASH PANEL

7. Pull the cluster forward and gently release it from the dash panel (Item 2, Figure 15). If the cluster does not come loose easily, put more pressure and continue to pull gently. Do not attempt to pry the cluster from the dash panel as damage will result.

8. Disconnect the two (2) wiring harness connectors from the back of the cluster assembly (Figure 16).

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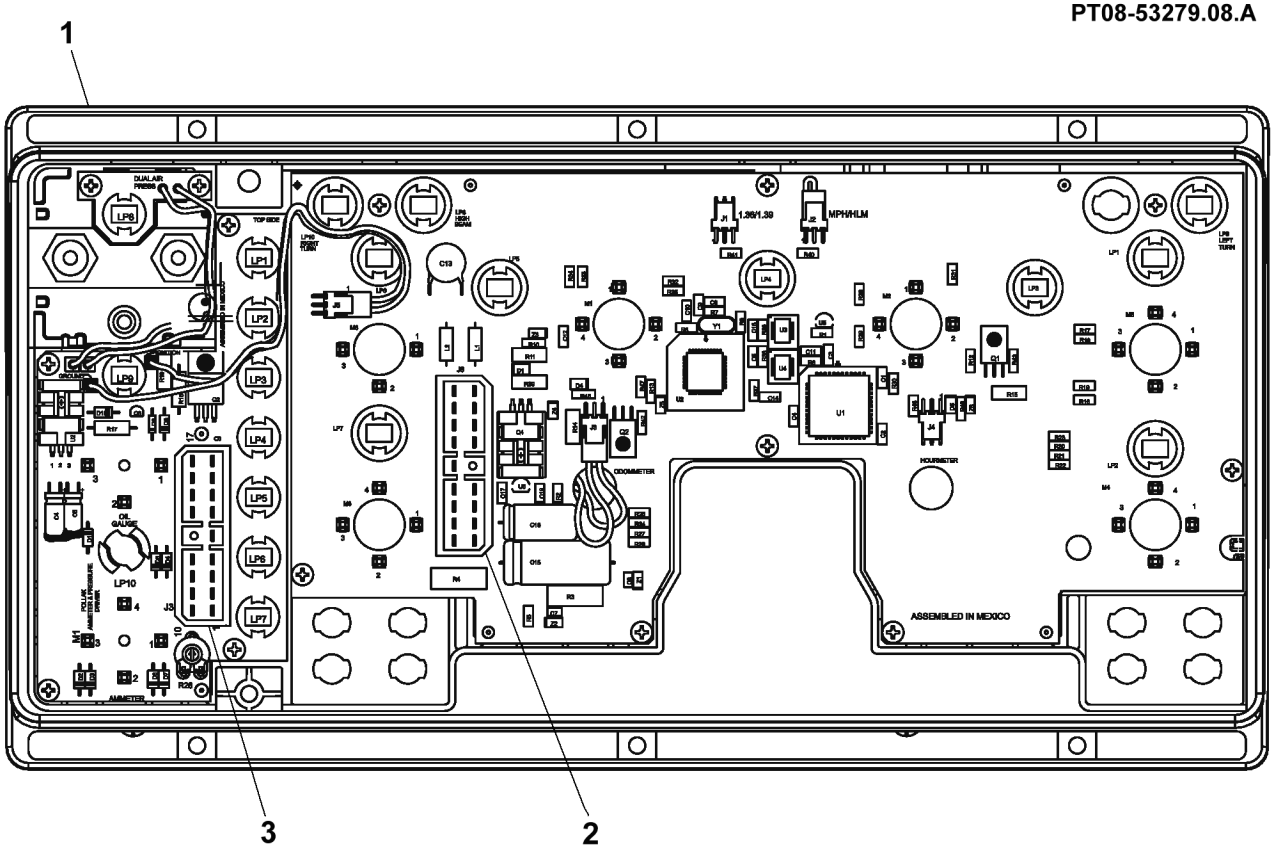

Figure 16 Disconnect Wiring Harness Connectors

1. CLUSTER
2. WIRING HARNESS GREEN CONNECTOR (11)
3. WIRING HARNESS NATURAL CONNECTOR (12)

WARNING – Whenever any component is serviced or removed from the air system, be sure to set the parking brake and/or block the vehicle to prevent it from moving while the service is being performed. Also drain air from the system to prevent dirt or debris from being propelled into one's eyes.

9. After bleeding the air system, disconnect the air lines from the fittings on the back of the air gauge. A double needle air pressure gauge is used with vehicles with air brakes (Figure 17).

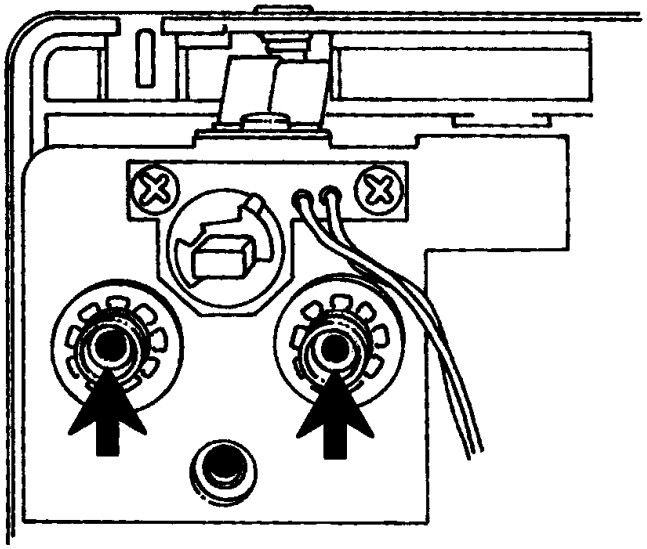

Figure 17 Disconnect Air Lines From Fittings on Back of Air Gauge

NOTE – Note the color of the air lines being removed from the gauge. The green line is for the primary system and the orange line is for the secondary system.

10. The instrument cluster assembly is now free to be removed from the instrument panel.

Install

1. Connect the air lines to the air pressure gauge. The green line is for the primary system and the orange for the secondary system.

   NOTE – Do not exceed 36 in-lbs. (4.0 Nm) of torque when tightening air lines.

2. Connect the two (2) wiring harness connectors to the back of the cluster. These connectors are color-coded for proper orientation.

3. Align the cluster in the instrument panel frame and push and hold the cluster gently into place.

4. Install the six (6) cluster mounting screws on the upper and lower front face of the cluster.

5. Install the vinyl instrument console on the drivers instrument console.

6. Install the two (2) instrument console screws located on the side wall of the bus below the defroster duct.

7. Install the nine (9) instrument console screws located on the instrument console.

8. Install the nine (9) gray vinyl button fasteners located on the instrument console.

3.2. INSTRUMENT CLUSTER COMPONENTS

Remove

1. With the cluster released from the dash panel (refer to INSTRUMENT CLUSTER, Remove), remove the five (5) bezel screws that fasten the bezel to the cluster housing (Figure 18). Place the instrument cluster face up on a clean, horizontal surface to prevent loss of unused gauge covers, gauges, etc.

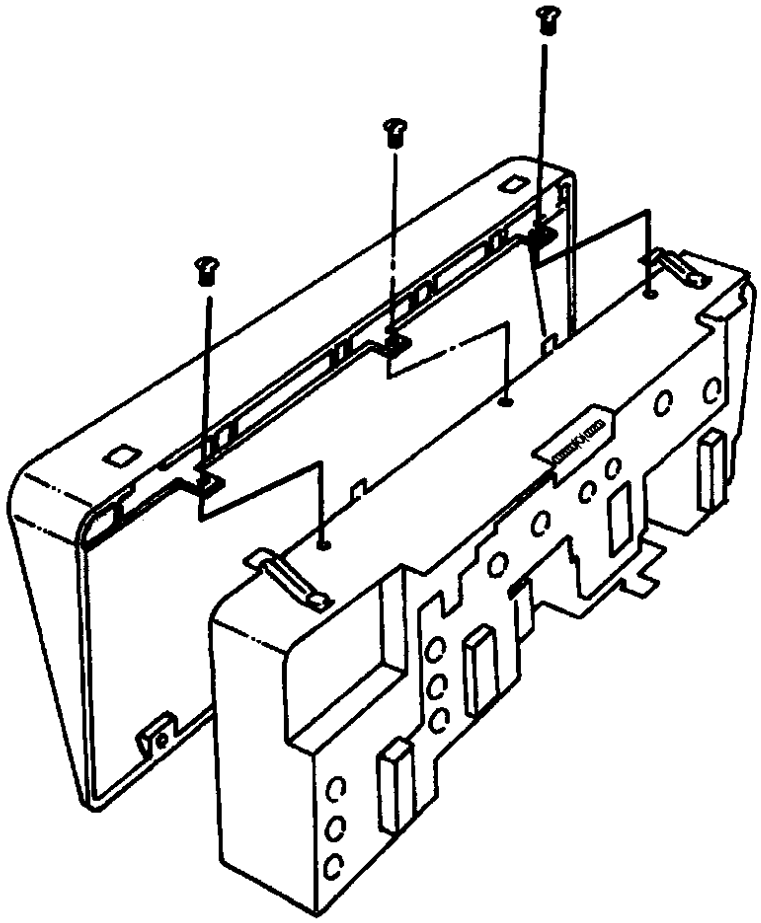

Figure 18 Remove Bezel Screws Fastening Bezel to Cluster Housing

2. Remove the bezel lens assembly from the housing and put it in a safe place to prevent scratching. Take care not to damage the gauge pointers with the bezel.

> **CAUTION – Individual gauge dials are not protected by a lens. When removing or installing gauges, handle them by the edge of the dial face only. Do not touch the gauge pointer.**

3. All gauges, with the exception of the air pressure, hour-meter and odometer, are plug-in gauges. To remove, locate the hole in the back of the cluster behind the gauge and using a small, blunt tool such as a small screwdriver handle, push the gauge out of the housing. Once the gauge has cleared the housing, it may be removed from the front.

CAUTION – After a gauge is removed from the cluster, it is important that the exposed terminals attached to the circuit board are not touched or shorted across. Static electricity or shorting between power and ground terminals can damage the cluster.

4. To remove the hour-meter and/or odometer, disconnect the wiring plugs from the circuit board at the back of the cluster. At the front of the cluster, remove the adhesive-backed mask covering the gauge, then retract the two fingers that hold the gauges in the cluster and lift the gauge out of the cluster.

CAUTION – When removing or installing the hour-meter or odometer, do not touch the metal portion of the leads that fasten to the circuit board. A static discharge could damage the cluster.

5. The mechanical type air gauge is front serviceable after the air line fittings and the retaining nuts have been removed from the rear of the gauge.

6. The panel lamp bulbs are the push-in type and are mounted in a twist lock receptacle. They are serviceable from the rear of the instrument cluster by twisting to remove (Figure 19).

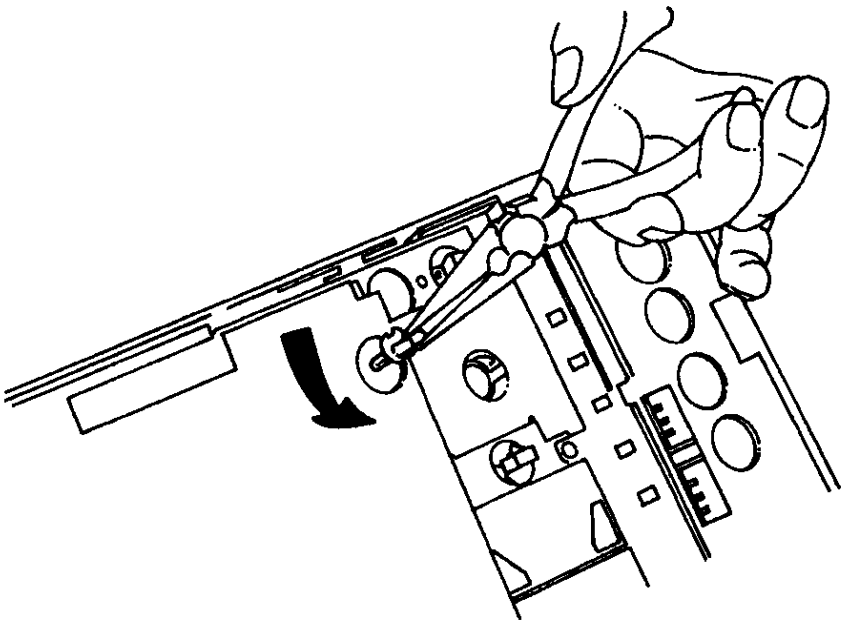

Figure 19 Twist Panel Lamp Bulbs to Remove

The gauge back lights are #936 bulbs and the turn signals, high beam and warning lights are #37.

3.3. PRINTED CIRCUIT BOARDS

Replacement

Since printed circuit boards are fastened to and integral with the instrument cluster body, the boards and cluster are available for replacement as a complete assembly only. Where replacement is required, obtain

a new gaugeless instrument cluster assembly and transfer all gauges, warning light masks and light bulbs from old cluster body to the new.

3.4. SPEEDOMETER SENSOR

IMPORTANT – Turn the key switch to OFF before removing or installing the speedometer sensor.

Remove

1. Disconnect the sensor connector from the wiring harness connector (Figure 19).

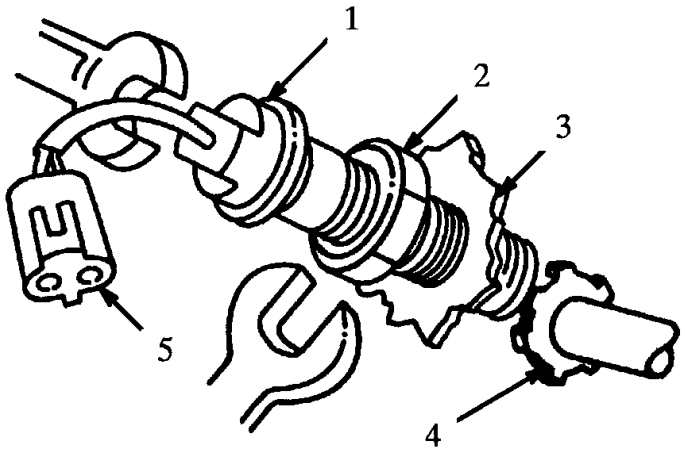

Figure 20 Disconnect Sensor Connector From Wiring Harness Connector

1. SENSOR BODY
2. LOCKNUT
3. HOUSING
4. TRANSMISSION SPEEDOMETER GEAR
5. SENSOR CONNECTOR

2. Loosen the sensor locknut and remove the sensor from the back of the transmission housing.

IMPORTANT – Allison automatic transmissions use a **non-adjustable** speedometer sensor, but its electrical operation is similar to the standard International sensor.

Install

1. Install the new sensor by turning into the housing until it bottoms out against the speedometer gear. **Back off one (1) turn.**

2. Tighten the lock nut using two wrenches to keep the sensor from turning while tightening the locknut. Tighten to 15 ft-lbs. (20 Nm).

3. Reconnect the sensor connector to the wiring harness connector.

4. Test drive the vehicle to test the speedometer.

4. INSTRUMENT CLUSTER JUMPER USAGE

The speedometer jumper pins are used to set up the cluster for MPH or KPH as the primary speedometer readout, and to select axle ratios. They are located at the top edge of the cluster and can be accessed by pulling the cluster out of the instrument panel (Item 3, Figure 21). All other speedometer and tachometer parameters are programmed electronically through the data link into the engine ECM2.

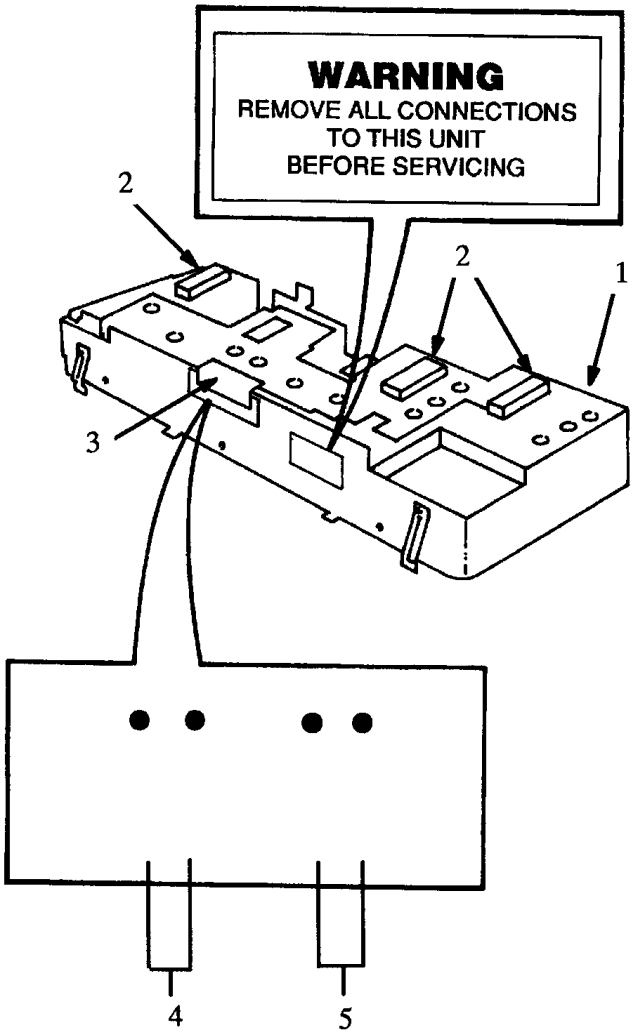

Figure 21 Jumper Pin Location

1. CLUSTER
2. WIRING HARNESS CONNECTORS
3. RECEPTACLE PINS FOR JUMPERS
4. ENGLISH-METRIC CONVERSION SPEEDOMETER AND ODOMETER JUMPER PINS (MPH/KPH)
5. ONE AXLE RATIO SETTING JUMPER PINS

There may be two jumpers visible. The left jumper is for setting the odometer from English to metric readings (Item 4, Figure 21). For miles per hour (MPH), the jumper is not installed. For a kilometers per hour (KPH) speedometer, the jumper is installed.

The right jumper (Item 5, Figure 21) is for calibration of the two available two-speed axle ratios. These are 1.36:1 (jumper not installed) and 1.39:1 (jumper installed). If the vehicle does not have a two-speed axle, the jumper setting is inactive and a jumper is not needed.

IMPORTANT – For the speedometer and tachometer to function properly when tire sizes and/or rear axle ratios are changed, the engine ECM2 must be reprogrammed so that it will send the correct data to the instrument cluster.

5. CLUSTER FAILURE DIAGNOSIS

CAUTION – Be sure to turn the key switch to OFF when the cluster or any cluster part is inserted or removed. Shorting across the meter pins could cause permanent damage to the cluster.

CAUTION – Static electricity can cause permanent damage to the cluster. Before working on the cluster, be sure you have removed all static electricity from your body by touching metal that is grounded. Do not wear clothing that causes static build up (such as nylon). Do not touch any pin connectors during removal and installation of gauges. Work on the cluster in a clean environment to avoid dust.

After a cluster failure or suspected malfunction, turn off electrical power to the cluster by switching off accessory voltage. Remove the cluster from the dash. Refer to INSTRUMENT CLUSTER, Remove.

5.1. CLUSTER HARNESS CONNECTORS

Connecting the instrument panel to the vehicle are two vehicle harness connectors fastened to the back of cluster. The center connector (11) is green color and the right or passenger's side connector (12) is natural in color.

Each harness connector has seventeen (17) pins numbered right to left. The bottom row contains pins 1 through 9 and the top row, pins 10 through 17. There is a space between pins 13 and 14 (Figure 22).

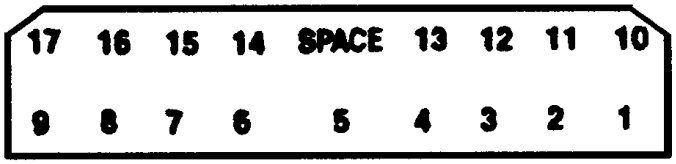

Figure 22 Harness Connector Pins

Center Harness Connector Pinouts (Green) (11)

BOTTOM ROW

1. Center Cluster Gauge Backlighting (+) Cir A62C
2. Cluster Ground (-) Cir A28-G
3. Fuel Sensor Cir A36

4. High Beam (+) Cir A52A
5. (No Connection)
6. Left Turn (+) Cir A56B
7. J1587/J1708 Data Link Cir A98E(+)
8. (No Connection)
9. J1587/J1708 Data Link Cir A98F(-)

TOP ROW

10. Ignition Voltage (+) Cir A28B
11. Center Cluster Gauge Backlighting (-) Cir A62-GB
12. Right Turn (+) Cir A57B
13. (No Connection)
14. (No Connection)
15. SERVICE Engine Coolant Level Cir K34A
16. (No Connection)
17. (No Connection)

Right Side Harness Connector Pinouts (Natural) (12)

BOTTOM ROW

1. Right Cluster Gauge Backlighting (+) Cir A62D
2. Transmission Oil Temperature Cir A31A
3. (No Connection)
4. Gauge Feed Cir A28D
5. WAIT TO START (-) Cir A18-G
6. Cruise Control Cir A97AA
7. CHECK TRANS Cir A125
8. Ignition Voltage (+) Cir A28C
9. BRAKE Cir A40A W/Air Pressure, Cir **A90N **W/Hydraulic Brakes

TOP ROW

10. Right Cluster Gauge Backlighting (-) Cir A62-GC

11. (No Connection)

12. AMMETER (+) Cir A26

13. Gauge Feed Cir A28A

14. OIL/WATER Cir A29/35

15. Cruise Control Cir A97T

16. (No Connection)

17. PARKING BRAKE (+) **Cir A44 **W/Hydraulic Brakes

5.2. CLUSTER CONNECTORS

Looking at the rear of the cluster (Figure 21), the two connectors (Figure 23) will be the reverse of the plug-in harness connectors (Figure 22). The center is green (11) and the left is natural (12).

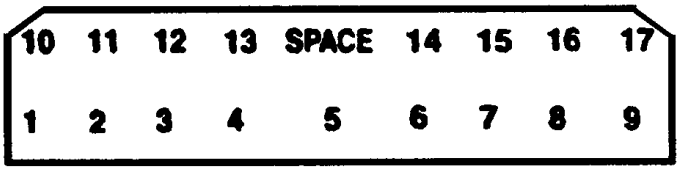

Figure 23 Cluster Connectors

The connector pins are numbered from left to right. The bottom row has pins 1 through 9. The top row has pins 10 through 17. There is a space between pins 13 and 14 in the top row.

5.3. AIR GAUGE FAILURE

If either air gauge pressure reading is outside a ± 5 psi range of the shop gauge reading, replace the cluster air gauge.

5.4. FUEL LEVEL SENSOR

If the electric fuel gauge shows a reading and it is suspected of being in error and the steps defined in FUEL GAUGE, OPTIONAL ELECTRICALLY OPERATED TEMPERATURE GAUGE, OR AMMETER FAILURE, do not locate the problem, the fuel level sensor must be checked. The fuel level sensor used is a float/resistive potentiometer type with the following output characteristics at different fuel levels.

IMPORTANT – Before checking the fuel gauge, be sure the vehicle has been parked long enough on a level surface for the fuel to settle out, and in cold weather be sure the cab interior is warmed up.

Table 2 Fuel Tank Level to Sensor Output Ohms

Fuel Tank Levels	Sensor Output Ohms
Full	88±3
3/4	66±3
1/2	44±2

Table 2 Fuel Tank Level to Sensor Output Ohms (cont.)

Fuel Tank Levels	Sensor Output Ohms
1/4	22±2
Empty	1±1

When the sensor wire is shorted to ground, the gauge should read "E"mpty. When the sensor wire is disconnected, the gauge should read "F"ull.

Locate the fuel level sensor circuit pin in the cluster harness [connector (27)/pin 3] and measure resistance to ground. If the resistance reading and the fuel level agrees with the above listing and the gauge does not match, replace the fuel gauge.

If readings and fuel level do not match, disconnect harness at sensor and measure resistance at the sensor. If correct readings are obtained, repair harness. If readings are out of specification, replace fuel level sensor.

5.5. FUEL GAUGE, OPTIONAL ELECTRICALLY OPERATED TEMPERATURE GAUGE, OR AMMETER FAILURE

If any of the five possible electrical temperature gauges or the fuel gauge is suspected of displaying incorrectly, the vehicle circuits that affect the suspected gauge must be checked for clean, tight, unbroken and non-shorted connections. If the wiring and connector are OK, the thermistor type temperature sensor's electrical resistance must be checked with a quality ohmmeter at the cluster harness connector. Refer to CLUSTER HARNESS CONNECTORS for the pin locations.

NOTE – The following tests are for the three pin electric gauges and circuitry only. These tests do not apply to the four pin data link driven electronic gauges and circuitry.

Instrument Gauge Tester Operation

The Instrument Gauge Tester (Special Tool Catalog #ZE-2781) (Figure 24) permits testing of electric gauges without removing them from the vehicle. This tester will provide up to 2050 ohms required for making low scale readings on temperature gauges.

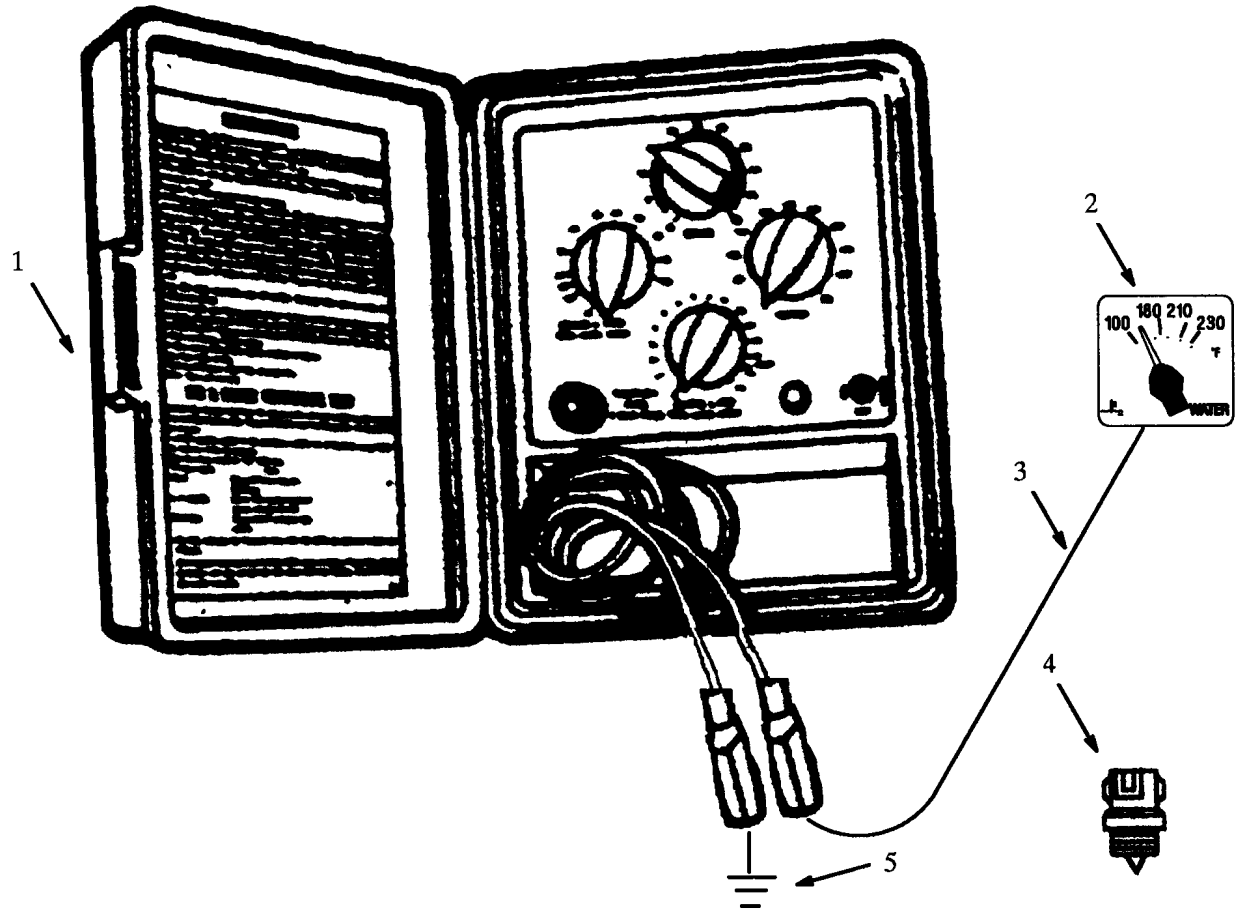

Figure 24 Instrument Gauge Tester

1. INSTRUMENT GAUGE TESTER
2. ELECTRIC GAUGE
3. WIRE TO GAUGE
4. SENDER
5. GROUND

To test an electric gauge:

1. With key off, disconnect the sensor wire at the sensor.
2. Connect one lead of the Instrument Gauge Tester to the sensor wire.
3. Connect the other tester lead to a good vehicle ground.
4. Set the resistance to the values shown in Gauge Tester Resistance Settings.
5. Turn key switch to ON.
6. Note gauge needle positions.

If gauge responds correctly to the tests:

- Gauge is OK.
- Sender unit may be faulty, or
- Sender unit ground may be faulty.

NOTE – Sealant or dirt on the sender unit or engine threads may prevent good electrical ground. Check for this condition before replacing sender unit.

If gauge does not respond to the tester:

- Check continuity of gauge wiring circuits for opens or shorts.
- Check connectors for clean, tight fits.
- Check gauge cluster ground circuit. Make sure circuit is grounded.
- If wiring is OK, replace gauge.

Gauge Tester Resistance Settings

Table 3 Gauge Tester Resistance Settings (Ohms) — For Use With ZE-2781 Gauge Tester)

Type of Gauge	Gauge Reading (Within Two Needle Widths ±)		
	Low Scale	Half Scale	Full Scale
Fuel Level	1	44	88
Oil Temperature: Engine	1365	63	28
Oil Temperature: Transmission	1365	63	28
Oil Temperature: Rear Axle	1365	63	28

Thermistor Resistance Check

To check thermistor type temperature sensors, the approximate temperature of the component being checked must be known to determine the amount of resistance that will be read at the cluster harness connector.

Table 4 Component Temperature to Thermistor Resistance

Component Temperature		Thermistor Resistance (Ohms)
Fahrenheit	Centigrade	
32	0	8,335
50	10	4,945
68	20	3,010
86	30	1,871
104	40	1,185
140	60	505
158	70	341
194	90	169.8
212	100	125.6

Table 4 Component Temperature to Thermistor Resistance (cont.)

Component Temperature		Thermistor Resistance (Ohms)
Fahrenheit	Centigrade	
230	110	95.2
248	120	73.5
266	130	57.5

The thermistor type sensor is used in the following electrical gauge applications:

- Engine Coolant Temperature
- Engine Oil Temperature
- Transmission Oil Temperature
- Forward Rear Axle Temperature
- Rear Rear Axle Temperature.

NOTE – The two axle gauges and the transmission oil temperature gauge may not indicate a gauge reading due to a low/short run time condition. If there is no gauge reading and any of these gauges is suspected of having a faulty reading, short out the appropriate leads at the sensor. When the sensor leads are shorted together, the gauge should read full scale.

Restricted Needle Movement

If the sensor electrical resistance checks OK, the gauge should be checked for restricted needle movement. Very gently move the needle between the minimum and maximum dial positions. If the needle moves freely, the gauge must be checked for an open or shorted winding. Make sure the key is in the "OFF" position.

Open or Shorted Gauge Winding Check

CAUTION – Static electricity can cause permanent damage to the cluster. Before working on the cluster, be sure you have removed all static electricity from your body by touching metal that is grounded. Do not wear clothing that causes static build up (such as nylon). Do not touch any pin connectors during removal and installation of gauges. Work on the cluster in a clean environment to avoid dust.

After it has been determined that an individual gauge is defective by using the substitution of a known good gauge method, the gauge can be further quick tested as follows:

Remove the gauge and use an ohmmeter to check for an open or shorted winding between the two terminals that connect to that winding. Refer to Cluster Pinouts Table.

- Below 20 ohms - SHORT - Replace Gauge
- Above 1000 ohms - OPEN - Replace Gauge
- Between 20 and 1000 ohms - OK - Refer to Harness Continuity and Voltage Tests.

Cluster Pinouts 16.73 in 8.0 in 72

Refer to Figure 25 and Figure 26.

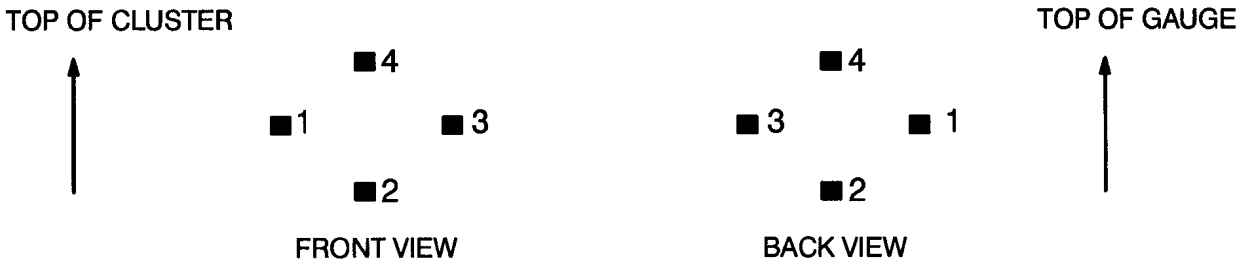

Figure 25 Cluster Pinouts

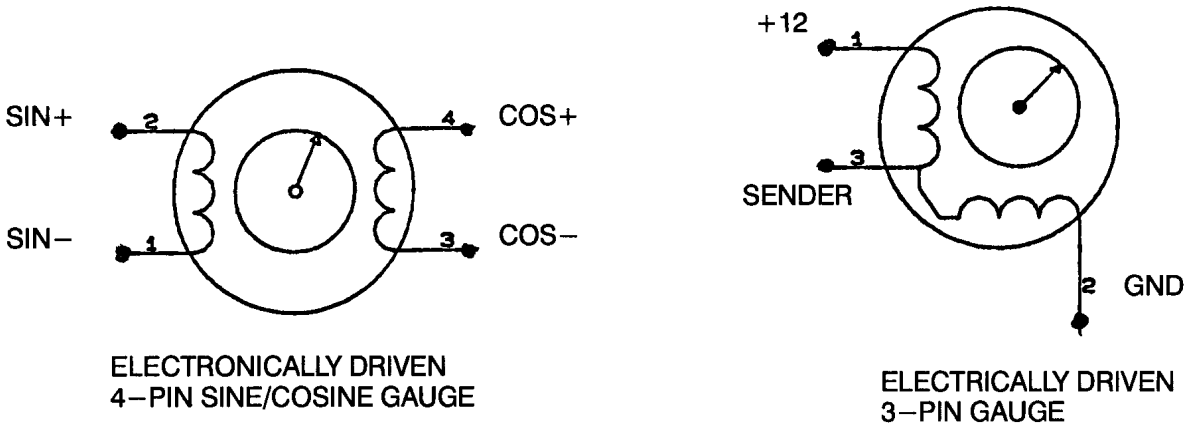

Figure 26 Gauge Position

Table 5 Cluster Pinouts Table

Gauge	Position			
	1	2	3	4
Speedometer	SIN-	SIN+	COS-	COS+
Tachometer	SIN-	SIN+	COS-	COS+
Voltmeter	SIN-	SIN+	COS-	COS+
Oil Pressure	SIN-	SIN+	COS-	COS+
Water Temp. Gauge	SIN-	SIN+	COS-	COS+
Temp. Gauges (N/Water Temp.)	+12V	Ground	Sender	Not used
Fuel Level	+12V	Ground	Sender	Not used
Pyrometer	Reference voltage*	Ground	Sender	Not used

Table 5 Cluster Pinouts Table (cont.)

Gauge	Position			
	1	2	3	4
Ammeter	Positive	Not used	Negative	Not used
* Stewart Warner (round amplifier) 3.5 to 3.9 volts; Isspro (square amplifier) 7.7 to 8.7 volts				

Harness Continuity and Voltage Tests

1. Turn the key switch to OFF.
2. Unplug the wiring harness connector servicing the gauge in question from the cluster. Refer to CLUSTER HARNESS CONNECTORS and GROUP 08 - ELECTRICAL, Circuit Diagrams.
3. Using an ohmmeter, check the resistance of the harness ground circuit and sensor circuit affecting the gauge in question. The resistance should read less than one (1) ohm.
4. Turn the key switch to accessories position and using a voltmeter, check the harness power circuit. It should read just under battery voltage.
5. If both harness circuits check OK, install a new cluster that does not yet contain plug-in gauges.
6. If the voltage measurement or either of the two electrical resistances is incorrect, a faulty sensor, connector, wiring harness or other failure is indicated and further testing is required.

5.6. VOLTMETER DISPLAY FAILURE

If the voltmeter display is indicating a problem, the circuits that serve it must be checked for clean, tight, unbroken and non-shorted connections. If the circuits check OK, measure the appropriate voltage at the appropriate cluster harness connector (refer to CLUSTER HARNESS CONNECTORS and GROUP 08 - ELECTRICAL, Circuit Diagrams). Turn the key switch to ACC and read across the accessory voltage and ground with a good test voltmeter. Replace the voltmeter display gauge if it does not read near the test accessory voltage.

5.7. EXHAUST TEMPERATURE DISPLAY FAILURE

Exhaust Temperature Display Gauge

1. If the exhaust temperature display gauge indicates a problem, check the circuits serving the pyrometer for clean, tight, unbroken and non-shorted connections (refer to CLUSTER HARNESS CONNECTORS and GROUP 08 - ELECTRICAL, Circuit Diagrams).
2. If the circuits are OK, measure the appropriate voltages through the cluster harness connector that services the pyrometer. The pyrometer is supplied with two driving voltages. ALL VOLTAGES ARE MEASURED WITH RESPECT TO THE ELECTRONIC GROUND PIN:
   a. Pyrometer power voltage for Isspro is 8.2 ± 0.5 volts, for Stewart Warner 3.7 ± 0.2 volts (Connector 26-Yellow, Terminal 16).
   b. Sensor voltage that varies according to the exhaust gas temperature and will range from .15 to 6.1 (vdc) (Connector 26-Yellow, Terminal 7).
   c. Ground is at Connector 26-Yellow, Terminal 6.

Pyrometer Sensor Voltage

Table 6 Pyrometer Sensor Voltage

Temperature		Voltage (DC)
Fahrenheit	Centigrade	
300	149	0.15
600	315	1.60
900	482	3.10
1200	649	4.60
1500	816	6.10

1. If voltages **are not** within limits, a faulty sensor, connector or wiring harness is indicated and further testing is required.

2. If the voltages are within limits, the pyrometer gauge should be checked for a sticky needle (refer to Restricted Needle Movement).
   a. The needle sticks, replace the pyrometer gauge.
   b. The needle moves freely, check internal voltage.

Internal Voltage Check

1. Turn key switch to OFF, remove the pyrometer gauge from cluster and make sure the cluster harness connectors are properly installed on the cluster (refer to CLUSTER HARNESS CONNECTORS).

2. Turn the key switch to ACC and measure the voltage across the gauge's cluster socket pins. Refer to GROUP 08 - ELECTRICAL, Circuit Diagrams. Pyrometer reference voltage is at Terminal 1, Sensor voltage at Terminal 3 and Ground at Terminal 2.
   a. If the proper voltages **are not** present, replace cluster with a new gaugeless cluster and re-install gauges.
   b. If the voltages are correct, turn the key switch to OFF and re-install the pyrometer gauge. Turn the key switch to ACC and if the gauge **does not** operate, replace the gauge.

5.8. SPEEDOMETER, ODOMETER, TACHOMETER, HOURMETER, VOLTMETER, OIL PRESSURE GAUGE, AND WATER TEMPERATURE GAUGE FAILURE ISOLATION

If the speedometer, odometer, tachometer, hourmeter, voltmeter, oil pressure, or water temperature gauge indicates a failure, the circuits serving the instrument in question must be checked for clean, tight, unbroken and non-shorted connections.

IMPORTANT – Be sure all relays in the vehicle are the suppressed type.

IMPORTANT – Make sure the accessory voltage to the cluster is within a range of 11 to 16 volts.

The instrument cluster has self testing capabilities that will identify various failures in the electronic portions of the unit. The self testing diagnostics provide a strong indication of exactly what is wrong with the unit, without removing the cluster from the vehicle or spending a large amount of time troubleshooting.

Pass Indications

The cluster will test itself each time the vehicle is powered up. If all tests pass, the unit will drive the speedometer, tachometer, voltmeter, oil pressure gauge, and water temperature gauge needles through one complete sweep. This indicates that all input circuits are good and tells the driver that all output circuits driving the gauges are good.

Fail Indications

The cluster will provide failure indications in two ways:

1. Does not provide a proper gauge sweep on power up.

2. The speedometer, tachometer, voltmeter, oil pressure gauge, and water temperature gauge needles "wave" on power up.

If the unit senses a circuit problem at power up, the speedometer, tachometer, voltmeter, oil pressure gauge, and water temperature gauge needles will simultaneously wave from 0 and one of the numbers on the speedometer and tachometer dial faces three times. Corrective action is defined in the following failure chart.

Electronic Service Tool (EST) Diagnostics

Operation and accuracy of the speedometer, tachometer, fuel, oil pressure, water temperature and voltmeter can be verified with an EST, without removing the cluster. The EZ-Tech, with the instrument cluster software, can be used to exercise the speedometer/tachometer, through the J1708 data link . Refer to the instrument cluster software manual for instructions.

5.9. SPEEDOMETER, ODOMETER, TACHOMETER, HOURMETER, VOLTMETER, OIL PRESSURE GAUGE, AND WATER TEMPERATURE GAUGE FAILURE CHART

Table 7 Speedometer, Odometer, Tachometer, Hourmeter, Voltmeter, Oil Pressure Gauge, and Water Temperature Gauge Failure Chart

FAILURE MODE	FIRST ACTION	SECOND ACTION
1. Speedometer, tachometer, voltmeter, oil pressure gauge, and water temperature gauge needles do not move on power up.	Verify that ignition voltage and ground are provided to cluster. Refer to CLUSTER HARNESS CONNECTORS and GROUP 08 - ELECTRICAL, Circuit Diagrams.	Replace cluster.
2. Speedometer, tachometer, voltmeter, oil pressure or water temperature gauge needle moves erratically on power up sweep.	Swap the speedometer and tachometer in the cluster, or water temperature gauge for another temperature gauge, etc. in the cluster. If the defect follows the meter, replace the meter.	If the defect stays at the same meter location, replace the cluster.

Table 7 Speedometer, Odometer, Tachometer, Hourmeter, Voltmeter, Oil Pressure Gauge, and Water Temperature Gauge Failure Chart (cont.)

FAILURE MODE	FIRST ACTION	SECOND ACTION
3. Speedometer and tachometer sweep in unison and the tachometer needle points to three (3) times.	J1587/J1708 Data Link failure. Insure that the vehicle Data Link is not shorted or wired incorrectly. With the ignition on, voltage from Positive data link circuit to ground should be approximately 4 volts. Voltage from Negative data link circuit to ground should be approximately 1 volt. Refer to CLUSTER HARNESS CONNECTORS and GROUP 08 - ELECTRICAL, Circuit Diagrams.	Verify data from the ECM2 by using an electronic service tool (EST), such as the EZ-Tech™ or Pro-Link® 9000, with the applicable engine software. If data is present replace cluster.
4. Speedometer and tachometer sweep in unison and the tachometer needle points to three (3) times.	Cluster electronics failed. Replace cluster.	
5. Speedometer and tachometer sweep in unison and the tachometer needle points to three (3) times.	Odometer drive circuit failed, odometer is disconnected, or odometer coil is open. Insure odometer connector is properly seated to the printed wiring board connector.	Disconnect odometer connector, swap with hour-meter or connect to hour-meter connector, start engine, and note if odometer advances once every 6 minutes. If odometer advances, replace cluster. If odometer does not advance, replace odometer.
6. Speedometer and tachometer go through a good power up sweep, but **speedometer does not work** when driving.	Check speedometer sensor wiring continuity and sensor output signal levels. Refer to CLUSTER HARNESS CONNECTORS and GROUP 08 - ELECTRICAL, Circuit Diagrams.	Verify signal to ECM2 by using an electronic service tool (EST), such as the EZ-Tech™ or Pro-Link® 9000.
7. Speedometer and tachometer go through a good power up sweep, but **tachometer does not work** when driving.	Verify signal to ECM2 by using an electronic service tool.	

Table 7 Speedometer, Odometer, Tachometer, Hourmeter, Voltmeter, Oil Pressure Gauge, and Water Temperature Gauge Failure Chart (cont.)

FAILURE MODE	FIRST ACTION	SECOND ACTION
8. Speedometer and tachometer go through a good power up sweep, but **odometer does not work** when driving.	Remove odometer and swap with hour-meter or connect to hour-meter connector, start engine, and note if odometer advances every 6 minutes. If odometer advances, replace the cluster.	If odometer does not advance, replace odometer.
9. Speedometer and tachometer go through a good power up sweep, but hour—meter does not work when driving.	Swap hour-meter with odometer, drive truck and note if the hour-meter (placed in odometer location) advances every tenth of a mile. If the hour-meter operates, replace the cluster.	If the hour-meter does not advance, replace the hour-meter.

6. TROUBLESHOOTING (INDICATOR AND WARNING LIGHT DIAGNOSTICS)

Before beginning these test procedures, do the following:

A. Make sure the vehicle batteries are at 75% state of charge (SOC) or higher. This represents an open circuit voltage (OCV) of 12.4 volts. Batteries with an OCV of 12 volts or less are either completely discharged or have a dead cell.

B. Check any light or indicator lamp filaments that are suspected of being open (burned out). This is done to avoid unnecessary extensive circuit checks.

C. Inspect all connectors for loose or damaged pins, wires, etc. Refer to TEST EQUIPMENT AND CONNECTOR REPAIR section in GROUP 08 - ELECTRICAL in CTS-5000 Master Service Manual.

D. When the technician determines that a fuse is blown, while checking its condition, he is directed to locate the cause of the overload condition and to repair it. While no further instruction on this procedure is listed in the diagnostic tables, the common procedure is as follows: isolate sections of the circuit by disconnecting connectors, and measure the resistance to ground to find the circuit that is shorted to ground. Then locate the damaged spot in the wire or connector and repair.

E. Diagnostics for circuits that are malfunctioning by sticking in the on position are generally not covered in detail. It is assumed that the technician knows to check for a malfunctioning switch, relay, or solenoid.

6.1. LEFT TURN

RE 200/RE 300 With International Turn Signal Switch (Stationary Column)

Table 8 RE 200/RE 300 With International Turn Signal Switch (Stationary Column)

Step	Key	Action	Test Points	Spec.	Yes-In Spec.	No-Out of Spec
1.	Off	Move turn signal switch (62) to left turn position. Does left turn signal light illuminate?			Go to next step.	Refer to Electrical Troubleshooting Manual (ETM) for troubleshooting of turn signal lights and switch.
2.	Off	Loosen cluster and remove LEFT TURN signal indicator light bulb. Test for continuity.	Across indicator light bulb.	<100 ohms.	Re-install bulb. Go to next step.	Replace defective bulb and reconnect connector. Repeat all tests if problem persists.
3.	Off	Disconnect connector (11), and measure voltage from circuit A56B to ground.	(11), A56B to gnd.	Pulsating 12±1.5 volts.	Go to next step.	Locate cause of no or low voltage in circuit A56B, then repair. Reconnect connectors.
4.	Off	At connector (11), measure voltage from circuit A56B to circuit A28-G with turn signal in left turn position.	(11), A56B to A28-G.	Pulsating 12±1.5 volts.	Go to next step.	Locate open or poor connection in circuit A28-G or A11-G to platform ground, then repair.
5.	Off	Reconnect connector (11). Does turn signal indicator blink with turn signal lights?			Left turn indicator and circuits test good.	Replace defective cluster assembly.

RE 200/RE 300 With Douglas Turn Signal Switch (Tilt Column)

Table 9 RE 200/RE 300 With Douglas Turn Signal Switch (Tilt Column)

Step	Key	Action	Test Points	Spec.	Yes-In Spec.	No-Out of Spec
1.	Off	Move turn signal switch (95) to left turn position. Does left turn signal light illuminate?			Go to next step.	Refer to Electrical Troubleshooting Manual (ETM) for troubleshooting of turn signal lights and switch.
2.	Off	Loosen cluster and remove LEFT TURN signal indicator light bulb. Test for continuity.	Across indicator light bulb.	<100 ohms.	Re-install bulb. Go to next step.	Replace defective bulb and reconnect connector. Repeat all tests if problem persists.
3.	Off	Disconnect connector (11), and measure voltage from circuit A56B to ground.	(11), A56B to gnd.	Pulsating 12±1.5 volts.	Go to next step.	Locate cause of no or low voltage in circuit A56B, then repair. Reconnect connectors.

Table 9 RE 200/RE 300 With Douglas Turn Signal Switch (Tilt Column) (cont.)

Step	Key	Action	Test Points	Spec.	Yes-In Spec.	No-Out of Spec
4.	Off	At connector (11), measure voltage from circuit A56B to circuit A28-G with turn signal in left turn position.	(11), A56B to A28-G.	Pulsating 12±1.5 volts.	Go to next step.	Locate open or poor connection in circuit A28-G or A11-G to platform ground, then repair.
5.	Off	Reconnect connector (11). Does turn signal indicator blink with turn signal lights?			Left turn indicator and circuits test good.	Replace defective cluster assembly.

6.2. (ABS) ANTI-LOCK BRAKE

RE 200/RE 300 With WTEC or Allison 2000 ICT Air Brakes

Table 10 RE 200/RE 300 With WTEC or Allison 2000 ICT Air Brakes

Step	Key	Action	Test Points	Spec.	Yes-In Spec.	No-Out of Spec
1.	Off/ On	Disconnect ABS ECU connector (288) and use a test jumper to connect pin E3 to ground. Move key switch to ignition position. Does ABS warning light illuminate?			Warning light circuits test good. Turn key off, reconnect conn. (288), and turn key on. If warning light does not illuminate during bulb check, reprogram/ replace ECU.	Go to next step.
2.	Off	Loosen cluster and remove (ABS) anti-lock brake warning light bulb. Test for continuity.	Across warning light bulb.	<100 ohms.	Re-install bulb. Go to next step.	Replace defective bulb and reconnect connector. Repeat all tests if problem persists.
3.	Off/ On	Disconnect connector (297), move key switch to ignition position, and measure voltage from circuit A94B to ground.	(297), A94B to gnd.	12±1.5 volts.	Go to next step.	Locate cause of no or low voltage in circuits A28, A13N or A94B from fuse (F22), then repair.

Table 10 RE 200/RE 300 With WTEC or Allison 2000 ICT Air Brakes (cont.)

Step	Key	Action	Test Points	Spec.	Yes-In Spec.	No-Out of Spec
4.	On	Remove warning light relay (284), and at relay socket, measure voltage from circuit A94E to ground.	(284), A94E to gnd.	12±1.5 volts.	Go to next step.	Locate cause of no or low voltage in circuit A94E, then repair.
5.	On	At relay socket (284), measure voltage from circuit A94E to A94-GA.	(284), A94E to A94-GA.	12±1.5 volts.	Go to next step.	Locate open or poor connection in circuits A94-GA, A94-GB or A11-GB, then repair.
6.	On	With jumper still connected at ECU, at relay socket (284), measure voltage from circuit A94E to A94H.	(284), A94E to A94H.	12±1.5 volts.	Go to next step.	Locate open or poor connection in circuits A94H, conn. (2), N94H or gray wire, then repair.
7.	Off	Bench test warning light relay (284) by measuring resistance from pin 30 to 87A.	Relay, pin 30 to 87A.	<1 ohm.	Go to next step.	Replace defective warning light relay.
8.	Off	Bench test warning light relay (284) by applying +12V to pin 86, gnd. to pin 85, and measuring resistance from pin 30 to 87.	Energized relay, pin 30 to 87.	<1 ohm.	Go to next step.	Replace defective warning light relay.
9.	Off/ On	Re-install warning light relay, and with jumper still installed at connector (288), move key switch to ignition position. Does warning light illuminate?			ABS warning light circuits test good. Turn key off. Reconnect conn. (288) and turn key on. If warning light does not illuminate during bulb check, reprogram/ replace ECU.	Locate open or poor connection in circuit A94E, then repair.

RE 200/RE 300 With Hydraulic Brakes GEN 4

Table 11 RE 200/RE 300 With Hydraulic Brakes GEN 4

Step	Key	Action	Test Points	Spec.	Yes-In Spec.	No-Out of Spec
1.	Off/ On	Disconnect ABS ECU connector (279) and use a test jumper to connect pin 1 to ground. Move key switch to ignition position. Does ABS warning light illuminate?			Warning light circuits test good. Turn key off, reconnect conn. (279), and turn key on. If warning light does not illuminate during bulb check, reprogram/ replace ECU.	Go to next step.
2.	Off	Loosen cluster and remove (ABS) anti-lock brake warning light bulb. Test for continuity.	Across warning light bulb.	<100 ohms.	Re-install bulb. Go to next step.	Replace defective bulb and reconnect connector. Repeat all tests if problem persists.
3.	Off/ On	Disconnect connector (297), move key switch to ignition position, and measure voltage from circuit A94B to ground.	(297), A94B to gnd.	12±1.5 volts.	Go to next step.	Locate cause of no or low voltage in circuits A28, A13N or A94B from fuse (F22), then repair.
4.	On	Remove warning light relay (R2), and at relay socket, measure voltage from circuit A94E to ground.	(R2), A94E to gnd.	12±1.5 volts.	Go to next step.	Locate cause of no or low voltage in circuit A94E, then repair.
5.	On	At relay socket (R2),, measure voltage from circuit A94E to A94-GB.	(R2), A94E to A94-GB.	12±1.5 volts.	Go to next step.	Locate open or poor connection in circuit A94-GB or A11-G, then repair.
6.	On	With jumper still connected at ECU, at relay socket (R2),, measure voltage from circuit A94E to A94H.	(R2),, A94E to A94H.	12±1.5 volts.	Go to next step.	Locate open or poor connection in circuits A94H, conn. (2), N94H or gray wire, then repair.

Table 11 RE 200/RE 300 With Hydraulic Brakes GEN 4 (cont.)

Step	Key	Action	Test Points	Spec.	Yes-In Spec.	No-Out of Spec
7.	Off	Bench test warning light relay (R2), by measuring resistance from pin 30 to 87A.	Relay, pin 30 to 87A.	<1 ohm.	Go to next step.	Replace defective warning light relay.
8.	Off	Bench test warning light relay (R2), by applying +12V to pin 86, gnd. to pin 85, and measuring resistance from pin 30 to 87.	Energized relay, pin 30 to 87.	<1 ohm.	Go to next step.	Replace defective warning light relay.
9.	Off/ On	Re-install warning light relay, and with jumper still installed at connector (279), move key switch to ignition position. Does warning light illuminate?			ABS warning light circuits test good. Turn key off. Reconnect conn. (279) and turn key on. If warning light does not illuminate during bulb check, reprogram/ replace ECU.	Locate open or poor connection in circuit A94E, then repair.

6.3. HIGH BEAM

RE 200/RE 300 With Douglas Turn Signal Switch (Tilt Column)

Table 12 RE 200/RE 300 With Douglas Turn Signal Switch (Tilt Column)

Step	Key	Action	Test Points	Spec.	Yes-In Spec.	No-Out of Spec
1.	Off	Loosen cluster, remove HIGH BEAM indicator bulb, and test for continuity	Across light bulb.	<100 ohms.	Re-install bulb. Go to next step.	Replace defective bulb and repeat test if problem persists.

Table 12 RE 200/RE 300 With Douglas Turn Signal Switch (Tilt Column) (cont.)

Step	Key	Action	Test Points	Spec.	Yes-In Spec.	No-Out of Spec
2.	Off	Disconnect connector (11), move headlight switch to on, and dimmer switch to high beam position. Measure voltage from connector (11) pin 4, circuit A52A to ground.	(11), pin 4 to gnd.	12±1.5 volts.	Go to next step.	Go to Step 4.
3.	Off	With switches still set, measure voltage at connector (11) from pin 4, circuit A52A to pin 2, circuit A28-G.	(11), pin 4 to pin 2.	12±1.5 volts.	High beam circuits check good. Reconnect conn. (11) and replace cluster if warning light fails to illuminate.	Locate open or poor connection in circuit A28-G or A11-G, then repair.
4.	Off	Remove connector (4) and with switches still set, measure voltage from circuit A51B to ground.	(4), A51B to gnd.	12±1.5 volts.	Go to next step.	Locate cause of no or low voltage in circuit A50C, switch and conn. (23) or circuit A51B, then repair.
5.	Off	On switch half of connector (4), measure resistance from green wire to brown wire with switch in high beam position.	(4), green to brown.	<1 ohm.	Go to next step.	Replace defective dimmer switch.
6.	Off	Reconnect connector (4), and with switches still set, at connector (11), measure voltage from circuit A52A to ground.	(11), A52A to gnd.	12±1.5 volts.	Circuits test good. Reconnect conn. (11) and replace cluster if warning light fails to illuminate.	Locate cause of low or no voltage in circuit A52 or 52A, then repair.

RE 200/RE 300 With International Turn Signal Switch (Stationary Column)

Table 13 RE 200/RE 300 With International Turn Signal Switch (Stationary Column)

Step	Key	Action	Test Points	Spec.	Yes-In Spec.	No-Out of Spec
1.	Off	Loosen cluster, remove HIGH BEAM indicator bulb, and test for continuity	Across light bulb.	<100 ohms.	Re-install bulb. Go to next step.	Replace defective bulb and repeat test if problem persists.
2.	Off	Disconnect connector (11), move headlight switch to on, and dimmer switch to high beam position. Measure voltage from connector (11) pin 4, circuit A52A to ground.	(11), pin 4 to gnd.	12±1.5 volts.	Go to next step.	Go to Step 4.
3.	Off	With switches still set, measure voltage at connector (11) from pin 4, circuit A52A to pin 2, circuit A28-G.	(11), pin 4 to pin 2.	12±1.5 volts.	High beam circuits check good. If light fails to turn off, check relay or switch.	Locate open or poor connection in circuit A28-G or A11-G, then repair.
4.	Off	Remove lift-to-dim relay (100) and with switches still set, measure voltage from circuit A51A to ground.	Socket (100), A51A to gnd.	12±1.5 volts.	Go to next step.	Locate cause of no or low voltage in circuit A50C, switch and conn. (23) or circuit A51A, then repair.
5.	Off	With switches still set, at relay socket (100), measure voltage from circuit A51F to ground.	Socket (100), A51F to gnd.	12±1.5 volts.	Go to next step.	Locate cause of low or no voltage in circuit A51F, then repair.
6.	Off	With switches still set, at relay socket (100), measure voltage from circuit A51F to A51D.	Socket (100), A51F to A51D.	12±1.5 volts.	Go to next step.	Locate open or poor connection in circuit A51D, switch and conn. (6), circuit A51-G or A11-GBA to cab ground, then repair.
7.	Off	Bench test lift-to-dim relay (100) by measuring resistance from pin 30 to 87A.	Relay, pin 30 to 87A.	<1 ohm.	Go to next step.	Replace defective lift-to-dim relay.

Table 13 RE 200/RE 300 With International Turn Signal Switch (Stationary Column) (cont.)

Step	Key	Action	Test Points	Spec.	Yes-In Spec.	No-Out of Spec
8.	Off	Bench test lift-to-dim relay (100) by applying +12V to pin 85, gnd. to pin 86, and measuring resistance from pin 30 to 87.	Energized relay, pin 30 to 87.	<1 ohm.	Go to next step.	Replace defective lift-to-dim relay.
9.	Off	Re-install relay. With headlight switch in on position and dimmer switch in high beam position, at connector (11) measure voltage from pin 4, circuit A52A to ground.	(11), pin 4 to gnd.	12±1.5 volts.	Circuits to cluster check good. Reconnect cluster. If warning light fails to illuminate, replace defective cluster.	Locate cause of low or no voltage in circuit A52C or A52A, then repair.

6.4. RIGHT TURN

RE 200/RE 300 With International Turn Signal Switch (Stationary Column)

Table 14 RE 200/RE 300 With International Turn Signal Switch (Stationary Column)

Step	Key	Action	Test Points	Spec.	Yes-In Spec.	No-Out of Spec
1.	Off	Move turn signal switch (62) to right turn position. Does right turn signal light illuminate?			Go to next step.	Refer to Electrical Troubleshooting Manual (ETM) for troubleshooting of turn signal lights and switch.
2.	Off	Loosen cluster and remove RIGHT TURN signal indicator light bulb. Test for continuity.	Across indicator light bulb.	<100 ohms.	Re-install bulb. Go to next step.	Replace defective bulb and reconnect connector. Repeat all tests if problem persists.
3.	Off	Disconnect connector (11), and measure voltage from circuit A57B to ground.	(11), A57B to gnd.	Pulsating 12±1.5 volts.	Go to next step.	Locate cause of no or low voltage in circuit A57B, then repair. Reconnect connectors.

Table 14 RE 200/RE 300 With International Turn Signal Switch (Stationary Column) (cont.)

Step	Key	Action	Test Points	Spec.	Yes-In Spec.	No-Out of Spec
4.	Off	At connector (11), measure voltage from circuit A57B to circuit A28-G with turn signal in right turn position.	(11), A57B to A28-G.	Pulsating 12±1.5 volts.	Go to next step.	Locate open or poor connection in circuit A28-G, or A11-G to cab ground, then repair.
5.	Off	Reconnect connector (11). Does turn signal indicator blink with turn signal lights?			Right turn indicator and circuits test good.	Replace defective cluster assembly.

RE 200/RE 300 With Douglas Turn Signal Switch (Tilt Column)

Table 15 RE 200/RE 300 With Douglas Turn Signal Switch (Tilt Column)

Step	Key	Action	Test Points	Spec.	Yes-In Spec.	No-Out of Spec
1.	Off	Move turn signal switch (95) to right turn position. Does right turn signal light illuminate?			Go to next step.	Refer to Electrical Troubleshooting Manual (ETM) for troubleshooting of turn signal lights and switch.
2.	Off	Loosen cluster and remove RIGHT TURN signal indicator light bulb. Test for continuity.	Across indicator light bulb.	<100 ohms.	Re-install bulb. Go to next step.	Replace defective bulb and reconnect connector. Repeat all tests if problem persists.
3.	Off	Disconnect connector (11), and measure voltage from circuit A57B to ground.	(11), A57B to gnd.	Pulsating 12±1.5 volts.	Go to next step.	Locate cause of no or low voltage in circuit A57B, then repair. Reconnect connectors.
4.	Off	At connector (11), measure voltage from circuit A57B to circuit A28-G with turn signal in right turn position.	(11), A57B to A28-G.	Pulsating 12±1.5 volts.	Go to next step.	Locate open or poor connection in circuit A28-G or A11-G to platform ground, then repair.
5.	Off	Reconnect connector (11). Does turn signal indicator blink with turn signal lights?			Right turn indicator and circuits test good.	Replace defective cluster assembly.

6.5. WAIT-TO-START

RE 200/RE 300 With International Engines

Table 16 RE 200/RE 300 With International Engines

Step	Key	Action	Test Points	Spec.	Yes - In Spec.	No - Out of Spec.
1.	Off/ On	1. Turn key to RUN 2. Connect J1939 sniffer		Are both the engine (0x00) and the MSM (aka ESC) on the Data-link?	Go to step 2.	Go to step 4.
2.	Off/ On	1. Disconnect J1939 sniffer. 2. Connect Master Diagnostics 3. Monitor the "Wait to start" output.		Does the "Wait to Start" output change?	Go to step 3.	ECM2 is not updating "Wait to Start" output. See engine troubleshooting guide.
3.	Off/ On	1. Disconnect MSM1 connector (3114). 2. Connect pin 10 to ground.	(3114), pin 10 to gnd.	Does the "Wait to Start" lamp turn on?	Replace MSM and retest	Go to next step.
4.	Off	1. Remove instrument cluster. 2. Remove WAIT-TO- START indicator bulb. 3. Test bulb for continuity.	Across light bulb.	<100 ohms.	Re-install bulb. Go to next step.	Replace defective bulb. Repeat all tests if problem persists.
5.	Off	1. Instrument cluster removed. 2. Measure resistance from disconnected conn. (12), pin 5, circuit A18-G to MSM1 disconnected conn. (3114) pin 10.	(12), pin 5, cir. A18-G to (3114) pin 10.	<1 ohm.	Go to next step.	Locate open or poor connection in circuit A18-G or cluster, then repair.

Table 16 RE 200/RE 300 With International Engines (cont.)

Step	Key	Action	Test Points	Spec.	Yes - In Spec.	No - Out of Spec.
6.	Off/ On	1. Instrument cluster removed. 2. Move key switch to ignition. 3. Measure voltage from conn. (11), pin 10, circuit A28B to ground.	(11), pin 10, cir. A28B to gnd.	12±1.5 volts.	Install cluster. Go to next step.	Locate cause of no or low voltage in circuits A28B, A28 or fuse F22, then repair.
7.	Off/ On	1. Leave J1939 sniffer connected		Is the engine (0x00) on the Data-link?	Go to step 8.	Go to step 11.
8.	Off/ On	1. Turn the key to OFF. 2. Disconnect MSM1 connector (3114). 3. Measure resistance across data-link pins 5 & 6, in wiring harness	(3114), pins 5 and 6.	Is the resistance approx. 60 ohms?	Go to step 9.	Fix data-link wiring, cir A5DD(-) and A5DD(+), retest
9.	Off/ On	1. Turn the key to Ignition. 2. Measure the voltage at the MSM1 conn. (3114) harness ignition pin 7 to ground.	(3114), pin 7, cir A97AB, A97AC.	Is the voltage 12-16 volts?	Go to step 7.	Fix wiring cir A97AB, A97AC. or fuse F20, retest.
10.	Off/ On	1. Measure the resistance between the MSM1 conn. (3114) harness ground pin 8 and ground	(3114), pin 8, cir A97–G, A11–G to gnd.	Is the resistance less than 10 ohms?	Replace MSM and retest	Fix ground wiring cir A97–G, A11–G and platform ground, retest.
11.	Off/ On	1. Leave J1939 sniffer connected NOTE: This assumes the "Wait to Start" output can be monitored using MD.		Is the MSM (aka ESC) on the data-link?	Check the engine's power connections and data link wiring.	Verify sniffer is working properly

6.6. BRAKE PRESS

RE 200/RE 300 With Hydraulic Brakes

Table 17 RE 200/RE 300 With Hydraulic Brakes

Step	Key	Action	Test Points	Spec.	Yes-In Spec.	No-Out of Spec
1.	Off/ On	Disconnect hydraulic brake booster monitor module connector (86) and use a test jumper to connect pin C/circuit A90M to ground. Move key switch to ignition position. Does warning light illuminate?			Warning light circuits test good. Turn key off, reconnect conn. (86), and turn key on. If warning light does not illuminate during bulb check, replace brake monitor module.	Go to next step.
2.	Off	Loosen cluster and remove BRAKE PRESS light bulb. Test for continuity.	Across warning light bulb.	<100 ohms.	Re-install bulb. Go to next step.	Replace defective bulb and reconnect connector. Repeat all tests if problem persists.
3.	Off	Disconnect connector (25), and with jumper still attached at connector (86), measure resistance from connector (25) circuit A90N to ground.	(25), A90N to gnd.	<1 ohm.	Go to next step.	Locate open or poor connection in circuit A90N or A90M, then repair. Reconnect connectors.
4.	On	Move key switch to ignition position and measure voltage from connector (25) circuit A28C to ground.	(25), A28C to gnd.	12±1.5 volts.	Go to next step.	Locate cause of no or low voltage in circuit A28 or A28C from fuse F22, then repair. Reconnect connectors.
5.	On	With jumper still installed at connector (86), reconnect connector (25). Does warning light illuminate?			Warning light circuits test good. Reconnect connector (86).	Replace defective cluster assembly. Reconnect connector.

RE 200/RE 300 With Air Brakes

Table 18 RE 200/RE 300 With Air Brakes

Step	Key	Action	Test Points	Spec.	Yes-In Spec.	No-Out of Spec
1.	Off/ On	Disconnect air pressure switch connector (1LA) and use a test jumper to connect circuit K40 to ground. Move key switch to ignition position. Does warning light illuminate?			Warning light circuits test good. Reconnect conn. (1LA), and drain air from brake system. If warning light does not illuminate when press. <60 psi, replace pressure switch.	Go to next step.
2.	Off	Loosen cluster and remove BRAKE PRESS light bulb. Test for continuity.	Across warning light bulb.	<100 ohms.	Re-install bulb. Go to next step.	Replace defective bulb and reconnect connector. Repeat all tests if problem persists.
3.	Off	Disconnect connector (2), and with jumper still attached at connector (1LA), measure resistance from connector (2) circuit A40A to ground.	(2), A40A to gnd.	<1 ohm.	Go to next step.	Locate open or poor connection in circuits A40A, A40, connector (2), circuit N40, connector (9850) or circuit K40, then repair. Reconnect connectors.
4.	On	Move key switch to ignition position and measure voltage from connector (2) circuit A28D to ground.	(2), A28D to gnd.	12±1.5 volts.	Go to next step.	Locate cause of no or low voltage in circuit A28 or A28D from fuse F22, then repair. Reconnect connectors.
5.	On	With jumper still installed at connector (1LA), reconnect connector (2). Does warning light illuminate?			Warning light circuits test good. Reconnect connector (1LA).	Replace defective cluster assembly. Reconnect connector.

6.7. ((P)) LOW AIR

RE 200/RE 300 With Low Air Suspension

Table 19 RE 200/RE 300 With Low Air Suspension

Step	Key	Action	Test Points	Spec.	Yes-In Spec.	No-Out of Spec
1.	Off/ On	Disconnect low air suspension pressure switch connector (1LA) and use a test jumper to connect circuit K40 to ground. Move key switch to ignition position. Does warning light illuminate?			Warning light circuits test good. Reconnect conn. (1LA), and drain air from suspension system. If warning light does not illuminate when press. <60 psi, replace pressure switch.	Go to next step.
2.	Off	Loosen cluster and remove ((P)) LOW AIR suspension pressure light bulb. Test for continuity.	Across warning light bulb.	<100 ohms.	Re-install bulb. Go to next step.	Replace defective bulb and reconnect connector. Repeat all tests if problem persists.
3.	Off	Disconnect connector (2), and with jumper still attached at connector (1LA), measure resistance from connector (2) circuit A40A to ground.	(2), A40A to gnd.	<1 ohm.	Go to next step.	Locate open or poor connection in circuits A40A, A40, connector (2), circuit N40, connector (9850) or circuit K40, then repair. Reconnect connectors.
4.	On	Move key switch to ignition position and measure voltage from connector (2) circuit A28D to ground.	(2), A28D to gnd.	12±1.5 volts.	Go to next step.	Locate cause of no or low voltage in circuit A28 or A28D from fuse F22, then repair. Reconnect connectors.
5.	On	With jumper still installed at connector (1LA), reconnect connector (2). Does warning light illuminate?			Warning light circuits test good. Reconnect connector (1LA).	Replace defective cluster assembly. Reconnect connector.

Table 19 RE 200/RE 300 With Low Air Suspension (cont.)

Step	Key	Action	Test Points	Spec.	Yes-In Spec.	No-Out of Spec
6.	Off/ On	Disconnect low air pressure conn. switch (475). Use a test jumper to connect pin C, circuit A40 (on wire harness not going to air tank) to ground. Move key switch to ignition position. Does alarm sound?		Alarm sounds.	Go to next step.	Go to Step 4.
7.	Off	Drain air from suspension system and measure resistance across pins A and C of conn. (475) on air tank.	Across switch.	<1 ohm.	Go to next step.	Replace defective air pressure switch.
8.	Off	At pin A of air pressure switch conn. (475), circuit A61-G, measure resistance to ground.	Pin A of conn. (475), cir. A61-G to gnd.	<1 ohm.	Go to next step.	Locate open or poor connection in circuit A61-G, then repair.
9.	On	Measure voltage at pin 2 of conn. (474) on wiring harness.	Pin 2 of conn. (474).	12±1.5 volts.	Go to next step.	Locate cause of no or low voltage in circuits A13B, A61A from fuse F24, then repair. Reconnect connectors.
10.	Off	Measure resistance between pin A of conn. (475) and ground.	Conn. (475), pin A to gnd.	<1 ohm.	Go to next step.	Locate open or poor connection in circuit A61-G, then repair.
11.	Off	Measure resistance between pin C of conn. (475) and pin 5 of conn. (474).	Conn. (475), pin C to conn. (474), pin 5.	<1 ohm.	Replace defective low air alarm. Reconnect conn. (474) and (475).	Locate open or poor connection in circuit A40, then repair.

6.8. SERVICE

RE 200/RE 300 With Hydraulic Brakes

Table 20 RE 200/RE 300 With Hydraulic Brakes

Step	Key	Action	Test Points	Spec.	Yes - In Spec.	No - Out of Spec.
1.	Off/ On	Disconnect coolant level tank MAG switch conn. (400), and connect a jumper wire on circuit K34A (going to service warning light) to ground. Move key switch to ignition position. Does warning light illuminate?		Warning light illuminates.	Go to Step 6.	Go to next step.
2.	On	Remove instrument cluster and remove SERVICE indicator bulb. Test bulb for continuity.	Across bulb.	<100 ohms.	Re-install bulb. Go to next step.	Replace defective bulb and if problem persists, replace cluster, repeat all tests.
3.	Off	With jumper still in place, disconnect conn. (11). Measure resistance between pin 17 , circuit K34A and ground.	Conn. (11), pin 17, cir. K34A to gnd.	<1 ohm.	Go to next step.	Locate open or poor connection in circuit K34A or ECM2 (6020) pin 4, then repair.
4.	Off/ On	Disconnect wire harness conn. (11). Move key switch to ignition position and measure voltage from pin 10, circuit A28B to 7ground.	Conn. (11), pin 10, cir. A28B to gnd.	12±1.5 volts.	Reconnect conn. (11). Go to next step.	Locate cause of no or low voltage in circuit A28B from fuse F22, then repair. Reconnect connectors.
5.	On	With jumper still installed, reconnect conn. (11). Does warning light illuminate?		Warning light illuminates.	Go to next step.	Replace defective cluster assembly. Reconnect connector and clear fault codes.

Table 20 RE 200/RE 300 With Hydraulic Brakes (cont.)

Step	Key	Action	Test Points	Spec.	Yes - In Spec.	No - Out of Spec.
6.	Off	With coolant level MAG sw. closed, measure resistance across coolant level switch.	Across switch.	<1 ohm.	Go to next step.	Replace defective coolant level switch. Reconnect (400).
7.	Off	At coolant level switch, measure resistance from ground wire to ground.	Near switch, ground wire to gnd.	<1 ohm.	Warning light circuits test good. Reconnect circuits. Reconnect (400).	Locate open or poor connection in ground circuit, then repair.

RE 200/RE 300 With Air Brakes

Table 21 RE 200/RE 300 With Air Brakes

Step	Key	Action	Test Points	Spec.	Yes - In Spec.	No - Out of Spec.
1.	Off/ On	Disconnect coolant level tank MAG switch conn. (6400), and connect a jumper wire on circuit K34A (going to service warning light) to ground. Move key switch to ignition position. Does warning light illuminate?		Warning light illuminates.	Go to Step 6.	Go to next step.
2.	On	Remove instrument cluster and remove SERVICE indicator bulb. Test bulb for continuity.	Across bulb.	<100 ohms.	Re-install bulb. Go to next step.	Replace defective bulb and if problem persists, replace cluster, repeat all tests.
3.	Off	With jumper still in place, disconnect conn. (11). Measure resistance between pin 17 , circuit K34A and ground.	Conn. (11), pin 17, cir. K34A to gnd.	<1 ohm.	Go to next step.	Locate open or poor connection in circuit K34A or ECM2 (6020) pin 4, then repair.

Table 21 RE 200/RE 300 With Air Brakes (cont.)

Step	Key	Action	Test Points	Spec.	Yes - In Spec.	No - Out of Spec.
4.	Off/ On	Disconnect wire harness conn. (11). Move key switch to ignition position and measure voltage from pin 10, circuit A28B to ground.	Conn. (11, pin 10, cir. A28B to gnd.	12±1.5 volts.	Reconnect conn. (11). Go to next step.	Locate cause of no or low voltage in circuit A28B from fuse F22, then repair. Reconnect connectors.
5.	On	With jumper still installed, reconnect conn. (11). Does warning light illuminate?		Warning light illuminates.	Go to next step.	Replace defective cluster assembly. Reconnect connector and clear fault codes.
6.	Off	With coolant level MAG sw. closed, measure resistance across coolant level switch.	Across switch.	<1 ohm.	Go to next step.	Replace defective coolant level switch. Reconnect (6400).
7.	Off	At coolant level switch, measure resistance from ground wire to ground.	Near switch, ground wire to gnd.	<1 ohm.	Warning light circuits test good. Reconnect circuits. Reconnect (6400).	Locate open or poor connection in ground circuit, then repair.

6.9. PARK BRAKE

RE 200/RE 300 With Hydraulic Brakes

Table 22 RE 200/RE 300 With Hydraulic Brakes

Step	Key	Action	Test Points	Spec.	Yes-In Spec.	No-Out of Spec
1.	Off/ On	Disconnect park brake switch conn. (218), and connect a jumper wire from circuit A44A to ground. Move key switch to ignition position. Does park brake warning light illuminate?			Go to Step 6.	Go to next step.
2.	On	Remove instrument cluster and remove PARK BRAKE indicator bulb. Test bulb for continuity.	Across warning light bulb.	<100 ohms.	Re-install bulb. Go to next step.	Replace defective bulb and reconnect connector. Repeat all tests if problem persists.
3.	Off	With jumper still in place, disconnect connector (12) and at pin 17, circuit A44, measure resistance to ground.	(12), A44 to gnd.	<1 ohm.	Go to next step.	Locate open or poor connection in circuit A44 or A44A, then repair.
4.	On	With jumper still in place, move key switch to ignition position, and at connector (12), measure voltage from pin 8, circuit A28C to pin 17, circuit A44.	(12), A28C to A44.	12±1.5 volts.	Go to next step.	Locate cause of no or low voltage in circuit A28 or A28C from fuse F22, then repair.
5.	On	With jumper still installed, reconnect connector (12). Does warning light illuminate?			Go to next step.	Replace defective cluster assembly. Reconnect connector and clear fault codes.
6.	Off	With parking brake applied, measure resistance across park brake switch (218).	Across switch (218).	<1 ohm.	Go to next step.	Replace defective park brake switch.
7.	Off	At park brake switch (218), measure resistance from circuit A44-GA to ground.	(218), A44-GA to gnd.	<1 ohm.	Warning light circuits test good. Reconnect circuits.	Locate open or poor connection in A44-GA, A11-GB or A11-G to platform ground, then repair.

RE 200/RE 300 With Air Brakes

Table 23 RE 200/RE 300 With Air Brakes

Step	Key	Action	Test Points	Spec.	Yes-In Spec.	No-Out of Spec
1.	Off/ On	Disconnect park brake air switch conn. (168), and connect a jumper wire from circuit A66K to ground. Move key switch to ignition position. Does park brake warning light illuminate?			Go to Step 6.	Go to next step.
2.	On	Remove instrument cluster and remove PARK BRAKE indicator bulb. Test bulb for continuity.	Across warning light bulb.	<100 ohms.	Re-install bulb. Go to next step.	Replace defective bulb and reconnect connector. Repeat all tests if problem persists.
3.	Off	With jumper still in place, disconnect connector (12) and at pin 17, circuit A44, measure resistance to ground.	(12), A44 to gnd.	<1 ohm.	Go to next step.	Locate open or poor connection in circuit A44 or A66K, then repair.
4.	On	With jumper still in place, move key switch to ignition position, and at connector (12), measure voltage from pin 8, circuit A28C to pin 17, circuit A44.	(12), A28C to A44.	12±1.5 volts.	Go to next step.	Locate cause of no or low voltage in circuit A28 or A28C from fuse F22, then repair.
5.	On	With jumper still installed, reconnect connector (12). Does warning light illuminate?			Go to next step.	Replace defective cluster assembly. Reconnect connector and clear fault codes.
6.	Off	With parking brake applied, measure resistance across park brake air switch.	Across switch.	<1 ohm.	Go to next step.	Replace defective park brake air switch.
7.	Off	At connector (168), measure resistance from circuit A66-G to ground.	(168), A66-G to gnd.	<1 ohm.	Warning light circuits test good. Reconnect circuits.	Locate open or poor connection in A66-G to cab ground, then repair.

6.10. OIL/WATER

RE 200/RE 300 With Air Brakes

Table 24 RE 200/RE 300 With Air Brakes

Step	Key	Action	Test Points	Spec.	Yes - In Spec.	No - Out of Spec.
1.	Off/ On	1. Turn key to RUN 2. Connect J1939 sniffer		Are both the engine (0x00) and the MSM (aka ESC) on the data-link?	Go to step 2.	Go to step 4.
2.	Off/ On	1. Disconnect J1939 sniffer. 2. Connect Master Diagnostics 3. Monitor the "Oil/Water" output.		Does the "Oil/Water" output change?	Go to step 3.	ECM2 is not updating "Oil/Water" output. See engine troubleshooting guide.
3.	Off/ On	1. Disconnect MSM1 connector (3114). 2. Connect pin 1 to ground.	(3114), pin 1 to gnd.	Does the "Oil/Water" lamp turn on and alarm sounds?	Replace MSM and retest	Go to next step.
4.	Off	1. Remove instrument cluster. 2. Remove OIL/WATER indicator bulb. 3. Test bulb for continuity.	Across warning light bulb.	<100 ohms.	Re-install bulb. Go to next step.	Replace defective bulb and reconnect connector. Repeat all tests if problem persists.
5.	Off	1. Instrument cluster removed. 2. Measure resistance from disconnected conn. (12), pin 14, circuit A97AF, A29A/35 to MSM1 disconnected conn. (3114) pin 1.	(12), pin 14, cir. A97AF, A29A/35 to (3114) pin 1.	<1 ohm.	Go to next step.	Locate open or poor connection in circuit A97AF, A29A/35 or cluster, then repair.

Table 24 RE 200/RE 300 With Air Brakes (cont.)

Step	Key	Action	Test Points	Spec.	Yes - In Spec.	No - Out of Spec.
6.	Off/ On	1. Instrument cluster removed. 2. Move key switch to ignition. 3. Measure voltage from conn. (12), pin 13, circuit A28A/A28 to ground.	(12), pin 13, cir. A28A/A28 to gnd.	12±1.5 volts.	Install cluster. Go to next step.	Locate cause of no or low voltage in circuit A28A/A28 from fuse F22, then repair.
7.	Off/ On	1. Leave J1939 sniffer connected		Is the engine (0x00) on the data-link?	Go to step 8.	Go to step 11.
8.	Off/ On	1. Turn the key to OFF. 2. Disconnect MSM1 connector (3114). 3. Measure resistance across data-link pins 5 & 6, in wiring harness	(3114), pins 5 and 6.	Is the resistance approx. 60 ohms?	Go to step 9.	Fix data-link wiring, cir A5DD(-) and A5DD(+), retest
9.	Off/ On	1. Turn the key to Ignition. 2. Measure the voltage at the MSM1's harness ignition pin 7 to ground.	(3114), pin 7, cir A97AC/A97AB to gnd.	Is the voltage 12-16 volts?	Go to step 7.	Fix wiring cir A97AC/A97AB or fuse F20, retest.
10.	Off/ On	1. Measure the resistance between the MSM1's harness ground pin 8 and ground	(3114), pin 8, cir A97–G/A11–G to gnd.	Is the resistance less than 10 ohms?	Replace MSM and retest	Fix ground wiring cir A97–G/A11–G and cab ground, retest.
11.	Off/ On	1. Leave J1939 sniffer connected NOTE: This assumes the "Oil/Water" output can be monitored using MD.		Is the MSM (aka ESC) on the data-link?	Check the engine's power connections and data link wiring.	Verify sniffer is working properly

RE 200/RE 300 With Hydraulic Brakes

Table 25 RE 200/RE 300 With Hydraulic Brakes

Step	Key	Action	Test Points	Spec.	Yes - In Spec.	No - Out of Spec.
1.	Off/ On	1. Turn key to RUN 2. Connect J1939 sniffer		Are both the engine (0x00) and the MSM (aka ESC) on the data-link?	Go to step 2.	Go to step 4.
2.	Off/ On	1. Disconnect J1939 sniffer. 2. Connect Master Diagnostics 3. Monitor the "Oil/Water" output.		Does the "Oil/Water" output change?	Go to step 3.	ECM2 is not updating "Oil/Water" output. See engine troubleshooting guide.
3.	Off/ On	1. Disconnect MSM1 connector (3114). 2. Connect pin 1 to ground.	(3114), pin 1 to gnd.	Does the "Oil/Water" lamp turn on and alarm sounds?	Replace MSM and retest	Go to next step.
4.	Off	1. Remove instrument cluster. 2. Remove OIL/WATER indicator bulb. 3. Test bulb for continuity.	Across warning light bulb.	<100 ohms.	Re-install bulb. Go to next step.	Replace defective bulb and reconnect connector. Repeat all tests if problem persists.
5.	Off	1. Instrument cluster removed. 2. Measure resistance from disconnected conn. (12), pin 14, circuit A97AF, A29/35 to MSM1 disconnected conn. (3114) pin 1.	(12), pin 14, cir. A97AF, A29/35 to (3114) pin 1.	<1 ohm.	Go to next step.	Locate open or poor connection in circuit A97AF, A29/35 or cluster, then repair.

Table 25 RE 200/RE 300 With Hydraulic Brakes (cont.)

Step	Key	Action	Test Points	Spec.	Yes - In Spec.	No - Out of Spec.
6.	Off/ On	1. Instrument cluster removed. 2. Move key switch to ignition. 3. Measure voltage from conn. (12), pin 4, circuit A28D/A28 to ground.	(12), pin 4, cir. A28D/A28 to gnd.	12±1.5 volts.	Install cluster. Go to next step.	Locate cause of no or low voltage in circuit A28D/A28 from fuse F22, then repair.
7.	Off/ On	1. Leave J1939 sniffer connected		Is the engine (0x00) on the data-link?	Go to step 8.	Go to step 11.
8.	Off/ On	1. Turn the key to OFF. 2. Disconnect MSM1 connector (3114). 3. Measure resistance across data-link pins 5 & 6, in wiring harness	(3114), pins 5 and 6.	Is the resistance approx. 60 ohms?	Go to step 9.	Fix data-link wiring, cir A5DD(-) and A5DD(+), retest
9.	Off/ On	1. Turn the key to Ignition. 2. Measure the voltage at the MSM1's harness ignition pin 7 to ground.	(3114), pin 7, cir A97AC/A97AB to gnd.	Is the voltage 12-16 volts?	Go to step 7.	Fix wiring cir A97AC/A97AB or fuse F20, retest.
10.	Off/ On	1. Measure the resistance between the MSM1's harness ground pin 8 and ground	(3114), pin 8, cir A97–G/A11–G to gnd.	Is the resistance less than 10 ohms?	Replace MSM and retest	Fix ground wiring cir A97–G/A11–G and cab ground, retest.
11.	Off/ On	1. Leave J1939 sniffer connected NOTE: This assumes the "Oil/Water" output can be monitored using MD.		Is the MSM (aka ESC) on the data-link?	Check the engine's power connections and data link wiring.	Verify sniffer is working properly

6.11. WARN ENGINE

RE 200/RE 300 With International Engines

Table 26 RE 200/RE 300 With International Engines

Step	Key	Action	Test Points	Spec.	Yes - In Spec.	No - Out of Spec.
1.	Off/ On	1. Turn key to RUN 2. Connect J1939 sniffer		Are both the engine (0x00) and the MSM (aka ESC) on the data-link?	Go to step 2.	Go to step 4.
2.	Off/ On	1. Disconnect J1939 sniffer. 2. Connect Master Diagnostics 3. Monitor the "Warn Engine" output.		Does the "Warn Engine" output change?	Go to step 3.	ECM2 is not updating "Warn Engine" output. See engine troubleshooting guide.
3.	Off/ On	1. Disconnect MSM1 connector (3114). 2. Connect pin 9 to ground.	(3114), pin 9 to gnd.	Does the "Warn Engine" lamp turn on?	Replace MSM and retest	Go to next step.
4.	Off	1. Remove instrument cluster. 2. Remove WARN ENGINE indicator bulb. 3. Test bulb for continuity.	Across warning light bulb..	<100 ohms.	Re-install bulb. Go to next step.	Replace defective bulb and reconnect connector. Repeat all tests if problem persists.
5.	Off	1. Instrument cluster removed. 2. Measure resistance from disconnected conn. (12), pin 15, circuit A97T to MSM1 disconnected conn. (3114) pin 9.	(12), pin 15, cir. A97T to (3114) pin 9.	<1 ohm.	Go to next step.	Locate open or poor connection in circuit A97T or cluster, then repair.

Table 26 RE 200/RE 300 With International Engines (cont.)

Step	Key	Action	Test Points	Spec.	Yes - In Spec.	No - Out of Spec.
6.	Off/ On	1. Instrument cluster removed. 2. Move key switch to ignition. 3. Measure voltage from conn. (12), pin 4, circuit A28D to ground.	(12), pin 4, cir. A28D to gnd.	12±1.5 volts.	Install cluster. Go to next step.	Locate cause of no or low voltage in circuit A28, A28D or fuse F22, then repair.
7.	Off/ On	1. Leave J1939 sniffer connected		Is the engine (0x00) on the data-link?	Go to step 8.	Go to step 11.
8.	Off/ On	1. Turn the key to OFF. 2. Disconnect MSM1 connector (3114). 3. Measure resistance across data-link pins 5 & 6, in wiring harness	(3114), pins 5 and 6.	Is the resistance approx. 60 ohms?	Go to step 9.	Fix data-link wiring, cir A5DD(-) and A5DD(+), retest
9.	Off/ On	1. Turn the key to Ignition. 2. Measure the voltage at the MSM1 conn. (3114) harness ignition pin 7 to ground.	(3114), pin 7, cir A97AB, A97AC.	Is the voltage 12-16 volts?	Go to step 7.	Fix wiring cir A97AB, A97AC or fuse F20, retest.
10.	Off/ On	1. Measure the resistance between the MSM1 conn. (3114) harness ground pin 8 and ground	(3114), pin 8, cir A97–G, A11–G to gnd.	Is the resistance less than 10 ohms?	Replace MSM and retest	Fix ground wiring cir A97–G, A11–G and platform ground, retest.
11.	Off/ On	1. Leave J1939 sniffer connected NOTE: This assumes the "Warn Engine" output can be monitored using MD.		Is the MSM (aka ESC) on the data-link?	Check the engine's power connections and data link wiring.	Verify sniffer is working properly

6.12. CHANGE OIL

RE 200/RE 300 With International Engines

Table 27 RE 200/RE 300 With International Engines

Step	Key	Action	Test Points	Spec.	Yes - In Spec.	No - Out of Spec.
1.	Off/ On	1. Turn key to RUN 2. Connect J1939 sniffer		Are both the engine (0x00) and the MSM (aka ESC) on the data-link?	Go to step 2.	Go to step 4.
2.	Off/ On	1. Disconnect J1939 sniffer. 2. Connect Master Diagnostics 3. Monitor the "Change Oil" output.		Does the "Change Oil" output change?	Go to step 3.	ECM2 is not updating "Change Oil" output. See engine troubleshooting guide.
3.	Off/ On	1. Disconnect MSM2 connector (3115). 2. Connect pin 2 to ground.	(3115), pin 2 to gnd.	Does the "Change Oil" lamp turn on?	Replace MSM and retest	Go to next step.
4.	Off	1. Remove instrument cluster. 2. Remove CHANGE OIL indicator bulb. 3. Test bulb for continuity.	Across warning light bulb.	<100 ohms.	Re-install bulb. Go to next step.	Replace defective bulb and reconnect connector. Repeat all tests if problem persists.
5.	Off	1. Instrument cluster removed. 2. Measure resistance from disconnected conn. (12), pin 6, circuit A97AA to MSM2 disconnected conn. (3115) pin 2.	(12), pin 7, cir. A97AA to (3115) pin 2.	<1 ohm.	Go to next step.	Locate open or poor connection in circuit A97AA or cluster, then repair.

Table 27 RE 200/RE 300 With International Engines (cont.)

Step	Key	Action	Test Points	Spec.	Yes - In Spec.	No - Out of Spec.
6.	Off/ On	1. Instrument cluster removed. 2. Move key switch to ignition. 3. Measure voltage from conn. (11), pin 10, circuit A28B to ground.	(11), pin 10, cir. A28B to gnd.	12±1.5 volts.	Install cluster. Go to next step.	Locate cause of no or low voltage in circuit A28, A28B from fuse F22, then repair.
7.	Off/ On	1. Leave J1939 sniffer connected		Is the engine (0x00) on the data-link?	Go to step 8.	Go to step 11.
8.	Off/ On	1. Turn the key to OFF. 2. Disconnect MSM1 connector (3114). 3. Measure resistance across data-link pins 5 & 6, in wiring harness	(3114), pins 5 and 6.	Is the resistance approx. 60 ohms?	Go to step 9.	Fix data-link wiring, cir A5DD(-) and A5DD(+), retest
9.	Off/ On	1. Turn the key to Ignition. 2. Measure the voltage at the MSM1 conn. (3114) harness ignition pin 7 to ground.	(3114), pin 7, cir A97AB, A97AC.	Is the voltage 12-16 volts?	Go to step 7.	Fix wiring cir A97AB, A97AC or fuse F20, retest.
10.	Off/ On	1. Measure the resistance between the MSM1 conn. (3114) harness ground pin 8 and ground	(3114), pin 8, cir A97–G, A11–G to gnd.	Is the resistance less than 10 ohms?	Replace MSM and retest	Fix ground wiring cir A97–G, A11–G and platform ground, retest.
11.	Off/ On	1. Leave J1939 sniffer connected NOTE: This assumes the "Change Oil" output can be monitored using MD.		Is the MSM (aka ESC) on the data-link?	Check the engine's power connections and data link wiring.	Verify sniffer is working properly

6.13. CHECK TRANS

RE 200/RE 300 With Allison WTEC III Transmission With Hydraulic Brakes

Table 28 RE 200/RE 300 With Allison WTEC III Transmission With Hydraulic Brakes

Step	Key	Action	Test Points	Spec.	Yes-In Spec.	No-Out of Spec
1.	Off/ On	Disconnect Allison ECU connector (7204) and use a test jumper to connect pin 31, circuit K#115 to ground. Move key switch to ignition position. Does warning light illuminate?			Warning light circuits test good. Turn key off, reconnect conn. (7204), and turn key on. If warning light does not illuminate during bulb check, reprogram/ replace ECU.	Go to next step.
2.	Off	Loosen cluster and remove CHECK TRANS warning light bulb. Test for continuity.	Across warning light bulb.	<100 ohms.	Re-install bulb. Go to next step.	Replace defective bulb and reconnect connector. Repeat all tests if problem persists.
3.	Off	Disconnect connector (12), and with jumper still attached at connector (7204), measure resistance from connector (12), pin 7, circuit A125 to ground.	(12), A125 to gnd.	<1 ohm.	Go to next step.	Locate open or poor connection in connector (7204), pin 31, circuit K#115, connector (523), circuit N125, connector (644), circuit A115, connector (377), circuit A125 or connector (12), pin 7, then repair. Reconnect connectors.
4.	On	Move key switch to ignition position and measure voltage from connector (12), pin 8, circuit A28C to ground.	(12), A28C to gnd.	12±1.5 volts.	Go to next step.	Locate cause of no or low voltage in circuit A28 or A28C from fuse F22, then repair. Reconnect connectors.
5.	On	With jumper still installed at connector (7204), reconnect connector (12). Does warning light illuminate?			Warning light circuits test good. Reconnect connector (7204).	Replace defective cluster assembly. Reconnect connector.

RE 200/RE 300 With Allison WTEC III GEN 4 Transmission With Hydraulic Brakes

Table 29 RE 200/RE 300 With Allison WTEC III GEN 4 Transmission With Hydraulic Brakes

Step	Key	Action	Test Points	Spec.	Yes-In Spec.	No-Out of Spec
1.	Off/ On	Disconnect Allison ECU connector (7150) and use a test jumper to connect pin 29, circuit K#129 to ground. Move key switch to ignition position. Does warning light illuminate?			Warning light circuits test good. Turn key off, reconnect conn. (7150), and turn key on. If warning light does not illuminate during bulb check, reprogram/ replace ECU.	Go to next step.
2.	Off	Loosen cluster and remove CHECK TRANS warning light bulb. Test for continuity.	Across warning light bulb.	<100 ohms.	Re-install bulb. Go to next step.	Replace defective bulb and reconnect connector. Repeat all tests if problem persists.
3.	Off	Disconnect connector (12), and with jumper still attached at connector (7150), measure resistance from connector (12), pin 7, circuit A125 to ground.	(12), A125 to gnd.	<1 ohm.	Go to next step.	Locate open or poor connection in connector (7150), pin 29, circuit K#129, connector (523), circuit N125, connector (644), circuit A115, connector (377), circuit A125 or connector (12), pin 7, then repair. Reconnect connectors.
4.	On	Move key switch to ignition position and measure voltage from connector (12), pin 8, circuit A28C to ground.	(12), A28C to gnd.	12±1.5 volts.	Go to next step.	Locate cause of no or low voltage in circuit A28 or A28C from fuse F22, then repair. Reconnect connectors.
5.	On	With jumper still installed at connector (7150), reconnect connector (12). Does warning light illuminate?			Warning light circuits test good. Reconnect connector (7150).	Replace defective cluster assembly. Reconnect connector.

RE 200/RE 300 With Allison WTEC III Transmission With Air Brakes

Table 30 RE 200/RE 300 With Allison WTEC III Transmission With Air Brakes

Step	Key	Action	Test Points	Spec.	Yes-In Spec.	No-Out of Spec
1.	Off/ On	Disconnect Allison ECU connector (7204) and use a test jumper to connect pin 31, circuit K#115 to ground. Move key switch to ignition position. Does warning light illuminate?			Warning light circuits test good. Turn key off, reconnect conn. (7204), and turn key on. If warning light does not illuminate during bulb check, reprogram/ replace ECU.	Go to next step.
2.	Off	Loosen cluster and remove CHECK TRANS warning light bulb. Test for continuity.	Across warning light bulb.	<100 ohms.	Re-install bulb. Go to next step.	Replace defective bulb and reconnect connector. Repeat all tests if problem persists.
3.	Off	Disconnect connector (12), and with jumper still attached at connector (7204), measure resistance from connector (12), pin 7, circuit A125 to ground.	(12), A125 to gnd.	<1 ohm.	Go to next step.	Locate open or poor connection in connector (7204), pin 31, circuit K#115, connector (523), circuit N125, connector (644), circuit A125, connector (377), circuit A125 or connector (12), pin 7, then repair. Reconnect connectors.
4.	On	Move key switch to ignition position and measure voltage from connector (12), pin 8, circuit A28C to ground.	(12), A28C to gnd.	12±1.5 volts.	Go to next step.	Locate cause of no or low voltage in circuit A28 or A28C from fuse F22, then repair. Reconnect connectors.
5.	On	With jumper still installed at connector (7204), reconnect connector (12). Does warning light illuminate?			Warning light circuits test good. Reconnect connector (7204).	Replace defective cluster assembly. Reconnect connector.

RE 200/RE 300 With Allison WTEC III GEN 4 Transmission With Air Brakes

Table 31 RE 200/RE 300 With Allison WTEC III GEN 4 Transmission With Air Brakes

Step	Key	Action	Test Points	Spec.	Yes-In Spec.	No-Out of Spec
1.	Off/ On	Disconnect Allison ECU connector (7150) and use a test jumper to connect pin 29, circuit K#129 to ground. Move key switch to ignition position. Does warning light illuminate?			Warning light circuits test good. Turn key off, reconnect conn. (7150), and turn key on. If warning light does not illuminate during bulb check, reprogram/ replace ECU.	Go to next step.
2.	Off	Loosen cluster and remove CHECK TRANS warning light bulb. Test for continuity.	Across warning light bulb.	<100 ohms.	Re-install bulb. Go to next step.	Replace defective bulb and reconnect connector. Repeat all tests if problem persists.
3.	Off	Disconnect connector (12), and with jumper still attached at connector (7150), measure resistance from connector (12), pin 7, circuit A125 to ground.	(12), A125 to gnd.	<1 ohm.	Go to next step.	Locate open or poor connection in connector (7150), pin 29, circuit K#129, connector (523), circuit N129, connector (644), circuit A125, connector (377), circuit A125 or connector (12), pin 7, then repair. Reconnect connectors.
4.	On	Move key switch to ignition position and measure voltage from connector (12), pin 8, circuit A28C to ground.	(12), A28C to gnd.	12±1.5 volts.	Go to next step.	Locate cause of no or low voltage in circuit A28 or A28C from fuse F22, then repair. Reconnect connectors.
5.	On	With jumper still installed at connector (7150), reconnect connector (12). Does warning light illuminate?			Warning light circuits test good. Reconnect connector (7150).	Replace defective cluster assembly. Reconnect connector.

RE 200/RE 300 With Allison 2000 (LCT) Transmission

Table 32 RE 200/RE 300 With Allison 2000 (LCT) Transmission

Step	Key	Action	Test Points	Spec.	Yes-In Spec.	No-Out of Spec
1.	Off/ On	Disconnect Allison ECU connector (7305) and use a test jumper to connect pin 25, circuit K#125 to ground. Move key switch to ignition position. Does warning light illuminate?			Warning light circuits test good. Turn key off, reconnect conn. (7305), and turn key on. If warning light does not illuminate during bulb check, reprogram/ replace ECU.	Go to next step.
2.	Off	Loosen cluster and remove CHECK TRANS warning light bulb. Test for continuity.	Across warning light bulb.	<100 ohms.	Re-install bulb. Go to next step.	Replace defective bulb and reconnect connector. Repeat all tests if problem persists.
3.	Off	Disconnect connector (12), and with jumper still attached at connector (7305), measure resistance from connector (12), pin 7, circuit A125 to ground.	(12), A125 to gnd.	<1 ohm.	Go to next step.	Locate open or poor connection in connector (7305), pin 25, circuit K#125, connector (9875), circuit N125, connector (644), circuit A125, connector (377), circuit A125 or connector (12), pin 7, then repair. Reconnect connectors.
4.	On	Move key switch to ignition position and measure voltage from connector (12), pin 8, circuit A28C to ground.	(12), A28C to gnd.	12±1.5 volts.	Go to next step.	Locate cause of no or low voltage in circuit A28 or A28C from fuse F22, then repair. Reconnect connectors.
5.	On	With jumper still installed at connector (7305), reconnect connector (12). Does warning light illuminate?			Warning light circuits test good. Reconnect connector (7305).	Replace defective cluster assembly. Reconnect connector.

RE 200/RE 300 With Allison 1000/2000 GEN 4 Transmission

Table 33 RE 200/RE 300 With Allison 1000/2000 GEN 4 Transmission

Step	Key	Action	Test Points	Spec.	Yes-In Spec.	No-Out of Spec
1.	Off/ On	Disconnect Allison ECU connector (7150) and use a test jumper to connect pin 29, circuit K#129 to ground. Move key switch to ignition position. Does warning light illuminate?			Warning light circuits test good. Turn key off, reconnect conn. (7150), and turn key on. If warning light does not illuminate during bulb check, reprogram/ replace ECU.	Go to next step.
2.	Off	Loosen cluster and remove CHECK TRANS warning light bulb. Test for continuity.	Across warning light bulb.	<100 ohms.	Re-install bulb. Go to next step.	Replace defective bulb and reconnect connector. Repeat all tests if problem persists.
3.	Off	Disconnect connector (12), and with jumper still attached at connector (7150), measure resistance from connector (12), pin 7, circuit A125 to ground.	(12), A125 to gnd.	<1 ohm.	Go to next step.	Locate open or poor connection in connector (7150), pin 29, circuit K#129, connector (9875), circuit N129, connector (644), circuit A125, connector (377), circuit A125 or connector (12), pin 7, then repair. Reconnect connectors.
4.	On	Move key switch to ignition position and measure voltage from connector (12), pin 8, circuit A28C to ground.	(12), A28C to gnd.	12±1.5 volts.	Go to next step.	Locate cause of no or low voltage in circuit A28 or A28C from fuse F22, then repair. Reconnect connectors.
5.	On	With jumper still installed at connector (7150), reconnect connector (12). Does warning light illuminate?			Warning light circuits test good. Reconnect connector (7150).	Replace defective cluster assembly. Reconnect connector.

6.14. WATER-IN-FUEL

RE 200 (V8 ENGINE)

Table 34 RE 200 (V8 ENGINE)

Step	Key	Action	Test Points	Spec.	Yes-In Spec.	No-Out of Spec
1.	Off/ On	Disconnect connector (6704) from water probe, and connect circuit K19C to ground with a jumper wire. Move key switch to ignition position. Does warning light illuminate?			Warning light circuits test good.	Go to next step.
2.	On	Remove WATER-IN-FUEL indicator bulb (9) and check for continuity.	Across warning light bulb.	<100 ohms.	Re-install bulb. Go to next step.	Replace defective bulb and reconnect connector. Repeat all tests if problem persists.
3.	Off	With jumper still in place, disconnect water-in-fuel module connector (16) and measure resistance from circuit A19C to ground.	(16), A19C to gnd.	<1 ohm.	Go to next step.	Locate open or poor connection in circuit K19C, conn. (9851), circuit N19C, conn. (2), circuit A19C, conn. (3116), then repair.
4.	On	Move key switch to ignition position, and with jumper still in place, measure voltage at connector (16) from circuit A19E to A19C.	(16), A19E to A19C.	12±1.5 volts.	Go to next step.	Locate cause of no or low voltage in conn. (3116), circuit A19D or A19E from fuse F20, then repair.
5.	On	At warning light bulb socket (9), measure resistance from circuit A19-G to ground.	(9), A19-G to gnd.	<1 ohm.	Go to next step.	Locate open or poor connection in circuit A19-G, conn. (3116), circuit A19–GC or A11-G, then repair.
6.	On	Re-install warning light bulb and use a jumper wire to connect circuit A19E to A19F. Does warning light illuminate?			Go to next step.	Locate cause of low or no voltage in conn. (3116), circuit A19F, then repair.
7.	On	Reconnect water-in-fuel module (16) and leave jumper at circuit A19C connected. Does warning light illuminate?			Warning light circuits test good. Remove jumper and reconnect conn. (6704).	Replace defective water-in-fuel module (16).

RE 300 (I6 ENGINE)

Table 35 RE 300 (I6 ENGINE)

Step	Key	Action	Test Points	Spec.	Yes - In Spec.	No - Out of Spec.
1.	Off/ On	1. Turn key to RUN 2. Connect J1939 sniffer		Are both the engine (0x00) and the MSM (aka ESC) on the data-link?	Go to step 2.	Go to step 4.
2.	Off/ On	1. Disconnect J1939 sniffer. 2. Connect Master Diagnostics 3. Monitor the "Water-In-Fuel" output.		Does the "Water-In-Fuel" output change?	Go to step 3.	ECM2 is not updating "Water-In-Fuel" output. See engine troubleshooting guide.
3.	Off/ On	1. Disconnect MSM2 connector (3115). 2. Connect pin 3 to ground.	(3115), pin 3 to gnd.	Does the "Water-In-Fuel" lamp turn on?	Replace MSM and retest	Go to next step.
4.	Off	1. Remove instrument cluster. 2. Remove WATER-IN-FUEL indicator bulb. 3. Test bulb for continuity.	Across warning light bulb.	<100 ohms.	Re-install bulb. Go to next step.	Replace defective bulb and reconnect connector. Repeat all tests if problem persists.
5.	Off	1. Instrument cluster removed. 2. Measure resistance from disconnected conn. (9), pin A, circuit A19F to MSM2 disconnected conn. (3115) pin 3.	(9), pin A, cir. A19F to (3115) pin 3.	<1 ohm.	Go to next step.	Locate open or poor connection in circuit A19F, conn. (3116), pin B, circuit A19F, conn. (3116), pin H, circuit A19–GD or cluster, then repair.

Table 35 RE 300 (I6 ENGINE) (cont.)

Step	Key	Action	Test Points	Spec.	Yes - In Spec.	No - Out of Spec.
6.	Off/ On	1. Instrument cluster removed. 2. Move key switch to ignition. 3. Measure voltage from conn. (9), pin B, circuit A19–G to ground.	(9), pin B, cir. A19–G to gnd.	12±1.5 volts.	Install cluster. Go to next step.	Locate cause of no or low voltage in circuit A19–G, conn. (3116), pin C, circuit A19–G, conn. (3116), pin G, circuit A19K, A97AC or fuse F20, then repair.
7.	Off/ On	1. Leave J1939 sniffer connected		Is the engine (0x00) on the data-link?	Go to step 8.	Go to step 11.
8.	Off/ On	1. Turn the key to OFF. 2. Disconnect MSM1 connector (3114). 3. Measure resistance across data-link pins 5 & 6, in wiring harness	(3114), pins 5 and 6.	Is the resistance approx. 60 ohms?	Go to step 9.	Fix data-link wiring, cir A5DD(-) and A5DD(+), retest
9.	Off/ On	1. Turn the key to Ignition. 2. Measure the voltage at the MSM1 conn. (3114) harness ignition pin 7 to ground.	(3114), pin 7, cir A97AB, A97AC.	Is the voltage 12-16 volts?	Go to step 7.	Fix wiring cir A97AB, A97AC or fuse F20, retest.
10.	Off/ On	1. Measure the resistance between the MSM1 conn. (3114) harness ground pin 8 and ground	(3114), pin 8, cir A97–G, A11–G to gnd.	Is the resistance less than 10 ohms?	Replace MSM and retest	Fix ground wiring cir A97–G, A11–G and platform ground, retest.
11.	Off/ On	1. Leave J1939 sniffer connected NOTE: This assumes the "Water-In-Fuel" output can be monitored using MD.		Is the MSM (aka ESC) on the data-link?	Check the engine's power connections and data link wiring.	Verify sniffer is working properly

6.15. FUEL FILTER

RE 200/RE 300

Table 36 RE 200/RE 300

Step	Key	Action	Test Points	Spec.	Yes - In Spec.	No - Out of Spec.
1.	Off/ On	1. Turn key to RUN 2. Connect J1939 sniffer		Are both the engine (0x00) and the MSM (aka ESC) on the data-link?	Go to step 2.	Go to step 4.
2.	Off/ On	1. Disconnect J1939 sniffer. 2. Connect Master Diagnostics 3. Monitor the "FUEL FILTER" output.		Does the "FUEL FILTER" output change?	Go to step 3.	ECM2 is not updating "FUEL FILTER" output. See engine troubleshooting guide.
3.	Off/ On	1. Disconnect MSM2 connector (3115). 2. Connect pin 1 to ground.	(3115), pin 1 to gnd.	Does the "FUEL FILTER" lamp turn on?	Replace MSM and retest	Go to next step.
4.	Off	1. Remove instrument cluster. 2. Remove FUEL FILTER indicator bulb. 3. Test bulb for continuity.	Across warning light bulb.	<100 ohms.	Re-install bulb. Go to next step.	Replace defective bulb and reconnect connector. Repeat all tests if problem persists.
5.	Off	1. Instrument cluster removed. 2. Measure resistance from disconnected conn. (69), pin B, circuit A19B to MSM2 disconnected conn. (3115) pin 1.	(69), pin B, cir. A19B to (3115) pin 1.	<1 ohm.	Go to next step.	Locate open or poor connection in circuit A19B, conn. (69), pin B or cluster, then repair.

Table 36 RE 200/RE 300 (cont.)

Step	Key	Action	Test Points	Spec.	Yes - In Spec.	No - Out of Spec.
6.	Off/ On	1. Instrument cluster removed. 2. Move key switch to ignition. 3. Measure voltage from conn. (69), pin A, circuit A19J to ground.	(69), pin A, cir. A19J to gnd.	12±1.5 volts.	Install cluster. Go to next step.	Locate cause of no or low voltage in circuit A19J, conn. (69), pin A or fuse F25, then repair.
7.	Off/ On	1. Leave J1939 sniffer connected		Is the engine (0x00) on the data-link?	Go to step 8.	Go to step 11.
8.	Off/ On	1. Turn the key to OFF. 2. Disconnect MSM1 connector (3114). 3. Measure resistance across data-link pins 5 & 6, in wiring harness	(3114), pins 5 and 6.	Is the resistance approx. 60 ohms?	Go to step 9.	Fix data-link wiring, cir A5DD(-) and A5DD(+), retest
9.	Off/ On	1. Turn the key to Ignition. 2. Measure the voltage at the MSM1 conn. (3114) harness ignition pin 7 to ground.	(3114), pin 7, cir A97AB, A97AC.	Is the voltage 12-16 volts?	Go to step 7.	Fix wiring cir A97AB, A97AC or fuse F20, retest.
10.	Off/ On	1. Measure the resistance between the MSM1 conn. (3114) harness ground pin 8 and ground	(3114), pin 8, cir A97–G, A11–G to gnd.	Is the resistance less than 10 ohms?	Replace MSM and retest	Fix ground wiring cir A97–G, A11–G and platform ground, retest.
11.	Off/ On	1. Leave J1939 sniffer connected NOTE: This assumes the "FUEL FILTER" output can be monitored using MD.		Is the MSM (aka ESC) on the data-link?	Check the engine's power connections and data link wiring.	Verify sniffer is working properly

6.16. TRANS OIL TEMP

RE 200/RE 300 With Allison Transmission

Table 37 RE 200/RE 300 With Allison Transmission

Step	Key	Action	Test Points	Spec.	Yes-In Spec.	No-Out of Spec
1.	Off/ On	Disconnect transmission oil temp. connector (N/L) and use a test jumper to connect circuit A31 to ground. Move key switch to ignition position. Does warning light illuminate?			Warning light circuits test good. Turn key off, reconnect conn. (N/L), and turn key on. If warning light does not illuminate when trans. temp. sensor senses 305°F or above, replace temp. sensor.	Go to next step.
2.	Off	Loosen cluster and remove trans oil temp warning light bulb. Test for continuity.	Across warning light bulb.	<100 ohms.	Re-install bulb. Go to next step.	Replace defective bulb and reconnect connector. Repeat all tests if problem persists.
3.	Off	Disconnect connector (11), and with jumper still attached at sensor conn. (N/L), measure resistance from connector (11) circuit A31/pin 6 to ground.	(11), A31 to gnd.	<1 ohm.	Go to next step.	Locate open or poor connection in circuit A31, connector (2), or circuit A31A, then repair. Reconnect connectors.
4.	On	Move key switch to ignition position and measure voltage from connector (11) circuit A28B to ground.	(11), A28B to gnd.	12±1.5 volts.	Go to next step.	Locate cause of no or low voltage in circuit A28 or A28B from fuse F22, then repair. Reconnect connectors.
5.	On	With jumper still installed at connector (N/L), reconnect connector (11). Does warning light illuminate?			Warning light circuits test good. Reconnect connector (N/L).	Replace defective cluster assembly. Reconnect connector.

6.17. LOW BRAKE FLUID

RE 200/RE 300

Table 38 RE 200/RE 300

Step	Key	Action	Test Points	Spec.	Yes-In Spec.	No-Out of Spec
1.	Off/ On	Disconnect connector (90) from brake fluid level sensor, and connect circuit N90P, going to warning light, to ground with a jumper wire. Move key switch to ignition position. Does warning light illuminate?			Warning light circuits test good. Reconnect conn. (90). If warning light fails to illuminate when reservoir level is low, replace level sensor.	Go to next step.
2.	Off	Loosen cluster and remove LOW BRAKE FLUID warning light bulb. Test for continuity.	Across warning light bulb.	<100 ohms.	Re-install bulb. Go to next step.	Replace defective bulb and reconnect connector. Repeat all tests if problem persists.
3.	Off	With jumper still in place, at bulb socket (89), measure resistance from circuit A90V to ground.	(89), A90V to gnd.	<1 ohm.	Go to next step.	Locate open or poor connection in circuits A90V, N90P, conn. (2), circuits N90P, N11–GF, or N11–GB, then repair.
4.	Off/ On	Re-install bulb and move key switch to ignition position. Does warning light illuminate?			Warning light circuits test good. Reconnect conn. (90). If warning light fails to illuminate when reservoir level is low, replace level sensor.	Locate cause of low or no voltage in circuit A28, or A90R from fuse F22, then repair.

6.18. TRAC CTRL

RE 200/RE 300 With Anti-lock Brake System (ABS) — Hydraulic Brakes

Table 39 RE 200/RE 300 With Anti-lock Brake System (ABS) — Hydraulic Brakes

Step	Key	Action	Test Points	Spec.	Yes-In Spec.	No-Out of Spec
1.	Off/ On	Disconnect traction control switch conn. (1101), and connect a jumper wire from circuit A94W to ground. Move key switch to ignition position. Does warning light illuminate?			Go to Step 6.	Go to next step.
2.	Off	Loosen cluster and remove TRAC CTRL warning light bulb. Test for continuity.	Across warning light bulb.	<100 ohms.	Re-install bulb. Go to next step.	Replace defective bulb and reconnect connector. Repeat all tests if problem persists.
3.	Off	With jumper still in place, disconnect connector (1500) and at pin B, circuit A94U, measure resistance to ground.	(1500), A94U, to gnd.	<1 ohm.	Go to next step.	Locate open or poor connection in circuit A94U, conn. (2), pin F6 or N94U, then repair.
4.	On	With jumper still in place, move key switch to ignition position, and at connector (1500) and at pin A, circuit A94T, measure voltage from pin A, circuit A94U, to pin B, circuit A94T.	(1500), A94U to A94T.	12±1.5 volts.	Go to next step.	Locate cause of no or low voltage in circuit A28 or A94T from fuse F22, then repair.
5.	On	With jumper still installed, reconnect connector (1500). Does warning light illuminate?			Go to next step.	Replace defective cluster assembly. Reconnect connector and clear fault codes.
6.	Off	With traction control switch conn. (1101) applied, measure resistance across traction control switch conn. (1101).	Across switch (1101).	<1 ohm.	Go to next step.	Replace defective traction control switch.
7.	Off	At traction control switch conn. (1101), measure resistance from circuit A94-GT to ground.	(1101), A94-GT to gnd.	<1 ohm.	Warning light circuits test good. Reconnect circuits.	Locate open or poor connection in circuits A94W, conn. (2), pin A2, N94W, A94-GT or A11-G to platform ground, then repair.

RE 200/RE 300 With WTEC or Allison 2000 ICT Anti-lock Brake System (ABS) — Air Brakes

Table 40 RE 200/RE 300 With WTEC or Allison 2000 ICT Anti-lock Brake System (ABS) — Air Brakes

Step	Key	Action	Test Points	Spec.	Yes-In Spec.	No-Out of Spec
1.	Off	Disconnect ABS ECU connector (288) and use a test jumper to connect pin C2 to +12 volts. Does warning light illuminate?			Warning light circuits test good. Turn key off, reconnect conn. (288), and turn key on. If warning light does not illuminate during bulb check, reprogram/ replace ECU.	Go to next step.
2.	Off	Loosen cluster and remove TRAC CTRL warning light bulb. Test for continuity.	Across warning light bulb.	<100 ohms.	Re-install bulb. Go to next step.	Replace defective bulb and reconnect connector. Repeat all tests if problem persists.
3.	On	Disconnect connector (3127), and with jumper still attached at connector (288), measure voltage from connector (3127), pin A, circuit A94CT to ground.	(3127), A94CT to gnd.	12±1.5 volts.	Go to next step.	Locate cause of no or low voltage in, N94CT connector (2), or circuit A94CT then repair. Reconnect connectors.
4.	Off	At connector (3127), measure voltage from connector (3127), pin B, circuit A94GT to ground.	(3127), A94GT to gnd.	12±1.5 volts.	Go to next step.	Locate open or poor connection in circuits A11-GB, A94–GB, coil of relay (283), circuits A94BT, A94GT or A13M, from fuse F27, then repair. Reconnect connectors.
5.	On	With jumper still installed at connector (288), reconnect connector (3127). Does warning light illuminate?			Warning light circuits test good. Reconnect connector (288).	Replace defective cluster assembly. Reconnect connector.
6.	Off	With traction control switch conn. applied,	Across switch.	<1 ohm.	Locate open or poor connection	Replace defective traction control switch.

Table 40 RE 200/RE 300 With WTEC or Allison 2000 ICT Anti-lock Brake System (ABS) — Air Brakes (cont.)

Step	Key	Action	Test Points	Spec.	Yes-In Spec.	No-Out of Spec
		measure resistance across traction control switch conn.			in circuits N94DT, conn. (2), pin A7, or N94FT, then repair.	

6.19. RETARD ON

RE 200/RE 300 With Allison WTEC III XMSN GEN 4

Table 41 RE 200/RE 300 With Allison WTEC III XMSN GEN 4

Step	Key	Action	Test Points	Spec.	Yes-In Spec.	No-Out of Spec
1.	Off/ On	Disconnect ECU connector (7202), pin 18, connect a test jumper from circuit K#125 to ground, and move key switch to ignition position. Does RETARD ON warning light illuminate?	(7202), pin 18, K#125. to gnd.	12±1.5 volts.	Warning light circuitry tests good. Refer to Electrical Troubleshooting Manual to locate problem with transmission circuitry.	Go to next step.
2.	Off	Remove RETARD ON warning light bulb conn. (926). Test for continuity.	Across warning light bulb.	<100 ohms.	Re-install bulb. Go to next step.	Replace defective bulb and repeat all tests if problem persists.
3.	Off/ On	Remove retard on relay (7807), move key switch to ignition position, and measure voltage from circuit V146D to ground.	Relay socket (7807), V146D to gnd.	12±1.5 volts.	Go to next step.	Locate cause of no or low voltage in circuit V146C or V146D from fuse F4, then repair.
4.	On	With key switch still in ignition position, at relay socket, measure voltage from circuit V146D to ground.	Relay socket, V146D to gnd.	12±1.5 volts.	Go to next step.	Locate cause of no or low voltage in circuit V146D then repair.
5.	On	With key switch still in ignition position and jumper still installed, at relay socket, measure voltage from circuit V146D to K#125.	Relay socket, V146D to K#125.	12±1.5 volts.	Go to next step.	Locate open or poor connection in circuit K#125., then repair.

Table 41 RE 200/RE 300 With Allison WTEC III XMSN GEN 4 (cont.)

Step	Key	Action	Test Points	Spec.	Yes-In Spec.	No-Out of Spec
6.	Off	Bench test retard on relay by measuring resistance from pin 30 to 87A.	Relay, pin 30 to 87A.	<1 ohm.	Go to next step.	Replace defective relay.
7.	Off	Bench test retard on relay by applying +12V to pin 85, gnd. to pin 86, and measuring resistance from pin 30 to 87.	Energized relay, pin 30 to 87.	<1 ohm.	Go to next step.	Replace defective relay.
8.	Off/ On	Re-install retard on relay, and with jumper still installed, move key switch to ignition position. Remove warning light bulb and measure voltage from circuit A92H to ground.	Socket, A92H to gnd.	12±1.5 volts.	Go to next step.	Locate cause of low or no voltage in circuit A92H, conn. (1601–A), circuit N92H, conn. (523–V), circuit K92H, conn. (7100–L), or circuit V92H, then repair.
9.	On	With jumper still installed, re-install warning light bulb. Does warning light illuminate?			retard on warning light circuits test good. Turn key off. Reconnect conn. (7202). If problems persist, reprogram/ replace ECU after checking input circuits.	Locate open or poor connection in circuit A92-GA, A186, conn. (377–A), circuit A186 or A11-G to ground, then repair.

6.20. CHANGE TRANS FILTER

RE 200/RE 300 With Allison WTEC III XMSN GEN 4

Table 42 RE 200/RE 300 With Allison WTEC III XMSN GEN 4

Step	Key	Action	Test Points	Spec.	Yes-In Spec.	No-Out of Spec
1.	Off/ On	Disconnect black wire from transmission filter and connect to ground with a test jumper. Move key switch to ignition position. Does warning light illuminate?			Warning light circuits test good. Turn key off and reconnect black wire.	Go to next step.

Table 42 RE 200/RE 300 With Allison WTEC III XMSN GEN 4 (cont.)

Step	Key	Action	Test Points	Spec.	Yes-In Spec.	No-Out of Spec
2.	Off	Remove CHANGE TRANS FILTER warning light bulb. Test for continuity.	Across warning light bulb.	<100 ohms.	Re-install bulb. Go to next step.	Replace defective bulb and reconnect black wire to filter. Repeat all tests if problem persists.
3.	Off	Disconnect connector (94), and with jumper still attached at black wire, measure resistance from connector (94) circuit A31-GA to ground.	(94), A31-GA to gnd.	<1 ohm.	Go to next step.	Locate open or poor connection in circuit A31-GA, connector (344), a blue wire, conn. (N/L), or a black wire, then repair. Reconnect connectors.
4.	On	Move key switch to ignition position and measure voltage from connector (94) circuit A31D to ground.	(94), A31D to gnd.	12±1.5 volts.	Go to next step.	Locate cause of no or low voltage in circuit A31D from fuse F10, then repair. Reconnect connectors.
5.	Off	With jumper still installed at black wire, reconnect connector (94). Does warning light illuminate?			Warning light circuits test good. Reconnect conn. (94) and black wire.	Replace defective socket assembly. Reconnect conn. (94) and black wire.

6.21. RETARD OVER HEAT

RE 200/RE 300 With Allison WTEC III XMSN

Table 43 RE 200/RE 300 With Allison WTEC III XMSN

Step	Key	Action	Test Points	Spec.	Yes-In Spec.	No-Out of Spec
1.	Off/ On	Disconnect ECU connector (7202) and use a test jumper to connect pin 19 circuit K#105. to ground. Move key switch to ignition position. Does warning light illuminate?	(7202), pin 19, K#105. to gnd.	12±1.5 volts.	Warning light circuits test good. Turn key off and reconnect conn. (7202). Turn key on. If warning light does not illuminate during bulb check, reprogram/ replace ECU.	Go to next step.
2.	Off	Remove RETARDER OVER HEAT warning light bulb conn. (925). Test for continuity.	Across warning light bulb.	<100 ohms.	Re-install bulb. Go to next step.	Replace defective bulb and reconnect connector. Repeat all tests if problem persists.
3.	Off	With jumper still attached at conn. (7202), measure resistance at socket from circuit K#105. to ground.	Socket, K#105. to gnd.	<1 ohm.	Go to next step.	Locate open or poor connection in circuit A105B, connector (1601), circuit N105B, connector (523), circuit K105B, connector (7999), or circuits K#105B/K#105A, K#105, then repair. Reconnect connector and bulb.
4.	On	Move key switch to ignition position and measure voltage from circuit A13J to ground.	Socket, A13J to gnd.	12±1.5 volts.	Warning light circuits test good. Reconnect conn. (7202).	Locate cause of no or low voltage in circuit A13J, conn. (377), circuits A13J, or A28, from fuse F22, then repair. Reconnect connector.

RE 200/RE 300 With Allison WTEC III XMSN GEN 4

Table 44 RE 200/RE 300 With Allison WTEC III XMSN GEN 4

Step	Key	Action	Test Points	Spec.	Yes-In Spec.	No-Out of Spec
1.	Off/ On	Disconnect ECU connector (7150) and use a test jumper to connect pin 64 circuit K#164. to ground. Move key switch to ignition position. Does warning light illuminate?	(7150), pin 64, K#164. to gnd.	12±1.5 volts.	Warning light circuits test good. Turn key off and reconnect conn. (7150). Turn key on. If warning light does not illuminate during bulb check, reprogram/ replace ECU.	Go to next step.
2.	Off	Remove RETARDER OVER HEAT warning light bulb conn. (925). Test for continuity.	Across warning light bulb.	<100 ohms.	Re-install bulb. Go to next step.	Replace defective bulb and reconnect connector. Repeat all tests if problem persists.
3.	Off	With jumper still attached at conn. (7150), measure resistance at socket from circuit K#164. to ground.	Socket, K#164. to gnd.	<1 ohm.	Go to next step.	Locate open or poor connection in circuit A164B, connector (1601), circuit N164B, connector (523), circuit K164B, connector (7999), or circuits K#164B/K#164A, K#164, then repair. Reconnect connector and bulb.
4.	On	Move key switch to ignition position and measure voltage from circuit A13J to ground.	Socket, A13J to gnd.	12±1.5 volts.	Warning light circuits test good. Reconnect conn. (7150).	Locate cause of no or low voltage in circuit A13J, conn. (377), circuits A13J, or A28, from fuse F22, then repair. Reconnect connector.

6.22. ALTERNATOR

RE 200/RE 300

Table 45 RE 200/RE 300

Step	Key	Action	Test Points	Spec.	Yes - In Spec.	No - Out of Spec.
1.	On	Disconnect circuit 1C from lug 1 of alternator. Connect a jumper between wire from lug 1 and ground. Does warning light illuminate?		Warning light illuminates.	Warning light circuits test good. Troubleshoot alternator.	Go to next step.
2.	Off	Remove cluster and remove ALTERNATOR indicator light bulb. Test bulb for continuity.	Across indicator light bulb.	<100 ohms.	Re-install bulb. Go to next step.	Replace defective bulb or replace cluster, repeat tests if problem persists.
3.	Off	Disconnect conn. (12). With jumper still in place, measure resistance from pin 16 of wire harness conn. (12), circuit 1C to ground.	Conn. (12), pin 16, cir. 1C to gnd.	<1 ohm.	Go to next step.	Locate open or poor connection in circuit 1C, then repair.
4.	On	Move key switch to ignition position and measure voltage at pin 10 of wiring harness conn. (11), circuit A28B.	Conn. (11), pin 10, cir. A28B.	12±1.5 volts.	Go to next step.	Locate cause of no or low voltage in circuit A28B, conn. (11), fuse F22, then repair.
5.	On	With jumper still installed at circuit 1C, reconnect connector (12). Does indicator light?		Warning light illuminates.	Warning light circuits test good. Reconnect circuit 1C to alternator lug 1.	Replace defective cluster assembly and reconnect all connectors.