

Troubleshooting Manual

Allison Transmission

MD/HD/B Series Transmissions
WTEC II Controls
(Pre-TransID and TID 1)

MD 3060/MD 3066/MD 3560(P)(R)
MD 3070PT
HD 4060/HD 4560(P)(R)
B 300/B 400/ B 500(P)(R)

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Allison Transmission

Division of General Motors Corporation
P.O. Box 894 Indianapolis, Indiana 46206-0894

FOREWORD — How to Use This Manual

This manual provides troubleshooting information for Allison Transmission Division, MD/HD/B Series Transmissions. Service Manuals SM2148EN and SM2457EN, and Parts Catalogs PC2150EN and PC2456EN may be used in conjunction with this manual.

This manual includes:

- Description of the WTEC II electronic control system.
- Description of the electronic control system components.
- Description of diagnostic codes, system responses to faults, and troubleshooting.
- Wire, terminal, and connector repair information.

Specific instructions for using many of the available or required service tools and equipment are not included in this manual. The service tool manufacturer will furnish instructions for using the tools or equipment.

Additional information may be published from time to time in Service Information Letters (SIL) and will be included in future revisions of this and other manuals. Please use these SILs to obtain up-to-date information concerning Allison Transmission products.

This publication is revised periodically to include improvements, new models, special tools, and procedures. A revision is indicated by a letter suffix added to the publication number. Check with your Allison Transmission service outlet for the currently applicable publication. Additional copies of this publication may be purchased from authorized Allison Transmission service outlets. Look in your telephone directory under the heading of Transmissions — Truck, Tractor, etc.

Take time to review the Table of Contents and the manual. Reviewing the Table of Contents will aid you in quickly locating information.

NOTE: *Allison Transmission is providing for service of WTEC II wiring harnesses and wiring harness components as follows: (See Service Information Letter 1-WT-97 for further information.)*

- Repair parts for the internal wiring harness and for wiring harness components attached to the shift selector will be available through the Allison Transmission Parts Distribution Center (PDC). Use the P/N from your appropriate parts catalog or from Appendix E in this manual. Allison Transmission is responsible for warranty on these parts.
- Since January, 1998, all WTEC II external harnesses and external harness components must be obtained from St. Clair Technologies Inc. (SCTI). SCTI provides parts to any Allison customer or OEM and is responsible for warranty on these parts. SCTI recognizes ATD, manufacturers, and SCTI part numbers. SCTI provides a technical HELPLINE at 519-627-1673 (Wallaceburg). SCTI has parts catalogs available. The SCTI addresses and phone numbers for parts outlets are:

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IMPORTANT SAFETY NOTICE

IT IS YOUR RESPONSIBILITY to be completely familiar with the warnings and cautions used in this manual. These warnings and cautions advise against using specific service procedures that can result in personal injury, equipment damage, or cause the equipment to become unsafe. These warnings and cautions are not exhaustive. Allison Transmission could not possibly know, evaluate, or advise the service trade of all conceivable procedures by which service might be performed or of the possible hazardous consequences of each procedure. Consequently, Allison Transmission has not undertaken any such broad evaluation. Accordingly, **ANYONE WHO USES A SERVICE PROCEDURE OR TOOL WHICH IS NOT RECOMMENDED BY ALLISON TRANSMISSION MUST** first be thoroughly satisfied that neither personal safety nor equipment safety will be jeopardized by the service procedures used.

Also, be sure to review and observe **WARNINGS, CAUTIONS, and NOTES** provided by the vehicle manufacturer and/or body builder before servicing the Allison transmission in that vehicle.

Proper service and repair is important to the safe and reliable operation of the equipment. The service procedures recommended by Allison Transmission and described in this manual are effective methods for performing troubleshooting operations. Some procedures require using specially designed tools. Use special tools when and in the manner recommended.

The **WARNINGS, CAUTIONS, and NOTES** in this manual apply only to the Allison transmission and not to other vehicle systems which may interact with the transmission. Be sure to review and observe any vehicle system information provided by the vehicle manufacturer and/or body builder at all times the Allison transmission is being serviced.

WARNINGS, CAUTIONS, AND NOTES

Three types of headings are used in this manual to attract your attention:

WARNING! Is used when an operating procedure, practice, etc., which, if not correctly followed, could result in injury or loss of life.

CAUTION: Is used when an operating procedure, practice, etc., which, if not strictly observed, could result in damage to or destruction of equipment.

NOTE: *Is used when an operating procedure, practice, etc., is essential to highlight.*

TRADEMARKS USED IN THIS MANUAL

The following trademarks are the property of the companies indicated:

- LPS® Cleaner is a registered trademark of LPS Laboratories.
- VCI #10® is the registered trademark for a vapor phase rust preventive manufactured by Daubert Chemical Company, Chicago, Illinois. VCI #10 is covered by Military Specifications MIL-L-46002 (ORD) and MIL-I-23310 (WEP) under the designation of Nucle Oil.
- Biobor JF® is the registered trademark for a biological inhibitor manufactured by Hammonds Fuel Additives Corporation.
- Loctite® is a registered trademark of the Loctite Corporation.
- Teflon® is a registered trademark of the DuPont Corporation.
- Pro-Link® is a registered trademark of MicroProcessor Systems, Inc.

SHIFT SELECTOR TERMS AND DISPLAY INDICATIONS

Shift selector terms and displays are represented in this manual as follows:

- Button Names — ↑ ↓, **DISPLAY MODE**, **MONITOR**, **SELECT**, etc.
- Transmission Ranges — **D** (Drive), **N** (Neutral), **1** (First), **R** (Reverse), etc.
- Displays — “**OL**”, “**OK**”, etc.



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SECTION 1 — GENERAL DESCRIPTION

1-1. TRANSMISSION

The World Transmission Electronic Controls WTEC II system features closed-loop clutch control to provide superior shift quality over a wide range of operating conditions. MD 3000 (except 3070), HD 4000, and B Series configurations can be programmed to have up to six forward ranges, neutral, and one reverse range. The MD 3070 has seven forward ranges and one reverse range. Figures 1-1 and 1-2 show electronic control unit components.

WTEC II Electronic Controls consist of the following components:

- Basic or Max Feature Electronic Control Unit (ECU)
- Pushbutton or Lever Shift Selectors (remote or integral to the ECU)
- Optional Secondary Shift Selector
- Engine, Turbine and Output Speed Sensors
- Throttle Position Sensor (TPS) (or electronic engine throttle signal or PWM signal)
- Control Module (Electro-Hydraulic Valve Body)
- Wiring Harnesses
- Vehicle Interface Module (VIM)
- Optional Retarder Controls
- TransID Feature

NOTE: Model Year '94 and earlier WT Series Electronic Controls operate on 12VDC. Vehicles with a 24VDC system require a voltage equalizer or converter to supply 12V to the electronic control system. Model Year '95 and later transmissions operating on 24VDC require a 24V VIM and a 24V wiring harness which includes shielding for the turbine and output speed sensors.

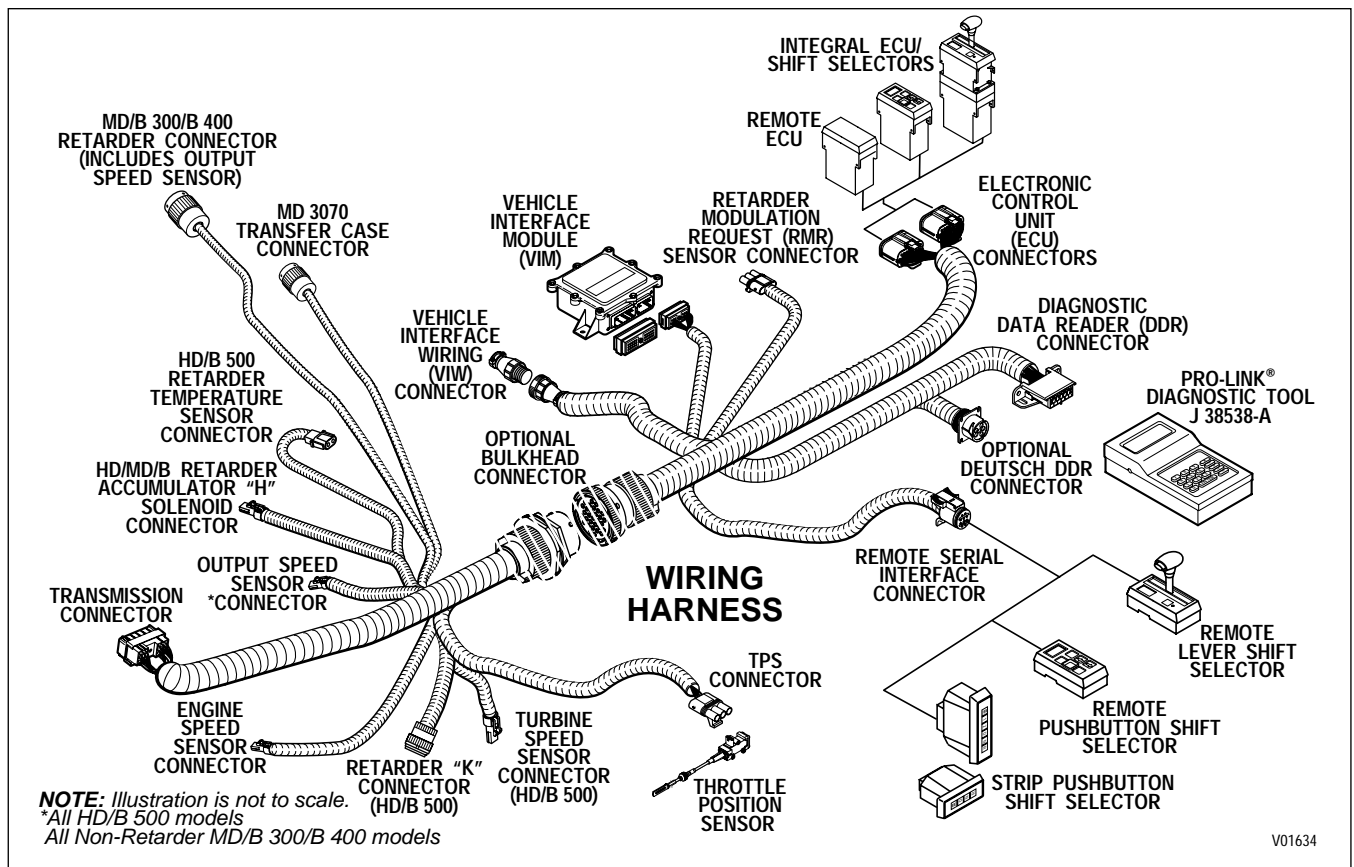


Figure 1-1. WTEC II Electronic Control Components (Units Produced Before 9/94)

GENERAL DESCRIPTION

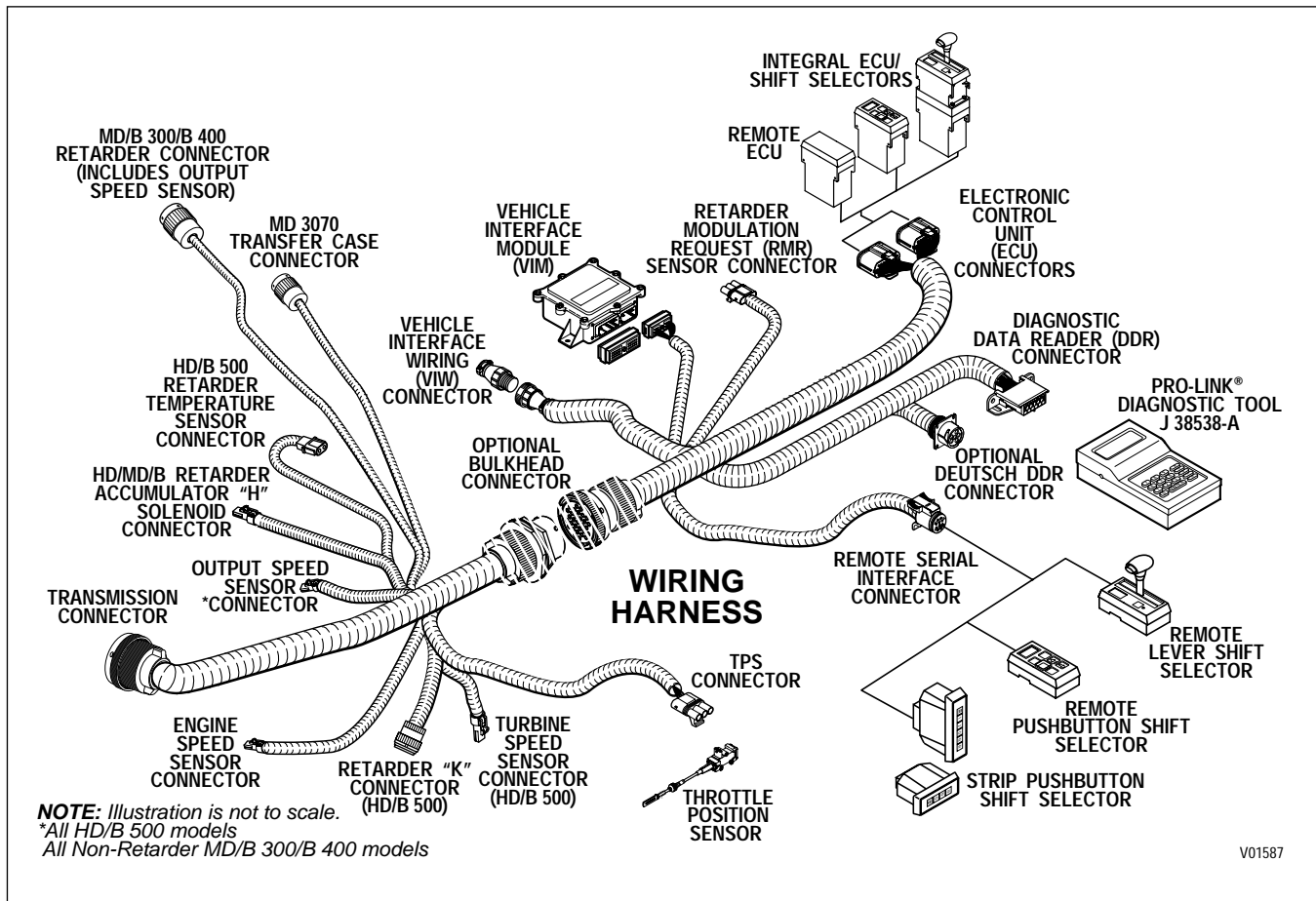


Figure 1-2. WT Electronic Control Unit Components (Units Produced 9/94-12/97)

Figure 1-3 is a block diagram of the basic system's inputs and outputs.

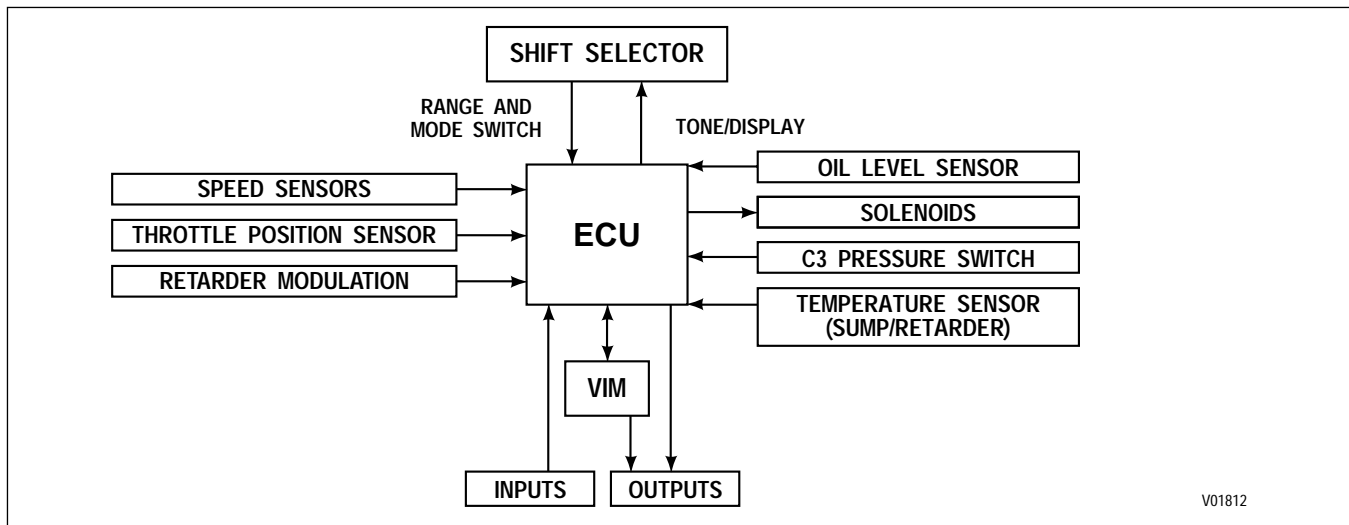


Figure 1-3. Electronic Control Unit Block Diagram

GENERAL DESCRIPTION

1-2. ELECTRONIC CONTROL UNIT (ECU)

The ECU (Figure 1-4) contains the microcomputer which is the brain of the control system. The ECU receives and processes information defining: shift selector position, throttle position, sump/retarder temperature, engine speed, turbine speed, and transmission output speed. The ECU uses the information to control transmission solenoids and valves, supply system status, and provide diagnostic information.

The ECU contains an Electronically Erasable Programmable Read Only Memory (EEPROM) which is programmed with the shift calibration and other data for a specific transmission assembly, engine, and vehicle vocation.

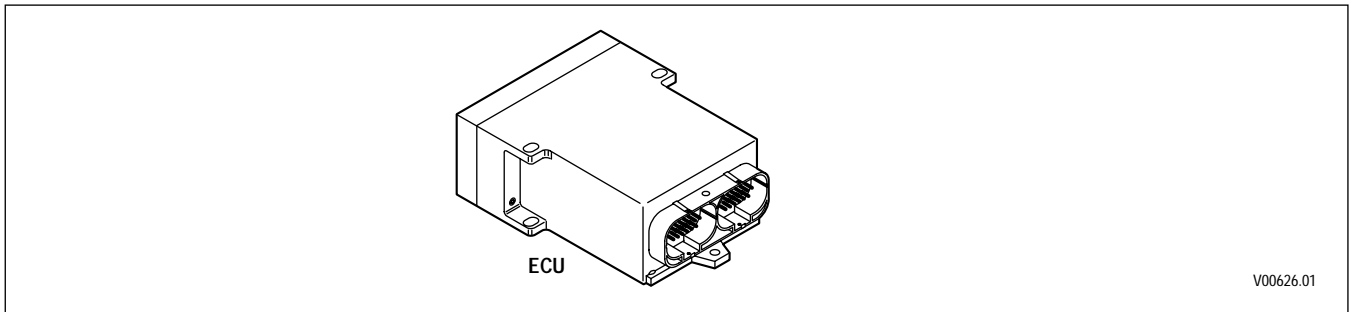


Figure 1-4. Electronic Control Unit (ECU)

1-3. SHIFT SELECTOR

Pushbutton and lever shift selectors are available for the WT Series. Either shift selector may be ordered attached to (integral with), or remote from, the ECU. Both shift selectors are equipped with a digital display. However, the strip pushbutton shift selector does not have a digital display.

On the shift selectors, between the range selected and the range monitored (attained) digits, is a **MODE ON** indicator position. During normal transmission operation **MODE ON** indicates that a secondary or special operating condition has been selected by pressing the **MODE** button. In diagnostic display mode, **MODE ON** indicates the displayed diagnostic code is active. There is a **SERVICE** indicator icon under the **MODE ON** indicator. It is illuminated when codes 21 XX, 63 00, and 66 00 are active (for ECUs programmed after 9/26/94). When a transmission fault occurs that causes the **DO NOT SHIFT** light to turn on, the shift selector sounds a tone to indicate transmission shifting is restricted.

A. Pushbutton Shift Selector (Figure 1-5)

The full-function pushbutton shift selector has six (6) buttons and a digital display. The six buttons are: **R** (Reverse), **N** (Neutral), **D** (Drive), \uparrow (Up), \downarrow (Down), and **MODE**. Manual forward range downshifts; upshifts are made by pressing the \uparrow (Up) or \downarrow (Down) arrow buttons after selecting **D** (Drive). The **N** (Neutral) button has a raised lip to aid in finding it by touch. The digital display on the pushbutton selector indicates the range selected on the left side and the range monitored (attained) on the right side. The **MODE** button is pressed to select a secondary or special operating condition, such as **ECONOMY** shift schedule. The vehicle dimmer-control changes display brightness. Diagnostic information is obtained by pressing the \uparrow (Up) and \downarrow (Down) arrow buttons at the same time.

GENERAL DESCRIPTION

A strip pushbutton shift selector does not have a **MODE** button, **SERVICE** icon, or diagnostic display capability. The Pro-Link® 9000 or a customer-furnished remote display must be used for diagnostic purposes.

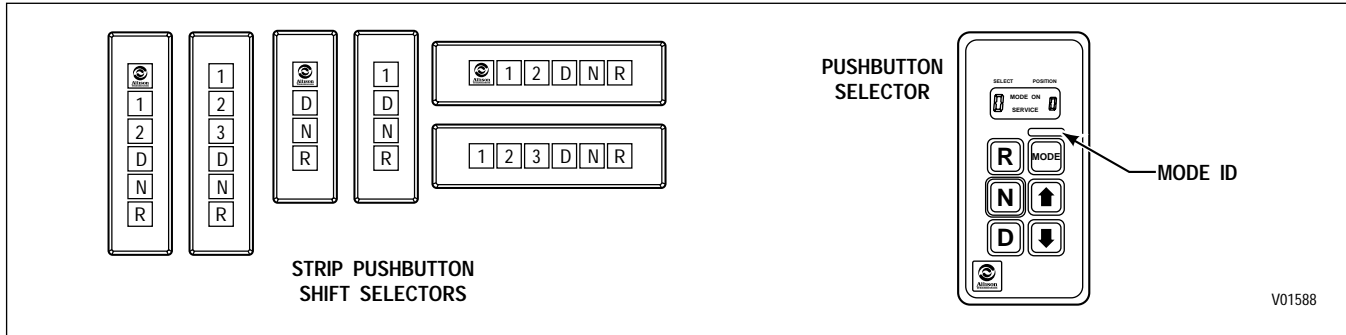


Figure 1-5. Pushbutton Shift Selectors

B. Lever Shift Selector (Figure 1-6)

The lever shift selector can only be ordered with as many as six forward range positions (seven for the MD 3070), as well as **R** (Reverse) and **N** (Neutral). The shift hold mechanism is released by pressing a button on the side of the shift handle. The range selector lever can be moved freely between numbered forward ranges. Press and hold the shift hold button to move into or out of the **D** (Drive) position or when moving into or out of **N** (Neutral) or **R** (Reverse).

The digital display on the lever selector indicates the selected range at the top and the range monitored (attained) at the bottom. A **MODE** button and a recessed **DISPLAY MODE** button are also on the face of the lever shift selector. The **MODE** button is pressed to select a secondary or special operating condition, such as **ECONOMY** shift schedule. Diagnostic information is obtained by pressing the **DISPLAY MODE** button. The vehicle dimmer-control changes display brightness.

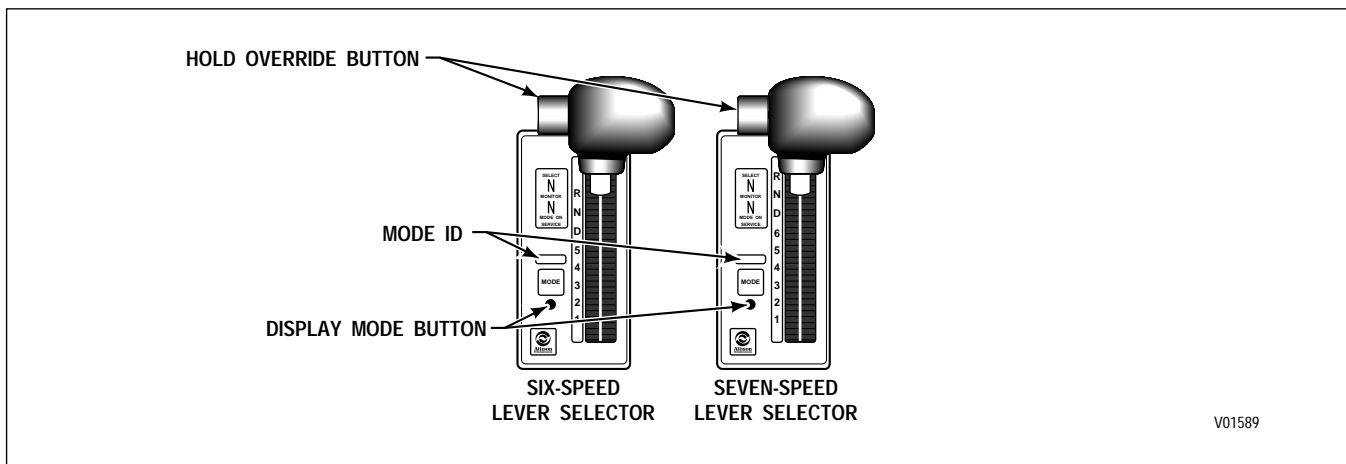


Figure 1-6. Six-Speed And Seven-Speed Lever Shift Selectors

GENERAL DESCRIPTION

1-4. THROTTLE POSITION SENSOR (Figure 1-7)

The Throttle Position Sensor (TPS) can be mounted to the engine, chassis, or transmission. The TPS contains a pull actuation cable and a potentiometer. One end of the cable is attached to the engine fuel lever and the other, inside a protective housing, to the TPS potentiometer. Output voltage from the TPS is directed to the ECU through the external harness. The voltage signal indicates the throttle position and, in combination with other input data, determines shift timing.

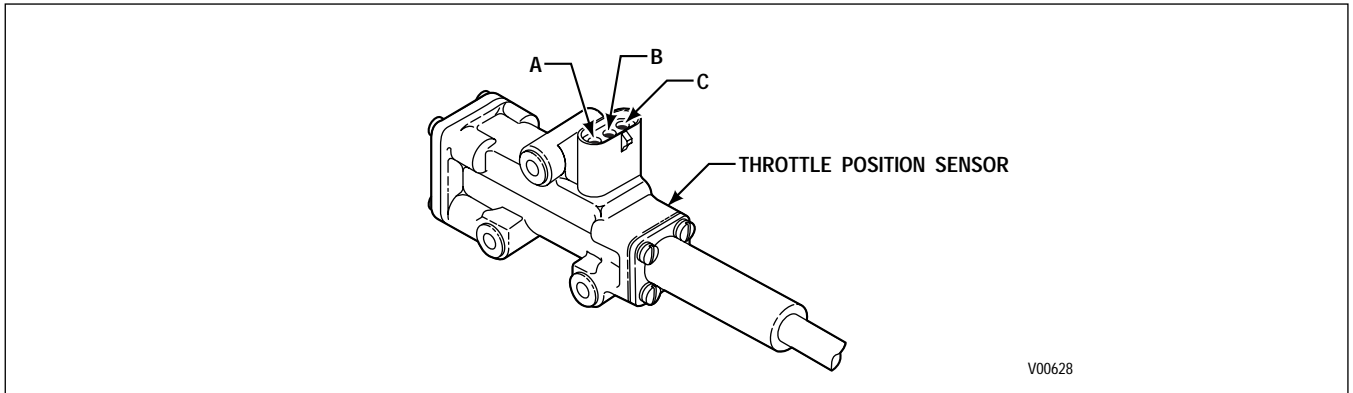


Figure 1-7. Throttle Position Sensor

1-5. SPEED SENSORS (Figure 1-8)

Three speed sensors — engine speed, turbine speed, and output speed — provide information to the ECU. The engine speed signal is generated by ribs on the shell of the torque converter pump. The turbine speed signal is generated by the rotating-clutch housing spline contours. The output speed signal is generated by a toothed member attached to the output shaft (except for the MD 3070, where the toothed member is the transfer case idler gear). The speed ratios between the various speed sensors allow the ECU to determine if the transmission is in the selected range. Speed sensor information is also used to control the timing of clutch apply pressures, resulting in the smoothest shifts possible. Hydraulic problems are detected by comparing the speed sensor information for the current range to that range's speed sensor information stored in the ECU memory.

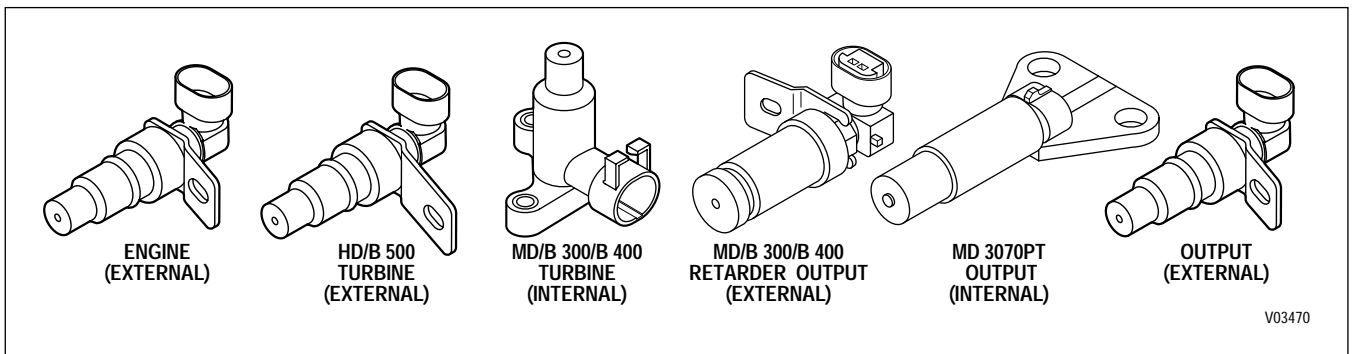


Figure 1-8. Speed Sensors

GENERAL DESCRIPTION

1-6. CONTROL MODULE (Figure 1-9)

The WT Series transmission control module contains a channel plate on which is mounted: the main valve body assembly, the stationary-clutch valve body assembly, and the rotating-clutch valve body assembly. For valve locations, refer to SIL 27-WT-93, Rev. A. Pulse width modulated solenoids are used in the valve bodies. The rotating-clutch valve body assembly contains A (C1), B (C2), and F (lockup) solenoids, solenoid regulator valves controlled by the solenoids, and the C3 pressure switch. The stationary-clutch valve body assembly contains C (C3), D (C4), and E (C5) solenoids and solenoid regulator valves controlled by the solenoids and the C3 accumulator relay valve. The main valve body assembly contains G solenoid and the C1 and C2 latch valves controlled by the solenoid, the main and lube regulator valves, the control main and converter regulator valves, and the converter flow valve and exhaust backfill valves.

A temperature sensor (thermistor) is located in the internal wiring harness. Changes in sump fluid temperature are indicated by changes in sensor resistance which changes the signal sent to the ECU (see chart in Section 6, Code 24).

The oil level sensor is required on all models with a shallow sump but is optional on other models. The oil level sensor is a float-type device, mounted on the control module channel plate, which senses transmission fluid level by electronically measuring the buoyancy forces on the float. The sensor operates on 5VDC supplied by the ECU.

The C3 pressure switch is mounted on the rotating-clutch valve body assembly and indicates when pressure exists in the C3 clutch-apply passage. An accumulator/relay valve is in-line ahead of the C3 pressure switch and prevents high frequency hydraulic pulses generated by the C3 solenoid from cycling the C3 pressure switch.

Also mounted in the control module is the turbine speed sensor for the MD/B 300/B 400 models. The turbine speed sensor is directed at the rotating-clutch housing. (The turbine speed sensor on the HD/B 500 models is located on the outside of the main housing.)

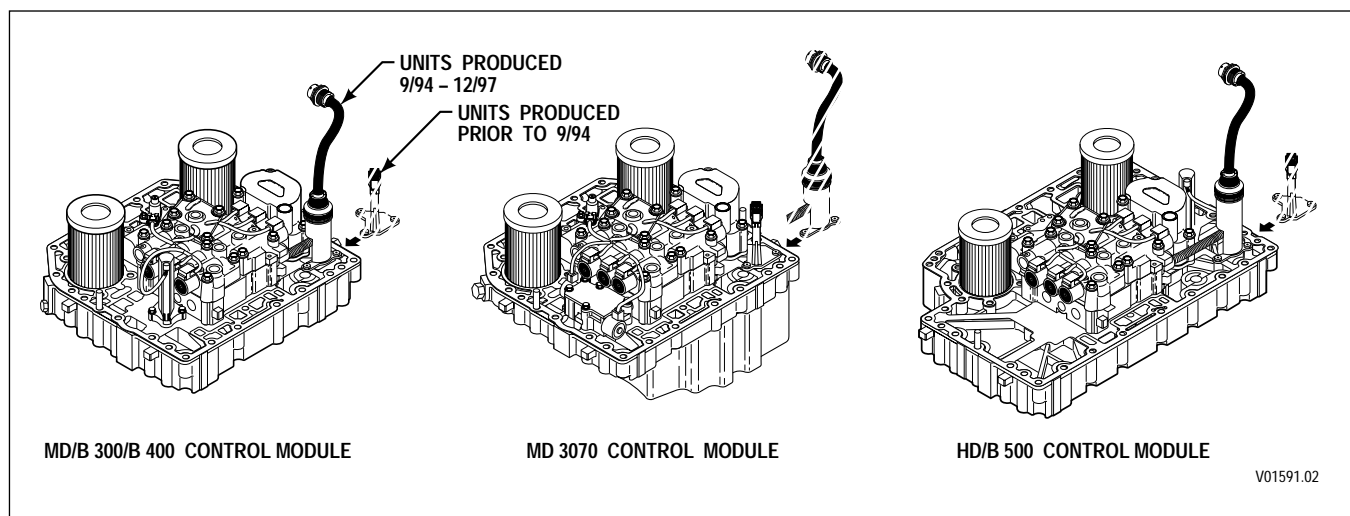


Figure 1-9. Control Module

GENERAL DESCRIPTION

1-7. WIRING HARNESSES

A. External Wiring Harness (Figures 1-10 and 1-11)

The external wiring harness provides a connection between the ECU, the transmission (including engine, turbine, and output speed sensors), the throttle position sensor, the vehicle interface module (VIM), retarder control module, shift selectors, diagnostic tool connector, retarder, retarder temperature sensor, accumulator, and vehicle interface. Many harnesses will include a bulkhead to separate cab and chassis components. Also, many different styles and materials for harnesses are likely to be encountered.

NOTE: *Allison Transmission is providing for service of WTEC II wiring harnesses and wiring harness components as follows: (See Service Information Letter 1-WT-97 for further information.)*

- Repair parts for the internal wiring harness and for wiring harness components attached to the shift selector will be available through the Allison Transmission Parts Distribution Center (PDC). Use the P/N from your appropriate parts catalog or from Appendix E in this manual. Allison Transmission is responsible for warranty on these parts.
- Since January, 1998, all WTEC II external harnesses and external harness components must be obtained from St. Clair Technologies Inc. (SCTI). SCTI provides parts to any Allison customer or OEM and is responsible for warranty on these parts. SCTI recognizes ATD, manufacturers, and SCTI part numbers. SCTI provides a technical HELPLINE at 519-627-1673 (Wallaceburg). SCTI has parts catalogs available. The SCTI addresses and phone numbers for parts outlets are:

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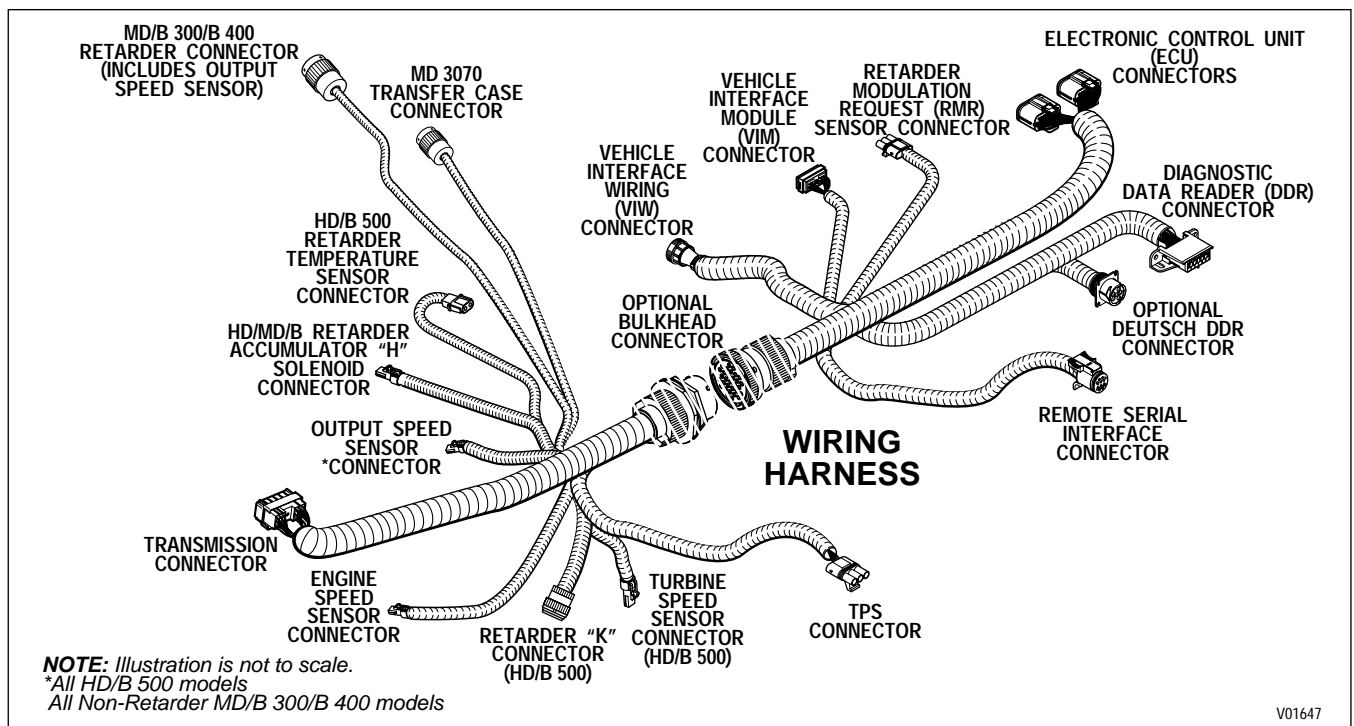


Figure 1-10. WTEC II External Wiring Harness (Units Produced Before 9/94)

GENERAL DESCRIPTION

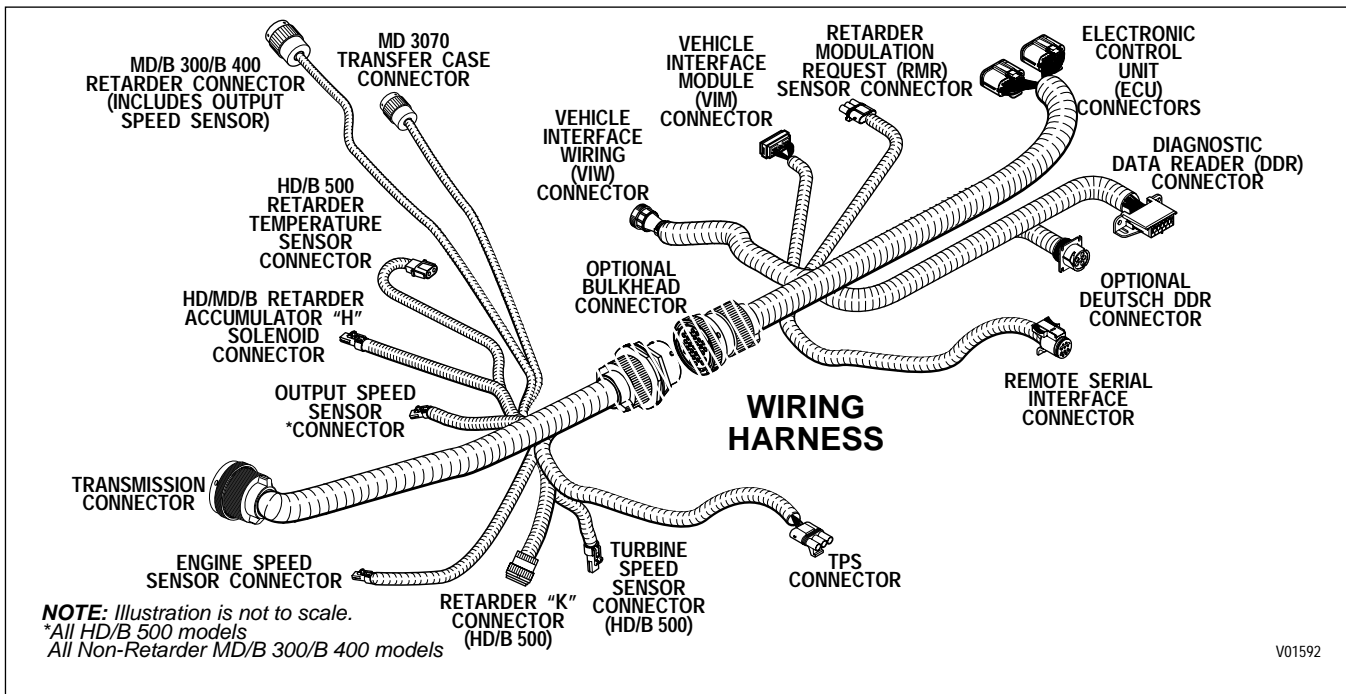


Figure 1-11. WTEC II External Wiring Harness (Units Produced 9/94-12/97)

B. Internal Wiring Harness (Figures 1-12, 1-13, and 1-14)

The internal wiring harness provides connection between the external harness, the pulse width modulated solenoids, oil level sensor, C3 pressure switch, and the temperature sensor.

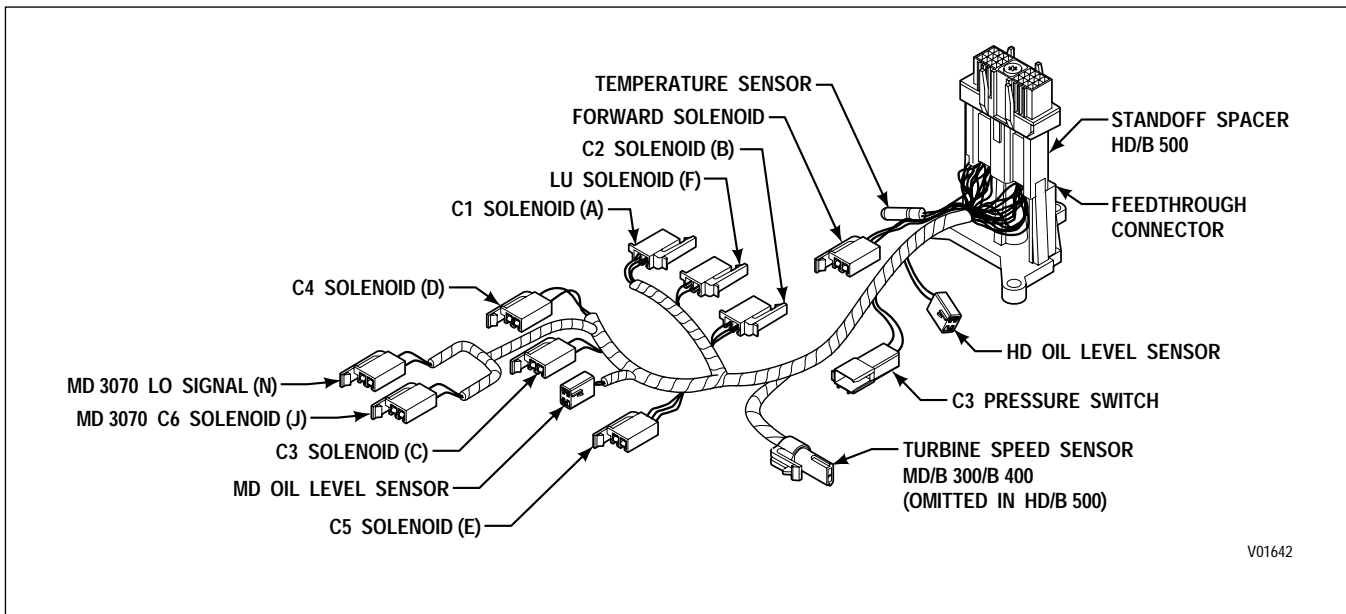
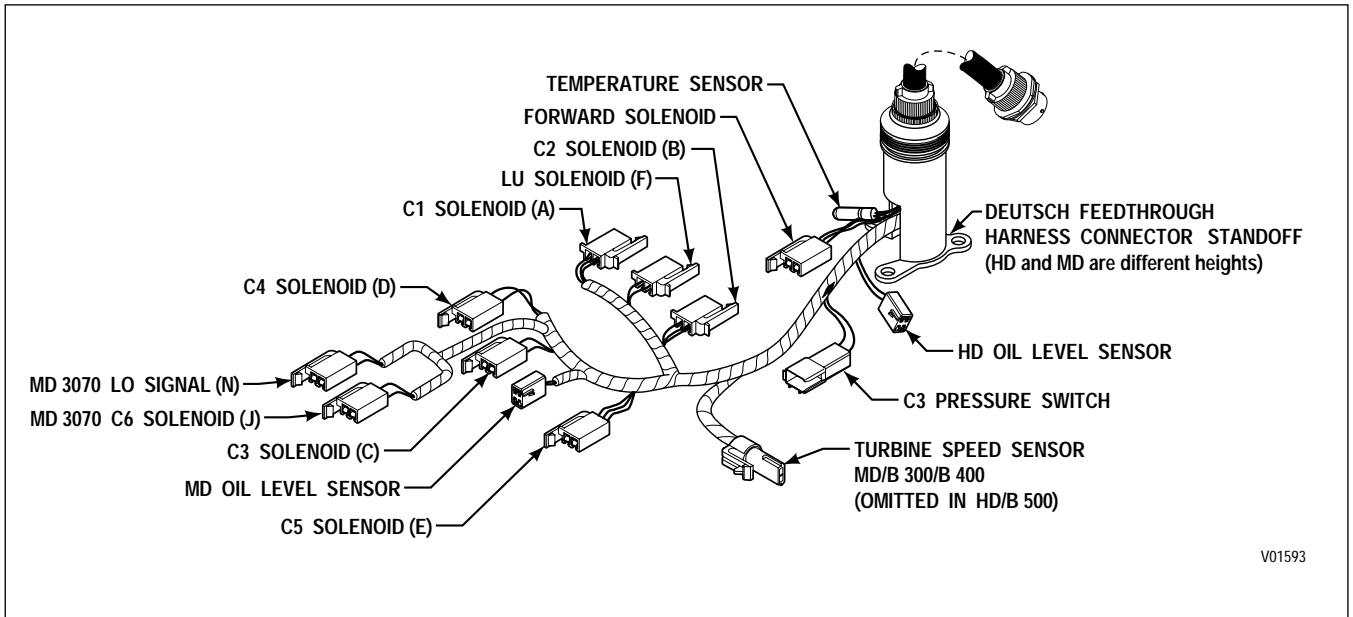


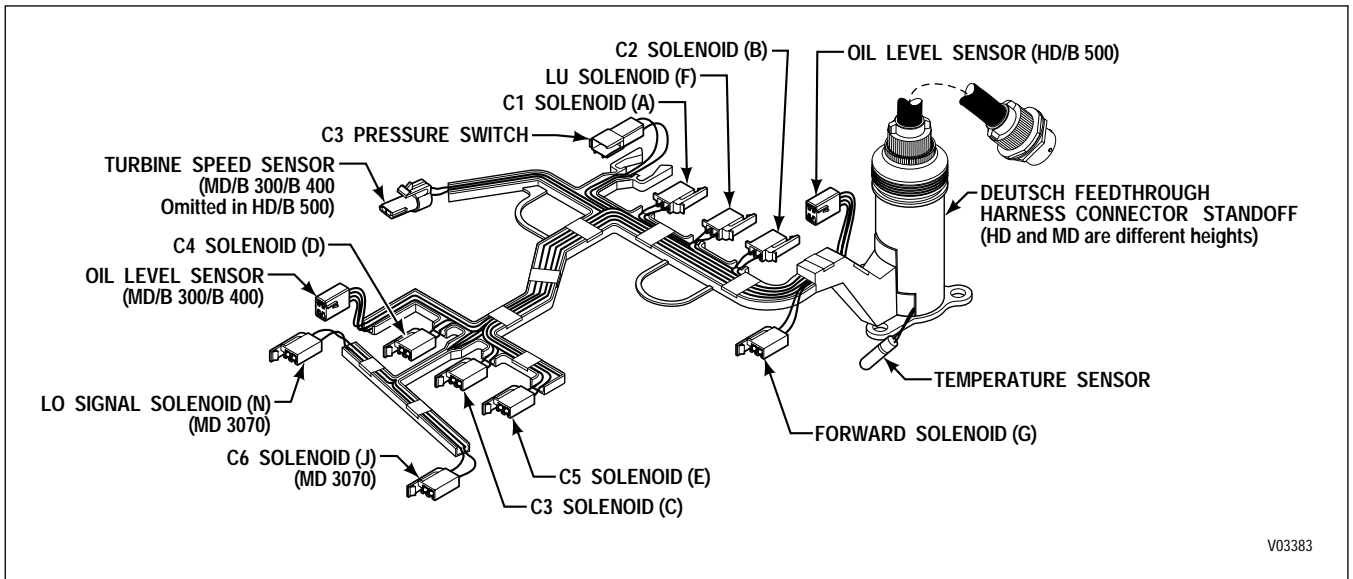
Figure 1-12. WTEC II Internal Wiring Harness (Units Produced Before 9/94)

GENERAL DESCRIPTION



V01593

Figure 1-13. WTEC II Internal Wiring Harness (Units Produced 9/94-11/96)



V03383

Figure 1-14. WTEC II Internal Wiring Harness (Units Produced 11/96-12/97)

GENERAL DESCRIPTION

1-8. VEHICLE INTERFACE MODULE (Figure 1-15)

The vehicle interface module (VIM) provides relays, fuses, and connection points for interface with the output side of the vehicle electrical system. VIMs are available for both 12V and 24V electrical systems. The VIM for 12V systems uses all 12V relays. The VIM for 24V systems had four 24V relays and two 12V relays prior to Model Year 1995 and all 24V relays beginning with Model Year 1995. Refer to the Parts Catalog for the transmission assembly number that you are servicing for detailed parts information. Refer to pages D-25 and D-26 for VIM wire number and terminal information.

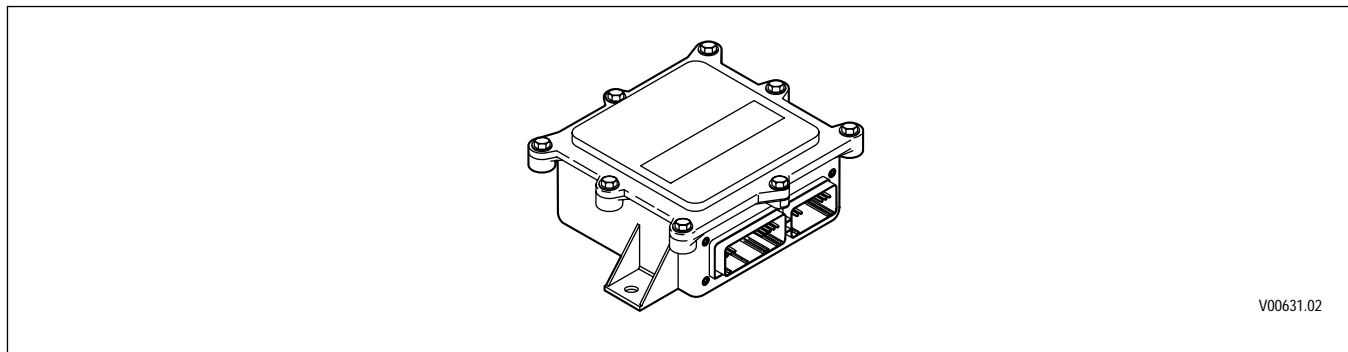


Figure 1-15. Vehicle Interface Module (VIM)

1-9. TRANSID FEATURE

A. General Description

The TransID feature has been provided so that Allison Transmission can make component changes which require calibration changes but still retain both the original transmission A/N and the original calibrated ECU A/N. The purpose of TransID is to reduce the need for OEMs to use cross-reference lists of transmission and calibrated ECU A/Ns when such changes to the transmission are made. TransID allows OEMs to order specific transmission A/Ns and calibrated ECU A/Ns and receive all changes made to the transmission and all of the corresponding calibrations. This will reduce the number of A/N changeovers with which an OEM must contend.

The basis for the TransID system is the creation of a TransID wire in the WTEC II and III system to provide a signal to the ECU of the TransID level of the transmission. This wire for WTEC II and III will be connected directly to the Analog Ground (wire 135) to signal TransID level 1 (TID 1). TransID levels 2 through 8 will only apply to WTEC III and are covered in TS2973EN, WTEC III Troubleshooting. The connection point of the TransID wire will provide the signal to tell the ECU which calibration is required by the transmission.

Whenever a TransID level change is to be made, the new TransID level calibrations will be placed in the PROM Calibration Configurator System (PCCS) ninety days before the change(s) is(are) made in production to the transmissions. All ECUs programmed and sold after that date will then be loaded with the new TransID level calibration. These ECUs will contain calibrations for the new level transmission and all previous TransID levels and will automatically load the correct calibration for the transmission. This eliminates worry on the part of the OEM of coordinating the implementation of the new ECU and the new transmission and allows their focus to be on using the stock of the earlier level ECU.

GENERAL DESCRIPTION

B. Transmission Changes Versus TransID Number

1. TransID 1

The internal wiring harness wiring change to make a TID 1 transmission was put into production before the introduction of the WTEC III system and does pertain to some WTEC II units. The TID 1 internal harness was made by connecting the C3 Pressure Switch ground (digital/signal ground; WTEC II wire 161) to the Sump Temperature Sensor and Oil Level Sensor ground (analog ground; wire 135) in the internal harness. In WTEC II, the signal ground wire (wire 161) is routed through the transmission connector, terminal W, and then to the ECU, terminal B27. In WTEC III, this same wire in the internal harness becomes the TransID wire (wire 195), and it goes to the ECU, terminal T13 (blue connector). The purpose of TransID 1 was to provide a common transmission for use with both WTEC II and WTEC III systems (V7A and V8).

The only difference between a pre-TransID transmission and a TransID 1 transmission is the internal wiring harness which connects the digital and analog grounds on the TID 1 harness. Adapter harness P/N 200100 can be ordered from St. Clair Technologies to provide the same connection outside the transmission and allow a pre-TransID transmission to be “converted” to a TransID 1 transmission.

All models of the World Transmission were built with the TransID 1 internal (feedthrough) harness beginning in September, 1996. Two changes were rolled into this update: the wiring change for TID 1 and a change to use a molded channel rather than the braided covering which was previously used. Both changes were rolled into the same internal harness P/N even though there was a delay in implementing the channel which resulted in the two S/N breaks. Table 1-1 lists the internal harness P/Ns for the different transmission models along with the S/Ns for both changes for each harness.

Table 1-1. TransID 1 S/N Breakpoint

Transmission Model	Pre-TransID Harness P/N	TransID 1 Harness P/N	S/N at Wiring Change	S/N at U-Channel
MD 3000/B 300/B 400 w/OLS	29516322	29529472	6510088864	6510096671
MD 3000/B 300/B 400 w/o OLS	29516323	29529473	6510089316	6510096683
MD 3070PT	29516324	29529474	6510090786	6510096675
HD 4000/B 500 w/OLS	29516325	29529475	6610014067	6610015591
HD 4000/B 500 w/o OLS	29516326	29529476	6610014084	6610015700

2. TransID 2

TransID 2 is only used with WTEC III controls and is covered in TS2973EN Troubleshooting Manual.

GENERAL DESCRIPTION

C. Compatibility Between TransID Level And ECU Calibration Level

Table 1–2 shows the compatibility of the different ECU software levels with the different TransID level transmissions.

Table 1–2. Software Level And TransID Compatibility

	CIN Compatibility Number	Software Level	Compatible with TransID Level	ECU Production Dates
WTEC II	07	V6E	pre-TransID and TID 1	until 9/94
	08	V7 and V7A	pre-TransID and TID 1	9/94 until 12/97
WTEC III	0A	V8	TID 1	2/97 until 9/97
	0B	V8A	TID 1 and TID 2 (and beyond)	beginning 10/97

The manufacture and sale of both WTEC II and WTEC III ECUs during most of 1997 required a means of using a common transmission with either a WTEC II or a WTEC III ECU. A TID 1 transmission is the common transmission configuration for both control systems and production began in September, 1996 (see Table 1–2). A TransID level 1 transmission is compatible with V6E, V7, V7A, V8, and V8A ECUs.

TransID level 2 transmissions were produced beginning in late December, 1997 and all were for WTEC III units. A TransID 2 transmission is compatible with only V8A ECUs.

Pre-TransID transmissions are only compatible with V6E, V7, and V7A ECUs. Pre-TransID transmissions were produced before the first S/N break in Table 1–1.

SECTION 2 — DEFINITIONS AND ABBREVIATIONS

2-1. DO NOT SHIFT LIGHT

If the ECU detects a serious transmission fault, the **DO NOT SHIFT** light (usually located on the vehicle instrument panel) illuminates, the shift selector sounds short beeps for eight seconds, and the SELECT digit on the shift selector display becomes blank. Transmission shifting is restricted while the **DO NOT SHIFT** light is illuminated. The ECU will not respond to shift selector requests including direction changes and shifts to or from Neutral.

If the shift selector lever is moved while **DO NOT SHIFT** is illuminated, a continuous alarm will sound until the lever is moved back to the position where **DO NOT SHIFT** was first indicated. Normal shift selector operation is restored when the conditions causing the **DO NOT SHIFT** alarm are corrected.

The ECU will log a diagnostic code when the **DO NOT SHIFT** light is illuminated. Use the shift selector display or the Pro-Link® 9000 Diagnostic Tool to display the diagnostic code. Codes related to the **DO NOT SHIFT** light are detailed in the code chart (refer to Section 6).

2-2. DIAGNOSTIC DATA READER (Figure 2-1)

The current Diagnostic Data Reader (DDR) is the Pro-Link® 9000 (J 38538-D) diagnostic tool which is available through Kent-Moore Heavy-Duty Division. A portable microcomputer-based receiver/transmitter/display unit, the Pro-Link® transmits and receives data to and from the ECU, processes the data, and displays appropriate information. Use the Pro-Link® during installation checkout and troubleshooting. There is a new Pro-Link® cartridge needed for use with WTEC III controls. The new Multi-Protocol Cartridge (MPC) contains a programmed PCMCIA card which allows for reprogramming of GPI/GPO packages. Reprogramming includes selection of a GPI/GPO package, enabling/disabling of wires, and modification of certain data parameters. Operating instructions are supplied with each Pro-Link® and further information is also included in Appendix N of this manual. Connect the Pro-Link® 9000 to the diagnostic connector provided in the selector wiring harness.

NOTE: *The new MPC is usable with WTEC II controls but the old WTEC II reprogramming cartridge will not display the WTEC III new information. The new MPC must be used to reprogram WTEC III systems.*

Tool part numbers for the Pro-Link® are as follows:

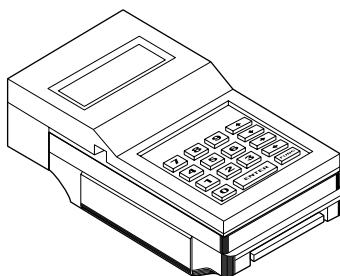
Diagnostic Kit J 38538D + J 38500-313 (PROM Update) = J 38538E

Diagnostic Cartridge J 38500-302 + J 38500-313 = J 38500-303

MPC J 38500-1500C

PCMCIA (Diagnostic And Reprogramming) J 38500-1700B

PCMCIA (Diagnostic Only) J 38500-1800A



V04842

Figure 2-1. Pro-Link® 9000 Diagnostic Tool

DEFINITIONS AND ABBREVIATIONS

2-3. ABBREVIATIONS

A/N	Assembly Number
Amp	Unit of electrical current.
C3PS	C3 Pressure Switch — Pressure switch to signal the presence or absence of pressure in the C3 clutch-apply circuit.
COP	Central Operating Processor — Hardware protection which causes the ECU to reset if software gets lost.
CT	Closed Throttle.
DDR	Diagnostic Data Reader — Diagnostic tool; most current version is the Pro-Link® 9000 made by MicroProcessor Systems, Inc. Used to interrogate the ECU for diagnostic information and for reprogramming I/O packages in a calibration.
DNA	Does Not Adapt — Adaptive shift control is disabled.
DNS	DO NOT SHIFT — Refers to DO NOT SHIFT light and DO NOT SHIFT diagnostic response during which the transmission will not shift and will not respond to the Shift Selector.
DVOM	Digital Volt-Ohmmeter.
ECU	Electronic Control Unit (also commonly referred to as the “computer”).
EEPROM	Electronically Erasable Programmable Read Only Memory — This is the microchip that contains the transmission shift calibration information. The EEPROM is soldered into the ECU and is not removable.
IF	Input Function — Input signal to the ECU to request a special operating mode or condition.
LED	Light-Emitting Diode — Electronic device used for illumination.
MPC	Multi-Protocol Cartridge — Added to Pro-Link 9000® to do reprogramming.
NNC	Neutral No Clutches — Neutral commanded with no clutches applied.
NVL	Neutral Very Low — The ECU has sensed turbine speed below 350 rpm. This is usually caused by a dragging C1 or C3 clutch or a failed turbine speed sensor. When attained, the C4 and C5 clutches are applied to lock the transmission output.
OEM	Original Equipment Manufacturer — Maker of vehicle or equipment.
Ohm	Unit of electrical resistance.
OF	Output Function — Output signal from the ECU to control vehicle components (such as PTOs, backup lights, etc.) or allow a special operating mode or condition.

DEFINITIONS AND ABBREVIATIONS

2-3. ABBREVIATIONS (*cont'd*)

OL	Over Limit or Oil Level — For Over Limit see “∞.” Indicates Oil Level is being displayed on a shift selector.
OLS	Oil Level Sensor — Electronic device (optional) on control module for indicating transmission fluid level.
PCCS	PROM Calibration Configurator System.
PCMCIA	Personal Computer Memory Card International Association — Memory device for use with Pro-Link [®] . Contains Allison Transmission programming and diagnostics.
PROM	Programmable Read Only Memory.
PTO	Power Takeoff.
PWM Solenoid	Pulse Width Modulated Solenoid — Solenoids are controlled by pulse width modulation. Solenoid control of clutch pressures is based on the solenoid's duty cycle. Duty cycle is determined by the ratio of solenoid's on-time to off-time.
RMR	Retarder Modulation Request.
RPR	Return to Previous Range — Diagnostic response in which the transmission is commanded to return to previously commanded range.
RSI	Remote Serial Interface — Communications lines between remote shift selector and the ECU.
SCI	Serial Communication Interface — Used to transmit data and messages between the diagnostic tool and the ECU and other systems such as electronically-controlled engines.
SOL OFF	All SOLenoids OFF.
SPI	Serial Peripheral Interface — Connection between ECU and integral shift selector.
TID	TransID — A feature which allows the ECU to know the transmission configuration and provide the corresponding calibration required.
TPS	Throttle Position Sensor — Potentiometer for signaling the position of the engine fuel control lever.
V	Version — Abbreviation used in describing ECU software level.
VDC	Volts Direct Current (DC).
VIM	Vehicle Interface Module — A watertight box containing relays and fuses — interfaces the transmission electronic control system with components on the vehicle.
VIW	Vehicle Interface Wiring — Interfaces ECU programmed input and output functions with the vehicle wiring. Also contains the Serial Communications Interface.

DEFINITIONS AND ABBREVIATIONS

2-3. ABBREVIATIONS (*cont'd*)

Volt	Unit of electrical force.
VOM	Volt-Ohmmeter.
WOT	Wide Open Throttle.
WT	World Transmission.
∞	Infinity — Condition of a circuit with higher resistance than can be measured, effectively an open circuit.

SECTION 3 — BASIC KNOWLEDGE

3-1. BASIC KNOWLEDGE REQUIRED

To service WT Series Electronic Controls, the technician must understand basic electrical concepts. Technicians need to know how to use a Volt-Ohmmeter to make resistance and continuity checks. Most troubleshooting checks consist of checking resistance, continuity, and checking for shorts between wires and to ground. The technician should be able to use jumper wires and breakout harnesses and connectors. Technicians unsure of making the required checks should ask questions of experienced personnel or find instruction.

The technician should also have the mechanical aptitude required to connect pressure gauges or transducers to identified pressure ports used in the troubleshooting process. Pressure tap locations and pressure values are shown in Appendix B — Checking Clutch Pressures.

Input power, ground, neutral start circuitry, etc., can cause problems with electronic controls or vehicle functioning and may not generate a diagnostic code. A working knowledge of WT Series Electronic Controls vehicle installation is necessary in troubleshooting installation-related problems.

Refer to Section 8 for information concerning performance complaints (non-code) troubleshooting. A complete wiring schematic is shown in Appendix J. Refer to the MD, HD, B 300, and B 500 Series Sales Tech Data Book for information concerning electronic controls installation and the Installation Checklist. Reliable transmission operation and performance depend upon a correctly installed transmission. Review the Installation Checklist to ensure proper installation.

NOTE: *Allison Transmission is providing for service of WTEC II wiring harnesses and wiring harness components as follows: (See Service Information Letter 1-WT-97 for further information.)*

- Repair parts for the internal wiring harness and for wiring harness components attached to the shift selector will be available through the Allison Transmission Parts Distribution Center (PDC). Use the P/N from your appropriate parts catalog or from Appendix E in this manual. Allison Transmission is responsible for warranty on these parts.
- Since January, 1998, all WTEC II external harnesses and external harness components must be obtained from St. Clair Technologies Inc. (SCTI). SCTI provides parts to any Allison customer or OEM and is responsible for warranty on these parts. SCTI recognizes ATD, manufacturers, and SCTI part numbers. SCTI provides a technical HELPLINE at 519-627-1673 (Wallaceburg). SCTI has parts catalogs available. The SCTI addresses and phone numbers for parts outlets are:

St. Clair Technologies, Inc.
1050 Old Glass Road
Wallaceburg, Ontario, Canada, N8A 3T2
Phone: (519) 627-1673
Fax: (519) 627-4227

St. Clair Technologies, Inc.
1111 Mikesell Street
Charlotte, Michigan 48813
Phone: (517) 541-8166
Fax: (517) 541-8167

St. Clair Technologies, Inc.
c/o Mequillas Tetakawi
Carr. Internationale KM 1969
Guadalajara – Nogales, KM2
Empalme, Sonora, Mexico
Phone: 011-52-622-34661
Fax: 011-52-622-34662

3-2. USING THE TROUBLESHOOTING MANUAL

Use this manual as an aid to troubleshooting the WT Series Electronic Controls. Every possible problem and its solution cannot be encompassed by any manual. However, this manual does provide a starting point from which most problems can be resolved.

Once a solution to a problem is discovered in the manual do not look further for other solutions. It is necessary to determine *why* a problem occurred. For example, taping a wire that has been rubbing on a frame rail will not correct the problem unless the rubbing contact is eliminated.

BASIC KNOWLEDGE

3-3. SYSTEM OVERVIEW

WT Series Electronic Control functions are controlled by the ECU. The ECU reads shift selector range selection, output speed, and throttle position to determine when to command a shift. When a shift occurs, the ECU monitors turbine speed, output speed, and throttle position to control the oncoming and off-going clutches during the shift.

When the ECU detects an electrical fault, it logs a diagnostic code indicating the faulty circuit and alters the operation of the transmission to prevent or reduce damage.

When the ECU detects a non-electrical problem while trying to make a shift, the ECU may try that shift a second or third time before setting a diagnostic code. Once that shift has been retried, and a fault is still detected, the ECU sets a diagnostic code and holds the transmission in a fail-to-range mode of operation.

3-4. IMPORTANT INFORMATION IN THE TROUBLESHOOTING PROCESS

Before beginning the troubleshooting process, read and understand the following:

- Shut off the engine and ignition before any harness connectors are disconnected or connected.
- Remember to do the following when checking for shorts and opens:
 - Minimize movement of wiring harnesses when looking for shorts. Shorts involve wire-to-wire or wire-to-ground contacts and moving the harnesses may eliminate the problem.
 - Wiggle connectors, harnesses, and splices when looking for opens. This simulates vehicle movements which occur during actual operation.
- When disconnecting a harness connector, be sure that pulling force is applied to the connector itself and **not the wires** extending from the connector.
- *When conducting circuit checks that include the external harness, add 1 Ohm to the values shown.*
- Inspect all connector terminals for damage. Terminals may have bent or lost the necessary tension to maintain firm contact.
- Clean dirty terminals or connectors with isopropyl alcohol and a cotton swab, or a good quality, non-residue, non-lubricating, cleaning solvent such as LPS Electro Contact Cleaner® or LPS NoFlash Electro Contact Cleaner®.

CAUTION:

The cleaning solvent must not be chlorine based, contain petroleum distillates, or conduct electricity. The cleaning solvent should evaporate quickly to prevent the possibility of condensation within the connectors. Always blow or shake any excess cleaner from the connector before assembling it to its mating connector or hardware. Cleaner trapped in the connector can affect the connector seal. (Refer to SIL 17-TR-94 for detailed information on the recommended cleaners.)

CAUTION:

Care should be taken when welding on a vehicle equipped with electronic controls. Refer to Appendix G, Paragraph 1-1.

- Diagnostic codes displayed after system power is turned on with a harness connector disconnected can be ignored and cleared from memory. Refer to Section 6, Diagnostic Codes, for the code clearing procedure.

BASIC KNOWLEDGE

3-5. BEGINNING THE TROUBLESHOOTING PROCESS

NOTE: *Whenever a transmission is overhauled, exchanged, or has undergone internal repairs, the Electronic Control Unit (ECU) must be "RESET TO UNADAPTED SHIFTS." See Service Information Letter 16-WT-96, Revision A for further details.*

1. Begin troubleshooting by checking the transmission fluid level and ECU input voltage. Remember that some problems may be temperature related. Do troubleshooting at the temperature level where the problem occurs. Check diagnostic codes by:
 - Using the shift selector display.
 - Using the Pro-Link[®] 9000 diagnostic tool.
2. When a problem exists but a diagnostic code is not indicated, refer to the Performance Complaint Section for a listing of various electrical and hydraulic problems, their causes, and remedies.
3. If a diagnostic code is found in the ECU memory, record all available code information and clear the active indicator (refer to Section 6).
4. Test drive the vehicle to confirm a diagnostic code or performance complaint.
 - If the code reappears, refer to the Diagnostic Code section (Section 6) and the appropriate code chart. The Diagnostic Code section lists diagnostic codes and their description. Locate the appropriate troubleshooting chart and follow the instructions.
 - If the code does not reappear, it may be an intermittent problem. Use the Pro-Link[®] and the code display procedure described in Section 6. The code display procedure will indicate the number of times the diagnostic code has occurred. Refer to the troubleshooting chart for possible cause(s) of the problem.
 - Appendix A deals with the identification of potential circuit problems. Refer to Appendix A if a circuit problem is suspected.

NOTE: *Information concerning specific items is contained in the appendices located in the back of this manual. The appendices are referred to throughout the manual.*

BASIC KNOWLEDGE

NOTES

SECTION 4 — WIRE CHECK PROCEDURES

4-1. CHECKING OPENS, SHORTS BETWEEN WIRES, AND SHORTS-TO-GROUND

(Use Digital Volt-Ohmmeter J 34520-A and Jumper Wire Set J 39197).

NOTE: Please refer to Section 3-5 to begin the troubleshooting process.

1. Make sure all connectors are tightly connected and recheck the circuit.
2. Disconnect and inspect all connectors.
3. Thoroughly clean corroded or dirty terminals. If dirty or corroded terminals are the probable cause of the problems, reconnect the clean connectors and operate the vehicle normally. If the problem recurs, proceed with Step 4.

CAUTION:

The cleaning solvent must not be chlorine based, contain petroleum distillates, or conduct electricity. The cleaning solvent should evaporate quickly to prevent the possibility of condensation within the connectors. Always blow or shake any excess cleaner from the connector before assembling it to its mating connector or hardware. Cleaner trapped in the connector can affect the connector seal. (Refer to SIL 17-TR-94 for detailed information on the recommended cleaners.)

4. If all connectors are clean and connected correctly, determine which wires in the chassis harness are indicated by the diagnostic code. For example, Code 41 12, indicates an open or short-to-ground in the solenoid A circuit — wires 102 and 120.
 - a. Check continuity of wires 102 and 120 by performing the following (refer to Figure 4-1):
 - (1) Disconnect both connectors at the ECU and disconnect the harness from the transmission main connector. At one end of the harness, using jumper wire kit J 39197, connect wire 102 and 120 to each other, being careful not to distort the terminals. Jumping the wires together creates a circuit between wires 102 and 120.
 - (2) On the opposite end of the harness, check the continuity of the jumpered pair. No continuity in a jumpered pair circuit (infinite resistance reading) indicates an open in the wire being tested. Locate and repair the damaged portion of the wire.

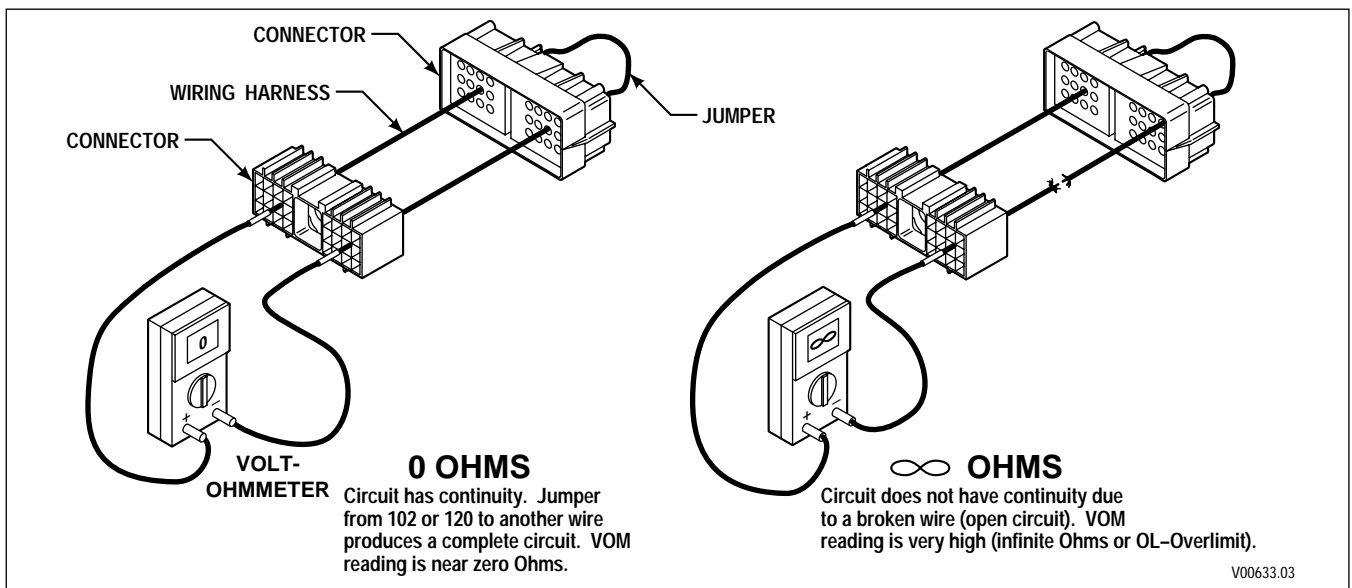


Figure 4-1. Open Circuit

WIRE CHECK PROCEDURES

- b. If the continuity check is good (0–2 Ohms resistance), remove the jumpers. Check the harness for shorts between wires and shorts-to-ground by performing the following (refer to Figure 4–2):
- (1) At the ECU end of the harness, touch one VOM probe to one wire of the circuit being tested and touch the other probe to each terminal (in both connectors), then touch the probe to chassis ground and to the transmission main housing. Do this for both wires in the circuit being tested.
 - (2) If at any time the VOM shows zero to low resistance, or the meter's continuity beeper sounds, there is a short between the two points being probed — wire-to-wire or wire-to-ground. Isolate and repair the short.

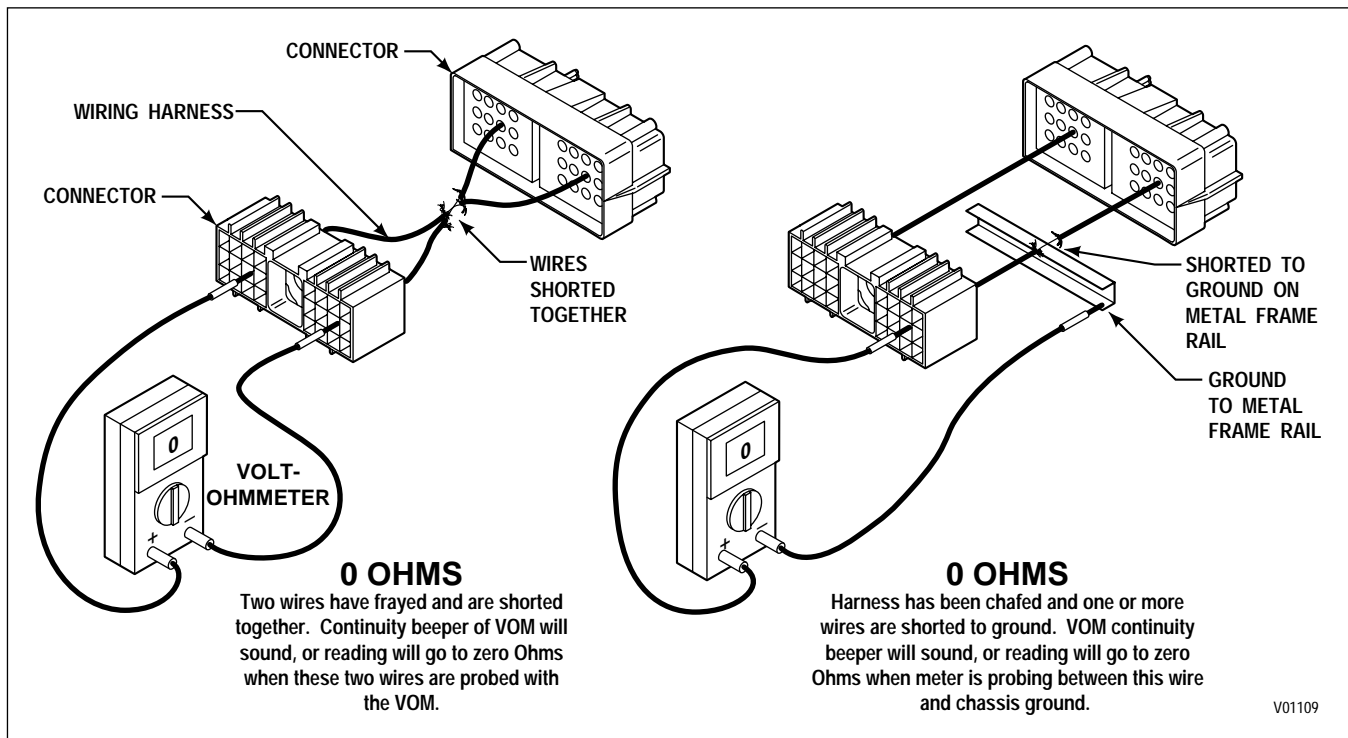


Figure 4–2. Short Between Wires And To Ground

4-2. CHECKING AT TRANSMISSION CONNECTOR AND THE INTERNAL HARNESS FOR OPENS, SHORTS BETWEEN WIRES, AND SHORTS-TO-GROUND

1. Disconnect the external wiring harness from the transmission.
 - a. For MD, B 300, and B 400 transmissions prior to S/N 6510015259, refer to SIL 11-WT-94, Rev. A.
 - b. Water and white film contamination have been found in the main transmission connector (external) in these transmissions. This condition has usually caused the setting of diagnostic codes 25 11 or 22 16.
 - c. If water is found at the main transmission connector, properly torque the retaining bolt to 2.0–2.8 N·m (18–25 lb in.) following the prescribed cleaning of the connector terminals.
2. Inspect the connectors. Any terminals which are corroded or dirty must be thoroughly cleaned.

WIRE CHECK PROCEDURES

3. If all connectors are clean and connected correctly, and the unit being serviced is an MD, B 300, or B 400 transmission prior to S/N 6510015259, refer to SIL 11-WT-94, Rev. A.

CAUTION:

The cleaning solvent must not be chlorine based, contain petroleum distillates, or conduct electricity. The cleaning solvent should evaporate quickly to prevent the possibility of condensation within the connectors. Always blow or shake any excess cleaner from the connector before assembling it to its mating connector or hardware. Cleaner trapped in the connector can affect the connector seal. (Refer to SIL 17-TR-94 for detailed information on the recommended cleaners.)

- a. If diagnostic code 25 11 or 22 16 is still being set and no water was found in the main transmission connector (external), the problem may be a white film contamination found inside the transmission.
- b. Remove the control module. Inspect for white film contamination. (Refer to appropriate transmission Service Manual for proper procedure.)
- c. If white film contamination is present, clean the interior of the transmission using mineral spirits.
- d. Replace the feedthrough connector and internal harness with wire seals (Figure 4-3).

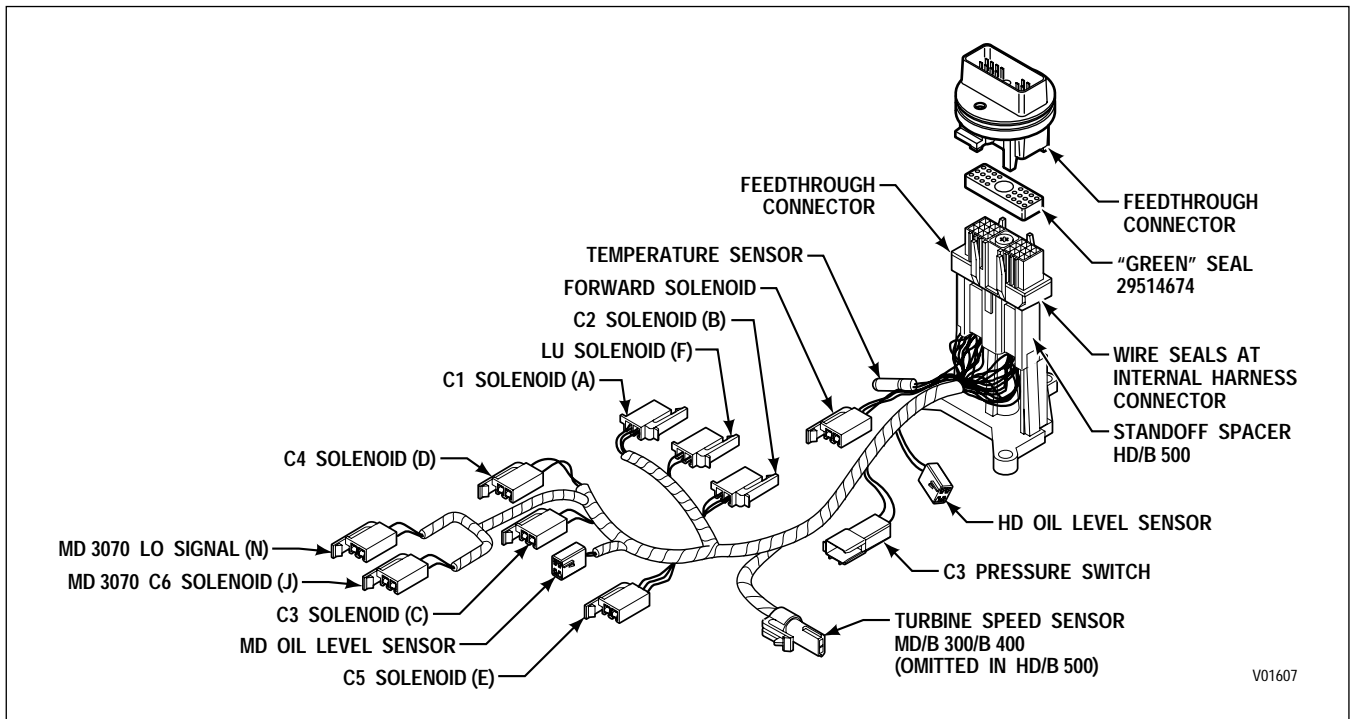


Figure 4-3. Feedthrough Connector, "Green Seal," And Internal Harness

WIRE CHECK PROCEDURES

4. If the transmission being tested is an MD 3000, B 300, or B 400 after S/N 6510015259 or is an HD 4000 or B 500, and if the connectors are clean and connected correctly, determine which wires in the harness to test. Use the diagnostic code system schematic to locate the wire terminals. For this example, Code 41 12, indicates an open or short-to-ground in solenoid “A” circuit — wires 102 and 120 (refer to Figure 4-4).
 - a. At the transmission connector, check the resistance of the A solenoid circuit. Resistance of a solenoid circuit should be 2.4–5.0 Ohms — covering a temperature range of –18°C to 149°C (0°F to 300°F). Refer to Solenoid Resistance vs. Temperature chart in Appendix K. No continuity in the circuit (infinite resistance) indicates an open in the internal harness, the feedthrough connector, or the solenoid coil. Locate and repair the open in the internal harness or replace the internal harness, replace the feedthrough connector, or replace the solenoid.

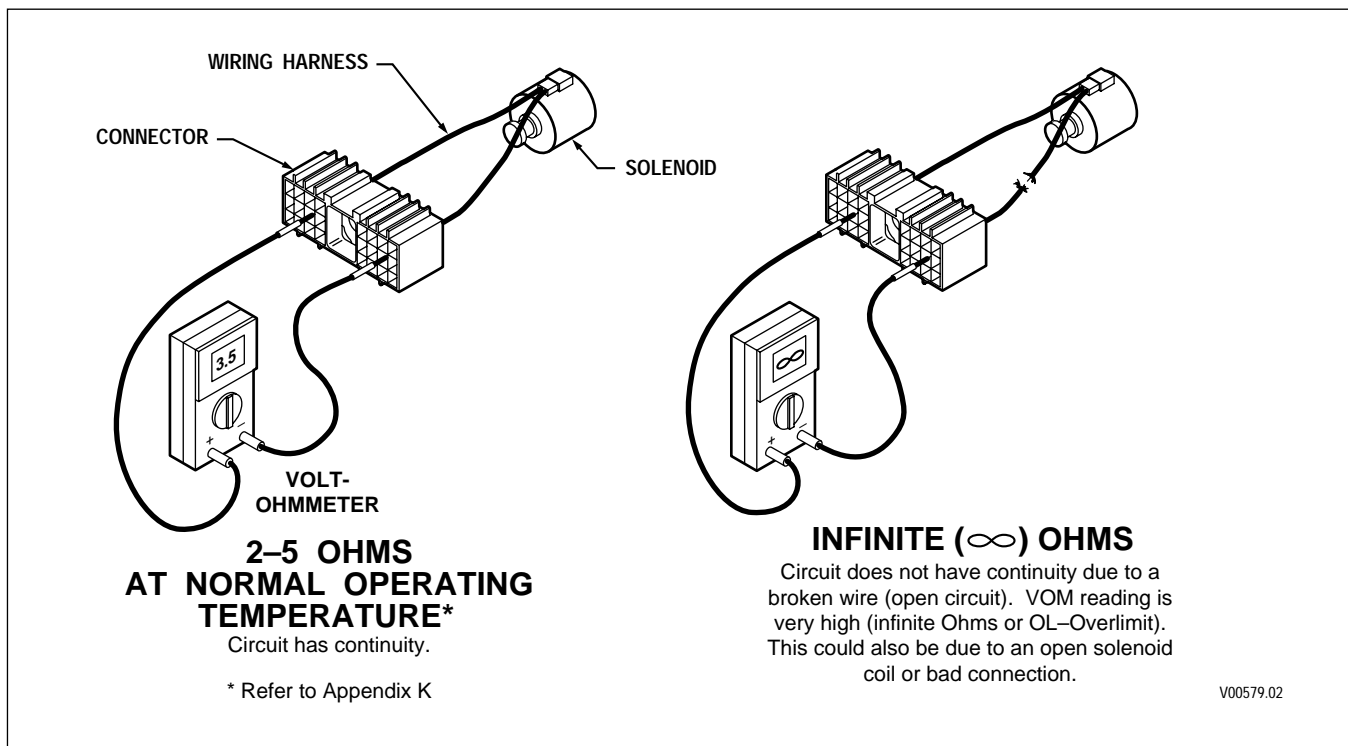


Figure 4-4. Checking Continuity

- b. If the resistance check is good, check the harness for shorts between wires and to ground by performing the following (refer to Figure 4-5):
 - (1) At the transmission connector, touch one probe of the VOM to one wire of the circuit being tested and touch the other probe to each terminal in the connector and to chassis ground and to the transmission main housing. Do this for both wires in the circuit being tested.
 - (2) If the VOM shows zero to low resistance, or the continuity beeper sounds, there is a short between the two points being probed, wire-to-wire or wire-to-ground. An indication of a short may be caused by a splice to the wire being checked. Check the wiring diagram in Appendix J for splice locations. If the short is not a splice, then isolate and repair the short.

WIRE CHECK PROCEDURES

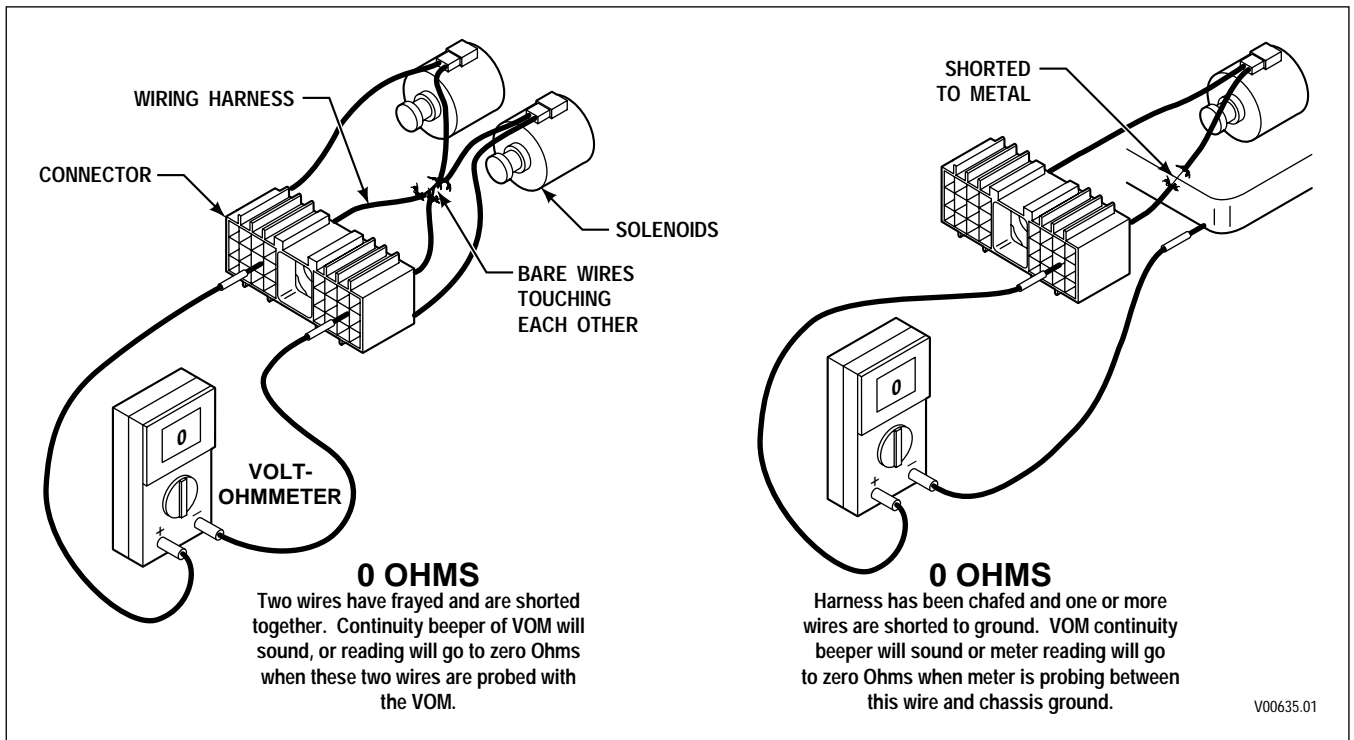


Figure 4-5. Short Between Wires And To Ground

NOTE: When conducting circuit checks that include the external harness, add one (1) Ohm to the values shown. Speed sensor resistance is 270–330 Ohms. C3 pressure switch resistance is two (2) Ohms maximum when switch is closed and 20,000 Ohms minimum when switch is open.

WIRE CHECK PROCEDURES

NOTES

SECTION 5 — OIL LEVEL SENSOR

The Oil Level Sensor (Figure 5-1) provides a means of electronically checking the transmission fluid level from the shift selector display, the Pro-Link® 9000 diagnostic tool, or a custom-furnished remove display.

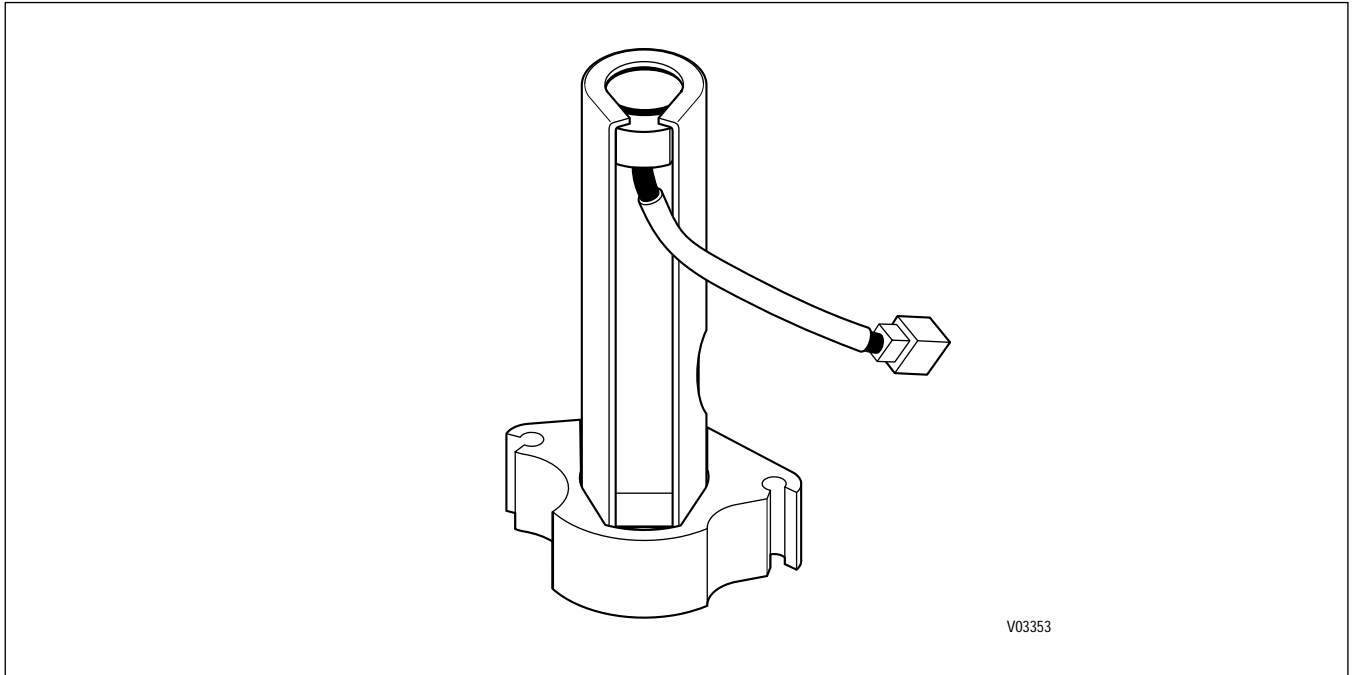


Figure 5-1. Oil Level Sensor

5-1. ELECTRONIC FLUID LEVEL CHECK (SHIFT SELECTOR)

NOTE: *The Pushbutton and Lever shift selectors can display two characters at one time. One character is displayed under the SELECT label and one under the MONITOR label. The strip pushbutton shift selector uses illuminated pushbuttons and tones to convey fluid level information.*

A. Fluid Level Check Procedure

1. Park the vehicle on a level surface and shift to **N** (Neutral). Apply the parking brake.
2. On the Pushbutton shift selector, simultaneously press the \uparrow (Up) and \downarrow (Down) arrow buttons once.
3. On the Lever shift selector, press the **DISPLAY MODE** button once.
4. For a strip pushbutton shift selector, go directly to Step 11.

NOTE: *The ECU may delay the fluid level check until the following conditions are met:*

- *The fluid temperature is above 60°C (140°F) or below 104°C (220°F).*
- *The transmission is in neutral.*
- *The vehicle has been stationary for approximately two minutes to allow the fluid to settle.*
- *The engine is at idle (below 1000 rpm — not “fast” idle).*

A delayed fluid level display is signaled by sequentially illuminated segments of the digital display under the SELECT display and a countdown from 8 to 1 under the MONITOR display.

OIL LEVEL SENSOR

5. Correct fluid level is reported when **O L** is displayed (**O L** indicates the Oil Level Check Mode), followed by **O K**. The **O K** display indicates the fluid level is within the **O K** zone. The sensor display and the transmission dipstick may not agree exactly because the oil level sensor compensates for fluid temperature.

Example: O L, O K, O K — Indicates correct fluid level

6. Low fluid level is reported when **O L** is displayed, followed by **L O** and a number. **L O** indicates a low fluid level and the number is the number of quarts of fluid the transmission requires.

Example: O L, L O, 0 2 — Indicates 2 additional quarts of fluid will bring the fluid level within the middle of the **O K** zone.

7. High fluid level is reported when **O L** is displayed, followed by **H I**. **H I** indicates high fluid level and the number of quarts the transmission is overfilled.

Example: O L, H I, 0 1 — Indicates 1 quart of fluid past the full level.

CAUTION:

A low or high fluid level causes overheating and irregular shift patterns. An incorrect fluid level can damage the transmission.

8. An Invalid for Display condition is reported when **O L** is displayed, followed by “--” and a number display. The displayed number is a fault code, and indicates improper conditions or a system malfunction.

Example: O L, --, 70 — Indicates an Invalid for Display condition and fault code 70.

9. Invalid for Display is activated when conditions do not allow the fluid level to be checked electronically. Review the following codes and conditions, and correct as necessary. If these conditions cannot be corrected, contact the nearest distributor or dealer in your area (check the telephone directory for the Allison Transmission service outlet nearest you).

10. To exit the oil level display mode:

- Pushbutton shift selector — press the **R** (Reverse), **N** (Neutral), or **D** (Drive) pushbutton.
- Lever shift selector — press the **DISPLAY MODE** button two times or move the lever.

11. The strip pushbutton selector indicates fluid level as follows:

- a. Initiate display of oil level information using separate switch provided by the vehicle manufacturer.
- b. Correct Fluid Level — Indicated by a flashing red LED on the **N** (Neutral) pushbutton. When this occurs, the fluid is within the “**O K**” zone.

OIL LEVEL SENSOR

- c. Low Fluid Level — Indicated by a flashing red LED on the **R** (Reverse) pushbutton and a tone. The number of times the tone sounds indicates the number of quarts of transmission fluid which need to be added to produce an “**O K**” level. The **N** (Neutral) pushbutton red LED will remain on during this display.
- d. High Fluid Level — Indicated by a flashing red LED on the **D** (Drive) pushbutton and a tone. The number of times the tone sounds indicates the number of quarts of transmission fluid which need to be drained to produce an “**O K**” level. The **N** (Neutral) pushbutton red LED will remain on during this check.
- e. Invalid for Display — Indicated by flashing red LED in a repeated sequence from **R** (Reverse) down through the lowest **D** (Drive) range while the **N** (Neutral) red LED remains constantly illuminated. A constant tone will sound until the fluid level mode is exited. (Reasons for Invalid for Display are the same as those shown in Table 5–1 under Cause of Code.)
- f. To exit the fluid level display mode, press any pushbutton or deactivate the separate switch provided by the vehicle manufacturer that was used to enter the fluid level display mode in Step a.

Table 5–1. Invalid for Display Codes

CODE	CAUSE OF CODE
0 X*	— Settling time too short
5 0	— Engine speed (rpm) too low
5 9	— Engine speed (rpm) too high
6 5	— Neutral (N) must be selected
7 0	— Sump fluid temperature too low
7 9	— Sump fluid temperature too high
8 9	— Output shaft rotation
9 5	— Sensor failure**
<p>* The zero represents “chasing segments” in the SELECT display and the X is a number between 8 and 1 which appears in the MONITOR display during the countdown period.</p> <p>** Report sensor failure to a distributor or dealer in your area (check the telephone directory for an Allison Transmission distributor or dealer nearest you).</p>	

OIL LEVEL SENSOR

5-2. ELECTRONIC FLUID LEVEL CHECK (PRO-LINK® 9000)

The Pro-Link® 9000 can also be used to electronically check the transmission fluid level. Further detail is also provided in Appendix N of this manual.

CAUTION: A low or high fluid level causes overheating and irregular shift patterns and, if not corrected, can damage the transmission.

A. Fluid Level Check Procedure

1. Connect the DDR to the DDR connector.
2. Scroll (down) the Diagnostic Data List to “OIL LVL” display.
3. Read the fluid level, repeat the check to confirm the first reading.

NOTE: *The ECU may delay the fluid level check until the following conditions are met:*

- *The fluid temperature is above 60°C (140°F) or below 104°C (220°F).*
- *The transmission is in neutral.*
- *The vehicle has been stationary for approximately two minutes to allow the fluid to settle.*
- *The engine is at idle (below 1000 rpm — not “fast” idle).*

The reason for a delayed fluid level check is indicated on the DDR by one of the following diagnostic messages as shown in Table 5-2:

Table 5-2.

DDR MESSAGE		
OL	—	SETTLING TIME (8 down to 1)
OL	—	ENGINE SPEED LO
OL	—	ENGINE SPEED HI
OL	—	SELECT N (NEUTRAL)
OL	—	SUMP TEMP LO
OL	—	SUMP TEMP HI
OL	—	OUTPUT SPEED HI
OL	—	CHECK CODES

SECTION 6 — DIAGNOSTIC CODES

6-1. DIAGNOSTIC CODE MEMORY

Diagnostic codes are logged in a list in memory (sometimes referred to as the queue), listing the most recently occurring code first and logging up to five codes. The codes contained in the list have information recorded as shown in the chart below (codes are examples). Access to the code list position, main code, subcode and active indicator is through either the shift selector display or the Pro-Link® 9000 diagnostic tool. Access to ignition cycle counter and event counter information is through the diagnostic tool only. Further detail on the use of Pro-Link® 9000 is presented in Appendix N of this manual.

Table 6-1. Code List

Code List Position	Main Code	Subcode	Active Indicator	Ignition Cycle Counter	Event Counter
d1	21	12	YES	00	10
d2	41	12	YES	00	04
d3	23	12	NO	08	02
d4	34	12	NO	13	01
d5	56	11	NO	22	02
Displayed on shift selector and diagnostic tool d = "diagnostic"			YES = MODE ON displayed	Not available on shift selector display	

The following paragraphs define the different parts of the code list.

- A. **Code List Position.** The position which a code occupies in the code list. Positions are displayed as "d1" through "d5" (Code List Position #1 through Code List Position #5).
- B. **Main Code.** The general condition or area of fault detected by the ECU.
- C. **Subcode.** The specific area or condition related to the main code in which a fault is detected.
- D. **Active Indicator.** Indicates when a diagnostic code is active. The shift selector displays **MODE ON**, the diagnostic tool displays **YES**.
- E. **Ignition Cycle Counter.** Determines when inactive diagnostic codes are automatically cleared from the code list. The counter is incremented each time a normal ECU powerdown occurs (ignition turned off). Inactive codes are cleared from the code list after the counter exceeds 25.
- F. **Event Counter.** Counts the number of occurrences of a diagnostic code. If a code is already in the code list and the code is again detected, that code is moved to position d1, the active indicator is turned on, the Ignition Cycle Counter is cleared, and 1 is added to the Event Counter.

6-2. CODE READING AND CODE CLEARING

Diagnostic codes can be read and cleared by two methods: by using the Pro-Link® 9000 diagnostic tool or by using the shift selector display. The use of the Pro-Link® 9000 diagnostic tool is described in the instruction manual furnished with each tool. The method of reading and clearing codes described in this section refers to only entering the Diagnostic Display Mode by the proper button and/or lever movements on the shift selector.

The Diagnostic Display Mode may be entered for viewing of codes at any speed. Codes can only be cleared when the output speed = 0 and no output speed sensor failure is active.

- A. **Reading Codes.** Enter the diagnostic display mode by pressing the ↑ (Up) and ↓ (Down) arrow buttons at the same time on a pushbutton selector, or by momentarily pressing the **DISPLAY MODE** button on a lever shift selector.

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NOTE: *If a DO NOT SHIFT condition is present at this time, the shift lever should remain in the same position where it was when the DO NOT SHIFT was detected. If the lever is moved, a continuous tone will be heard until the lever is returned to the correct position.*

NOTE: *If an oil level sensor is present, then fluid level will be displayed first. Diagnostic code display is achieved by depressing the ↑ (Up) and ↓ (Down) arrow buttons or the DISPLAY MODE button a second time.*

The code list position is the first item displayed, followed by the main code and the Subcode. Each item is displayed for two seconds. The two second item display cycles continuously until the next code list position is accessed. The following list represents the display cycle using Code 25 11 as an example:

1. Code list position — **d1**
2. Main code — **25**
3. Subcode — **11**
4. Cycle repeats — **d1**

To view the second, third, fourth, and fifth positions (d2, d3, d4, and d5), momentarily press the **MODE** button as explained above.

Momentarily press the **MODE** button after the fifth position is displayed to restart the sequence of code list positions.

An active code is indicated by the **MODE ON** indicator (active indicator) illuminating when a code position is displayed. In the normal operating mode, the **MODE ON** display indicates secondary mode operation.

Any code position which does not have a diagnostic code logged will display “--” for both the main and Subcodes. No diagnostic codes are logged after an empty code position.

- B. Clearing Active Indicators.** A diagnostic code's active indicator can be cleared, which allows the code to be removed from the code list.

The active indicator clearing methods are:

1. Power down — All active indicators, except Code 69 34 (refer to the code chart), are cleared at ECU power down.
2. Self-clearing — Some codes will clear their active indicator when the condition causing the code is no longer detected by the ECU.
3. Manual — Some active indicators can be cleared manually, while in the diagnostic display mode, after the condition causing the code is corrected.

CAUTION: If an active indicator is cleared while the transmission is locked in a forward range or reverse (fail-to-range), the transmission will remain in the forward range or reverse after the clearing procedure is completed. Neutral must be manually selected.

- C. Manually Clearing Codes and Active Indicators from the Code List.** To clear active indicators or all codes:

1. Enter the Diagnostic Display Mode.
2. Press and hold the **MODE** button, approximately three seconds, until a tone sounds once. All active indicators are cleared. To remove all codes, press and hold the **MODE** button for ten seconds until the shift selector tone sounds twice. All codes will be cleared at ECU power down.

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D. Exiting the Diagnostic Display Mode. Exit the diagnostic display mode using one of the following procedures:

1. On a pushbutton shift selector, press the ↑ (Up) and ↓ (Down) arrow buttons at the same time or press any range button, **D**, **N**, or **R**. The shift (**D**, **N**, or **R**) is commanded if not inhibited by an active code.
2. On a lever shift selector, momentarily press the **DISPLAY MODE** button or move the shift lever to any shift position other than the one it was in when the diagnostic display mode was activated. If the shift is inhibited, the ECU will continue to command the current range and sound the tone continuously until the lever is returned to its original position.
3. Wait until timeout (approximately 10 minutes) and the system will automatically return to the normal operating mode.
4. Turn off power to the ECU (turn off the vehicle engine at the ignition switch).

6-3. DIAGNOSTIC CODE RESPONSE

The following ECU responses to a fault provide for safe transmission operation:

- **Do Not Shift (DNS) Response**
 - Release lockup clutch and inhibit lockup operation.
 - Inhibit all shifts.
 - Turn on **Do Not Shift** light.
 - Pulse the tone generator for 8 seconds when the fault is first detected.
 - Blank the select digit in the display.
 - Ignore any range selection inputs and disable the button feedback tone for the pushbutton shift selector. On the lever shift selector sound the tone continuously if the shift lever is moved to a position other than the one selected when the fault was first detected.
- **Do Not Adapt (DNA) Response**
 - The ECU stops adaptive shift control while the code is active. Do not adapt shifts when a code with the DNA response is active.
- **Solenoid Off (SOL OFF) Response**
 - All solenoids are commanded off (turning solenoids “A” and “B” off electrically causes them to be on hydraulically).
- **Return to Previous Range (RPR) Response**
 - When the speed sensor ratio or C3 pressure switch tests associated with a shift are not successful, the ECU commands the same range as commanded before the shift.
- **Neutral No Clutches (NNC) Response**
 - When certain speed sensor ratio or C3 pressure switch tests are not successful, the ECU commands a neutral condition with no clutches applied.

6-4. SHIFT SELECTOR DISPLAYS RELATED TO ACTIVE CODES

- “Cateyes” — The forward slash segments and the middle horizontal segments (-\;- \-) will be on for each display digit under the following conditions:
 - RSI link fault is active (Code 23 12 or 23 14)
 - When two COP timeouts occur within two seconds of each other (reference Code 69 33) for a remote selector display
 - An SPI communications fault is active (Code 69 32)

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- All Segments Displayed — All display segments will be illuminated if a severity 1 diagnostic code is present during initialization or if an electrical code for solenoids A, B, C, D, E, or G is logged before initialization completes.
- All Segments Blank — When two COP timeouts occur within two seconds of each other (reference Code 69 33) for an integral selector display.

6-5. DIAGNOSTIC CODE LIST AND DESCRIPTION

Table 6-2. WT Series Diagnostic Codes

Main Code	Subcode	Description	DO NOT SHIFT Light	Inhibited Operation Description
13	12	ECU input voltage, low	Yes	DNS, SOL OFF (Hydraulic default), DNA
	13	ECU input voltage, medium low	No	None, DNA
	23	ECU input voltage, high	Yes	DNS, SOL OFF (Hydraulic default)
14	12	Oil level sensor, failed low	No	None
	23	Oil level sensor, failed high (not used)	No	None
21	12	Throttle position sensor, failed low	No	Use full throttle default, DNA
	23	Throttle position sensor, failed high	No	Use full throttle default, DNA
22	14	Engine speed sensor reasonableness test	No	Use default engine speed, DNA
	15	Turbine speed sensor reasonableness test	Yes	DNS, Lock in current range, DNA
	16	Output speed sensor reasonableness test	Yes ⁽¹⁾	DNS, Lock in current range, DNA
23	12	Primary Shift Selector or RSI Link Fault	No	Hold in last valid direction. May cause “cateyes” display.
	13	Primary Shift Selector Mode Function Fault	No	Mode change not permitted
	14	Secondary Shift Selector or RSI Link Fault	No	Hold in last valid direction. May cause “cateyes” display.
	15	Secondary Shift Selector Mode Function Fault	No	Mode change not permitted
24	12	Sump fluid temperature, cold	Yes	DNS, Lock-in-neutral
	23	Sump fluid temperature, hot	No	No upshifts above a calibration rang

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Table 6-2. WT Series Diagnostic Codes (cont'd)

Main Code	Subcode	Description	DO NOT SHIFT Light	Inhibited Operation Description
25	00	Output speed sensor detected at 0 output rpm, Low	Yes ⁽¹⁾	DNS, Lock in current range (Low), DNA
	11	Output speed sensor, detected at 0 output rpm, 1st	Yes ⁽¹⁾	DNS, Lock in current range (1st), DNA
	22	Output speed sensor, detected at 0 output rpm, 2nd	Yes ⁽¹⁾	DNS, Lock in current range (2nd), DNA
	33	Output speed sensor, detected at 0 output rpm, 3rd	Yes ⁽¹⁾	DNS, Lock in current range (3rd), DNA
	44	Output speed sensor, detected at 0 output rpm, 4th	Yes ⁽¹⁾	DNS, Lock in current range (4th), DNA
	55	Output speed sensor, detected at 0 output rpm, 5th	Yes ⁽¹⁾	DNS, Lock in current range (5th), DNA
	66	Output speed sensor, detected at 0 output rpm, 6th	Yes ⁽¹⁾	DNS, Lock in current range (6th), DNA
	77	Output speed sensor, detected at 0 output rpm, Reverse range	Yes ⁽¹⁾	DNS, Lock in current range (R), DNA
32	00	C3 pressure switch open	Yes	DNS, Lock in current (Low), DNA
	33	C3 pressure switch open, 3rd range	Yes	DNS, Lock in current range (3rd), DNA
	55	C3 pressure switch open, 5th range	Yes	DNS, Lock in current range (5th), DNA
	77	C3 pressure switch open, Reverse range	Yes	DNS, Lock in current range (R), DNA
33	12	Sump oil temperature sensor, failed low	No	Use default value of 93°C (200°F)
	23	Sump oil temperature sensor, failed high	No	Use default value of 93°C (200°F)
34	12	EEPROM, factory calibration compatibility number wrong	Yes ⁽²⁾	DNS, SOL OFF (Hydraulic default), DNA
	13	EEPROM, factory calibration block checksum	Yes ⁽²⁾	DNS, SOL OFF (Hydraulic default), DNA
	14	EEPROM, Power Off Block Checksum	No	Use previous location, or factory calibration and reset adaptive, DNA
	15	EEPROM, Diagnostic Queue Block Checksum	No	Use previous location, or clear diagnostic queue, DNA
	16	EEPROM, Real Time Block Checksum	Yes	DNS, SOL OFF (Hydraulic default), DNA

DIAGNOSTIC CODES

Table 6-2. WT Series Diagnostic Codes *(cont'd)*

Main Code	Subcode	Description	DO NOT SHIFT Light	Inhibited Operation Description
35	00	Power interruption (Code set after power restored)	No	None (Hydraulic default during interruption)
	16	Real Time EEPROM Write Interruption	Yes	DNS, SOL OFF (Hydraulic default), DNA
36	00	Hardware/Software not compatible	Yes ⁽³⁾	DNS, SOL OFF (Hydraulic default), DNA
41	12	Open or short-to-ground, A solenoid circuit	Yes	DNS, SOL OFF (Hydraulic default), DNA
	13	Open or short-to-ground, B solenoid circuit	Yes	DNS, SOL OFF (Hydraulic default), DNA
	14	Open or short-to-ground, C solenoid circuit	Yes	DNS, SOL OFF (Hydraulic default), DNA
	15	Open or short-to-ground, D solenoid circuit	Yes	DNS, SOL OFF (Hydraulic default), DNA
	16	Open or short-to-ground, E solenoid circuit	Yes	DNS, SOL OFF (Hydraulic default), DNA
	21	Open or short-to-ground, F solenoid circuit	No	Lockup inhibited, DNA
	22	Open or short-to-ground, G solenoid circuit	Yes	DNS, SOL OFF (Hydraulic default), DNA
	23	Open or short-to-ground, H solenoid circuit	No	Retarder allowed, differential lock inhibited
	24	Open or short-to-ground, J solenoid circuit	No	Low and 1st inhibited
	25	Open or short-to-ground, K solenoid circuit	No	K solenoid operation inhibited
42	12	Short-to-battery, A solenoid circuit	Yes	DNS, Lock in a range, DNA
	13	Short-to-battery, B solenoid circuit	Yes	DNS, Lock in a range, DNA
	14	Short-to-battery, C solenoid circuit	Yes	DNS, Lock in a range, DNA
	15	Short-to-battery, D solenoid circuit	Yes	DNS, Lock in a range, DNA
	16	Short-to-battery, E solenoid circuit	Yes	DNS, Lock in a range, DNA
	21	Short-to-battery, F solenoid circuit	No	Lockup inhibited, DNA

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Table 6-2. WT Series Diagnostic Codes (*cont'd*)

Main Code	Subcode	Description	DO NOT SHIFT Light	Inhibited Operation Description
42 <i>(cont'd)</i>	22	Short-to-battery, G solenoid circuit	Yes	DNS, Lock in a range, DNA
	23	Short-to-battery, H solenoid circuit	No	Retarder allowed, differential lock inhibited
	24	Short-to-battery, J solenoid circuit	No	Low and 1st inhibited
	25	Short-to-battery, K solenoid circuit	No	Retarder operation inhibited
	26	Short-to-battery, N solenoid circuit	No	Low and 1st inhibited
43	21	Low side driver, F solenoid circuit	No	Lockup inhibited, DNA
	25	Low side driver, K solenoid circuit	No	K solenoid operation inhibited, DNA
	26	Low side driver, N solenoid circuit	No	Low and 1st inhibited, DNA
44	12	Short-to-ground, A solenoid circuit	Yes	DNS, SOL OFF (Hydraulic default), DNA
	13	Short-to-ground, B solenoid circuit	Yes	DNS, SOL OFF (Hydraulic default), DNA
	14	Short-to-ground, C solenoid circuit	Yes	DNS, SOL OFF (Hydraulic default), DNA
	15	Short-to-ground, D solenoid circuit	Yes	DNS, SOL OFF (Hydraulic default), DNA
	16	Short-to-ground, E solenoid circuit	Yes	DNS, SOL OFF (Hydraulic default), DNA
	21	Short-to-ground, F solenoid circuit	No	Lockup inhibited, DNA
	22	Short-to-ground, G solenoid circuit	Yes	DNS, SOL OFF (Hydraulic default), DNA
	23	Short-to-ground, H solenoid circuit	No	Retarder allowed, differential lock inhibited
	24	Short-to-ground, J solenoid circuit	No	Low and 1st inhibited
	25	Short-to-ground, K solenoid circuit	No	K solenoid operation inhibited
45	12	Open circuit, A solenoid circuit	Yes	DNS, SOL OFF (Hydraulic default), DNA
	13	Open circuit, B solenoid circuit	Yes	DNS, SOL OFF (Hydraulic default), DNA
	14	Open circuit, C solenoid circuit	Yes	DNS, SOL OFF (Hydraulic default), DNA

DIAGNOSTIC CODES

Table 6-2. WT Series Diagnostic Codes *(cont'd)*

Main Code	Subcode	Description	DO NOT SHIFT Light	Inhibited Operation Description
45 <i>(cont'd)</i>	15	Open circuit, D solenoid circuit	Yes	DNS, SOL OFF (Hydraulic default), DNA
	16	Open circuit, E solenoid circuit	Yes	DNS, SOL OFF (Hydraulic default), DNA
	21	Open circuit, F solenoid circuit	No	Lockup inhibited, DNA
	22	Open circuit, G solenoid circuit	Yes	DNS, SOL OFF (Hydraulic default), DNA
	23	Open circuit, H solenoid circuit	No	Retarder allowed, differential lock inhibited
	24	Open circuit, J solenoid circuit	No	Low and 1st inhibited
	25	Open circuit, K solenoid circuit	No	Retarder operation inhibited
	26	Open circuit, N solenoid circuit	No	Low and 1st inhibited
51	01	Offgoing ratio test (during shift), L to 1	Yes	DNS, RPR, DNA
	10	Offgoing ratio test (during shift), 1 to L	Yes	DNS, RPR, DNA
	12	Offgoing ratio test (during shift), 1 to 2	Yes	DNS, RPR, DNA
	21	Offgoing ratio test (during shift), 2 to 1	Yes	DNS, RPR, DNA
	23	Offgoing ratio test (during shift), 2 to 3	Yes	DNS, RPR, DNA
	24	Offgoing ratio test (during shift), 2 to 4	Yes	DNS, RPR, DNA
	35	Offgoing ratio test (during shift), 3 to 5	Yes	DNS, RPR, DNA
	42	Offgoing ratio test (during shift), 4 to 2	Yes	DNS, RPR, DNA
	43	Offgoing ratio test (during shift), 4 to 3	Yes ⁽¹⁾	DNS, RPR, DNA
	45	Offgoing ratio test (during shift), 4 to 5	Yes ⁽¹⁾	DNS, RPR, DNA
	46	Offgoing ratio test (during shift), 4 to 6	Yes	DNS, RPR, DNA
	53	Offgoing ratio test (during shift), 5 to 3	Yes	DNS, RPR, DNA

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Table 6-2. WT Series Diagnostic Codes (cont'd)

Main Code	Subcode	Description	DO NOT SHIFT Light	Inhibited Operation Description
51 (cont'd)	64	Offgoing ratio test (during shift), 6 to 4	Yes	DNS, RPR, DNA
	65	Offgoing ratio test (during shift), 6 to 5	Yes	DNS, RPR, DNA
	XY	Offgoing ratio test, X to Y ⁽⁴⁾		
52	01	Offgoing C3PS test (during shift), L to 1	Yes	DNS, RPR, DNA
	08	Offgoing C3PS test (during shift), L to N1	Yes	DNS, NNC, DNA
	32	Offgoing C3PS test (during shift), 3 to 2	Yes	DNS, RPR, DNA
	34	Offgoing C3PS test (during shift), 3 to 4	Yes	DNS, RPR, DNA
	54	Offgoing C3PS test (during shift), 5 to 4	Yes	DNS, RPR, DNA
	56	Offgoing C3PS test (during shift), 5 to 6	Yes	DNS, RPR, DNA
	71	Offgoing C3PS test (during shift), R to 1	Yes	DNS, NNC, DNA
	72	Offgoing C3PS test (during shift), R to 2	Yes	DNS, NNC, DNA
	78	Offgoing C3PS test (during shift), R to N1	Yes	DNS, NNC, DNA
	79	Offgoing C3PS test, R to 2 (R to NNC to 2)	Yes	DNS, NNC, DNA
	99	Offgoing C3PS test (during shift), N3 to N2	Yes	DNS, RPR, DNA
XY	Offgoing C3PS test, X to Y ⁽⁴⁾			
53	08	Offgoing speed test (during shift), L to N1	Yes ⁽¹⁾	DNS, NNC, DNA
	09	Offgoing speed test, Low to NNC	Yes ⁽¹⁾	DNS, NNC, DNA
	18	Offgoing speed test (during shift), 1 to N1	Yes ⁽¹⁾	DNS, NNC, DNA
	28	Offgoing speed test (during shift), 2 to N1	Yes ⁽¹⁾	DNS, NNC, DNA
	29	Offgoing speed test (during shift), 2 to N2	Yes ⁽¹⁾	DNS, RPR, DNA

DIAGNOSTIC CODES

Table 6-2. WT Series Diagnostic Codes *(cont'd)*

Main Code	Subcode	Description	DO NOT SHIFT Light	Inhibited Operation Description
53 <i>(cont'd)</i>	38	Offgoing speed test (during shift), 3 to N1	Yes ⁽¹⁾	DNS, NNC, DNA
	39	Offgoing speed test (during shift), 3 to N3	Yes ⁽¹⁾	DNS, RPR, DNA
	48	Offgoing speed test (during shift), 4 to N1	Yes ⁽¹⁾	DNS, NNC, DNA
	49	Offgoing speed test (during shift), 4 to N3	Yes ⁽¹⁾	DNS, RPR, DNA
	58	Offgoing speed test (during shift), 5 to N1	Yes ⁽¹⁾	DNS, NNC, DNA
	59	Offgoing speed test (during shift), 5 to N3	Yes ⁽¹⁾	DNS, RPR, DNA
	68	Offgoing speed test (during shift), 6 to N1	Yes ⁽¹⁾	DNS, NNC, DNA
	69	Offgoing speed test (during shift), 6 to N4	Yes ⁽¹⁾	DNS, RPR, DNA
	78	Offgoing speed test (during shift), R to N1	Yes	DNS, NNC, DNA
	99	Offgoing speed test (during shift), N2 to N3 or N3 to N2	Yes	DNS, RPR, DNA
	XY	Offgoing speed test, X to Y ⁽⁴⁾		
54	01	Oncoming ratio test (after shift), L to 1	Yes	DNS, RPR, DNA
	07	Oncoming ratio test (after shift), L to R	Yes	DNS, NNC, DNA
	10	Oncoming ratio test (after shift), 1 to L	Yes	DNS, RPR, DNA
	12	Oncoming ratio test (after shift), 1 to 2	Yes	DNS, RPR, DNA
	17	Oncoming ratio test (after shift), 1 to R	Yes	DNS, NNC, DNA
	21	Oncoming ratio test (after shift), 2 to 1	Yes	DNS, RPR, DNA
	23	Oncoming ratio test (after shift), 2 to 3	Yes	DNS, RPR, DNA
	24	Oncoming ratio test (during shift), 2 to 4	Yes	DNS, RPR, DNA

DIAGNOSTIC CODES

Table 6-2. WT Series Diagnostic Codes (*cont'd*)

Main Code	Subcode	Description	DO NOT SHIFT Light	Inhibited Operation Description
54 (<i>cont'd</i>)	27	Oncoming ratio test (after shift), 2 to R	Yes	DNS, NNC, DNA
	32	Oncoming ratio test (after shift), 3 to 2	Yes	DNS, RPR, DNA
	34	Oncoming ratio test (after shift), 3 to 4	Yes	DNS, RPR, DNA
	35	Oncoming ratio test (during shift), 3 to 5	Yes	DNS, RPR, DNA
	42	Oncoming ratio test (during shift), 4 to 2	Yes	DNS, RPR, DNA
	43	Oncoming ratio test (after shift), 4 to 3	Yes	DNS, RPR, DNA
	45	Oncoming ratio test (after shift), 4 to 5	Yes	DNS, RPR or SOL OFF (Hydraulic default), DNA
	46	Oncoming ratio test (during shift), 4 to 6	Yes	DNS, RPR, DNA
	53	Oncoming ratio test (during shift), 5 to 3	Yes	DNS, RPR, DNA
	54	Oncoming ratio test (after shift), 5 to 4	Yes	DNS, RPR, DNA
	56	Oncoming ratio test (after shift), 5 to 6	Yes	DNS, RPR, DNA
	64	Oncoming ratio test (after shift), 6 to 4	Yes	DNS, RPR, DNA
	65	Oncoming ratio test (after shift), 6 to 5	Yes	DNS, RPR, DNA
	70	Oncoming ratio test (after shift), R to L	Yes	DNS, NNC, DNA
	71	Oncoming ratio test (after shift), R to 1	Yes	DNS, NNC, DNA
	72	Oncoming ratio test (after shift), R to 2	Yes	DNS, NNC, DNA
	80	Oncoming ratio test (after shift), N1 to L	Yes	DNS, RPR, DNA
	81	Oncoming ratio test (after shift), N1 to 1	Yes	DNS, RPR, DNA
	82	Oncoming ratio test (after shift), N1 to 2	Yes	DNS, RPR, DNA

DIAGNOSTIC CODES

Table 6-2. WT Series Diagnostic Codes (cont'd)

Main Code	Subcode	Description	DO NOT SHIFT Light	Inhibited Operation Description
54 (cont'd)	83	Oncoming ratio test (after shift), N1 to 3	Yes	DNS, RPR, DNA
	85	Oncoming ratio test (after shift), N1 to 5	Yes	DNS, RPR, DNA
	86	Oncoming ratio test (after shift), N1 to 6	Yes	DNS, RPR, DNA
	92	Oncoming ratio test (after shift), N2 to 2	Yes	DNS, RPR, DNA
	93	Oncoming ratio test (after shift), N3 to 3	Yes	DNS, RPR, DNA
	95	Oncoming ratio test (after shift), N3 to 5	Yes	DNS, RPR, DNA
	96	Oncoming ratio test (after shift), N4 to 6	Yes	DNS, RPR, DNA
	97	Oncoming ratio test (after shift), 2 to R (2 to NNC to R)	Yes	DNS, NNC, DNA
	XY	Oncoming ratio test, X to Y ⁽⁴⁾		
55	07	Oncoming C3PS test, L to R	Yes ⁽¹⁾	DNS, NNC, DNA
	17	Oncoming C3PS test (after shift), 1 to R	Yes ⁽¹⁾	DNS, NNC, DNA
	27	Oncoming C3PS test (after shift), 2 to R	Yes ⁽¹⁾	DNS, NNC, DNA
	87	Oncoming C3PS test (after shift), N1 to R	Yes	DNS, RPR, DNA
	97	Oncoming C3PS test (after shift), NVL to Reverse	Yes ⁽¹⁾	DNS, NNC, DNA
		XY	Oncoming C3PS test, X to Y ⁽⁴⁾	
56	00	Range verification test, L	Yes ⁽¹⁾	DNS, 1st, Low, or SOL OFF (Low), DNA
	11	Range verification ratio test, 1st	Yes	DNS, 6th, DNA
	22	Range verification ratio test, 2nd	Yes ⁽¹⁾	DNS, 6th or 5th, DNA
	33	Range verification ratio test, 3rd	Yes ⁽¹⁾	DNS, 5th or SOL OFF (4th), DNA
	44	Range verification ratio test, 4th	Yes	DNS, 3rd or 5th, DNA
	55	Range verification ratio test, 5th	Yes ⁽¹⁾	DNS, SOL OFF, 5th or 3rd, DNA
	66	Range verification ratio test, 6th	Yes	DNS, 5th, 3rd, or SOL OFF (3rd), DNA
	77	Range verification ratio test, R	Yes	DNS, N2 or N3, DNA

DIAGNOSTIC CODES

Table 6-2. WT Series Diagnostic Codes *(cont'd)*

Main Code	Subcode	Description	DO NOT SHIFT Light	Inhibited Operation Description
57	11	Range verification C3PS test, 1st	Yes	DNS, SOL OFF (3rd), DNA
	22	Range verification C3PS test, 2nd	Yes	DNS, 3rd, DNA
	44	Range verification C3PS test, 4th	Yes	DNS, 5th or SOL OFF (3rd), DNA
	66	Range verification C3PS test, 6th	Yes	DNS, SOL OFF (5th), DNA
	88	Range verification C3PS test, N1	Yes	DNS, N3, DNA
	99	Range verification C3PS test, N2 or N4	Yes	DNS, N3, DNA
61	00	Retarder oil temperature, hot	No	None
62	12	Retarder oil temperature sensor, failed low	No	None
	23	Retarder oil temperature sensor, failed high	No	None
63	00	Input function fault	No	Depends on input function, DNA
	26	Kickdown input failed on	No	Kickdown operation inhibited
	40	Service brake status input failed on	No	No auto neutral to drive shifts for refuse packer. (I/O package #41)
	41	Pump/pack and a neutral general purpose input	No	No auto Neutral to drive shifts for refuse packer. (I/O package #41)
64	12	Retarder modulation request sensor, failed low	No	Retarder operation inhibited
	23	Retarder modulation request sensor, failed high	No	Retarder operation inhibited
65	00	Engine rating too high	Yes	DNS, Lock-in-neutral
66	00	Serial communications interface fault	No	Use default throttle values, DNA
69	12	ECU, A solenoid driver open	Yes	DNS, SOL OFF (Hydraulic default), DNA
	13	ECU, B solenoid driver open	Yes	DNS, SOL OFF (Hydraulic default), DNA
	14	ECU, C solenoid driver open	Yes	DNS, SOL OFF (Hydraulic default), DNA
	15	ECU, D solenoid driver open	Yes	DNS, SOL OFF (Hydraulic default), DNA
	16	ECU, E solenoid driver open	Yes	DNS, SOL OFF (Hydraulic default), DNA
	21	ECU, F solenoid driver open	No	Lockup inhibited, DNA

DIAGNOSTIC CODES

Table 6–2. WT Series Diagnostic Codes *(cont'd)*

Main Code	Subcode	Description	DO NOT SHIFT Light	Inhibited Operation Description
69 <i>(cont'd)</i>	22	ECU, G solenoid driver open	Yes	DNS, SOL OFF (Hydraulic default), DNA
	23	ECU, H solenoid driver open	No	Retarder allowed, DNA
	24	ECU, J solenoid driver open	No	Low and 1st inhibited, DNA
	25	ECU, K solenoid driver open	No	Retarder operation inhibited, DNA
	26	ECU, N solenoid driver open	No	Low and 1st inhibited, DNA
	32	ECU, SPI communications link fault	No	Induce COP timeout (reset ECU), DNA
	33	ECU, Computer Operating Properly (COP) timeout	No ⁽⁵⁾	Reset ECU, Shutdown ECU on 2nd occurrence. This code may cause “cateyes” or all segments blank, DNA
	34	ECU, EEPROM write timeout	Yes	DNS, SOL OFF (Hydraulic default), DNA
	35	ECU, EEPROM checksum test	No ⁽⁵⁾	Induce COP timeout (reset ECU), DNA
36	ECU, RAM self test	No ⁽⁵⁾	Induce COP timeout (reset ECU), DNA	
41	ECU, I/O ASIC addressing test	No ⁽⁵⁾	Induce COP timeout (reset ECU), DNA	

NOTES

- (1) This code is logged to real time to protect the transmission in case a loss of power to the ECU (Power Interruption, Code 35 00) occurs.
- (2) The factory calibration must be rewritten to the ECU, or a different factory calibration is required to match the software in the ECU.
- (3) The ECU hardware or software must be changed so that they are compatible.
- (4) Additional codes could be logged for other shifts where X indicates range shifted from and Y indicates range shifted to.
- (5) The COP reset will clear the active inhibit.

TRANSMISSION COMPONENT WIRING DIAGRAMS AND DIAGNOSTICS

DIAGNOSTIC CODES

NOTES

DIAGNOSTIC CODES

6-6. DIAGNOSTIC CODE TROUBLESHOOTING

A. Beginning The Troubleshooting Process

1. Begin troubleshooting by checking the transmission fluid level and ECU input voltage. Check diagnostic codes by:
 - Using the shift selector display.
 - Using the Pro-Link[®] 9000 diagnostic tool.
2. When a problem exists but a diagnostic code is not indicated, refer to the Performance Complaint Section for a listing of various electrical and hydraulic problems, their causes, and remedies.
3. If a diagnostic code is found in the ECU memory, record all available code information and clear the active indicator (refer to Section 6).
4. Test drive the vehicle to confirm a diagnostic code or performance complaint.
 - If the code reappears, refer to the Diagnostic Code section (Section 6) and the appropriate code chart. The Diagnostic Code section lists diagnostic codes and their description. Locate the appropriate troubleshooting chart and follow the instructions.
 - If the code does not reappear, it may be an intermittent problem. Use the Pro-Link[®] and the code display procedure described in Section 6. The code display procedure will indicate the number of times the diagnostic code has occurred. Refer to the troubleshooting chart for possible cause(s) of the problem.
 - Appendix A deals with the identification of potential circuit problems. Refer to Appendix A if a circuit problem is suspected.

NOTE: Information concerning specific items is contained in the appendices located in the back of this manual. The appendices are referred to throughout the manual.

B. Solenoid Locations

Solenoid locations in the control module are as illustrated in Figure 6-1. Refer to Figure 6-1 as necessary when using the diagnostic code schematics.

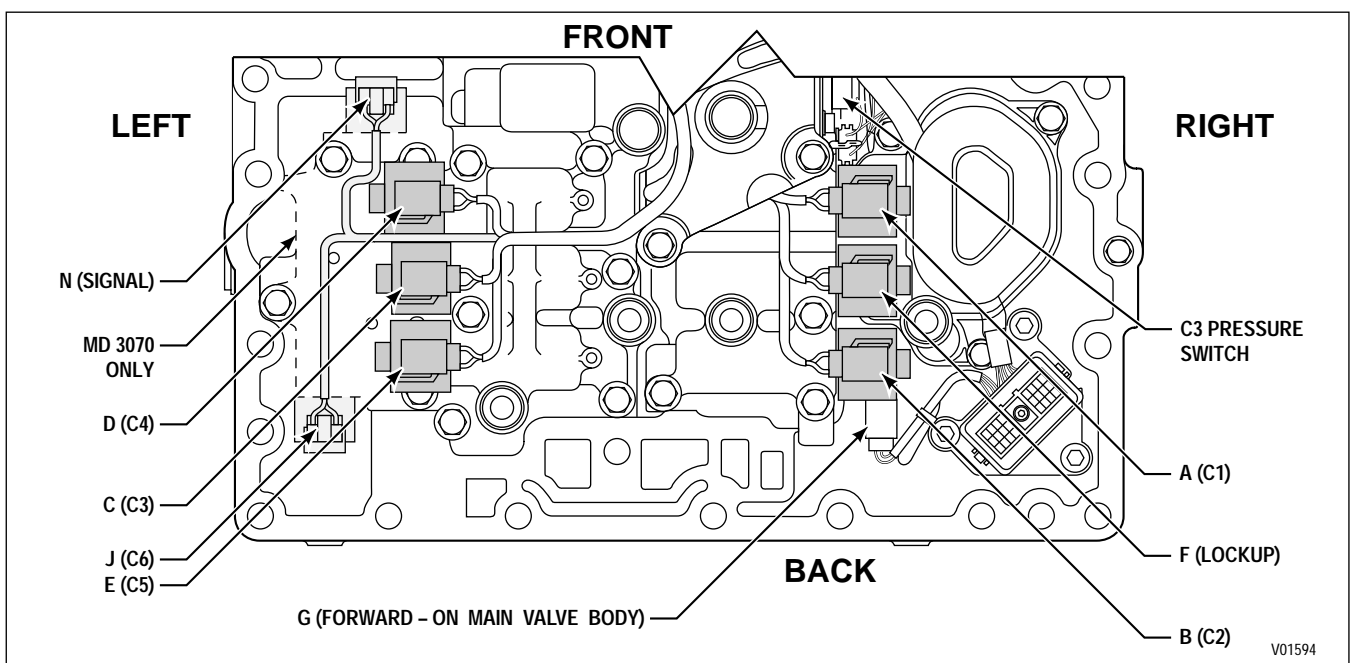


Figure 6-1. Control Module Solenoid Location

DIAGNOSTIC CODES

C. Diagnostic Code Schematics

The diagnostic code schematics in this section show wiring for both the optional oil level sensor and retarder, where applicable. If your transmission is not equipped with an oil level sensor or retarder, disregard the portions of the schematic pertaining to those optional pieces of equipment. Refer to the appropriate transmission Service Manual for solenoid replacement procedures.

D. Diagnostic Code 13 and 35 Schematics

The shaded area in Code 13 and 35 schematics indicates a change in the wiring harness incorporated in transmissions manufactured before September 1993.

CODE 13 XX — ECU INPUT VOLTAGE

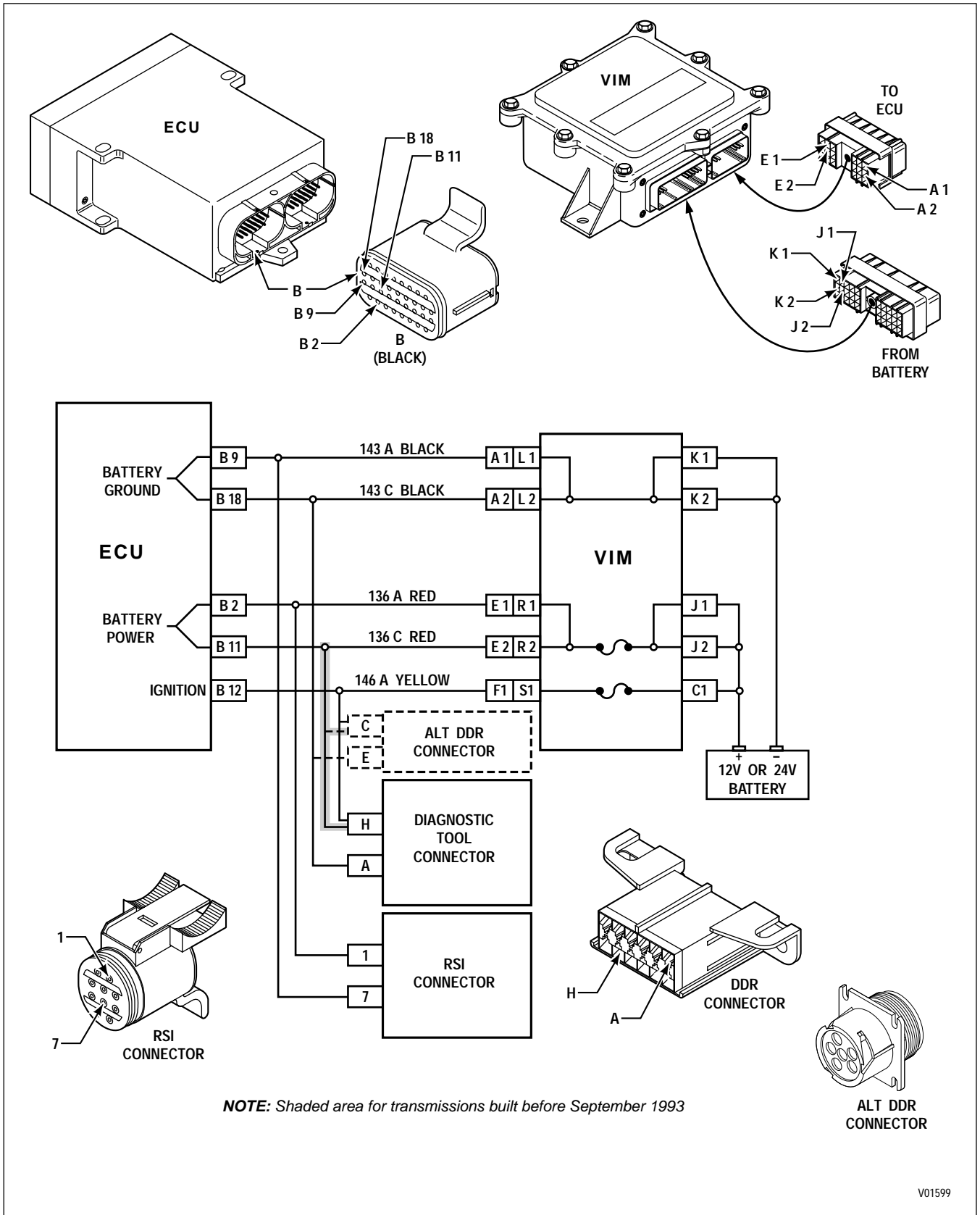


Figure 6-2. Code 13 Schematic Drawing

CODE 13 XX — ECU INPUT VOLTAGE (*Figure 6-2*)

Main code 13 indicates either a high or low input voltage. Low voltage is less than 8V. High voltage is over 35V.

Common causes for a low voltage code are:

- Bad batteries
- Faulty vehicle charging system
- No battery-direct power and ground

Common causes for the high voltage code are:

- Faulty vehicle alternator
- Faulty vehicle voltage regulator

In the event of a power loss, the transmission fails to the ranges indicated in the following, depending upon which latch valve releases first:

Attained Range	Fail to Range
Reverse and Neutral	Neutral
Low, 1	3C
2, 3, 4	4C usually, 3C sometimes
5	4C usually, 5C sometimes
6	5C

Main Code	Subcode	Meaning
13	12	Battery voltage to the ECU too low
13	13	Battery voltage to the ECU too low (medium)
13	23	Battery voltage to the ECU too high

Active Indicator Clearing Procedure:

- Power down
- Manual
- Self-clearing

Troubleshooting:

1. Connect the diagnostic tool and turn on vehicle ignition. Select Diagnostic Data to find input voltage. Record reading.
2. Turn off vehicle ignition and remove the connectors from the ECU.
3. Check system voltage at wire 136A and 136C, pin B2 and B11. If power is low or high at this point, and the diagnostic tool reading is also low or high, the vehicle wiring is suspect. Check for fuse problems, lack of battery-direct power and ground, faulty charging system/batteries, and loose or dirty connections (see Appendix A). Power may also be low or high at pins B2 and B11 (system power) if the batteries/charging system is faulty. Bad grounds may also cause incorrect input power readings.

CODE 13 XX — ECU INPUT VOLTAGE (*Figure 6-2*)

4. If power is correct but the diagnostic tool reading indicates incorrect voltage, closely inspect terminals B2 and B11; make sure they are not corroded or deformed. Clean or replace as necessary (see Appendix E, Paragraph 1-1).
5. If the voltage condition is intermittent, closely inspect the vehicle wiring for transmission system power and grounds. Check for loose, dirty, or painted connections. Check the VIM for loose, incorrect, or overheating relays or fuses (refer to Appendix G). Check for wires that are chafed and touching other components.
6. If no other cause is found, replace the ECU. If replacing the ECU corrects the problem, reinstall the original (bad) ECU to confirm that the problem is in the ECU. If the original ECU now works, inspect the ECU connectors for any corrosion or damage which may cause an intermittent condition. If the original problem recurs, reinstall the replacement ECU.

Table 6-3. Voltage Chart

Voltage	Condition
35.0 (High Set Point)	Maximum Surge For 2 Minutes, High Fail Limit
32.0	Maximum Continuous ECU Voltage
10.0 (Med. Low Set Point)	Cannot Compensate W/Sub-Modulation (Bad Shifts). Adaptive logic stops functioning
8.0	Low Voltage Fail Limit, Set Code, DNS
7.0 (Low Set Point)	Software Off (ECU loses power)
4.5	Neutral Start Off

DIAGNOSTIC CODES

NOTES

CODE 14 XX — OIL LEVEL SENSOR

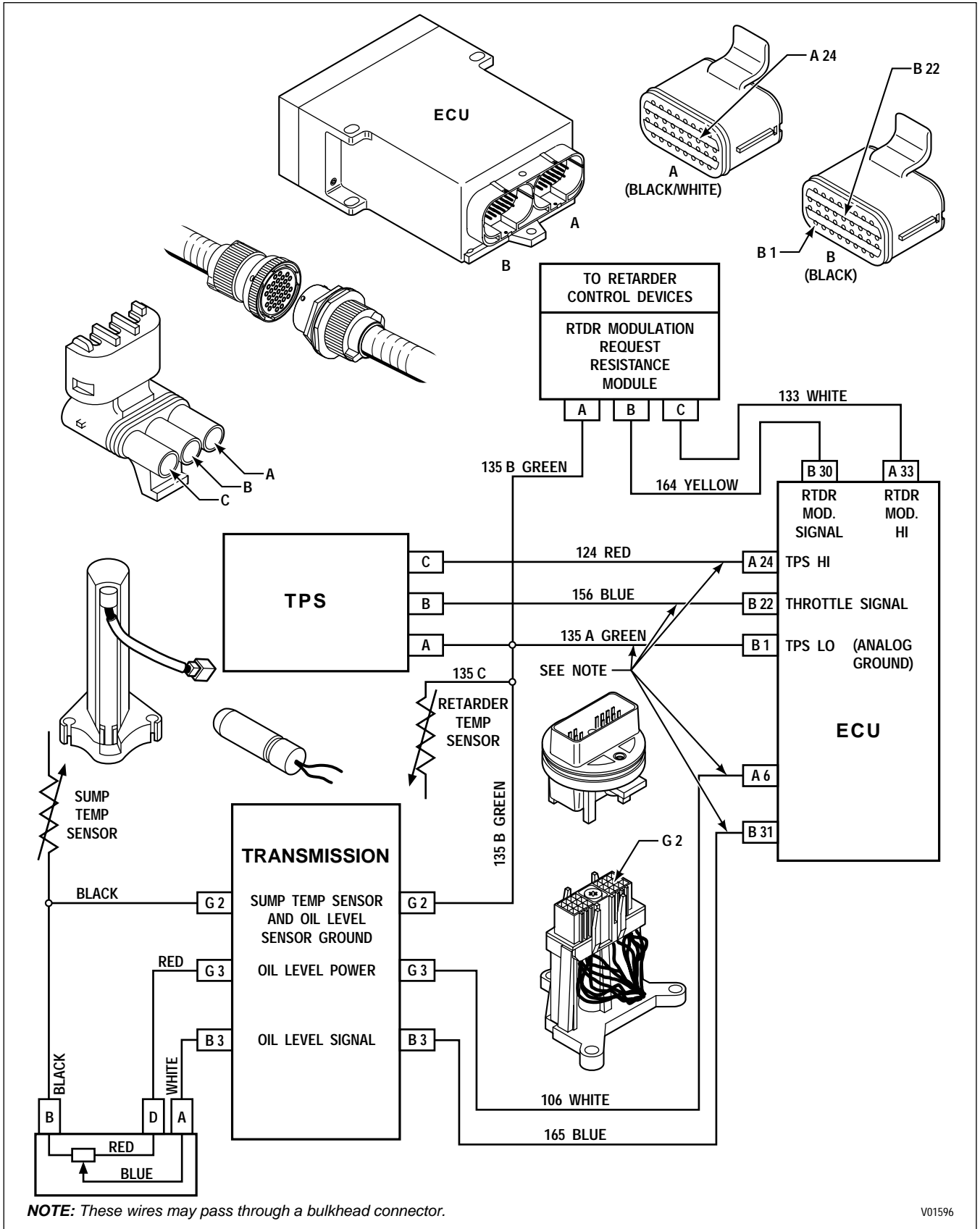


Figure 6-3. Code 14 Schematic Drawing (Units Produced Prior To 9/94)

CODE 14 XX — OIL LEVEL SENSOR

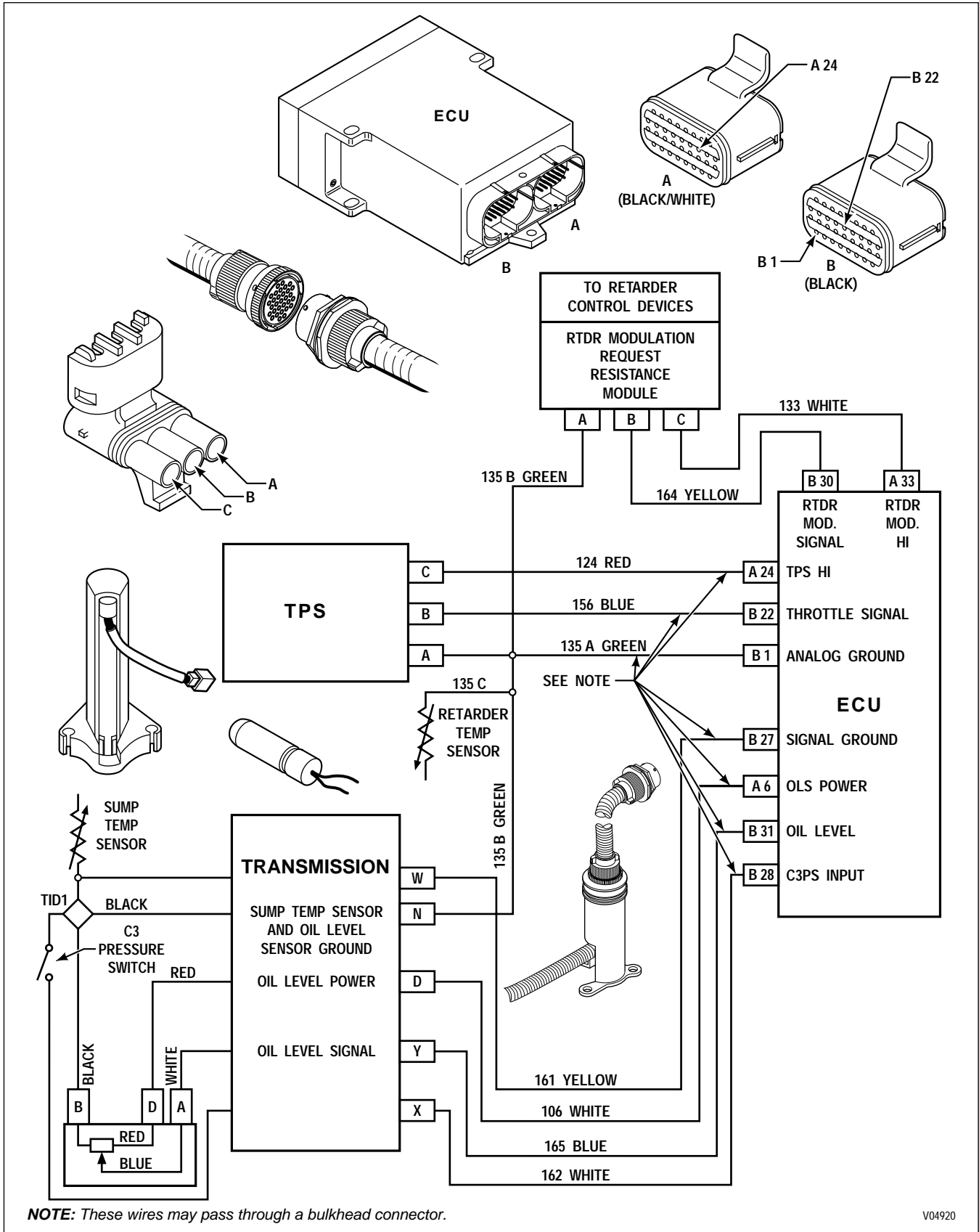


Figure 6-4. Code 14 Schematic Drawing (Units Produced 9/94-12/97)

CODE 14 XX — OIL LEVEL SENSOR (OLS) (*Figures 6-3, 6-4*)

Code 14 12 indicates the ECU has detected a voltage signal in the low error zone.

Code 14 12 can be caused by:

- Faulty wiring to the OLS
- A faulty OLS
- A faulty ECU

CAUTION: Never use a Volt-Ohmmeter to measure any parameters on the OLS. Damage to the OLS will result.

OLS ground wire 135B is common to the TPS and the RMR devices. A power wire short-to-ground for any of these devices will cause “sensor failed low” codes (21 12 and 64 12). An OLS signal open or short-to-ground results in a Code 14 12 only. Code 14 23 is programmed out of all calibrations.

A permanent maximum voltage signal generates a steady OLS sensor maximum count and a maximum fluid level overfill indication. A maximum overfill indication occurs if signal wire 165 or power wire 106 are shorted to battery or the ground wire (wire 135). An open in the ground circuit wire 135 in the portion common to the OLS, TPS and RMR devices results in Code 14 12, 21 23, and 64 23.

If the ECU software supports it, Oil Level Sensor counts can be read by a DDR with Pro-Link® version 3.0 (or later). For complete description of oil level checking procedures using the oil level sensor, see Section 5. Normal operation of the OLS can be checked as follows: Attach the DDR and display OIL LEVEL COUNTS. Read the number of counts when the engine is not running, but the ignition is ON. The count reading should be near 255. Start the engine and observe the counts. In normal operation, the count should be 100–200 because the oil level drops when the engine starts and oil from the sump is delivered to other parts of the transmission.

NOTE: *Intermittent connections or lack of battery-direct power and ground connections can cause this and other electronic control codes.*

Main Code	Subcode	Meaning
14	12	Oil level sensor failed low
14	23	Oil level sensor failed high (not used)

Active Indicator Clearing Procedure:

- Power down
- Manual
- Self-clearing

NOTE: *Before troubleshooting, read Pages 6-17 and 6-18 of Section 6-5. Also, check the following:*

- *Fluid level, using dipstick*
- *Battery voltage*
- *ECU input voltage*
- *Other diagnostic codes*

CODE 14 XX — OIL LEVEL SENSOR (OLS) (*Figures 6-3, 6-4*)**Troubleshooting:**

The following procedure is to find the cause for an OLS problem. The procedure is sequential. Follow the procedure until the cause for the OLS problem is found and repaired. Once the problem is found and repaired, STOP. For example, if the problem is fixed in Step 3, there is no need to continue to the other steps.

1. Disconnect the external wiring harness at the transmission feedthrough connector. With the ignition ON, verify there is 5.0VDC between the OLS power and ground pins (see Page D-8 or D-9) on the external harness connector. This is to verify that power and ground are getting to the OLS. If 5.0VDC is not present, check the wiring for the OLS power and ground circuits (wires 124 and 135, respectively). If there are no wiring problems (opens, shorts-to-ground, shorts-to-battery), and if 5.0VDC is present, go to Step 2.
2. Observe the OIL LEVEL COUNTS on the DDR while jumpering the OLS power pin to the OLS signal pin. If the count jumps from 0 to 250+, the OLS signal line is good and the ECU function is good. Continue to Step 3. If the count remains at zero, locate and repair problems in the wiring of OLS signal (wire 165). If there are no wiring problems, and the count still remains at zero, the ECU may be bad. Go to Step 5.
3. If all checks prior to this have been normal, the problem is either in the OLS itself, the internal harness wires, or the transmission side of the feedthrough harness connection. Inspect the transmission feedthrough harness connector to be sure that the OLS power, ground, and signal pins are not loose or out of position. Correct any connector problems found. Reconnect the external harness to the transmission feedthrough harness connector. See if Code 14 12 recurs before continuing to Step 4.
4. Consult the appropriate transmission Service Manual for proper procedure and remove the control module from the transmission. Remove the OLS from the channel plate. Reconnect the external harness to the transmission feedthrough connector, if not done in Step 3. With the ignition ON, observe OIL LEVEL COUNTS on the DDR. With the OLS in normal position, the count should be 8-35. Invert the OLS and the count should be 192-255. If the counts are abnormal, replace the sensor. Check the new sensor in both normal and inverted positions. If the counts respond correctly, the problem should be resolved. Attach the new OLS to the channel plate and reinstall the control module using the appropriate transmission Service Manual for proper procedure.
5. Replace the ECU. If replacing the ECU corrects the problem, reinstall the original (bad) ECU to confirm that the problem is in the ECU. If the original ECU now works, inspect the ECU connectors for any corrosion or damage which may cause an intermittent condition. If the original problem recurs, reinstall the replacement ECU.

CODE 21 XX — THROTTLE POSITION SENSOR FAULT OR ADJUSTMENT

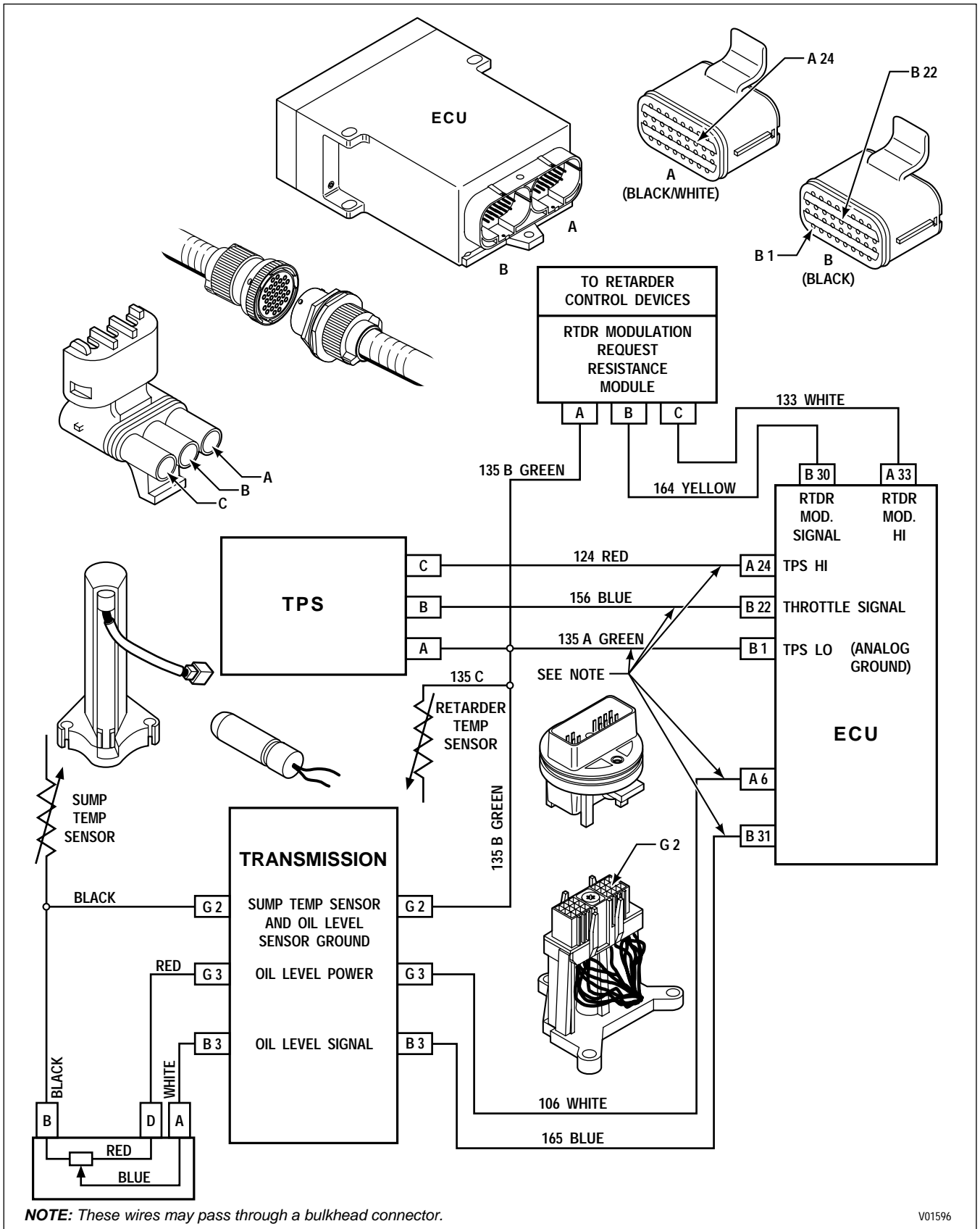


Figure 6-5. Code 21 Schematic Drawing (Units Produced Prior to 9/94)

CODE 21 XX — THROTTLE POSITION SENSOR FAULT OR ADJUSTMENT

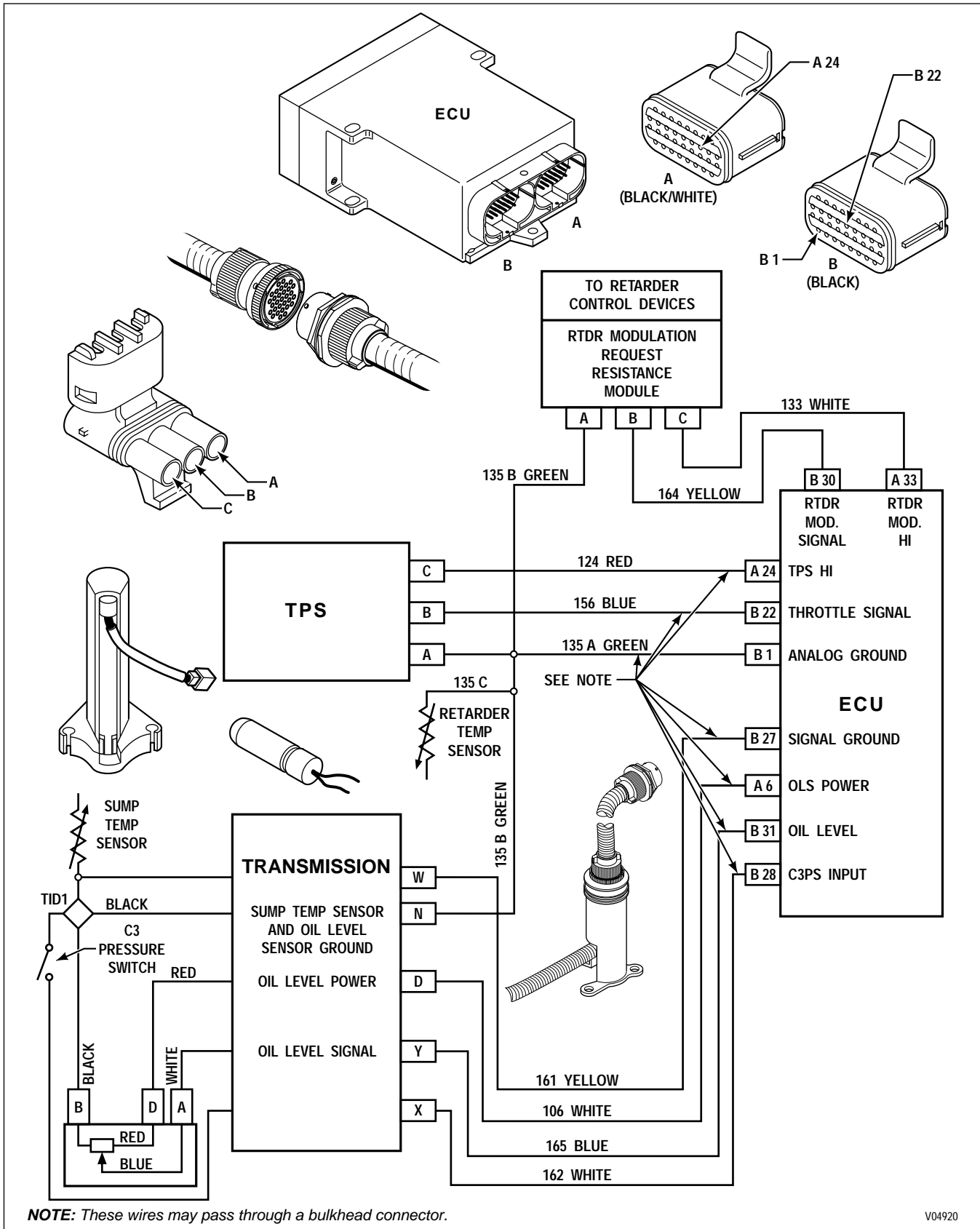


Figure 6-6. Code 21 Schematic Drawing (Units Produced 9/94-12/97)

CODE 21 XX — THROTTLE POSITION SENSOR OR PWM FAULT OR ADJUSTMENT (Figures 6-5, 6-6)

Main code 21 indicates the throttle position sensor has been retracted or extended by its linkage into an error zone. This may be due to a fault with the sensor, or a fault in the wiring to the sensor or to the ECU. This code may also indicate a PWM signal problem. Code 21 12 is set when the ECU receives TPS counts of 14 or less. Code 21 23 is set when the ECU senses TPS counts of 233–255. Whenever a Code 21 XX condition is detected, the system defaults to 100 percent throttle and part throttle shifts will be abrupt.

NOTE: *Whenever Code 21 12 or 21 23 is set and the ECU was programmed after 9/26/94, the SERVICE icon on the shift selector will be illuminated.*

NOTE: *Code 21 XX in conjunction with Code 33 XX or Code 14 XX indicates the potential loss of common ground wire 135 between the throttle, temperature sensor, and oil level sensor.*

Main Code	Subcode	Meaning
21	12	Throttle position sensor failed low and ECU signals 100 percent throttle
21	23	Throttle position sensor failed high

Active Indicator Clearing Procedure:

- Power down
- Manual
- Self-clearing

NOTE: *Before troubleshooting, read Pages 6-17 and 6-18 of Section 6-5. Also, check the ECU input voltage.*

Troubleshooting:

1. Plug in the DDR, select Diagnostic Data, and read throttle counts and percent. If the TPS failed high (Code 21 23), the problem may be toward the full throttle end of the TPS travel. If the TPS failed low (Code 21 12), the problem may be at the closed throttle end of the TPS travel.
2. If counts are high but the percentage never reaches 100 percent, TPS linkage may have bound up and overstroked the TPS to set a false 100 percent reading. After TPS overstroking ceases, the TPS will not automatically return to 100 percent. After the TPS is correctly installed and adjusted, use the Pro-Link® to reset throttle calibration or cycle the ignition 5 times to reset the 0 percent and 100 percent settings. See TPS section of this book (Appendix F) for installation and adjustment procedures.
3. If the throttle counts do not change or are erratic, check the throttle sensor wiring for opens, shorts between wires, or shorts-to-ground. Also check for correct TPS voltages using test wiring harness J 41339. If wiring problems are found, isolate and repair the fault (refer to Appendix E for repair information).
4. If the wiring is satisfactory, replace the throttle position sensor and adjust its linkage so the counts are not in the error zones (See Appendix F).
5. If the throttle sensor and its linkage adjustment are correct and the wiring to the sensor is satisfactory, the condition is intermittent. Replace the sensor and properly adjust the new sensor.
6. If the condition recurs, use spare harness wires for the throttle sensor circuit. See Appendix D for available spare wires and Appendix E for connector repair information.

CODE 21 XX — THROTTLE POSITION SENSOR OR PWM FAULT OR ADJUSTMENT (*Figures 6-5, 6-6*)

7. If the condition persists, replace the ECU. If replacing the ECU corrects the problem, reinstall the original (bad) ECU to confirm that the problem is in the ECU. If the original ECU now works, inspect the ECU connectors for any corrosion or damage which may cause an intermittent condition. If the original problem reoccurs, reinstall the replacement ECU.
8. The only troubleshooting necessary for a PWM fault is to check for an open, short-to-ground, or short-to-battery in the signal wire from the PWM source. An open or short-to-ground will set Code 21 12. A short to battery will set Code 21 23.

NOTE: *A good throttle position sensor should have resistance of:*

1. *9000–15,000 Ohms across terminals A and C.*
2. *500 ohms, moving to 9000–15,000 Ohms as TPS is stroked (measured across terminals A and B).*

CODE 22 XX — SPEED SENSOR/CIRCUITRY FAULT

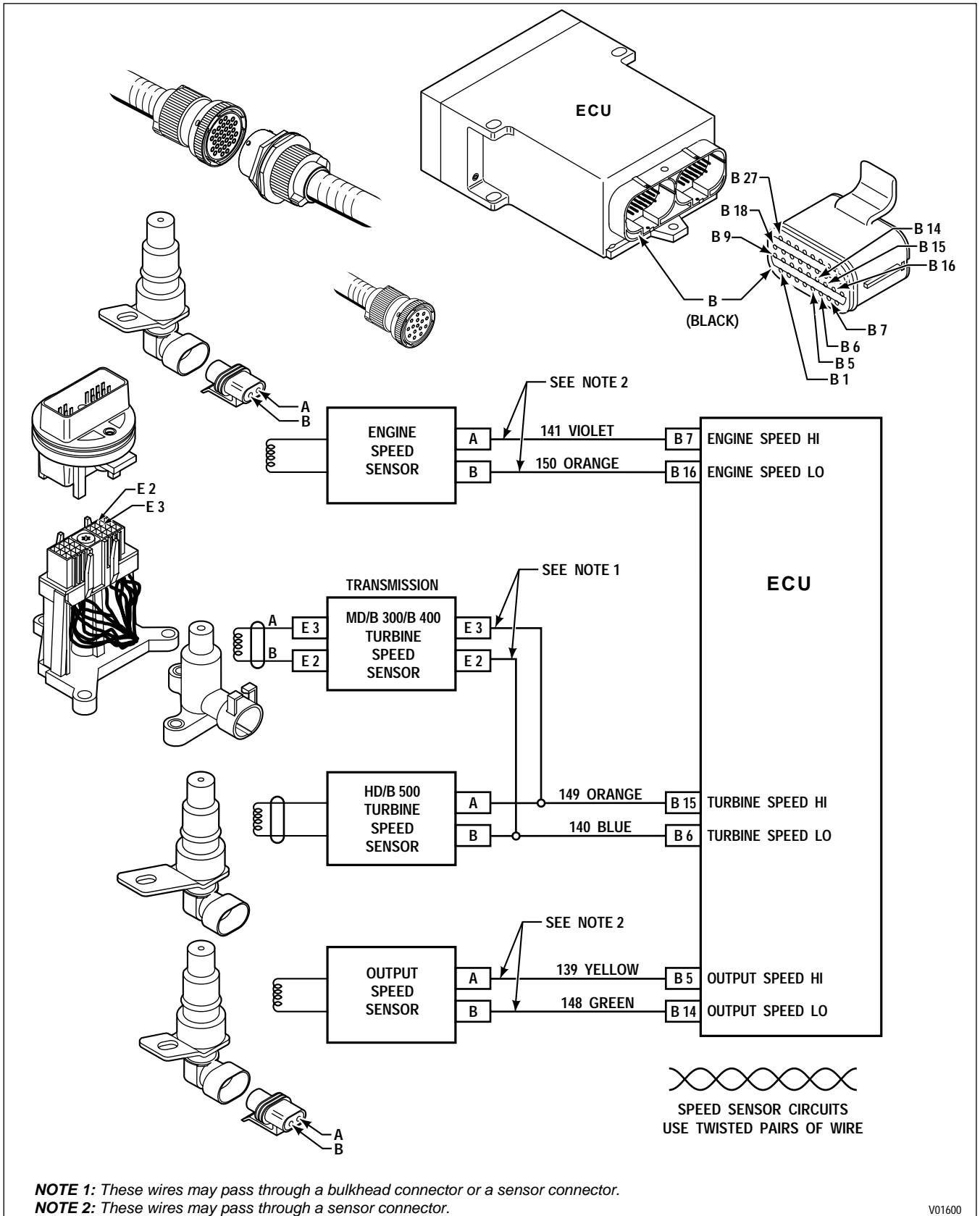


Figure 6-7. Code 22 Schematic Drawing (Units Produced Prior To 9/94)

CODE 22 XX — SPEED SENSOR/CIRCUITRY FAULT

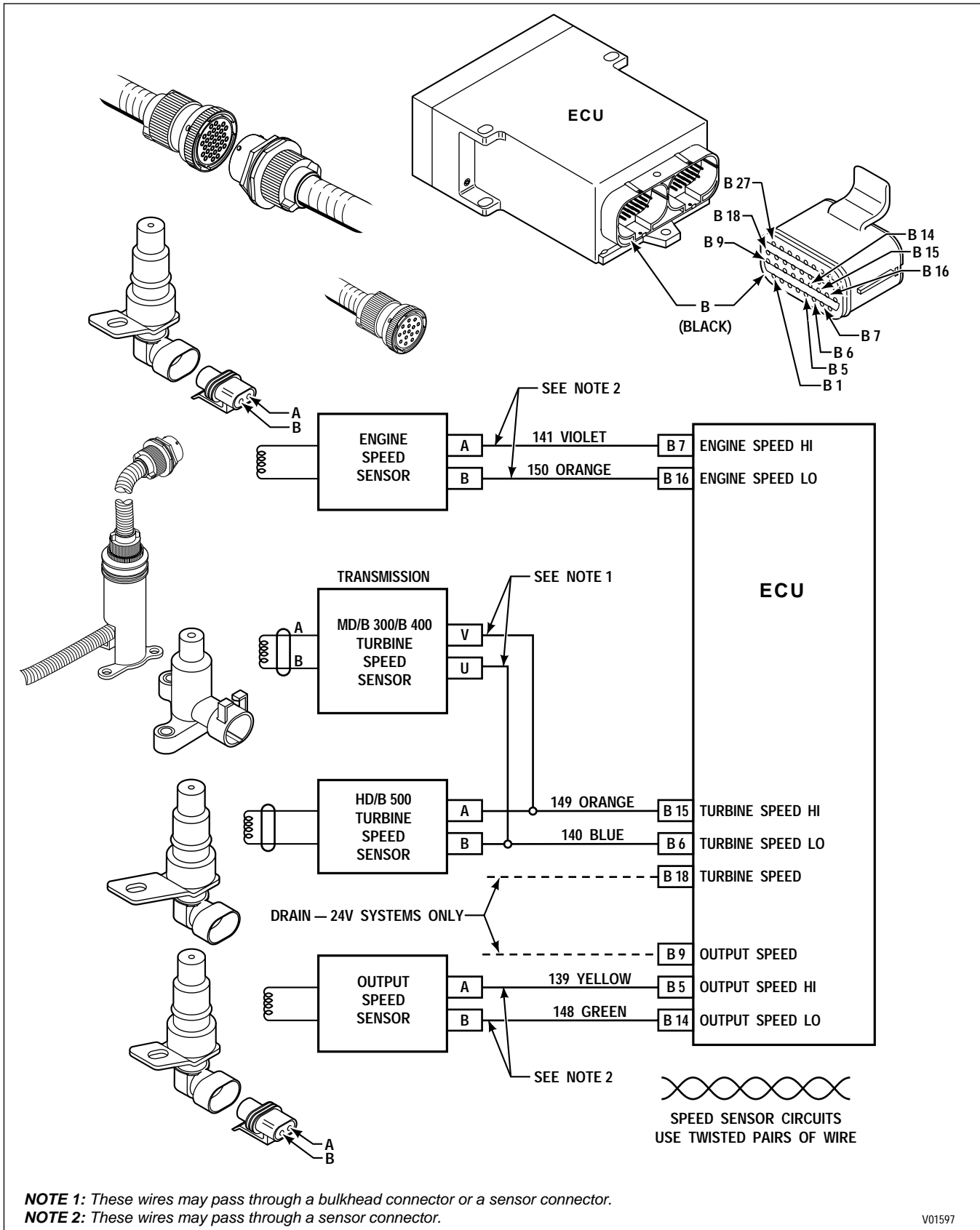


Figure 6-8. Code 22 Schematic Drawing (Units Produced 9/94-12/97)

CODE 22 XX — SPEED SENSOR/CIRCUITRY FAULT (*Figures 6–7, 6–8*)

Main code 22 indicates a fault within a speed sensor, the wiring to a speed sensor, incorrect speed sensor gap, or damaged bumps or teeth which create the speed signal. This fault is determined by the reasonableness of a speed sensor signal when compared with the other two speed sensors and the commanded range. A speed sensor will not pass the reasonableness test if there is no signal at all from that sensor when a signal should be present.

NOTE: *If the engine speed sensor code (22 14) is active and a range verification test is failed, the range verification code will not be set but a DO NOT SHIFT response is commanded.*

Main Code	Subcode	Failed Sensor
22	14	Engine Speed
22	15	Turbine Speed
22	16	Output Speed

Active Indicator Clearing Procedure:

- Power down
- Manual
- Self-clearing

NOTE: *Before troubleshooting, read Pages 6–17 and 6–18 of Section 6–5. Also, check the ECU input voltage.*

Troubleshooting:

1. Check to see if the sensor is loose, missing, or disconnected. If not, disconnect the wiring harness from the sensor and measure the resistance of the sensor (see chart below). Also check the terminals for dirt, corrosion, or damage. If resistance is not correct, replace the sensor.

Resistance	Temp. °C	Temp. °F
200 Ω	–40	–40
300 Ω	20	68
400 Ω	110	230

2. Remove the connectors from the ECU. Check the sensor circuit (in the external harness) for open wires, shorts between wires, or shorts-to-ground. Isolate and repair any faults (refer to Appendix E for repair information).
3. If no opens or shorts are found, the condition must be intermittent. Replace the sensor indicated by the trouble code. Before replacing a speed sensor, check the sensor for physical damage or contamination. Refer to the appropriate transmission Service Manual for proper replacement procedure.
4. If the condition recurs, install new wiring (twisted-pair) for the sensor circuit between the ECU and the transmission. Use P/N 29522703 Service Harness Twisted Shielded Pair for this purpose.
5. If the condition again recurs, connect the diagnostic tool and select the speed signal indicated by the trouble code. Drive the vehicle and watch the speed reading on the diagnostic tool. If the signal is erratic, sensor gap, vehicle vibration, an external AC signal source, or intermittent connector

CODE 22 XX — SPEED SENSOR/CIRCUITRY FAULT (*Figures 6-7, 6-8*)

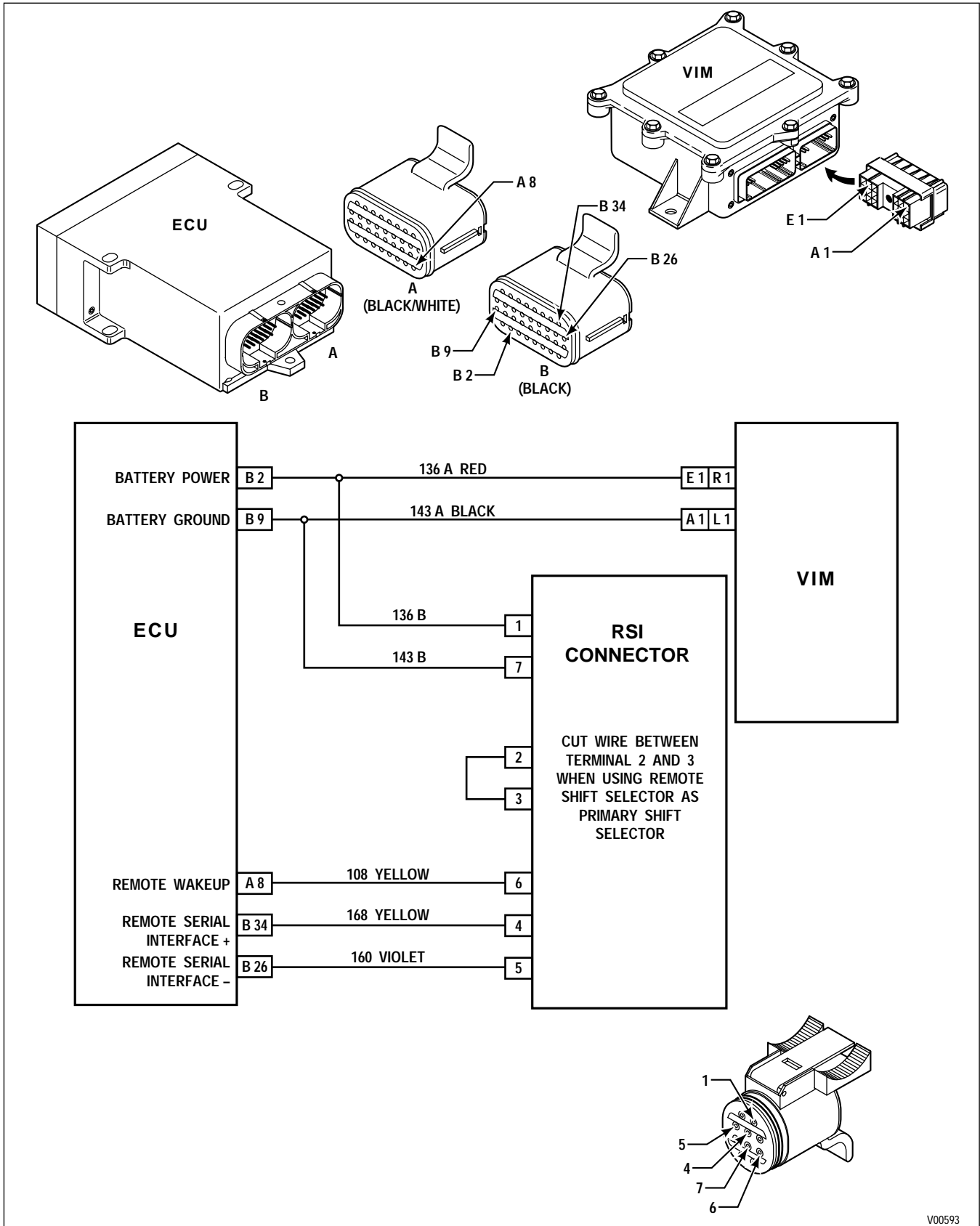
contact may be inducing the erratic signal. Inspect the sensor and its surroundings for irregularities that would affect sensor gap. Isolate and correct any abnormal vehicle vibrations (particularly driveline and abnormal engine torsionals, see Sales Tech Data Book (SA2404EN) Part II Section C). Recheck the sensor wiring for intermittent conditions (see Appendix A).

6. If the condition persists, replace the ECU. If replacing the ECU corrects the problem, reinstall the original (bad) ECU to confirm that the problem is in the ECU. If the original ECU now works, inspect the ECU connectors for any corrosion or damage which may cause an intermittent condition. If the original problem recurs, reinstall the replacement ECU.

DIAGNOSTIC CODES

NOTES

CODE 23 XX — SHIFT SELECTOR



V00593

Figure 6-9. Code 23 Schematic Drawing

CODE 23 XX — SHIFT SELECTOR (*Figures 6–9*)

Main code 23 indicates a fault with a shift selector or the wiring between a shift selector and the ECU.

Main Code	Subcode	Meaning
23	12	Primary shift selector or RSI link fault — a “catereyes” type display may occur
23	13	Primary shift selector mode button
23	14	Secondary shift selector or RSI link fault — a “catereyes” type display may occur
23	15	Second shift selector mode button

Active Indicator Clearing Procedure:

- Power down
- Manual
- Self-clearing

NOTE: *Before troubleshooting, read Pages 6–17 and 6–18 of Section 6–5.*

Troubleshooting:

1. Clear the active indicator for Code 23 XX. If code recurs, continue to Step 2.
2. Check for a poor connection at the shift selector.
3. If this is a remote shift selector, disconnect the external harness connectors from the ECU and from the remote shift selector and check for opens, shorts, and shorts-to-ground between the shift selector and ECU (refer to Section 4). Repair as needed (refer to Appendix E).
4. If no problem is found with the shift selector connection or wiring, replace the shift selector.
5. Use care in separating and disconnecting the shift selector head from the ECU. If this is a remote shift selector, replace the shift selector assembly.
6. If the condition persists, replace the ECU. If replacing the ECU corrects the problem, reinstall the original (bad) ECU to confirm that the problem is in the ECU. If the original ECU now works, inspect the ECU connectors for any corrosion or damage which may cause an intermittent condition. If the original problem recurs, reinstall the replacement ECU.

CAUTION:

Static electricity can destroy the EEPROM. When replacing an integral shift selector, use Anti-Static Wrist Strap BT 8639-B to prevent a static electricity discharge to the EEPROM.

DIAGNOSTIC CODES

NOTES

CODE 24 XX — SUMP FLUID TEMPERATURE

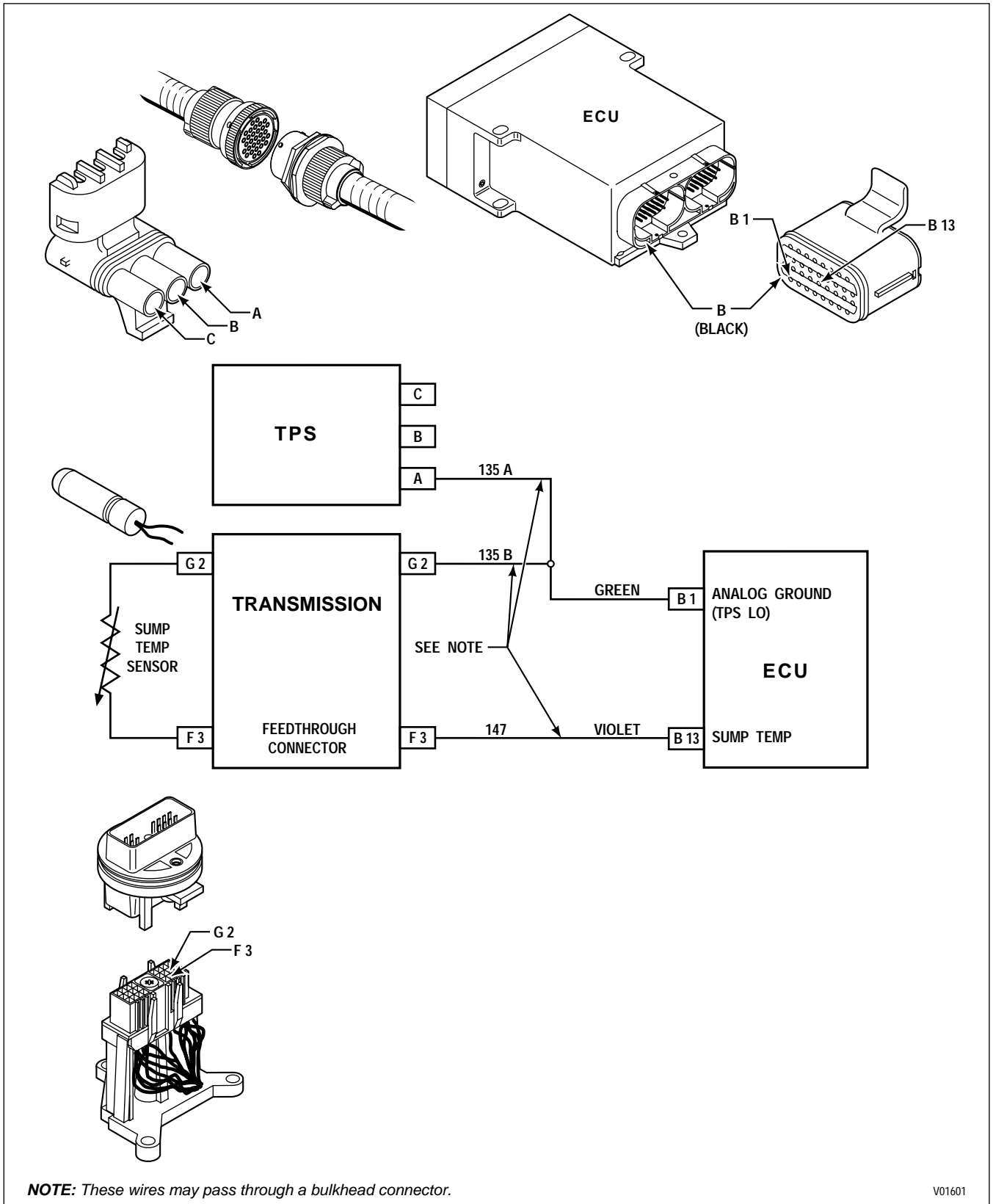


Figure 6-10. Code 24 Schematic Drawing (Units Produced Prior To 9/94)

CODE 24 XX — SUMP FLUID TEMPERATURE

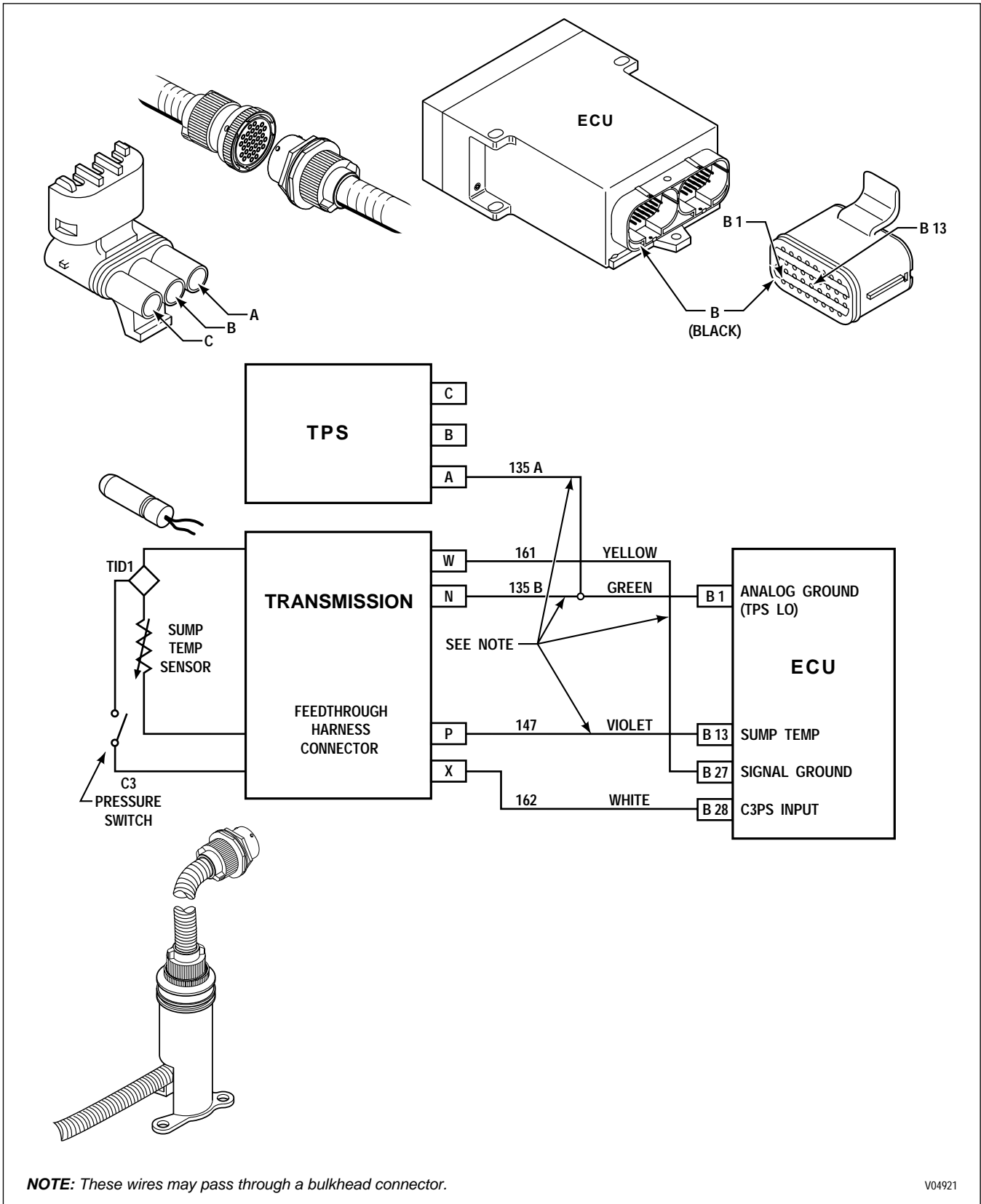


Figure 6-11. Code 24 Schematic Drawing (Units Produced 9/94-12/97)

CODE 24 XX — SUMP FLUID TEMPERATURE (*Figures 6–10, 6–11*)

Main code 24 indicates the ECU has detected either a high or low fluid temperature in the transmission sump (via the sump temperature sensor in the internal harness). All shifts are inhibited when Code 24 12 is set (only Neutral range operation is allowed). No upshifts are allowed above a calibration range when Code 24 23 is set. All inhibits are cleared when the temperature conditions are normal. A related code is 33 12 which indicates a temperature reading outside the usable range of the sensor and indicates a probable sensor failure.

Main Code	Subcode	Meaning
24	12	Oil temperature cold
24	23	Oil temperature hot

Active Indicator Clearing Procedure:

- Power down
- Manual
- Self-clearing

NOTE: *Before troubleshooting, read Pages 6–17 and 6–18 of Section 6–5. Also, check the ECU input voltage.*

Troubleshooting:**A. Code 24 12:**

1. If Code 24 12 is set and the outside temperature is low enough to cause this trouble, lower than -32°C (-25°F), the ECU will not allow range operation (See Table 6–4 on next page). The sump must be preheated to an acceptable temperature to avoid logging codes and transmission diagnostic response.

NOTE: *Medium cold fluid, -29°C (-20°F) to -7°C ($+20^{\circ}\text{F}$), will allow reverse, neutral, and second-range-start operation. Only hold override upshifts are allowed.*

2. If ambient temperature does not match the sump temperature reading (check using diagnostic tool), compare resistance versus sump fluid temperature (refer to Figure 6–12). Then check the sensor wiring for opens, shorts, or shorts-to-ground.
3. If the sensor wiring is satisfactory, drain the fluid, remove the control module, and replace the temperature sensor (refer to appropriate transmission Service Manual).
4. If the condition persists, replace the ECU. If replacing the ECU corrects the problem, reinstall the original (bad) ECU to confirm that the problem is in the ECU. If the original ECU now works, inspect the ECU connectors for any corrosion or damage that may cause an intermittent condition. If the original problem recurs, reinstall the replacement ECU.

CODE 24 XX — SUMP FLUID TEMPERATURE (Figures 6-10, 6-11)

Table 6-4. Transmission Operation As A Function Of Temperature

Condition	Version 6 Software*	Version 7 Software*	V7A/V6E/V7 Recals
	°C (°F)	°C (°F)	°C (°F)
Temperature sensor failed high (Refer to Code 33 23)	177 (351)	177 (351)	
Hot fluid (Code 24 23) adaptive turned off; max range limited	128 (262)	128 (262)	132 (270)
Output function “on” for sump over temp above this temperature	119 (246)	121 (250)	132 (270)
Output function “off” for sump over temp below this temperature	113 (235)	116 (240)	
Cool/cold fluid; adaptive turned off	34 (93)	34 (93)	
Turbine reasonableness and speed tie-up tests turned off	0 (32)	0 (32)	
Medium cold fluid R, N, D allowed, 2nd gear start (hold override upshifts only)	-7 (19)	-7 (19)	
All C3 Pressure Switch tests turned off (Neutral operation only for R03, D4C, and 200 software version. Also, DO NOT SHIFT light is illuminated.)	-32 (-25)	-32 (-25)	
Temperature sensor failed low (Refer to Code 33 12)	-45 (-49)	-45 (-49)	

* **NOTE:** Use the Pro-Link[®] diagnostic tool to determine the software version being used. Version 6 software includes R03, D4C, 200, 501, and 502. Version 7 software is D70.

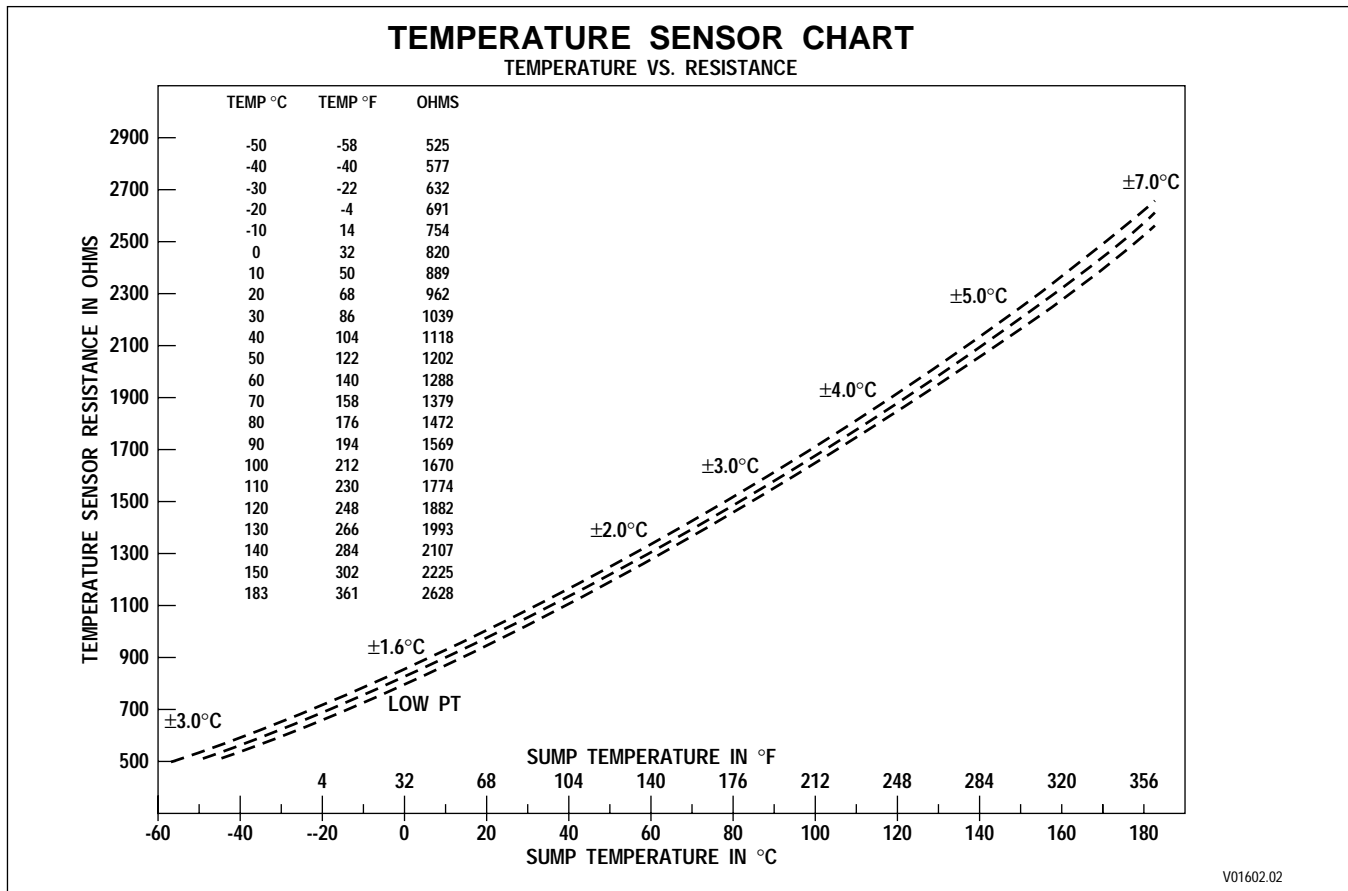


Figure 6-12. TransID 1 Temperature Sensor Chart

CODE 24 XX — SUMP FLUID TEMPERATURE (Figures 6–10, 6–11)

B. Code 24 23:

1. Install temperature gauges for transmission temperature and engine water temperature. Drive the vehicle. Verify the code can be reproduced and verify the reading shown on the diagnostic tool. Observe the gauges and check for hot fluid when the code is produced.
2. If the fluid is not hot when the code is produced, remove the connectors at the ECU and the transmission. Check the fluid temperature sensor wiring for opens, shorts, and shorts-to-ground. Compare the resistance readings of the sensor and the actual temperature as shown on the gauge with Figure 6–12 on previous page. If wiring problems or a great difference between temperature and resistance compared with the chart are found, drain the fluid, remove the control module, and replace the temperature sensor (refer to the Service Manual for the transmission being checked). If wiring problems are found, repair or replace as necessary.
3. If the fluid is hot when the code is produced, observe the gauges to see if the engine became hot before the transmission. If the engine cooling system is overheating and heating the transmission, the problem is with the engine or its cooling system.
4. If the transmission became hot before the engine, allow the vehicle to idle for 3–5 minutes and check the transmission fluid level. Correct the fluid level if necessary.
5. Attach pressure gauges to the cooling system (from a “to cooler” connection to a point after the cooling circuit filter) and check for pressure drop problems. If pressure drop is excessive (refer to Table 6–5), check for a plugged cooler filter, collapsed lines, obstructions, etc.
6. If the fluid level is correct and the cooling circuits satisfactory, drain the fluid, remove the control module, and inspect for damaged valve body gaskets. Replace any damaged gaskets (refer to the appropriate transmission Service Manual).
7. If no problems are found in the control module area, remove the transmission and disassemble, inspecting for causes of overheating (stuck stator, plugged orifices, dragging clutches, etc.). (See the Service Manual for the transmission being checked.)

**Table 6–5. External Hydraulic Circuit Characteristics
Non-Retarder, PTO, 93°C (200°F) Sump Temperature**

HD/B 500

**CONVERTER OPERATION
MAXIMUM
COOLER FLOW**

Input rpm	Flow		Pressure Drop	
	L/s	gpm	kPa	psi
600	0.22	3.4	0	0
900	0.38	6.1	0	0
1200	0.55	8.7	0	0
1500	0.80	12.7	0	0
1800	1.03	16.4	0	0
2100	1.13	18.0	0	0
2300	1.20	19.0	0	0

**CONVERTER OPERATION
MAXIMUM ALLOWABLE
PRESSURE DROP**

Input rpm	Flow		Pressure Drop	
	L/s	gpm	kPa	psi
600	0.20	3.2	31	4.5
900	0.37	5.8	63	9.1
1200	0.55	8.7	108	15.7
1500	0.77	12.2	167	24.2
1800	0.92	14.5	213	30.9
2100	0.97	15.3	238	34.5
2300	1.00	15.9	250	36.3

CODE 24 XX — SUMP FLUID TEMPERATURE (*Figures 6–10, 6–11*)

**Table 6–6. External Hydraulic Circuit Characteristics
Non-Retarder, PTO, 93°C (200°F) Sump Temperature**

MD/B 300/B 400

**CONVERTER OPERATION
MAXIMUM COOLER FLOW**

Input rpm	Flow		Pressure Drop	
	L/s	gpm	kPa	psi
600	0.10	1.6	0	0
800	0.23	3.7	0	0
1200	0.47	7.4	0	0
1400	0.61	9.7	0	0
1600	0.74	11.7	0	0
2000	0.94	14.9	0	0
2400	1.19	18.9	0	0
3200	1.28	20.3	0	0

**LOCKUP OPERATION
MAXIMUM COOLER FLOW**

Input rpm	Flow		Pressure Drop	
	L/s	gpm	kPa	psi
600	0.10	1.6	0	0
800	0.23	3.7	0	0
1200	0.50	7.9	0	0
1400	0.63	10.0	0	0
1600	0.77	12.2	0	0
2000	0.95	15.1	0	0
2400	1.12	17.8	0	0
2800	1.22	19.3	0	0
3200	1.28	20.3	0	0

**CONVERTER OPERATION
MAXIMUM ALLOWABLE
PRESSURE DROP**

Input rpm	Flow		Pressure Drop	
	L/s	gpm	kPa	psi
600	0.10	1.6	10	1.5
800	0.22	3.5	40	5.8
1200	0.45	7.1	159	23.1
1400	0.57	9.0	252	36.6
1600	0.67	10.6	338	49.0
2000	0.80	12.7	481	69.8
2400	0.85	13.5	549	79.6
3200	0.85	13.5	549	79.6

**LOCKUP OPERATION
MAXIMUM ALLOWABLE
PRESSURE DROP**

Input rpm	Flow		Pressure Drop	
	L/s	gpm	kPa	psi
600	0.10	1.6	5	0.7
800	0.23	3.7	46	6.7
1200	0.48	7.6	148	21.5
1400	0.62	9.8	247	35.8
1600	0.73	11.6	346	50.2
2000	0.90	14.3	561	81.4
2400	1.07	17.0	737	106.9
2800	1.10	17.4	770	111.7
3200	1.10	17.4	791	114.7

CODE 25 XX — OUTPUT SPEED SENSOR, DETECTED AT ZERO SPEED, X RANGE

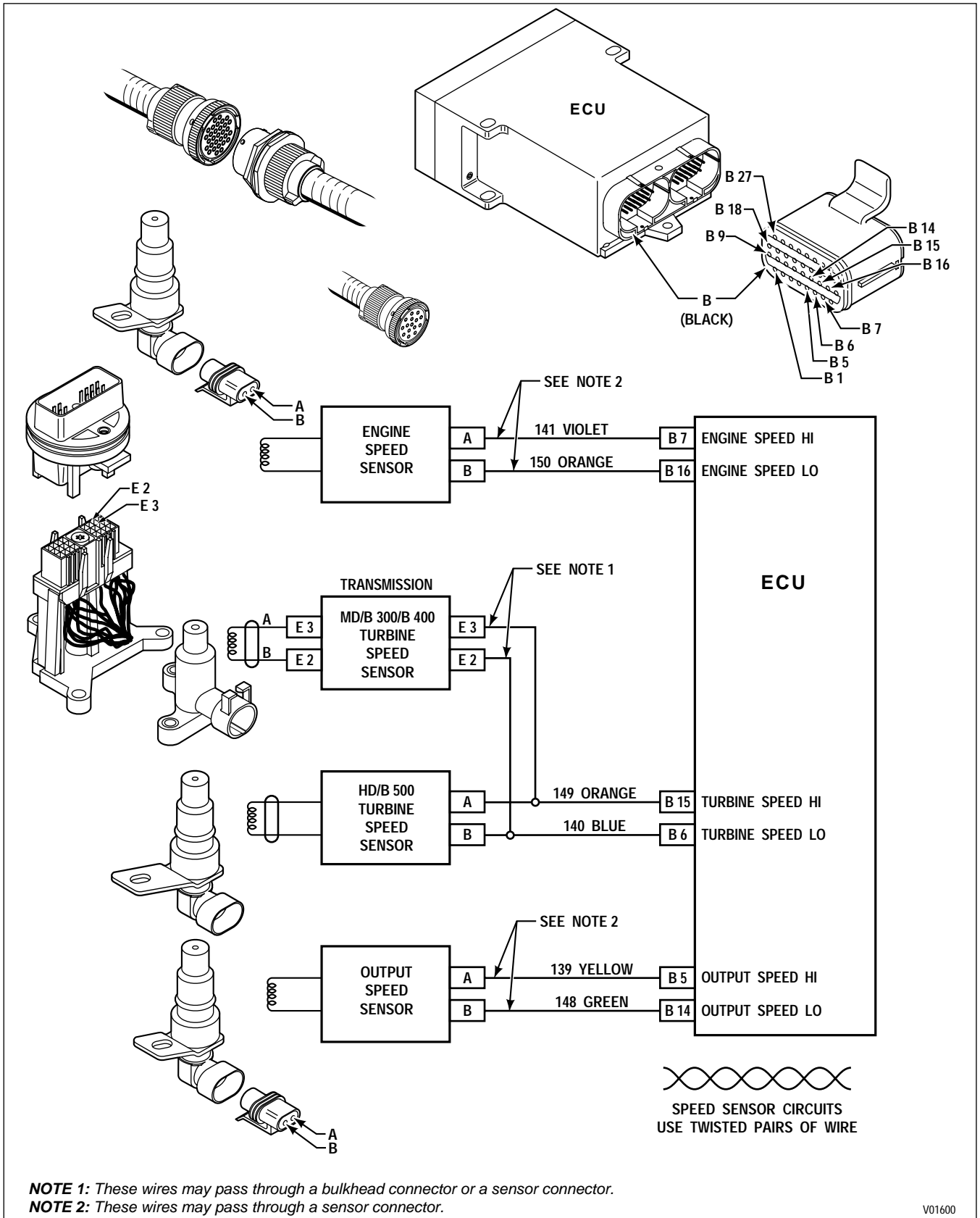


Figure 6-13. Code 25 Schematic Drawing (Units Produced Prior To 9/94)

CODE 25 XX — OUTPUT SPEED SENSOR, DETECTED AT ZERO SPEED, X RANGE

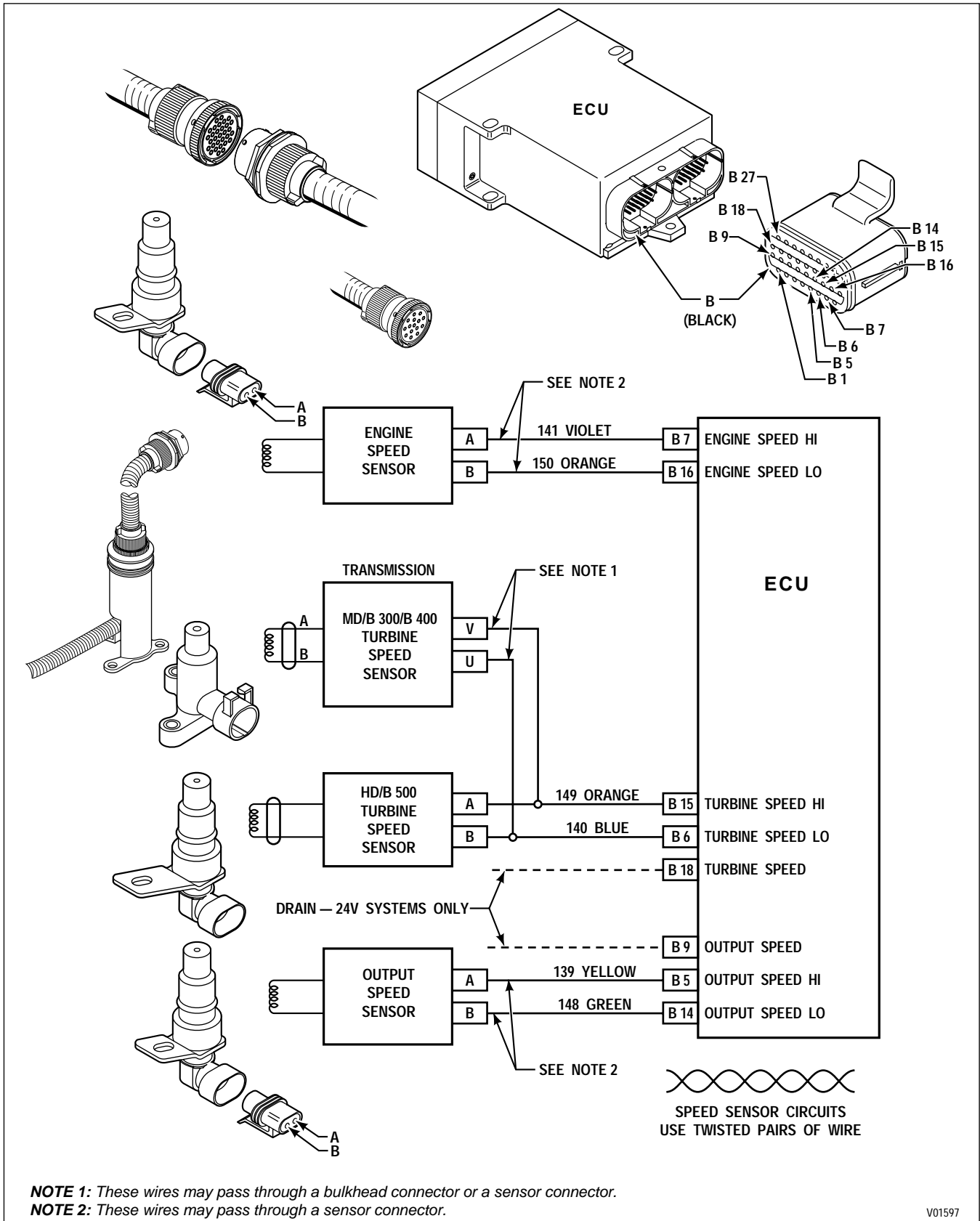


Figure 6-14. Code 25 Schematic Drawing (Units Produced 9/94-12/97)

CODE 25 XX — OUTPUT SPEED SENSOR, DETECTED AT ZERO SPEED, X RANGE (*Figures 6-13, 6-14*)

Main code 25 occurs if the output speed sensor reports a zero speed reading while both engine and turbine speeds are approximately equal, turbine speed is above a calibration value, and neutral is not selected or commanded. Main code 25 indicates either the output speed sensor has failed or the required oncoming clutch or clutches did not come on. Code 25 11 can be generated by a false turbine speed reading. This may be due to crosstalk between solenoid and turbine speed sensor circuits caused by direct wire-to-wire short or by water in the electrical connectors. See Section 4 for corrective action.

NOTE: *If Code 25 XX is in memory at ECU initialization (ignition on) all display segments are illuminated.*

Main Code	Subcode	Meaning	Applied Clutches
25	00	Output speed sensor, detected at zero speed, low range	C3, C6
25	11	Output speed sensor, detected at zero speed, 1st range	C1, C5
25	22	Output speed sensor, detected at zero speed, 2nd range	C1, C4
25	33	Output speed sensor, detected at zero speed, 3rd range	C1, C3
25	44	Output speed sensor, detected at zero speed, 4th range	C1, C2
25	55	Output speed sensor, detected at zero speed, 5th range	C2, C3
25	66	Output speed sensor, detected at zero speed, 6th range	C2, C4
25	77	Output speed sensor, detected at zero speed, reverse	C3, C5

Active Indicator Clearing Procedure:

- Power down
- Manual
- Self-clearing

NOTE: *Before troubleshooting, read Pages 6-17 and 6-18 of Section 6-5. Also, check battery and ECU input voltages.*

NOTE: *Intermittent connections or lack of battery-direct power and ground connections can cause this and other codes.*

1. Check the transmission fluid level and ensure correct fluid level.
2. Check for the presence of Code 22 16. If Code 22 16 is in the code list, go to Code 22 XX section and follow troubleshooting steps for Code 22 16.
3. Connect the Pro-Link® 9000 with ignition on, engine off; check for indication of turbine speed. If turbine speed is indicated, refer to Section 4-2 for corrective action.
4. If the output speed sensor and wiring are satisfactory, install pressure gauges into the appropriate clutch pressure taps (see appropriate transmission Service Manual or Appendix B in this manual) and make the shift again. See if either of the clutches has low or no pressure. Lack of pressure in first range may be due to a G solenoid stuck closed.
5. If a clutch is leaking pressure, drain the fluid, remove the control module and check for damaged valve body gaskets and stuck or sticky valves. If no problems are found, replace the solenoids for the clutches used in the range indicated by the code (refer to Figure 6-1). Refer to the appropriate transmission Service Manual for replacement procedure.

**CODE 25 XX — OUTPUT SPEED SENSOR, DETECTED AT ZERO SPEED,
X RANGE** (*Figures 6-13, 6-14*)

6. If, after detecting leaking pressure and replacing solenoids, the problem persists, check for worn clutch or piston seals. Remove the transmission and repair or replace as necessary (refer to the proper transmission Service Manual).
7. This code requires accurate output and turbine speed readings. If there were no transmission problems detected, use the diagnostic tool and watch the speed readings for noise (erratic signals) from low speed to high speed in the range indicated by the code.
8. If a noisy sensor is found, check the sensor resistance (refer to the sensor resistance chart below) and check its wiring for opens, shorts, and shorts-to-ground (see Code 22 XX). Also closely check the terminals in the connectors for corrosion, contamination, or damage. Ensure the wiring to the sensors is a properly twisted wire pair. Remove the sensor and check for damage at the tone wheel end. Check for looseness of the tone wheel. Refer to the appropriate Service Manual if repair of a loose tone wheel is necessary. Replace the sensor if it is damaged or if its resistance (refer to Service Manual for proper procedure) is incorrect and isolate and repair any noted wiring problems. (Use twisted-pair if new speed sensor circuit is needed in external harness. Service Harness Twisted Shielded Pair P/N 29522703 is available for this procedure.)

Resistance	Temp. °C	Temp. °F
200 Ω	-40	-40
300 Ω	20	68
400 Ω	110	230

9. If no apparent cause for the code can be located, replace the turbine and output speed sensors. Refer to the appropriate transmission Service Manual for proper procedure.
10. If the condition persists, replace the ECU. If replacing the ECU corrects the problem, reinstall the original (bad) ECU to confirm that the problem is in the ECU. If the original ECU now works, inspect the ECU connectors for any corrosion or damage which may cause an intermittent condition. If the original problem recurs, reinstall the replacement ECU.

CODE 32 XX — C3 PRESSURE SWITCH

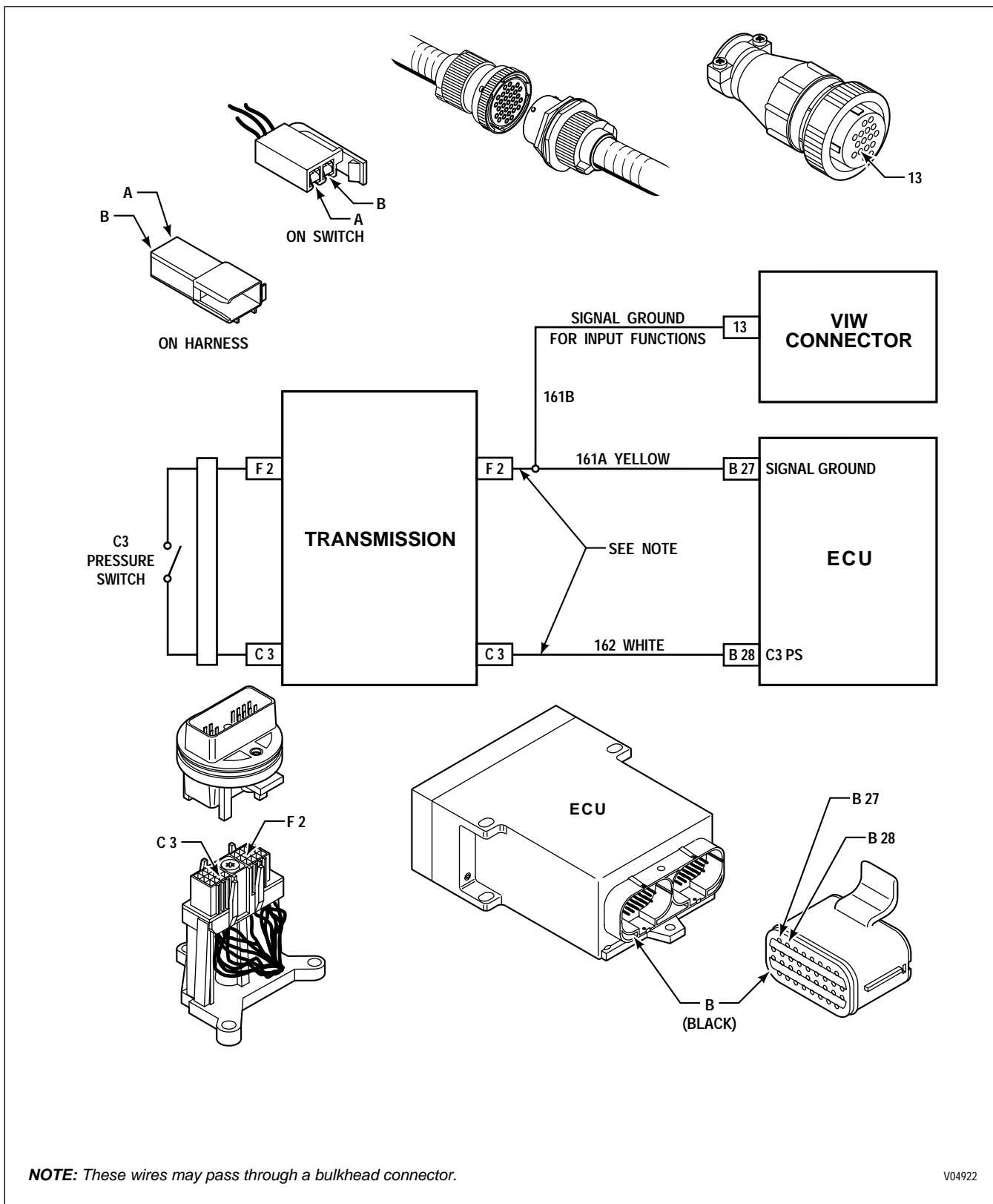


Figure 6-15. Code 32 Schematic Drawing (Units Produced Prior To 9/94)

CODE 32 XX — C3 PRESSURE SWITCH

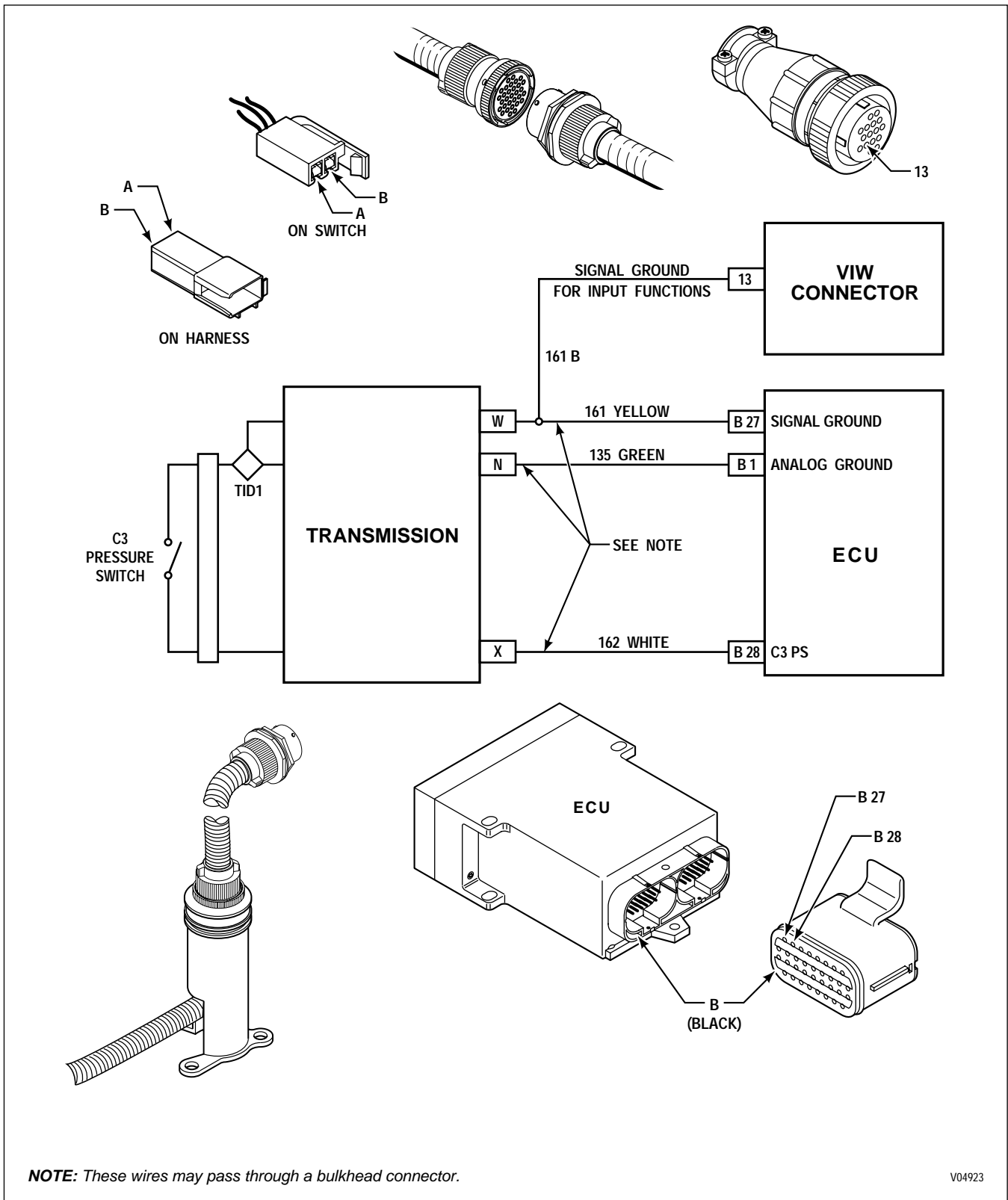


Figure 6-16. Code 32 Schematic Drawing (Units Produced 9/94-12/97)

CODE 32 XX — C3 PRESSURE SWITCH (*Figures 6-15, 6-16*)

Main code 32 indicates the transmission gear ratio is correct, but the C3 pressure switch is open when it should be closed.

Main Code	Subcode	Meaning
32	00	C3 switch open in low range
32	33	C3 switch open in third range
32	55	C3 switch open in fifth range
32	77	C3 switch open in reverse range

Active Indicator Clearing Procedure:

- Power down
- Manual
- Self-clearing

NOTE: *Before troubleshooting, read Pages 6-17 and 6-18 of Section 6-5. Also, check battery and ECU input voltages.*

CAUTION:

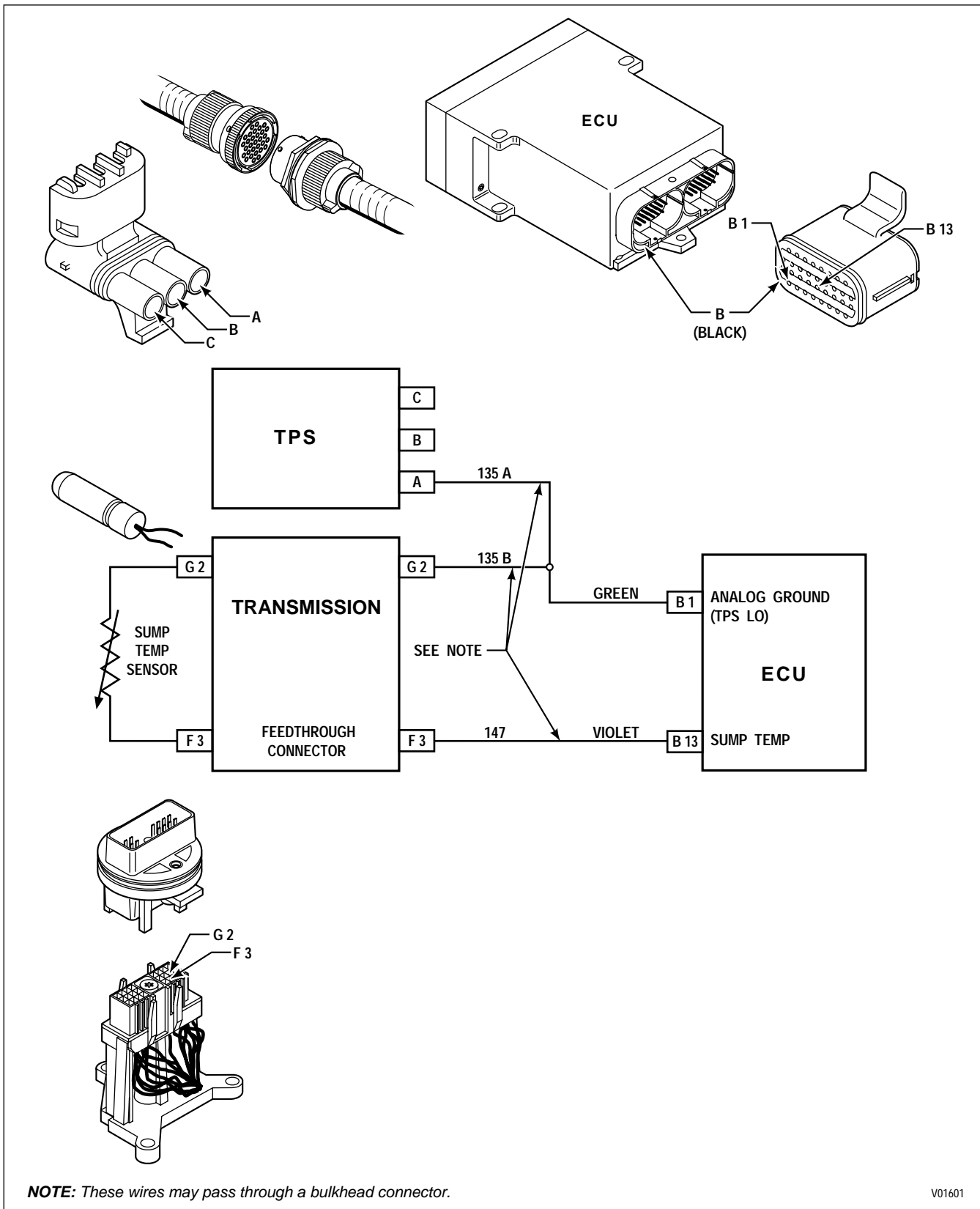
It is very important to correct any short-to-battery condition found. A short-to-battery can damage a circuit in the ECU, requiring the ECU to be replaced. Replacing a failed ECU without correcting the short-to-battery could damage the new ECU.

1. Disconnect the connectors at the ECU and the transmission. Check the C3 switch circuit for opens, shorts to other wires, shorts-to-ground, or shorts-to-battery. If wiring problems are found, isolate and repair. The C3 pressure switch closes at 206.8 ± 48 kPa (30 ± 7 psi). Resistance should be 2 Ohms maximum when the switch is closed and 20,000 – infinity (overlimit) Ohms when the switch is open.
2. If problems are not found in the external harness, drain the fluid, remove the control module, and check the internal harness for opens, shorts between wires, or shorts-to-ground (refer to the proper transmission Service Manual). If wiring problems are found, isolate and repair (see Appendix E, Paragraph 1-9).
3. If no wiring problems are found, replace the C3 pressure switch (refer to transmission Service Manual).
4. If the problem recurs, use spare wires for the C3 pressure switch circuit.
5. If the problem recurs again, replace the internal harness.
6. If the condition persists, replace the ECU. If replacing the ECU corrects the problem, reinstall the original (bad) ECU to confirm that the problem is in the ECU. If the original ECU now works, inspect the ECU connectors for any corrosion or damage which may cause an intermittent condition. If the original problem recurs, reinstall the replacement ECU.

DIAGNOSTIC CODES

NOTES

CODE 33 XX — SUMP OIL TEMPERATURE SENSOR



V01601

Figure 6-17. Code 33 Schematic Drawing (Units Produced Prior To 9/94)

CODE 33 XX — SUMP OIL TEMPERATURE SENSOR

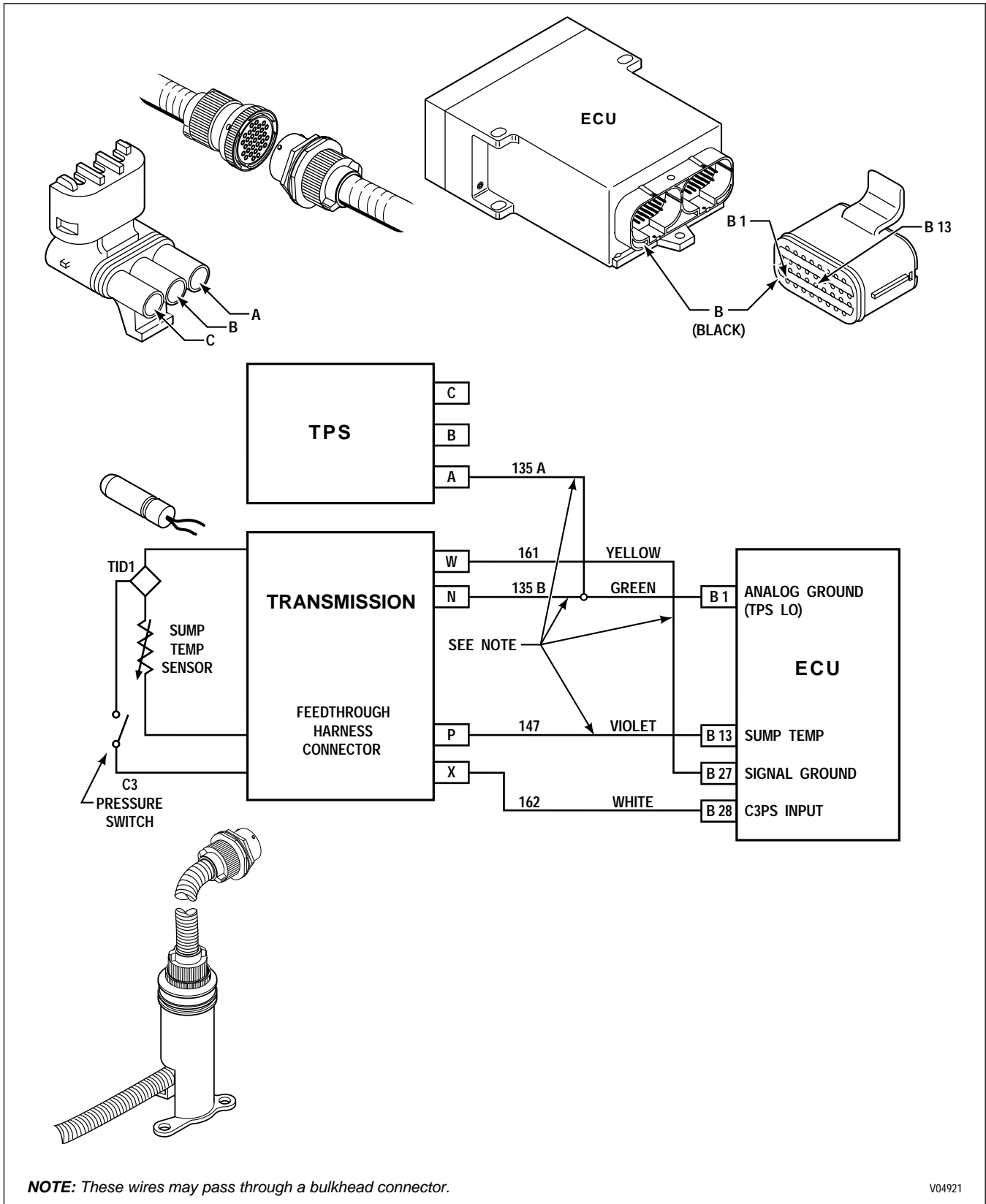


Figure 6-18. Code 33 Schematic Drawing (Units Produced 9/94-12/97)

CODE 33 XX — SUMP OIL TEMPERATURE SENSOR (*Figures 6–17, 6–18*)

Main code 33 indicates the sump temperature sensor is providing a signal outside the usable range of the ECU. This code indicates the sensor failed showing abnormally high or low temperature readings. Main code 33 can be caused by a component or circuit failure or by extremely high or low temperatures. There are no operational inhibits related to main code 33. The ECU assumes a hardware failure and that transmission temperatures are normal (93°C; 200°F). Temperatures above or below normal cause poor shift quality.

NOTE: *Code 33 23 in conjunction with Code 21 23 indicates the loss of common ground (wire 135) between the throttle and temperature sensors.*

Main Code	Subcode	Meaning
33	12	Temperature sensor failed low
33	23	Temperature sensor failed high

Active Indicator Clearing Procedure:

- Power down
- Manual
- Self-clearing

NOTE: *Before troubleshooting, read Pages 6–17 and 6–18 of Section 6–5. Also, check the transmission fluid level.*

Troubleshooting:

1. If possible, check the sump temperature with a DDR. If a DDR is not available, use the shift selector display to determine if the code is active (refer to Section 6–2). Disconnect harness at ECU and check resistance of the sensor and compare with Figure 6–19.
2. If Step 1 reveals that the extreme temperature indication is no longer present, the temperature limit could have been reached due to operational or ambient temperature extremes. Also, you may be experiencing an intermittent problem and the code will not be active. Proceed cautiously, it is unlikely there is a sensor hardware fault.
3. Disconnect the external harness at the transmission. Check the connectors and terminals for dirt, corrosion, or damage. Clean or replace as necessary.
4. Check the sensor wires in the external harness for opens (Code 33 23), shorts between wires, or shorts-to-ground (code 33 12 — refer to Section 4). If wiring problems are found, isolate and repair as described in Appendix E.
5. If no harness problems are found check the feedthrough connector for damage. If the feedthrough harness connector is satisfactory, drain the fluid and remove the control module. Check for chafing of the sensor wires, especially near the separator plate. Eliminate the chafe point and repair the wire as required. If no chafe point is found, replace the sensor (refer to the Transmission Service Manual and Appendix E, Paragraph 1–14 in this Manual).
6. If the problem recurs, use spare wires in the external harness for the temperature sensor circuit.
7. If the condition persists, replace the ECU. If replacing the ECU corrects the problem, reinstall the original (bad) ECU to confirm that the problem is in the ECU. If the original ECU now works, inspect the ECU connectors for any corrosion or damage which may cause an intermittent condition. If the original problem recurs, reinstall the replacement ECU.

CODE 33 XX — SUMP OIL TEMPERATURE SENSOR (Figures 6-17, 6-18)

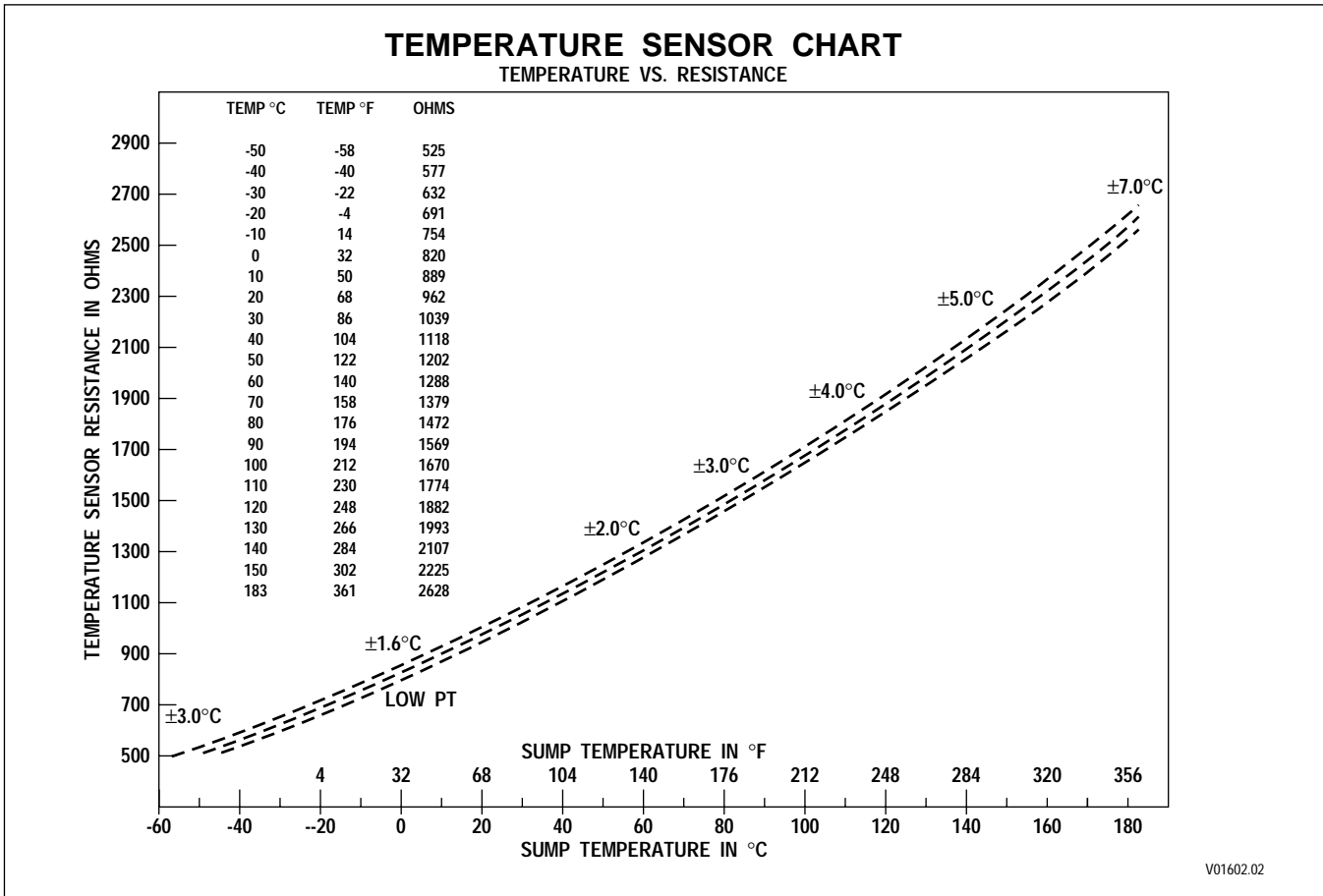


Figure 6-19. Temperature Sensor Chart

CODE 34 XX — EEPROM COMPATIBILITY OR CHECKSUM FAULT

Main code 34 indicates there is a problem with the calibration EEPROM.

Main Code	Subcode	Meaning
34	12	EEPROM, factory calibration compatibility number wrong
34	13	EEPROM, factory calibration checksum
34	14	EEPROM, power off block checksum
34	15	EEPROM, diagnostic queue block checksum
34	16	EEPROM, real-time block checksum

Active Indicator Clearing Procedure:

- Power down

NOTE: *Copying and reloading the current calibration into the ECU will not correct the fault.*

Troubleshooting:

1. If the code set is 34 14 and it occurs in conjunction with Code 35 00, proceed to find the cause for Code 35 00 and correct it.
2. After the cause for Code 35 00 has been corrected, drive the vehicle to see if Code 34 14 recurs. If Code 34 14 recurs, proceed to Step 3.
3. Reprogram the correct calibration into the EEPROM. Contact your nearest Allison distributor/ dealer for locations qualified to do recalibration. Be certain the calibration and the software level are compatible.
4. If the code recurs after reprogramming the EEPROM calibration, replace the ECU.

CODE 35 XX — POWER INTERRUPTION

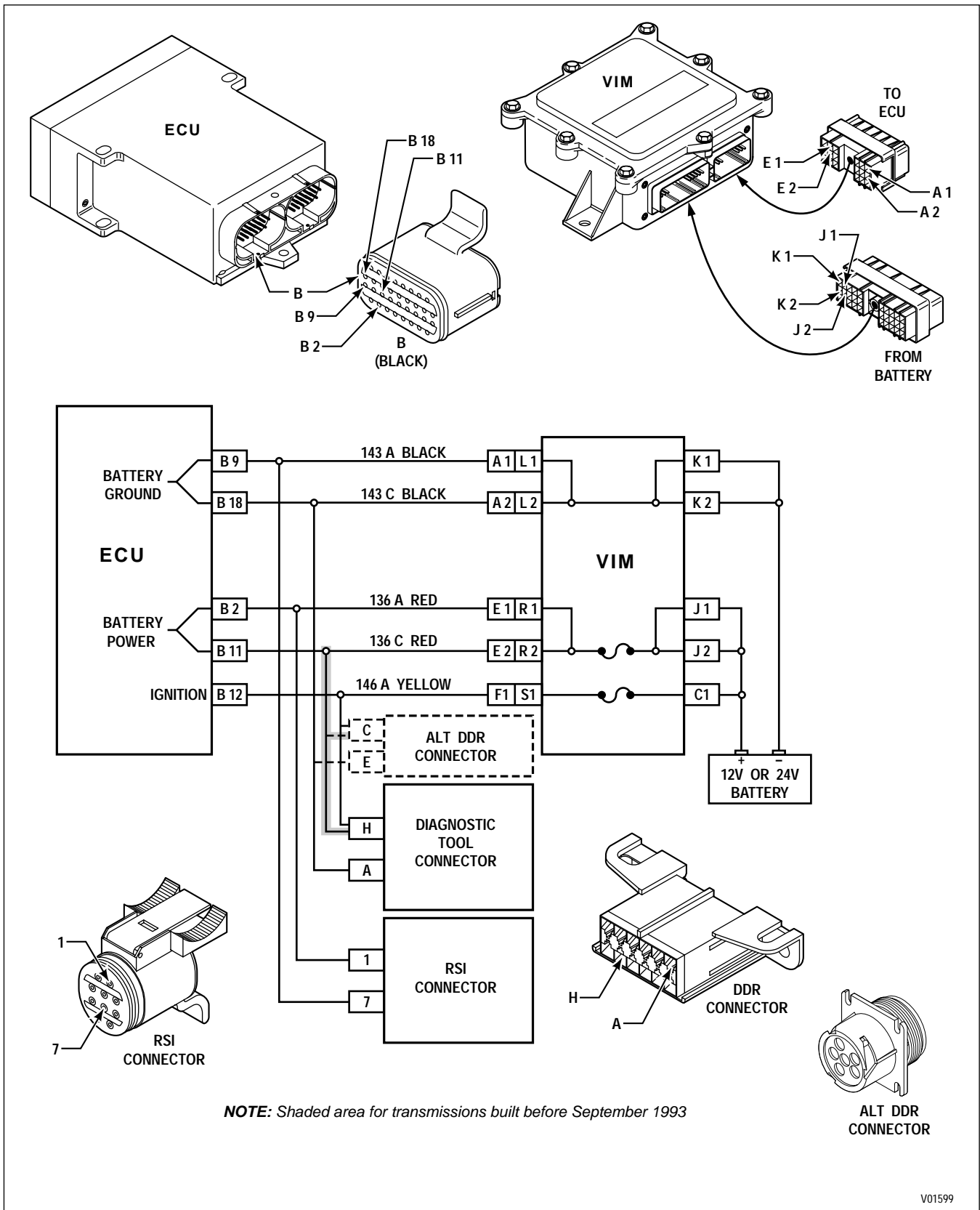


Figure 6-20. Code 35 Schematic Drawing

CODE 35 XX — POWER INTERRUPTION (*Figure 6–20*)

Main code 35 indicates the ECU has detected a complete power loss before the ignition was turned off. When this happens, the ECU is not able to save the current operating parameters in memory before turning itself off.

Main Code	Subcode	Meaning
35	00	Power interruption. (Not an active code; only appears after power is restored.) During power interruption, DNS light is not illuminated and the transmission will not shift.
35	16	Real-time EEPROM write interruption. (Power interruption at the same time the ECU is recording a critical code to the real-time section of the EEPROM.)

Active Indicator Clearing Procedure:

- Power down
- Manual — except Code 35 16

NOTE: *Before troubleshooting, read Pages 6–17 and 6–18 of Section 6–5. Also, check battery and ECU input voltages.*

Troubleshooting:

1. If the vehicle has a master switch controlling battery power to the ECU and an ignition switch, turning the master switch off before turning the ignition switch off can cause this code. No troubleshooting is necessary.
2. If improper switch sequencing is not the cause, check ECU power and ground for opens, shorts, and shorts-to-ground. Not using battery-direct power and battery ground connections can cause this code. A defective charging system, or open battery fuse or fusible link can also cause this code. The battery fuse or fusible link may be at the battery or in the VIM. Dirty, corroded, or painted power and ground connections can also cause this code.
3. If all system power and ground connections are satisfactory and the problem persists, replace the ECU. If replacing the ECU corrects the problem, reinstall the original (bad) ECU to confirm that the problem is in the ECU. If the original ECU now works, inspect the ECU connectors for any corrosion or damage which may cause an intermittent condition. If the original problem reoccurs, reinstall the replacement ECU.

CODE 36 XX — HARDWARE AND SOFTWARE NOT COMPATIBLE

Main code 36 indicates the system has detected a mismatch between the ECU hardware and the ECU EPROM software or that there is a TransID (TID) problem.

Main Code	Subcode	Meaning
36	00	Mismatch between ECU hardware and software

Active Indicator Clearing Procedure:

- Power down

CAUTION: Static electricity can destroy the EEPROM. If the ECU must be opened, use the Anti-Static Wrist Strap BT 8639-B to prevent a static electricity discharge to the EEPROM.

Troubleshooting:

1. Correction for subcode 36 00 requires the installation of EPROM software that is compatible with the ECU hardware involved. (If a different EEPROM calibration is required, update the ECU hardware to be compatible.)

CODE 41 XX — OPEN OR SHORT-TO-GROUND IN SOLENOID CIRCUIT

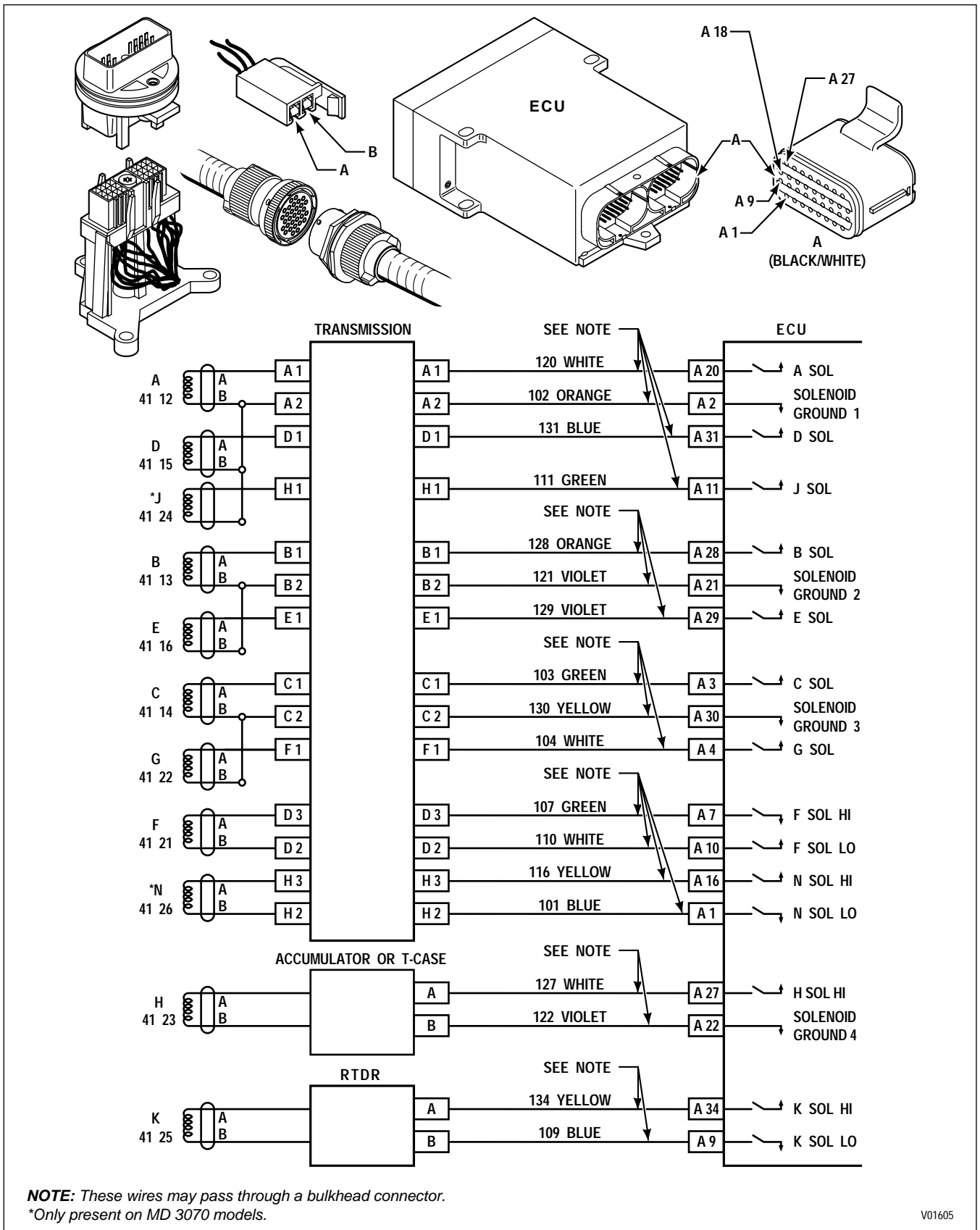


Figure 6-21. Code 41 Schematic Drawing (Units Produced Prior To 9/94)

CODE 41 XX — OPEN OR SHORT-TO-GROUND IN SOLENOID CIRCUIT

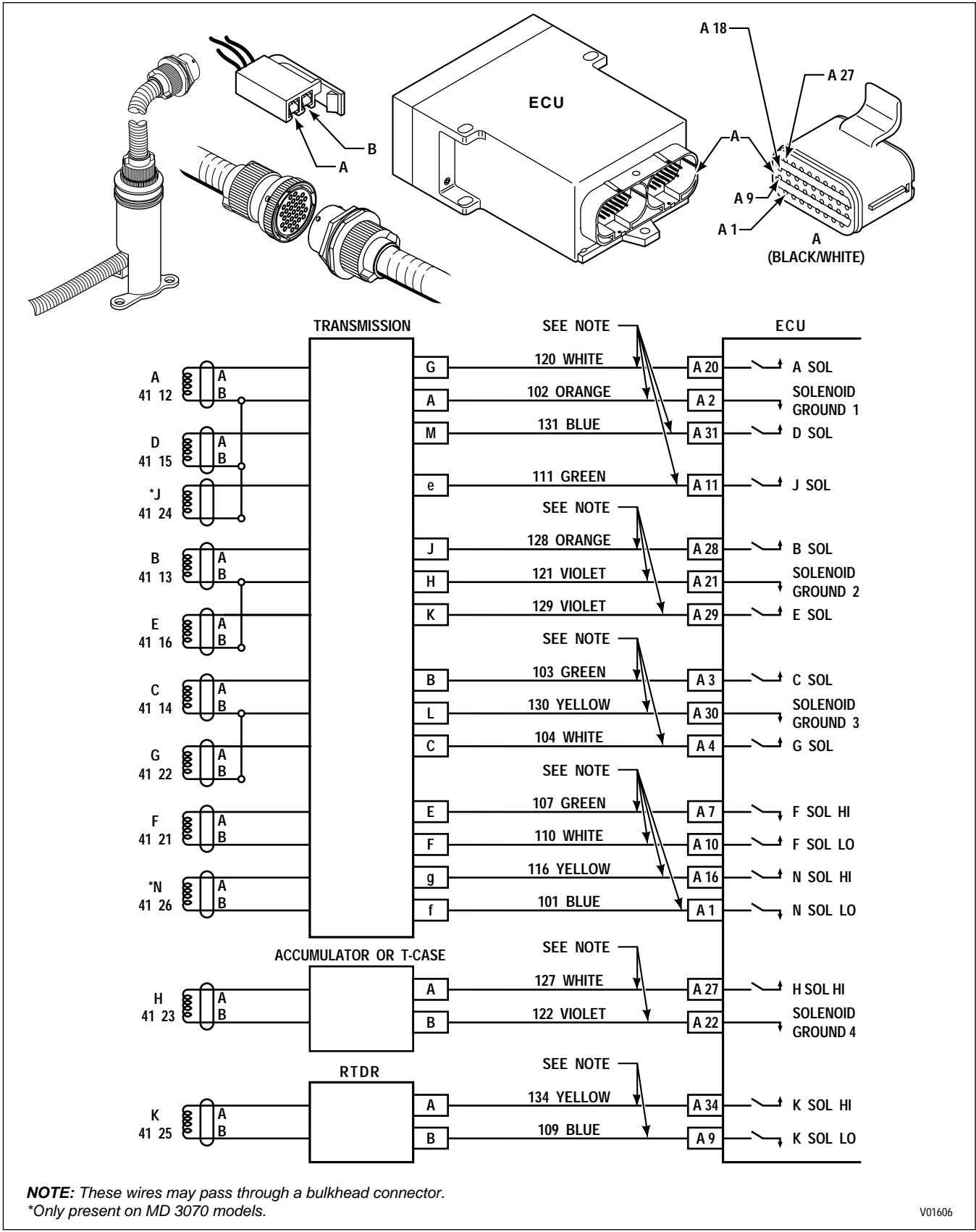


Figure 6-22. Code 41 Schematic Drawing (Units Produced 9/94-12/97)

CODE 41 XX — OPEN OR SHORT-TO-GROUND IN SOLENOID CIRCUIT

(Figures 6–21, 6–22)

Main code 41 indicates the ECU has detected either an open circuit or a short-to-ground in a solenoid or the solenoid wiring. The **DO NOT SHIFT** response is activated when this code is detected and all solenoids are turned off.

NOTE: For subcodes 12, 13, 14, 15, 16, 22 — neutral start is inoperable; all display segments are on if the code is logged during ECU initialization (ignition on). Subcodes 21, 23, 24, 25, and 26 will not trigger the DO NOT SHIFT light.

NOTE: If solenoid resistance is about 1–2 Ohms, a short-to-ground code may not be set but could cause a burned-out solenoid driver in the ECU. Replace the solenoid when this occurs (see appropriate transmission Service Manual for replacement procedure). If the solenoid driver is burned out, 69 XX codes will be set. See the troubleshooting procedure for 69 XX codes.

Main Code	Subcode	Meaning
41	12	Open or Short-to-Ground A Solenoid Circuit
41	13	Open or Short-to-Ground B Solenoid Circuit
41	14	Open or Short-to-Ground C Solenoid Circuit
41	15	Open or Short-to-Ground D Solenoid Circuit
41	16	Open or Short-to-Ground E Solenoid Circuit
41	21	Open or Short-to-Ground F Solenoid Circuit
41	22	Open or Short-to-Ground G Solenoid Circuit
41	23	Open or Short-to-Ground H Solenoid Circuit
41	24	Open or Short-to-Ground J Solenoid Circuit
41	25	Open or Short-to-Ground K Solenoid Circuit
41	26	Open or Short-to-Ground N Solenoid Circuit

Active Indicator Clearing Procedure:

- Power down
- Manual

NOTE: Intermittent connections or lack of battery-direct power and ground connections may cause this and other codes.

CAUTION:

All solenoids (except “H”) are pulse width modulated to control current levels. Any DC battery voltage applied directly to the solenoid must be no greater than 5–6V to prevent damage to the solenoid coil.

CODE 41 XX — OPEN OR SHORT-TO-GROUND IN SOLENOID CIRCUIT

(Figures 6-21, 6-22)

PROBING THE CONNECTOR

When testing the control system from the feedthrough connector with the internal harness connected, contact with the following pairs of terminals will result in resistance measurements of two solenoids through a shared ground. The resistance should be twice that of a single solenoid. Refer to Figure 6-23 for solenoid resistance values versus temperature.

Terminals	Solenoids Which Share Ground
A1, D1	A, D
B1, E1	B, E
C1, F1	C, G

NOTE: Before troubleshooting, read Pages 6-17 and 6-18 of Section 6-5. Also, check battery and ECU input voltages.

NOTE: The retarder accumulator solenoid (“H”) has a 30 Ohm coil. Since “H” solenoid is not mounted in the sump, no relationship between temperature and resistance is required.

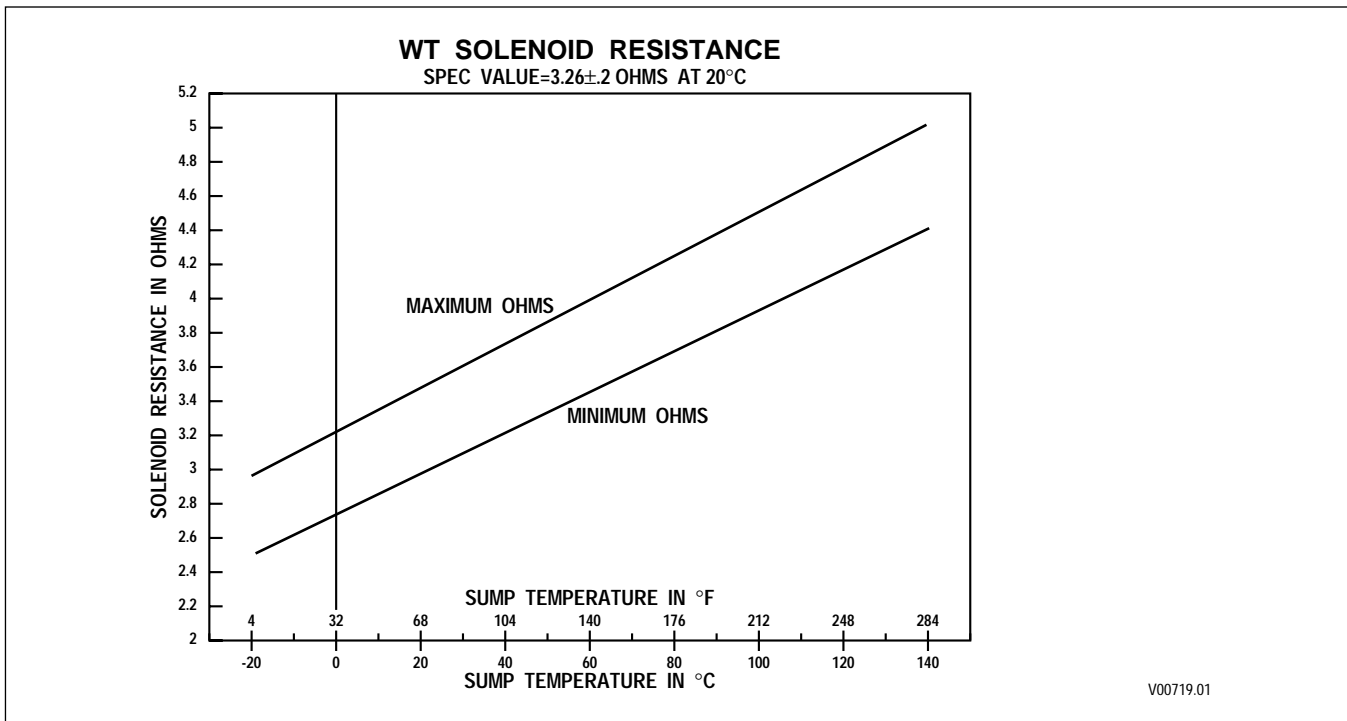


Figure 6-23. Solenoid Resistance vs. Temperature

CODE 41 XX — OPEN OR SHORT-TO-GROUND IN SOLENOID CIRCUIT*(Figures 6–21, 6–22)***Troubleshooting:**

1. Make sure the transmission connector is tightly connected. If the connector is properly connected, disconnect the harness at the transmission and check the terminals in the external harness and feedthrough connectors. Clean or replace as necessary.
2. If the connector is connected, clean, and not damaged, check the solenoid circuit in the transmission for opens or shorts to other wires (refer to the temperature/resistance chart). Refer to the system schematic and/or chart to identify wires in the internal harness which are connected. If an open or short circuit is located, drain the fluid, remove the control module (refer to the transmission Service Manual), and isolate the open or short. The fault is probably in the feedthrough connector, the internal harness, or the solenoid itself (refer to Figure 6–1 for solenoid location).
3. If the open or short is not found at the transmission connector, disconnect the connectors at the ECU and inspect the terminals in the connectors and the ECU for damage or contamination. Clean or replace as necessary. If the terminals are satisfactory, check the wires of the solenoid circuit in the external harness for continuity and shorts-to-ground or shorts between wires. If an open or short is found in one of the wires, isolate and repair it or use a spare wire in the external harness.
4. If the open or short is not found in either the transmission or the harness, the condition must be intermittent.
5. Drain the fluid, remove the control module, and replace the solenoid and internal harness (refer to the transmission Service Manual).
6. If the condition recurs, use spare wire(s) for the solenoid circuit indicated by the trouble code. See Appendix D for location of spare wires and Appendix E for connector assembly/disassembly information.
7. If the condition persists, replace the ECU. If replacing the ECU corrects the problem, reinstall the original (bad) ECU to confirm that the problem is in the ECU. If the original ECU now works, inspect the ECU connectors for any corrosion or damage which may cause an intermittent condition. If the original problem recurs, reinstall the replacement ECU.

DIAGNOSTIC CODES

NOTES

CODE 42 XX — SHORT-TO-BATTERY IN SOLENOID CIRCUIT

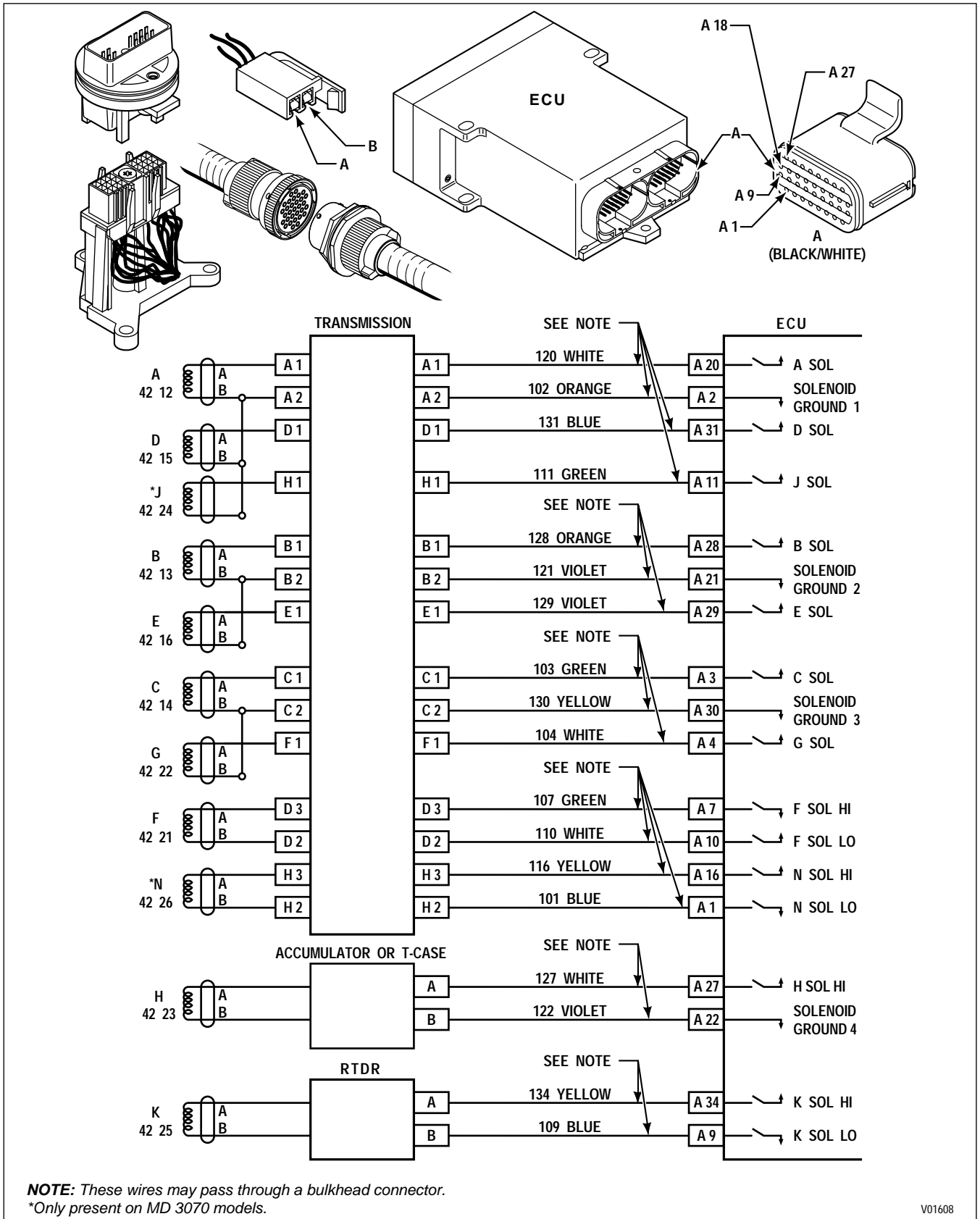


Figure 6-24. Code 42 Schematic Drawing (Units Produced Prior To 9/94)

CODE 42 XX — SHORT-TO-BATTERY IN SOLENOID CIRCUIT

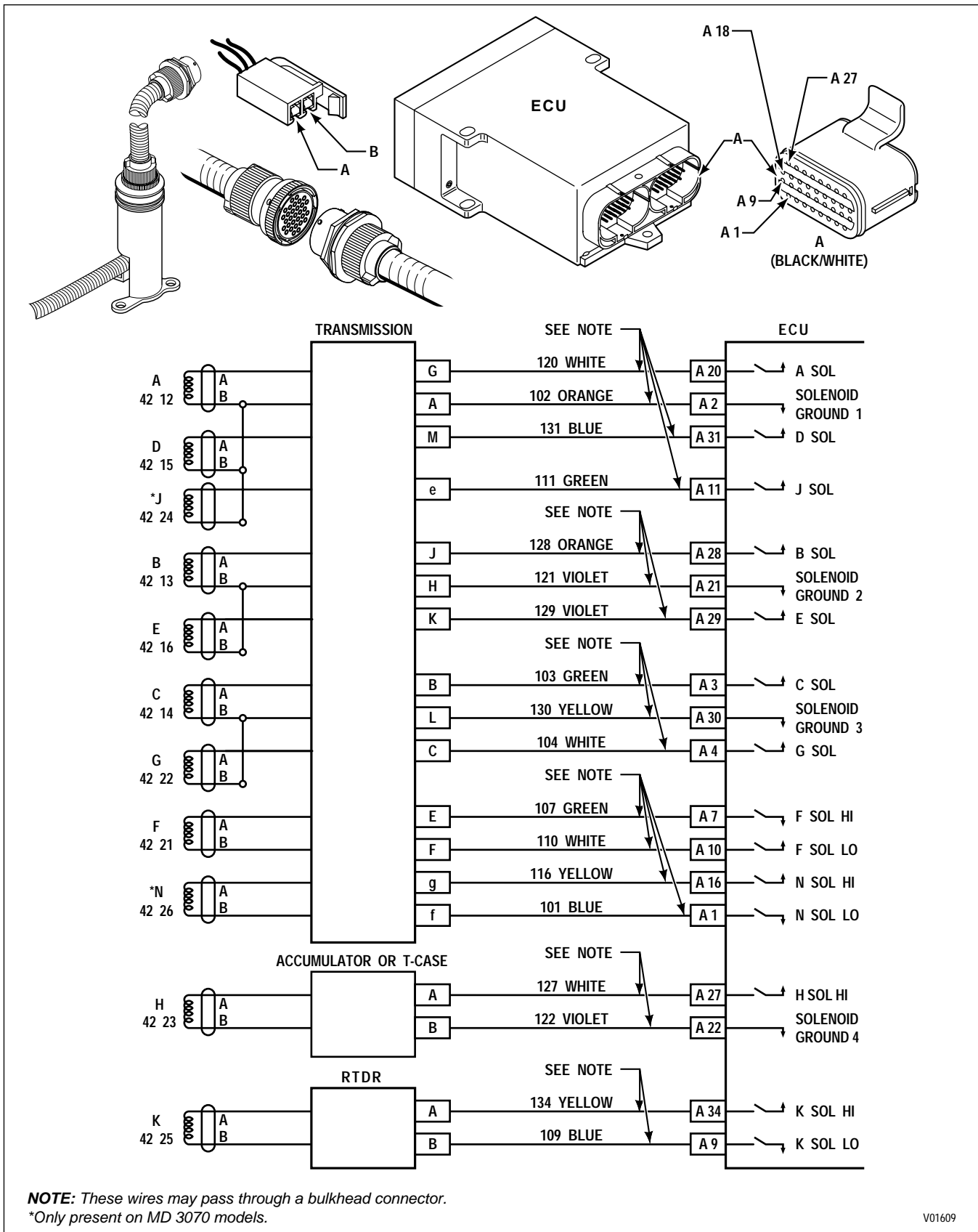


Figure 6-25. Code 42 Schematic Drawing (Units Produced 9/94-12/97)

CODE 42 XX — SHORT-TO-BATTERY IN SOLENOID CIRCUIT*(Figures 6–24, 6–25)*

Main code 42 indicates the ECU has detected a short-to-battery condition in a solenoid wiring circuit. Solenoids F and K have a second driver on the low (ground) side which can turn off the solenoid. All other solenoids have a driver only on the high (power) side of the solenoid. Even though the driver can be turned off, a stuck solenoid is shorted-to-battery which means it is continuously powered at an unregulated 12V or 24V instead of a regulated (pulse width modulated) voltage. A power-side driven solenoid stuck closed will not allow current regulation and the same code will occur. Eventually, the solenoid coil will burn up and become open. If the vehicle is turned off and restarted, a Code 41 XX occurs in early units and a Code 45 XX in later units.

NOTE: *For subcodes 12, 13, 14, 15, 16, 22 — neutral start is inoperable; all display segments are on if the code is logged during ECU initialization (ignition on). Subcodes 21, 23, 24, 25, and 26 will not trigger the DO NOT SHIFT light.*

NOTE: *If solenoid resistance is about 1–2 Ohms, a short-to-ground code may not be set but could cause a burned-out solenoid driver in the ECU. Replace the solenoid when this occurs (see appropriate transmission Service Manual for replacement procedure). If the solenoid driver is burned out, 69 XX codes will be set. See the troubleshooting procedure for 69 XX codes.*

Main Code	Subcode	Meaning
42	12	Short-to-Battery A Solenoid Circuit
42	13	Short-to-Battery B Solenoid Circuit
42	14	Short-to-Battery C Solenoid Circuit
42	15	Short-to-Battery D Solenoid Circuit
42	16	Short-to-Battery E Solenoid Circuit
42	21	Short-to-Battery F Solenoid Circuit
42	22	Short-to-Battery G Solenoid Circuit
42	23	Short-to-Battery H Solenoid Circuit
42	24	Short-to-Battery J Solenoid Circuit
42	25	Short-to-Battery K Solenoid Circuit
42	26	Short-to-Battery N Solenoid Circuit

Active Indicator Clearing Procedure:

- Power down
- Manual

NOTE: *Intermittent connections or lack of battery-direct power and ground connections may cause this and other codes.*

NOTE: *The retarder accumulator solenoid (“H”) has a 30 Ohm coil. Since “H” solenoid is not mounted in the sump, no relationship between temperature and resistance is required.*

NOTE: *Before troubleshooting, read Pages 6–17 and 6–18 of Section 6–5. Also, check battery and ECU input voltages.*

NOTE: *Energizing the solenoids and listening for ball/plunger movement is sometimes useful in troubleshooting.*

CODE 42 XX — SHORT-TO-BATTERY IN SOLENOID CIRCUIT
(Figures 6-24, 6-25)

PROBING THE CONNECTOR

When testing the control system from the feedthrough connector with the internal harness connected, contact with the following pairs of terminals will result in resistance measurements of two solenoids through a shared ground. The resistance should be twice that of a single solenoid. Refer to Figure 6-26 for solenoid resistance versus temperature.

Terminals	Solenoids Which Share Ground
A1, D1	A, D
B1, E1	B, E
C1, F1	C, G

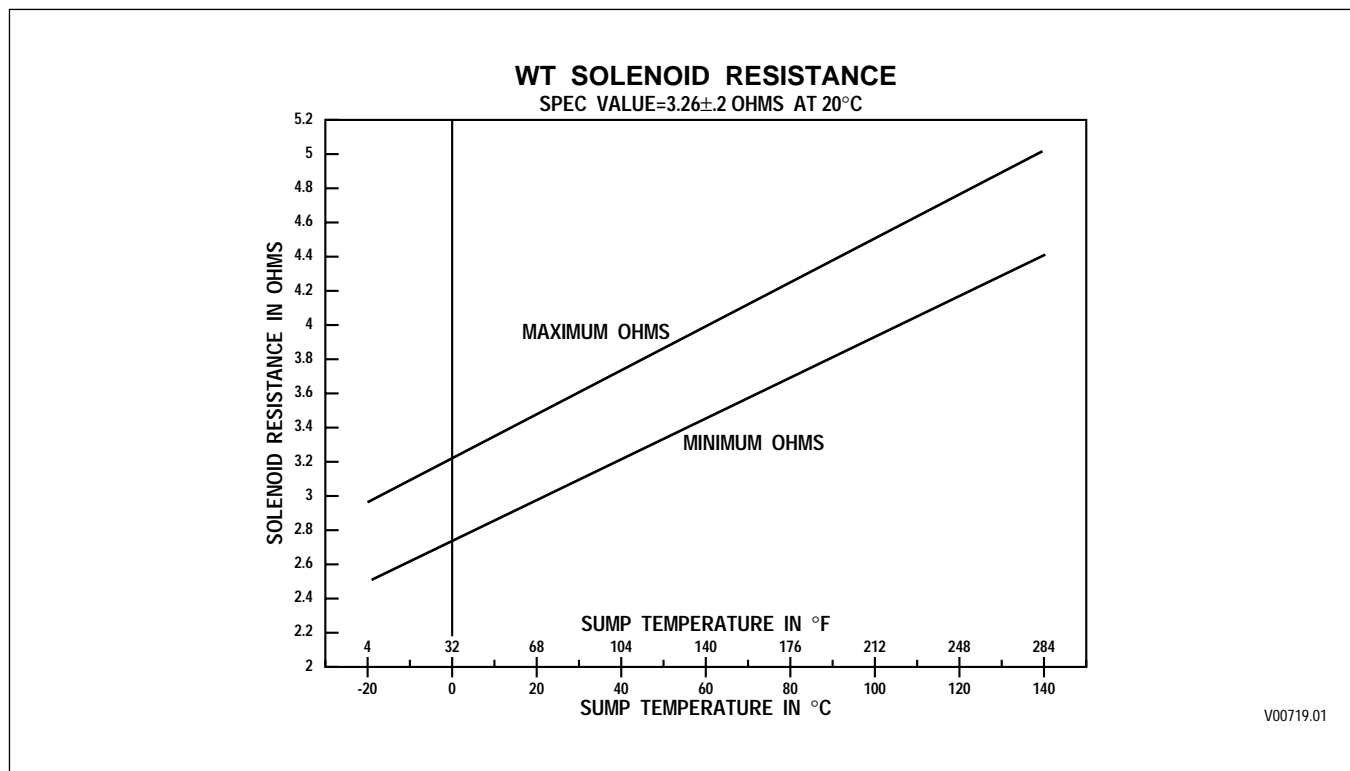


Figure 6-26. Solenoid Resistance vs. Temperature

Troubleshooting:

1. Make sure the transmission connector is tightly connected. If the connector is properly connected, disconnect the wiring harness at the transmission. Check the connector for water contamination and for corroded or damaged terminals. Clean or replace as necessary.
2. Test solenoid circuit at the transmission connector for shorts between the solenoid circuit being diagnosed and all other terminals in the connector. This test may be simplified by using the J 38850 test tool. Refer to the system schematic and/or chart to identify wires in the internal harness which are connected. If a short is found, isolate and repair the short. The short will probably be in the internal wiring harness.

CODE 42 XX — SHORT-TO-BATTERY IN SOLENOID CIRCUIT*(Figures 6–24, 6–25)*

3. If the short is not found at the transmission connector, disconnect the connectors at the ECU and check the wires of the solenoid circuit for shorts between the solenoid wires and all other terminals in both connectors (at the ECU). If the short is found in one of the wires, isolate and repair it or use a spare wire (Appendix E, 1–7).
4. If the short is not found in either the transmission or the harness, the condition must be intermittent.
5. Drain the fluid, remove the control module (see the transmission Service Manual), and replace the internal harness.
6. If the condition recurs, use spare wire(s) in the external harness for the solenoid circuit indicated by the trouble code. (Refer to Appendix D for location of spare wire(s) and Appendix E for connector assembly/disassembly information.)
7. If the condition persists, replace the ECU. If replacing the ECU corrects the problem, reinstall the original (bad) ECU to confirm that the problem is in the ECU. If the original ECU now works, inspect the ECU connectors for any corrosion or damage which may cause an intermittent condition. If the original problem recurs, reinstall the replacement ECU.

DIAGNOSTIC CODES

NOTES

CODE 43 XX — SOLENOID LOW SIDE CIRCUIT, OPEN DRIVER, OR WIRE SHORTED-TO-GROUND

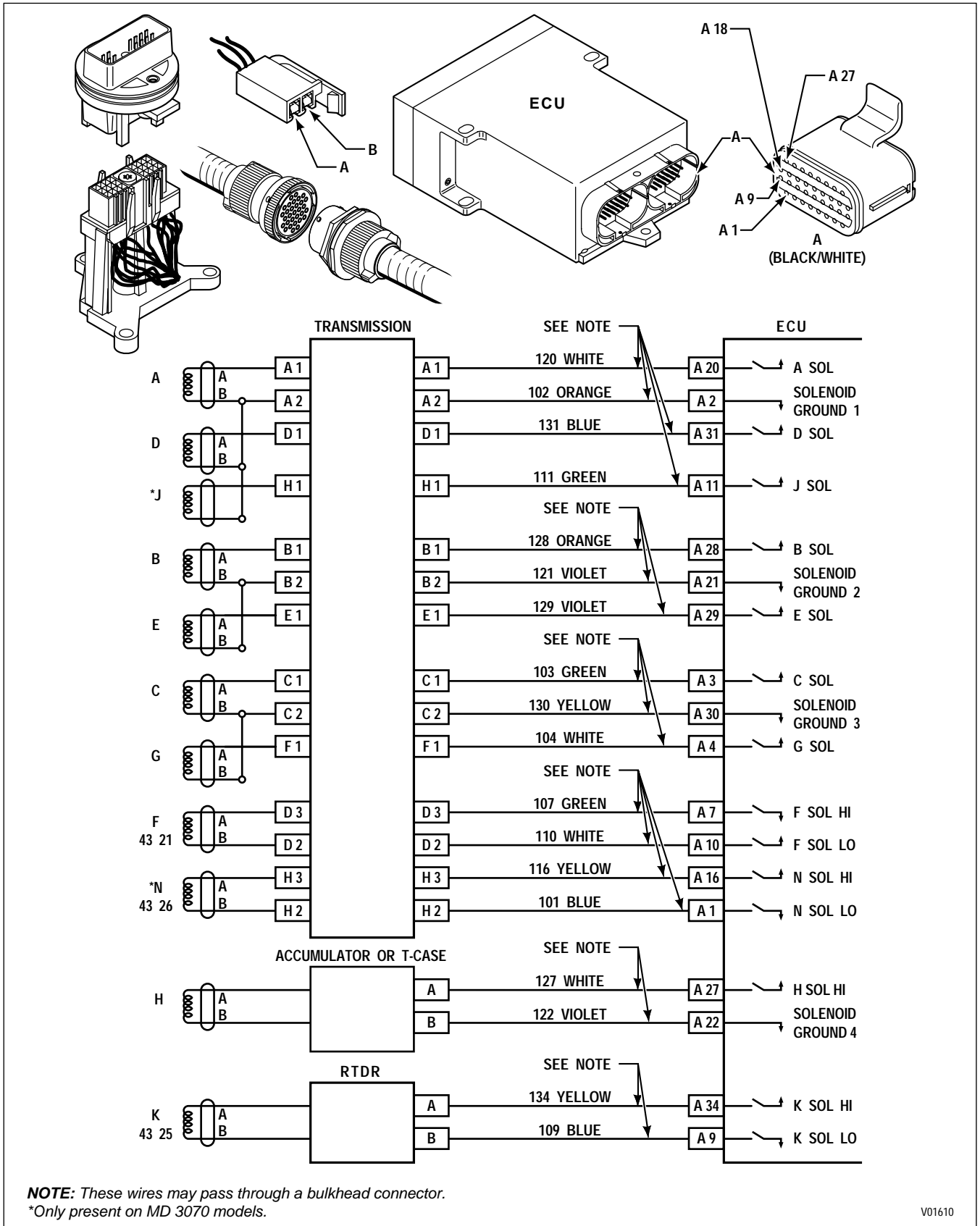
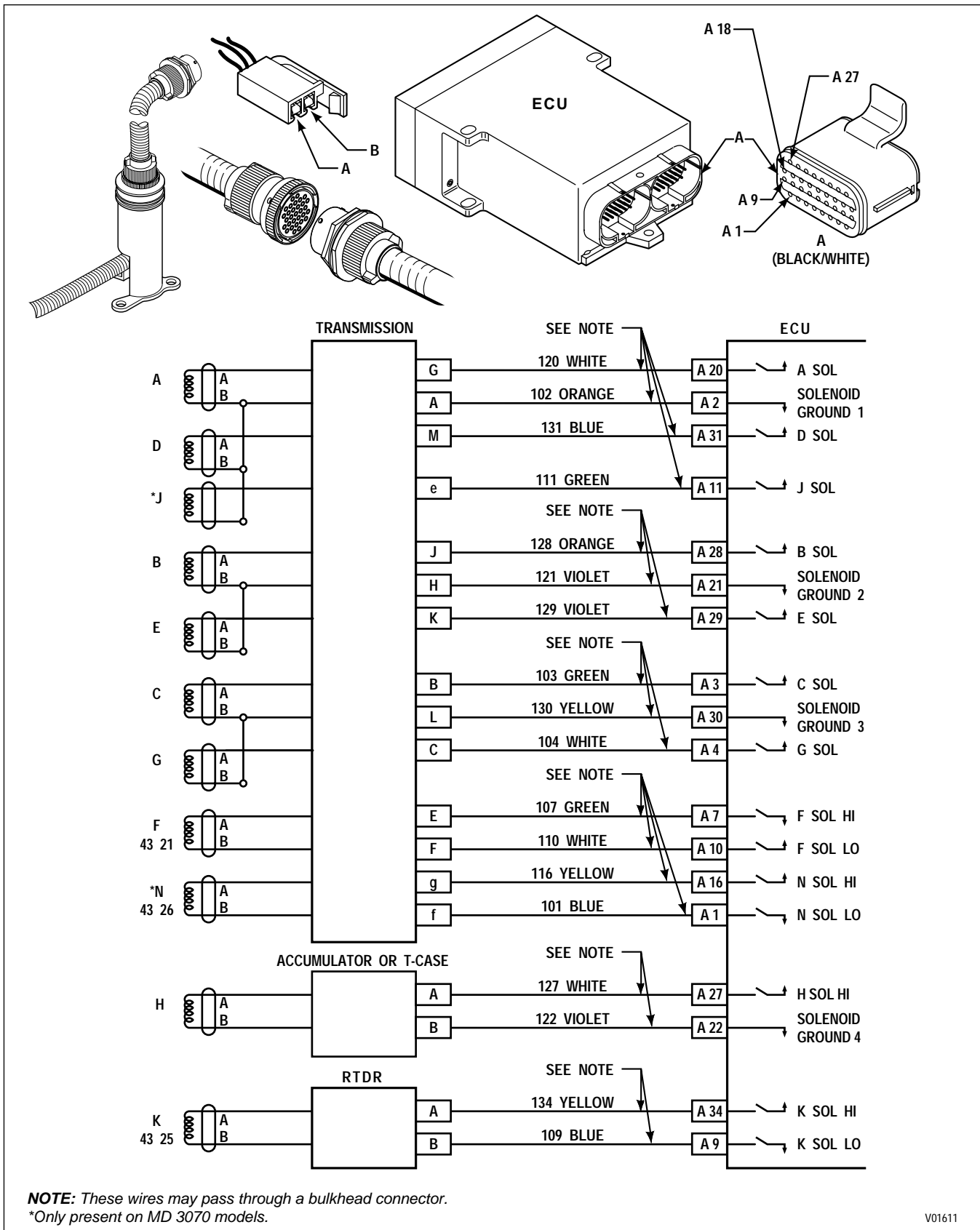


Figure 6-27. Code 43 Schematic Drawing (Units Produced Prior To 9/94)

CODE 43 XX — SOLENOID LOW SIDE CIRCUIT, OPEN DRIVER, OR WIRE SHORTED-TO-GROUND



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Figure 6-28. Code 43 Schematic Drawing (Units Produced 9/94-12/97)

CODE 43 XX — SOLENOID LOW SIDE CIRCUIT, OPEN DRIVER, OR WIRE SHORTED-TO-GROUND (Figures 6–27, 6–28)

Main code 43 indicates the ECU has detected an open solenoid low side driver (switch) or a low side (ground) solenoid wire shorted-to-ground. An open or short prevents the ECU from turning off the F or K solenoid on the high (power) and the low (ground) sides as required (described in Code 42 XX). A Code 43 XX can trigger a Code 45 XX.

NOTE: *If solenoid resistance is about 1–2 Ohms, a short-to-ground code may not be set but could cause a burned-out solenoid driver in the ECU. Replace the solenoid when this occurs (see appropriate transmission Service Manual for replacement procedure). If the solenoid driver is burned out, 69 XX codes will be set. See the troubleshooting procedure for 69 XX codes.*

Main Code	Subcode	Meaning
43	21	Low Side Driver F Solenoid Circuit open
43	25	Low Side Driver K Solenoid Circuit open
43	26	Low Side Driver N Solenoid Circuit open

Active Indicator Clearing Procedure:

- Power down
- Manual

NOTE: *Intermittent connections or lack of battery-direct power and ground connections may cause this and other codes.*

NOTE: *Before troubleshooting, read Pages 6–17 and 6–18 of Section 6–5. Also, check battery and ECU input voltages.*

Troubleshooting:

1. Make sure the transmission connector is tightly connected. If the connector is properly connected, disconnect the wiring harness at the transmission. Check the connector for water contamination and check terminals for corrosion or damage. Clean or replace as necessary.
2. If the external harness-to-transmission connection is satisfactory, check the solenoid circuits at the transmission connector for a short-to-chassis ground or a short-to-ground wire. (Tool J 38850 may be useful in making this test.) If a short is found, drain the fluid, remove the control module (refer to the Service Manual), isolate and repair the short. The short will probably be in the internal wiring harness (refer to Figure 6–1 for solenoid location).
3. If the short is not found at the transmission connector, disconnect the connectors at the ECU and check the wires of the solenoid circuit for shorts between the solenoid wires and all other terminals in both connectors (at the ECU). If the short-to-ground is found in any of the wires, isolate and repair the problem.
4. If the condition recurs, use spare wire(s) in the external harness for the solenoid circuit indicated by the trouble code. See Appendix D for location of spare wire(s) and Appendix E for connector assembly/disassembly information.
5. If the condition continues, examine the feedthrough connector. Replace if necessary (refer to transmission Service Manual).
6. If the condition occurs again, replace the internal harness (refer to transmission Service Manual).
7. If the condition again recurs, replace the solenoid (refer to transmission Service Manual).
8. If the condition persists, replace the ECU. If replacing the ECU corrects the problem, reinstall the original (bad) ECU to confirm that the problem is in the ECU. If the original ECU now works, inspect the ECU connectors for any corrosion or damage which may cause an intermittent condition. If the original problem recurs, reinstall the replacement ECU.

DIAGNOSTIC CODES

NOTES

CODE 44 XX — SHORT-TO-GROUND IN SOLENOID CIRCUIT

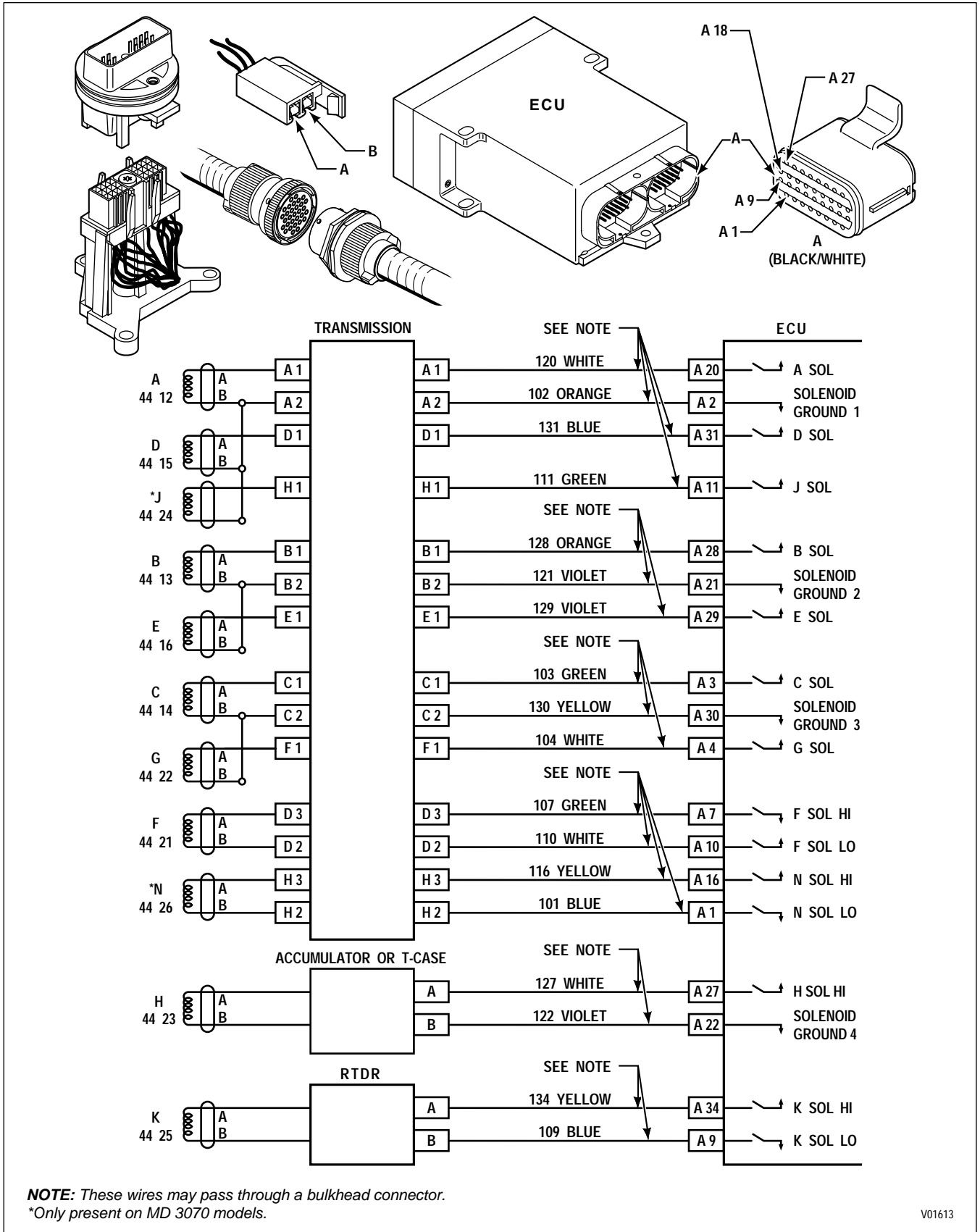


Figure 6-29. Code 44 Schematic Drawing (Units Produced Prior To 9/94)

CODE 44 XX — SHORT-TO-GROUND IN SOLENOID CIRCUIT

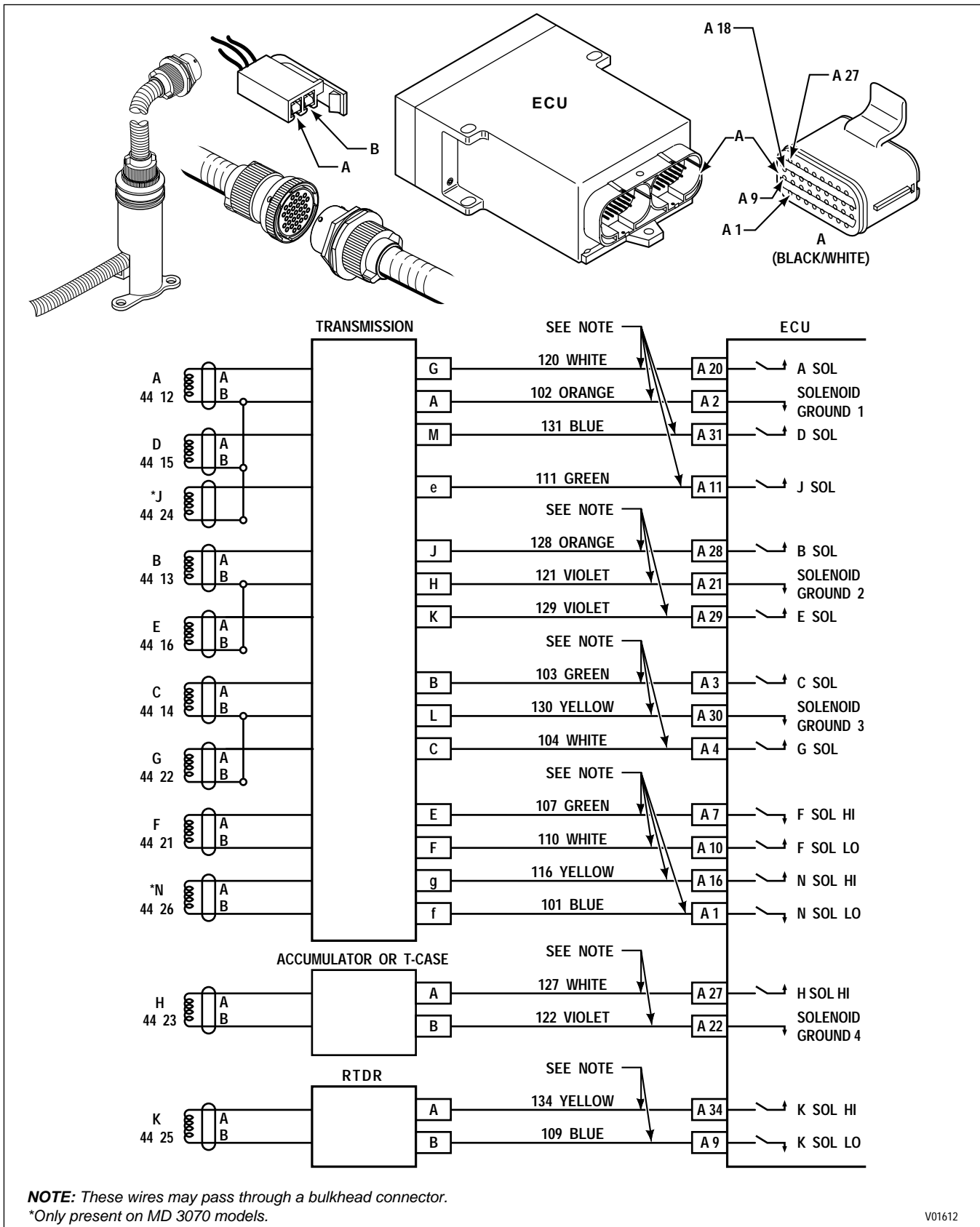


Figure 6-30. Code 44 Schematic Drawing (Units Produced 9/94-12/97)

CODE 44 XX — SHORT-TO-GROUND IN SOLENOID CIRCUIT
(Figures 6–29, 6–30)

Main code 44 indicates the ECU has detected a short-to-ground in a solenoid or its wiring. The **DO NOT SHIFT** response is activated when this code is detected and all solenoids are turned off.

NOTE: *For subcodes 12, 13, 14, 15, 16, 22 — neutral start is inoperable. Subcodes 21, 23, 24, 25, and 26 do not trigger the DO NOT SHIFT light.*

NOTE: *If solenoid resistance is about 1–2 Ohms, a short-to-ground code may not be set but could cause a burned-out solenoid driver in the ECU. Replace the solenoid when this occurs (see appropriate transmission Service Manual for replacement procedure). If the solenoid driver is burned out, 69 XX codes will be set. See the troubleshooting procedure for 69 XX codes.*

Main Code	Subcode	Meaning
44	12	Short-to-Ground A Solenoid Circuit
44	13	Short-to-Ground B Solenoid Circuit
44	14	Short-to-Ground C Solenoid Circuit
44	15	Short-to-Ground D Solenoid Circuit
44	16	Short-to-Ground E Solenoid Circuit
44	21	Short-to-Ground F Solenoid Circuit
44	22	Short-to-Ground G Solenoid Circuit
44	23	Short-to-Ground H Solenoid Circuit
44	24	Short-to-Ground J Solenoid Circuit
44	25	Short-to-Ground K Solenoid Circuit
44	26	Short-to-Ground N Solenoid Circuit

Active Indicator Clearing Procedure:

- Power down
- Manual

NOTE: *Intermittent connections or lack of battery-direct power and ground connections may cause this and other codes.*

NOTE: *The retarder accumulator solenoid (“H”) has a 30 Ohm coil. Since “H” solenoid is not mounted in the sump, no relationship between temperature and resistance is required.*

NOTE: *Before troubleshooting, read Pages 6–17 and 6–18 of Section 6–5. Also, check battery and ECU input voltages.*

CODE 44 XX — SHORT-TO-GROUND IN SOLENOID CIRCUIT
(Figures 6–29, 6–30)

PROBING THE CONNECTOR

When testing the control system from the feedthrough connector with the internal harness connected, contact with the following pairs of terminals will result in resistance measurements of two solenoids through a shared ground. The resistance should be twice that of a single solenoid. Refer to Figure 6–31 for resistance values versus temperature.

Terminals	Solenoids Which Share Ground
A1, D1	A, D
B1, E1	B, E
C1, F1	C, G

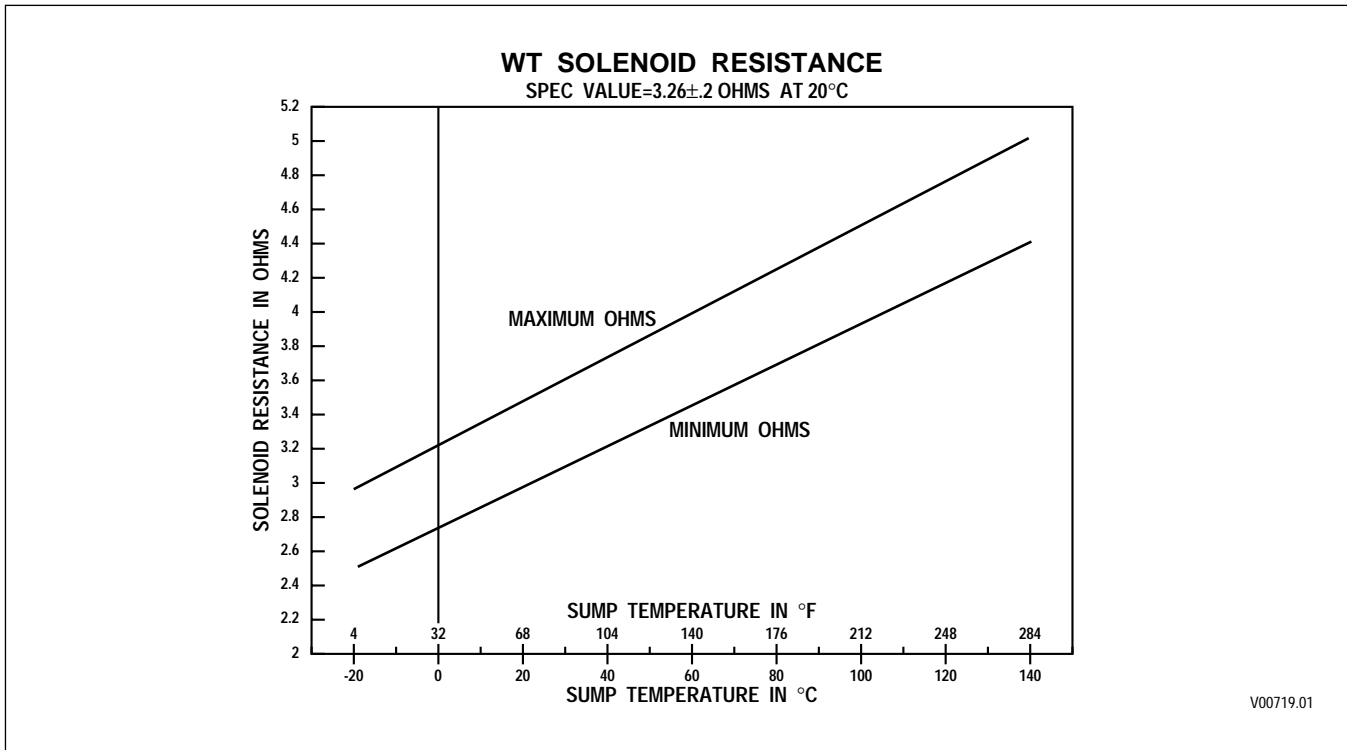


Figure 6–31. Solenoid Resistance vs. Temperature

CODE 44 XX — SHORT-TO-GROUND IN SOLENOID CIRCUIT
(*Figures 6–29, 6–30*)**Troubleshooting:**

1. Check the transmission connector and make sure it is tightly connected. If the connector is properly connected, disconnect the harness at the transmission and check for water contamination and inspect the terminals in the external harness and feedthrough connectors. Clean or replace as necessary (Appendix D).
2. If the connector is connected, clean, and not damaged, check the solenoid circuit in the transmission for shorts to other wires. (Tool J 38850 may be useful in making this test.) Refer to the system schematic and/or chart to identify wires in the internal harness which are connected. If the short circuit is found, drain the fluid, remove the control module (refer to the transmission Service Manual), and isolate the short. The short is probably in the feedthrough connector, internal harness, or the solenoid itself (refer to Figure 6–1 for solenoid locations).
3. If the short is not found at the transmission connector, disconnect the connectors at the ECU and inspect their terminals for damage or contamination. Clean or replace as necessary. If the terminals are satisfactory, check the wires of the solenoid circuit in the external harness for shorts-to-ground or shorts between wires. If a short is found in one of the wires, isolate and repair it or use a spare wire in the external harness. Refer to Appendix E for connector/terminal repair information.
4. If the short is not found in either the transmission or the harness, the condition must be intermittent.
5. Drain the fluid, remove the control module, and replace the solenoid and internal harness (refer to the transmission Service Manual).
6. If the condition recurs, use spare wire(s) for the solenoid circuit indicated by the diagnostic code. See Appendix D for location of spare wires and Appendix E for connector assembly/disassembly information.
7. If the condition persists, replace the ECU. If replacing the ECU corrects the problem, reinstall the original (bad) ECU to confirm that the problem is in the ECU. If the original ECU now works, inspect the ECU connectors for any corrosion or damage which may cause an intermittent condition. If the original problem recurs, reinstall the replacement ECU.

DIAGNOSTIC CODES

NOTES

CODE 45 XX — OPEN CONDITION IN SOLENOID CIRCUIT

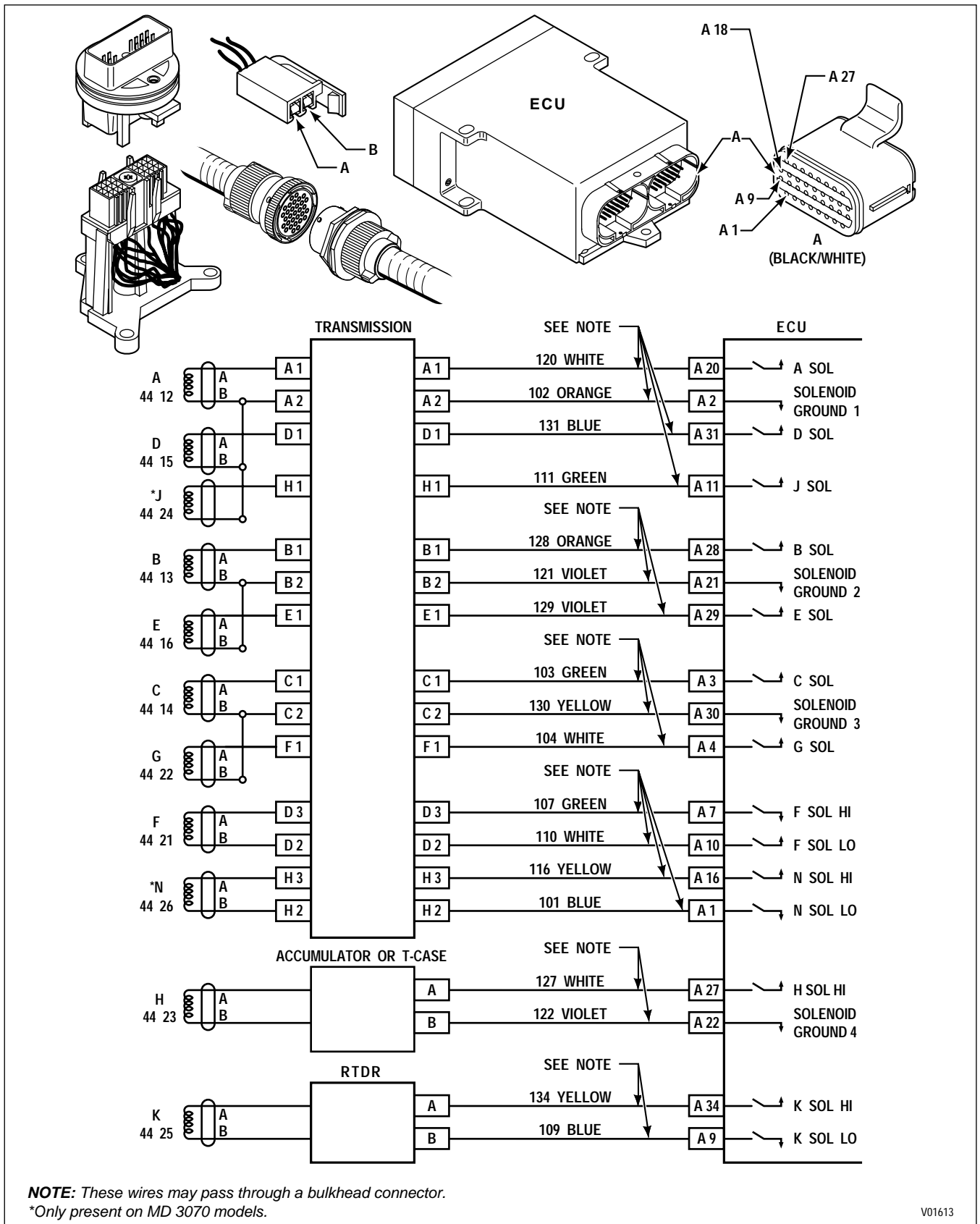


Figure 6-32. Code 45 Schematic Drawing (Units Produced Prior To 9/94)

CODE 45 XX — OPEN CONDITION IN SOLENOID CIRCUIT

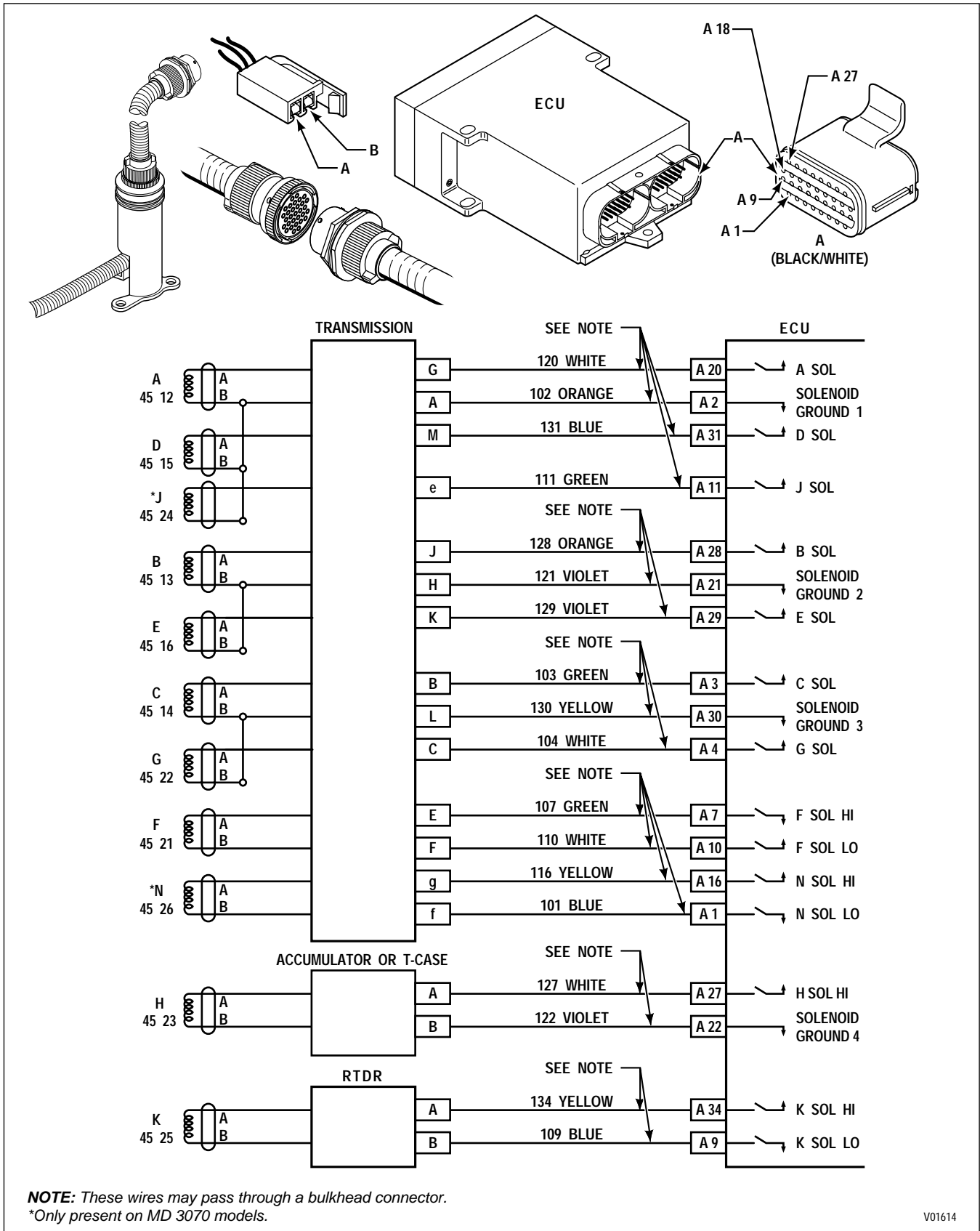


Figure 6-33. Code 45 Schematic Drawing (Units Produced 9/94-12/97)

CODE 45 XX — OPEN CONDITION IN SOLENOID CIRCUIT

(Figures 6–32, 6–33)

Main code 45 indicates the ECU has detected either an open circuit condition in a solenoid coil or the wiring to that solenoid. The **DO NOT SHIFT** response is activated when this code is detected and all solenoids are turned off.

NOTE: For subcodes 12, 13, 14, 15, 16, 22 — neutral start is inoperable. For subcodes 21, 23, 24, 25, and 26 the **DO NOT SHIFT** light is not illuminated.

NOTE: If solenoid resistance is about 1–2 Ohms, a short-to-ground code may not be set but could cause a burned-out solenoid driver in the ECU. Replace the solenoid when this occurs (see appropriate transmission Service Manual for replacement procedure). If the solenoid driver is burned out, 69 XX codes will be set. See the troubleshooting procedure for 69 XX codes.

Main Code	Subcode	Meaning
45	12	Open Circuit A Solenoid Circuit
45	13	Open Circuit B Solenoid Circuit
45	14	Open Circuit C Solenoid Circuit
45	15	Open Circuit D Solenoid Circuit
45	16	Open Circuit E Solenoid Circuit
45	21	Open Circuit F Solenoid Circuit
45	22	Open Circuit G Solenoid Circuit
45	23	Open Circuit H Solenoid Circuit
45	24	Open Circuit J Solenoid Circuit
45	25	Open Circuit K Solenoid Circuit
45	26	Open Circuit N Solenoid Circuit

Active Indicator Clearing Procedure:

- Power down
- Manual

NOTE: Intermittent connections or lack of battery-direct power and ground connections may cause this and other codes.

NOTE: The retarder accumulator solenoid (“H”) has a 30 Ohm coil. Since “H” solenoid is not mounted in the sump, no relationship between temperature and resistance is required.

NOTE: Before troubleshooting, read Pages 6–17 and 6–18 of Section 6–5. Also, check battery and ECU input voltages.

CODE 45 XX — OPEN CONDITION IN SOLENOID CIRCUIT

(Figures 6-32, 6-33)

PROBING THE CONNECTOR

When testing the control system from the feedthrough connector with the internal harness connected, contact with the following pairs of terminals will result in resistance measurements of two solenoids through a shared ground. The resistance should be twice that of a single solenoid. Refer to Figure 6-34 for solenoid resistance values versus temperature.

Terminals	Solenoids Which Share Ground
A1, D1	A, D
B1, E1	B, E
C1, F1	C, G

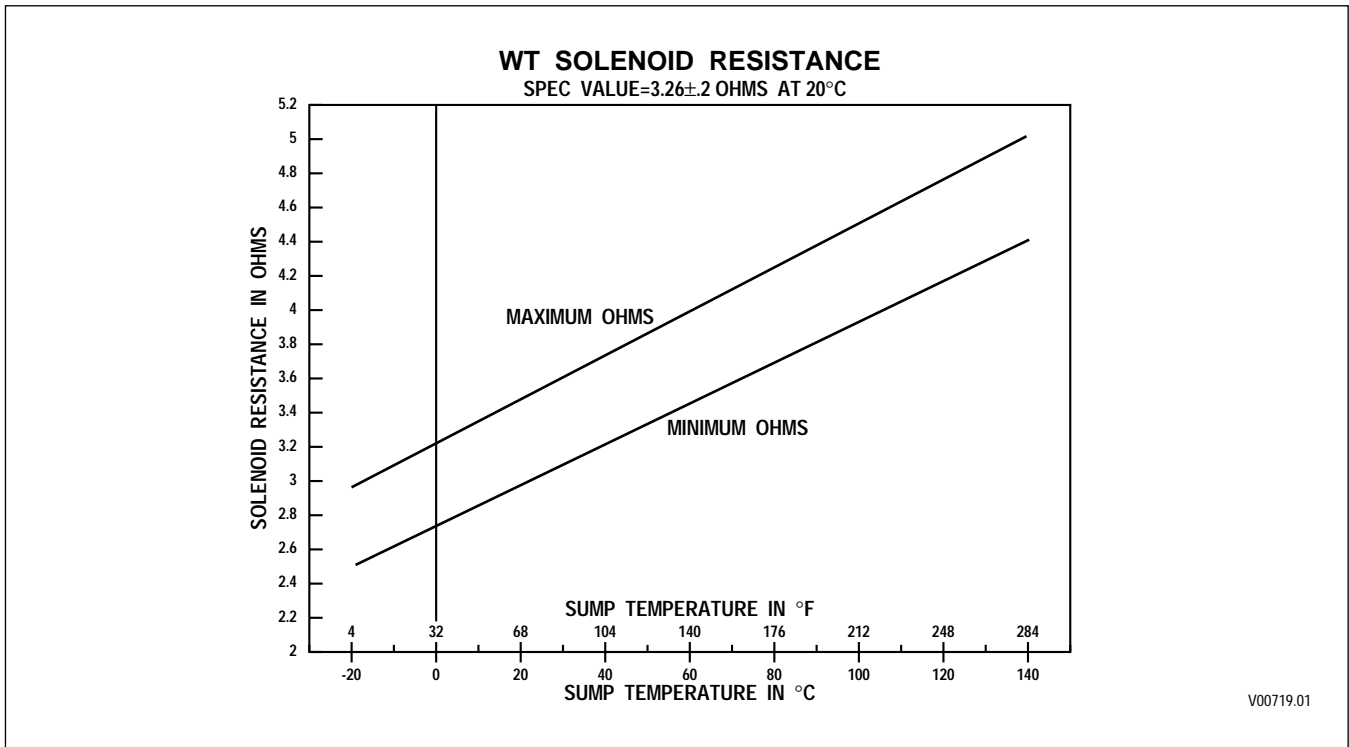


Figure 6-34. Solenoid Resistance vs. Temperature

CODE 45 XX — OPEN CONDITION IN SOLENOID CIRCUIT*(Figures 6–32, 6–33)***Troubleshooting:**

1. Check the transmission connector and make sure it is tightly connected. If the connector is properly connected, disconnect the harness at the transmission and check the terminals in the external harness and feedthrough connectors. Clean or replace as necessary (Appendix E).
2. If the connector is connected, clean, and not damaged, check the solenoid circuit in the transmission for opens. Refer to the system schematic and/or chart to identify wires in the internal harness which are connected. If the open circuit is found, drain the fluid, remove the control module (see the transmission Service Manual), and isolate the open. The fault will be in the feedthrough connector, internal harness, or the solenoid itself (see Figure 6–1 for solenoid locations).
3. If the open is not found at the transmission connector, disconnect the connectors at the ECU and inspect the terminals in the connectors and the ECU for damage or contamination. Clean or replace as necessary. If the terminals are satisfactory, check the wires of the solenoid circuit in the external harness for continuity. If the open is found in one of the wires, isolate and repair it or use a spare wire in the external harness. See Appendix D for location of spare wires and Appendix E for information on connector/wire repair.
4. If the open is not found in either the transmission or the harness, the condition must be intermittent.
5. Drain the fluid, remove the control module, and replace the solenoid and internal harness (refer to the transmission Service Manual).
6. If the condition recurs, use spare wire(s) for the solenoid circuit indicated by the diagnostic code. See Appendix D for location of spare wires and Appendix E for information on connector assembly/disassembly.
7. If the condition persists, replace the ECU. If replacing the ECU corrects the problem, reinstall the original (bad) ECU to confirm that the problem is in the ECU. If the original ECU now works, inspect the ECU connectors for any corrosion or damage which may cause an intermittent condition. If the original problem recurs, reinstall the replacement ECU.

CODE 51 XX — OFFGOING RATIO TEST DURING SHIFT (TIE-UP TEST)

Main code 51 indicates a failed offgoing ratio test. An offgoing ratio test occurs during a shift and uses turbine and output speed sensor readings to calculate the ratio between them. The calculated speed sensor ratio is then compared to the programmed speed sensor ratio of the commanded range. After a shift is commanded, the ECU, after a period of time, expects the old ratio to be gone. If the ratio does not change properly, the ECU assumes the offgoing clutch did not release. The shift is retried if conditions still exist to schedule the shift. If the second shift is not successfully completed, Code 51 XX is set and the ECU returns the transmission to the previous range. Additional codes could be logged for other shifts where “X” indicates the range from and “Y” indicates the range to.

NOTE: *This test is not performed below a calibrated transmission output speed of 200 rpm.*

Main Code	Subcode	Meaning
51	01	Low-1 upshift
51	10	1-Low downshift
51	12	1-2 upshift
51	21	2-1 downshift
51	23	2-3 upshift
51	24	2-4 upshift
51	35	3-5 upshift
51	42	4-2 downshift
51	43	4-3 downshift
51	45	4-5 upshift
51	46	4-6 upshift
51	53	5-3 downshift
51	64	6-4 downshift
51	65	6-5 downshift
51	XY	X to Y shift

Active Indicator Clearing Procedure:

- Power down
- Manual — except subcodes 35, 42, 43, 45, 53

NOTE: *Before troubleshooting, read Pages 6-17 and 6-18 of Section 6-5. Also, check battery and ECU input voltages.*

NOTE: *Intermittent connections or lack of battery-direct power and ground connections may cause this and other codes.*

CODE 51 XX — OFFGOING RATIO TEST DURING SHIFT (TIE-UP TEST)**Troubleshooting:**

1. Incorrect fluid level can cause 51 Series codes. Allow the vehicle to idle for 3–4 minutes and check the transmission fluid level. If level is not correct, add or drain fluid to correct level.
2. If the fluid level is correct, connect a pressure gauge into the pressure tap for the offgoing clutch indicated by the code (refer to solenoid and clutch chart, Appendix C). Make the shift indicated by the code or use the Pro-Link[®] diagnostic tool clutch test mode to put the transmission in the offgoing and oncoming ranges (refer to Appendix B for clutch pressure check information).
3. If the offgoing clutch stays pressurized, drain the fluid, remove the control module, disassemble the control module and clean it, inspecting for damaged valve body gaskets and stuck or sticky valves. Inspect the transmission for signs of clutch damage indicating the need to remove and overhaul the transmission (refer to the transmission Service Manual).
4. If the problem has not been isolated, replace the solenoid for the offgoing clutch (refer to the transmission Service Manual).
5. If after replacing the solenoid the problem persists, install another ECU. If this corrects the problem, temporarily reinstall the old ECU to verify the repair.
6. If this does not correct the problem, reinstall the original ECU and check for mechanical problems. The clutch may be mechanically held (coned, burned and welded, etc.). It may be necessary to remove the transmission and repair or rebuild as required (see the transmission Service Manual).

CODE 52 XX — OFFGOING C3 PRESSURE SWITCH TEST DURING SHIFT

Main code 52 indicates a failed C3 pressure test. When a shift is commanded and C3 is the offgoing clutch, the ECU expects the C3 pressure switch to open within a period of time after the shift is commanded. If the ECU does not see the switch open, it assumes C3 has not released. If conditions for a shift exist, the shift is retried. If the C3 pressure switch still remains closed, the code is logged and the **DO NOT SHIFT** response is commanded. If the code is set during a direction change, neutral with no clutches is commanded, otherwise the transmission is commanded to the previous range. Additional codes could be logged for other shifts where “X” indicates the range from and “Y” indicates the range to.

NOTE: *C3 tests are turned off below a calibrated temperature of -32°C (-25°F).*

Main Code	Subcode	Meaning
52	01	L-1 upshift
52	08	L-N1 shift
52	32	3-2 downshift
52	34	3-4 upshift
52	54	5-4 downshift
52	56	5-6 upshift
52	71	R-1 shift
52	72	R-2 shift
52	78	R-N1 shift
52	79	R-2 shift (R to NNC to 2)
52	99	N3-N2 shift
52	XY	X to Y shift

Active Indicator Clearing Procedure:

- Power down
- Manual

NOTE: *Before troubleshooting, read Pages 6-17 and 6-18 of Section 6-5. Also, check battery and ECU input voltages.*

NOTE: *Intermittent connections or lack of battery-direct power and ground connections may cause this and other codes.*

CODE 52 XX — OFFGOING C3 PRESSURE SWITCH TEST DURING SHIFT**Troubleshooting:**

1. Use the Pro-Link[®] diagnostic tool to check the state of the C3 pressure switch.

NOTE: *Energizing the solenoids and listening for ball/plunger movement is sometimes useful in troubleshooting.*

2. Check the C3 pressure switch wiring for a short-to-power or a switch stuck closed (refer to Code 32 XX). If a short is found, isolate and repair; or replace the switch if it is stuck closed.
3. If a fault is not found with the C3 pressure switch or circuitry, connect a pressure gauge to the C3 pressure tap.
4. Drive the vehicle to make the shift indicated by the code or use the DDR clutch test mode. Compare actual C3 pressure value with the table of specifications in Appendix B.
5. If C3 is being held on hydraulically (C3 remains pressurized), drain the fluid, remove the control module, disassemble and clean the control module, checking for damaged valve body gaskets or stuck and sticky valves (see the transmission Service Manual).
6. If the problem recurs, use spare wire(s) for the C3 pressure switch in the external harness. See Appendix D for location of spare wires and Appendix E for connector service information.
7. If the problem again recurs, replace the C solenoid (refer to the transmission Service Manual).
8. If the condition persists, replace the ECU. If replacing the ECU corrects the problem, reinstall the original (bad) ECU to confirm that the problem is in the ECU. If the original ECU now works, inspect the ECU connectors for any corrosion or damage which may cause an intermittent condition. If the original problem recurs, reinstall the replacement ECU.

CODE 53 XX — OFFGOING SPEED TEST (DURING SHIFT)

Main code 53 indicates a failed offgoing speed test. The speed test during a shift is designed to ensure neutral is attained during shifts to neutral. This test compares engine speed to turbine speed. If neutral is selected and turbine speed is found to be much lower than engine speed, the ECU sees this as neutral not being attained. The transmission is commanded to Neutral with No Clutches and Code 53 XX is set. Additional codes could be logged for other shifts where “X” indicates the range from and “Y” indicates the range to.

NOTE: *This test is not performed if neutral output is below 200 rpm or when temperatures are below a calibrated 0°C (32°F).*

Main Code	Subcode	Meaning
53	08	L–N1 shift
53	09	Low–NNC shift
53	18	1–N1 shift
53	28	2–N1 shift
53	29	2–N2 shift
53	38	3–N1 shift
53	39	3–N3 shift
53	48	4–N1 shift
53	49	4–N3 shift
53	58	5–N1 shift
53	59	5–N3 shift
53	68	6–N1 shift
53	69	6–N4 shift
53	78	R–N1 shift
53	99	N3–N2 or N2–N3 shift
53	XY	X to Y shift

Active Indicator Clearing Procedure:

- Power down
- Manual — subcodes 78 and 99 only

NOTE: *Before troubleshooting, read Pages 6–17 and 6–18 of Section 6–5. Also, check battery and ECU input voltages.*

NOTE: *Intermittent connections or lack of battery-direct power and ground connections may cause this and other codes.*

NOTE: *Energizing the solenoids and listening for ball/plunger movement is sometimes useful in troubleshooting.*

CODE 53 XX — OFFGOING SPEED TEST (DURING SHIFT)**Troubleshooting:**

1. Be sure the transmission is warm and the fluid level is correct. Correct transmission fluid level as necessary.
2. Using the DDR, check the engine and turbine speed sensor signals under steady conditions. If a tachometer is available, compare the tachometer reading with the engine rpm reading on the diagnostic tool. Check signals in neutral, at idle, high idle and maximum no load rpms. If a signal is erratic, check sensor wiring for opens, shorts, and shorts-to-ground (refer to Code 22 XX). Check all connections for dirt and corrosion. If wiring problems are found, repair or replace as necessary. See Appendix E for connector service information.
3. If fluid and wiring are satisfactory, install a pressure gauge in the pressure tap for the offgoing clutch. Make the shift indicated by the code using the clutch test mode of the Pro-Link[®] diagnostic tool. If the pressure gauge shows clutch pressure (above 55 kPa or 8 psi) remains in the offgoing clutch, drain the fluid and remove the control module (see the transmission Service Manual). Disassemble and clean the control module and check for damaged valve body gaskets and stuck or sticky valves, particularly latch valves and solenoid second-stage valves.
4. If excessive clutch pressure is not remaining in the offgoing clutch, replace the engine speed sensor and the turbine speed sensor (refer to the transmission Service Manual).
5. If the control module is removed to replace the turbine speed sensor (MD, B 300, B 400), clean the control module and inspect for stuck or sticky valves (particularly the latch valves and solenoid G second stage valve). Check the rotating clutch drum to which the turbine speed sensor is directed for damage, contamination, or signs of contact between the drum and the sensor.
6. If the problem recurs, replace the solenoid(s) for the offgoing clutch(es) (refer to the transmission Service Manual).
7. If the problem again recurs, the offgoing clutch must be held on mechanically (coned, burned, etc.). Remove the transmission and repair or rebuild as necessary (see the transmission Service Manual).
8. If the condition persists, replace the ECU. If replacing the ECU corrects the problem, reinstall the original (bad) ECU to confirm that the problem is in the ECU. If the original ECU now works, inspect the ECU connectors for any corrosion or damage which may cause an intermittent condition. If the original problem recurs, reinstall the replacement ECU.

CODE 54 XX — ONCOMING RATIO TEST (AFTER SHIFT)

Main code 54 indicates a failed oncoming ratio test. The ratio test after a shift is failed when the ECU has commanded the end of a shift and has not seen the transmission shift into the target range (comparing turbine and output speeds). Erratic readings from speed sensors are a likely cause of an oncoming ratio test failure. If conditions for a shift still exist, the shift will be retried one more time. If the ratio test is still not met, a code is logged and the **DO NOT SHIFT** response is commanded. If the code is set during a direction change, Neutral with No Clutches is commanded, otherwise the transmission is commanded to the previous range. **Main code 54 can also be caused by the EEPROM being calibrated for a close ratio transmission and installed in a wide ratio transmission, or vice versa.** Additional codes could be logged for other shifts where “X” indicates the range from and “Y” indicates the range to (there have been occurrences of Code 54 87, N1–R, for example).

NOTE: *This test is not performed below a calibrated transmission output speed of 200 rpm.*

Main Code	Subcode	Meaning
54	01	L–1 upshift
54	07	L–R shift
54	10	1–L downshift
54	12	1–2 upshift — incorrect calibration, wide ratio vs. close ratio
54	17	1–R shift
54	21	2–1 downshift
54	23	2–3 upshift
54	24	2–4 upshift
54	27	2–R shift
54	32	3–2 downshift
54	34	3–4 upshift
54	35	3–5 upshift
54	42	4–2 downshift
54	43	4–3 downshift
54	45	4–5 upshift
54	46	4–6 upshift
54	53	5–3 downshift
54	54	5–4 downshift
54	56	5–6 upshift
54	64	6–4 downshift
54	65	6–5 downshift
54	70	R–L shift
54	71	R–1 shift
54	72	R–2 shift
54	81	N1–1 shift
54	82	N1–2 shift
54	83	N1–3 shift
54	85	N1–5 shift
54	86	N1–6 shift
54	92	N2–2 shift
54	93	N3–3 shift
54	95	N3–5 shift
54	96	N4–6 shift
54	97	NVL–Reverse shift
54	XY	X to Y shift

CODE 54 XX — ONCOMING RATIO TEST (AFTER SHIFT)**Active Indicator Clearing Procedure:**

- Power down
- Manual

NOTE: *Before troubleshooting, read Pages 6–17 and 6–18 of Section 6–5. Also, check battery and ECU input voltages.*

NOTE: *Intermittent connections or lack of battery-direct power and ground connections may cause this and other codes.*

NOTE: *Energizing the solenoids and listening for ball/plunger movement is sometimes useful in troubleshooting.*

Troubleshooting:

1. After the transmission is at operating temperature, allow the vehicle to idle on level ground for 3–4 minutes. Check transmission fluid level. If improper fluid level is found, correct as necessary. Improper fluid level could be the cause of the code (not enough or too much fluid may produce inadequate clutch pressure).
2. Connect a pressure gauge and check main pressure. If pressure is not adequate, the pump is possibly worn. See Appendix B for main pressure specifications.
3. If the fluid level is correct, check the turbine and output speed sensors for accurate, steady signals (not noisy) using the diagnostic tool (check with vehicle stopped and in range to confirm a zero speed reading from the turbine and output speed sensors). Check the wiring for opens and shorts (refer to Code 22 XX) and the sensor coils for proper resistance. If problems are found, repair or replace as necessary. Remove the speed sensor and check for a loose tone wheel.
4. If sensor and wiring resistance is acceptable, connect a pressure gauge(s) to the pressure tap for the oncoming clutches indicated by the code (refer to solenoid and clutch chart in Appendix C). Make the shift indicated by the code by operating the vehicle or by using the diagnostic tool's clutch test mode.
5. If the clutch pressure does not show on the gauge(s), the control module is probably not commanding the clutch on. Drain the fluid and remove the control module (see the transmission Service Manual). Disassemble and clean the control module, inspect for stuck or sticking valves.
6. Internal leakage is indicated by the clutch pressure gauge showing that pressure is being sent to the clutch but the clutch fails to hold. The fault may be: missing or damaged face seals, burnt clutch, leaking piston sealrings, or damaged control module gaskets. Drain the fluid, remove the control module (refer to the transmission Service Manual), and inspect the face seals and control module gaskets. If the seals and gaskets are satisfactory, replace the solenoid(s) indicated by the code. If replacing the solenoid does not eliminate the code, remove the transmission and repair as necessary.
7. If clutch pressures are correct and the clutch appears to be holding, replace the output and turbine speed sensors (refer to the transmission Service Manual for the proper procedure).
8. If the problem recurs, use the diagnostic tool to check the speed sensor signals for erratic readings. Possible causes of erratic speed readings are: loose sensors, intermittent contact in the wiring, vehicle-induced vibrations, or speed sensor wiring that is not a twisted-pair. If necessary, use a twisted-pair for a new speed sensor circuit — Service Harness Twisted Shielded Pair P/N 29522703 is available for this purpose.
9. If the condition persists, replace the ECU. If replacing the ECU corrects the problem, reinstall the original (bad) ECU to confirm that the problem is in the ECU. If the original ECU now works, inspect the ECU connectors for any corrosion or damage which may cause an intermittent condition. If the original problem recurs, reinstall the replacement ECU.

CODE 55 XX — ONCOMING C3 PRESSURE SWITCH (AFTER SHIFT)

Main code 55 indicates the C3 clutch is the oncoming clutch in a shift and the C3 pressure switch did not close at the end of the shift. When this code is set, the **DO NOT SHIFT** response and Neutral with **No Clutches** is commanded. On the N1 to R shift the transmission is commanded to the previous range. Additional codes could be logged for other shifts where “X” indicates the range from and “Y” indicates the range to. **Main code 55 can also be caused by the EEPROM being calibrated for a close ratio transmission and installed in a wide ratio transmission, or vice versa.**

Main Code	Subcode	Meaning
55	07	Oncoming C3PS (after shift), L–R shift
55	17	Oncoming C3PS (after shift), 1–R shift
55	27	Oncoming C3PS (after shift), 2–R shift
55	87	Oncoming C3PS (after shift), N1–R shift
55	97	Oncoming C3PS (after shift), N1–L to R shift
55	XY	Oncoming C3PS (after shift), X to Y shift

NOTE: *When sump temperature is below 10°C (50°F), and transmission fluid is C4 (not DEXRON), follow this procedure when making directional change shifts:*

- *To shift from forward to reverse; select N (Neutral) and then R (Reverse).*
- *Failure to follow this procedure may cause illumination of the CHECK TRANS light and then transmission operation will be restricted to N (Neutral).*

Active Indicator Clearing Procedure:

- Power down
- Manual — subcode 87 only

NOTE: *Intermittent connections or lack of battery-direct power and ground connections may cause this and other codes.*

NOTE: *Check battery and ECU input voltages before troubleshooting.*

NOTE: *Energizing the solenoids and listening for ball/plunger movement is sometimes useful in troubleshooting.*

Troubleshooting:

NOTE: *Do not bring the transmission to operating temperature if the problem occurs at sump temperatures below that level. Do troubleshooting at the temperature level where the problem occurs.*

1. After the transmission is at operating temperature, allow vehicle engine to idle on level ground for 3–4 minutes. Check transmission fluid level. If improper fluid level is found, correct as necessary. Improper fluid level could be the cause of the code (not enough or too much fluid may produce inadequate clutch pressure).
2. Connect a pressure gauge and check main pressure. If pressure is not adequate, the pump is possibly worn. See Appendix B for main pressure specifications.

CODE 55 XX — ONCOMING C3 PRESSURE SWITCH (AFTER SHIFT)

3. If fluid level and main pressure are adequate, connect a pressure gauge to the C3 pressure tap on the transmission and make the shift indicated by operating the vehicle using the Pro-Link[®] diagnostic tool's CLUTCH TEST MODE.

NOTE: *When using the CLUTCH TEST MODE on the Pro-Link[®], be sure to use the correct pressure specification. If testing is done with the vehicle stopped, the lockup clutch is not applied, so use the clutch pressure specification for converter operation. If testing is done with the vehicle moving, the lockup clutch may be applied depending upon the vehicle speed and throttle position. Be sure to use the clutch pressure specification for lockup operation (see Appendix B).*

4. If, when making the shift and producing the code, the C3 clutch does not show any pressure, drain the fluid and remove the control module (refer to the transmission Service Manual). Disassemble, clean, and inspect the control module for stuck or sticky valves (particularly the solenoid C second stage valve and C-1 latch valve). If no obvious problems are found, replace the C solenoid and reassemble (see Figure 6-1 for location of the C solenoid).
5. If the gauge shows inadequate pressure being sent to the clutch, the clutch is probably worn, has leaking piston or face seals, or the control module gaskets are damaged. See Appendix B for clutch pressure specification. Drain the fluid, remove the control module and inspect the face seals and valve body gaskets. If the face seals or control module gaskets are not damaged, remove and repair the transmission (refer to the transmission Service Manual for repair procedure).
6. If the gauge shows adequate clutch apply pressure, the problem is with the C3 pressure switch or its wires. Check the C3 switch wires in the chassis harness for opens, shorts, or shorts-to-ground (see Code 32 XX). If found, isolate and repair the C3 circuit. See Appendix E for connector service information.

NOTE: *A leakage problem may be temperature related. Be sure to check pressures at the sump temperature where the problem occurred.*

7. If the problem is not in the chassis harness, drain the fluid and remove the control module. Check the internal harness and feedthrough connector for opens. If wiring problems are found, repair as necessary (refer to Appendix E). If no wiring problems are found, replace the C3 pressure switch (see Figure 6-1 for the location). Refer to the transmission Service Manual for proper procedure.
8. If the condition persists, replace the ECU. If replacing the ECU corrects the problem, reinstall the original (bad) ECU to confirm that the problem is in the ECU. If the original ECU now works, inspect the ECU connectors for any corrosion or damage which may cause an intermittent condition. If the original problem recurs, reinstall the replacement ECU.

CODE 56 XX — RANGE VERIFICATION RATIO TEST (BETWEEN SHIFTS)

Main code 56 indicates a failed range verification speed sensor ratio test. The ratio test occurs after a shift and determines if a clutch has lost torque carrying capability. If output speed is above programmed output speed for a range but the correct speed sensor ratio is not present, the **DO NOT SHIFT** response is commanded and a range which can carry the torque without damage is commanded or attempted. Turbine and output speed sensor readings are used to calculate the actual ratio that is compared to the commanded ratio. **Main code 56 can also be caused by the EEPROM being calibrated for a close ratio transmission and installed in a wide ratio transmission, or vice versa.**

Main Code	Subcode	Meaning
56	00	Range verification ratio test (between shifts) L
56	11	Range verification ratio test (between shifts) 1
56	22	Range verification ratio test (between shifts) 2
56	33	Range verification ratio test (between shifts) 3
56	44	Range verification ratio test (between shifts) 4
56	55	Range verification ratio test (between shifts) 5
56	66	Range verification ratio test (between shifts) 6
56	77	Range verification ratio test (between shifts) R

Active Indicator Clearing Procedure:

- Power down
- Manual — subcodes 11, 44, 66, 77 only

NOTE: *Before troubleshooting, read Pages 6–17 and 6–18 of Section 6–5. Also, check battery and ECU input voltages.*

NOTE: *Intermittent connections or lack of battery-direct power and ground connections may cause this and other codes.*

NOTE: *Energizing the solenoids and listening for ball/plunger movement is sometimes useful in troubleshooting.*

Troubleshooting:

1. After the transmission is at operating temperature, allow vehicle to idle on level ground for 3–4 minutes. Check the transmission fluid level. If improper fluid level is found, correct as necessary. Improper fluid level could be the cause of the code. Not enough or too much fluid may produce inadequate clutch pressure.
2. Connect a pressure gauge and check main pressure. If the pressure is not adequate, the pump is probably worn. See Appendix B for main pressure specifications.
3. If main pressure is adequate, check clutch pressure for the range indicated by following the procedure in Appendix B. The transmission range indicated by the trouble code can be found by referring to the solenoid and clutch chart in Appendix C. Drive the vehicle or use the diagnostic tool's clutch test mode and check clutch pressure.

CODE 56 XX — RANGE VERIFICATION RATIO TEST (BETWEEN SHIFTS)

4. If a clutch is leaking pressure, drain the fluid, remove the control module and check for damaged control module gaskets and stuck or sticking valves (see the transmission Service Manual). Also look for damaged or missing face seals. If no problems are found, replace the solenoids for the clutches used in the range indicated by the code.
5. If replacing solenoids does not correct the pressure problem, a worn clutch or worn piston seals are probably the source of the pressure leak. Remove the transmission and repair or replace as necessary (refer to the transmission Service Manual).
6. This code requires accurate output and turbine speed readings. If there were no transmission problems detected, use the diagnostic tool and check the speed sensor signals for noise (erratic signals) from low speed to high speed in the range indicated by the code.
7. If a noisy sensor is found, check the resistance of the sensor (300 ± 30 Ohms, refer to the Code 22 XX temperature variation chart) and its wiring for opens, shorts, and shorts-to-ground (refer to Code 22 XX). Carefully check the terminals in the connectors for corrosion, contamination, or damage. Ensure the wiring to the sensors is a properly twisted wire pair. Replace a speed sensor if its resistance is incorrect. Isolate and repair any wiring problems. (Use a twisted-pair if a new speed sensor circuit is needed — Service Harness Twisted Shielded Pair P/N 29522703 is available for this purpose.)
8. If no apparent cause for the code can be found, replace the turbine and output speed sensors (refer to the transmission Service Manual for proper procedure).
9. If the condition persists, replace the ECU. If replacing the ECU corrects the problem, reinstall the original (bad) ECU to confirm that the problem is in the ECU. If the original ECU now works, inspect the ECU connectors for any corrosion or damage which may cause an intermittent condition. If the original problem recurs, reinstall the replacement ECU.

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CODE 57 XX — RANGE VERIFICATION C3 PRESSURE TEST (BETWEEN SHIFTS)

Main code 57 indicates failure of the range verification C3 pressure switch test. This test determines if the C3 pressure switch is closed when it should be open. The test occurs when a range is commanded that does not use the C3 clutch (neutral, 1, 2, 4, and 6). The code is set if the C3 pressure switch is closed when it should be open. If C3 clutch comes on when not needed, three clutches are applied and a transmission tie-up occurs. The ECU will command a range which does not use the C3 clutch and activate the **DO NOT SHIFT** response.

Main Code	Subcode	Meaning	Replace Solenoid
57	11	Range verification C3 pressure switch while in 1st	B
57	22	Range verification C3 pressure switch while in 2nd	C
57	44	Range verification C3 pressure switch while in 4th	C
57	66	Range verification C3 pressure switch while in 6th	A
57	88	Range verification C3 pressure switch while in N1	C
57	99	Range verification C3 pressure switch while in N2/N4	C

Active Indicator Clearing Procedure:

- Power down
- Manual

NOTE: *Before troubleshooting, read Pages 6–17 and 6–18 of Section 6–5. Also, check battery and ECU input voltages.*

NOTE: *Intermittent connections or lack of battery-direct power and ground connections may cause this and other codes.*

NOTE: *Energizing the solenoids and listening for ball/plunger movement is sometimes useful in troubleshooting.*

Troubleshooting:

1. Disconnect the external harness from the transmission. Check the C3 pressure switch circuit at the transmission for continuity (refer to Code 32 XX).
2. Continuity at the transmission indicates the C3 pressure switch is closed or the C3 circuit is shorted together. Drain the fluid, remove the control module (refer to the transmission Service Manual), and isolate the short. The fault is either a shorted internal harness or stuck C3 pressure switch. Repair or replace as necessary.
3. If there is no continuity at the transmission, disconnect the harness connectors from the ECU and check the C3 pressure switch wires in the external harness for shorts. Use the system wiring diagram to identify wires which are connected. If a shorted C3 pressure switch circuit in the external harness is found, isolate and repair.
4. If the C3 pressure switch or circuit is not shorted either in the transmission or the external harness, connect a pressure gauge in the C3 pressure tap (refer to Appendix B for pressure tap location). Drive the vehicle in the range indicated by the code or use the diagnostic tool's clutch test mode to attain that range.
5. If the gauge shows C3 pressure is present in the range indicated by the code, drain the fluid and remove the control module (refer to the transmission Service Manual). Check for damaged valve body gaskets or stuck or sticking valves. Repair or replace as necessary. If no obvious defects are found, replace the listed solenoid.
6. If the gauge shows C3 pressure is not present in the range indicated by the code, drain the fluid and remove the control module (refer to the transmission Service Manual). Replace the C3 pressure switch.
7. If the condition persists, replace the ECU. If replacing the ECU corrects the problem, reinstall the original (bad) ECU to confirm that the problem is in the ECU. If the original ECU now works, inspect the ECU connectors for any corrosion or damage which may cause an intermittent condition. If the original problem reoccurs, reinstall the replacement ECU.

CODE 61 XX — RETARDER FLUID HOT

Main code 61 indicates the ECU has detected a hot fluid condition in the output retarder.

Possible causes (but not all causes) for hot fluid are:

1. Prolonged retarder use.
2. Low fluid level.
3. High fluid level.
4. A retarder apply system that allows the throttle and retarder to be applied simultaneously.
5. Cooler inadequately sized for retarder.

If the validity of the hot fluid diagnosis is in question, temperature can be checked by using a temperature gauge at the retarder-out port or by reading retarder temperature with the Pro-Link[®] diagnostic tool. Another method of checking retarder temperature is to remove the B connector at the ECU and measure resistance (Ohms) between terminals B1 and B4. Compare the resistance value to the value in Figure 6–35 to see if result is within the expected operating range.

NOTE: Use the Pro-Link[®] diagnostic tool to determine the software version being used.

The retarder temperature sensor is located externally on the retarder housing. When retarder temperature reaches a preset level, a retarder overtemp light is illuminated. The preset temperature for Version 6 software is 138°C (281°F) and for Version 7 software is 141°C (285°F).

Table 6–7. Transmission Retarder Operation as a Function of Temperature

Description	Version 6* (501 and 502)	Version 7 (D70)	Version 7A (P01)
MD Retarder, Light On MD Retarder, Light Off	166°C (330°F) 159°C (318°F)	141°C (285°F) 135°C (275°F) +	166°C (330°F) 159°C (318°F)
MD Retarder, Set Hot Code (61 00) MD Retarder, Clear Active Indicator	166°C (330°F) 159°C (318°F)	168°C (335°F) 162°C (323°F)	168°C (335°F) 162°C (323°F)
HD Retarder, Light On HD Retarder, Light Off	138°C (281°F) 131°C (268°F)	141°C (285°F) 135°C (275°F) +	166°C (330°F) 159°C (318°F)
HD Retarder, Set Hot Code (61 00) HD Retarder, Clear Active Indicator	138°C (281°F) 131°C (268°F)	168°C (335°F) 162°C (323°F)	168°C (335°F) 162°C (323°F)
MD Retarder, Capacity Reduction (Total Reduction Over Temperature Range)	166–182°C (330–360°F)	149–182°C (300–360°F)	149–182°C (300–360°F)
HD Retarder, Capacity Reduction (Total Reduction Over Temperature Range)	138–182°C (280–360°F)**	149–182°C (300–360°F)	149–182°C (300–360°F)
MD Retarder, Preselect On Preselect remains on until the retarder is deactivated.	NONE	143°C (289°F) (1st)	143°C (289°F)
HD Retarder, Preselect On (V7) HD Retarder, Preselect On (V6) Preselect remains on until the retarder is deactivated.	----- 103°C (218°F) (1st)	143°C (289°F) (1st) -----	143°C (289°F)
* No retarder calibrations were made prior to the release of Version 6E (501) software in 8/92.			
** The Version 6E (501) capacity reduction set point temperature for HD retarders is output speed-dependent; however, the total reduction is always 13.5% between the set point temperature and 360°F.			
+ Effective 3/13/95, these values become 330°F Light On and 318°F Light Off.			

CODE 61 XX — RETARDER OVER TEMPERATURE

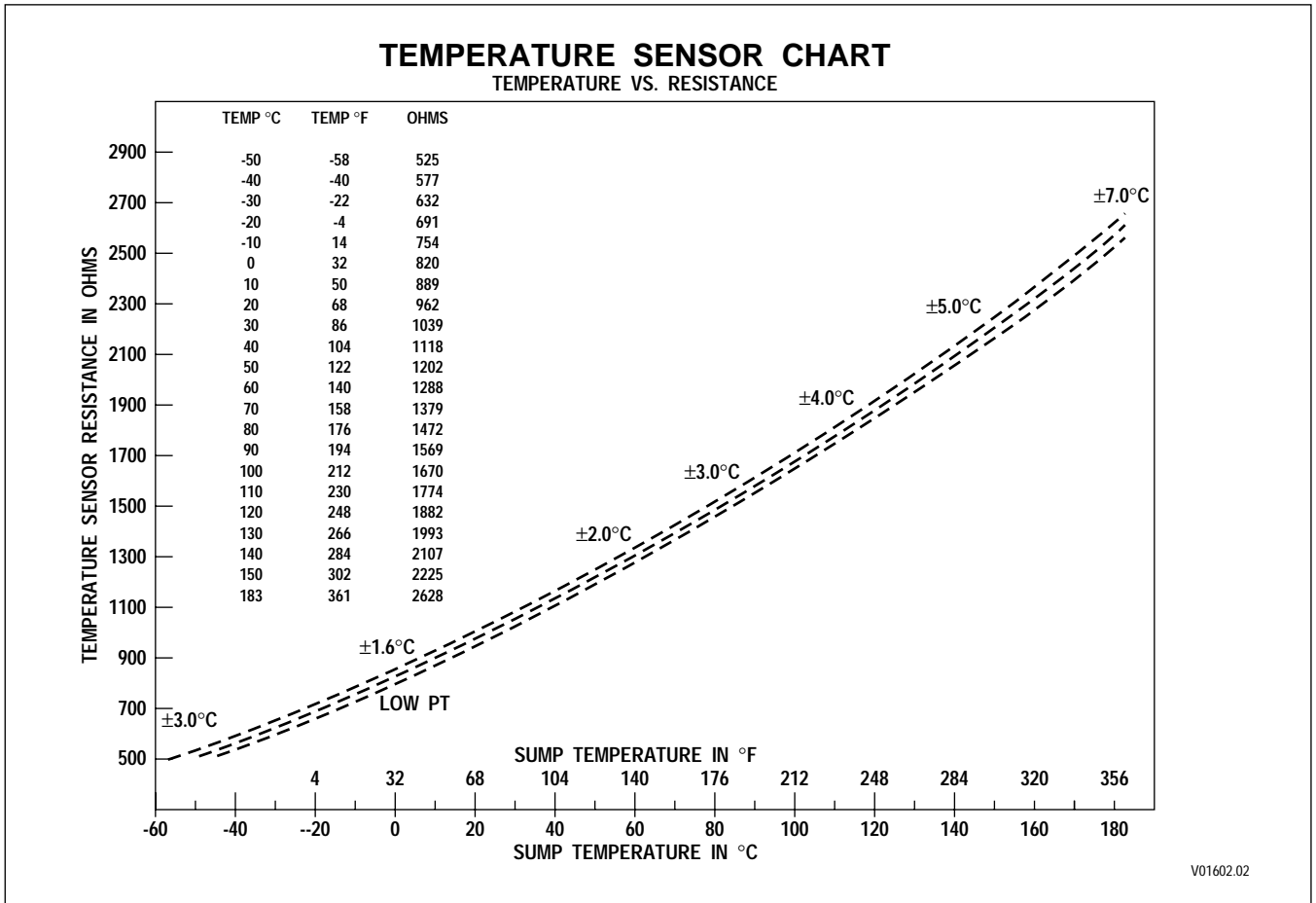


Figure 6-35. Temperature Sensor Chart

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CODE 62 XX — RETARDER TEMPERATURE SENSOR

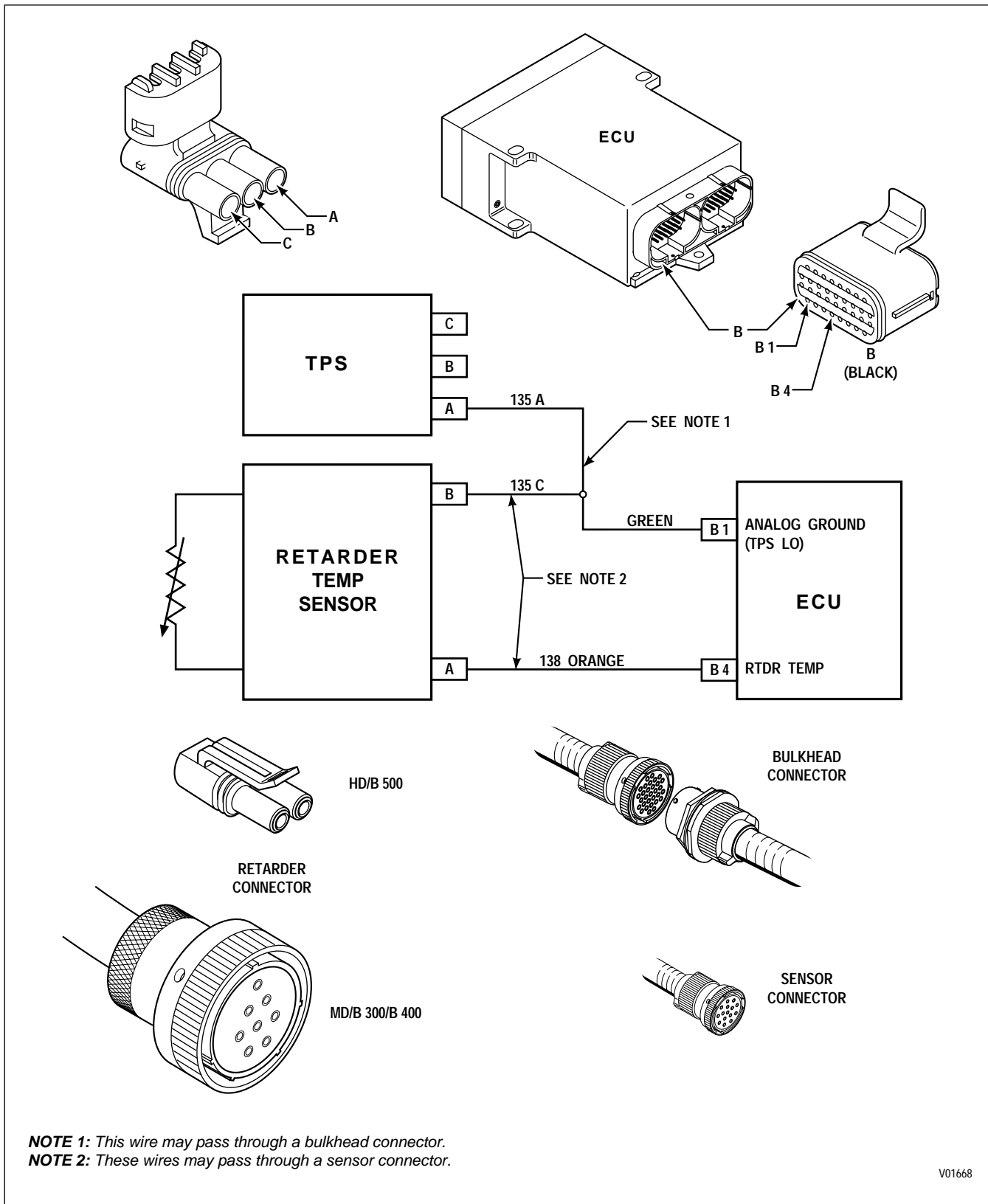


Figure 6-36. Code 62 Schematic Drawing (Units Produced Prior To 9/94)

CODE 62 XX — RETARDER TEMPERATURE SENSOR

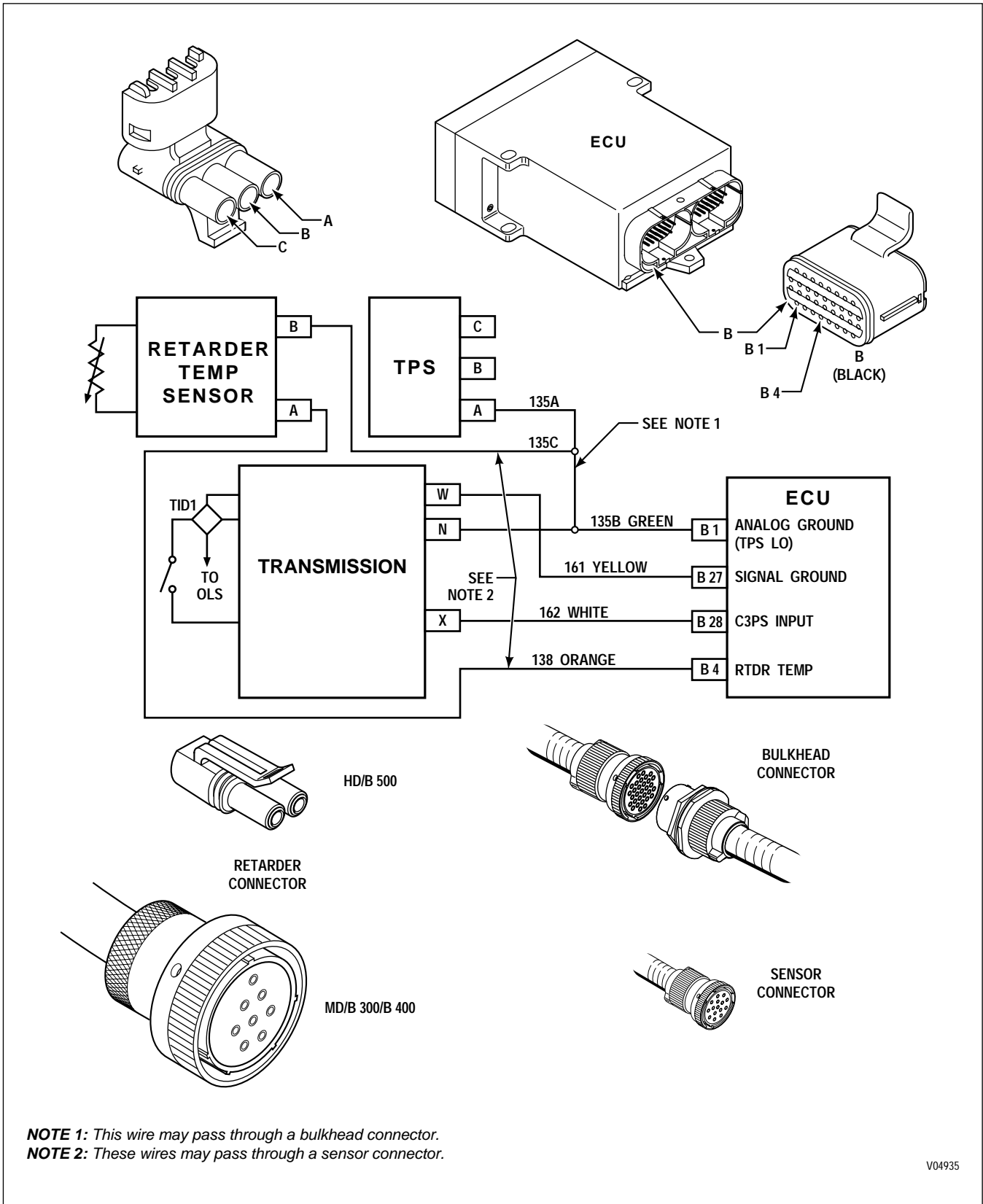


Figure 6-37. Code 62 Schematic Drawing (Units Produced 9/94-12/97)

CODE 62 XX — RETARDER TEMPERATURE SENSOR (*Figures 6–36, 6–37*)

Main code 62 indicates the retarder temperature sensor or circuitry is providing a signal outside the usable range of the ECU. Main code 62 can be the result of a hardware failure or an actual extremely high or low temperature condition.

NOTE: *A combination of codes 62 23, 33 23, and 21 23 indicates a problem with one of the branches of the common ground wire (wire 135) between the throttle and temperature sensors.*

Main Code	Subcode	Meaning
62	12	Retarder temperature sensor failed low (–45°C; –49°F)
62	23	Retarder temperature sensor failed high (178°C; 352°F)

Active Indicator Clearing Procedure:

- Power down
- Manual
- Self-clearing

NOTE: *Before troubleshooting, read Pages 6–17 and 6–18 of Section 6–5. Also, check the transmission fluid level.*

Troubleshooting:

1. Check the retarder temperature with a DDR. If a DDR is not available, use the shift selector display to determine if the code is active (cycle the ignition on and off at least once since the code was logged to clear the active indicator). If a condition that is unreasonable for the current conditions exists, go to Step 3.
2. If Step 1 reveals that the extreme temperature indication is no longer present, the temperature limit could have been reached due to operational or ambient temperature extremes. Proceed cautiously, it is unlikely there is a sensor hardware fault.
3. Remove the connector at the ECU. Measure resistance between B1 and B4. Compare resistance value to chart (see Figure 6–35) to see if reading is within expected operating range.
4. Disconnect the sensor connector and remove the connector at the ECU. Check the sensor and the ECU terminals for dirt, corrosion, and damage. Clean or replace as necessary (refer to Appendix E).
5. Check the temperature sensor circuit for opens (Code 62 23), shorts between wires, and short-to-ground (Code 62 12). If a wiring problem is found, isolate and repair. See Appendix E for connector service information.
6. If no wiring problem is found, replace the retarder temperature sensor (refer to transmission Service Manual for proper procedure).
7. If the problem recurs, run spare wires for the retarder temperature circuit. See Appendix D for location of spare wires and Appendix E for connector service information.
8. If the condition continues to recur, replace the ECU. If replacing the ECU corrects the problem, reinstall the original (bad) ECU to confirm that the problem is in the ECU. If the original ECU now works, inspect the ECU connectors for any corrosion or damage which may cause an intermittent condition. If the original problem recurs, reinstall the replacement ECU.

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CODE 63 XX — INPUT FUNCTION FAULT

Code 63 00 is set when one of the two inputs for an input function Auxiliary Function Range Inhibit (Special) is in a different state (on or off) from the other input for longer than two minutes. When this condition is detected, Code 63 00 is set, the Service Indicator output is turned on. The transmission will not be inhibited in shifting from neutral to range.

NOTE: *If Code 63 00 is set and the ECU was programmed after 9/26/94, the SERVICE icon on the shift selector will be illuminated.*

Main Code	Subcode	Meaning
63	00	Auxiliary Function Range Inhibit (Special) inputs states are different
63	26	Kickdown input failed on
63	40	Service brake status failed on
63	41	Pump/pack and auto Neutral GPI failure

Subcode 26 is set when this function (Kickdown) is selected by calibration, the calibration designated input is active but not failed, and throttle position is less than the calibration value defined. The kickdown shift schedule is inhibited when subcode 26 is active. The service indicator will be turned on if it is selected by the calibration. The kickdown shift schedule is not inhibited, the code is cleared and the service indicator will be turned off if the kickdown input remains inactive for the calibration time period while throttle position is less than the calibration value.

Subcode 40 is set when this function (Service Brake Status) is selected by calibration, and the specified input remains active for a calibration number of consecutive acceleration events. The service indicator will be turned on if it is selected by the calibration. A vehicle acceleration event is defined as an increase in transmission output speed from 1 rpm to a calibration value. The operation of the Automatic Neutral For Refuse Packer will be limited when this code is active. The active inhibit for this code is self-cleared and the service indicator will be turned off if the designated input for the Service Brake Status function becomes inactive.

Subcode 41 is set when the states of the calibration inputs are different for a calibration number of consecutive updates. The inputs in this case are Pump/Pack Enable and Automatic Neutral For Refuse Packer. The service display will also be turned ON if selected by calibration.

Active Indicator Clearing Procedure:

- Power down
- Manual — subcode 26 only
- Self-clearing — subcode 26 only

Troubleshooting:**A. Code 63 00**

1. Use the DDR to identify the two input wires programmed with Auxiliary Function Range Inhibit (Special). Inspect the input wiring, connectors, and switches to determine why the input states are different. Correct any problems which are found.
2. If the condition persists, replace the ECU. If replacing the ECU corrects the problem, reinstall the original (bad) ECU to confirm that the problem is in the ECU. If the original ECU now works, inspect the ECU connectors for any corrosion or damage which may cause an intermittent condition. If the original problem recurs, reinstall the replacement ECU.

CODE 63 XX — INPUT FUNCTION FAULT

B. Code 63 26

1. Inspect kickdown switch.

C. Code 63 40

1. Inspect service brake status switch.
2. Use the DDR to identify the two wires associated with the input functions for Pump/Pack Enable and Automatic Neutral For Refuse Packer. Inspect the input wiring, connectors, and switches to determine why the input states are different. Correct problems which are found. There is further information on these input functions on Pages P-25, P-26, P-29, and P-30.

CODE 64 XX — RETARDER MODULATION REQUEST DEVICE FAULT

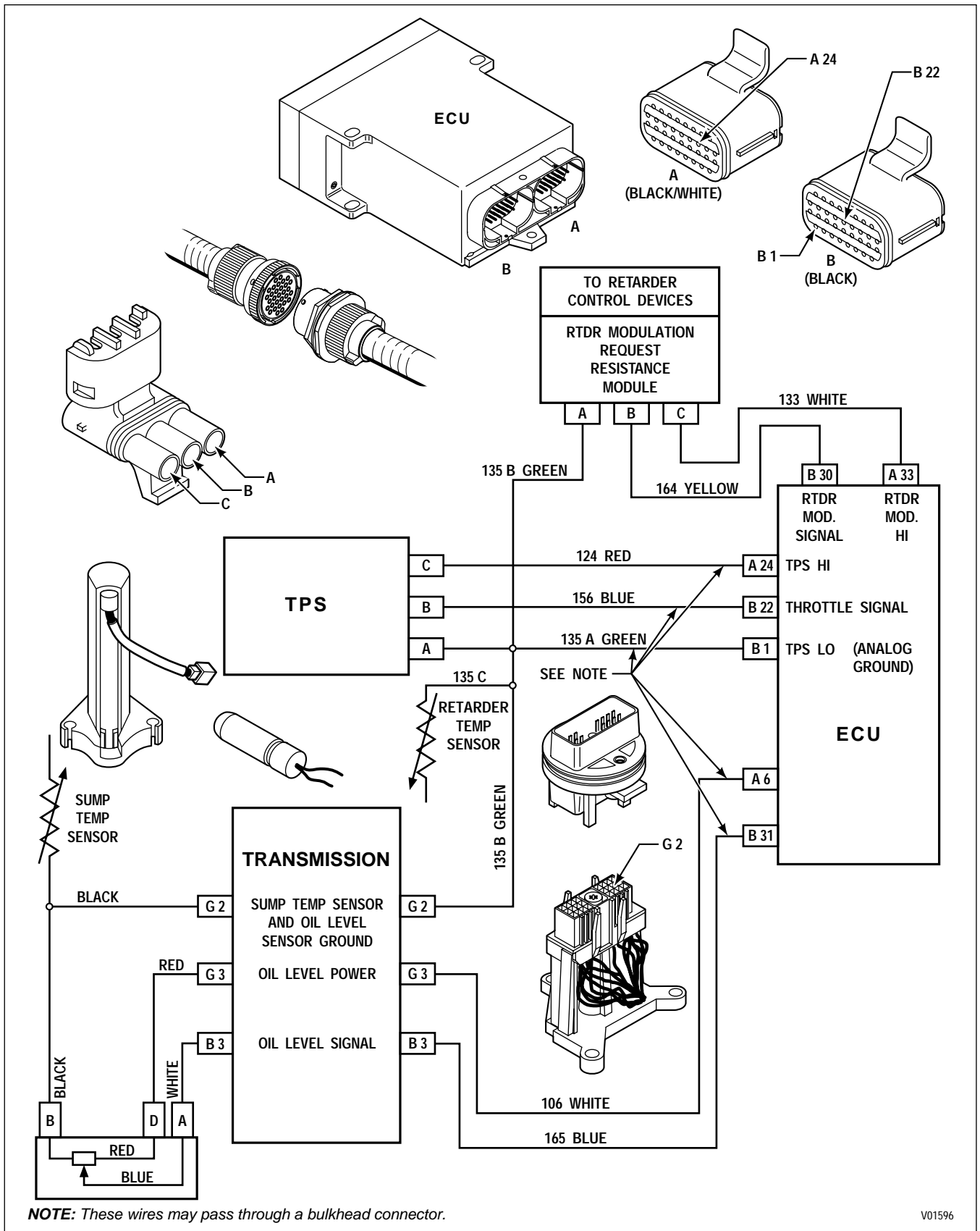


Figure 6-38. Code 64 Schematic Drawing (Units Produced Prior To 9/94)

CODE 64 XX — RETARDER MODULATION REQUEST DEVICE FAULT

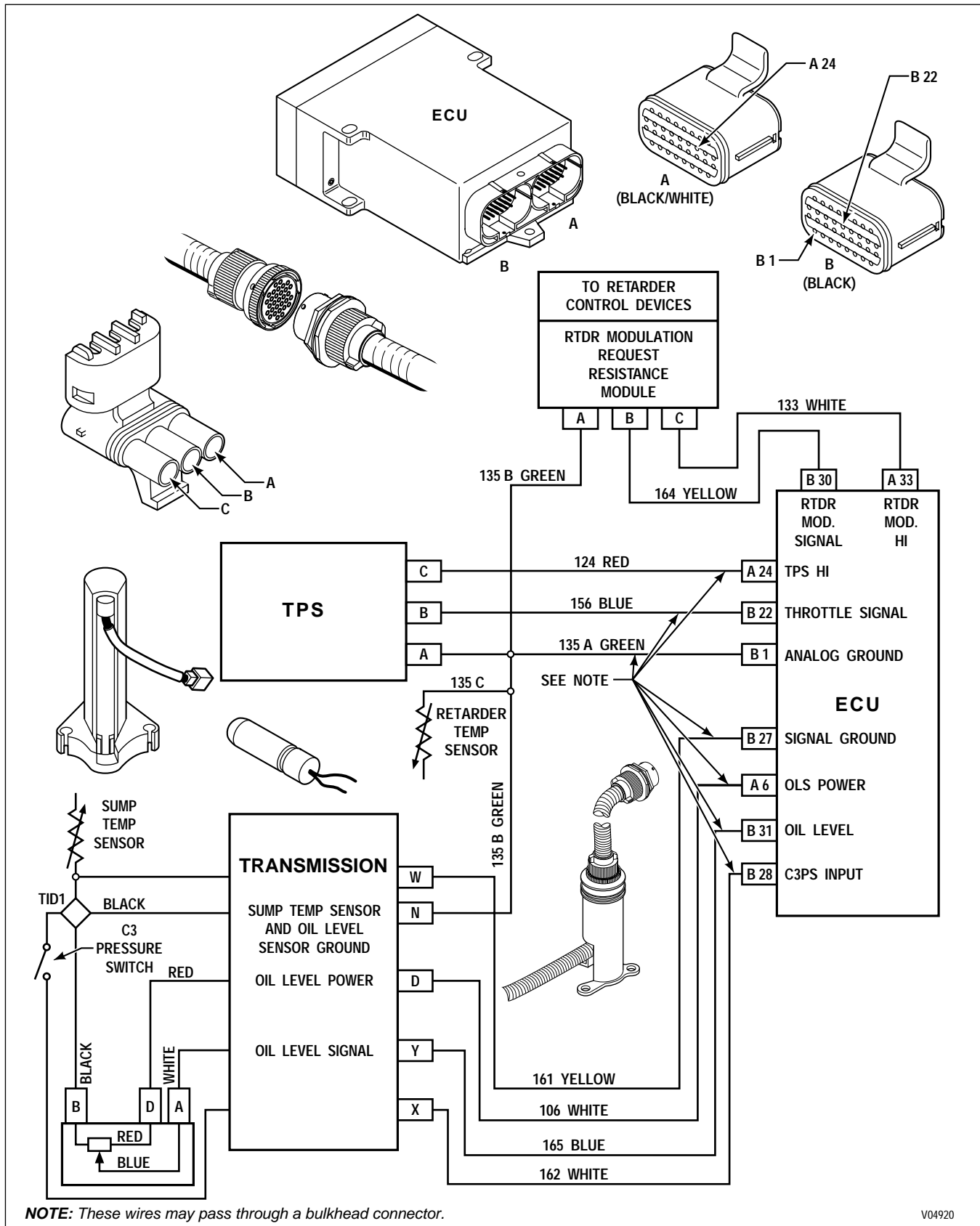


Figure 6-39. Code 64 Schematic Drawing (Units Produced 9/94-12/97)

CODE 64 XX — RETARDER MODULATION REQUEST DEVICE FAULT (Figures 6–38, 6–39)

Main code 64 indicates the ECU has detected a voltage signal from the retarder request modulation sensor (consisting of a module and a retarder control device) in either the high or low error zone. These codes can be caused by faulty wiring, faulty connections to the resistance module or retarder control device, a faulty resistance module, a faulty retarder control device, or a faulty ECU. Power wire 133 and ground wire 135 for the retarder modulation request sensor share a common power and ground with the TPS and OLS devices. A short-to-ground on the common power wire causes a “sensor failed low” code for the other devices (Codes 21 12, and 14 12). An open or a short-to-ground on retarder modulation request sensor signal wire 164 results in a Code 64 12 only.

Retarder modulation request sensor diagnostic codes may not reflect retarder response problems. If this occurs, test the retarder control devices for proper voltage signals at each of the percentage of retarder application settings. Table 6–8 contains the voltage measurements for each device’s application percentage and resistances measured across terminals A and C of the retarder request sensor. **Use test wiring harness J 41339 when conducting voltage tests.** Table 6–9 shows connector and wire numbers to assist in making these checks. A TPS failure changes the status of the output retarder. The retarder is enabled by the Service Brake Status (wire 137) when a TPS code is active (21 XX). If a Code 63 40 is also active, the Service Brake Status (wire 137) is ignored and the retarder will not work.

Main Code	Subcode	Meaning
64	12	Retarder Modulation request sensor failed Low (14 counts and below)
64	23	Retarder Modulation request sensor failed High (232 counts and above)

Active Indicator Clearing Procedure:

- Power down

NOTE: *Before troubleshooting, read Pages 6–17 and 6–18 of Section 6–5. Also, check battery and ECU input voltages.*

NOTE: *Intermittent connections or lack of battery-direct power and ground connections can cause this and other electronic control codes.*

Troubleshooting:

1. Plug in the DDR and set to read retarder counts and percent (0 percent will be between 15 and 60 counts and 100 percent will be between 150 and 233 counts). A retarder request sensor failed high code can be caused by a short-to-battery of either signal wire 164 or power wire 133 or an open on ground wire 135. An open in the portion of the ground circuit common to the TPS and OLS devices will also result in a Code 21 23 and a high fluid level reading. A retarder request sensor failed low code can be caused by an open or short-to-ground on either signal wire 164 or power wire 133.
2. Isolate and repair any wiring problems found. See Appendix E for connector service information.
3. If no wiring or connector problems are found, check the retarder request sensor voltages for each position on each of the retarder request sensors used on the vehicle. If two resistance modules are used, disconnect one of them when measuring voltage signals from the other. If problems are found, replace the resistance modules or retarder control devices.
4. If the problem persists, replace the ECU. If replacing the ECU corrects the problem, reinstall the original (bad) ECU to confirm that the problem is in the ECU. If the original ECU now works, inspect the ECU connectors for any corrosion or damage which may cause an intermittent condition. If the original problem recurs, reinstall the replacement ECU.

CODE 64 XX — RETARDER MODULATION REQUEST DEVICE FAULT
(Figures 6–38, 6–39)

Table 6–8. RMR Device Resistance Checks

Description	Resistance Check in Resistance Module*		Voltage Signal **		Wiring to Control Device	
	Terminals	Resistance ± 5%	% Retarder Application	Voltage ± 0.2V	Device Terminal	Wire Color
Auto Full On	A to C	12 K	100	3.6	No connections	
Pressure Switch Full On High	A to C	32 K	0 100	1.1 3.6	A B	White Blue
3-Step E-10R Bendix Pedal	A to C	32 K	0 32 58 100	1.1 1.9 2.8 3.6	A B C D	Blue Violet White Orange
6-Step Hand Lever — Off Position 1 Position 2 Position 3 Position 4 Position 5 Position 6	A to C	32 K	0 14 28 45 65 82 100	1.1 1.5 1.9 2.3 2.8 3.2 3.6	+ 1 2 3 4 5 6	White Blue Orange Violet Green Yellow Red
Auto 1/2 On	A to C	12 K	50	2.4	No connections	
3 Pressure Switches — Low Medium High	A to C	32 K	0 32 68 100	1.1 1.9 2.8 3.6	A B A B A B	White Blue White Orange White Violet
Auto 1/3 On 2 Pressure Switches Auto Medium High	A to C	21.4 K	32 68 100	1.9 2.8 3.6	A B A B	White Orange White Violet
Dedicated Pedal	No Checks	Interface not a resistance module	0 100	0.7 – 1.2 3.4 – 3.5	A B C	Green Yellow White

* Resistance module must be disconnected from the wiring harness and retarder control devices
 ** These voltages must be measured between terminals A and B.

CODE 64 XX — RETARDER MODULATION REQUEST DEVICE FAULT

(Figures 6-38, 6-39)

Table 6-9. RMR Device Connections

Device Description	Connector Terminal	Wire Number	Wire Color
RMR	A	135D	Green
	B	164	Yellow
	C	133	White
Hand Lever	1	176	Red
	2	175	Yellow
	3	174	Green
	5	173	Violet
	6	172	Orange
	7	171	Blue
	8	133	White
Dedicated Pedal	A	135D	Green
	B	164	Yellow
	C	133	White
3-Pressure Switch Hi	A	133	White
3-Pressure Switch Med	B	173	Violet
	A	133	White
3-Pressure Switch Lo	B	172	Orange
	A	133	White
2-Pressure Switch Hi	B	171	Blue
	A	133	White
	B	173	Violet
	A	133	White
2-Pressure Switch Med	B	172	Orange
	A	133	White
1-Pressure Switch	B	171	Blue
	A	133	White
Bendix E-10R Pedal	B	173	Violet
	A	171	Blue
	C	133	White
	D	172	Orange

DIAGNOSTIC CODES

NOTES

CODE 65 XX — ENGINE RATING HIGH

Main code 65 indicates the engine horsepower/governor speed rating is too high. This code is set only when computer-controlled engines are used. Code 65 means the engine computer is able to tell the transmission, the engine horsepower and/or governor speed is beyond the transmission rating or does not match the transmission shift calibration.

When a code 65 is set, no shifts out of neutral are allowed. It is possible the transmission calibration selected for this engine is improper. Contact local Allison Transmission Division distributor for assistance in selecting a proper calibration.

If the engine is beyond transmission ratings, contact the vehicle OEM for correction. The local ATD regional representative may also be contacted for assistance.

This code cannot be cleared until the proper level engine is installed or the transmission is properly calibrated.

CODE 66 XX — SCI (SERIAL COMMUNICATION INTERFACE) FAULT

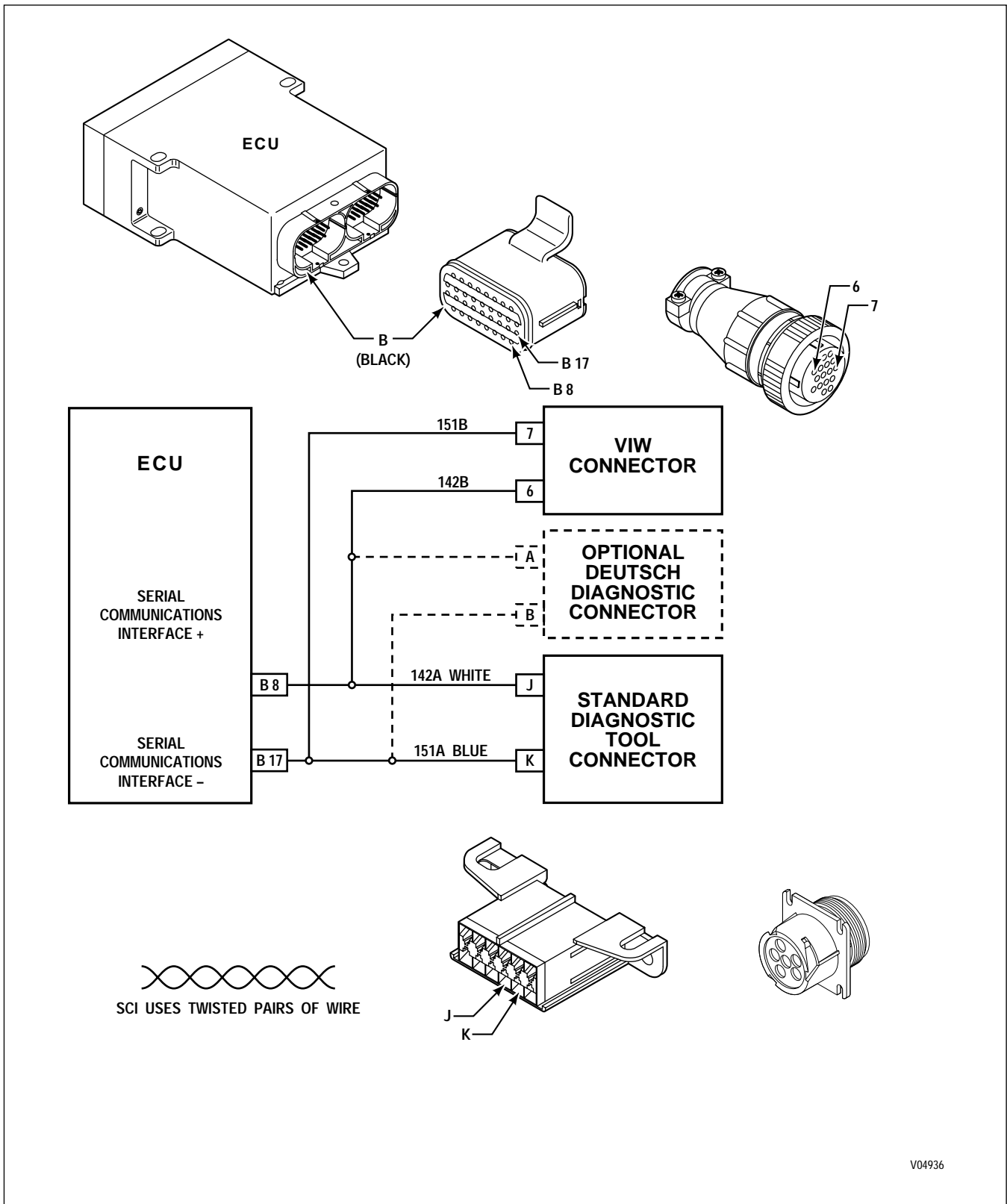


Figure 6-40. Code 66 Schematic Drawing

CODE 66 XX — SCI (SERIAL COMMUNICATION INTERFACE) FAULT*(Figure 6-40)*

Main code 66 indicates the ECU is expecting to get its throttle position sensor (TPS) signal across a serial communication interface from a computer-controlled engine. Either the engine computer is not sending the TPS information or the wiring between the engine and transmission computers has failed.

Code 66 00 can occur when the transmission ECU remains powered when the engine ECM is powered down. The transmission sees this as a communication link failure.

NOTE: *If a Code 66 00 is set and the ECU was programmed after 9/26/94, the SERVICE icon on the shift selector will be illuminated.*

Active Indicator Clearing Procedure:

- Power down
- Manual
- Self-clearing

Troubleshooting:

1. Check for a TPS signal from the engine to the transmission, an engine computer malfunction, or an engine TPS fault.

NOTE: *Throttle position data sent from a computer-controlled engine will not register counts on the DDR.*

2. Check wires 142 and 151 between the engine and transmission ECUs, for an open or short, and check that all connectors are clean and tightly connected.
3. Use the Pro-Link® to see if the ECU is receiving power when it should not.

DIAGNOSTIC CODES

NOTES

CODE 69 XX — ECU MALFUNCTION

Main code 69 indicates the ECU has malfunctioned. To assist in tracking ECU reliability, the subcode has been included to indicate the cause of the ECU malfunction. Most codes, except Code 69 34, can be cleared; but they will probably recur. Replacing the ECU corrects the problem.

NOTE: A “cateyes” display may occur with subcode 32.

A “cateyes” display may occur with subcode 33 if a remote ECU is used, or a blank display may occur if the ECU is integral to the shift selector.

Main Code	Subcode	Meaning
69	12	ECU, open driver, A solenoid circuit
69	13	ECU, open driver, B solenoid circuit
69	14	ECU, open driver, C solenoid circuit
69	15	ECU, open driver, D solenoid circuit
69	16	ECU, open driver, E solenoid circuit
69	21	ECU, open driver, F solenoid circuit
69	22	ECU, open driver, G solenoid circuit
69	23	ECU, open driver, H solenoid circuit
69	24	ECU, open driver, J solenoid circuit
69	25	ECU, open driver, K solenoid circuit
69	26	ECU, open driver, N solenoid circuit
69	32	ECU, SPI communications link fault
69	33	ECU, central operating processor timeout
69	34	ECU, EEPROM write timeout
69	35	ECU, EEPROM checksum
69	36	ECU, RAM self-check failure
69	41	ECU, I/O ASIC addressing test

Active Indicator Clearing Procedure:

- Power down
- Manual — except subcodes 32, 33, 35, 36, 41
- Self-clearing — subcode 32 after an ECU reset

NOTE: Subcode 34 cannot be cleared.

CODE 69 XX — ECU MALFUNCTION

CAUTION: Static electricity can destroy the EEPROM. If the ECU must be opened, use Anti-Static Wrist Strap BT 8639-B to prevent a static electricity discharge to the EEPROM.

NOTE: *Code 69 XX can be generated by low solenoid resistance, approximately 1–2 Ohms.*

For subcodes 12 through 26, 34, and 36:

1. Replace ECU and note diagnostic code on paperwork accompanying the ECU being returned.

For subcode 32:

1. Turn off vehicle ignition and restart the ECU. If the code recurs, replace the ECU.

For subcodes 33 through 41, except 34 and 36:

1. Remove the ECU core cover or shift selector.
2. Reseat the EPROM.
3. Reinstall the core cover or shift selector.
4. If problem recurs, reload the calibration in the EEPROM.
5. If problem recurs, replace the ECU and note diagnostic code(s) on paperwork accompanying the ECU being returned.

DIAGNOSTIC CODES

SECTION 7 — INPUT AND OUTPUT FUNCTIONS

7-1. INPUT FUNCTIONS

Input functions are signals sent into the ECU that prompt the ECU to take action. Input functions are activated and deactivated by switched ignition power or ground (wire 161B) to the ECU (wired through the VIW), or through the **MODE** button on the shift selector. The following input functions can be activated using the **MODE** button:

- Secondary Shift Schedule
- PTO Enable
- Auxiliary Hold
- Automatic Neutral for PTO (Special) (Refuse Packers only)
- Manual Lockup (Oil Field only)

The wiring schematic in Appendix J illustrates installation requirements for input functions and designates specific wire numbers in the transmission control system to be used for the activation of these input functions. However, in earlier versions of the Allison WT Controls, specific wire numbers were not assigned to each input function. For example, the control for the PTO Enable may have been on wire 118 in one calibration, but on wire 153 in another calibration. Therefore, the wiring schematic in Appendix J should be used for reference only. Ask the vehicle manufacturer which input functions are programmed, which wires are used, and whether voltage input was positive or ground. The Pro-Link® 9000 can also be utilized to determine which wire was programmed for a particular input function and the wiring schematic can be consulted to find out if input to the ECU is + or – voltage. Refer to the Pro-Link® 9000 diagnostic tool Operator’s Manual for further information regarding special input functions and other inhibits.

NOTE: *The schematic in Appendix J shows the intended use of the control features specified. These features have only been validated in the configuration shown. ANY USE OF THESE FEATURES WHICH DIFFERS FROM WHAT IS SHOWN IS NOT THE RESPONSIBILITY OF ALLISON TRANSMISSION.*

CAUTION: Never use chassis ground as an **INPUT FUNCTION** ground. Chassis ground can carry voltage potential of 1V or 2V above battery ground. This non-approved input will “confuse” the ECU and cause erroneous input results.

Activating an input function can inhibit transmission operation in the same manner as diagnostic code. Use the Pro-Link® 9000 to verify an active input function or a diagnostic code inhibit. Refer to the Pro-Link® 9000 diagnostic tool Operator’s Manual for further information regarding special input functions and other inhibits. Also, for more detailed information on input functions, refer to the Sales Tech Data Book “WT Controls and General Information.”

The maximum number of input and output functions which may be used in any installation depends upon the transmission model, its features, and the transmission control system. Refer to Table 7-1.

Table 7-1. Input/Output Function Availability

Transmission Model and Controls System Level	Auxiliary Transmission Controls Functions	Number Of Input Functions	Number Of Output Functions
6-Speed, Non-retarder Basic ECU	None	8 + Mode Button	3
6-Speed, Non-retarder Max-Feature ECU	None	8 + Mode Button	5
6-Speed, Retarder Max-Feature ECU	Retarder	6 + Mode Button	3
7-Speed (MD 3070PT) Max-Feature ECU	Transfer Case	7 + Mode Button	3

INPUT AND OUTPUT FUNCTIONS

The following input functions inhibit direction change shifts (forward to reverse or reverse to forward):

- Auxiliary Function Range Inhibit (standard)
- Auxiliary Function Range Inhibit (special)
- Quick-to-Neutral, Pump
- Automatic Neutral for PTO (standard)
- Automatic Neutral for PTO (special)
- Automatic Neutral at Stop
- Reverse Enable
- Automatic Neutral for Refuse Packers

The following input functions lock the transmission in fourth range:

- Fire Truck Pump Mode
- Fourth Lockup Pump Mode

The following input functions preselect a lower range:

- Engine Brake and Preselect Request (Standard)
- Engine Brake and Preselect Request (Special)

The following input functions inhibit upshifts:

- D1 Selection
- Auxiliary Hold

The following input functions inhibit lockup shifts:

- Manual Lockup
- Antilock Brake response

The following input function inhibits range and lockup shifts at high horsepower:

- Shift Enable/Shift in Process (Oil Field Application)

The following functions are general restrictions to normal operation:

- High Input Speed causes neutral to range inhibit
- Cold Oil restricts operation to Neutral Range only
- Medium Cold Oil causes operation confined to **R**, **N**, and 2nd range start
- Hot Oil restricts operation to 4th range maximum
- Special Pattern Logic
- Wheel Lock
- High Throttle
- Power loss to the ECU restricts operation to certain ranges

INPUT AND OUTPUT FUNCTIONS

7-2. OUTPUT FUNCTIONS

Output functions are signals sent out by the ECU that activate or control devices or mechanisms. These control devices or mechanisms are controlled by relays or direct connection signals from the ECU.

Many input and output functions are closely related. For instance, the PTO Enable option (input function) also includes PTO Output wiring information. When searching for output function information, be sure to check any related input function information references.

The wiring schematics in Appendix J illustrate installation requirements for output functions as well as input functions and designate specific wire numbers in the transmission control system to be used for the activation of these output functions. The wiring schematics in Appendix J should be used for reference only. Ask the vehicle manufacturer which specific output functions are programmed and which wires are used. Output function polarity is not significant when an Allison-supplied VIM is used. The Pro-Link® 9000 can also be utilized to determine which wire was programmed for a particular output function. For more detailed information on output functions, refer to the Sales Tech Data Book "WT Controls and General Information."

INPUT AND OUTPUT FUNCTIONS

NOTES

SECTION 8 — GENERAL TROUBLESHOOTING OF PERFORMANCE COMPLAINTS

IMPORTANT:

Make the following general checks before beginning specific troubleshooting, removing the transmission, or removing attached components.

- Is the lever shift selector lever in **N** (Neutral) to allow starting the engine?
- Is the battery properly connected and charged?
- Is isolated battery properly connected (if used)?
- Have the items on Pages 6–17 and 6–18 in Section 6–5 been checked?
- Is the fluid level correct?
- Is voltage to the ECU correct?
- Is the engine properly tuned?
- Is fuel flow to the engine correct?
- Are wheel chocks in place?
- Is air flow to the cooler and radiator unrestricted?
- Is the driveline properly connected?
- Are there signs of fluid leakage under the vehicle? What is the origination point?
- Are hydraulic connections correctly made and not leaking?
- Is vehicle acceleration from a stop changed?
- Are electrical connections correctly made?
- Are there any other obvious vehicle or transmission problems?

After making these general checks use the various sections of this Manual to isolate the listed problems. The following charts address specific vehicle complaints. Some complaints involve diagnostic codes, so all troubleshooting checks should involve checking the system for diagnostic codes.

GENERAL TROUBLESHOOTING OF PERFORMANCE COMPLAINTS

Table 8-1. Troubleshooting Performance Complaints

Problem	Probable Cause	Suggested Remedy
SHIFT SELECTOR DISPLAYS "CATEYES" AND VEHICLE IS NOT OPERABLE	Primary shift selector is remote and terminal 2 to 3 jumper wire in RSI connector is in place	Remove, cut, and seal ends of jumper wire. If removed, install cavity plugs in the terminal cavities.
	No communication between the ECU and a remote shift selector	Refer to Code 23 XX in Troubleshooting Procedure
SHIFT SELECTOR DISPLAY IS BLANK	VIM fuse is blown	Replace VIM fuse
	Poor battery power or ground connection	Clean and/or repair battery connections
	Blown fuse or fusible link at battery	Replace battery fuse or fusible link
VEHICLE WILL NOT START (ENGINE WILL NOT CRANK)	Lever shift selector not in neutral	Select N (Neutral) and restart
	Dead battery	Recharge battery
	Disconnected battery	Reconnect battery
No display	Faulty ignition circuit (wire 146)	Repair wire 146
	Faulty starter circuit	Repair vehicle starter circuit
	Faulty neutral start relay	Replace neutral start relay
	Faulty wiring in neutral start circuit	Repair wiring
	Voltage to ECU too low	Check battery and charging system voltage
	Faulty lever shift selector	Replace lever shift selector
	Lack of battery voltage on Circuit 123 from ECU when in neutral	Repair Circuit 123 or replace ECU
All display segments on both sides of display lighted	No calibration installed in ECU Voltage to ECU too low	Load Calibration Check battery and charging system voltage
All display segments on right side of display lighted, left side of display blank	Calibration corrupted by repeatedly turning off ECU power before turning off ignition (check for codes)	Replace ECU and rewire switching so that the ECU has power before ignition is on and after ignition is off

GENERAL TROUBLESHOOTING OF PERFORMANCE COMPLAINTS

Table 8-1. Troubleshooting Performance Complaints (*cont'd*)

Problem	Probable Cause	Suggested Remedy
DO NOT SHIFT LIGHT WILL NOT GO OUT AT START-UP		
A. Vehicle Drives Normally	Faulty DO NOT SHIFT light, relay, or circuit.	Replace relay or repair circuit
	An LED rather than a lamp is installed for the DO NOT SHIFT light and the LED is partially lighted from leakage current	Install a lamp rather than an LED for the DO NOT SHIFT light
B. Vehicle Does Not Drive	Faulty ECU	Replace the ECU
	Engine does not start	Repair engine starting system
	Faulty harness	Repair harness (See Section 4 and Appendix E)
	Faulty interface wiring to vehicle electrical system	Repair wiring (See Appendix E)
	Fluid temperature too low	Warm transmission fluid
	Faulty fluid temperature sensor/circuit	Repair sensor or circuits
	Faulty ECU	Replace the ECU
DO NOT SHIFT LIGHT FLASHES INTERMITTENTLY	Intermittent power to ECU	Check input power to the ECU and correct if necessary
	Loose wiring to DO NOT SHIFT light	Repair wiring
	Faulty or incorrect ground wire attachment	Repair ground circuit
	Intermittent opening in Circuit 115	Repair Circuit 115
NO DO NOT SHIFT LIGHT AT IGNITION	Faulty light bulb or socket	Replace light bulb or socket
	Incorrect wiring to and from DO NOT SHIFT light bulb	Repair wiring (See Appendix E)
	Faulty wiring harness	Check wiring between ECU and DO NOT SHIFT light, and repair where necessary (See Appendix E)
	Circuit 115 open	Repair Circuit 115
	Faulty ECU	Replace ECU

GENERAL TROUBLESHOOTING OF PERFORMANCE COMPLAINTS

Table 8–1. Troubleshooting Performance Complaints *(cont'd)*

Problem	Probable Cause	Suggested Remedy
ECU WILL NOT TURN OFF WHEN IGNITION SWITCH OFF	Faulty ignition switch	Replace ignition switch
	Externally-generated speed sensor signal(s) (refer to Appendix L for detailed inspection)	Find source of false speed sensor signal(s) and correct problem
TRANSMISSION WILL NOT SHIFT TO FORWARD OR REVERSE (STAYS IN NEUTRAL)	Engine rpm too high	Reduce engine rpm
	Low fluid level	Add fluid to proper level (refer to transmission Mechanic's Tips for proper dipstick calibration)
	Fluid temperature too low	Warm fluid
	Throttle position sensor or linkage is not functioning properly	Refer to throttle position sensor for correct set-up (Appendix F)
	Voltage to ECU too low	Check vehicle battery and charging system
	Shift selector is not functioning properly	Replace shift selector
	Disconnected or dirty connectors	Perform connector checkout (Appendix E)
	Faulty wiring harnesses	Repair harness (Appendix E)
	Speed sensor(s) not functioning properly	Repair or replace speed sensor(s) or circuitry (see transmission Service Manual and Appendix E)
	Faulty ECU	Replace the ECU
Input function wire open and auxiliary function range inhibit in the calibration EEPROM	Check input function programming with Pro-Link®. Correct wiring or switch problem which does not allow input function wire to be grounded	
TRANSMISSION WILL NOT STAY IN FORWARD OR REVERSE	Auto-neutral or quick-to-neutral circuit (input function) faulty	Repair quick-to-neutral circuit
	Leaking at solenoid assembly	Rebuild solenoid assembly (see transmission Service Manual)
	Faulty solenoid — leaking	Replace solenoid (see transmission Service Manual)

GENERAL TROUBLESHOOTING OF PERFORMANCE COMPLAINTS

Table 8-1. Troubleshooting Performance Complaints *(cont'd)*

Problem	Probable Cause	Suggested Remedy
TRANSMISSION WILL NOT MAKE A SPECIFIC SHIFT	Low engine power	Correct engine problem, see Engine Service Manual
	Incorrect fluid level	Correct fluid level (refer to transmission Mechanic's Tips for proper dipstick calibration)
	Extreme fluid temperature	Inspect cooling system and fluid level
	Faulty speed sensor/circuit	Repair circuit or replace speed sensor(s) (see Code 22 XX)
	Faulty temperature sensor/circuit	Check for temperature reading which inhibits shifts
	Faulty shift selector	Replace shift selector
	Hydraulic problem	Refer to Range Clutch Troubleshooting section
	Faulty ECU	Replace ECU
TRANSMISSION DOES NOT SHIFT PROPERLY (ROUGH SHIFTS, SHIFTS OCCURRING AT TOO LOW OR TOO HIGH SPEED)	Engine idle speed too fast (neutral to range shift)	Adjust engine idle speed (refer to Vehicle Service Manual)
	Faulty throttle sensor/circuit	Refer to throttle sensor section for installation and operation information (Appendix F)
	ECU input voltage low	Check power, ground, charging system, and battery function
	Incorrect shift calibration for vehicle	Install correct calibration
	Instrument panel tachometer incorrect	Repair or replace tachometer
	Incorrectly calibrated electronic speedometer	Calibrate electronic speedometer
	Faulty speed sensor/circuit	Repair circuit or replace speed sensor (see Code 22 XX)
	Loose speed sensor	Tighten speed sensor retaining bracket bolt
	Incorrect fluid level	Correct fluid level (refer to Mechanic's Tips for proper dipstick calibration)

GENERAL TROUBLESHOOTING OF PERFORMANCE COMPLAINTS

Table 8–1. Troubleshooting Performance Complaints *(cont'd)*

Problem	Probable Cause	Suggested Remedy
TRANSMISSION DOES NOT SHIFT PROPERLY (ROUGH SHIFTS, SHIFTS OCCURRING AT TOO LOW OR TOO HIGH SPEED) <i>(cont'd)</i>	Crossed wires in harness	Check for crossed wires and correct
	Intermittent problems	Check wiring harnesses and connectors (Appendix E)
	Loose or damaged speed gear	Replace output bearing nut sensor retainer
	Control spool valve sticking	Overhaul valve body assembly (refer to transmission Service Manual)
	Sticking stage 2 solenoid valve	Overhaul valve body assembly (refer to transmission Service Manual)

RETARDER PERFORMANCE COMPLAINTS

A. Retarder Does Not Apply	Retarder enable input not activated	Turn on retarder enable switch (if present).
	Retarder enable switch not working	Replace retarder enable switch (if present).
	ABS input is active (if vehicle is equipped with ABS)	None — This is normal. If ABS is active, retarder will not apply.
	Retarder request below 10.2 percent	Use DDR to determine counts signaled by each RMR device present. At least 15 counts are required for some retarder apply and 150–232 counts are required for full apply. Replace RMR device, based on test results.
	Closed throttle not sensed	Use DDR to check throttle signal. Throttle must be below 9.8 percent before retarder will apply. Readjust or replace TPS. Exception: If TPS has failed and Service Brake Status input is sensed by ECU, the retarder will still be applied.
	Active code inhibiting retarder	Correct cause for setting these codes: 42 23, 44 23, 45 23, 46 26, 64 12, 64 23, or 69 29
	Transmission output speed below 350 rpm (450 rpm for HD/B 500)	Raise output speed to above 350 rpm (450 rpm for HD/B 500)
	Transmission not in a forward range	Shift to a forward range

GENERAL TROUBLESHOOTING OF PERFORMANCE COMPLAINTS

Table 8–1. Troubleshooting Performance Complaints *(cont'd)*

Problem	Probable Cause	Suggested Remedy
B. Reduced Retarder Effect	Retarder accumulator solenoid not being energized	Correct cause for setting these codes: 42 26, 44 26, 45 26, or 69 26.
	ECU sensing false overheat condition	Use DDR or VOM to check retarder temperature sensor. Replace sensor as required.
	Normal response to overheating	See Table 6–7 in Section 6 (Code 61)
C. Less Retarder Effect Than Expected	Transmission fluid aerated due to incorrect level	Check transmission fluid level and correct as required.
	Wrong retarder control regulator valve spring	Check retarder charging pressure. Change retarder control valve regulator spring, if necessary. See PO2454EN WT Series Principles of Operation.
D. Retarder Stays On	Autoflow valve not returning to “off” position	<ul style="list-style-type: none"> — Autoflow valve spring weak or broken — Autoflow valve stuck “on” — “K” solenoid stuck “on”
ABNORMAL ACTIVITIES OR RESPONSES		
A. Excessive Creep in First and Reverse Gears	Engine idle speed too high	Adjust to correct idle speed — between 500–800 rpm (refer to Vehicle Service Manual)
B. No Response to Shift Selector	Shift selector not properly connected	Check shift selector response with diagnostic tool. If no response, check remote connection and replace if necessary
	Using wrong selector on dual station equipment	Use other selector
	Faulty shift selector	Replace shift selector
	Incorrect fluid level	Correct fluid level (refer to transmission Mechanic’s Tips for proper dipstick calibration)
	Main pressure low	Refer to Low Pressure section
	Control spool valves sticking (C1, C3, or C5 clutch pressure low)	Overhaul valve body assembly (refer to transmission Service Manual)

GENERAL TROUBLESHOOTING OF PERFORMANCE COMPLAINTS

Table 8–1. Troubleshooting Performance Complaints *(cont'd)*

Problem	Probable Cause	Suggested Remedy
C. Vehicle Moves Forward in Neutral*	C1 clutch failed or not released	Rebuild C1 clutch (refer to transmission Service Manual)
D. Vehicle Moves Backward in Neutral*	C3 clutch failed or not released	Rebuild C3 clutch assembly (refer to transmission Service Manual)
EXCESSIVE FLARE — ENGINE OVERSPEED ON FULL-THROTTLE UPSHIFTS	TPS Adjustment:	
	— Overstroke	— Adjust TPS linkage for proper stroke (see Appendix F)
	— Loose	— Tighten loose bolts or connections
	Incorrect calibration	Correct calibration
	ECU input voltage low	Check electrical system and all connections from battery and ECU
	Incorrect fluid level	Add fluid to proper level (refer to transmission Mechanic's Tips for proper dipstick calibration)
	Low main pressure	See Low Pressure section
	Erratic speed sensor signal	See Code 22 XX
Sticking stage 2 solenoid valve (see Solenoid and Clutch sections)	Clean and repair stage 2 valve (refer to transmission Service Manual)	
Piston seals leaking or clutch plates slipping in range involved (see Range Clutch Troubleshooting section)	Overhaul transmission (refer to transmission Service Manual)	

RANGE CLUTCH TROUBLESHOOTING SECTION

EXCESSIVE SLIPPAGE AND CLUTCH CHATTER	Incorrect calibration	Verify calibration
	ECU input voltage low	Check power, ground, charging system, and battery functions
	Throttle position sensor out of adjustment or failed	Adjust or replace throttle position sensor (refer to Appendix F)
	Incorrect speed sensor readings	See Code 22 XX

* See explanation of NVL in Section 2–3

GENERAL TROUBLESHOOTING OF PERFORMANCE COMPLAINTS

Table 8–1. Troubleshooting Performance Complaints *(cont'd)*

Problem	Probable Cause	Suggested Remedy
EXCESSIVE SLIPPAGE AND CLUTCH CHATTER <i>(cont'd)</i>	Incorrect fluid level	Correct fluid level (refer to Mechanic's Tips for proper dipstick calibration measurements)
	Main pressure low	Refer to the Low Pressure section
	Lockup clutch not applied	Inspect lockup clutch system wiring, pressure, and controls; repair as necessary (refer to transmission Service Manual)*
A. Ranges 1, 2, 3, 4 Only (6-Speed) Ranges 2, 3, 4, 5 only (7-Speed)	C1 clutch slipping, leaks at splitline gasket, leaks at rotating clutch seals, leaks at piston seals, C1 clutch plates worn	Inspect control module gasket, C1 clutch plates, and piston and rotating seals; replace/rebuild as necessary (refer to transmission Service Manual)*
B. Ranges 4, 5, 6 Only (6-Speed) Ranges 5, 6, 7 only (7-Speed)	C2 clutch slipping, leaks at splitline gasket, leaks at rotating clutch seals, leaks at piston seals, C2 clutch plates worn	Inspect control module gasket, C2 clutch plates, and piston and rotating seals; replace/rebuild as necessary (refer to transmission Service Manual)*
C. Ranges 3, 5, R Only (6-Speed) Ranges 1, 4, 6, R only (7-Speed)	C3 clutch slipping, leaks at face seals, leaks at piston seals, C3 clutch plates worn	Inspect control module face seals, C3 clutch plates, and piston seals; replace/rebuild as necessary (refer to transmission Service Manual)*
D. Ranges 2, 6 Only (6-Speed) Ranges 3, 7 only (7-Speed)	C4 clutch slipping, leaks at face seals, leaks at piston seals, C4 clutch plates worn	Inspect control module face seals, C4 clutch plates, and piston seals; replace/rebuild as necessary (refer to transmission Service Manual)*
E. Ranges 1, R Only (6-Speed) Ranges 2, R only (7-Speed)	C5 clutch slipping, leaks at face seals, leaks at piston seals, C5 clutch plates worn	Inspect control module face seals, C5 clutch plates, and piston seals; replace/rebuild as necessary (refer to transmission Service Manual)*
F. Range Lo Only (7-Speed)	C6 clutch slipping, leaks at splitline gasket(s), leaks at piston seals, C6 clutch plates worn	Inspect control module gasket, adapter gasket, T-Case gasket(s), C6 clutch plates, and piston seals; replace/rebuild as necessary (refer to transmission Service Manual)*

* See Appendix B — Check main pressure, clutch pressure, and pressure specifications.

GENERAL TROUBLESHOOTING OF PERFORMANCE COMPLAINTS

Table 8–1. Troubleshooting Performance Complaints *(cont'd)*

Problem	Probable Cause	Suggested Remedy
LOW PRESSURE SECTION		
<p>LOW PRESSURE</p> <p>A. Low Main Pressure in All Ranges (Including C6, T-Case)</p>	<p>Incorrect fluid level</p> <p>Oil filter element clogged or faulty</p> <p>Plugged or faulty suction filter</p> <p>Main pressure regulator valve sticking</p> <p>Main pressure regulator valve spring weak, broken, or missing</p> <p>Control module body leakage (separator plate not flat, separator plate gasket leakage, loose control valve body bolts)</p> <p>Faulty or incorrect fluid pressure gauge</p> <p>Oil pump worn or damaged</p>	<p>Correct fluid level (refer to the Mechanic's Tips Handbook for correct dipstick calibration)*</p> <p>Replace oil filter (refer to transmission Mechanic's Tips)</p> <p>Clean or replace oil suction filter element and refill the transmission (refer to transmission Mechanic's Tips)</p> <p>Overhaul control module assembly (refer to transmission Service Manual)</p> <p>Check spring and replace if necessary (refer to transmission Service Manual)</p> <p>Replace or rebuild control module assembly. Care should be taken when removing and labeling shift springs (refer to transmission Service Manual)</p> <p>Repair or replace gauge</p> <p>Replace or rebuild oil pump (refer to transmission Service Manual)</p>
<p>B. Clutch Pressure Low in Specific Ranges, Normal Pressure in Other Ranges</p>		<p>See Range Clutch Troubleshooting section and Appendix B</p>
<p>C. Low Lubrication Pressure</p>	<p>Incorrect fluid level</p> <p>Plugged lube filter</p>	<p>Correct fluid level (refer to the Mechanic's Tips Handbook for proper dipstick calibration)</p> <p>Change filter (refer to Transmission Mechanic's Tips)</p>

* See Appendix B — Check main pressure, clutch pressure, and pressure specifications.

GENERAL TROUBLESHOOTING OF PERFORMANCE COMPLAINTS

Table 8-1. Troubleshooting Performance Complaints *(cont'd)*

Problem	Probable Cause	Suggested Remedy
LOW PRESSURE <i>(cont'd)</i>	Excessive internal fluid leakage	Check other pressures (above items); also check control module mounting bolts; lubrication valve and spring (refer to transmission Service Manual)
C. Low Lubrication Pressure <i>(cont'd)</i>	Broken or damaged converter regulator retaining pin	Replace damaged or broken parts (refer to transmission Service Manual)
	Cooler lines restricted or leaking	Check for kinks, leakage; reroute or replace lines as necessary
	Lubrication valve sticking	Replace lubrication valve
	Cooler plugged	Clean or replace cooler
	Faulty gauge	Repair or replace gauge
ABNORMAL STALL SPEEDS (Stall In First Range — 6-Speed) (Stall In Second Range — 7-Speed)		
A. High Stall Speeds	Not in gear	Select D (Drive)
	Low fluid level, aerated fluid	Add fluid to proper level (refer to Mechanic's Tips for proper dipstick calibration)
	Incorrect torque converter	Replace torque converter (refer to transmission Service Manual)
	Clutch pressure low	Refer to Low Pressure section and Appendix B
	C1 or C5 clutch slipping. (7-speed, 2nd range start) (6-speed, 1st range start) <i>Note:</i> Use the diagnostic tool to check turbine speed	Rebuild C1 or C5 clutch (refer to transmission Service Manual)
B. Low Stall Speeds	Higher power engine	Confirm proper engine match
	Engine not performing efficiently (may be due to plugged or restricted injectors, high altitude conditions, dirty air filters, out of time, throttle linkage, electronic engine controls problem)	Refer to Vehicle Engine Manufacturer's Manual or Vehicle Service Manual

GENERAL TROUBLESHOOTING OF PERFORMANCE COMPLAINTS

Table 8–1. Troubleshooting Performance Complaints *(cont'd)*

Problem	Probable Cause	Suggested Remedy
ABNORMAL STALL SPEEDS (Stall In First Range — 6-Speed) (Stall In Second Range — 7-Speed) <i>(cont'd)</i>	Clutch partially applied	Check clutch pressures to identify cause of partial apply. Rebuild clutch if no pressure found to cause partial apply. If pressure found in clutch, find cause of pressure. (refer to Appendix B and transmission Service Manual)
	Stall speeds of 66 percent of normal implies freewheeling stator	Replace or rebuild converter assembly (refer to transmission Service Manual)
	Incorrect torque converter	Replace torque converter (refer to transmission Service Manual)
OVERHEATING IN ALL RANGES	Aerated fluid — incorrect fluid level	Adjust fluid to proper level, check for defective pump (refer to Mechanic's Tips and transmission Service Manual)
	Air flow to cooler obstructed	Remove air flow obstruction
	Engine overheat	Correct overheat situation (refer to Vehicle Service Manual)
	Inaccurate temperature gauge or sending unit	Replace gauge and/or sending unit
	Inaccurate sump temperature sensor	Replace temperature sensor or internal harness (refer to transmission Service Manual)
	Transmission cooler lines reversed	Connect cooler lines properly (oil and water should flow in opposite directions)
	Fluid cooler lines restricted	Remove restrictions, clean or replace lines (refer to Vehicle Service Manual)
	Torque converter (wrong converter, no lockup, stuck stator, or slipping stator)	Replace or repair converter assembly. (refer to transmission Service Manual) <i>Note:</i> Stuck stator will not allow cool down in neutral
	Cooler flow loss due to internal leakage	Overhaul transmission (refer to transmission Service Manual)
	Retarder stays "on"	See Retarder Performance Complaints earlier in this table

GENERAL TROUBLESHOOTING OF PERFORMANCE COMPLAINTS

Table 8-1. Troubleshooting Performance Complaints *(cont'd)*

Problem	Probable Cause	Suggested Remedy
OVERHEATING IN ALL RANGES <i>(cont'd)</i>	Inadequate cooler sizing	See vehicle OEM for specifications
	Excessive cooler circuit pressure drop	Check for plugged cooler, lines too small, collapsed hose, too many elbows in circuit
FLUID COMES OUT OF THE FLUID FILL TUBE AND/OR BREATHER	Dipstick loose	Tighten cap, replace if necessary
	Fluid level too high	Drain to proper level (refer to transmission Mechanic's Tips)
	Fluid level too low	Add fluid to proper level
	Breather stopped up — clogged	Clean or replace breather (refer to transmission Service Manual)
	Fluid contaminated with foreign liquid	Drain and replace fluid. Locate and fix source of additional fluid (refer to transmission Service Manual if repair is needed)
	Dipstick or fill tube seal worn	Replace seals or dipstick
	Incorrect dipstick marking	Calibrate dipstick (refer to transmission Mechanic's Tips)
NOISE OCCURRING INTERMITTENTLY (BUZZING)	Low fluid level	Add fluid to proper level (refer to transmission Mechanic's Tips for proper dipstick calibration)
	Air leak in oil suction screen canister	Replace oil suction screen canister (refer to transmission Service Manual)
	Clogged filters	Replace filters (refer to transmission Mechanic's Tips)
	Aerated fluid causes noisy pump	Correct fluid level (refer to transmission Mechanic's Tips for proper dipstick calibration)
	Low main pressure causes main regulator valve to oscillate	See Low Pressure section
LEAKING FLUID (OUTPUT SHAFT)	Faulty or missing seal at output flange	Install new lip-type seal in rear of transmission housing (refer to transmission Service Manual)

GENERAL TROUBLESHOOTING OF PERFORMANCE COMPLAINTS

Table 8–1. Troubleshooting Performance Complaints *(cont'd)*

Problem	Probable Cause	Suggested Remedy
LEAKING FLUID (OUTPUT SHAFT) <i>(cont'd)</i>	Machine lead on output flange seal surface	Replace flange
	Flange worn at seal surface	Replace flange
	Insufficient seal around seal OD	When replacing seal, apply sealant (refer to transmission Service Manual)
	Damaged, missing, or loose output flange bolts	Replace and/or torque output flange bolts
	Damaged or missing flange button O-ring	Replace flange button O-ring
	Damaged or missing flange button gasket	Replace flange button gasket
TRANSMISSION INPUT	Front seal leaks	Replace front seal (refer to transmission Service Manual)
	Converter leaks	Check converter seals, cracked converter pump tangs, converter cover, or converter housing porosity; replace parts as required (refer to transmission Service Manual)
	PTO driveline out of specification	Bring driveline into specification
DIRTY FLUID	Failure to change fluid and filters	Change fluid and install new filters (refer to transmission Mechanic's Tips)
	Excessive heat	Refer to Overheating section
	Damaged fluid filter/seals	Replace oil filter/seals (refer to transmission Mechanic's Tips)
	Substandard fluid	Use recommended fluid (refer to transmission Mechanic's Tips)
	Clutch/transmission failure	Overhaul transmission (refer to transmission Service Manual)
POWER TAKEOFF (PTO)*		
A. Leaks	Damaged or cocked seal	Replace seal
	PTO flange grooved at seal	Replace PTO flange

* Contact your nearest Allison dealer/distributor with specific questions relating to PTO repair.

GENERAL TROUBLESHOOTING OF PERFORMANCE COMPLAINTS

Table 8–1. Troubleshooting Performance Complaints *(cont'd)*

Problem	Probable Cause	Suggested Remedy
POWER TAKEOFF (PTO)* <i>(cont'd)</i>	Loose flange	Inspect flange and bolts; replace if necessary and properly torque bolts
	Loose bolts or damaged gaskets	Replace gasket and/or properly torque bolts
	Loose or damaged hydraulic lines (clutched drive)	Tighten fittings (replace if necessary)
B. Noisy PTO	Faulty driven component	Replace faulty driven component
	Gears or bearings worn, damaged, or contaminated	Rebuild PTO with new gears or bearings
C. No or Intermittent Operation (Clutched Drive)	Electrical problem (switch, connectors, solenoid, or wires)	Inspect for electrical problem and repair (see Appendix E)
	Damaged or worn clutch	Rebuild clutch assembly
	Clutch piston seals damaged or missing	Rebuild clutch assembly
	Inadequate fluid pressure to PTO	Inspect and repair fluid pressure supply; line kinked, loose, or plugged; orifice too small
	Engine speed outside operating band	Increase or reduce engine speed to move within operating band
	Drive or driven gear teeth damaged	Replace damaged gears (refer to transmission Service Manual)
TRANSFER CASE (T-CASE)		
A. Won't Go Into First Range	TPS adjustment	Properly adjust TPS (refer to Appendix F)
	Engine speed too high	Reduce Engine Speed
	Wrong calibration	Calibrate properly
	Wrong control module (6 speed instead of 7 speed)	Install correct control module
	Faulty wiring, solenoid connectors	Check wiring and connectors in control module (refer to transmission Service Manual)
	Faulty C6 seals	Replace C6 piston seals (refer to transmission Service Manual)

* Contact your nearest Allison dealer/distributor with specific questions relating to PTO repair.

GENERAL TROUBLESHOOTING OF PERFORMANCE COMPLAINTS

Table 8–1. Troubleshooting Performance Complaints *(cont'd)*

Problem	Probable Cause	Suggested Remedy
TRANSFER CASE (T-CASE) <i>(cont'd)</i>	Worn C6 clutch plates	Rebuild C6 (refer to transmission Service Manual)
B. Makes Excessive Noise	Improperly shimmed bearings	Check all T-case bearings as directed in transmission repair manual. Reshim as necessary.
C. No Front Output Drive	Differential clutch bad (C7 piston seals, C7 rotating seals, C7 clutch plates, C7 check ball)	Rebuild differential clutch (refer to transmission Service Manual)
D. Transmission Fluid Leaks	C7 electrical (wires, solenoids, terminals, connectors) Damaged output seal, output flange seal journal, gasketed mating surfaces, bearing endcaps, electrical connector, oil scavenge line	Inspect and repair C7 electrical system (refer to Appendix E) Determine source of leak and repair (refer to transmission Service Manual)

ELECTRONIC AND HYDRAULIC TROUBLESHOOTING

Table 8–2. Resistance Module Troubleshooting Data

Description	Resistance Check in Resistance Module*		Voltage Signal**		Wiring to Control Device	
	Terminals	Resistance ± 5%	% Retarder Application	Voltage ± 0.2V	Device Terminal	Wire Color
Auto Full On	A to C	12 K	100	3.6	No connections	
Pressure Switch Full On High	A to C	32 K	0 100	1.1 3.6	A B	White Blue
3-Step E-10R Bendix Pedal	A to C	32 K	0 32 58 100	1.1 1.9 2.8 3.6	A B C D	Blue Violet White Orange
6-Step Hand Lever — Off Position 1 Position 2 Position 3 Position 4 Position 5 Position 6	A to C	32 K	0 16 28 48 65 84 100	1.1 1.5 1.9 2.3 2.8 3.2 3.6	+ 1 2 3 4 5 6	White Blue Orange Violet Green Yellow Red
Auto 1/2 On	A to C	12 K	50	2.4	No connections	
3 Pressure Switches — Low Medium High	A to C	32 K	0 32 68 100	1.1 1.9 2.3 3.6	A B A B A B	White Blue White Orange White Violet
Auto 1/3 On 2 Pressure Switches Auto Medium High	A to C	21.4 K	32 68 100	1.9 2.8 3.6	A B A B	White Orange White Violet
Dedicated Pedal	No Checks	Interface not a resistance module	0 100	0.7–1.2 3.4–3.5	A B C	Green Yellow White

* Resistance module must be disconnected from the wiring harness and retarder control devices.

** These voltages must be measured between terminals A and B.

GENERAL TROUBLESHOOTING OF PERFORMANCE COMPLAINTS

NOTES

APPENDICES

Appendix A	Identification of Potential Circuit Problems
Appendix B	Checking Clutch Pressures
Appendix C	Solenoid and Clutch Chart
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Appendix H	Hydraulic Schematics
Appendix J	WT Wiring Schematics
Appendix K	Solenoid and Temperature Charts
Appendix L	Externally-Generated Electronic Interference
Appendix M	Diagnostic Tree — WT Series Hydraulic System
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Appendix P	Input/Output Function Wiring Schematics

APPENDICES

NOTES

APPENDIX A — IDENTIFICATION OF POTENTIAL CIRCUIT PROBLEMS

Intermittent codes are a result of faults that are detected, logged and then disappear, only to recur later. If, when troubleshooting, a code is cleared in anticipation of it recurring and it does not, check the items in the following list for the source of the fault.

A. Circuit Inspection

1. Intermittent power/ground problems — can cause voltage problems during ECU diagnostic checks which can set various codes depending upon where the ECU was in the diagnostic process.
2. Damaged terminals.
3. Dirty or corroded terminals.
4. Terminals not fully seated in the connector. Check indicated wires by uncoupling connector and gently pulling on the wire at the rear of the connector and checking for excessive terminal movement.
5. Connectors not fully mated. (Check for missing or damaged locktabs.)
6. Screws or other sharp pointed objects pushed into or through one of the harnesses.
7. Harnesses which have rubbed through and may be allowing intermittent electrical contact between two wires or between wires and vehicle frame members.
8. Broken wires within the braiding and insulation.

B. Finding an Intermittent Fault Condition

To find a fault, like one of those listed, examine all connectors and the external wiring harness. Harness routing may make it difficult to see or feel the complete harness. However, it is important to check the entire harness for chafed or damaged areas. Road vibrations and bumps can damage a poorly installed harness by moving it against sharp edges and cause some of the faults. If a visual inspection does not identify a cause, move and wiggle the harness by hand until the fault is duplicated.

The next most probable cause of an intermittent code is an electronic part exposed to excessive vibration, heat, or moisture. Examples of this are:

1. Exposed harness wires subjected to moisture.
2. A defective connector seal allows moisture to enter the connector or part.
3. An electronic part (ECU, shift selector, solenoid, or throttle sensor) affected by vibration, heat, or moisture may cause abnormal electrical conditions within the part.

Before troubleshooting Item 3, eliminate all other possible causes before replacing any parts.

Another cause of intermittent codes is good parts in an abnormal environment. The abnormal environment will usually include excessive heat, moisture, or voltage. For example, an ECU that receives excessive voltage will generate a diagnostic code as it senses high voltage in a circuit. The code may not be repeated consistently because different circuits may have this condition on each check. The last step in finding an intermittent code is to observe if the code is set during sudden changes in the operating environment.

Troubleshooting an intermittent code requires looking for common conditions that are present whenever the code is diagnosed.

APPENDIX A — IDENTIFICATION OF POTENTIAL CIRCUIT PROBLEMS

C. Recurring Conditions

A recurring condition might be:

- Rain
- Outside temperature above or below a certain temperature
- Only on right-hand or left-hand turns
- When the vehicle hits a bump, etc.

If such a condition can be related to the code, it is easier to find the cause. If the time between code occurrences is very short, troubleshooting is easier than if it is several weeks or more between code occurrences.

APPENDIX B — CHECKING CLUTCH PRESSURES

Checking individual clutch pressures helps to determine if a transmission malfunction is due to a mechanical or an electrical problem. Properly making these pressure checks requires transmission and vehicle (or test stand) preparation, recording of data, and comparing recorded data against specifications provided. These instructions are for all WT Series Transmissions.

NOTE: Check to see if there are diagnostic codes set which are related to the transmission difficulty you are evaluating. Proceed to make mechanical preparations for checking clutch pressures after codes have first been evaluated.

A. Transmission and Vehicle Preparation

1. Remove the plugs from the pressure tap locations where measurement is desired (refer to Figure B-1).

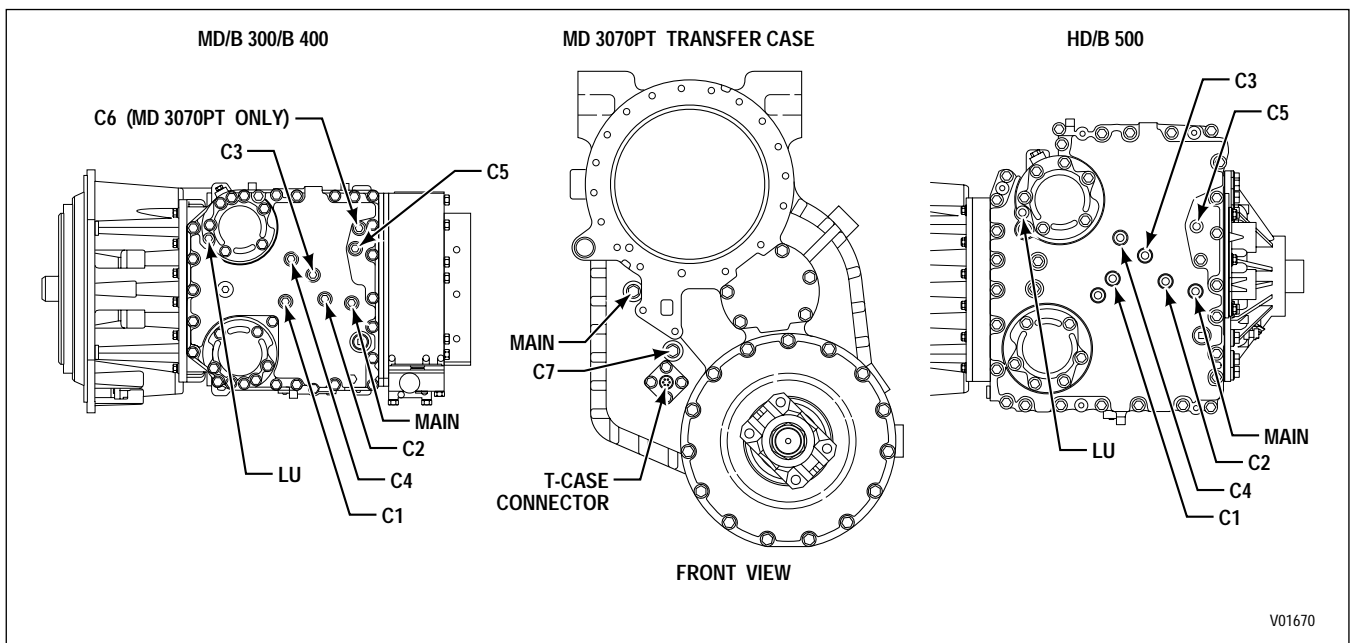


Figure B-1. Clutch Pressure Check Points

CAUTION:

Be sure that the hydraulic fittings have the same thread as the plugs removed (7/16-20 UNF-2A). Also please note that these fittings must be straight thread, O-ring style. Failure to do this will result in damage to the control module.

2. Install hydraulic fittings suitable for attaching pressure gauges or transducers.
3. Connect pressure gauges or transducers. Pressure gauge set J 26417-A is available for this purpose. See Table B-2 for pressure levels expected.
4. Check that engine speed can be monitored (Pro-Link® 9000 diagnostic tool may be used for this purpose).
5. Be sure that transmission sump fluid temperature can be measured. (Pro-Link® 9000 diagnostic tool may be used for this purpose.)

APPENDIX B — CHECKING CLUTCH PRESSURES

6. Be sure that the transmission has enough fluid for cold operation until an operating temperature fluid level can be set.
7. Bring the transmission to normal operating temperature of 71–93°C (160–200°F). Check for fluid leaks in the added pressure gauge/transducer lines. Repair leaks as needed. Be sure that fluid level is correct.

B. Recording Data

1. Use the Pro-Link® 9000 diagnostic tool, which allows checking of individual range clutch pressures, with the vehicle stationary. Consult Appendix N or the Pro-Link® 9000 operating instructions for Action Request and select Clutch Test Mode. Follow instructions to check clutch pressures in individual ranges.

NOTE: *Check lockup clutch pressure by driving the vehicle in a range where lockup can be obtained. Record the pressure values at the engine speed and sump fluid temperature values shown in Table B–1. The lockup clutch is functioning correctly when engine speed and turbine speed values are equal as recorded from the Pro-Link® 9000.*

2. Consult Table B–1 and locate the transmission model that you are testing.
3. Operate the transmission at the conditions shown in Table B–1 and record engine speed, transmission sump fluid temperature, main hydraulic pressure, and clutch pressures in the ranges where a problem is suspected.

Table B–1. Clutch Pressure Test Conditions

Transmission Model/Test Type	Engine rpm	Sump Fluid Temp	Range	Clutches Pressurized
All (except MD 3070) — Idle Check	580–620	71–93°C (160–200°F)	Neutral Reverse 1C 2C (2nd range start)	C5 C3 C5 C1 C5 C1 C4
MD 3070 — Idle Check	580–620	71–93°C (160–200°F)	Neutral Reverse LowC 1C	C5 C3 C5 C3 C6 C1 C5
MD (except 3070) B 300/B 400 — High Speed	2080–2120		Reverse Neutral 1C 2C 2L 3L 4L 5L 6L	C3 C5 C5 C1 C5 C1 C4 C1 C4 LU C1 C3 LU C1 C2 LU C2 C3 LU C2 C4 LU

APPENDIX B — CHECKING CLUTCH PRESSURES

Table B-1. Clutch Pressure Test Conditions (cont'd)

Transmission Model/Test Type	Engine rpm	Sump Fluid Temp	Range	Clutches Pressurized
MD 3070 — High Speed	2080–2120		Reverse	C3 C5
			Neutral	C5
			LoC	C3 C6
			1C	C1 C5
			2C	C1 C4
			2L	C1 C4 LU
			3L	C1 C3 LU
			4L	C1 C2 LU
			5L	C2 C3 LU
HD/B 500 — High Speed	1780–1820		Reverse	C3 C5
			Neutral	C5
			1C	C1 C5
			2C	C1 C4
			2L	C1 C4 LU
			3L	C1 C3 LU
			4L	C1 C2 LU
			5L	C2 C3 LU
			6L	C2 C4 LU

C. Comparing Recorded Data to Specifications

1. Be sure that engine speed and transmission sump fluid temperatures were within the values specified in Table B-1.
2. Compare the main pressure and clutch pressure data, recorded in Step B, with the specifications in Table B-2.
3. If clutch pressures are within specifications, return the transmission and vehicle to their original configuration and proceed with electrical troubleshooting.
4. If clutch pressures are not within specification, take corrective action to replace the internal parts of the transmission necessary to correct the problem. (Refer to the Transmission Service Manual for the model being checked.)
5. Recheck pressure values after the transmission has been repaired.
6. Return the transmission to its original configuration. (Remove instrumentation and reinstall any components removed for the pressure testing.)

APPENDIX B — CHECKING CLUTCH PRESSURES

**Table B-2. Main Pressure and Clutch Pressure Specifications
(Sump Fluid Temperature Same as in Table B-1)**

Transmission Model/Test Type	Engine rpm	Range	Clutches Applied	Main Press. Spec kPa/[psi]	Range Clutch Press. Spec* kPa/[psi]	LU Clutch Press. Spec kPa/[psi]	D'BOX MAIN Press. Spec kPa/[psi]
MD — Idle (except 3070)	580–620	Neutral	C5	1500–1900 [218–276]			
		Reverse	C3 C5	1500–1900 [218–276]			
		1C	C1 C5	1300–1900 [189–276]			
		2C	C1 C4	1300–1900 [189–276]			
MD 3070 — Idle		Neutral	C5	1500–1900 [218–276]	1480–1900 [215–276]		
		Reverse	C3 C5	1500–1900 [218–276]	1480–1900 [215–276]		
		LowC	C3 C6	1500–1900 [218–276]	1480–1900 [215–276]		
		1C	C1 C5	1500–1900 [218–276]	1280–1900 [186–276]		
MD — High Speed (except 3070)	2080–2120	Neutral	C5	1500–2300 [218–334]	0–35 (C5) [0–5]		
		Reverse	C3 C5	1500–2300 [218–334]	0–35 (C3) [0–5] 0–35 (C5) [0–5]		
		1C	C1 C5	1500–2100 [218–305]	0–80 (C1) [0–11.6] 0–35 (C5) [0–5]		
		2C	C1 C4	1500–2100 [218–305]	0–80 (C1) [0–11.6] 0–35 (C4) [0–5]		
		2L	C1 C4 LU	1000–1400 [145–203]	0–80 (C1) [0–11.6] 0–35 (C4) [0–5]	950–1400 [138–203]	

* Subtract clutch pressure from main pressure; the difference must fall within the specifications given (unless a pressure range is supplied).

APPENDIX B — CHECKING CLUTCH PRESSURES

Table B-2. Main Pressure and Clutch Pressure Specifications
(Sump Fluid Temperature Same as in Table B-1) (cont'd)

Transmission Model/Test Type	Engine rpm	Range	Clutches Applied	Main Press. Spec kPa/[psi]	Range Clutch Press. Spec* kPa/[psi]	LU Clutch Press. Spec kPa/[psi]	D'BOX MAIN Press. Spec kPa/[psi]
MD — High Speed (except 3070) (cont'd)		3C	C1 C3	1500–2100 [218–305]	0–80 (C1) [0–11.6] 0–35 (C3) [0–5]		
		3L	C1 C3 LU	1000–1400 [145–203]	0–80 (C1) [0–11.6] 0–35 (C3) [0–5]	950–1400 [138–203]	
		4C	C1 C2	1500–2100 [218–305]	0–80 (C1) [0–11.6] 0–80 (C2) [0–11.6]		
		4L	C1 C2 LU	1000–1400 [145–203]	0–80 (C1) [0–11.6] 0–80 (C2) [0–11.6]	950–1400 [138–203]	
		5C	C2 C3	1150–1650 [167–239]	0–80 (C2) [0–11.6] 0–35 (C3) [0–5]		
		5L	C2 C3 LU	900–1300 [131–189]	0–80 (C2) [0–11.6] 0–35 (C3) [0–5]	850–1300 [124–189]	
		6C	C2 C4	1150–1650 [167–239]	0–80 (C2) [0–11.6] 0–35 (C4) [0–5]		
		6L	C2 C4 LU	900–1300 [131–189]	0–80 (C2) [0–11.6] 0–35 (C4) [0–5]	850–1300 [124–189]	
MD 3070 — High Speed		Neutral	C5	1500–2300 [218–334]	1480–2300 [215–334]		1400–1600 [200–232]
		Reverse	C3 C5	1500–2300 [218–334]	1480–2300 [215–334]		1400–1600 [200–232]

* Subtract clutch pressure from main pressure; the difference must fall within the specifications given (unless a pressure range is supplied).

APPENDIX B — CHECKING CLUTCH PRESSURES

Table B-2. Main Pressure and Clutch Pressure Specifications
(Sump Fluid Temperature Same as in Table B-1) (cont'd)

Transmission Model/Test Type	Engine rpm	Range	Clutches Applied	Main Press. Spec kPa/[psi]	Range Clutch Press. Spec* kPa/[psi]	LU Clutch Press. Spec kPa/[psi]	D'BOX MAIN Press. Spec kPa/[psi]
MD 3070 — High Speed (cont'd)		LowC	C3 C6	1500–2300 [218–334]	1480–2300 [215–334]		1400–1600 [200–232]
		1C	C1 C5	1500–2100 [218–305]	1480–2100 [215–305]		1400–1600 [200–232]
		2C	C1 C4	1500–2100 [218–305]	1480–2100 [215–305]		1400–1600 [200–232]
		2L	C1 C4 LU	1000–1400 [145–203]	980–1400 [142–203]	980–1400 [142–203]	1400–1600 [200–232]
		3C	C1 C3	1500–2100 [218–305]	1480–2100 [215–305]		1400–1600 [200–232]
		3L	C1 C3 LU	1000–1400 [145–203]	980–1400 [142–203]	980–1400 [142–203]	1400–1600 [200–232]
		4C	C1 C2	1500–2100 [218–305]	1480–2100 [215–305]		1400–1600 [200–232]
		4L	C1 C2 LU	1000–1400 [145–203]	980–1400 [142–203]	980–1400 [142–203]	1400–1600 [200–232]
		5C	C2 C3	1150–1650 [167–239]	1130–1650 [164–239]		1400–1600 [200–232]
		5L	C2 C3 LU	900–1300 [131–189]	880–1300 [128–189]	880–1300 [128–189]	1400–1600 [200–232]
		6C	C2 C4	1150–1650 [167–239]	1130–1650 [164–239]		1400–1600 [200–232]
		6L	C2 C4 LU	900–1300 [131–189]	880–1300 [128–189]	880–1300 [128–189]	1400–1600 [200–232]
HD — Idle	580–620	Neutral	C5	1500–2070 [218–300]			
		Reverse	C3 C5	1500–2070 [218–300]			
		1C	C1 C5	1300–1800 [189–260]			
		2C	C1 C4	1300–1800 [189–260]			

* Subtract clutch pressure from main pressure; the difference must fall within the specifications given (unless a pressure range is supplied).

APPENDIX B — CHECKING CLUTCH PRESSURES

Table B-2. Main Pressure and Clutch Pressure Specifications
(Sump Fluid Temperature Same as in Table B-1) (cont'd)

Transmission Model/Test Type	Engine rpm	Range	Clutches Applied	Main Press. Spec kPa/[psi]	Range Clutch Press. Spec* kPa/[psi]	LU Clutch Press. Spec kPa/[psi]	D'BOX MAIN Press. Spec kPa/[psi]
HD — High Speed	1780–1820	Neutral	C5	1800–2100 [261–305]	0–70 (C5)/[0–10]		
		Reverse	C3 C5	1800–2100 [261–305]	0–70 (C3)/[0–10] 0–70 (C5)/[0–10]		
		1C	C1 C5	1550–1800 [225–261]	0–70 (C1)/[0–10] 0–50 (C5)/[0–7]		
		2C	C1 C4	1550–1800 [225–261]	0–70 (C1)/[0–10] 0–35 (C4)/[0–5]		
		2L	C1 C4 LU	1050–1400 [152–203]	0–70 (C1)/[0–10] 0–35 (C4)/[0–5]	950–1400 [138–203]	
		3C	C1 C3	1550–1800 [225–261]	0–70 (C1)/[0–10] 0–50(C3)/[0–7]		
		3L	C1 C3 LU	1050–1400 [152–203]	0–70 (C1)/[0–10] 0–50 (C3)/[0–7]	950–1400 [138–203]	
		4C	C1 C2	1550–1800 [225–261]	0–70 (C1)/[0–10] 0–70 (C2)/[0–10]		
		4L	C1 C2 LU	1050–1400 [152–203]	0–70 (C1)/[0–10] 0–70 (C2)/[0–10]	950–1400 [138–203]	
		5C	C2 C3	1190–1380 [173–200]	0–70 (C2)/[0–10] 0–70 (C3)/[0–10]		
		5L	C2 C3 LU	900–1250 [131–181]	0–70 (C2)/[0–10] 0–70 (C3)/[0–10]	850–1300 [124–189]	
		6C	C2 C4	1190–1830 [173–200]	0–70 (C2)/[0–10] 0–35 (C4)/[0–5]		
		6L	C2 C4 LU	900–1250 [131–181]	0–70 (C2)/[0–10] 0–35 (C4)/[0–5]	850–1300 [124–189]	

* Subtract clutch pressure from main pressure; the difference must fall within the specifications given (unless a pressure range is supplied).

APPENDIX B — CHECKING CLUTCH PRESSURES

NOTES

APPENDIX C — SOLENOID AND CLUTCH CHART

BASIC CONFIGURATION

Range	Solenoid Non-Latching Modulating							Clutches					
	A N/O	B N/O	C N/C	D N/C	E N/C	F N/C	G N/C	C1	C2	C3	C4	C5	LU
6	X			X		0			X		X		0
5	X		X			0	X		X	X			0
4						0	X	X	X				0
3		X	X			0	X	X		X			0
2		X		X		0	X	X			X		0
1		X			X	0		X				X	0
N1	X	X		*	X	0						X	0
N2	X	X		X							X		
N3	X	X	X							X			
N4	X	X		X							X		
R	X	X	X		X					X		X	

NOTE: See Page C-2 for legend.

7-SPEED (T-CASE) CONFIGURATION

Range	Solenoid Non-Latching Modulating										Clutches							
	N/O	N/O	N/C	N/C	N/C	N/C	N/C	N/C	N/C	N/C								
	C1	C2	C3	C4	C5	LU	FWD	LOW	C6	DIF	C1	C2	C3	C4	C5	LU	C6	DIF
	A	B	C	D	E	F	G	N	J	H	C1	C2	C3	C4	C5	LU	C6	DIF
6	X			X		0				0		X		X		0		0
5	X		X			0	X			0		X	X			0		0
4						0	X			0	X	X				0		0
3		X	X			0	X			0	X		X			0		0
2		X		X		0	X			0	X			X		0		0
1		X			X	0				0	X				X	0		0
LO	X					0	X	X	X	0			X			0	X	0
N1	X	X		*	X					0					X			0
N2	X	X		X				X		0				X				0
N3	X	X	X					X		0			X					0
N4	X	X		X				X		0				X				0
R	X	X	X		X					0			X		X			0

NOTE: See Page C-2 for legend.

APPENDIX C — SOLENOID AND CLUTCH CHART

LEGEND

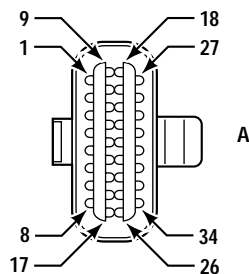
- X Electrically ON with respect to solenoids; hydraulically applied with respect to clutches.
- (Blank) Electrically OFF with respect to solenoids; hydraulically OFF with respect to clutches.
- 0 Optional ON or OFF.
- * If diagnostics indicate that turbine speed is below a calibration value (typically less than engine idle speed) when transmission input speed is greater than the minimum calculation value and **N1** (Neutral) has been selected and commanded, then Solenoid D must be turned ON. Otherwise, Solenoid D is turned OFF in **N1** (Neutral).

APPENDIX D — WIRE/CONNECTOR CHART

The connector information in this appendix is provided for the convenience of the servicing technician. The connector illustration and pin identifications for connection to Allison Transmission components will be accurate. Allison Transmission components are the ECU, speed sensors, retarder connectors, transmission connectors, and shift selectors. Other kinds of connectors for optional or customer-furnished components are provided based on typical past practice for an Allison-designed system. Wire number and color codes shown are for Allison-supplied harnesses. Harnesses supplied by OEMs and customers may use different wire numbers and colors.

Contact St. Clair Technologies, Inc. or your vehicle manufacturer for information on connectors not found in this appendix.

APPENDIX D — WIRE/CONNECTOR CHART



V00639

Figure D-1. ECU Connector "A"

ECU CONNECTOR "A" (BLACK/WHITE)

Terminal No.	Color	Wire No.	Description	Termination Point(s)
A1			Reserved	Trans Conn, H2
A2	Orange	102	Solenoid Ground 1 (A, D)	Trans Conn, A2
A3	Green	103	C (C3) Solenoid Hi	Trans Conn, C1
A4	White	104	G (Forward) Solenoid Hi	Trans Conn, F1
A5	Green	105	Output Function 5	VIW, 1
A6	White	106	Oil Level Sensor Power	Trans Conn, G3
A7	Green	107	F (Lockup) Solenoid Hi	Trans Conn, D3
A8	Yellow	108	Remote Power Wake Up	RSI Conn, 6
A9	Blue	109	K Solenoid Lo	Rtdr Conn, B
A10	White	110	F (Lockup) Solenoid Lo	Trans Conn, D2
A11			Reserved	
A12	Violet	112	Output Function 3	VIM Conn, D2
A13	White	113	Reverse Warning	VIM Conn, F2
A14	White	114	Output Function 1	VIM Conn, F3
A15	Green	115	"DO NOT SHIFT" Light	VIM Conn, A3
A16			Reserved	
A17	Green	117	Input Function 8 (-)	VIW, 16
A18	Blue	118	Input Function 3 (+)	VIW, 2
A19	Yellow	119	Input Function 4 (+)	VIW, 3
A20	White	120	A (C1) Solenoid Hi	Trans Conn, A1
A21	Violet	121	Solenoid Ground 2 (B, E)	Trans Conn, B2
A22	Violet	122	H (Accum.) Solenoid Ground	Accum. Conn, B
A23	Violet	123	Neutral Start	VIM Conn, D1
A24	Red	124	TPS Hi	TPS, C
A25	White	125	Output Function 4	VIM Conn, C2
A26	Yellow	126		VIW, 10
A27	White	127	H (Accum.) Solenoid Hi	Accum. Conn, A
A28	Orange	128	B (C2) Solenoid Hi	Trans Conn, B1
A29	Violet	129	E (C5) Solenoid Hi	Trans Conn, E1
A30	Yellow	130	Solenoid Ground 3 (C, G)	Trans Conn, C2
A31	Blue	131	D (C4) Solenoid Hi	Trans Conn, D1
A32	Orange	132	Output Function 2	VIM Conn, B1
A33	White	133	Rtdr. Mod. Hi	Rtdr Mod Sens Conn, C
A34	Yellow	134	K Sol Hi	Rtdr Conn, A

APPENDIX D — WIRE/CONNECTOR CHART

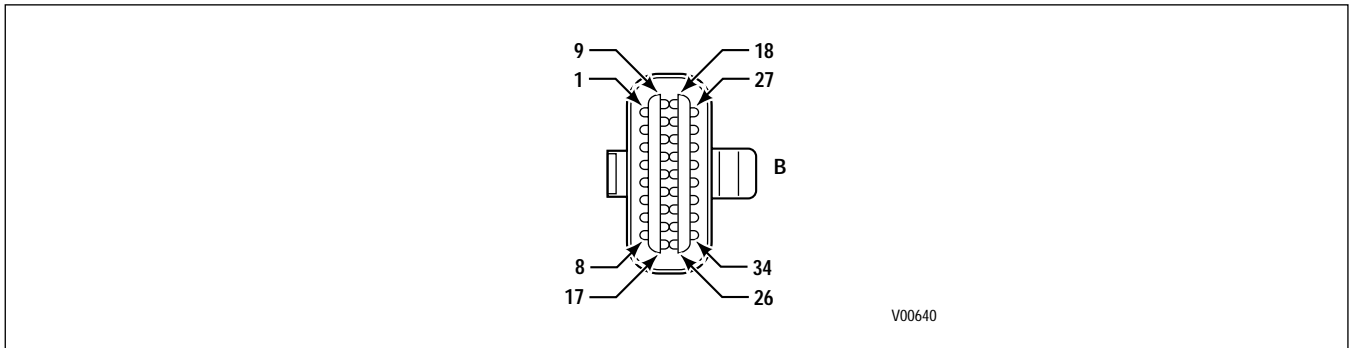


Figure D-2. ECU Connector "B"

ECU CONNECTOR "B" (BLACK)

Terminal No.	Color	Wire No.	Description	Termination Point(s)
B1	Green	135	Analog Ground	TPS A, Trans Conn G2; RMR A
B2	Red	136A	Battery (+)	RSI, 1; VIM Conn, E1
B3	Orange	137	Input Function 7 (-)	VIW, 5
B4	Orange	138	Retarder Temperature	Rtdr Conn, E
B5	Yellow	139	Output Speed Sensor Hi	Output Speed Sensor, A; Rtdr Conn, C
B6	Blue	140	Turbine Speed Sensor Lo	Trans Conn, E2
B7	Violet	141	Engine Speed Sensor Hi	Engine Speed Sensor, A
B8	White	142	Serial Communication (+)	DDR Conn, J; VIW, 6
B9	Black	143A	Battery (-)	RSI, 7; VIM Conn, A1
B10	Black	144	Chassis Ground	Chassis
B11	Red	136C	Battery (+)	DDR H, VIM Conn, E2
B12	Yellow	146	Ignition Sense	VIM Conn, F1
B13	Violet	147	Sump Temp Signal	Trans Conn, F3
B14	Green	148	Output Speed Sensor Lo	Output Speed Sensor, B; Rtdr Conn, D
B15	Orange	149	Turbine Speed Sensor Hi	Trans Conn, E3
B16	Orange	150	Engine Speed Sensor Lo	Engine Speed Sensor, B
B17	Blue	151	Serial Communication (-)	DDR, K; VIW, 7
B18	Black	143C	Battery (-)	DDR, A; VIM Conn, A2
B19	Yellow	153	Input Function 2 (-)	VIW, 8
B20	White	154	Input Function 5 (-) ABS	VIW, 12
B21	Green	155	Input Function 1 (-)	VIW, 9
B22	Blue	156	Throttle Position Signal	TPS Conn, B
B23	Violet	157	Speedometer Signal	VIM Conn, B2
B24	Orange	158	Dimmer Input	VIM Conn, C3
B25	Violet	159	ISO Serial Communication Link	VIW, 4
B26	Violet	160	Remote Serial Interface (-)	RSI Conn, 5
B27	Yellow	161	Signal Ground	Trans Conn, F2; VIW, 13
B28	White	162	C3 Pressure Switch Power	Trans Conn, C3
B29	Blue	163	Input Function 6 (-)	VIW, 14
B30	Yellow	164	Retarder Modulator	Rtdr Mod Sens Conn, B
B31	Blue	165	Oil Level Sensor Signal	Trans Conn, B3
B32			Reserved	
B33			Reserved	
B34	Yellow	168	Remote Serial Interface (+)	RSI Conn, 4

APPENDIX D — WIRE/CONNECTOR CHART

NOTES

BULKHEAD CONNECTOR CROSS-REFERENCE CHART

Connector Description		Deutsch 31-Way ECD	Deutsch 31-Way IPD	FMTV 37-Way ITT/Cannon	Ford 31-Way 29515702 ++ (Deutsch ECD)	Navistar 31-Way 29516973 ++ (Deutsch ECD)	Ford 29515707&8 Bulkhead A	Ford 29515707&8 Bulkhead B		
Wire #	Color	Bulkhead Term. ID	Bulkhead Term. ID	Bulkhead Term. ID	Term. ID	New Color	Term. ID	New Color	Bulkhead Term. ID*	Bulkhead Term. ID**
101	Blue			A						
102	Orange	A	1	B					2	
103	Green	B	2	C					3	
104	White	C	3	D					4	
106	White	D	4	E						1
107	Green	E	5	F					5	
109	Blue	f	30				323CM	Yellow		
110	White	F	6	H					6	
111	Green			J						
116	Yellow			K						
120	White	G	8	M					7	
121	Violet	H	9						8	
122	Violet	d	7	P	143C	Black				
124	Red	a	10	R	135B	Green				9
127	White	c	18	S	136B	Red	313CM	Yellow		
128	Orange	J	11	T					9	
129	Violet	K	12	U					10	
130	Yellow	L	13	V					11	
131	Blue	M	14	W					12	
134	Yellow	e	29		143B	Black	313NO	Blue		
135A	Green	N	15	Z						12
135B	Green		16	a						
136B	Red								13	
136C	Red								14	
138	Orange	g	31				323NO	Blue		
139	Yellow			n						2
140	Blue	U	24	r						6
141	Violet	T	23	m						10
143B	Black								15	
143C	Black								16	
147	Violet	P	17	d						4
148	Green	Q	20	g						3
149	Orange	V	25	p						7
150	Orange			s						11
156	Blue	b	19	f	136C	Red				13
161A	Yellow	W	26	h						14
162	White	X	27	j						15
165	Blue	Y	28	k						16
Drain 1		Z	16							
201	Orange			L						
202	Yellow			X						
203	Green			e						

++ Same as Deutsch ECD except as shown
 * 15-Way (16-way spacing) — Cavity number 1 is molded closed
 ** 14-Way (16-way spacing) — Cavities 5 and 8 are molded closed

Foldout D-1. Bulkhead Connector Cross-Reference Chart

APPENDIX D — WIRE/CONNECTOR CHART

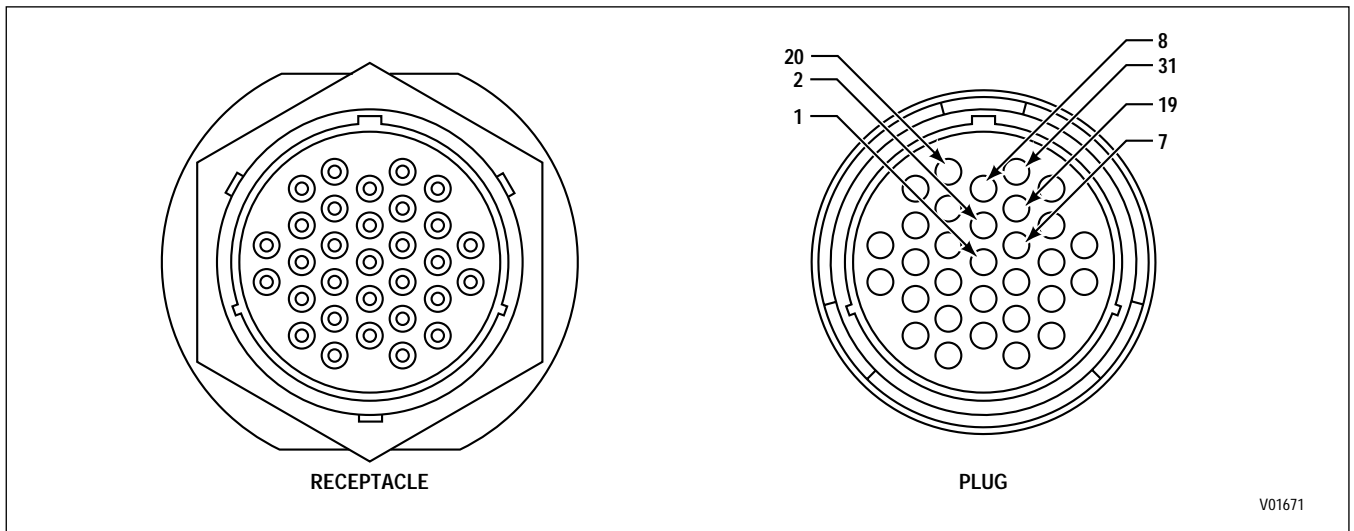


Figure D-3. 31-Way Deutsch IPD Bulkhead Connector

31-WAY DEUTSCH IPD BULKHEAD CONNECTOR

Terminal No.	Color	Wire No.	Description	Termination Point(s)		Bulkhead Side
				Transmission Side		
				Before MY '95	MY '95	
1	Orange	102	SG01	A-2	A	ECU, A2
2	Green	103	CSOL	C-1	B	ECU, A3
3	White	104	GSOL	F-1	C	ECU, A4
4	White	106	LOPR	G-3	D	ECU, A6
5	Green	107	FSHI	D-3	E	ECU, A7
6	White	110	FSOL	D-2	F	ECU, A10
7	Violet	122	SG04			ECU, A22
8	White	120	ASOL	A-1	G	ECU, A20
9	Violet	121	SG02	B-2	H	ECU, A21
10	Red	124	TPHI			ECU, A24
11	Orange	128	BSOL	B-1	J	ECU, A28
12	Violet	129	FSOL	E-1	K	ECU, A29
13	Yellow	130	SG03	C-2	L	ECU, A30
14	Blue	131	DSOL	D-1	M	ECU, A31
15	Green	135A	TPLO			ECU, B1
16	Green	135B	TPLO	G-2	N	Splice, 135A
17	Violet	147	OILT	F-3	P	ECU, B13
18	White	127	HSOL			ECU, A27
19	Blue	156	DSOL	D-1	M	ECU, A31
20	Green	148	NOLO			ECU
21	Orange	139	NOHI			ECU, B1
22	Orange	150	NELO			ECU, B16
23	Violet	141	NEHI			
24	Blue	140	NTLO			
25	Orange	149	NTHI			ECU, B13
26	Yellow	161A	SNGD	F-2	W	ECU, B27
27	White	162	C3PS	C-3	X	ECU, B22
28	Blue	165	LOIL			ECU, B14
29	Yellow	134	SNGD			ECU, A34
30	Blue	109	KSOL			ECU, B28
31	Orange	138	RETT			

APPENDIX D — WIRE/CONNECTOR CHART

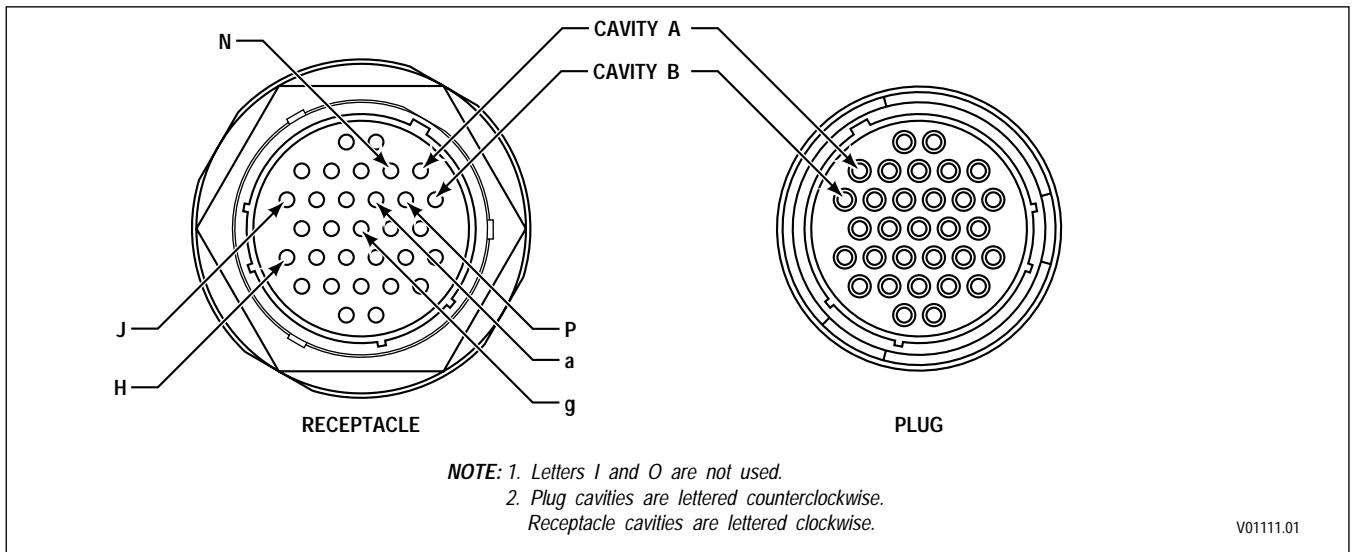


Figure D-4. Deutsch Bulkhead Connector, ECD (Male/Female)
DEUTSCH BULKHEAD CONNECTOR (MALE/FEMALE)

Terminal No.	Color		Wire No.		Description		Termination Point(s)	
	All But MY '95 3070	MY '95 3070	All But MY '95 3070	MY '95 3070	All But MY '95 3070	MY '95 3070	All But MY '95 3070	MY '95 3070
A	Orange		102		SGD1		ECU, A2	
B	Green		103		CSOL		ECU, A3	
C	White		104		GSOL		ECU, A4	
D	White		106		LOPR		ECU, A6	
E	Green		107		FSHI		ECU, A7	
f	Blue	Blue	109	101	KSOL	NSLO	ECU, A9	ECU, A1
F	White		110		FSOL		ECU, A10	
G	White		120		ASOL		ECU, A20	
H	Violet		121		SGD2		ECU, B21	
d	Violet		122		SGD4		ECU, A22	
a	Red		124		TPHI		ECU, A24	
c	White		127		HSOL		ECU, A27	
J	Orange		128		BSOL		ECU, A28	
K	Violet		129		FSOL		ECU, A29	
L	Yellow		130		SGD3		ECU, A30	
M	Blue		131		DSOL		ECU, A31	
e	Yellow	Green	134	111	KSHI	JSOL	ECU, A34	ECU, A11
N	Green		135A		TPLO		ECU, B1	
g	Orange	Yellow	138	116	RETT	NSHI	ECU, B4	ECU, A16
R	Yellow		139		NOHI		ECU, B5	
U	Blue		140		NTLO (MD Only)		ECU, B2	
T	Violet		141		NEHI		ECU, B7	
P	Violet		147		OILT		ECU, B13	
Q	Green		148		NOLO		ECU, B14	
V	Orange		149		NTHI (MD Only)		ECU, B15	
S	Orange		150		NELO		ECU, B16	
b	Blue		156		TPOT		ECU, B22	
W	Yellow		161A		SNGD		ECU, B27	
X	White		162		C3PS		ECU, B28	
Y	Blue		165		LOIL		ECU, B3	
Z	-----		Drain 1		NTDRN (24V Only)		Splice to 143D	
	Orange		201		Spare			
	Yellow		202		Spare			
	Green		203		Spare			

APPENDIX D — WIRE/CONNECTOR CHART

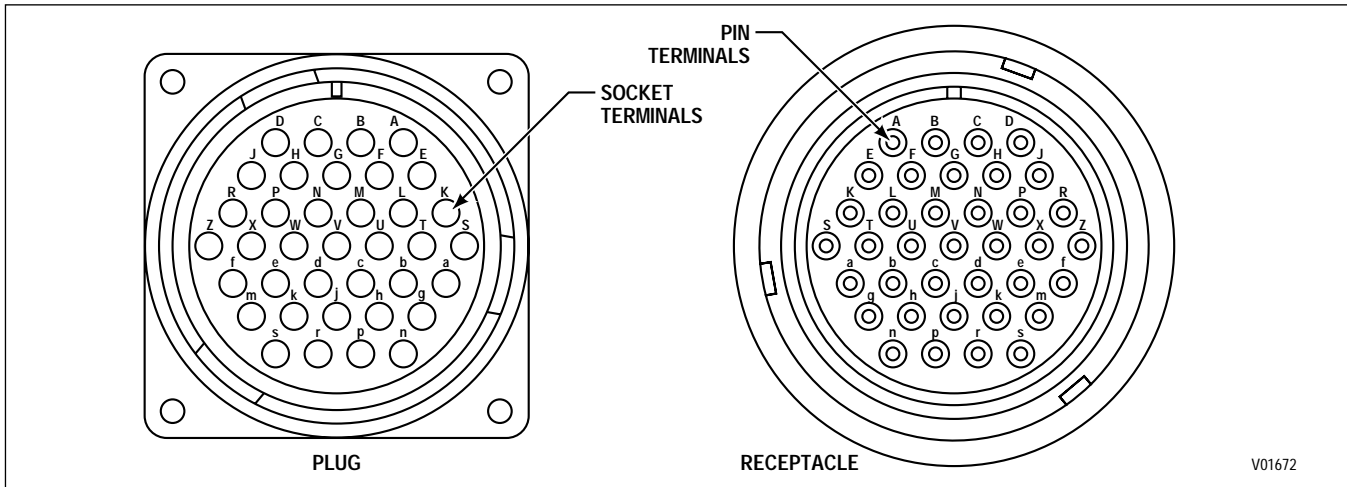


Figure D-5. Cannon 37-Way FMTV Bulkhead Connector

CANNON 37-WAY FMTV BULKHEAD CONNECTOR

Terminal No.	Color	Wire No.	Description	Termination Point(s)		Bulkhead Side
				Transmission Side Before MY '95	MY '95	
A	Blue	101	NSLO	H-2	f	ECU, A1
B	Orange	102	SG01	A-2	A	ECU, A2
C	Green	103	CSOL	C-1	B	ECU, A3
D	White	104	GSOL	F-1	C	ECU, A4
E	White	106	LOPR	G-3	D	ECU, A6
F	Green	107	FSHI	D-3	E	ECU, A7
H	White	110	FSLO	D-2	F	ECU, A10
J	Green	111	JSOL	H-1	e	ECU, A11
K	Yellow	116	NSHI	H-3	g	ECU, A16
L	Orange	201	SPARE			ECU
M	White	120	ASOL	A-1	G	ECU, A20
N	Violet	121	SG02	B-2	H	ECU, A21
P	Violet	122	SG04			ECU, A22
R	Red	124	TPHI			ECU, A24
S	White	127	HSOL			ECU, A27
T	Orange	128	BSOL	B-1	J	ECU, A28
U	Violet	129	ESOL	E-1	K	ECU, A29
V	Yellow	130	SG03	C-2	L	ECU, A30
W	Blue	131	DSOL	D-1	M	ECU, A31
X	Yellow	202	SPARE			ECU
Z	Green	135A	TPLO			ECU, B1
a	Green	135B	TPLO	G-2	N	Splice, 135A
b						
c						
d	Violet	147	OILT	F-3	P	ECU, B13
e	Green	203	SPARE			ECU
f	Blue	156	TPOT			ECU, B22
g	Green	148	NOLO			ECU, B14
h	Yellow	161A	SNGD	F-2	W	ECU, B27
j	White	162	C3PS	C-3	X	ECU, B28
k	Blue	165	LOIL	B-3	Y	ECU, B31
m	Violet	141	NEHI			ECU, B7
n	Yellow	139	NOHI			ECU, B5
p	Orange	149	NTHI	E-3	V	ECU, B15
r	Blue	140	NTLO	E-2	U	ECU, B6
s	Orange	150	NELO			ECU, B16

APPENDIX D — WIRE/CONNECTOR CHART

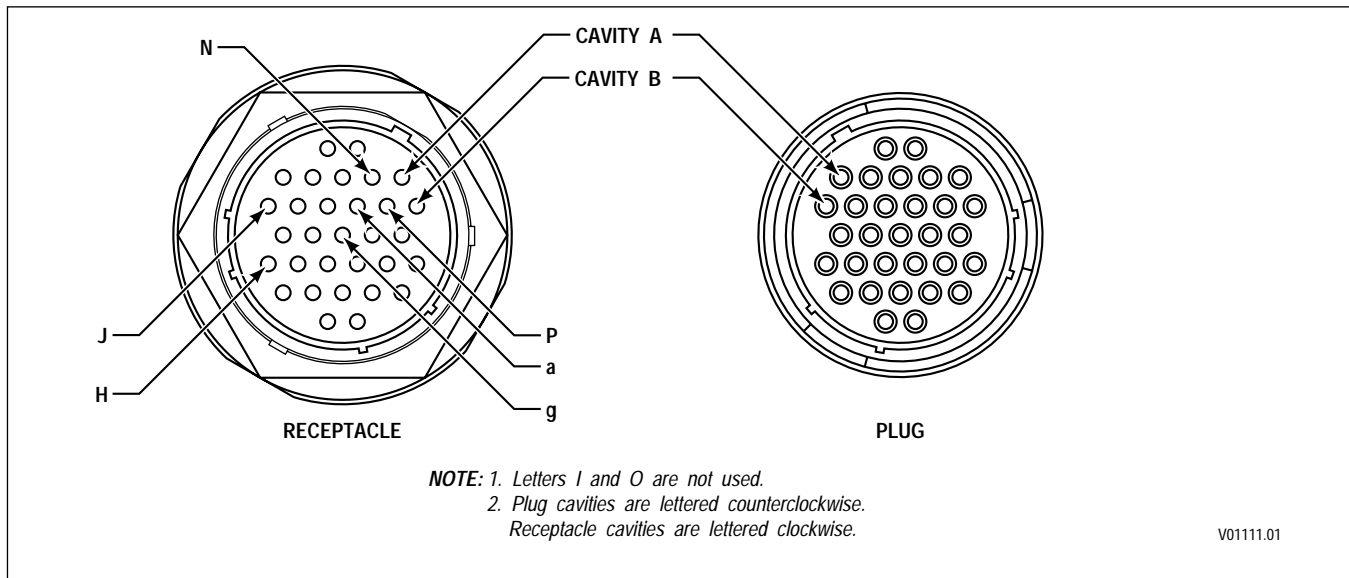


Figure D-6. Deutsch Transmission Connector, ECD (Male/Female)

DEUTSCH TRANSMISSION CONNECTOR (MALE/FEMALE)

Terminal No.	Color		Wire No.		Description		Termination Point(s)	
	All But MY '95 3070	MY '95 3070	All But MY '95 3070	MY '95 3070	All But MY '95 3070	MY '95 3070	All But MY '95 3070	MY '95 3070
A	Orange		102		SGD1		ECU, A2	
B	Green		103		CSOL		ECU, A3	
C	White		104		GSOL		ECU, A4	
D	White		106		OLS Power		ECU, A6	
E	Green		107		FSHI		ECU, A7	
f		Blue		101		NSLO		ECU, A1
F	White		110		FSOL		ECU, A10	
G	White		120		ASOL		ECU, A20	
H	Violet		121		SGD2		ECU, B21	
J	Orange		128		BSOL		ECU, A28	
K	Violet		129		ESOL		ECU, A29	
L	Yellow		130		SGD3		ECU, A30	
M	Blue		131		DSOL		ECU, A31	
e		Green		111		JSOL		ECU, A11
N	Green		135B		TPLO		ECU, B1	
g		Yellow		116		NSHI		ECU, A16
U	Blue		140		NTLO (MD Only)		ECU, B2	
P	Violet		147		OILT		ECU, B13	
V	Orange		149		NTHI (MD Only)		ECU, B15	
W	Yellow		161A		SNGD		ECU, B27	
X	White		162		C3PS		ECU, B28	
Y	Blue		165		LOIL		ECU, B3	
Spare	Orange		201					
Spare	Yellow		202					

APPENDIX D — WIRE/CONNECTOR CHART

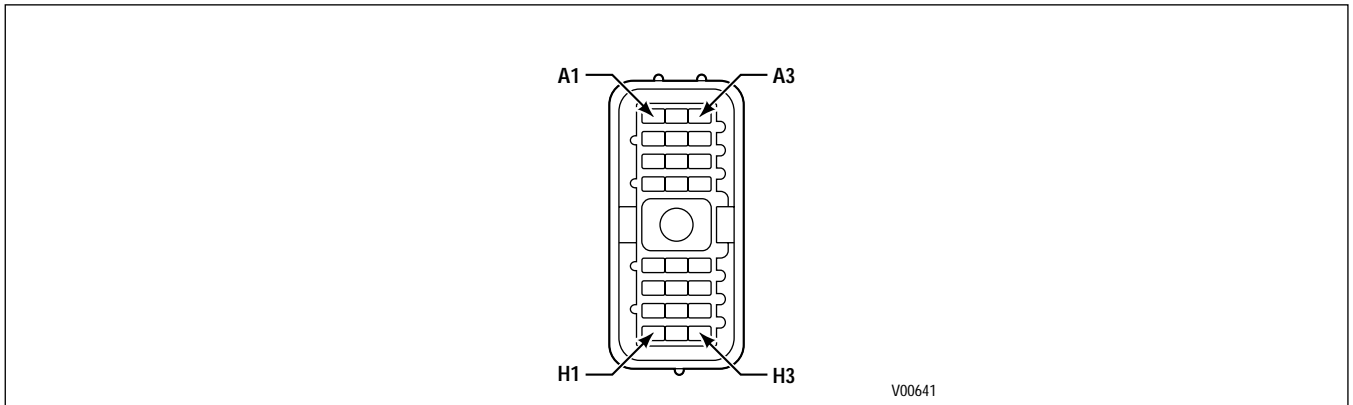


Figure D-7. Transmission Connector (Prior to Model Year '95)

TRANSMISSION CONNECTOR

Terminal No.	Color	Wire No.	Description	Termination Point(s)
A1	White	120	A (C1) Solenoid Hi	ECU, A20
A2	Orange	102	Solenoid Ground 1 (A, D)	ECU, A2
A3			Reserved	
B1	Orange	128	B (C2) Solenoid Hi	ECU, A28
B2	Violet	121	Solenoid Ground 2 (B, E)	ECU, A21
B3	Blue		Lo Oil Level	ECU, B31
C1	Green	103	C (C3) Solenoid Hi	ECU, A3
C2	Yellow	130	Solenoid Ground 3 (C, G)	ECU, A30
C3	White	162	C3 Pressure Switch Power	ECU, B28
D1	Blue	131	D (C4) Solenoid Hi	ECU, A31
D2	White	110	F (Lockup) Solenoid Lo	ECU, A10
D3	Green	107	F (Lockup) Solenoid Hi	ECU, A7
E1	Violet	129	E (C5) Solenoid	ECU, A29
E2			Reserved	
E3			Reserved	
F1	White	104	G (Forward) Solenoid Hi	ECU, A4
F2	Yellow	161	Signal Ground	ECU, B27; VIW (Amp), 13
F3	Violet	147	Sump Temp Signal	ECU, B13
G1			Reserved	
G2	Green	135	Analog Ground	ECU, B1; TPS A; RMR A
G3	White	106	Oil Level Power	ECU, A6
H1	Green	111	J (C6) Solenoid*	ECU, A11
H2	Blue	101	N (Signal) Solenoid Lo*	ECU, A1
H3	Yellow	116	N (Signal) Solenoid Hi*	ECU, A16

* Used with MD 3070 Models Only.

APPENDIX D — WIRE/CONNECTOR CHART

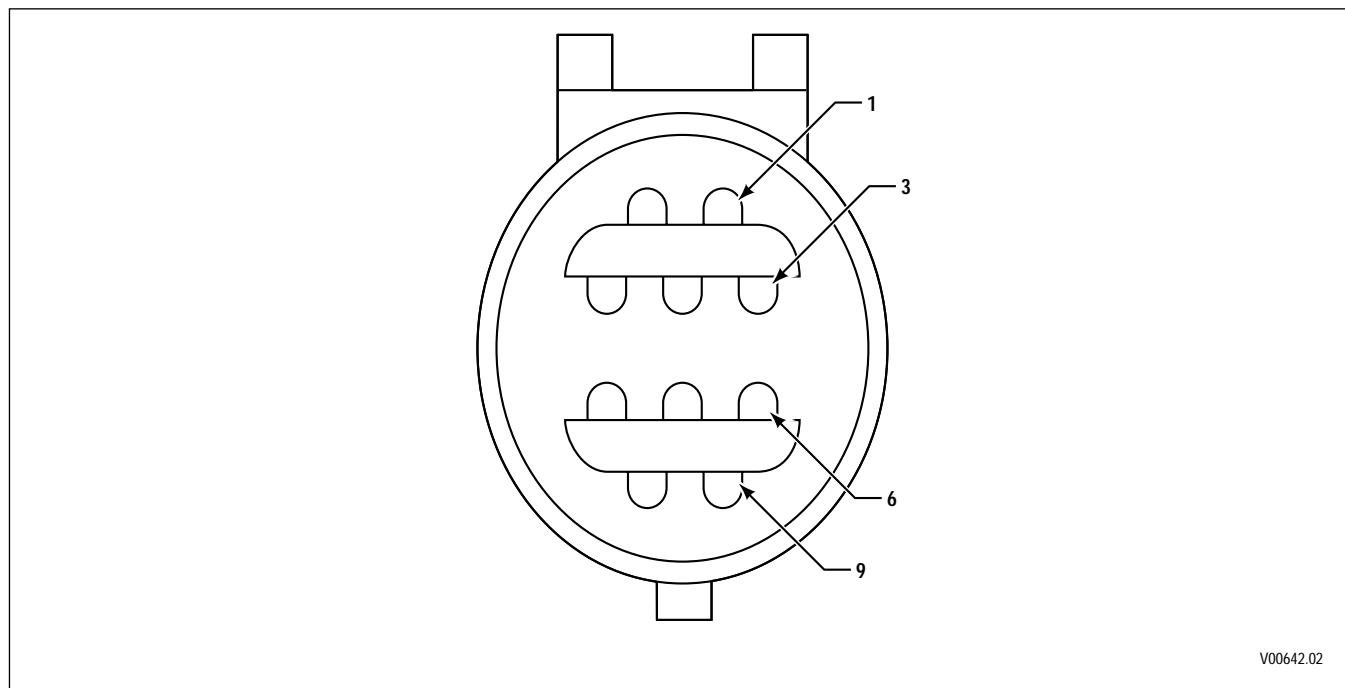


Figure D-8. RSI Connector

REMOTE SERIAL INTERFACE CONNECTOR

Terminal No.	Color	Wire No.	Description	Termination Point(s)
1	Red	136	Battery (+)	ECU, B2; VIM Conn, E1
2	Orange		Jumper	RSI Conn, 3 (Clip Jumper Wire When Remote Selector is Primary)
3	Orange		Jumper	RSI Conn, 2
4	Yellow	168	Remote Serial Interface (+)	ECU, B34
5	Violet	160	Remote Serial Interface (-)	ECU, B26
6	Yellow	108	Remote Power Wakeup	ECU, A8
7	Black	143	Battery (-)	ECU, B9; VIM Conn, A1; Battery (-)
8			Reserved	
9			Reserved	
10			Reserved	

APPENDIX D — WIRE/CONNECTOR CHART

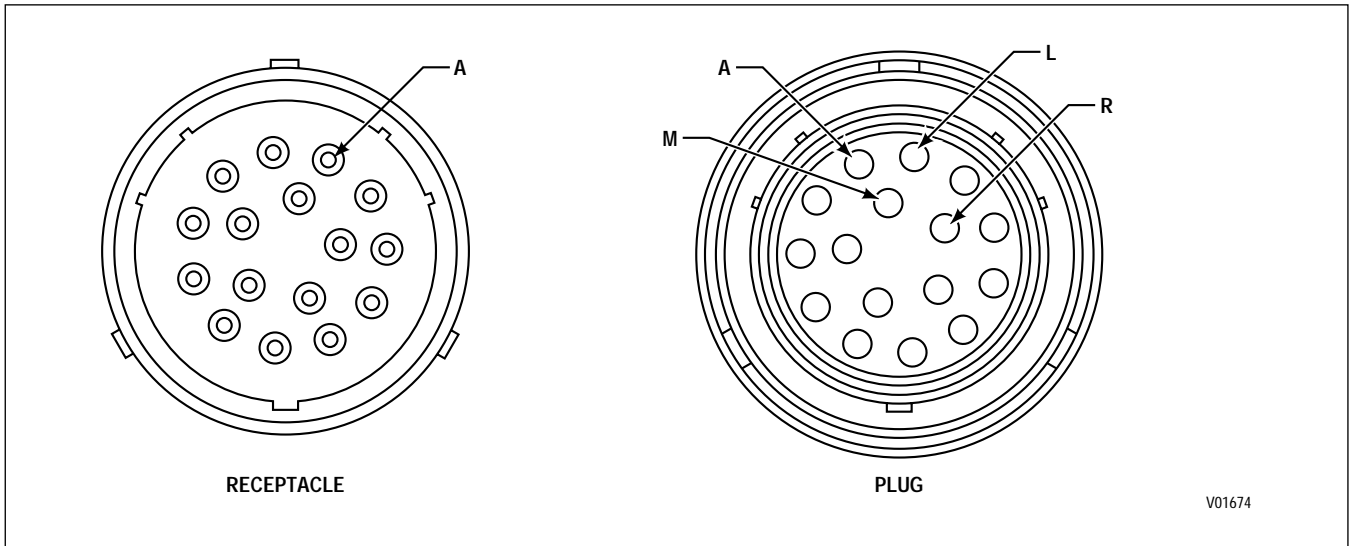


Figure D-9. Optional Deutsch Sensor Harness Connector

OPTIONAL DEUTSCH SENSOR HARNESS CONNECTOR

Terminal No.	Color	Wire No.	Description	Termination Point(s)
C	Green	135C	TPLO	ECU, B1
D	Orange	138	RETT	ECU, B4
E	Blue	109	KSLO	ECU, A9
F	Yellow	134	KSHI	ECU, A34
G	Violet	122	SGD4	ECU, A22
H	White	127	HSOL	ECU, A27
L	Blue	140B	NTLO	ECU, B6
M	Orange	149B	NTHI	ECU, B15
N	Orange	150	NELO	ECU, B16
P	Violet	141	NEHI	ECU, B7
R	Green	148	NOLO	ECU, B14
S	Yellow	139	NOHI	ECU, B5

APPENDIX D — WIRE/CONNECTOR CHART

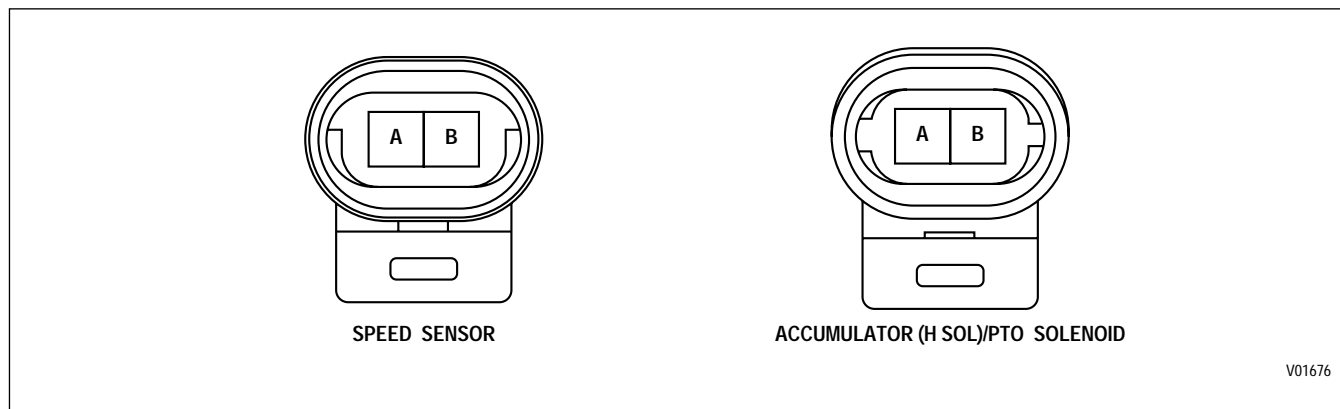


Figure D-10. Speed Sensor Connector

ENGINE SPEED SENSOR CONNECTOR

Terminal No.	Color	Wire No.	Description	Termination Point(s)
A	Violet	141	Engine Speed Sensor Hi	ECU, B7
B	Orange	150	Engine Speed Sensor Lo	ECU, B16

TURBINE SPEED SENSOR CONNECTOR (HD/B 500 ONLY)

Terminal No.	Color	Wire No.	Description	Termination Point(s)
A	Orange	149	Turbine Speed Sensor Hi	ECU, B15
B	Blue	140	Turbine Speed Sensor Lo	ECU, B6

OUTPUT SPEED SENSOR CONNECTOR

Terminal No.	Color	Wire No.	Description	Termination Point(s)
A	Yellow	139	Output Speed Sensor Hi	ECU, B5
B	Green	148	Output Speed Sensor Lo	ECU, B14

ACCUMULATOR (H) SOLENOID AND PTO SOLENOID CONNECTOR

Terminal No.	Color	Wire No.	Description	Termination Point(s)
A	White	127	H Solenoid Hi	ECU, A27
B	Violet	122	Solenoid Ground 4	ECU, A22

APPENDIX D — WIRE/CONNECTOR CHART

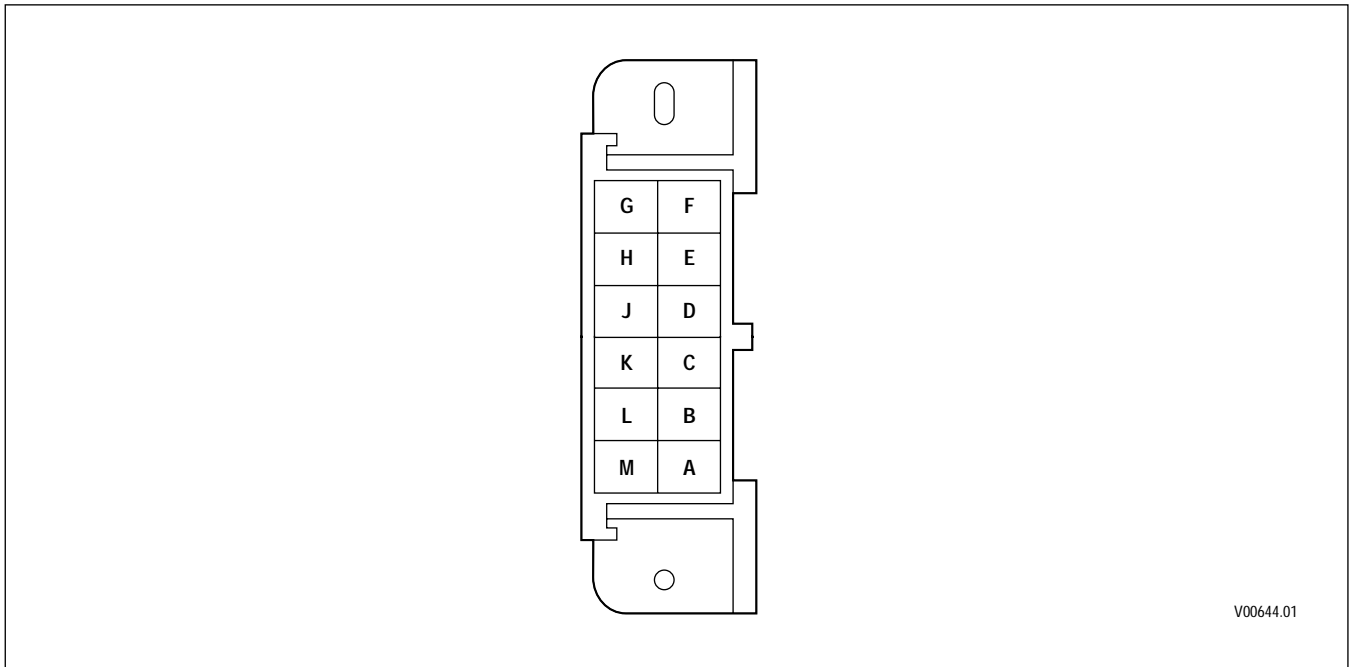


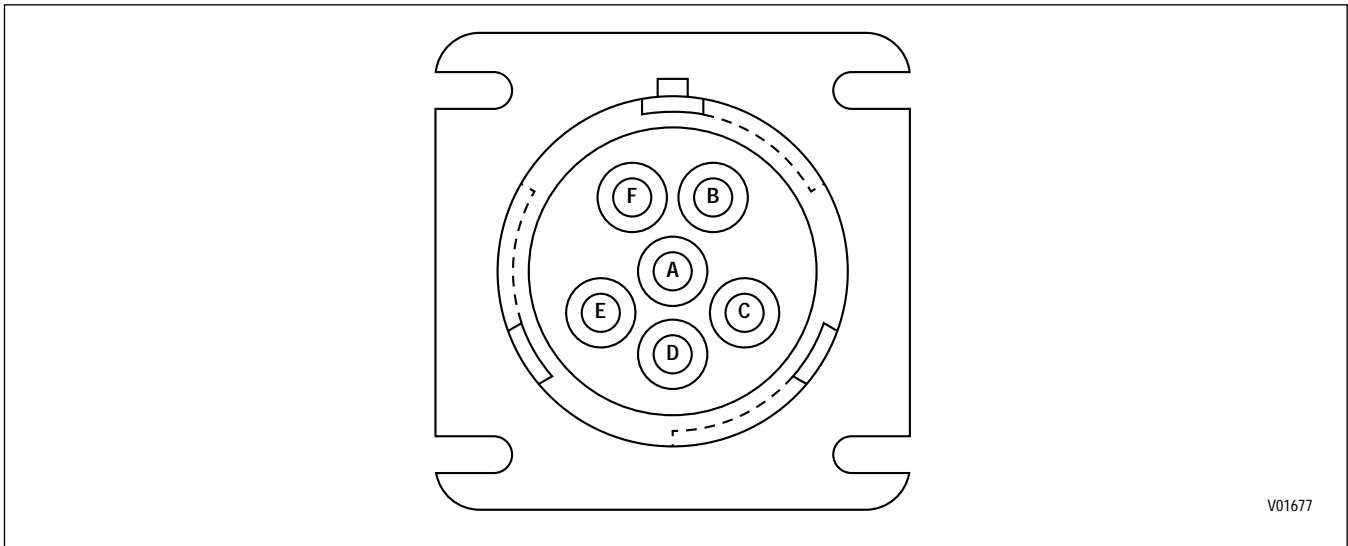
Figure D-11. Diagnostic Connector

DIAGNOSTIC CONNECTOR

Terminal No.	Color	Wire No.	Description	Termination Point(s)
A	Black	143	Battery (-)	ECU, B18; VIM Conn, A2
H*	Yellow	146B	Ignition Signal	ECU, B12; VIM Conn, F1
H**	Red	136D	Battery (+)	ECU, B12; VIM Conn, F1
J	White	142	Serial Communication (+)	ECU, B8; VIW (Amp), 6
K	Blue	151	Serial Communication (-)	ECU, B17; VIW (Amp), 7

* After 9/93
 ** Prior to 9/93

APPENDIX D — WIRE/CONNECTOR CHART



V01677

Figure D-12. Optional Deutsch DDR Connector

OPTIONAL DEUTSCH DDR CONNECTOR

Terminal No.	Color	Wire No.	Description	Termination Point(s)
A	White	142A	Serial Communication (+)	ECU, B8; VIW, 6
B	Blue	151A	Serial Communication (-)	ECU, B17; VIW, 7
C*	Yellow	146B	Ignition Signal	ECU, B12; VIM Conn, F1
C**	Red	136D	Battery (+)	ECU, B12; VIM Conn, F1
D			Open	
E	Black	143	Battery (-)	ECU, B18; VIM Conn, A2
F			Open	

* After 9/93

** Prior to 9/93

APPENDIX D — WIRE/CONNECTOR CHART

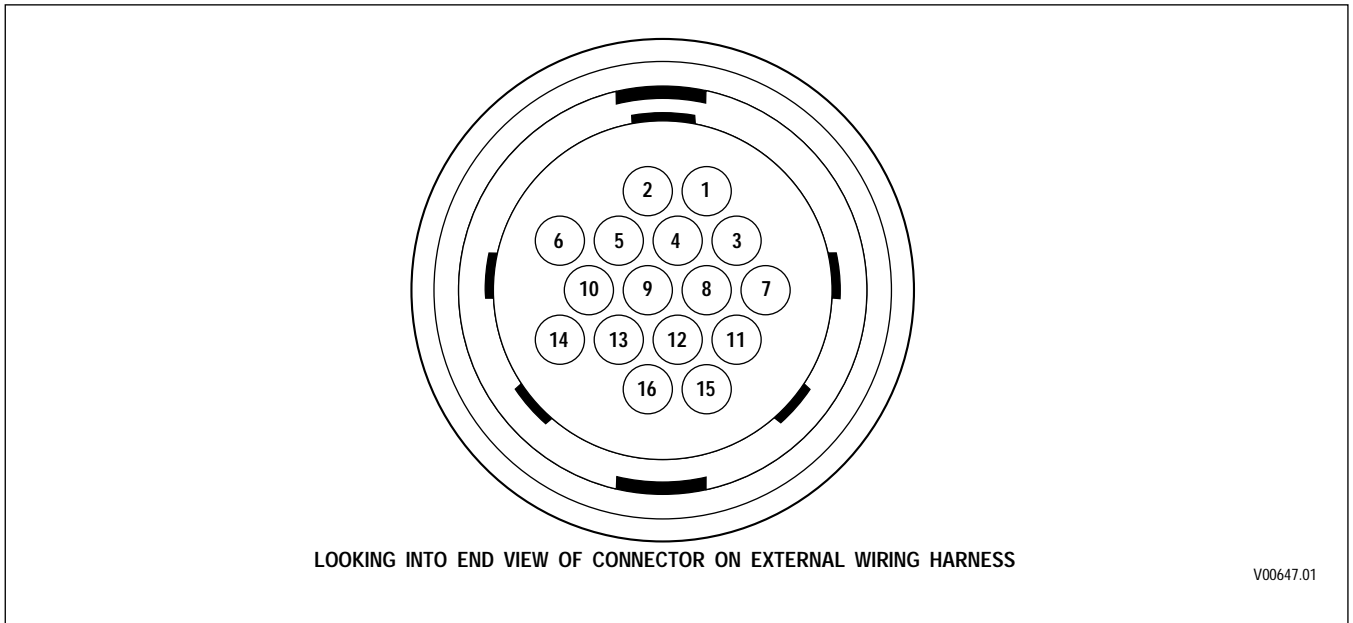


Figure D-13. VIW (Amp) Connector

VIW (AMP) CONNECTOR

Terminal No.	Color	Wire No.	Description	Termination Point(s)
1	Green	105	Spec Function Output 5 (-)	ECU, A5
2	Blue	118	Spec Function Input 3 (+)	ECU, A18
3	Yellow	119	Spec Function Input 4 (+)	ECU, A19
4			Reserved	
5	Orange	137	Spec Function Input 7 (-)	ECU, B3
6	White	142B	Serial Communication (+)	ECU, B8; DDR, J
7	Blue	151B	Serial Communication (-)	ECU, B17; DDR, K
8	Yellow	153	Spec Function Input 2 (-)	ECU, B19
9	Green	155	Spec Function Input 1 (-)	ECU, B21
10		157	Reserved	
11		158	Reserved	
12	White	154	Spec Function Input 5 (-) ABS	ECU, B20
13	Yellow	161B	Signal Ground	ECU, B27; Trans, F2
14	Blue	163	Spec Function Input 6 (-)	ECU, B29
15		143A	Reserved	
16	Green	117	Spec Function Input 8 (-)	ECU, A17

APPENDIX D — WIRE/CONNECTOR CHART

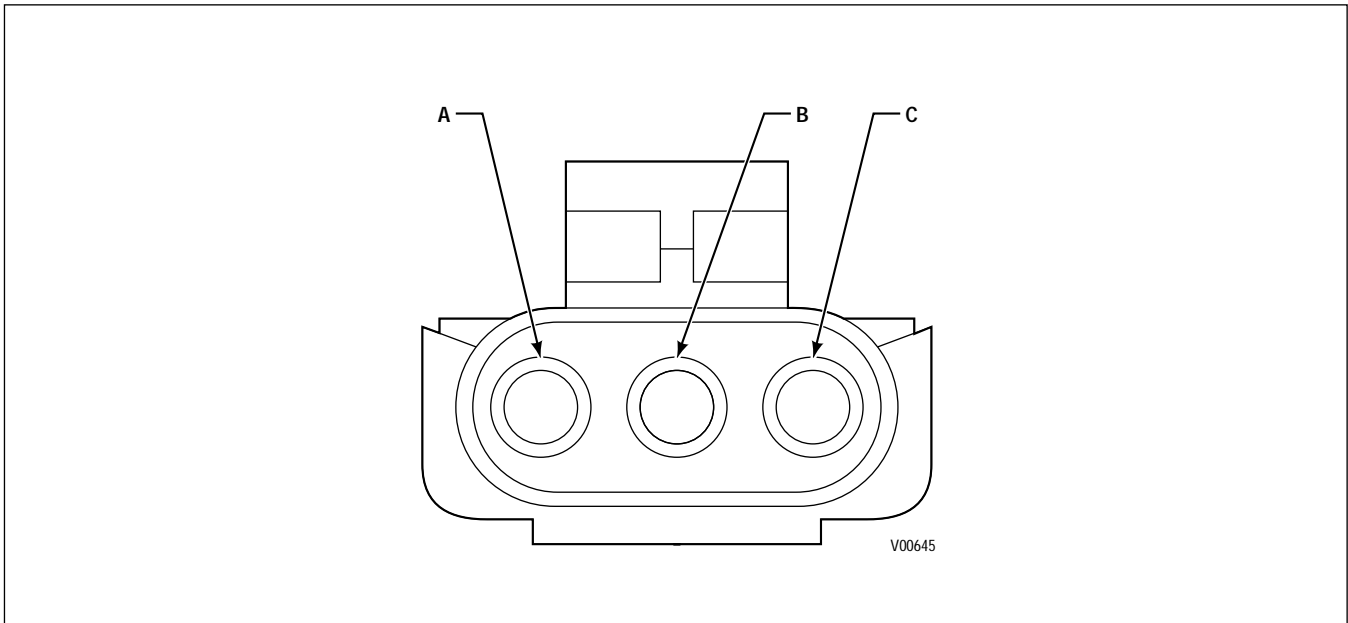
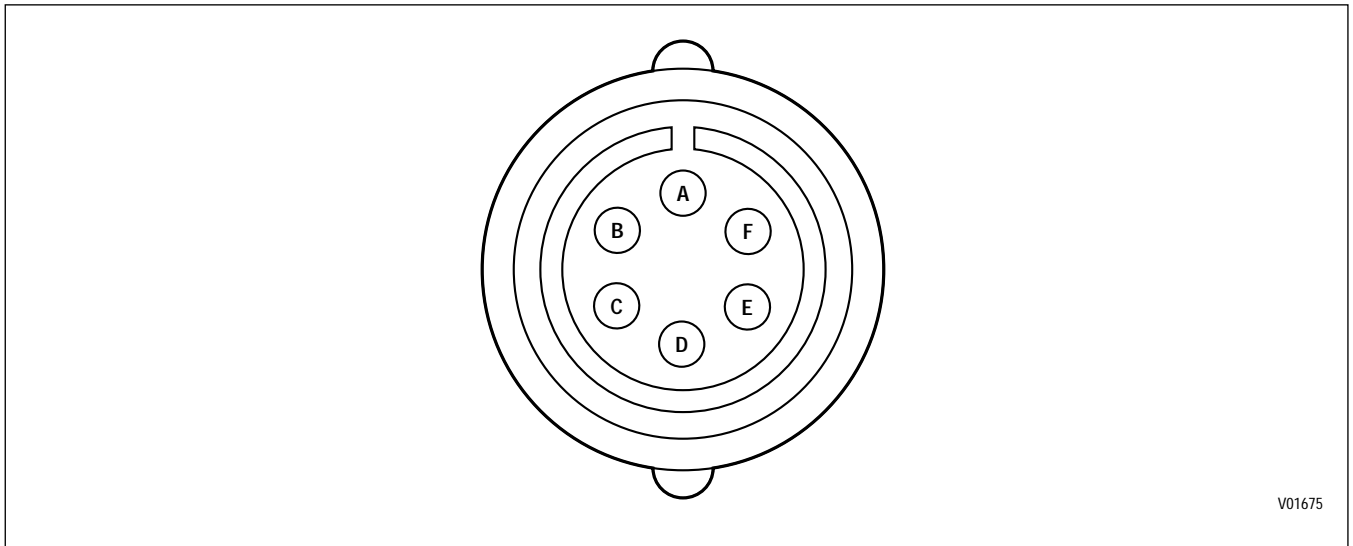


Figure D-14. TPS Connector

THROTTLE POSITION SENSOR CONNECTOR

Terminal No.	Color	Wire No.	Description	Termination Point(s)
A	Green	135A	Analog Ground	ECU, B1; Trans Conn, G2; RMR Conn, A
B	Blue	156	TPS Signal	ECU, B22
C	Red	124	TPS Hi	ECU, A24

APPENDIX D — WIRE/CONNECTOR CHART



V01675

Figure D-15. Transfer Case Connector

TRANSFER CASE CONNECTOR

Terminal No.	Color	Wire No.	Description	Termination Point(s)
A	White	127	H (Diff Lock) Solenoid Hi	ECU, A27
B	Violet	122	H (Diff Lock) Solenoid Lo	ECU, A22
C	Yellow	139	Output Speed Sensor Hi	ECU, B5
D	Green	148	Output Speed Sensor Lo	ECU, B14

APPENDIX D — WIRE/CONNECTOR CHART

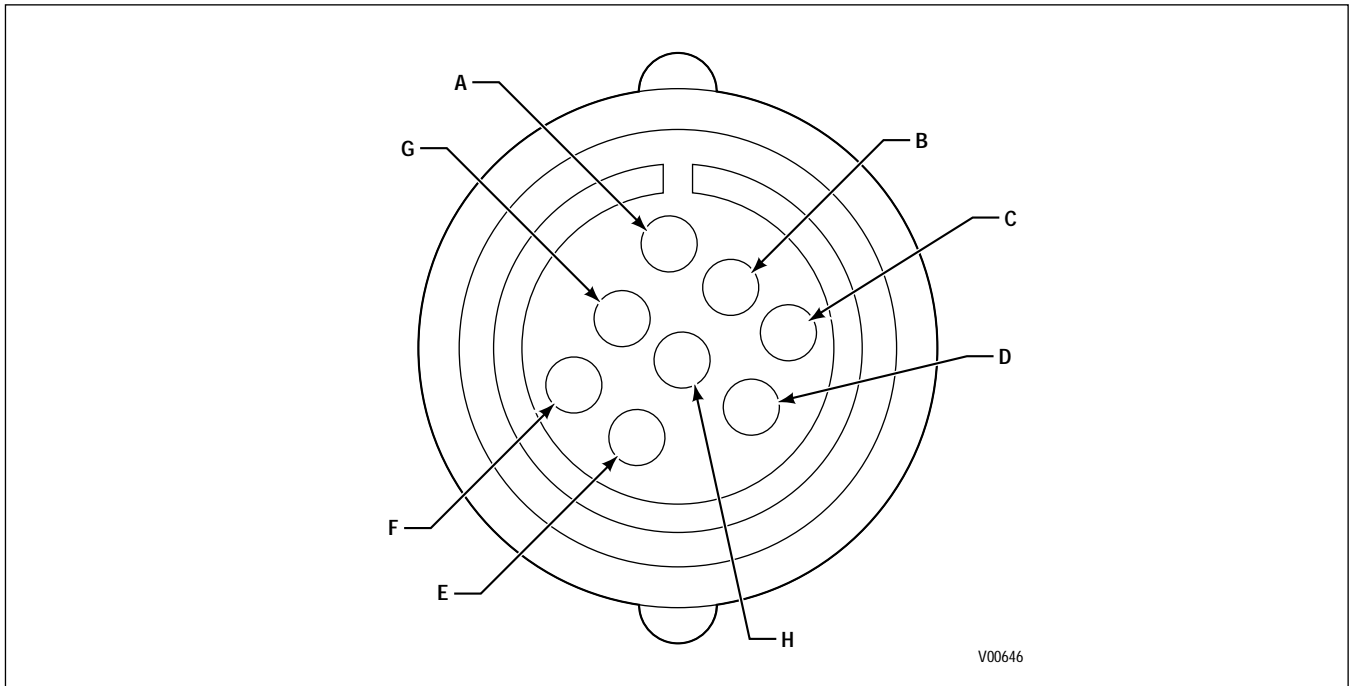
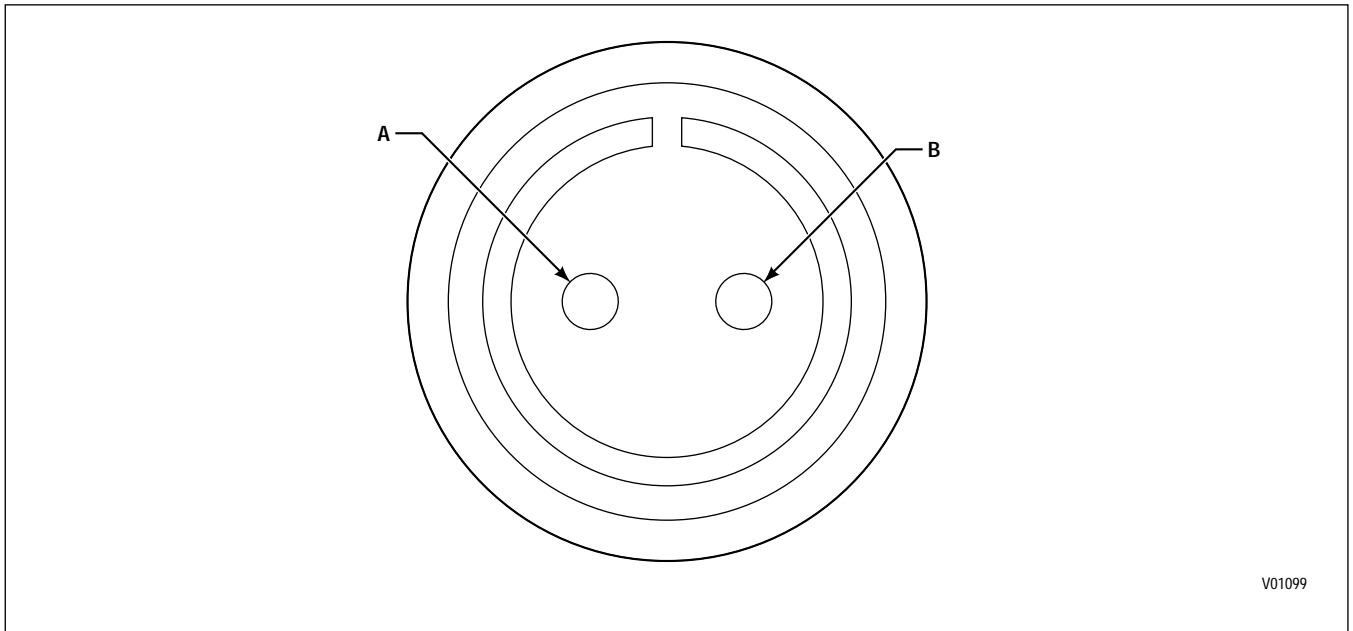


Figure D-16. Retarder Connector (MD/B 300/B 400)

RETARDER CONNECTOR — MD/B 300/B 400

Terminal No.	Color	Wire No.	Description	Termination Point(s)
A	Yellow	134	K (Rtdr Enable) Solenoid Hi	ECU, A34
B	Blue	109	K (Rtdr Enable) Solenoid Lo	ECU, A9
C	Yellow	139	Output Speed Sensor Hi	ECU, B5
D	Green	148	Output Speed Sensor Lo	ECU, B14
E	Orange	138	Retarder Temperature	ECU, B4
F	Green	135C	Analog Ground	ECU, B1; Trans Conn, Term G2; TPS A

APPENDIX D — WIRE/CONNECTOR CHART



V01099

Figure D-17. Retarder Connector (HD/B 500)

RETARDER CONNECTOR — HD/B 500

Terminal No.	Color	Wire No.	Description	Termination Point(s)
A	Yellow	134	K (Rtdr Enable) Solenoid Hi	ECU, A34
B	Blue	109	K (Rtdr Enable) Solenoid Lo	ECU, A9

APPENDIX D — WIRE/CONNECTOR CHART

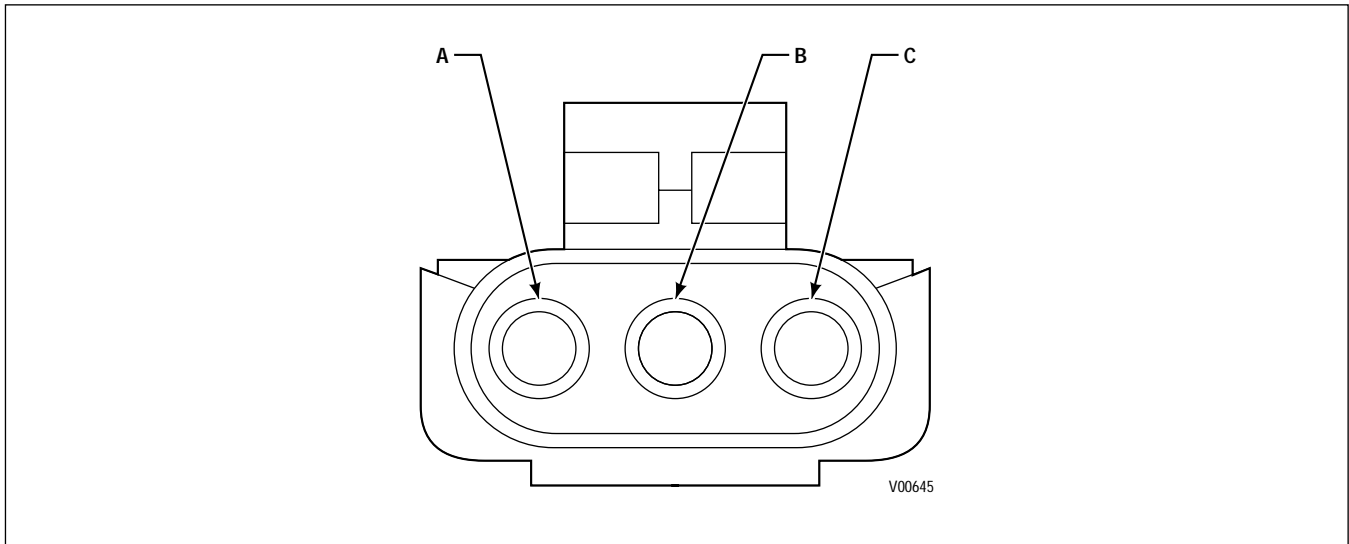


Figure D-18. Retarder Resistance Module/Interface Connector

RETARDER RESISTANCE MODULE / INTERFACE CONNECTOR

Terminal No.	Color	Wire No.	Description	Termination Point(s)
A	Green	135D	Analog Ground	ECU, B1; Trans Conn, G2; Rtdr Resist Module, A; TPS, A
B	Yellow	164	Retarder Mod.	ECU, B22; Rtdr Resist Module, B
C	White	133	Retarder Mod. Hi	ECU, A24; Rtdr Resist Module, C

APPENDIX D — WIRE/CONNECTOR CHART

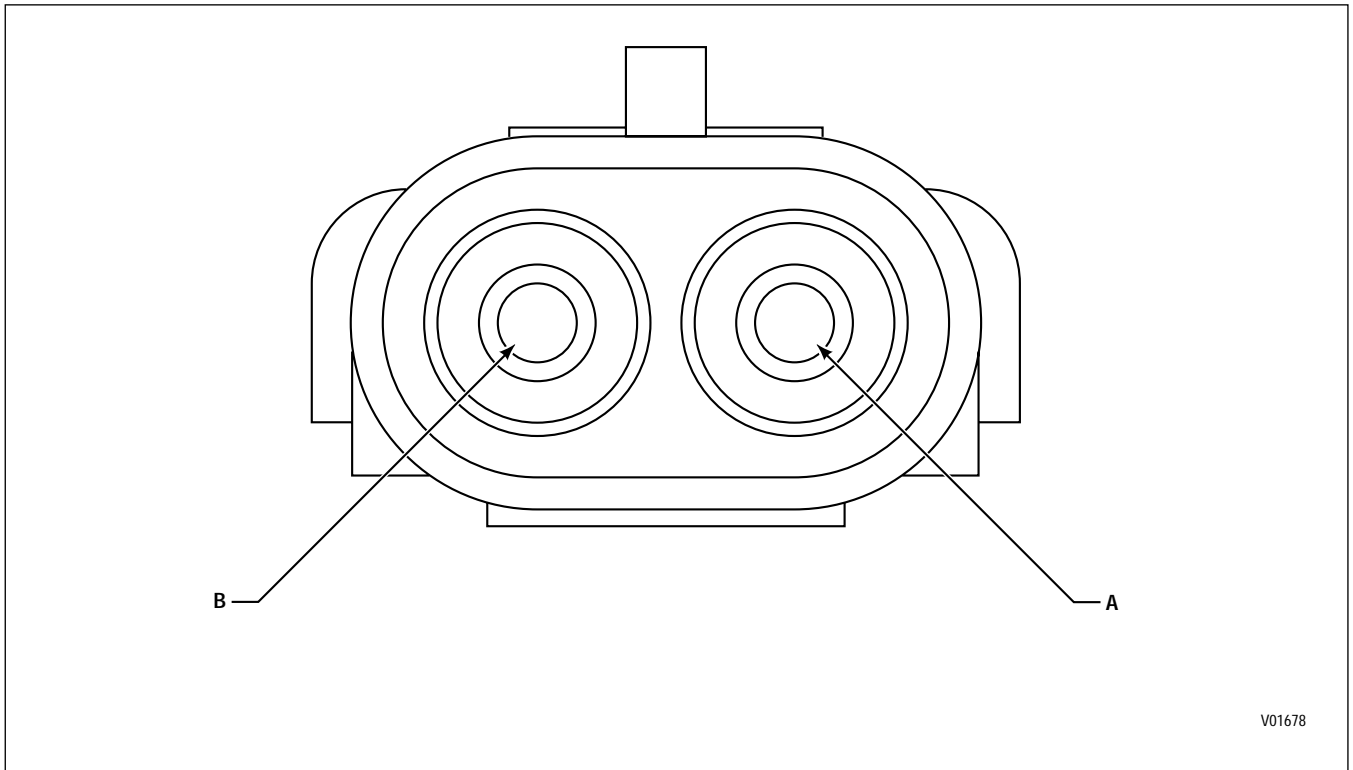


Figure D-19. Retarder Temperature Sensor Connector (HD/B 500)

RETARDER TEMPERATURE SENSOR CONNECTOR — HD/B 500

Terminal No.	Color	Wire No.	Description	Termination Point(s)
A	Orange	138	Retarder Temperature	ECU, B4
B	Green	135	Analog Ground	ECU, B1; Trans Conn, G2; TPS, A; Rtdr Module Sens, A

APPENDIX D — WIRE/CONNECTOR CHART

NOTES

CUSTOMER-FURNISHED VIW/VIM CONNECTOR CROSS-REFERENCE CHART

Connector Description	Navistar 29516972 VIW A 29511372			Navistar 29516972 VIW B 29511373			Navistar 29516972 VIW C 29511374			Freightliner 29517161 VIM A 12066195			Freightliner 29517161 VIM B			Freightliner 29517161 VIW		
	Wire #	Term. #	Color	Wire #	Term. #	Color	Wire #	Term. #	Color	Wire #	Term. #	Color	Wire #	Term. #	Color	Wire #	Term. #	Color
	105	9	Green	108	8	Yellow	117	3	Green	112	D	Violet	123	D	Violet	105	1	Green
	119	5	Yellow	136B	7	Red	118	5	Blue	113	E	White	136A	E	Red	117	16	Green
	137	12	Orange	142A	3	White	153	6	Yellow	114	F	White	136C	F	Red	118	2	Blue
	142B	11	White	143B	6	Black	155	2	Green	115	A	Green	143A	A	Black	119	3	Yellow
	151B	10	Blue	151A	4	Blue	161B	1	Yellow	125	C	White	143C	B	Black	137	5	Orange
	161C	1	Yellow	154	12	White	312CM	10	Yellow	132	B	Orange	146A	G	Yellow	142B	6	White
	163	2	Blue	160	10	Violet	312NO	12	Blue				157	C	Violet	151B	7	Blue
	325CM	3	Yellow	168	9	Yellow	312NC	11	Green				158	H	Orange	153	8	Yellow
	325NC	4	Green	315	5	White	314CM	7	Yellow							154	12	White
	332CM	6	Yellow	346	1	Orange	314NC	8	Green							155	9	Green
	332NC	7	Green	357UF	11	White	314NO	9	Blue							161B	13	Yellow
	332NO	8	Blue	358	2	White										163	14	Blue
Connector Description	Navistar 29516972 Rev. Warn/Neut Start 12084891			Navistar 29516972 Power/Ground 15300002			Ford 29515707&8 Fuse 12033769			Ford 29515704 Fuse 12033769			Gillig 29511644 6-Way Shroud #47 12010975			Gillig 29511644 6-Way Tower #51 12015799		
	313CM	A	Yellow	336B	A	Red	136E	A	Red	136D	A	Red	136A	A	Red	158	A	Red
	313NO	B	Blue	343B	B	Black	136F	B	Red	136E	B	Red	136C	B	Red		B	
	323NO	D	Blue									146A	C	Yellow	113	C	White	
	323CM	E	Yellow										D		157	D	Violet	
												143C	E	Black	123	E	Violet	
												143F	F	Black	115	F	Green	
Connector Description	Freightliner 29507731 2-Fuse Block 29509584			Freightliner 29507731 Relay Holder A 29509583			Freightliner 29507731 Relay Holder B 29509583			Freightliner 29507731 Relay Holder C 29509583			Freightliner 29520928 2-Fuse Block 29509584			Freightliner 29520928 Relay Holder A 29509583		
	14	1A	White	GND	30	White		30		20C	30	White	14	1A	White	15E	30	Black
	136D	2A	Red	115	85	Green	GND	85	White	113	85	White	136D	1B	Red	GND	85	White
	146A	2B	Yellow		86		123	86	Violet	20B	86	White		2A		123A	86	Violet
					87			87		20A	87	White	146A	2B	Yellow	15	87	Black
					87A			87A			87A			87A				
Connector Description	Freightliner 29520928 Relay Holder B 29509583																	
	20B	30	White															
	113	85	White															
	20A	86	White															
	304	87	White															
		87A																

Foldout D-2. Customer-Furnished VIW/VIM Connector Cross-Reference Chart

APPENDIX D — WIRE/CONNECTOR CHART

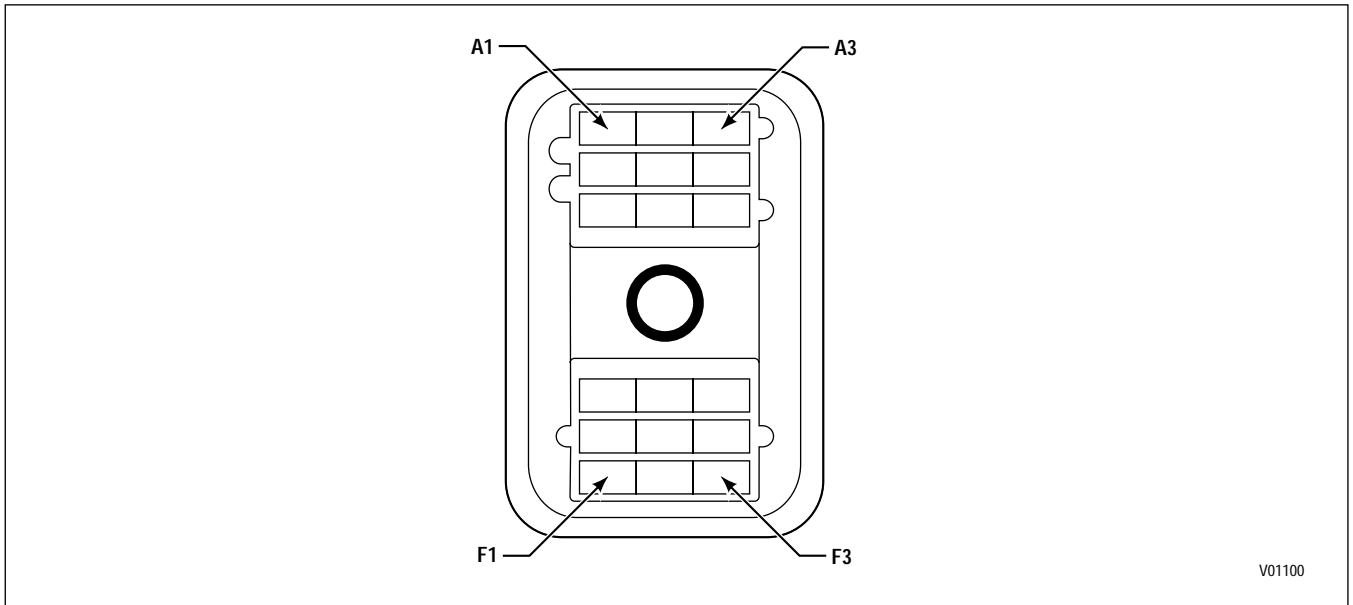
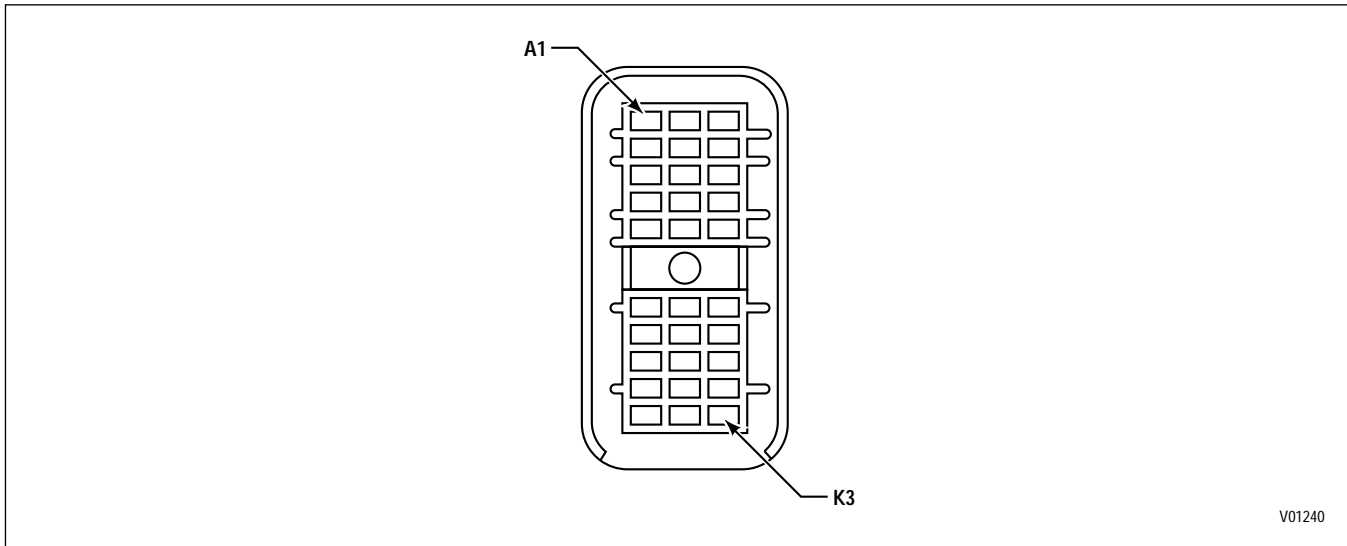


Figure D-20. VIM Connector (Harness)

VIM CONNECTOR (HARNESS)

Terminal No.	Color	Wire No.	Description	Termination Point(s)
A1	Black	143A	Battery (-)	ECU, B9; RSI, 7
A2	Black	143C	Battery (-)	ECU, B18; DDR, A
A3	Green	115	"DO NOT SHIFT" Light	ECU, A15
B1	Orange	132	Output Function 2	ECU, A32
B2	Violet	157	Speedometer Signal	ECU, B23
B3			Reserved	
C1			Reserved	
C2	White	125	Output Function 4	ECU, A25
C3	Orange	158	Dimmer Input	ECU, B24
D1	Violet	123	Neutral Start	ECU, A23
D2	Violet	112	Output Function 3	ECU, 112
D3			Reserved	
E1	Red	136A	Battery (+)	ECU, B2; RSI, 1
E2	Red	136C	Battery (+)	ECU, B11; DDR, H
E3			Reserved	
F1	Yellow	146	Ignition Sense	ECU, B12; DDR Conn, H
F2	White	113	Reverse Warning	ECU, A13
F3	White	114	Output Function 1	ECU, A14

APPENDIX D — WIRE/CONNECTOR CHART



V01240

Figure D-21. VIM Connector (Harness)

VIM CONNECTOR (HARNESS 30-WAY)

Terminal No.	Color	Wire No.	Description	Termination Point(s)*
A1	Blue	313NO	Reverse Warning Relay — Normally Open	
A2	Yellow	314CM	Output Wire 114 Relay — Common	
A3	Blue	314NO	Output Wire 114 Relay — Normally Open	
B1	Yellow	313CM	Reverse Warning Relay — Common	
B2	Green	314NC	Output Wire 114 Relay — Normally Closed	
B3		Reserved		
C1	Orange	346	Ignition Power	
C2	Green	312NC	Output Wire 112 Relay — Normally Closed	
C3		Reserved		
D1	Green	325NC	Output Wire 125 Relay — Normally Closed	
D2	Green	332NC	Output Wire 132 Relay — Normally Closed	
D3		Reserved		
E1	Yellow	325CM	Output Wire 125 Relay — Common	
E2	Yellow	332CM	Output Wire 132 Relay — Common	
E3	Blue	332NO	Output Wire 132 Relay — Normally Open	
F1	Blue	323NO	Neutral Start Relay — Normally Open	
F2	Yellow	312CM	Output Wire 112 Relay — Common	
F3	Blue	312NO	Output Wire 112 Relay — Normally Open	
G1	Yellow	323CM	Neutral Start Relay — Common	
G2		Reserved		
G3		Reserved		
H1		Reserved		
H2	White	357UF	Speedometer — Unfiltered	
H3		Reserved		
J1	Red	336A	Battery Power	
J2	Red	336C	Battery Power	
J3	White	358	Dimmer	
K1	Black	343A	Battery Ground	
K2	Black	343C	Battery Ground	
K3	White	315	“DO NOT SHIFT” Light	

* Termination Points are determined by OEM electrical system design.

APPENDIX D — WIRE/CONNECTOR CHART

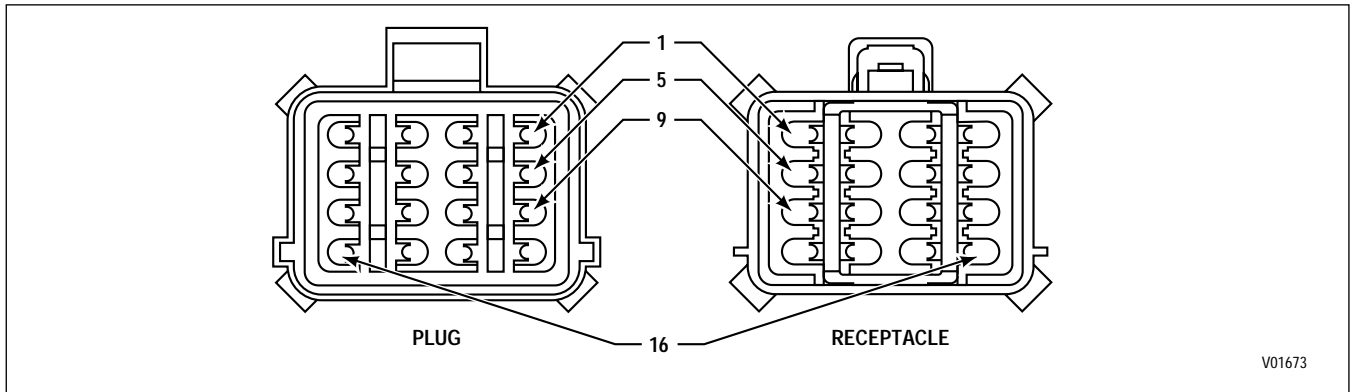


Figure D-22. Ford 16-Way Transmission Bulkhead Connector*

BULKHEAD A (GRAY)

Terminal No.	Color	Wire No.	Description	Termination Point(s)	
				Transmission Side	Bulkhead Side
1					Molded Closed
2	Orange	102	SGD1	A-2	ECU, A2
3	Green	103	CSOL	C-1	ECU, A3
4	White	104	GSOL	F-1	ECU, A4
5	Green	107	FSHI	D-3	ECU, A7
6	White	110	FSLO	D-2	ECU, A10
7	White	120	ASOL	A-1	ECU, A20
8	Violet	121	SGD2	B-2	ECU, A21
9	Orange	128	BSOL	B-1	ECU, A28
10	Violet	129	ESOL	E-1	ECU, A29
11	Yellow	130	SGD3	C-2	ECU, A30
12	Blue	131	DSOL	D-1	ECU, A31
13	Red	136B	12/24V	Splice to 136E	Splice to 136A
14	Red	136C	12/24V	Splice to 136E	ECU, B11
15	Black	143B	BTGD	Splice to 143F	Splice to 143A
16	Black	143C	BTGD	Splice to 143F	ECU, B18

BULKHEAD B (BLACK)

Terminal No.	Color	Wire No.	Description	Termination Point(s)	
				Transmission Side	Bulkhead Side
1	White	106	LOPR	G-3	ECU, A6
2	Yellow	139	NOHI	NO-A	ECU, B5
3	Green	148	NOLO	NO-B	ECU, B14
4	Violet	147	OILT	F-3	ECU, B4
5			Molded Closed		
6	Blue	140	NTLO	E-2	ECU, B6
7	Orange	149	NTHI	E-3	ECU, B15
8			Molded Closed		
9	Red	124	TPHI	TPS-C	ECU, A24
10	Violet	141	NEHI	NE-A	ECU, B7
11	Orange	150	NELO	NE-B	ECU, B16
12	Green	135A	TPLO	TPS-A	ECU, B1
13	Blue	156	TPOT	TPS-B	ECU, B22
14	Yellow	161A	SNGD	F-2	ECU, B27
15	White	162	C3PS	C-3	ECU, B28
16	Blue	165	LOIL	B-3	ECU, B31

* For Model Year 1995 and later units, consult the Ford Vehicle manual for terminal identification.

APPENDIX D — WIRE/CONNECTOR CHART

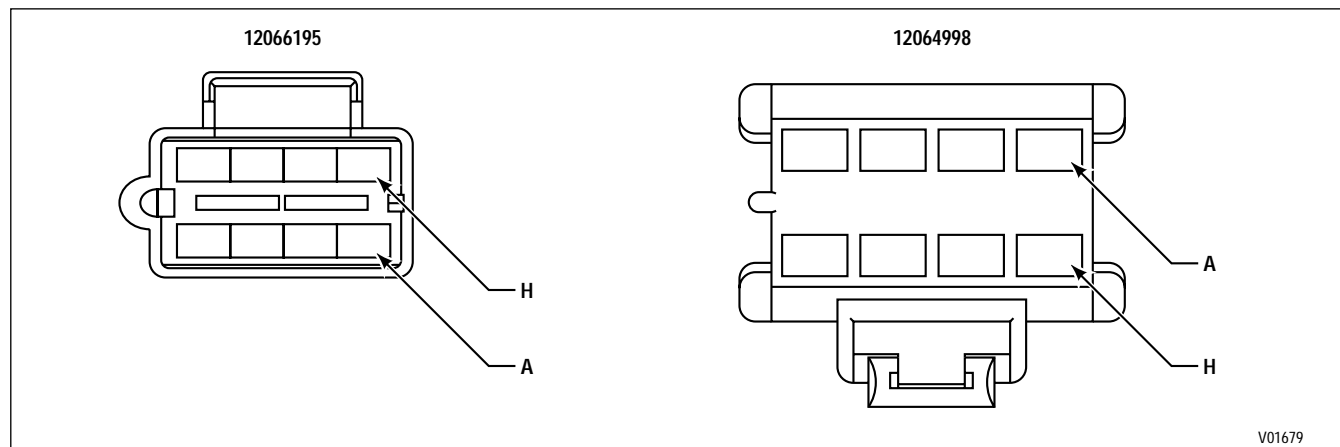


Figure D-23. Packard Metri-Pack VIM Connectors

VIM A: 8-WAY MALE P/N 12066195 (FREIGHTLINER HARNESS P/N 29517161)

Terminal No.	Color	Wire No.	Description	Termination Point(s)
A	Green	115	DNS	ECU, A15
B	Orange	132	SFO2	ECU, A32
C	White	125	SFO4	ECU, A25
D	Violet	112	SFO3	ECU, A12
E	White	113	RVWN	ECU, A13
F	White	114	SFO1	ECU, A14
G				
H				

VIM B: 8-WAY FEMALE P/N 12064998 (FREIGHTLINER HARNESS P/N 29517161)

Terminal No.	Color	Wire No.	Description	Termination Point(s)
A	Black	143A	BTGD	ECU, B9
B	Black	143C	BTGD	ECU, B18
C	Violet	157	VSPD	ECU, B23
D	Violet	123	NTST	ECU, A23
E	Red	136A	12/24V	ECU, B2
F	Red	136C	12/24V	ECU, B11
G	Yellow	146A	IGSN	ECU, B12
H	Orange	158	DIMR	ECU, B24

APPENDIX D — WIRE/CONNECTOR CHART

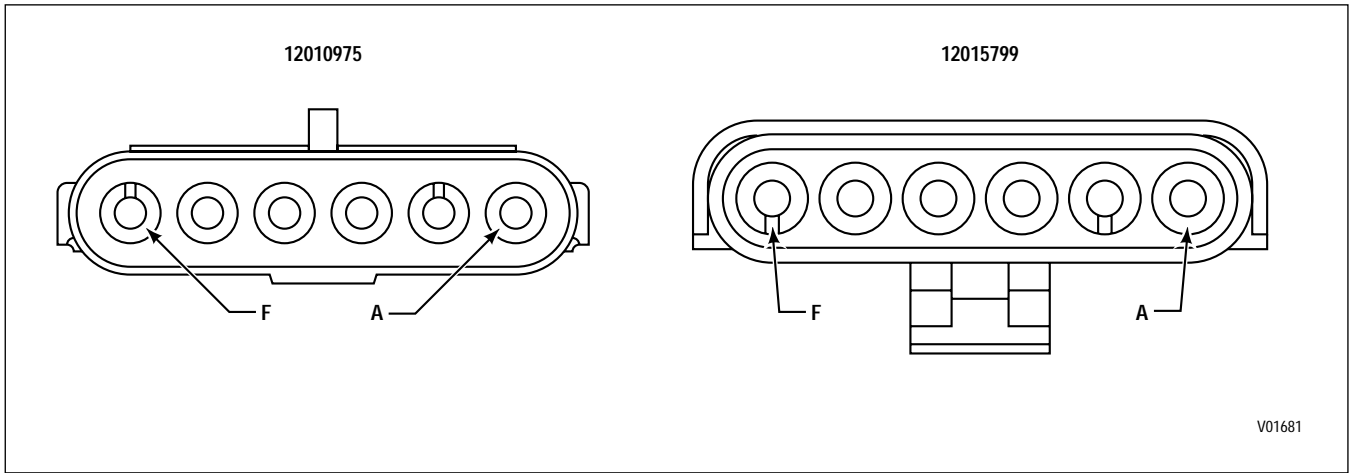


Figure D-24. Packard Weather Pack VIM Connectors

6-WAY SHROUD P/N 12010975 (GILLIG HARNESS P/N 29511644)

Terminal No.	Color	Wire No.	Description	Termination Point(s)
A	Red	136A	12/24V	ECU, B2
B	Red	136C	12/24V	ECU, B11
C	Yellow	146A	IGSN	ECU, B12
D				
E	Black	143C	BTGD	ECU, B18
F	Black	143A	BTGD	ECU, B9

6-WAY TOWER P/N 12015799 (GILLIG HARNESS P/N 29511644)

Terminal No.	Color	Wire No.	Description	Termination Point(s)
A	Orange	158	DIMR	ECU, B24
B				
C	White	113	RVWN	ECU, A13
D	Violet	157	VSPD	ECU, B23
E	Violet	123	NTST	ECU, A23
F	Green	115	DNS	ECU, A15

APPENDIX D — WIRE/CONNECTOR CHART

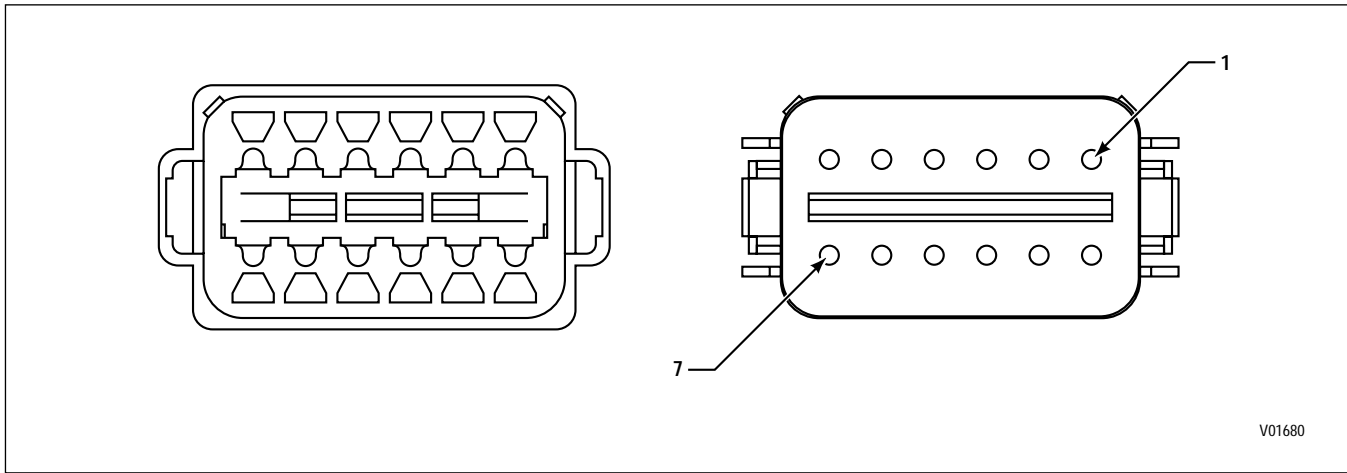


Figure D-25. Navistar Deutsch DT Series VIW Connector

VIW A (GRAY)

Terminal No.	Color	Current Configuration		Former Configuration		Termination Point(s)
		Wire No.	Description	Wire No.	Description	
1	Yellow	161C	Signal Ground	161B	Same as Current	Splice to 161A
2	Blue	163	SFI6	163	Same as Current	ECU, B29
3	Yellow	325CM	SFO4Com	320	Same as Current	VIM B, E1
4	Green	325NC	SFO4NC	321	Same as Current	VIM B, D1
5	Yellow	119	SFI4	153	SFI2	ECU, A19
6	Yellow	332CM	SFO2Com	315	SFO1Com	VIM B, E2
7	Green	332NC	SFO2NC	316	SFO1NC	VIM B, D2
8	Blue	332NO	SFO2NO	317	SFO1NO	VIM B, E3
9	Green	105	SFO5	105	Same as Current	ECU, A5
10	Blue	151B	SCI -	151B	Same as Current	Splice to 151A
11	White	142B	SCI +	142B	Same as Current	Splice to 142A
12	Orange	137	SF17	117	SFI8	ECU, B3

VIW B (BLACK)

Terminal No.	Color	Current Configuration		Former Configuration		Termination Point(s)
		Wire No.	Description	Wire No.	Description	
1	Orange	346	Ignition Signal	303	Same as Current	VIM B, C1
2	White	358	Dimmer	324	Same as Current	VIM B, J3
3	White	142A	SCI +	142A	Same as Current	ECU, B8
4	Blue	151A	SCI -	151A	Same as Current	ECU, B17
5	White	315	DNS	319	Same as Current	VIM B, K3
6	Black	143B	Battery Ground	143B	Same as Current	Splice to 143A

(continued on the next page)

APPENDIX D — WIRE/CONNECTOR CHART

VIW B (BLACK) *(cont'd)*

Terminal No.	Color	Current Configuration		Former Configuration		Termination Point(s)
		Wire No.	Description	Wire No.	Description	
7	Red	136B	12/24V	136B	Same as Current	Splice to 136A
8	Yellow	108	Remote Wakeup	108	Same as Current	ECU, A8
9	Yellow	168	RSI +	168	Same as Current	ECU, B34
10	Violet	160	RSI -	160	Same as Current	ECU, B26
11	White	357UF	Speedometer	313	Same as Current	VIM B, H2
12	White	154	SFI5	154	Same as Current	ECU, B20

VIW C (BLACK)

Terminal No.	Color	Current Configuration		Former Configuration		Termination Point(s)
		Wire No.	Description	Wire No.	Description	
1	Yellow	161B	Signal Ground	161B	Same as Current	Splice to 161A
2	Green	155	SFI1	155	Same as Current	ECU, B21
3	Green	117	SFI	137	SFI7	ECU, A17
4						
5	Blue	118	SFI3	118	Same as Current	ECU, A18
6	Yellow	153	SFI2	119	SFI4	ECU, B19
7	Yellow	314CM	SFO1COM	305	SFO2COM	VIM B, A2
8	Green	314NC	SFO1NC	306	SFO2NC	VIM B, B2
9	Blue	314NO	SFO1NO	307	SFO2NO	VIM B, A3
10	Yellow	312CM	SFO3COM	310	Same as Current	VIM B, F2
11	Green	312NC	SFO3NC	311	Same as Current	VIM B, C2
12	Blue	312NO	SFO3NO	312	Same as Current	VIM B, F3

APPENDIX D — WIRE/CONNECTOR CHART

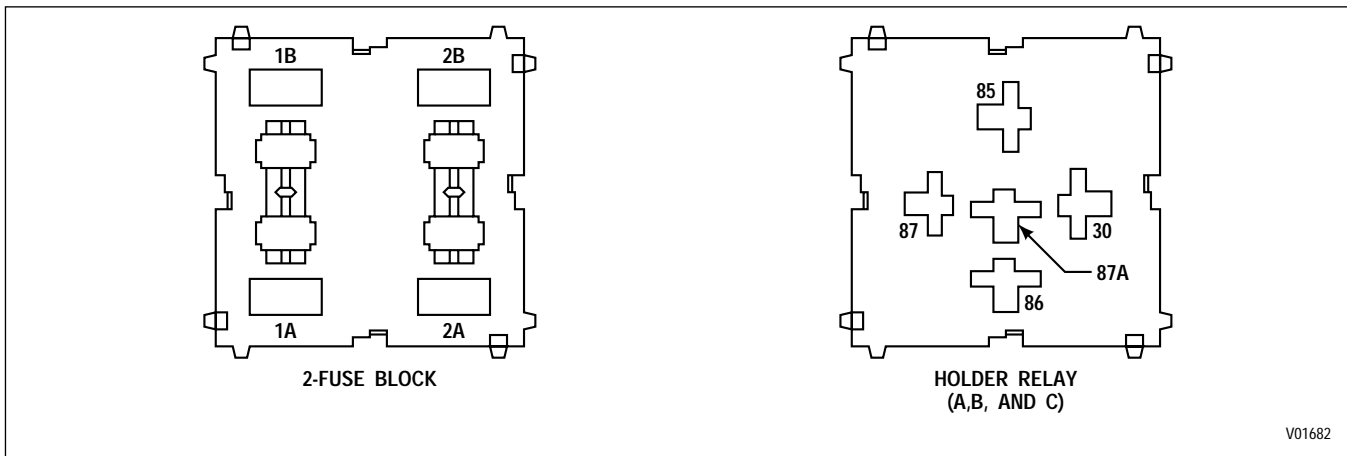


Figure D-26. Dill VIW Connectors

FREIGHTLINER HARNESS P/N 29507731 (PRIOR TO MODEL YEAR 1995)

2-Fuse Block — P/N 29509584

Terminal No.	Color	Wire No.	Description	Termination Point(s)
1A	White	14	Battery (+)	Battery Terminal
1B	White	306	Ignition Feed	CIW B, D
2A	Red	136D	12/24V	Splice A
2B	Yellow	146A	IGSN	ECU, B12

Relay Holder A — P/N 29509583

Terminal No.	Color	Wire No.	Description	Termination Point(s)
30	White	GND	GND SP	Splice Area C
85	Green	115	DNS	ECU, A15
86	White	305	ACC IGTN	CIW A, D
87	White	223	DNS LIGHT	CIW B, F
87A				

Relay Holder B — P/N 29509583

Terminal No.	Color	Wire No.	Description	Termination Point(s)
30	Black	15E	IG SRT	CIW A, A
85	White	GND	GND SP	Splice Area C
86	Violet	123	NTST	ECU, A23
87	Black	15	IG SRT	CIW A, F
87A				

Relay Holder C — P/N 29509583

Terminal No.	Color	Wire No.	Description	Termination Point(s)
30	White	20C	ACC PWR FD	CIW A, B
85	White	113	RVWN	ECU, A13
86	White	20B	ACC PWR FD	Splice Area E
87	White	20A	ACC PWR FD	CIW A, E
87A				

(continued on the next page)

APPENDIX D — WIRE/CONNECTOR CHART

FREIGHTLINER HARNESS P/N 29520928 (MODEL YEAR 1995)

2-Fuse Block — P/N 29509584

Terminal No.	Color	Wire No.	Description	Termination Point(s)
1A	White	14	Battery (+)	Battery Terminal
1B	Red	136D	12/24V	Splice Area A
2A	White	306	Ignition, Fused	CIW B, D
2B	Yellow	146A	IGSN	ECU, B12

Relay Holder A — P/N 29509583

Terminal No.	Color	Wire No.	Description	Termination Point(s)
30	Black	15E	IG SRT	CIW A, A
85	White	GND	RLYGND	CIW A, V
86	Violet	123A	NTST	ECU, A23
87	Black	15	IG SRT	CIW A, F
87A				

Relay Holder B — P/N 29509583

Terminal No.	Color	Wire No.	Description	Termination Point(s)
30	White	20B	ACC PWR FD	Relay B, 86
85	White	113	RVWN	ECU, A13
86	White	20A	ACC PWR FD	CIW A, E
87	White	304	REVWRN	CIW A, B
87A				

APPENDIX D — WIRE/CONNECTOR CHART

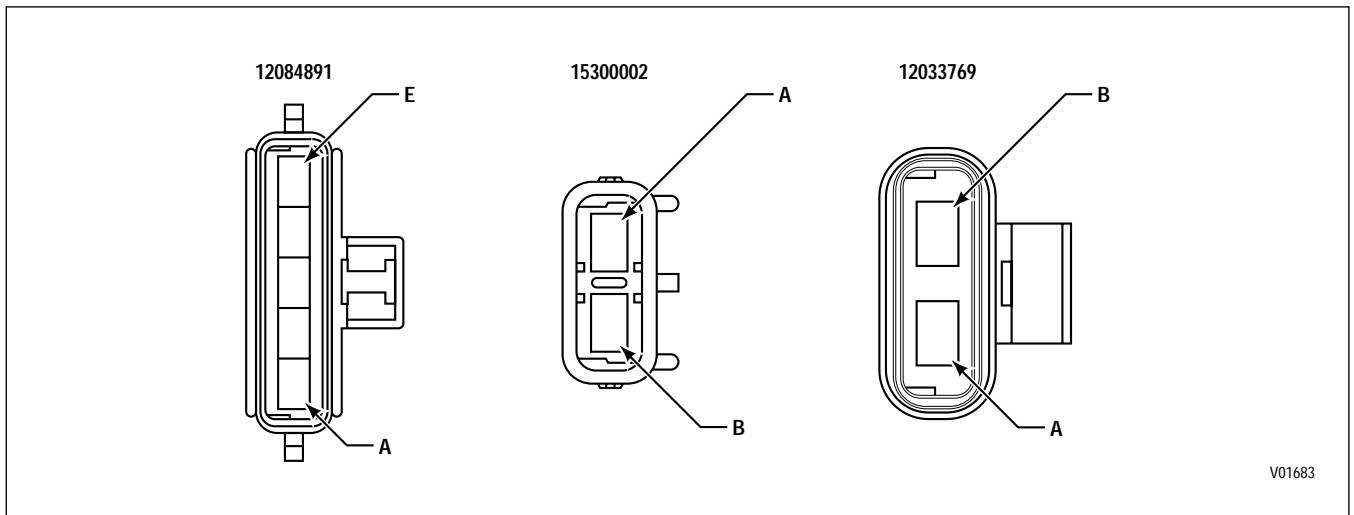


Figure D-27. Packard Metri-Pack Cab And Chassis Harness Connectors

REVERSE WARN / NEUTRAL START P/N 12084891 (NAVISTAR HARNESS P/N 29516972)

Terminal No.	Color	Wire No.	Description	Termination Point(s)
A	Yellow	313CM	RWCOM	VIM B, B1
B	Blue	313NO	RWNO	VIM B, A1
C				
D	Blue	323NO	NSNO	VIM B, F1
E	Yellow	323CM	NSCOM	VIM B, G1

POWER / GROUND P/N 15300002 (NAVISTAR HARNESS P/N 29516972)

Terminal No.	Color	Wire No.	Description	Termination Point(s)
A	Red	336B	12/24 UNF	Splice to 336A, C
B	Black	343B	BTGND	Splice to 343A, B

FUSE P/N 12033769 (FORD HARNESS P/N 29515708)

Terminal No.	Color	Wire No.	Description	Termination Point(s)
A	Red	136E	12/24V	Splice to 136B
B	Red	136F	12/24V	Battery Ring Terminal

FUSE P/N 12033769 (FORD HARNESS P/N 29515704)

Terminal No.	Color	Wire No.	Description	Termination Point(s)
A	Red	136D	12/24V	Splice to 136B
B	Red	136E	12/24V	Battery Ring Terminal

APPENDIX D — WIRE/CONNECTOR CHART

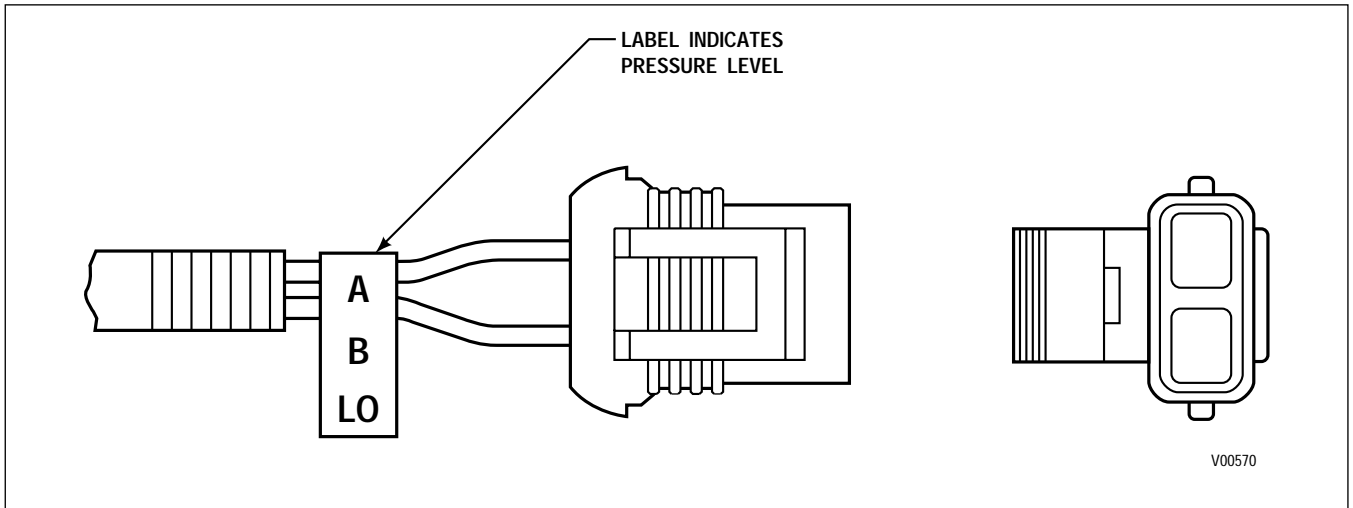


Figure D-28. Resistance Module Type 2 — Single Pressure Switch

RESISTANCE MODULE TYPE 2

Terminal No.	Color
A	White
B	Blue

APPENDIX D — WIRE/CONNECTOR CHART

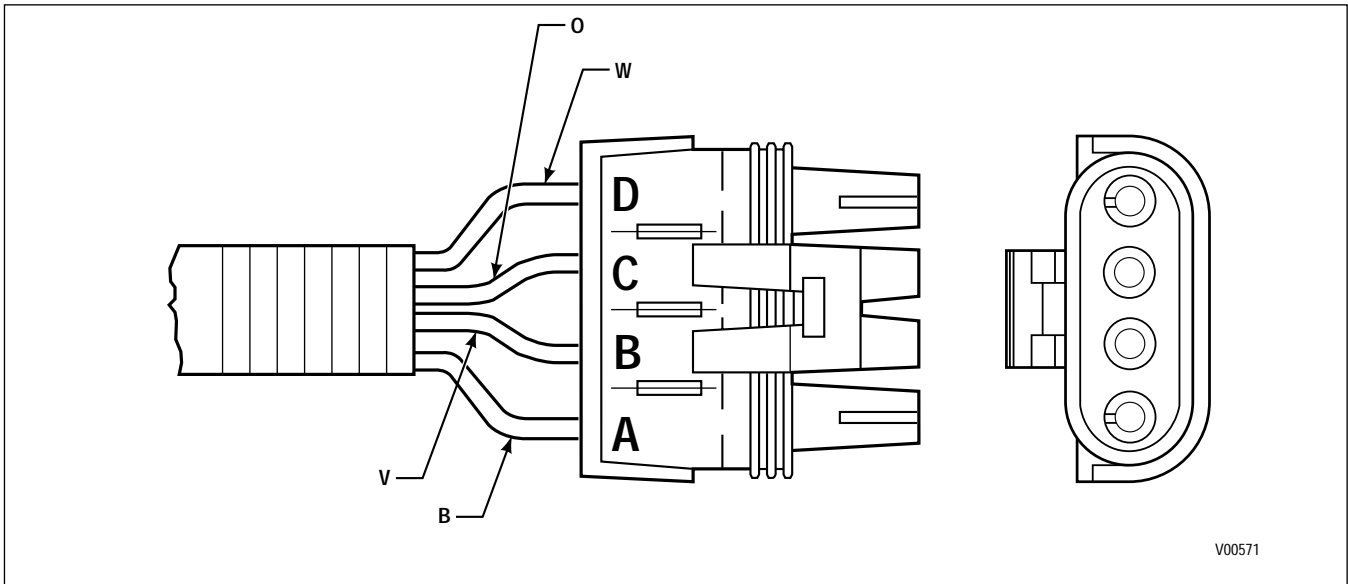


Figure D-29. Resistance Module Type 3 — Bendix E-10R Pedal

RESISTANCE MODULE TYPE 3

Terminal No.	Color
A	Blue
B	Violet
C	White
D	Orange

APPENDIX D — WIRE/CONNECTOR CHART

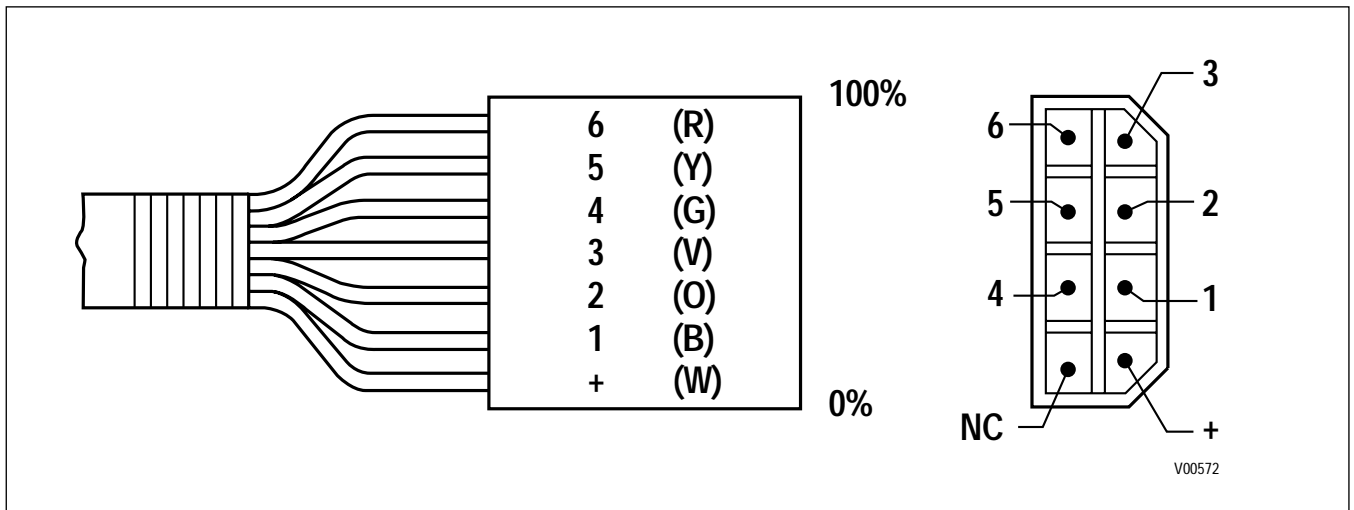
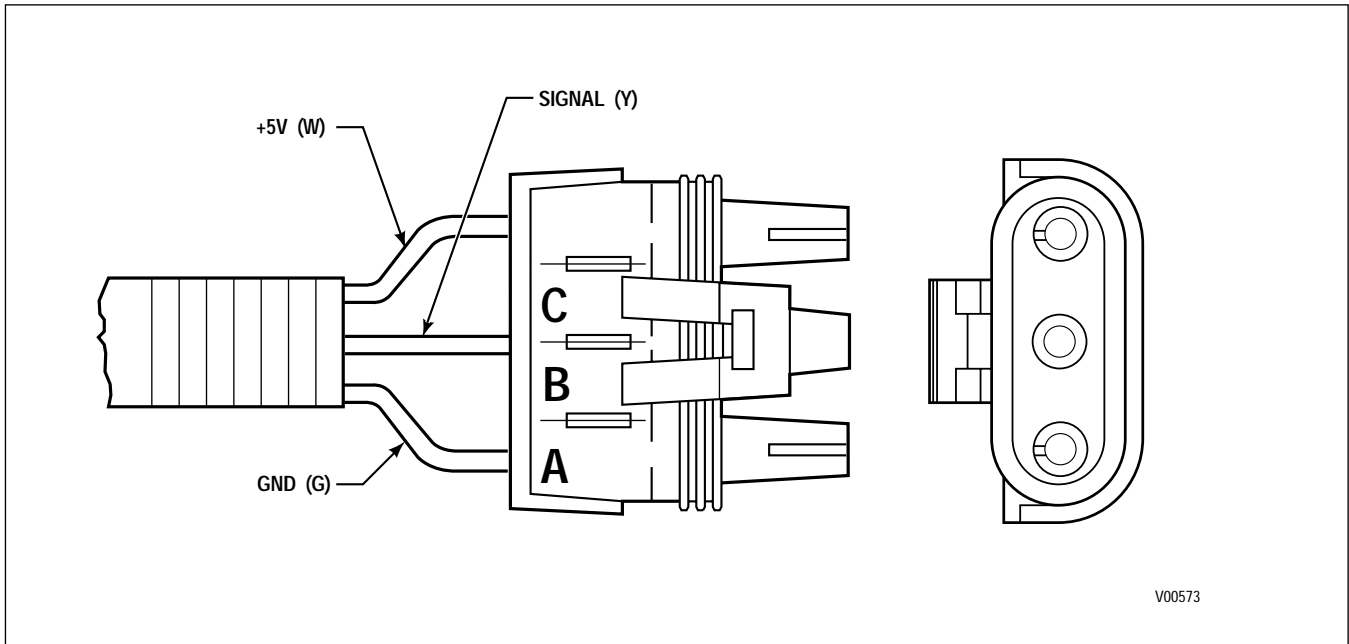


Figure D-30. Resistance Module Type 5 — Hand Lever

RESISTANCE MODULE TYPE 5

Terminal No.	Color
+	White
1	Blue
2	Orange
3	Violet
4	Green
5	Yellow
6	Red

APPENDIX D — WIRE/CONNECTOR CHART



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Figure D-31. Resistance Module Type 7 — Dedicated Pedal

RESISTANCE MODULE TYPE 7

Terminal No.	Color
A	Green
B	Yellow
C	White

APPENDIX D — WIRE/CONNECTOR CHART

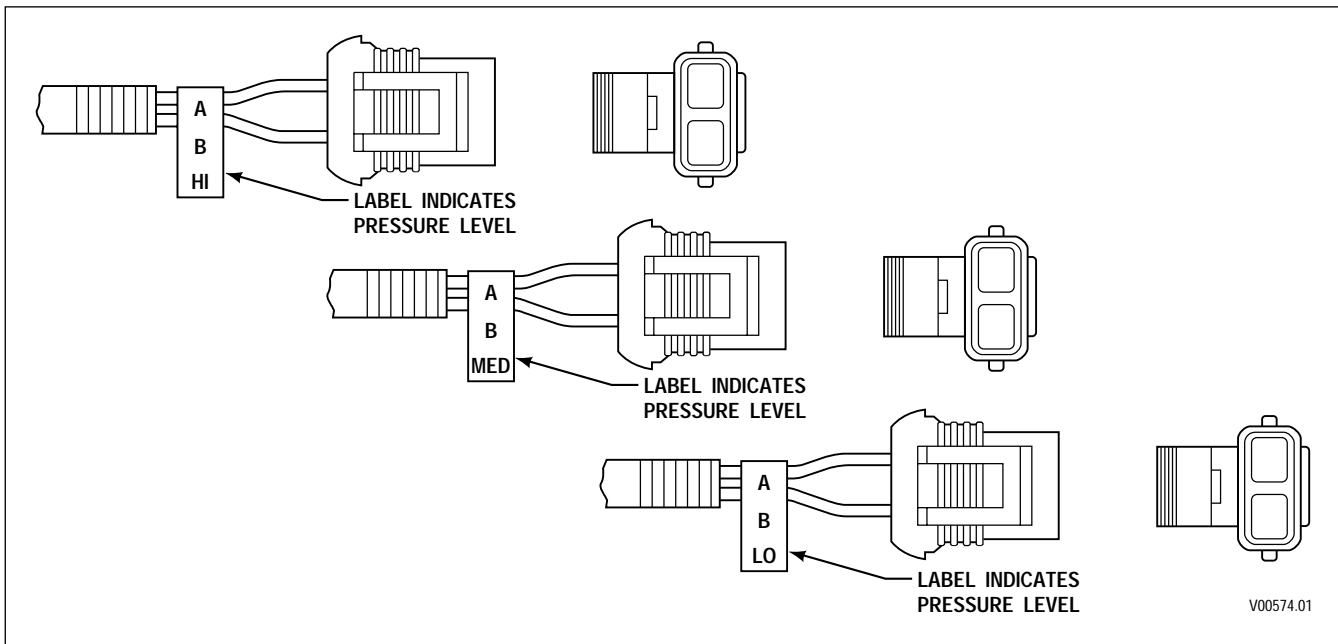


Figure D-32. Resistance Module Type 8 — Three Pressure Switch

RESISTANCE MODULE TYPE 8

LOW PRESSURE

Terminal No.	Color
A	White
B	Blue

MEDIUM PRESSURE

Terminal No.	Color
A	White
B	Orange

HIGH PRESSURE

Terminal No.	Color
A	White
B	Violet

APPENDIX D — WIRE/CONNECTOR CHART

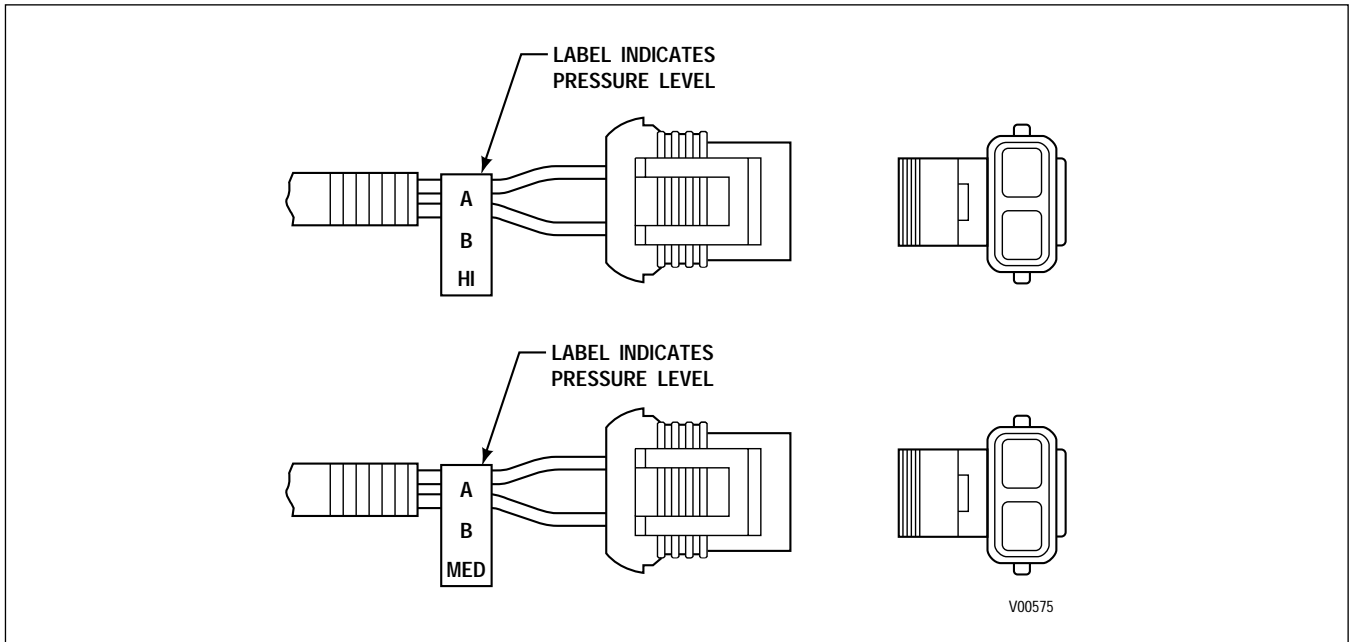


Figure D-33. Resistance Module Type 9 — Two Pressure Switch

RESISTANCE MODULE TYPE 9

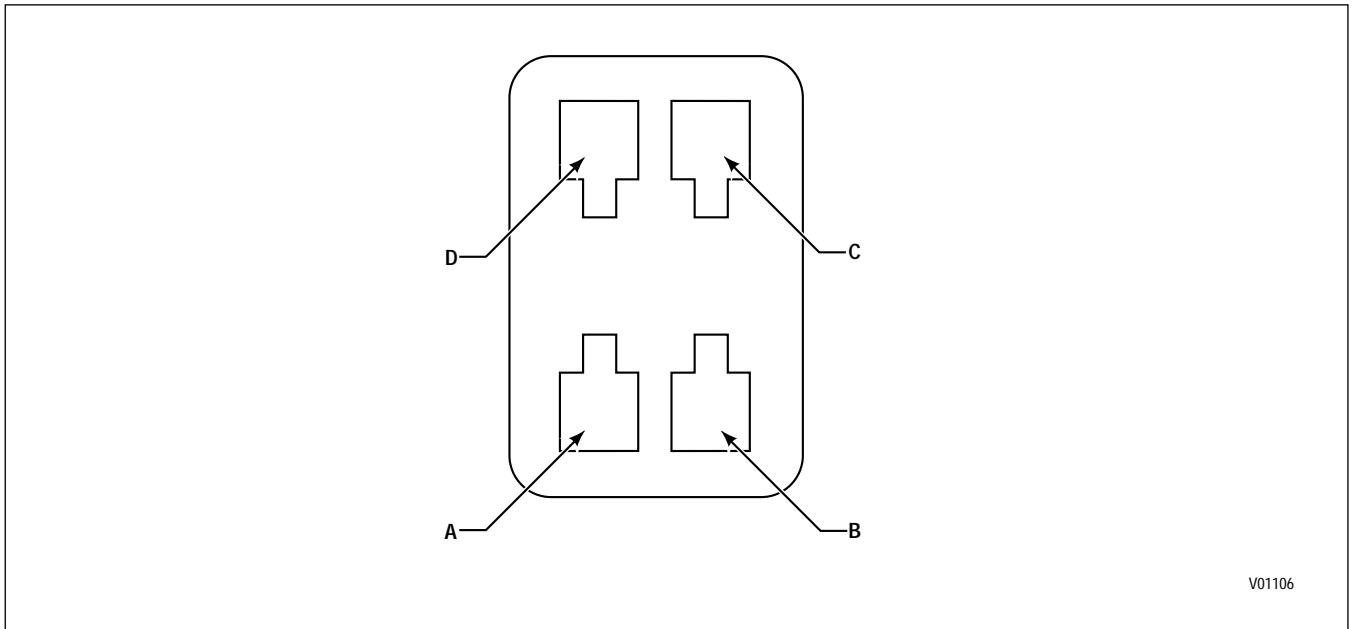
MEDIUM PRESSURE

Terminal No.	Color
A	White
B	Orange

HIGH PRESSURE

Terminal No.	Color
A	White
B	Violet

APPENDIX D — WIRE/CONNECTOR CHART



V01106

Figure D-34. End View of Oil Level Sensor Plug

OIL LEVEL SENSOR CONNECTOR

Terminal No.	Color	Wire No.	Description	Termination Point(s)	
				24-Way Transmission Connector	31-Way Feedthrough Harness Connector
A	White	165	LOIL	B3	Y
B	Black	135B	TPLO	G2	N
C					
D	Red	106	LOPR	G3	D

APPENDIX D — WIRE/CONNECTOR CHART

SPARE WIRES

Color	Wire No.	From	To
Orange	201	ECU	Trans Connector
Yellow	202	ECU	Trans Connector
Green	203	ECU	TPS Connector
Violet	204	ECU	RSI Connector
Blue	205	ECU	VIM Connector
White	206	ECU	VIW Connector

APPENDIX E — CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

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1-5.	Packard Metri-Pack 280 Series Connectors — Push-to-Seat (DDR)	E-17
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1-7.	Amp Products Connectors (16-Way VIW; 8-Way RMR Device (Hand Lever)).....	E-25
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1-9.	ITT Cannon Connectors — Crimped (37-Way FMTV Bulkhead; 6-Way Transfer Case; 8-Way MD Retarder)	E-33
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NOTE: *Allison Transmission is providing for service of WTEC II wiring harnesses and wiring harness components as follows: (See Service Information Letter 1-WT-97 for further information.)*

- Repair parts for the internal wiring harness and for wiring harness components attached to the shift selector will be available through the Allison Transmission Parts Distribution Center (PDC). Use the P/N from your appropriate parts catalog or from Appendix E in this manual. Allison Transmission is responsible for warranty on these parts.
- Since January, 1998, all WTEC II external harnesses and external harness components must be obtained from St. Clair Technologies Inc. (SCTI). SCTI provides parts to any Allison customer or OEM and is responsible for warranty on these parts. SCTI recognizes ATD, manufacturers, and SCTI part numbers. SCTI provides a technical HELPLINE at 519-627-1673 (Wallaceburg). SCTI has parts catalogs available. The SCTI addresses and phone numbers for parts outlets are:

St. Clair Technologies, Inc.
1050 Old Glass Road
Wallaceburg, Ontario, Canada, N8A 3T2
Phone: (519) 627-1673
Fax: (519) 627-4227

St. Clair Technologies, Inc.
1111 Mikesell Street
Charlotte, Michigan 48813
Phone: (517) 541-8166
Fax: (517) 541-8167

St. Clair Technologies, Inc.
c/o Mequilas Tetakawi
Carr. Internationale KM 1969
Guadalajara – Nogales, KM2
Empalme, Sonora, Mexico
Phone: 011-52-622-34661
Fax: 011-52-622-34662

APPENDIX E — CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

LIST OF SPECIAL TOOLS REQUIRED TO SERVICE WTEC II WIRING HARNESSSES

Tool Number	Tool Type	Paragraph Reference
23046604	Splice, Sealed (14–16 AWG)	1–14
23046605	Splice, Sealed (18–22 AWG)	1–14
J 25070	Heat Gun	1–14
J 34182	Crimper	1–8, 1–9, 1–11
J 34513	Remover	1–8
J 34823	Remover	1–7
J 35123	Crimper (alternate)	1–2, 1–3
J 35606	Crimper (alternate)	1–6
J 35615	Wire Stripper	1–14
J 35689-A	Remover	1–2, 1–3
J 38125-6	Crimper	1–5, 1–6
J 38125-7	Crimper	1–2, 1–3, 1–4, 1–5, 1–7, 1–12, 1–13
J 38125-8	Crimper	1–12
J 38125-10	Remover	1–6
J 38125-13	Remover	1–4, 1–5, 1–12, 1–13
J 38582-3	Remover	1–8
J38687	Crimper	1–1
J 38852	Crimper (alternate)	1–6
J 39227	Remover	1–1
J 39841	Terminal Remover/Installer (MD Retarder)	1–9
J 39842	Terminal Remover/Installer (MD 3070 T-case)	1–9
J 41193	Connector Repair Kit (FMTV)	1–9
J 41193-1	Guide Pin	1–9
J 41193-2	Insertion Tool	1–9
J 41193-3	Terminal Remover	1–9
J 41194	Extractor/Inserter	1–8
None	50–70 Percent Tin Resin Core Solder	1–10
None	Pen-Type Soldering Iron (Max OD = 3.175 mm)	1–10
None	Desoldering Braid	1–10

**APPENDIX E — CONNECTOR PART NUMBERS, TERMINAL PART
NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS**

NOTES

APPENDIX E — CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

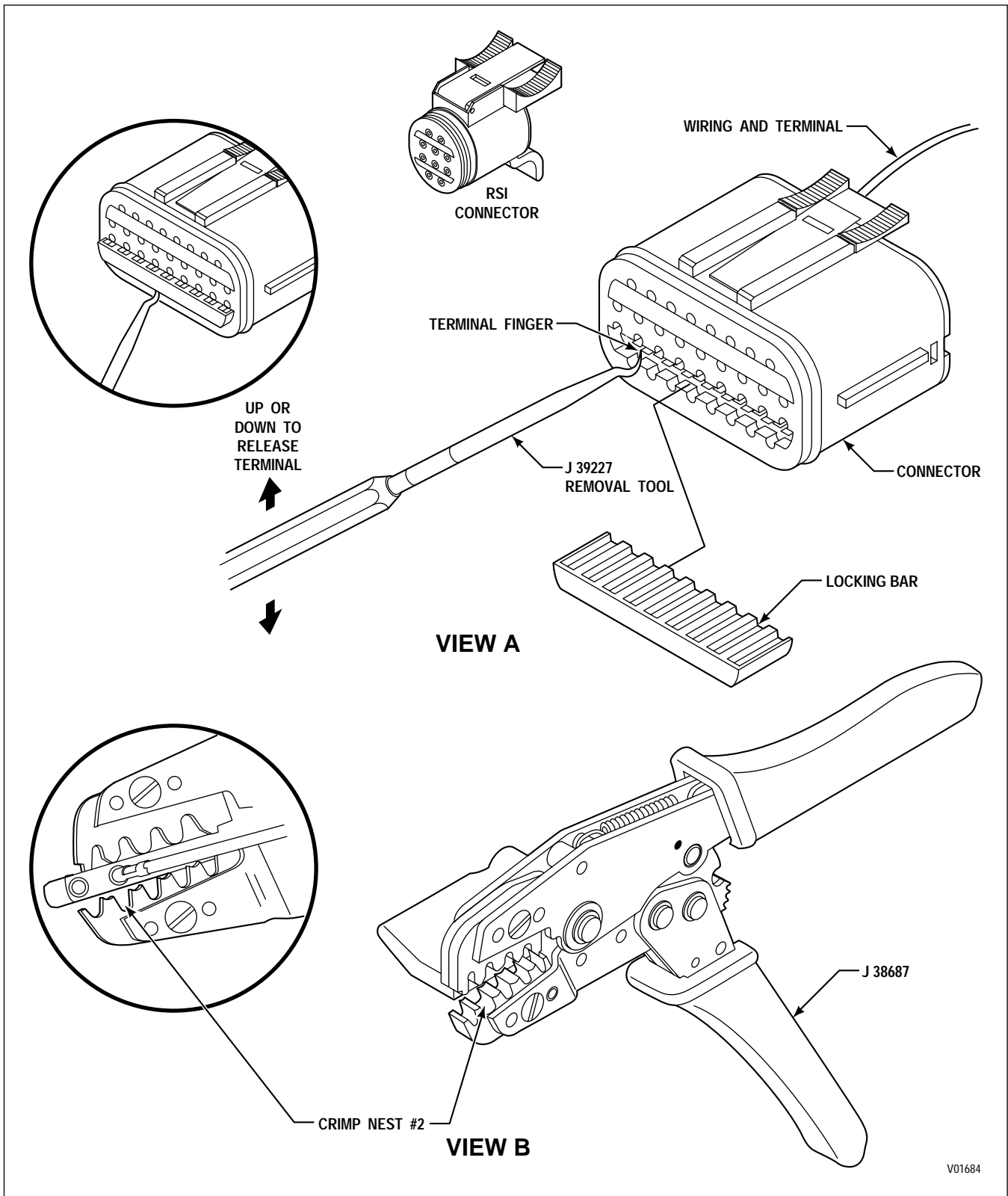


Figure E-1. Thomas & Betts ECU Connector, RSI Connector

APPENDIX E — CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

1-1. THOMAS & BETTS CONNECTORS (ECU AND RSI)

A. Connector/Terminal Repairs

Crimping Tool	J 38687	
Crimp Nest No. 2		
Remover Tool	J 39227	
Use	Description	P/N
Electronic Control Unit	Connector "A" (Black/White)	29500915
	Connector "B" (Black)	29500914
	Terminal	29500917
	O-ring Seal	29503055
	Locking Bar	29503057
	Cavity Plug	29500919
Remote Serial Interface (RSI)	Connector	29500916
	Terminal	29500917
	O-ring Seal	29503054
	Locking Bar	29503056
	Cavity Plug	29500919

B. Terminal Removal

1. Remove the locking bar(s) from front of the connector (Figure E-1, View A).
2. Move the appropriate terminal finger slightly up or down to release the desired terminal and pull on the wire to remove the terminal from the back of the connector.
3. If replacing the terminal, cut the wire between the core and insulation crimp to minimize wire loss.

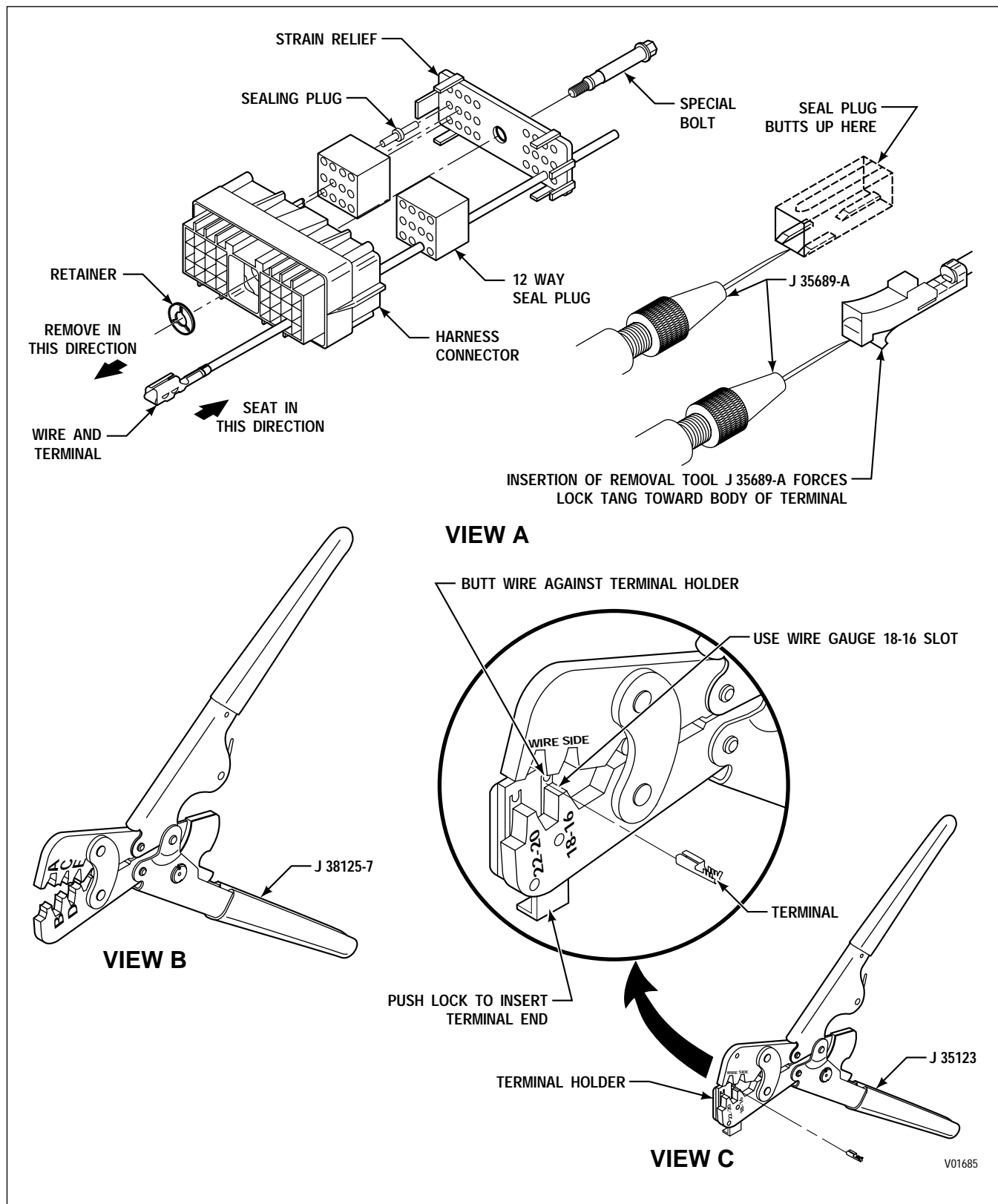
C. Terminal Crimping

1. Carefully strip insulation $4 \text{ mm} \pm 0.5 \text{ mm}$ (0.16 ± 0.02 inch). Automatic Wire Stripper J 35615 will remove insulation and crimp from old terminal without damaging the wire, unless the insulation crimp is overtight.
2. Insert a terminal into Crimp Nest No. 2 of crimping tool J 38687 (Figure E-1, View B).
3. Properly position the stripped wire in the terminal and squeeze the handles of the crimping tool until the ratchet mechanism releases.
4. Insert the newly crimped terminal back into its cavity and push until the terminal finger "locks" into place.
5. Reinsert the locking bar(s) into the front of the connector.

D. Deletion of RSI Jumper Wire

1. Follow Steps 1 and 2 of Paragraph B (Terminal Removal) above.
2. Insert cavity plugs in cavities 2 and 3.

APPENDIX E — CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS



V01685

Figure E-2. Packard Metri-Pack 150 Series Connectors — Pull-to-Seat (Internal/External Harness to Transmission Feedthrough; Speed Sensor; Accumulator Solenoid; 30-Way and 18-Way VIM)

APPENDIX E — CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

1-2. PACKARD METRI-PACK 150 SERIES CONNECTORS — PULL-TO-SEAT (INTERNAL/EXTERNAL HARNESS TO TRANSMISSION FEEDTHROUGH; SPEED SENSOR; ACCUMULATOR SOLENOID; 30-WAY AND 18-WAY VIM)

A. Connector/Terminal Repairs

Crimping Tool	J 38125-7	
Wire Crimp	Anvil "E"	
Insulation Crimp	Anvil "C"	
Alternate Crimping Tool	J 35123	
Remover Tool	J 35689-A	
Use	Description	P/N
External Harness to	Connector Body	12092201
Transmission Feedthrough	12-Way Seal (x2)	12092200
Connector	Special Bolt	12129426
	Retainer	12034236
	Strain Relief	12110234
	Terminal (Socket)	12110236
	Cavity Plug	12034413
Internal Harness to	Connector Assembly	12092197
Transmission Feedthrough	Terminal	12110236
Connector	12-Way Seal (x2) (Internal)	29514675
Turbine Speed	Connector	12092419
(Nt) Sensor (MD/B 300/B 400)	Terminal	12110236
Turbine Speed	Connector	12162193
(Nt) Sensor (HD/B 500)	Terminal	12103881
Engine/Output (All Models)	Connector	12162193
(Ne/No) Speed Sensor	Terminal	12103881
Accumulator (H Solenoid)	Connector	15326143
	Terminal	12103881
Vehicle Interface	Connector (VIM)	
Module (VIM)	Connector Body	12040920
	9-Way Seal (x2)	12040936
	18-Way Strain Relief	12110545
	Special Bolt	12129426
	Bolt Retainer	12034236
	Sealing Plug	12034413
	Terminal	12103881
Vehicle Interface	Harness Connector (OEM)	29506606
Module (Vehicle)	Connector Body	12034397
	15-Way Seal (x2)	12040879
	30-Way Strain Relief	12110546
	Special Bolt	12129426
	Bolt Retainer	12034236
	Sealing Plug	12034413
	Terminal	12103881

APPENDIX E — CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

NOTE: *Do not solder crimps.*

B. Terminal Removal

1. Insert needle end of terminal remover J 35689-A into the small notch between the connector and the terminal to be removed (Figure E-2, View A). Push the lock tang toward the terminal.
2. Push the wire and terminal out of the connector (this is a “pull-to-seat” terminal).
3. Pull terminal as far as necessary from the connector. This will be limited by the number of other wires inserted into the connector and by the distance between the back side of the connector and the beginning of the harness covering.
4. If terminal is to be replaced, cut the terminal between the core and insulation crimp to minimize wire loss.

NOTE: *If replacing the complete external harness to transmission connector assembly, a new connector should be assembled in the following order (see Figure E-2).*

1. *Insert the two 12-way seals in the back of the connector.*
2. *Insert the cavity plugs in the openings which will not be used.*
3. *Put the strain relief in place on the back of the connector.*
4. *Insert the bolt into the back side of the strain relief and push it through the front of the connector.*
5. *Install the retainer ring on the bolt.*
6. *Insert the harness wires in the proper connector positions and pull out the front of the connector.*
7. *Strip the wires and crimp the terminals as instructed.*

C. Terminal Crimping

Internal and external harness to feedthrough, VIM, and speed sensor terminals (standard crimping tool).

1. If a spare wire is used, the wire should be pushed through the proper hole in the strain relief (if used), through the green seal, and out the other side of the connector before stripping.
2. Carefully strip insulation $4.5 \text{ mm} \pm 0.5 \text{ mm}$ (0.18 ± 0.02 inch). Unless insulation crimp is overtight, Automatic Wire Stripper J 35615 will remove insulation and crimp from old terminal without damaging wire.
3. Place core crimp portion of terminal on bed of anvil “E” and squeeze crimper enough to keep terminal from dropping (Figure E-2, View B).
4. Position wire core in terminal and squeeze crimper tool to complete the core crimp. **Be sure to orient the terminal so that it is properly aligned with the terminal cavity in the connector.** The terminal should be positioned so that the lock tang is on the side of the cavity which has the notch in the middle (for the remover tool).
5. Position insulation crimp of terminal on anvil “C” so that the entire insulation crimp area and a portion of the terminal between the core and insulation crimp areas are supported by the anvil. Complete the insulation crimp.

APPENDIX E — CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS**C. Terminal Crimping** (*cont'd*)

6. Be sure lock tang is lifted to allow proper reseating of the terminal.
7. Pull on the wire to pull the terminal completely into the cavity. (A click will be heard and the terminal should stay in place if the wire is pushed.)

D. Terminal Crimping Using Alternate Tool J 35123

1. If a spare wire is used, the wire should be pushed through the proper hole in the strain relief (if used) and the seal (green), and out the other side of the connector prior to stripping.
2. Insert remover tool in front side of connector to release lock tab and push terminal out front of connector. Pull the terminal and wire out the front of the connector to complete Steps 3 through 7.
3. Push open the terminal holder on the crimper tool J 35123 and insert a terminal into the opening marked 18–16 (Figure E–2, View C) so that the crimp ends point up. Release the terminal holder.
4. Slightly close the crimping tool (close until one click is heard) but do not start to crimp the terminal. Place the terminal on the wire so it is in the same position as it will be when pulled back into the connector. The terminal should be positioned so that the lock tang is on the side of the cavity which has the notch in the middle (for the remover tool).
5. Insert the wire into the terminal until the wire contacts the holder. (By doing this, the core and insulation should be properly positioned for the core and insulation crimp wings.)
6. Squeeze the crimper fully until it opens when released.
7. Open the terminal holder and remove the wire and terminal from the crimping tool.
8. Pull on the terminal to assure a tight crimp.
9. Be sure lock tang is lifted to allow proper reseating of the terminal.
10. Pull on the wire to pull the terminal completely into the cavity. (A click will be heard and the terminal should stay in place if the wire is pushed.)

APPENDIX E — CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

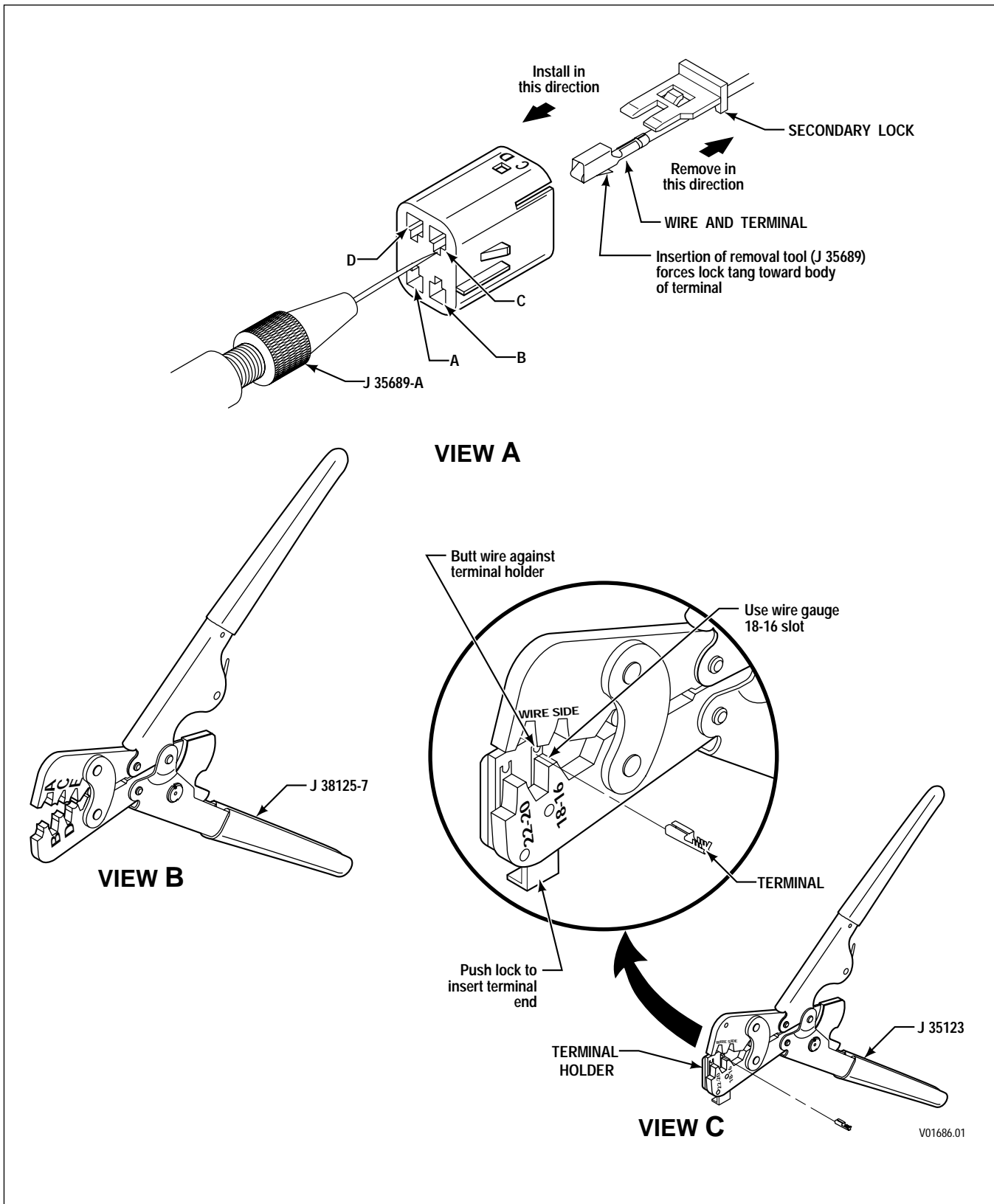


Figure E-3. Packard Metri-Pack 150 Series Connectors — Push-to-Seat (Oil Level Sensor)

APPENDIX E — CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

1-3. PACKARD METRI-PACK 150 SERIES CONNECTORS — PUSH-TO-SEAT (OIL LEVEL SENSOR)

A. Connector/Terminal Repairs

Crimping Tool	J 38125-7
Wire Crimp	Anvil “E”
Insulation Crimp	Anvil “C”
Alternate Crimping Tool	J 35123-7
Remover Tool	J 35689-A

Use	Description	P/N
Oil Level Sensor	4-Pin Plug	12047786
	Terminal (Pin)	12047581
	Secondary Lock	12047787
	4-Pin Receptacle	12047785
	Terminal (Socket)	12047767
	Secondary Lock	12047664

NOTE: *Do not solder crimps.*

B. Terminal Removal

1. Remove the secondary lock.
2. Insert needle end of terminal remover J 35689-A into the small notch between the connector and the terminal to be removed (Figure E-3, View A). Push the lock tang toward the terminal.
3. Pull the wire and terminal out the rear of the connector (this is a “push-to-seat” terminal).
4. Pull terminal as far as necessary from the connector. This will be limited by the number of other wires inserted into the connector and by the distance between the back side of the connector and the beginning of the harness covering.
5. If terminal is to be replaced, cut the terminal between the core and insulation crimp to minimize wire loss.

C. Terminal Crimping

1. Carefully strip insulation 4.5 mm ± 0.5 mm (0.18 ± 0.02 inch). Unless insulation crimp is overtight, Automatic Wire Stripper J 35615 will remove insulation and crimp from old terminal without damaging wire.
2. Place core crimp portion of terminal on bed of anvil “E” and squeeze crimper enough to keep terminal from dropping (Figure E-3, View B).
3. Position wire core in terminal and squeeze crimper tool to complete the core crimp. **Be sure to orient the terminal so that it is properly aligned with the terminal cavity in the connector.** The terminal should be positioned so that the lock tang is on the side of the cavity which has the notch in the middle (for the remover tool).
4. Position insulation crimp of terminal on anvil “C” so that the entire insulation crimp area and a portion of the terminal between the core and insulation crimp areas are supported by the anvil. Complete the insulation crimp.

APPENDIX E — CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS**C. Terminal Crimping** (*cont'd*)

5. Be sure lock tang is lifted to allow proper reseating of the terminal.
6. Push on the wire until the terminal is completely into the cavity. (A click will be heard and the terminal should stay in place when the wire is lightly pulled.)

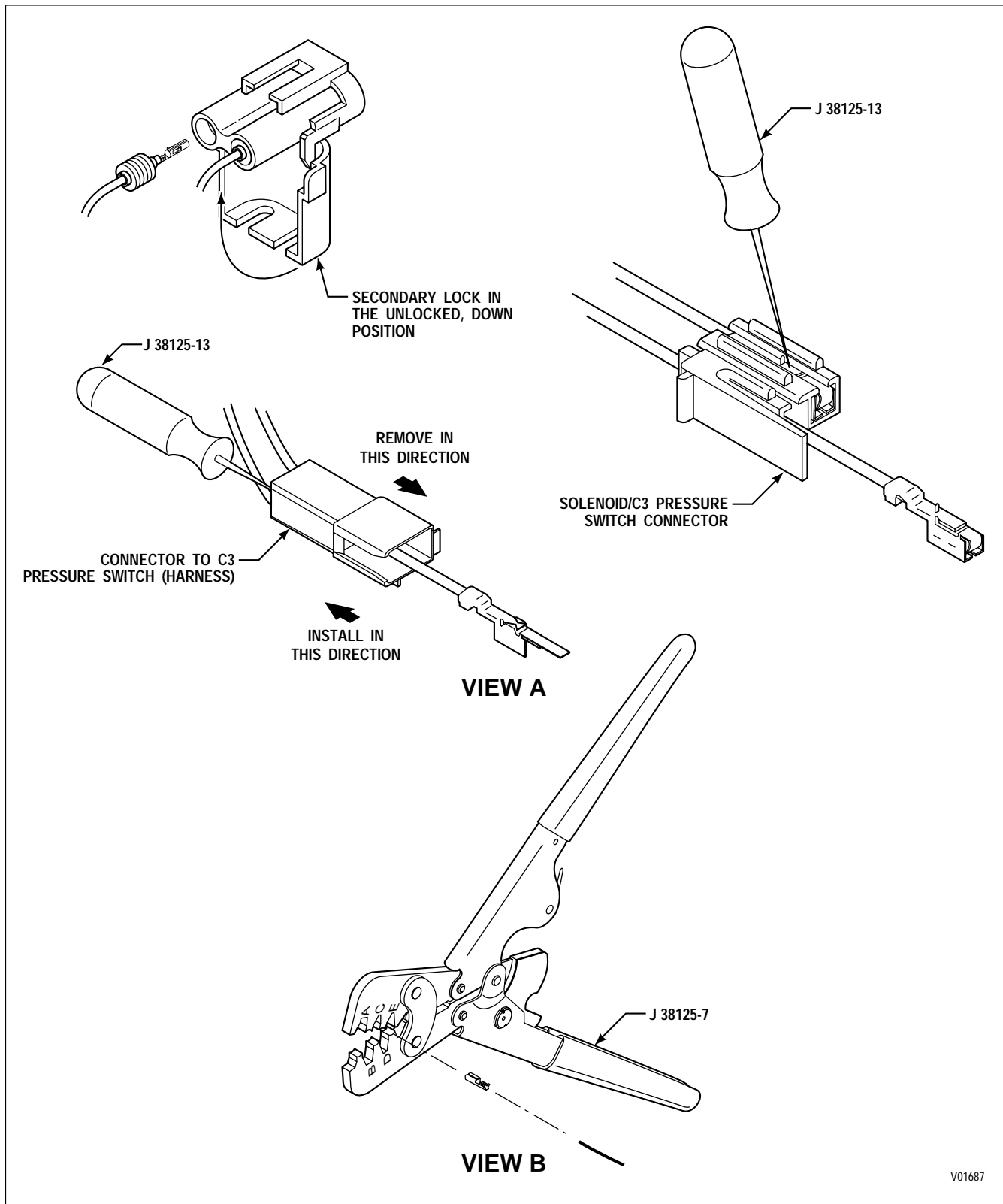
D. Terminal Crimping Using Alternate Tool J 35123

1. Insert remover tool in front side of connector to release lock tab and pull terminal out rear of connector. Pull the terminal and wire out the rear of the connector to complete Steps 3 through 7.
2. Push open the terminal holder on the crimper tool J 35123 and insert a terminal into the opening marked 18–16 (Figure E-2, View C) so that the crimp ends point up. Release the terminal holder.
3. Slightly close the crimping tool (close until one click is heard) but do not start to crimp the terminal. Place the terminal on the wire so it is in the same position as it will be when pulled back into the connector. The terminal should be positioned so that the lock tang is on the side of the cavity which has the notch in the middle (for the remover tool).
4. Insert the wire into the terminal until the wire contacts the holder. (By doing this, the core and insulation should be properly positioned for the core and insulation crimp wings.)
5. Squeeze the crimper fully until it opens when released.
6. Open the terminal holder and remove the wire and terminal from the crimping tool.
7. Pull on the terminal to assure a tight crimp.
8. Be sure lock tang is lifted to allow proper reseating of the terminal.
9. Push on the wire until the terminal is completely into the cavity. (A click will be heard and the terminal should stay in place if the wire is lightly pulled.)

**APPENDIX E — CONNECTOR PART NUMBERS, TERMINAL PART
NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS**

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APPENDIX E — CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS



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Figure E-4. Packard Metri-Pack 280 Series Connectors — Pull-to-Seat (8-Way Freightliner; 5-Way Navistar Cab Harness; 2-Way Navistar and Ford Cab Harness; Internal Harness Solenoid and C3 Pressure Switch)

APPENDIX E — CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

B. Terminal Removal

1. Remove secondary lock if one is present.
2. Depress lock tab on terminal (accessible in slot of connector) and push terminal out front of connector (Figure E-4, View A).
3. If replacing terminal, cut terminal between core and insulation crimp (to minimize wire loss).

C. Terminal Crimping

1. Carefully strip insulation $6.5 \text{ mm} \pm 0.5$ (0.26 ± 0.02 inch). Unless insulation crimp is overtight, Automatic Wire Stripper J 35615 will remove insulation and crimp from old terminal without damaging wire.
2. Place core crimp portion of terminal on bed of anvil indicated and squeeze crimper enough to hold terminal from dropping (Figure E-7, View B).
3. Position wire core in terminal and squeeze crimper tool to complete the core crimp. Be sure to orient the terminal so that it is properly aligned with the terminal cavity in the connector. (When crimping two wires in terminal P/N 12015243, strip and twist cores together before inserting into the terminal.)
4. Position insulation crimp of terminal on anvil indicated so that the entire insulation crimp area and a portion of the terminal between the core and insulation crimp areas are supported by the anvil. Complete the insulation crimp.
5. Slip the wire through the slot in the connector and pull to fully seat the terminal(s).
6. Reinstall the secondary lock, if one is required.

**APPENDIX E — CONNECTOR PART NUMBERS, TERMINAL PART
NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS**

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APPENDIX E — CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

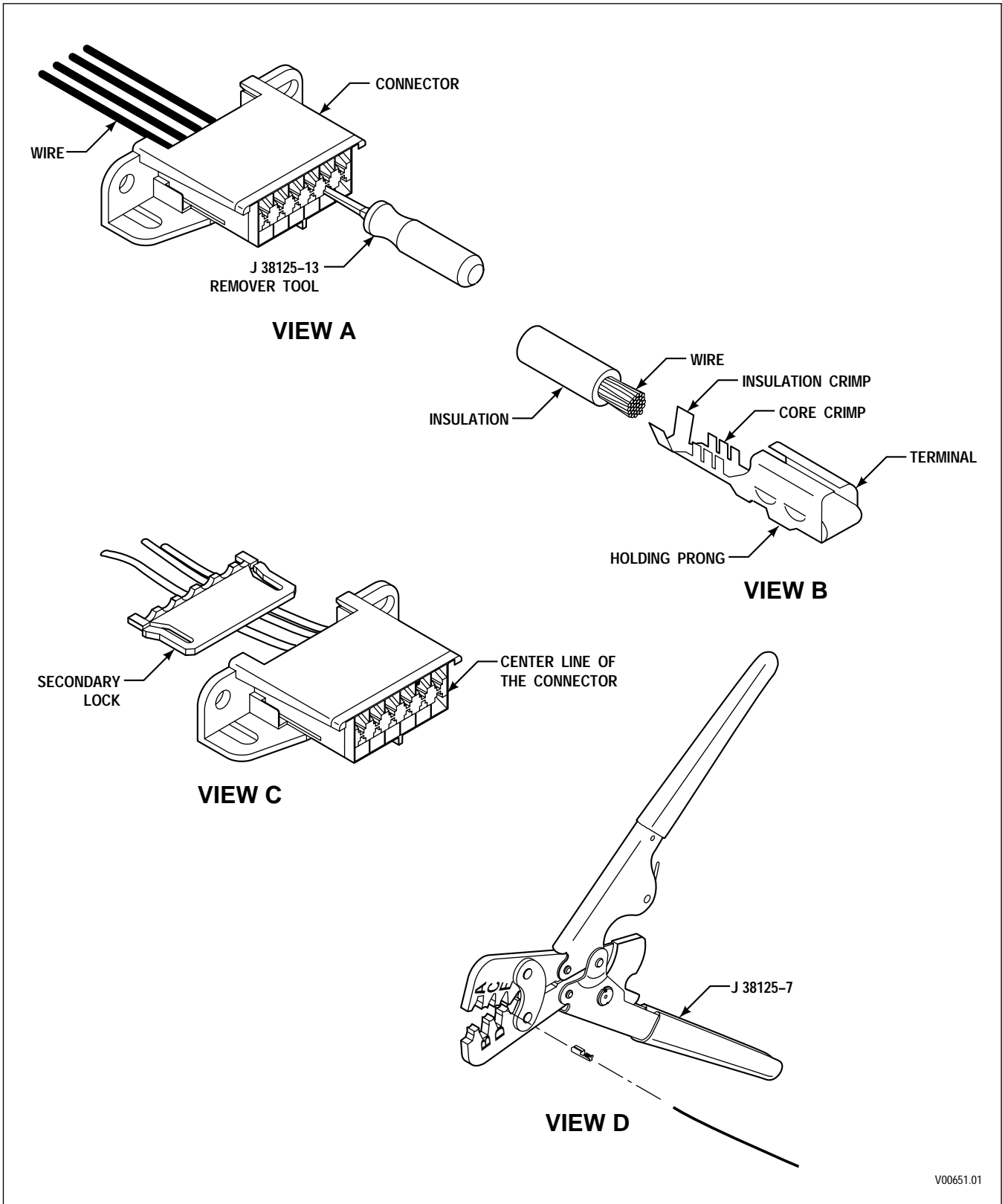


Figure E-5. Packard Metri-Pack 280 Series Connectors — Push-to-Seat (DDR)

APPENDIX E — CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

1-5. PACKARD METRI-PACK 280 SERIES CONNECTORS — PUSH-TO-SEAT (DDR)

A. Connector/Terminal Repairs

Crimping Tool	J 38125-7	
Wire Crimp	Anvil “2”	
Insulation Crimp	Anvil “A”	
Remover Tool	J 38125-13	
Use	Description	P/N
Diagnostic	Connector	12048105
Connector	Terminal	12034046
	Secondary Lock	12020219
	Cover	12048107

B. Terminal Removal

1. Remove secondary lock from back of connector (Figure E-5, View C). (Use a small screwdriver or pick in the slots on each side of the connector.)
2. Insert remover tool J 38125-13 into open (front) end of connector at terminal to be serviced (Figure E-3, View A).
3. Push the lock tang of the terminal straight and pull wire and terminal out the back of connector.
4. If the terminal is to be replaced, cut terminal between core and insulation crimp (this minimizes wire length loss).

C. Terminal Crimping

1. Strip wire to approximately 6.0 ± 0.25 mm (0.24 ± 0.01 inch).
2. Insert terminal into crimping tool (Figure E-5, View D), anvil “2.”
3. Slightly close crimping tool to hold the terminal steady.
4. Align the terminal with its position in the connector and insert wire so that the stripped portion of the wire is in the core crimping area and the insulated portion of the wire is in the insulation crimping area (Figure E-5, View B).
5. Crimp the stripped section of the wire (Figure E-5, View D).
6. Remove the terminal from the crimping tool.
7. Use a pair of needle nose pliers, if necessary, to start the bend on the insulation crimp wings (Figure E-5, View D).
8. Crimp the insulated section of wire using anvil “A” of the crimpers shown (Figure E-5, View D).
9. Remove the terminal from the crimping tool.

APPENDIX E — CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

C. Terminal Crimping (*cont'd*)

10. Tug on terminal and assure the crimp is tight.
11. Insert terminal into connector with the lock tab toward the center line of the connector (Figure E-5, View C).
12. The terminal should “click” into place and you should not be able to pull the terminal out by hand.
13. Reinstall the secondary lock.

**APPENDIX E — CONNECTOR PART NUMBERS, TERMINAL PART
NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS**

NOTES

APPENDIX E — CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

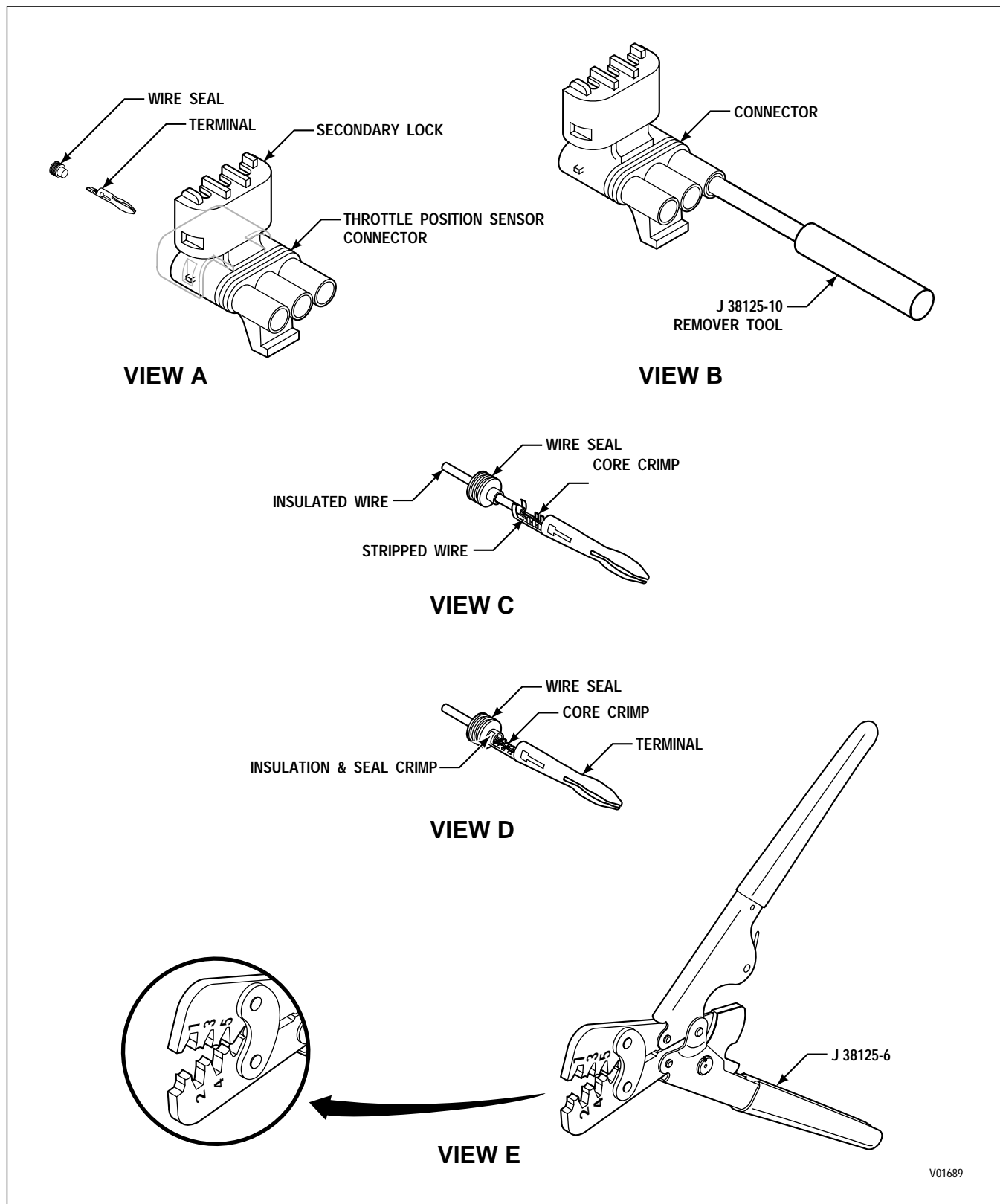


Figure E-6. Packard Weather Pack Connectors (TPS; 3-Way RMR Sensor; HD Retarder Temperature; 6-Way Gillig VIM; 4-Way RMR Device, Type 3; 3-Way RMR Device (Dedicated Pedal))

APPENDIX E — CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

1-6. PACKARD WEATHER PACK CONNECTORS (TPS; 3-WAY RMR SENSOR; HD RETARDER TEMPERATURE; 6-WAY GILLIG VIM; 4-WAY RMR DEVICE, TYPE 3; 3-WAY RMR DEVICE (DEDICATED PEDAL))

A. Connector/Terminal Repairs

Crimping Tool	J 38125-6
Wire Crimp	Anvil "2"
Insulation Crimp	Anvil "5"
Alternate Crimping Tool	J 35606 or J 38852
Remover Tool	J 38125-10

Use	Description	P/N
Throttle Position	Connector	12015793
Sensor (TPS)	Terminal	12089040
	Wire Seal	12015284
RMR Device	Connector	12015795
	Terminal	12089040
	Wire Seal	12015284
Retarder	Connector	12015792
Temperature	Terminal	12089040
Sensor	Wire Seal	12015284
6-Way Gillig VIM (Towers)	6-Way Plug	12015799
	Connector Seal	12010227
	Terminal (Socket)	12089188
	Wire Seal	12015323
	Cavity Plug	12010300
6-Way Gillig VIM (Shrouds)	6-Way Receptacle	12010975
	Terminal (Pin)	12089188
	Wire Seal	12015323
	Cavity Plug	12010300

B. Terminal Removal

1. Unlatch and open the secondary lock on the connector (Figure E-4, View A).
2. On the front of the connector, insert remover tool J 38125-10 over the terminal. Push the tool over the terminal and pull the terminal out of the back end of the connector (Figure E-4, View B).
3. If terminal is to be replaced, cut terminal between core and insulation crimp (this minimizes wire loss).

NOTE: *Two special tools are available for this operation: tool J 38125-6 (Paragraph C); tool J 35606 or J 38852 (Paragraph D).*

APPENDIX E — CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS**C. Terminal Crimping Using Crimping Tool J 38125-6**

1. Place the wire seal onto the wire before stripping the wire (Figure E-6, View C).
2. Strip wire to 6.0 ± 0.25 mm (0.24 ± 0.01 inch).
3. Place terminal onto crimping tool J 38125-6 (Figure E-6, View E), anvil “2.”
4. Slightly close crimping tool to hold terminal steady.
5. Insert wire so that the stripped portion of wire is in the core crimp area and the insulated portion of the wire is in the insulation crimping area (Figure E-6, View C).
6. Crimp the stripped section of the wire.
7. Remove the terminal from the crimping tool.
8. Push the wire seal into the terminal (Figure E-6, View D). The second crimp will wrap around the wire seal. This will seal the insulated area of wire.
9. Use a pair of needle nose pliers, if necessary, to squeeze the terminal wings together to fit in anvil “5.”
10. Crimp wire seal in anvil “5.”
11. Tug on terminal and be sure the crimp is tight.
12. Insert the terminal into the connector. The terminal will “click” into place and should not pull out.
13. Secure the secondary lock. Both sides of the connector must be latched.

D. Terminal Crimping Using Alternate Crimper Pliers J 35606 or J 38852

1. Place the wire seal onto the wire before stripping the wire (Figure E-6, View C).
2. Strip wire to 6.0 ± 0.25 mm (0.24 ± 0.01 inch).
3. Insert terminal into crimping tool J 35606 (Figure E-7, View A), opening marked 18-20.
4. Position the terminal so the crimp wings are pointing up from the bottom jaw of the crimper and are properly positioned.
5. Slightly close the crimping tool to hold the terminal steady.
6. Slide the wire seal to the edge of the insulation and insert the wire and seal into the terminal (Figure E-7, View B).
7. Position the wire and seal and squeeze the crimping tool until it opens when released.
8. Tug on terminal and be sure the crimp is tight.
9. Insert terminal into connector. The terminal will “click” into place and should not pull out.
10. Relatch the secondary lock. Both sides of the connector must be latched.

APPENDIX E — CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

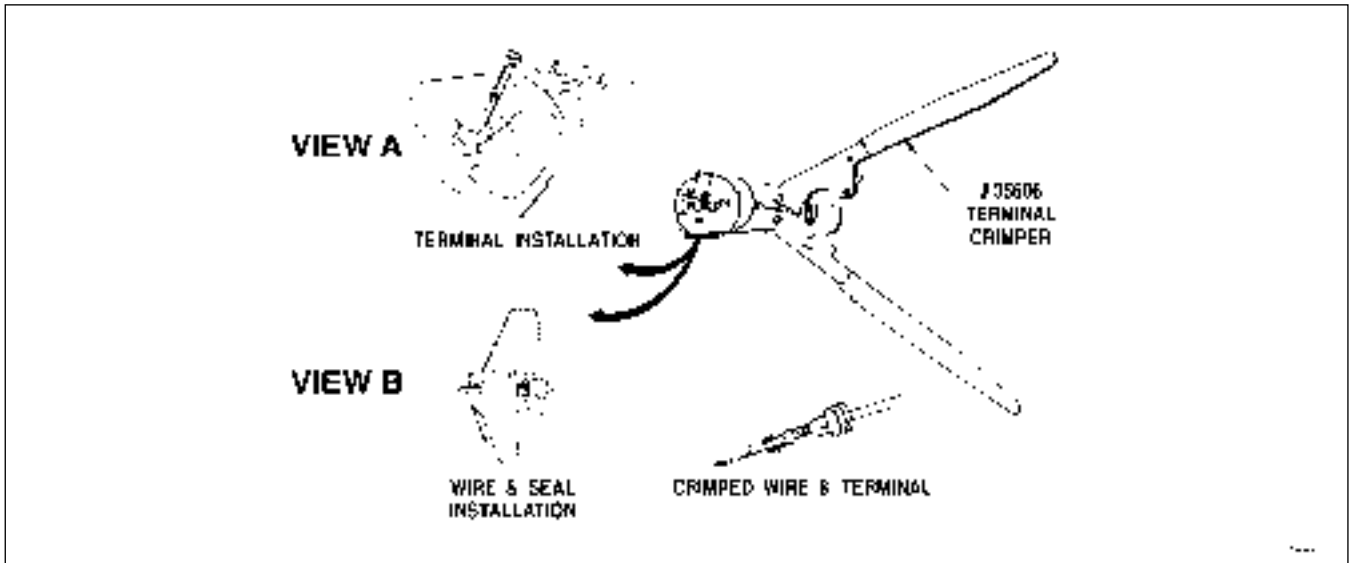


Figure E-7. Terminal Crimping With Tool J 35606

APPENDIX E — CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

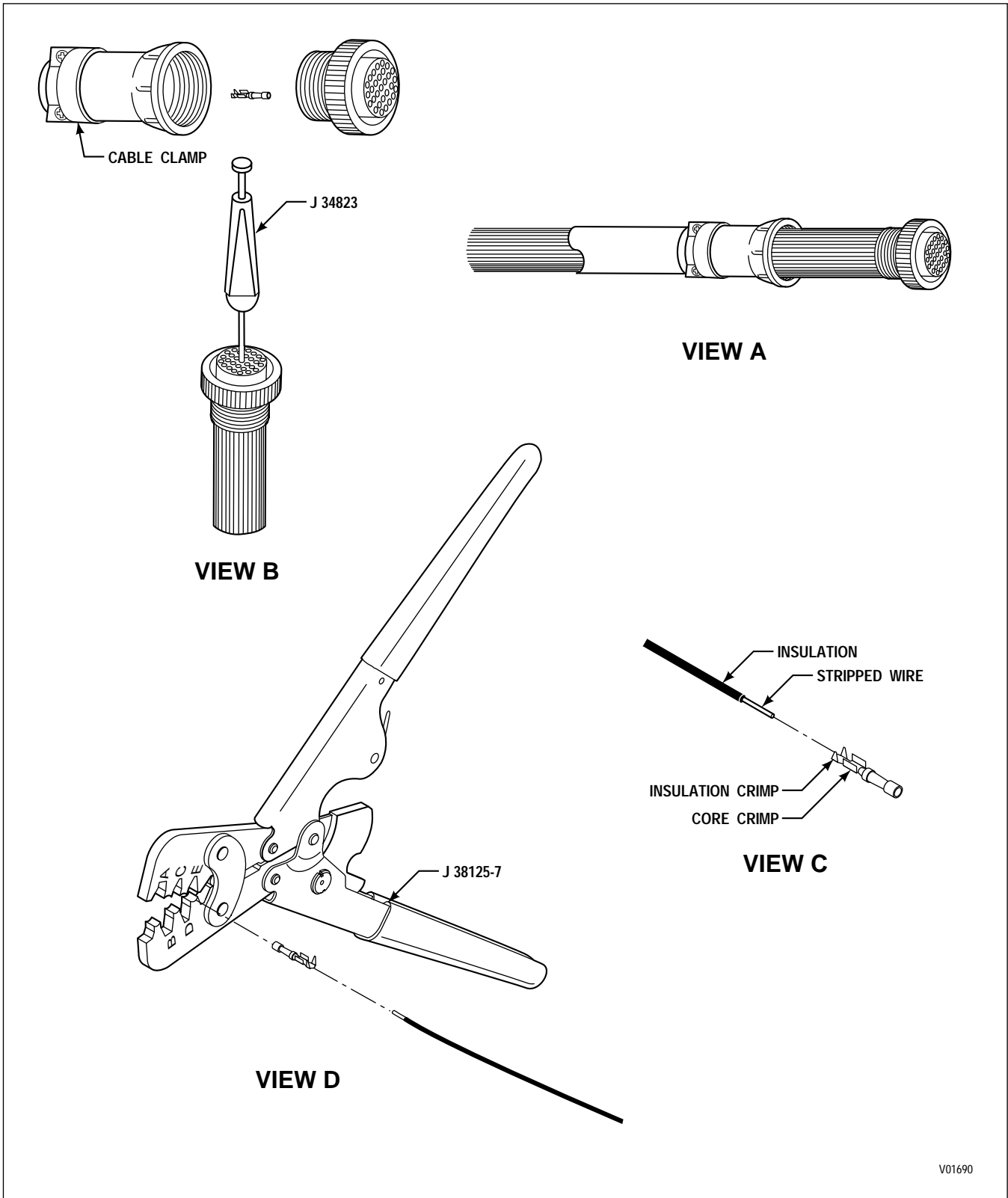


Figure E-8. Amp Products Connectors (16-Way VIW; 8-Way RMR Device (Hand Lever))

APPENDIX E — CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

1-7. AMP PRODUCTS CONNECTORS (16-WAY VIW; 8-WAY RMR DEVICE (HAND LEVER))

A. Connector/Terminal Repairs

Crimping Tool	J 38125-7	
Wire Crimp	Anvil "E"	
Insulation Crimp	Anvil "A"	
Remover Tool	J 34823	
Use	Description	P/N
Vehicle Interface	Connector (16-Way)	23016193
Wiring (VIW)	Terminal (Socket)	23015204
	Shell (16-Way)	23016490
VIW (Vehicle)	Harness	29518142
	Connector	29501001
	Terminal (Pin)	23015205
	Shell (16-Way)	23016490
8-Way RMR Device (Hand Lever)	8-Way Receptacle	29518007
	Terminal (Socket)	29518008

B. Terminal Removal

1. Remove the cable clamp from the connector (Figure E-6, View A).
2. Fully insert removal tool J 34823 into the top of the connector, over the terminal to be removed (Figure E-6, View B).
3. Push down on the plunger to release the terminal.
4. Pull the terminal and wire out the bottom of the connector.
5. If replacing terminal, cut terminal between core and insulation crimp (this minimizes wire loss).

C. Terminal Crimping

1. Strip wire to approximately 4.0 ± 0.25 mm (0.16 ± 0.01 inch) (Figure E-6, View C).
2. Place new terminal onto crimping tool J 38125-7, anvil "E" (Figure E-6, View D).
3. Slightly close the crimping tool to hold the terminal steady.
4. Insert the wire so that the stripped portion of the wire is in the core crimp area and the insulated portion of the wire is in the insulation crimping area.
5. Crimp the stripped section of the wire (Figure E-6, View C).
6. Remove the terminal from the crimping tool.
7. Use a pair of needle nose pliers, if necessary, to start the bend on the insulation crimp wings.
8. Crimp the insulated section of the wire using anvil "A" of the crimpers (Figure E-6, View D).
9. Remove the terminal from the crimping tool.
10. Tug on the terminal and assure the crimp is tight.
11. Insert the terminal into the connector. The terminal will "click" into place and should not pull out.
12. Install the cable clamp using the two Phillips-head screws.

APPENDIX E — CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

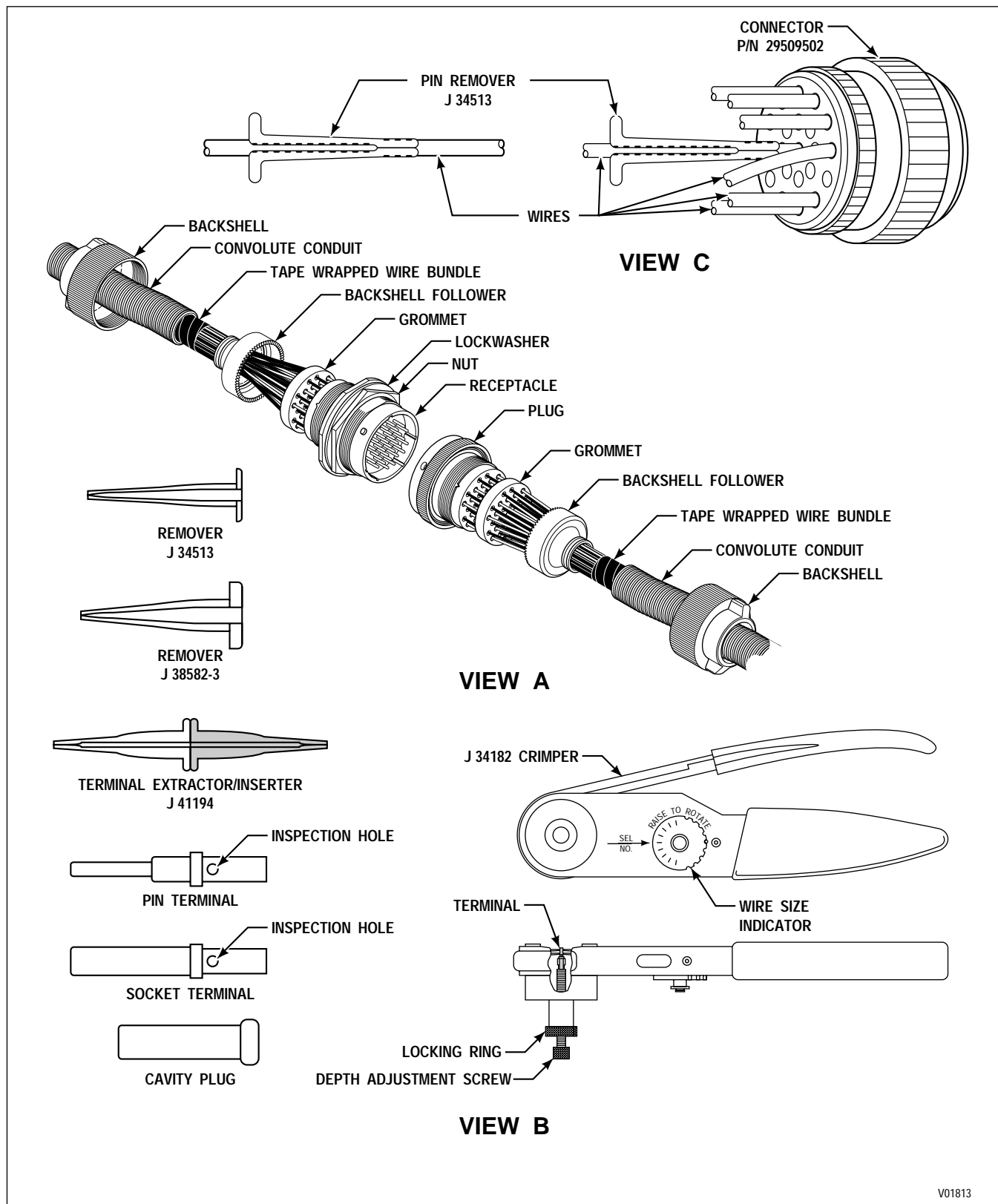


Figure E-9. Deutsch IPD/ECD Connectors (31-Way Bulkhead, 31-Way Feedthrough Harness; 16-Way Optional Sensor Harness; 6-Way Optional DDR)

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APPENDIX E — CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

1-8. DEUTSCH IPD/ECD CONNECTORS (31-WAY BULKHEAD, 31-WAY FEEDTHROUGH HARNESS; 16-WAY OPTIONAL SENSOR HARNESS; 6-WAY OPTIONAL DDR)

A. Connector/Terminal Repairs

Crimping Tool	J 34182	
Remover Tool	J 34513 (18 GA IPD Bulkhead)	
Extractor/Insertor Tool	J 41194 (18 GA ECD Bulkhead)	
Remover Tool (DDR Connector)	J 38582-3 (12-14 GA)	
Use	Description	P/N
Bulkhead Connector — IPD	31-Way Plug (M/F)	29509617
	Terminal (Socket)	23016502
	Cavity Plug	23016504
	31-Way Receptacle (F/M)	29509616
	Terminal (Pin)	23018768
	Cavity Plug	23016504
	Panel Nut	23016302
	Lockwasher	23016303
	31-Way Plug (M/M)	29509617
	Terminal (Pin)	23018768
	Cavity Plug	23016504
	31-Way Receptacle (F/F)	29509616
	Terminal (Socket)	23016502
	Cavity Plug	23016504
	Panel Nut	23016302
	Lockwasher	23016303
Bulkhead Connector/ Transmission Connector — ECD	Connector Plug (31-Way)	(Male/Female)
	31-Pin Plug	29511854
	Terminal (Socket)	29511366
	Cavity Plug	29511371
	Backshell Assembly	29514040
	Backshell Housing	29514041
	Backshell Follower	29514042
Backshell Grommet	29514043	
Bulkhead Connector/Transmission Connector — ECD	Connector Receptacle (31-Way)	(Female/Male)
	31-Pin Receptacle	29511368
	Terminal (pin)	29511369
	Cavity Plug	29511371
	Panel Nut	29527000
	O-ring Seal	29512839
	Lockwasher	23016303
	Backshell Assembly	29514040
	Backshell Housing	29514041
	Backshell Follower	29514042
Backshell Grommet	29514043	

APPENDIX E — CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

A. Connector/Terminal Repairs (*cont'd*)

Use	Description	P/N	
Bulkhead Connector — ECD	Connector Plug (31-Way)	(Male/Male)	
	31-Pin Plug	29511855	
	Terminal (Pin)	29511369	
	Cavity Plug	29511371	
	Backshell Assembly	29514040	
	Backshell Housing	29520050	
	Backshell Follower	29520049	
	Backshell Grommet	29514043	
	Bulkhead Connector — ECD	Connector Receptacle (31-Way)	(Female/Female)
31-Pin Receptacle		29511854	
Terminal (socket)		29511366	
Cavity Plug		29511371	
Panel Nut		29527000	
O-ring Seal		29512839	
Lockwasher		23016303	
Backshell Assembly		29514040	
Backshell Housing		29520050	
Backshell Follower		29520049	
Backshell Grommet		29514043	
16-Way Optional Sensor Harness		16-Way Plug	29516987
		Terminal (Socket)	29511366
	Cavity Plug	29511371	
	Backshell Assembly	29516990	
	Backshell Housing	29520394	
	Backshell Follower	29520395	
	Backshell Grommet	29516993	
	16-Way Receptacle	29516988	
	Terminal (Pin)	29511369	
	Cavity Plug	29511371	
	Panel Nut	29516989	
	O-ring Seal	29516994	
	Lockwasher	29519126	
	Backshell Assembly	29516990	
	Backshell Housing	29516991	
	Backshell Follower	29516992	
	Backshell Grommet	29516993	
	6-Way Optional DDR	6-Way Plug	29512133
		Terminal (Pin)	29514170
		Cavity Plug	23016504
		Backshell	29521260
		Cover	29521877

NOTE: *If difficulty is encountered in removing or installing the plug backshell, insert the plug into the receptacle, do not lock it into place, and loosen the backshell.*

APPENDIX E — CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

B. Terminal Removal (refer to Figure E-9, View A)

NOTE: *When using remover/insert tool J 41194, take care not to break the tip of the tool. Lay the wire in the widest part of the wire slot and work toward the tool tip.*

1. Loosen and slide the backshell along the convolute conduit.
2. Remove the convolute conduit from the base of the backshell follower. Peel enough conduit from the harness to allow working access.
3. Slide the backshell follower clear of the connector housing.
4. Remove as much tape wrap as necessary to allow working access.
5. Fully insert the proper remover/extractor tool into the back of the connector until it releases the terminal.
6. Pull the terminal, wire, and tool out the back of the connector.
7. If replacing the terminal, cut the wire through the middle of the terminal crimp (this minimizes wire loss).

C. Terminal Crimping (refer to Figure E-9, View B)

1. Strip approximately 6–8 mm (0.236–0.315 inch) of insulation from the wire.
2. Set the crimping tool wire size to number 18 for the ECD or IPD connector. For the optional DDR connector, set the wire size to number 12. To set the wire size, remove the retainer pin. Lift and rotate the indicator until the correct wire number is aligned with the SEL NO. arrow. Reinstall the retainer pin.
3. Insert the contact end of the terminal into crimping tool J 34182. Adjust the crimping tool depth by loosening the locking ring until the depth adjusting screw is free and turning the adjusting screw until the top of the terminal is just above flush with the crimping hole (the crimp jaws will contact the middle of the terminal barrel). Tighten the lock ring to retain the adjustment.
4. Fully insert the wire into the terminal so that the stripped portion of the wire is in the crimp area. A small section (0.5–1.0 mm (0.020–0.025 inch)) of wire will be visible above the terminal barrel.
5. Squeeze the crimping tool handle until it releases. The terminal is now crimped onto the wire.
6. Remove the terminal and wire from the crimping tool.
7. Tug on the terminal to ensure the crimp is tight.
8. For the optional DDR connector, apply a one inch long piece of heat shrink tubing over the wire insulation just behind the terminal. Apply heat to shrink and lock tubing to the insulation.

APPENDIX E — CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

D. Terminal Insertion (ECD Bulkhead)

NOTE: *If replacing an outside grommet (refer to Figure E-9 showing the ECD bulkhead), ensure the grommet is correctly installed. Each grommet hole is marked with the terminal ID of the wire that passes through that hole. The grommet holes match the pattern of either the pins or sockets in the connector. One side of the grommet is marked "PIN" and the other "SKT" or "SOC." "PIN" indicates the pin (receptacle) side of the connector and "SKT" or "SOC" the socket (plug) side. When installing the outer grommet in the receptacle, ensure "PIN" is showing and positioned so that the "A" terminal ID on the outer grommet aligns with the "A" terminal ID on the inner grommet. When installing the outer grommet in the plug, "SKT" or "SOC" must be showing and positioned so that the "A" terminal ID on the outer grommet aligns with the "A" terminal ID on the inner grommet. Reversing "PIN" and "SKT" or "SOC" sides of the grommet will cause the grommet holes to be misaligned with the holes in either the receptacle or plug. Perform Steps 1 and 2 only if the outer grommet has been removed.*

1. Place the correct side of the grommet upwards with the inner and outer grommet "A" terminal ID aligned.
2. Insert two cavity plugs in unused cavities to retain the grommet.

NOTE: *When using remover/insertor tool J 41194, take care not to break the tip of the tool. Lay the wire in the widest part of the wire slot and work toward the tool tip.*

1. Place the terminal and wire in the end of extractor/insertor tool J 41194.
2. Insert the tool through the grommet, into the back of the connector, and push until the terminal is seated. Remove the remover/insertor tool.
3. Insert cavity plugs into all unused cavities.
4. Wrap plastic electrical tape around the wire bundle.
5. Reassemble the connector in the reverse order of disassembly.

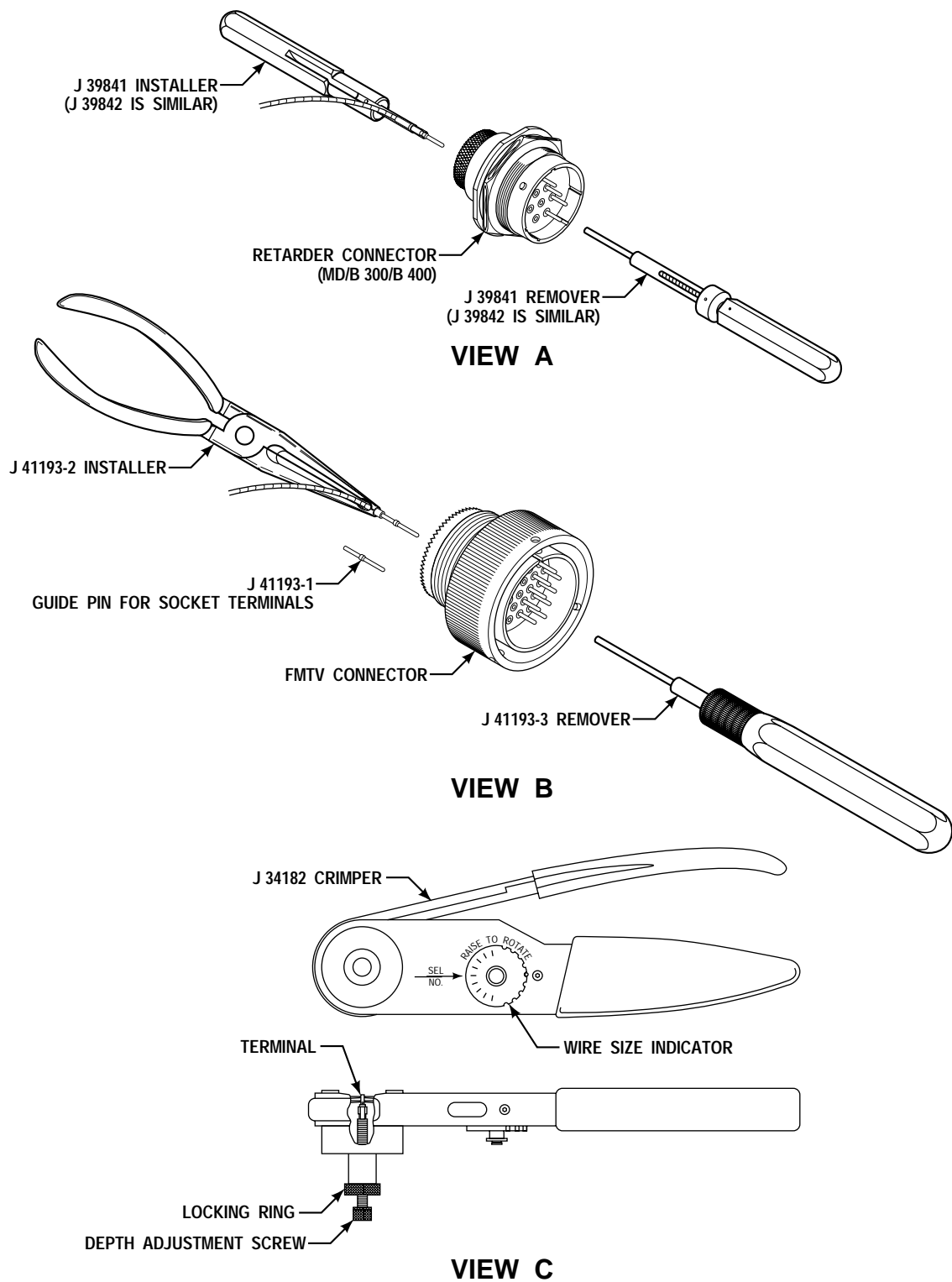
E. Terminal Insertion (all connectors except ECD bulkhead)

1. Insert wire with crimped terminal through the proper hole in the grommet.
2. Keep pushing on wire until the terminal "locks" into position.

**APPENDIX E — CONNECTOR PART NUMBERS, TERMINAL PART
NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS**

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APPENDIX E — CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS



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Figure E-10. ITT Cannon Connectors — Crimped (37-Way FMTV Bulkhead; 6-Way Transfer Case; 8-Way MD Retarder)

APPENDIX E — CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

1–9. ITT CANNON CONNECTORS — CRIMPED (37-WAY FMTV BULKHEAD; 6-WAY TRANSFER CASE; 8-WAY MD RETARDER)

A. Connector/Terminal Repair

Crimping Tool	J 34182
Connector Repair Kit (FMTV)	J 41193
Guide Pin	J 41193-1
Insertion Tool	J 41193-2
Terminal Remover	J 41193-3
Terminal Remover/Installer (MD Retarder)	J 39841
Terminal Remover/Installer (MD 3070 T-Case Connector)	J 39842

Use	Description	P/N
MD FMTV	37-Way Plug Assembly	29502375
	37-Way Receptacle Assembly	29502374
MD Transfer Case	6-Way Plug Assembly	29506418
	Terminal (Socket)	29517128
	Cavity Plug	29517132
	6-Way Receptacle Assembly	
	Terminal (Pin)	29517129
	Cavity Plug	29517132
MD Retarder	8-Way Plug	29506427
	Terminal, Socket	29517130
	Cavity Plug	29517133
	8-Way Receptacle	29505513
	Terminal, Pin	29517131
	Cavity Plug	29517133

B. Terminal Removal (refer to Figure E–10, Views A and B)

1. Select the remover tool for the plug or receptacle that is being repaired.
2. For the FMTV connector, choose either the pin or socket terminal remover tip and lock it into the handle.
3. Place the tip of the remover tool over the pin or into the socket and push the contact/terminal out the rear of the connector using slow, even pressure.
4. Pull the wire and terminal out the back of the connector.
5. If replacing the terminal, cut the wire through the middle of the terminal crimp to minimize wire loss.

APPENDIX E — CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

C. Terminal Crimping (refer to Figure E-10, View C)

1. Strip approximately 6–8 mm (0.236–0.315 inch) of insulation from the wire.
2. Set the crimping tool wire size to number 18. To set the wire size, remove the retainer pin. Lift and rotate the indicator until 18 is aligned with the SEL NO. arrow. Reinstall the retainer pin.
3. Insert the contact end of the terminal down into crimping tool J 34182. Adjust the crimping tool depth by loosening the locking ring until the depth adjusting screw is free and turning the adjusting screw until the wire end of the terminal is just above flush with the top of the crimping hole. The crimp jaws will now contact the middle of the terminal barrel. Tighten the lock ring to retain the adjustment.
4. Fully insert the wire into the terminal so that the stripped portion of the wire is in the crimp area. A small section (0.5–1.0 mm (0.020–0.040 inch)) of wire will be visible above the terminal barrel.
5. Squeeze the crimping tool handle until it releases. The terminal is now crimped onto the wire.
6. Remove the terminal and wire from the crimping tool.
7. Tug on the terminal to ensure the crimp is tight.

D. Terminal Insertion

1. Select the proper insertion tool for the connector or receptacle that is being reassembled.
2. Place the terminal and wire in the insertion tool (refer to Figure E-10, Views A and B).

NOTE: *When installing a socket terminal for the FMTV plug, use the J 41193-1 guide pin.*

3. Insert the terminal through the correct hole in the back of the connector and push until the terminal is seated. Remove the insertion tool. Check to see that the terminal is at the same height as other terminals. Tug on the wire at the rear of the connector to ensure that the terminal is locked in place.
4. Insert cavity plugs into all unused cavities.

**APPENDIX E — CONNECTOR PART NUMBERS, TERMINAL PART
NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS**

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APPENDIX E — CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

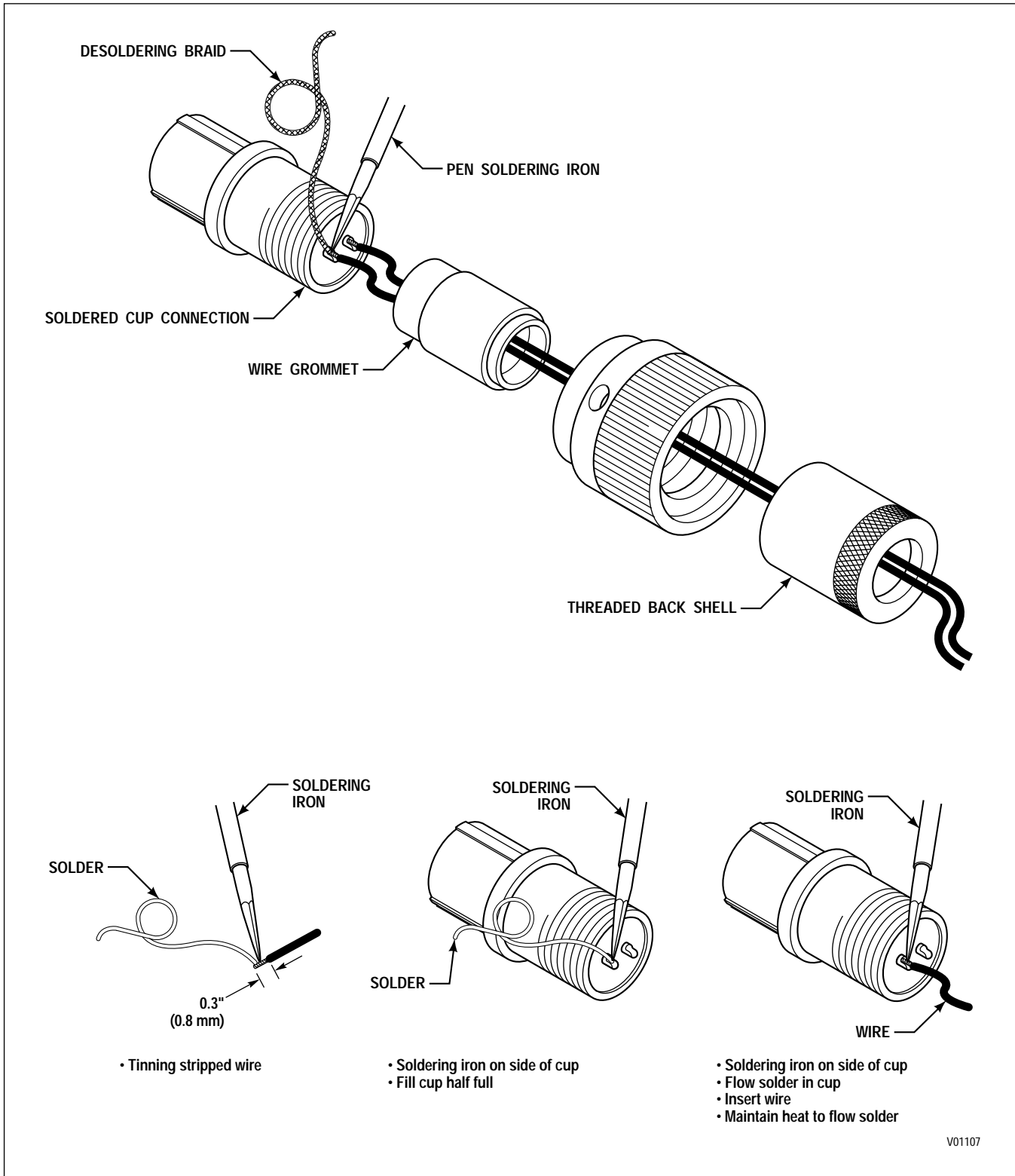


Figure E-11. ITT Cannon Connectors — Soldered (2-Way HD Retarder)

APPENDIX E — CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

1-10. ITT CANNON CONNECTORS — SOLDERED (2-WAY HD RETARDER)

A. Connector Terminal Repair (refer to Figure E-11)

Use	Description	P/N
Retarder Control (K Solenoid) (HD/B 500 Models)	Connector Plug (2-pin)	29505516
	Terminal (pin)	29511913
	Connector Receptacle	29505515

Use	Description	P/N
FMTV 37-Way Bulkhead	Plug Assembly	29502375
	Receptacle Assembly	29502374

B. Special Tools

- 50–70 percent tin resin core solder, 18–20 SWG (0.086–1.0 mm (0.036–0.040 inch))
- Pen-type soldering iron (60W maximum)— tip no larger than 3.175 mm (0.125 inch)
- Desoldering braid

NOTE: *Proper solder, techniques, equipment, and cleanliness are important to achieve a good solder joint. Clean connector and terminals being soldered of all dirt, grease, and oil. Always heat the piece onto which solder is to flow. A cold solder joint can cause intermittent continuity problems. Avoid a cold joint by heating the piece(s) being soldered to melt the solder rather than merely heating the solder until it melts. Excess solder applied to a stranded wire travels up the wire, stiffening it and making it inflexible. The wire can break at the point where the solder stops. Do not use acid core solder.*

C. Wire Removal — Desoldering

1. Unscrew backshell and slide the backshell away from the connector.
2. Slide the grommet away from the connector. Slide the grommet far enough to allow access to the terminals and wire ends. If the grommet is hard to slide, lubricate the wires with isopropyl alcohol. If necessary, move some of the harness covering. If no solder is present, proceed as in Section 1-9 for crimped terminals.
3. Place the desoldering braid (wick) on top of the soldered terminal cup and wire. Place the hot soldering iron on the desoldering braid and wait until the solder wicks up the braid, remove the wire.
4. If the other terminal is being repaired, repeat the desoldering operation on that terminal. When solder is removed, proceed as in Section 1-9 for crimped terminals.

D. Soldering Wire Into Terminal

NOTE: *If installing a new connector on a harness, ensure the backshell and grommet are in place before soldering the wires to the terminals. Clean wires and terminals of dirt or grease.*

1. Strip approximately 8 ± 0.8 mm (.31 \pm .031 inch) of insulation from the wire.
2. Tin the stripped end of the wire.
3. Insert the wire through the proper hole in the grommet.

NOTE: *Lubricate the wire(s) with isopropyl alcohol only if the wire(s) will not slide through the grommet. If installing a new connector on the harness, be sure the backshell is in place before inserting the wire(s) through the grommet.*

APPENDIX E — CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS**D. Soldering Wire Into Terminal** *(cont'd)*

4. Mount the connector in a holding fixture at a 45 degree angle. Hold the solder in the terminal cup and apply heat to the side of the cup until the solder flows.
5. Slowly feed solder into the cup until it is half-full. When the cup is half-full, remove the solder supply before removing the soldering iron. Half-fill all cup terminals that are to have wires inserted.

NOTE: *Feed solder slowly enough to prevent a flux gas pocket from forming. A gas pocket prevents sufficient solder from flowing into the cup — a false fill. Correct a false fill by re-heating the cup and adding solder.*

6. Start at the lowest cup and apply heat to the side of the cup until the solder melts.

NOTE: *Do not overheat the connector while soldering. If the connector gets too hot, stop work until it cools.*

7. Carefully insert the stripped end of the wire into the cup until the wire bottoms in the cup. The wire's insulation should be approximately 1.59 mm (0.0625 inch) above the solder.
8. Maintain heat until the solder has flowed in the cup and onto the wire. Overheating can cause the solder to wick up the stranded wire.

NOTE: *Indications of a good solder connection are:*

- *A minimum amount of solder showing*
- *Wire strands are clearly outlined in the joint*
- *The joint is completely covered with solder*
- *Fillets have a smooth even contour*
- *Edges are feathered*
- *The joint is bright, smooth, and appears clean*

Too little solder is better than too much. If the solder wicks up the wire, the wire may break at the point at which the solder stops.

9. After soldering and inspecting all connections, remove flux residue with a contact cleaner.
10. Slide the grommet into place and screw on the backshell.

**APPENDIX E — CONNECTOR PART NUMBERS, TERMINAL PART
NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS**

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APPENDIX E — CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

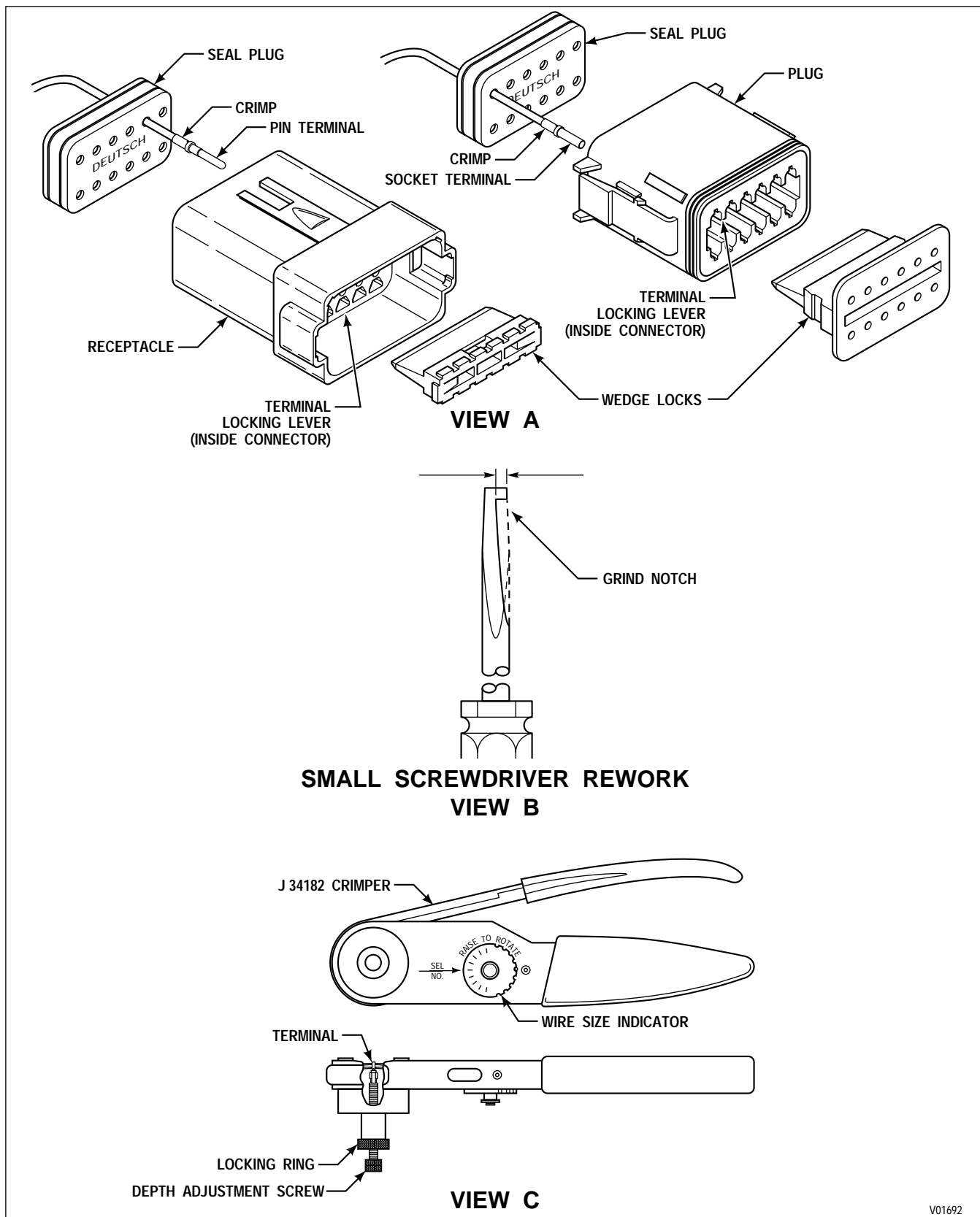


Figure E-12. Deutsch DT Series Connectors (12-Way Navistar VIW)

V01692

APPENDIX E — CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

1–11. DEUTSCH DT SERIES CONNECTORS (12-WAY NAVISTAR VIW)

A. Connector/Terminal Repair

Crimping Tool	J 34182	
Use	Description	P/N
Vehicle Interface	12-Way Plug (Gray)	29511372
	Terminal, Socket	29511366
	Wedge Lock	29511400
	Cavity Plug	23016504
	12-Way Receptacle (Gray)	29511754
	Terminal, Pin	23018768
	Wedge Lock	29511401
	Cavity Plug	23016504
	12-Way Plug (Black)	29511373
	Terminal, Socket	29511366
	Wedge Lock	29511400
	Cavity Plug	23016504
	12-Way Receptacle (Black)	29511755
	Terminal, Pin	23018768
	Wedge Lock	29511401
	Cavity Plug	23016504

B. Terminal Removal (refer to Figure E–12, Views A and B)

1. Use a small-bladed screwdriver with an added notch (as shown in View B) to remove the locking wedge that holds the terminals in place.
2. Use a small screwdriver to remove the 12-way seal plug from the rear of the connector plug or receptacle and slide the seal up the wires out of the way, temporarily.
3. Use a small screwdriver to release the locking lever for the individual terminals that need attention. Pull the wire and terminal out the rear of the connector.
4. If replacing the terminal, cut the wire through the middle of the terminal crimp to minimize wire loss.

C. Terminal Crimping (refer to Figure E–11, View C)

1. Strip approximately 6–8 mm (0.236–0.315 inch) of insulation from the wire.
2. Set the crimping tool wire size to number 18. To set the wire size, remove the retainer pin. Lift and rotate the indicator until 18 is aligned with the SEL NO. arrow. Reinstall the retainer pin.
3. Insert the contact end of the terminal down into crimping tool J 34182. Adjust the crimping tool depth by loosening the locking ring until the depth adjusting screw is free and turning the adjusting screw until the wire end of the terminal is just above flush with the top of the crimping hole. The crimp jaws will now contact the middle of the terminal barrel. Tighten the lock ring to retain the adjustment.

APPENDIX E — CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS**C. Terminal Crimping (refer to Figure E-11, View C) (cont'd)**

4. Fully insert the wire into the terminal so that the stripped portion of the wire is in the crimp area. A small section (0.5–1.0 mm (0.020–0.040 inch)) of wire will be visible above the terminal barrel.
5. Squeeze the crimping tool handle until it releases. The terminal is now crimped onto the wire.
6. Remove the terminal and wire from the crimping tool.
7. Tug on the terminal to ensure the crimp is tight.

D. Terminal Insertion

1. Slide the wire with crimped terminal attached into the rear of the connector.
2. Push the terminal and wire into the connector until it locks into position (refer to Figure E-11, View A). Check to see that the terminal is at the same height as other terminals. Tug on the wire at the rear of the connector to ensure that the terminal is locked in place.
3. Insert the wedge lock to hold the terminals in place. Slide the sealing plug back into place at the rear of the connector.

**APPENDIX E — CONNECTOR PART NUMBERS, TERMINAL PART
NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS**

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APPENDIX E — CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

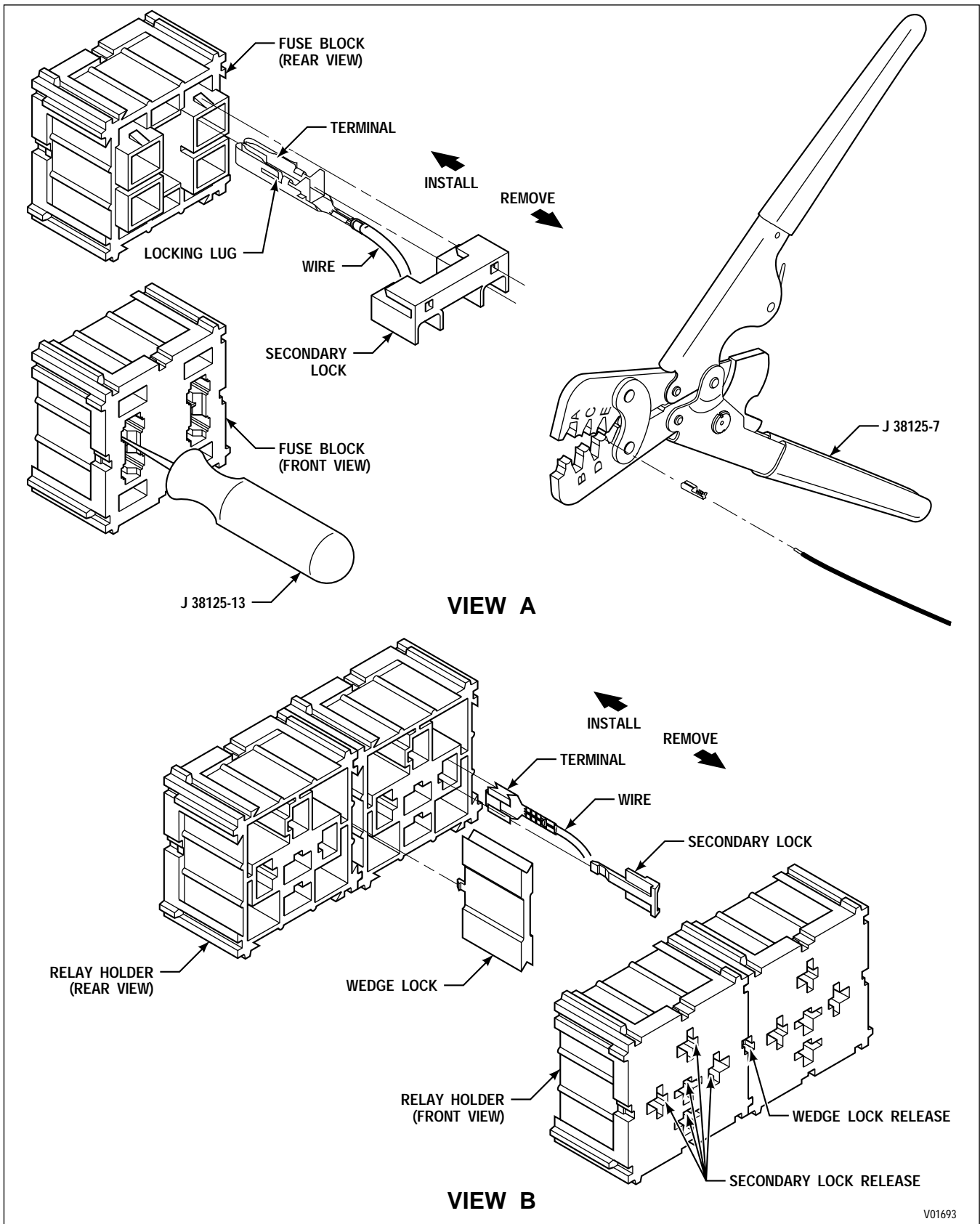


Figure E-13. Dill Connectors (Freightliner 4-Way Fuse and 5-Way Relay VIW)

V01693

APPENDIX E — CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

1-12. DILL CONNECTORS (FREIGHTLINER 4-WAY FUSE AND 5-WAY RELAY VIEW)

A. Connector/Terminal Repairs

Crimping Tool J 38125-7

NOTE: *Crimping anvils recommended are listed after terminal P/Ns. The core crimp anvil is listed first and the insulation crimp anvil is listed second.*

Remover Tool J 38125-13

Use	Description	P/N
Freightliner 4-Way Fuse Block	Fuse Block	29509584
	Terminal (Socket-12AWG) (Use crimping anvils "C" and "1")	29509589
	Terminal (Socket-10AWG) (Use crimping anvils "B" and "5")	29509588
	Secondary Lock	29509587
Freightliner 5-Way Relay Holder	Relay Holder	29509583
	Wedge Block	29509585
	Terminal (Socket-18 to 20 AWG) (Use crimping anvils "2" and "A")	29505869
	Terminal (Socket-14 to 16 AWG) (Use crimping anvils "C" and "B")	29505970
	Terminal (Socket-10 to 12 AWG) (Use crimping anvils "F" and "G")	29504590
	Secondary Lock	29509586

B. Terminal Removal (refer to Figure E-13, Views A and B)

1. Use Remover Tool J 38125-13 to release the secondary lock that is retaining the terminal that is being serviced.
2. Insert Remover Tool J 38125-13 in the notch beside the terminal and push the locking lug on the terminal toward the body of the terminal. Pull on the wire at the rear of the fuse block to remove the terminal.

NOTE: *If servicing relay holders that are connected with a wedge lock, separate the relay blocks by using Remover Tool J 38125-13 to release the Wedge Lock and push it out the rear of the relay holders.*

3. If replacing the terminal, cut the terminal between the core and insulation crimps to minimize wire loss.

APPENDIX E — CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS**C. Terminal Crimping**

1. Carefully strip insulation $6.5 \text{ mm} \pm 0.5$ (0.26 ± 0.02 inch). Unless insulation crimp is overtight, Automatic Wire Stripper J 35615 will remove insulation and crimp from old terminal without damaging wire.
2. Place the core crimp portion of the terminal on the bed of the designated crimping anvil and squeeze crimper enough to hold terminal from dropping (Figure E-13, View C).
3. Position wire core in terminal and squeeze the crimper tool to complete the core crimp. Be sure to orient the terminal so that it is properly aligned with the terminal cavity in the connector.
4. Position insulation crimp of terminal on proper anvil so that the entire insulation crimp area and a portion of the terminal between the core and insulation crimp areas are supported by the anvil. Complete the insulation crimp.
5. Push the wire through the slot in the connector until it clicks into position.
6. Reinstall the secondary lock by pushing it into the rear of the connector until it clicks into position.

**APPENDIX E — CONNECTOR PART NUMBERS, TERMINAL PART
NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS**

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APPENDIX E — CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

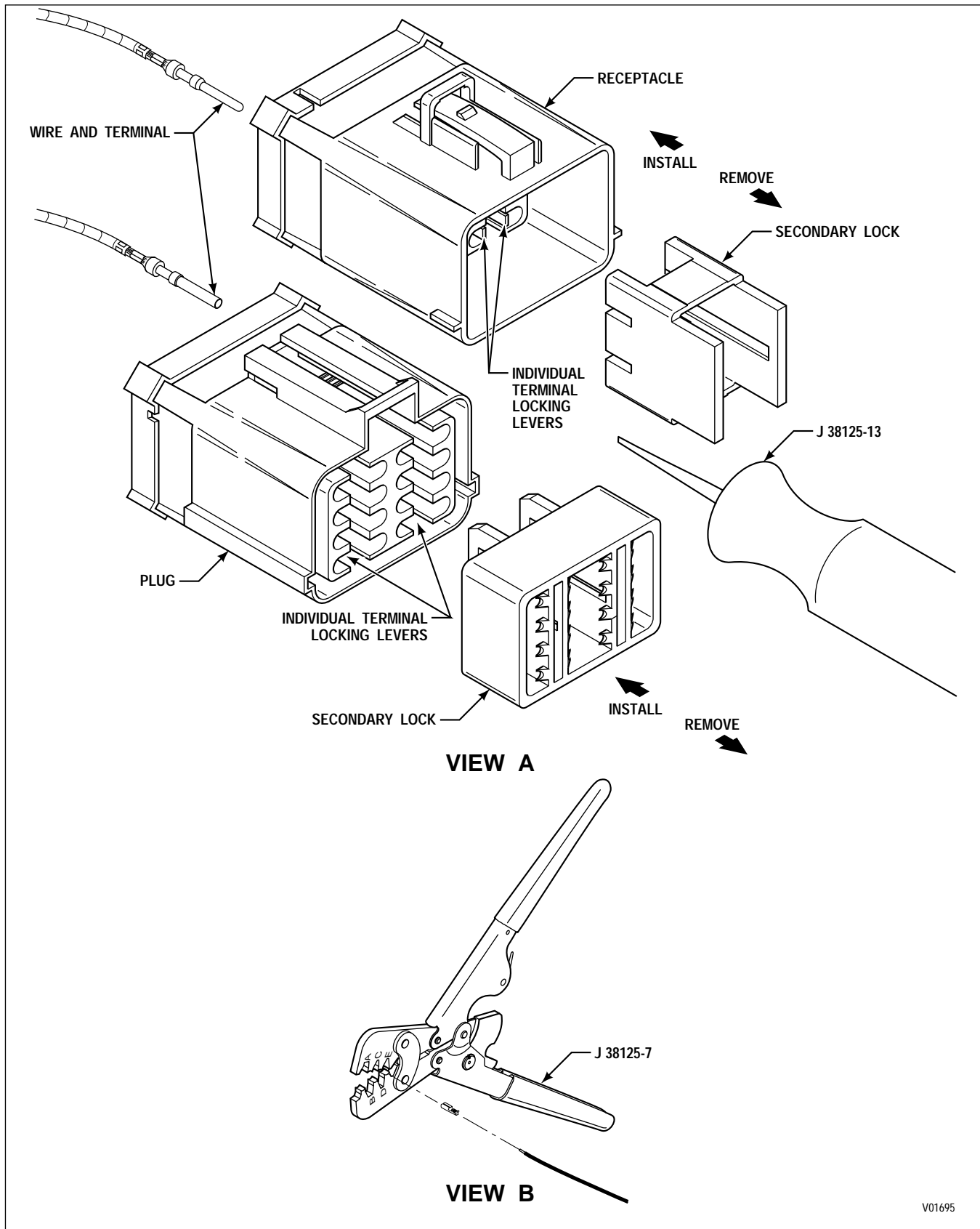


Figure E-14. EPC Connectors (Ford 16-Way Bulkhead)

APPENDIX E — CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

1-13. EPC CONNECTORS (FORD 16-WAY BULKHEAD)

A. Connector/Terminal Repairs

Crimping Tool	J 38125-7	
Anvil "E" (core crimp)		
Anvil "4" (insulation crimp)		
Remover Tool	J 38125-13	
Use	Description	P/N
Ford 16-Way Bulkhead A (Gray)	16-Way Plug	29516613
	Terminal (Socket)	29516152
	Secondary Lock	29516151
	16-Way Receptacle	29516614
	Terminal (Socket)	29516155
	Secondary Lock	29516154
Ford 16-Way Bulkhead A (Black)	16-Way Plug	29516150
	Terminal (Socket)	29516152
	Secondary Lock	29516151
	16-Way Receptacle	29516614
	Terminal (Socket)	29516155
	Secondary Lock	29516154

B. Terminal Removal (refer to Figure E-14, View A)

1. Use Remover Tool J 38125-13 or needle nose pliers to remove the secondary lock that is retaining the terminals.
2. Insert Remover Tool J 38125-13 beside the terminal to release the locking lever for the individual terminal being serviced. Pull on the wire at the rear of the connector to remove it while keeping the locking lever disengaged.
3. If replacing the terminal, cut the terminal between the core and insulation crimps to minimize wire loss.

C. Terminal Crimping

1. Carefully strip insulation $6.5 \text{ mm} \pm 0.5$ (0.26 ± 0.02 inch). Unless insulation crimp is overtight, Automatic Wire Stripper J 35615 will remove insulation and crimp from old terminal without damaging wire.
2. Place the core crimp portion of the terminal on the bed of the designated crimping anvil and squeeze crimper enough to hold terminal from dropping (Figure E-14, View B).
3. Position wire core in terminal and squeeze the crimper tool to complete the core crimp. Be sure to orient the terminal so that it is properly aligned with the terminal cavity in the connector.
4. Position insulation crimp of terminal on proper anvil so that the entire insulation crimp area and a portion of the terminal between the core and insulation crimp areas are supported by the anvil. Complete the insulation crimp.
5. Push the wire through the slot in the connector until it clicks into position.
6. Reinstall the secondary lock by pushing it into the front of the connector until it clicks into position.

APPENDIX E — CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

1-14. REPAIR OF A BROKEN WIRE WITH IN-LINE BUTT SPLICE

A. Connector Check Before Repair

NOTE: Before repairing or replacing wiring harness, sensor, solenoid, switch, or ECU as indicated for a diagnosed problem, follow the procedure below:

1. Disconnect the connector or connectors associated with the problem and inspect for:
 - Bent terminals
 - Broken terminals
 - Dirty terminals
 - Pushed back terminals
 - Missing terminals
 - Condition of mating tabs
 - Condition of mating terminals

Ensure that terminals are secure in the connector. Clean, straighten, or replace parts as required.

2. Reconnect all previous unmated connectors. Ensure connectors are fully inserted or twisted until they lock in place. Connectors with locking tabs make an audible “click” when the lock is engaged.
3. If trouble recurs after starting the vehicle, follow proper repair procedures for trouble code or complaint.
4. If trouble does not recur, or if the correct repairs and/or replacements have been made, the problem should be corrected.

B. Special Tools

- Heat Gun, J 25070 or equivalent
- Crimping Tool for Pre-insulated Crimp J 38125-8 (refer to Figure E-15)

NOTE: Use crimping anvils “F” and “G.”

- Wire Strippers, J 35615
- Splices P/N 23046604 14-16 AWG
- Splices P/N 23046605 18-22 AWG

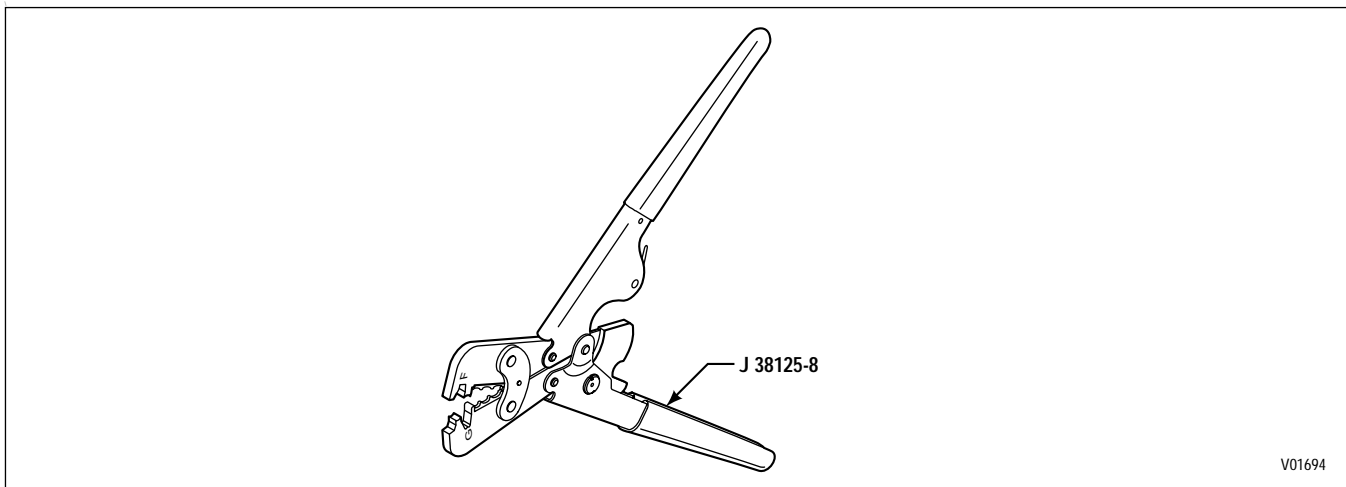


Figure E-15. Crimper J 38125-8

APPENDIX E — CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

NOTE: *Each splice must be properly crimped and then heated to shrink the covering to protect and insulate the splice. Insulation piercing splice clips should not be used.*

C. Straight Lead Repair Procedure

1. Locate damaged wire.
2. Remove insulation 8.0 mm (0.31 inch).
3. Insert one wire into crimp barrel and crimp.
4. Insert other wire into crimp barrel and crimp.
5. Pull on connection to ensure crimping integrity.
6. Heat splice with heat gun until covering shrinks and adhesive flows from under the covering.
7. The splice is now sealed and insulated. Electrical tape should not be used and is not necessary.

APPENDIX E — CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

LIST OF WORLD TRANSMISSION CONNECTOR PARTS

The following list provides detailed information on nearly all of the commonly-used electrical connectors for the World Transmission family produced by Allison Transmission. The information is organized so that detail parts are listed by harness name or OEM name and then by connector name within the harness. Information on each detail part includes the description, Allison part number, manufacturer, and manufacturer part number.

EXTERNAL HARNESS

DESCRIPTION	ATD P/N	MANUFACTURER	MFR P/N
ECU			
34-Pin "A" Plug	29500915	Thomas & Betts	400134
Terminal (Socket)	29500917	Thomas & Betts	6D871-2-1-T
Locking Bar	29503057	Thomas & Betts	6D729-07
O-ring Seal	29503055	Thomas & Betts	750001
Cavity Plug	29500919	Thomas & Betts	7B282
34-Pin "B" Plug	29500914	Thomas & Betts	400133
Terminal (Socket)	29500917	Thomas & Betts	6D871-2-1-T
Locking Bar	29503057	Thomas & Betts	6D729-07
O-ring Seal	29503055	Thomas & Betts	750001
Cavity Plug	29500919	Thomas & Betts	7B282
RSI			
10-Pin Plug	29500916	Thomas & Betts	6D530-10-40
Terminal (Socket)	29500917	Thomas & Betts	6D871-2-1-T
Locking Bar	29503056	Thomas & Betts	6D729-01
O-ring Seal	29503054	Thomas & Betts	6D656-01
Cavity Plug	29500919	Thomas & Betts	7B282
VIM			
18-Pin Plug	12040920	Packard Electric	
Terminal (Socket)	12103881	Packard Electric	
Seal (2)	12040936	Packard Electric	
Cavity Plug	12034413	Packard Electric	
Strain Relief	12110545	Packard Electric	
Bolt	12129426	Packard Electric	
Bolt Retainer	12034236	Packard Electric	
30-Pin Plug	12034397	Packard Electric	
Terminal (Socket)	12103881	Packard Electric	
Seal (2)	12040879	Packard Electric	
Cavity Plug	12034413	Packard Electric	
Strain Relief	12110546	Packard Electric	
Bolt	12129426	Packard Electric	
Bolt Retainer	12034236	Packard Electric	

APPENDIX E — CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

EXTERNAL HARNESS *(cont'd)*

DESCRIPTION	ATD P/N	MANUFACTURER	MFR P/N
VIW			
16-Pin Plug	23016193	Amp	206037-1
Terminal (Socket)	23015204	Amp	66101-2
Shell	23016490	Amp	206322-1
16-Pin Receptacle	29501001	Amp	206036-3
Terminal (Pin)	23015205	Amp	66099-2
Shell	23016490	Amp	206322-1
MAIN TRANSMISSION (8/15/94 AND LATER)			
31-Pin Plug	29511365	Deutsch ECD	WT06B24-31SN
Terminal (Socket)	29511366	Deutsch ECD	3662-204-1690
Cavity Plug	29511371	Deutsch ECD	0613-1-1601
Backshell Assembly	29514040	Deutsch ECD	WTA10-24-00
Backshell Housing	29514041	Deutsch ECD	WTA10-24-01
Backshell Follower	29514042	Deutsch ECD	WTA10-24-02
Backshell Grommet	29514043	Deutsch ECD	WTA10-24-03
MAIN TRANSMISSION (PRIOR TO 8/15/94)			
24-Pin Plug	12092201	Packard Electric	
Terminal (Socket) BeCu	12110236	Packard Electric	
Seal (2)	12092200	Packard Electric	
Cavity Plug	12034413	Packard Electric	
Strain Relief	12110234	Packard Electric	
Bolt	12129426	Packard Electric	
Bolt Retainer	12034236	Packard Electric	
DDR			
12-Pin Plug	12048105	Packard Electric	
Terminal (Socket)	12034046	Packard Electric	
Secondary Lock	12020219	Packard Electric	
Cover	12048107	Packard Electric	
6-Pin Plug	29512133	Deutsch	HD10-6-12P
Terminal (Pin)	29514170	Deutsch	0460-256-12233
Cavity Plug	23016504	Deutsch	114017
Backshell	29521260	Deutsch	HD18-006
Cover	29521877	Deutsch	HDC16-6
TPS			
3-Pin Plug/Seal	12015793	Packard Electric	
Connector Seal	12010718	Packard Electric	
Terminal (Pin)	12089040	Packard Electric	
Wire Seal	12015284	Packard Electric	

APPENDIX E — CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

EXTERNAL HARNESS (*cont'd*)

DESCRIPTION	ATD P/N	MANUFACTURER	MFR P/N
SPEED SENSORS BRANCH (8/15/94 AND LATER — OPTIONAL)			
16-Pin Plug	29516987	Deutsch ECD	WT06B-20-16SN
Terminal (Socket)	29511366	Deutsch ECD	3662-204-1690
Cavity Plug	29511371	Deutsch ECD	0613-1-1601
Backshell Housing	29520394	Deutsch ECD	WTA10-20-01/19
Backshell Follower	29520395	Deutsch ECD	WTA10-20-02/19
Backshell Grommet	29516993	Deutsch ECD	WTA10-20-03
16-Pin Receptacle	29516988	Deutsch ECD	WT04BB20-16SN
Terminal (Pin)	29511369	Deutsch ECD	3660-201-1690
Cavity Plug	29511371	Deutsch ECD	0613-1-1601
Panel Nut	29516989	Deutsch ECD	0926-207-2087
O-ring Seal	29516994	Deutsch ECD	9013-3-0201
Lockwasher	29519126	Deutsch ECD	0914-212-2086
Backshell Housing	29520394	Deutsch ECD	WTA10-20-01/19
Backshell Follower	29520395	Deutsch ECD	WTA10-20-02/19
Backshell Grommet	29516993	Deutsch ECD	WTA10-20-03
SPEED SENSOR			
2-Pin Plug/Seals	12040753	Packard Electric	
Connector Seal	12040750	Packard Electric	
Terminal (Socket)	12103881	Packard Electric	
Terminal (Socket) BeCu	12110236	Packard Electric	
OUTPUT (NON-RETARDER AND HD RETARDER) AND ENGINE SPEED SENSOR			
Sensor Assembly	29509637		
O-ring	29503383		
Retainer	29503843		
MD OUTPUT SPEED SENSOR (RETARDER)			
Sensor Assembly	29508034		
O-ring	29503383		
Retainer	29503843		
OUTPUT SPEED SENSOR (T-CASE)			
Sensor	29505601		
HD TURBINE SPEED SENSOR			
Sensor Assembly	29512201		
O-ring	29503383		
Retainer	29511508		

APPENDIX E — CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

EXTERNAL HARNESS *(cont'd)*

DESCRIPTION	ATD P/N	MANUFACTURER	MFR P/N
BULKHEAD			
31-Pin Plug Terminal (Socket)	29509617	Deutsch IPD (M/F)	HD36-24-31ST
Cavity Plug	23016502	Deutsch IPD	0462-201-16141
	23016504	Deutsch IPD	114017
31-Pin Receptacle Terminal (Pin)	29509616	Deutsch IPD (F/M)	HD34-24-31PT
Cavity Plug	23018768	Deutsch IPD	0460-202-16141
Panel Nut	23016504	Deutsch IPD	114017
Lockwasher	23016302	Deutsch IPD	112263-90
	23016303	Deutsch IPD	112264
31-Pin Plug Terminal (Pin)	29509617	Deutsch IPD (M/M)	HD36-24-31ST
Cavity Plug	23018768	Deutsch IPD	0460-202-16141
31-Pin Receptacle Terminal (Socket)	23016504	Deutsch IPD	114017
Cavity Plug	29509616	Deutsch IPD (F/F)	HD34-24-31PT
Panel Nut	23016502	Deutsch IPD	0462-201-16141
Lockwasher	23016504	Deutsch IPD	114017
	23016302	Deutsch IPD	112263-90
	23016303	Deutsch IPD	112264
37-Pin Plug Assembly	29502375	ITT Cannon (FMTV)	CA3106E28-21P-B
37-Pin Receptacle Assembly	29502374	ITT Cannon (FMTV)	CA3100E28-21S-B
31-Pin Plug Terminal (Socket)	29511365	Deutsch ECD (M/F)	WT06B24-31SN
Cavity Plug	29511366	Deutsch ECD	3662-204-1690
Backshell Housing	29511371	Deutsch ECD	0613-1-1601
Backshell Follower	29520050	Deutsch ECD	WTA10-24-01/22
Backshell Grommet	29520049	Deutsch ECD	WTA10-24-02/22
	29514043	Deutsch ECD	WTA10-24-03
31-Pin Receptacle Terminal (Pin)	29511368	Deutsch ECD (F/M)	WT04B24-31PN
Cavity Plug	29511369	Deutsch ECD	3660-201-1690
Panel Nut	29511371	Deutsch ECD	0613-1-1601
O-ring Seal	29512842	Deutsch ECD	0025-264-542
Lockwasher	29512839	Deutsch ECD	9013-3-0402
Backshell Housing	23016303	Deutsch ECD	0914-212-2486
Backshell Follower	29520050	Deutsch ECD	WTA10-24-01/22
Backshell Grommet	29520049	Deutsch ECD	WTA10-24-02/22
	29514043	Deutsch ECD	WTA10-24-03
31-Pin Plug Terminal (Pin)	29511855	Deutsch ECD (M/M)	WT06B24-31PN
	29511369	Deutsch ECD	3660-201-1690

APPENDIX E — CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

EXTERNAL HARNESS *(cont'd)*

DESCRIPTION	ATD P/N	MANUFACTURER	MFR P/N
BULKHEAD (cont'd)			
Cavity Plug	29511371	Deutsch ECD	0613-1-1601
Backshell Housing	29520050	Deutsch ECD	WTA10-24-01/22
Backshell Follower	29520049	Deutsch ECD	WTA10-24-02/22
Backshell Grommet	29514043	Deutsch ECD	WTA10-24-03
31-Pin Receptacle	29511854	Deutsch ECD (F/F)	WT04B24-31SN
Terminal (Socket)	29511366	Deutsch ECD	3662-204-1690
Cavity Plug	29511371	Deutsch ECD	0613-1-1601
Panel Nut	29512842	Deutsch ECD	0025-264-542
O-ring Seal	29512839	Deutsch ECD	9013-3-0402
Lockwasher	23016303	Deutsch ECD	0914-212-2486
Backshell Housing	29520050	Deutsch ECD	WTA10-24-01/22
Backshell Follower	29520049	Deutsch ECD	WTA10-24-02/22
Backshell Grommet	29514043	Deutsch ECD	WTA10-24-03
TRANSFER CASE			
6-Pin Plug Assembly	29506418	ITT Cannon	KPSE06E10-6S
Terminal (Socket)		ITT Cannon	031-9174-004
Cavity Plug	29517132	ITT Cannon	225-0070-000
6-Pin Receptacle Assembly		ITT Cannon	KPSE07E10-6P
Terminal (Pin)		ITT Cannon	030-9173-006
Cavity Plug	29517132	ITT Cannon	225-0070-000
RETARDER — “H” SOLENOID ACCUMULATOR			
2-Pin Plug/Seals	12041411	Packard Electric	
Connector Seal	12040750	Packard Electric	
Terminal (Socket)	12103881	Packard Electric	
MD RETARDER BULKHEAD			
8-Pin Plug Assembly	29506427	ITT Cannon	KPSE06E16-8S
Terminal (Socket)	29517130	ITT Cannon	031-9206-006
Cavity Plug	29517133	ITT Cannon	225-0071-000
8-Pin Receptacle Assembly	29505513	ITT Cannon	KPSE07E16-8P
Terminal (Pin)	29517131	ITT Cannon	030-9205-007
Cavity Plug	29517133	ITT Cannon	225-0071-000
RETARDER — “K” SOLENOID			
2-Pin Plug Assembly	29505516	ITT Cannon	KPT06E8-2S
Terminal (Socket)	29511913	ITT Cannon	031-9074-002
2-Pin Receptacle Assembly	29505515	ITT Cannon	KPT07E8-2P

APPENDIX E — CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

EXTERNAL HARNESS *(cont'd)*

DESCRIPTION	ATD P/N	MANUFACTURER	MFR P/N
HD RETARDER TEMPERATURE			
2-Pin Plug/Seal	12015792	Packard Electric	
Connector Seal	12010155	Packard Electric	
Terminal (Pin)	12089040	Packard Electric	
Wire Seal	12015284	Packard Electric	
2-Pin Receptacle	12010973	Packard Electric	
Terminal (Socket)	12089188	Packard Electric	
Wire Seal	12015284	Packard Electric	
HD RETARDER TEMPERATURE SENSOR			
Sensor	29511861	Philips Tech	
MD RETARDER TEMPERATURE SENSOR			
Sensor	29512616	Air Pax	
RETARDER MODULATION SENSOR (RMR)			
3-Pin Plug/Seal	12015795	Packard Electric	
Connector Seal	12010718	Packard Electric	
Terminal (Pin)	12089040	Packard Electric	
Wire Seal	12015284	Packard Electric	
3-Pin Receptacle	12015092	Packard Electric	
Terminal (Socket)	12089188	Packard Electric	
Wire Seal	12015284	Packard Electric	
RMR DEVICES			
3-Pin Receptacle	12015092	Packard Electric	
Terminal (Socket)	12089188	Packard Electric	
Wire Seal	12015284	Packard Electric	
2-Pin Plug/Seal	15300027	Packard Electric	
Connector Seal	15300020	Packard Electric	
Terminal (Socket)	12077411	Packard Electric	
Secondary Lock	15300014	Packard Electric	
Wire Seal	12015323	Packard Electric	
4-Pin Plug/Seal	12015797	Packard Electric	
Connector Seal	12010492	Packard Electric	
Terminal (Socket)	12089188	Packard Electric	
Wire Seal	12015284	Packard Electric	

APPENDIX E — CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

EXTERNAL HARNESS *(cont'd)*

DESCRIPTION	ATD P/N	MANUFACTURER	MFR P/N
RMR DEVICES (cont'd)			
8-Pin Receptacle	29518007	Amp	163007-0
Terminal (Socket)	29518008	Amp	42100-2
3-Pin Plug/Seal	12015795	Packard Electric	
Connector Seal	12010718	Packard Electric	
Terminal (Pin)	12089040	Packard Electric	
Wire Seal	12015284	Packard Electric	
PTO — PRESSURE SWITCH			
2-Pin Plug/Seal	12015378	Packard Electric	
Connector Seal	12010155	Packard Electric	
Terminal (Pin)	12089040	Packard Electric	
2-Pin Receptacle	12034074	Packard Electric	
Terminal (Socket)	12089188	Packard Electric	
PTO — SOLENOID			
2-Pin Plug/Seals	12041411	Packard Electric	
Connector Seal	12040750	Packard Electric	
Terminal (Socket)	12103881	Packard Electric	

APPENDIX E — CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

INTERNAL HARNESS

DESCRIPTION	ATD P/N	MANUFACTURER	MFR P/N
* SOLENOID A, B, G, (D)			
2-Pin Plug	12092420	Packard Electric	
Terminal (Socket) "A"	12124639	Packard Electric	
Terminal (Socket) "B"	12015243	Packard Electric	
* SOLENOID C, (D), E, F, J, N			
2-Pin Plug	12092420	Packard Electric	
Terminal (Socket)	12124639	Packard Electric	

*** (D) SOLENOID USES TERMINAL 12015243 ON MD 3070PT MODELS ONLY
ALL OTHER MODELS USE TWO 12124639 TERMINALS FOR (D) SOLENOID**

MD TURBINE SPEED SENSOR

Sensor	29503531	Philips Tech	
2-Pin Plug	12092419	Packard Electric	
Terminal (Socket) Becu	12110236	Packard Electric	

C3 PRESSURE SWITCH

2-Pin Plug	12092420	Packard Electric	
Terminal (Socket)	12110237	Packard Electric	
2-Pin Receptacle	12110139	Packard Electric	
Terminal (Pin)	12066337	Packard Electric	

OIL LEVEL SENSOR

4-Pin Plug	12047786	Packard Electric	
Terminal (Pin)	12047581	Packard Electric	
Secondary Lock	12047787	Packard Electric	
4-Pin Receptacle	12047785	Packard Electric	
Terminal (Socket)	12047767	Packard Electric	
Secondary Lock	12047664	Packard Electric	

TEMPERATURE SENSOR

Sensor	29501002	Air Pax	
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MAIN TRANSMISSION CONNECTOR (8/15/94 AND LATER)

31-Pin Receptacle	29511368	Deutsch ECD (F/M)	WT04B24-31PN
Terminal (Pin)	29511369	Deutsch ECD	3660-201-1690
Cavity Plug	29511371	Deutsch ECD	0613-1-1601
Panel Nut	29512842	Deutsch ECD	0025-264-542
O-ring Seal	29512839	Deutsch ECD	9013-3-0402
Lockwasher	23016303	Deutsch ECD	0914-212-2486

APPENDIX E — CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

INTERNAL HARNESS *(cont'd)*

DESCRIPTION	ATD P/N	MANUFACTURER	MFR P/N
MAIN TRANSMISSION CONNECTOR (8/15/94 AND LATER) (Cont'd)			
Backshell Assembly	29514040	Deutsch ECD	WTA10-24-00
Backshell Housing	29514041	Deutsch ECD	WTA10-24-01
Backshell Follower	29514042	Deutsch ECD	WTA10-24-02
Backshell Grommet	29514043	Deutsch ECD	WTA10-24-03
MAIN TRANSMISSION STANDOFF (8/15/94 AND LATER)			
Standoff, MD/B 300/400	29516327		
Standoff, HD/B 500	29516328		
Grommet Assembly	29513212		
Cavity Plug	29511371		
O-ring Seal	12092195	Packard Electric	
Feedthrough Seal	29520396	Deutsch ECD	0810-205-0001
Backshell Assembly	29514040	Deutsch ECD	WTA10-24-00
Backshell Housing	29514041	Deutsch ECD	WTA10-24-01
Backshell Follower	29514042	Deutsch ECD	WTA10-24-02
Backshell Grommet	29514043	Deutsch ECD	WTA10-24-03
MD MAIN INTERNAL CONNECTOR (PRIOR TO 8/15/94)			
24-Pin Plug	12092197	Packard Electric	
Terminal (Socket) BeCu	12110236	Packard Electric	
Standoff	12092199	Packard Electric	
Bolt	12092458	Packard Electric	
Internal 12-Way Seal	29514675	Packard Electric	
HD MAIN INTERNAL CONNECTOR (PRIOR TO 8/15/94)			
24-Pin Plug	12092197	Packard Electric	
Terminal (Socket) BeCu	12110236	Packard Electric	
Standoff	12092199	Packard Electric	
Spacer	12129710	Packard Electric	
Bolt	12129717	Packard Electric	
Internal 12-Way Seal	29514675	Deutsch	WTA01-03
FEEDTHROUGH CONNECTOR (PRIOR TO 8/15/94)			
24-Pin Plug Assembly	12129810	Packard Electric	
O-ring Seal	12092195	Packard Electric	
“Green” Seal	29514674	Deutsch	WTA01-02
“Orange” Seal	12092194	Packard Electric	

APPENDIX E — CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

R.V.I.

DESCRIPTION	ATD P/N	MANUFACTURER	MFR P/N
VIM			
21-Pin Plug	29516188	Deutsch IPD	HDP26-24-21SN
Terminal (Socket)	29511366	Deutsch	3662-204-1690
Cavity Plug	23016504	Deutsch	114017
21-Pin Receptacle	29516187	Deutsch IPD	HDP24-24-21PN
Terminal (Pin)	29511369	Deutsch	3660-201-1690
Cavity Plug	23016504	Deutsch	114017
BULKHEAD			
31-Pin Plug	29516184	Deutsch IPD	HDP26-24-31ST
Terminal (Socket)	29511366	Deutsch	3662-204-1690
Cavity Plug	23016504	Deutsch	114017
31-Pin Receptacle	29516183	Deutsch IPD	HDP24-24-31PT
Terminal (Pin)	29511369	Deutsch	3660-201-1690
Cavity Plug	23016504	Deutsch	114017
VIW			
13-Pin Receptacle	29521873	Amp	142176-2
Terminal (Socket)	29521874	Amp	142183-1

APPENDIX E — CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

NEW FLYER

DESCRIPTION	ATD P/N	MANUFACTURER	MFR P/N
OTHER CONNECTORS			
4-Pin Plug/Seal	12015798	Packard Electric	
Connector Seal	12020220	Packard Electric	
Terminal (Socket)	12089188	Packard Electric	
Cavity Plug	12010300	Packard Electric	
Wire Seal	12015284	Packard Electric	
24-Pin Plug	29520051	Amp	206837-1
Terminal (Socket)	23015204	Amp	66100-7
Shell	29502021	Amp	206138-1

APPENDIX E — CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

IVECO

DESCRIPTION	ATD P/N	MANUFACTURER	MFR P/N
19-Pin Plug "A"	29516947	Amp	281923-6
Terminal (Socket)	29516944	Amp	281938-1
Wire Seal	29516945	Amp	281934-2
19-Pin Receptacle "A"	29516949	Amp	281921-6
Terminal (Pin)	29516943	Amp	281937-1
19-Pin Plug "B"	29516948	Amp	281923-3
Terminal (Socket)	29516944	Amp	281938-1
Wire Seal	29516945	Amp	281934-2
Cavity Plug	29516946	Amp	282081-1
19-Pin Receptacle "B"	29516950	Amp	281921-3
Terminal (Pin)	29516943	Amp	281937-1

APPENDIX E — CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

SCANIA

DESCRIPTION	ATD P/N	MANUFACTURER	MFR P/N
OTHER CONNECTORS			
9-Pin Plug	29520275	Amp	206708-1
Terminal (Socket)	23015204	Amp	66101-2
Backshell	29520277	Amp	207008
9-Pin Receptacle	29520276	Amp	206705-2
Terminal (Pin)	23015205	Amp	66099-2
Backshell	29520277	Amp	207008

APPENDIX E — CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

GILLIG

DESCRIPTION	ATD P/N	MANUFACTURER	MFR P/N
OTHER CONNECTORS			
6-Pin Plug	12015799	Packard Electric	
Connector Seal	12010227	Packard Electric	
Terminal (Socket)	12089188	Packard Electric	
Wire Seal	12015323	Packard Electric	
Cavity Plug	12010300	Packard Electric	
6-Pin Receptacle	12010975	Packard Electric	
Terminal (Pin)	12089040	Packard Electric	
Wire Seal	12015323	Packard Electric	
Cavity Plug	12010300	Packard Electric	

APPENDIX E — CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

FREIGHTLINER

DESCRIPTION	ATD P/N	MANUFACTURER	MFR P/N
VEHICLE INTERFACE			
8-Pin Plug	12066195	Packard Electric	
Terminal (Pin)	12034047	Packard Electric	
Secondary Lock	12065141	Packard Electric	
8-Pin Receptacle	12064998	Packard Electric	
Terminal (Socket)	12034046	Packard Electric	
Secondary Lock	12064999	Packard Electric	
OTHER CONNECTORS			
1-Pin Receptacle	12015987	Packard Electric	
Terminal (Pin)	12020119	Packard Electric	
6-Pin Plug	12015344	Packard Electric	
Terminal (Socket)	12034046	Packard Electric	
Terminal (Socket)	12066214	Packard Electric	
6-Pin Receptacle	12015345	Packard Electric	
Terminal (Pin)	12034047	Packard Electric	
Fuse Block	29509584	Dill	59105
Terminal (Socket)	29509589	Dill	23432
Terminal (Socket)	29509588	Dill	23434
Secondary Lock	29509587	Dill	59099
Relay Holder	29509583	Dill	59022
Wedge Block	29509585	Dill	59011
Terminal (Socket)	12015869	Packard Electric	
Terminal (Socket)	12015870	Packard Electric	
Terminal (Socket)	12084590	Packard Electric	
Secondary Lock	29509586	Dill	59056

APPENDIX E — CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

FORD F-SERIES (FUSE-ALL)

DESCRIPTION	ATD P/N	MANUFACTURER	MFR P/N
GROMMET			
Pass-Through Grommet	29516010		
BULKHEAD (GRAY)			
16-Pin Plug	29516613	EPC	F2AB-14A464-RA
Terminal (Socket)	29516152	Cardell	E7EB-14487-AA
Connector Spacer	29516151	EPC	F2AB-14A468-CA
16-Pin Receptacle	29516614	EPC	F2AB-14A624-EA
Terminal (Pin)	29516155	Cardell	E7EB-14461-BA
Receptacle Spacer	29516154	EPC	F2AB-14A468-BA
BULKHEAD (BLACK)			
16-Pin Plug	29516150	EPC	F2AB-14A464-RA
Terminal (Socket)	29516152	Cardell	E7EB-14487-AA
Connector Spacer	29516151	EPC	F2AB-14A468-CA
16-Pin Receptacle	29516153	EPC	F2AB-14A624-EA
Terminal (Pin)	29516155	Cardell	E7EB-14461-BA
Receptacle Spacer	29516154	EPC	F2AB-14A468-BA
FUSE			
2-Pin Plug/Seals	12033769	Packard Electric	
Connector Seal	12077383	Packard Electric	
Wire Seal	12040972	Packard Electric	
Terminal (Socket)	12033997	Packard Electric	(12 Gauge Wire)
Terminal (Socket)	12020156	Packard Electric	(18 Gauge Wire)
Fuse (10 Amp)	12004007	Packard Electric	
Cover	12033731	Packard Electric	
TPS			
3-Pin Plug/Seal	12015793	Packard Electric	
Connector Seal	12010718	Packard Electric	
Terminal (Socket)	12089188	Packard Electric	
Wire Seal	12015284	Packard Electric	

APPENDIX E — CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

NAVISTAR

DESCRIPTION	ATD P/N	MANUFACTURER	MFR P/N
BULKHEAD			
31-Pin Plug	29509617	Deutsch IPD	HD36-24-31ST
Terminal (Socket)	23016502	Deutsch	0462-201-16141
31-Pin Receptacle	29509616	Deutsch IPD	HD34-24-31PT
Terminal (Pin)	23018768	Deutsch	0460-202-16141
NEUTRAL START (NON-RETARDER)			
1-Pin Plug	12010996	Packard Electric	
Terminal (Pin)	12089040	Packard Electric	
Wire Seal	12015323	Packard Electric	
1-Pin Plug/Seal	12015791	Packard Electric	
Connector Seal	12010149	Packard Electric	
Terminal (Socket)	12089188	Packard Electric	
REVERSE WARNING (NON-RETARDER)			
2-Pin Plug/Seal	12015792	Packard Electric	
Connector Seal	12010155	Packard Electric	
Terminal (Socket)	12089188	Packard Electric	
Wire Seal	12015284	Packard Electric	
NEUTRAL START AND REVERSE WARNING (RETARDER)			
5-Pin Plug/Seal	12084891	Packard Electric	
Connector Seal	15300023	Packard Electric	
Terminal (Socket)	12077411	Packard Electric	
Secondary Lock	15300017	Packard Electric	
Wire Seal	12015323	Packard Electric	
OTHER CONNECTORS			
2-Pin Receptacle	15300002	Packard Electric	
Terminal (Pin)	12040559	Packard Electric	
Secondary Lock	15300014	Packard Electric	
Wire Seal	12015360	Packard Electric	
1-Pin Plug	12065171	Packard Electric	
Terminal (Pin)	12040559	Packard Electric	
Lock	12065249	Packard Electric	
1-Pin Receptacle	12065172	Packard Electric	
Cavity Plug	12010300	Packard Electric	
Lock	12065249	Packard Electric	

APPENDIX E — CONNECTOR PART NUMBERS, TERMINAL PART NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS

NAVISTAR *(cont'd)*

DESCRIPTION	ATD P/N	MANUFACTURER	MFR P/N
OTHER CONNECTORS (cont'd)			
12-Pin Plug (Black)	29511373	Deutsch	DT0612SB
Terminal (Socket)	23016502	Deutsch	0462-201-16141
Wedge Lock	29511400	Deutsch	W12S
Cavity Plug	23016504	Deutsch	114017
12-Pin Receptacle (Black)	29511755	Deutsch	DT0412PB
Terminal (Pin)	23018768	Deutsch	0460-202-16141
Wedge Lock	29511401	Deutsch	W12P
Cavity Plug	23016504	Deutsch	114017
12-Pin Plug (Gray)	29511372	Deutsch	DT0612SA
Terminal (Socket)	23016502	Deutsch	0462-201-16141
Wedge Lock	29511400	Deutsch	W12S
Cavity Plug	23016504	Deutsch	114017
12-Pin Receptacle (Gray)	29511754	Deutsch	DT0412PA
Wedge Lock	29511401	Deutsch	W12P
Cavity Plug	23016504	Deutsch	114017
6-Pin Plug	29511752	Deutsch	DT066SA
Terminal (Pin)	23018768	Deutsch	0460-202-16141
6-Pin Receptacle	29511753	Deutsch	DT046PA
Terminal (Socket)	23016502	Deutsch	0462-201-16141

**APPENDIX E — CONNECTOR PART NUMBERS, TERMINAL PART
NUMBERS, TOOL PART NUMBERS, AND REPAIR INSTRUCTIONS**

NOTES

APPENDIX F — THROTTLE POSITION SENSOR ADJUSTMENT

A. Description of Operation (Figure F-1)

1. To properly communicate throttle position to the Electronic Control Unit (ECU), the throttle position sensor must convert its mechanical movement to an electrical form the ECU can understand. To accomplish this, contacts move across a resistive strip inside the sensor which translates position into voltage.

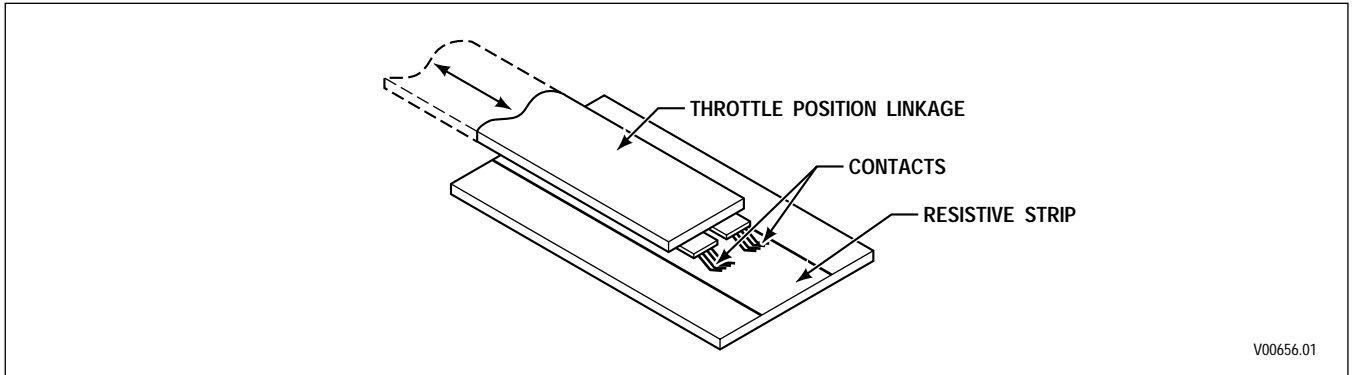


Figure F-1. Throttle Position to Voltage Conversion

2. Each position gives a different voltage. The ECU then converts the voltage to counts. Each count corresponds to approximately .179 mm (.007 inch) of throttle sensor movement. Figure F-2 diagrams the counts and throttle movement relationship.

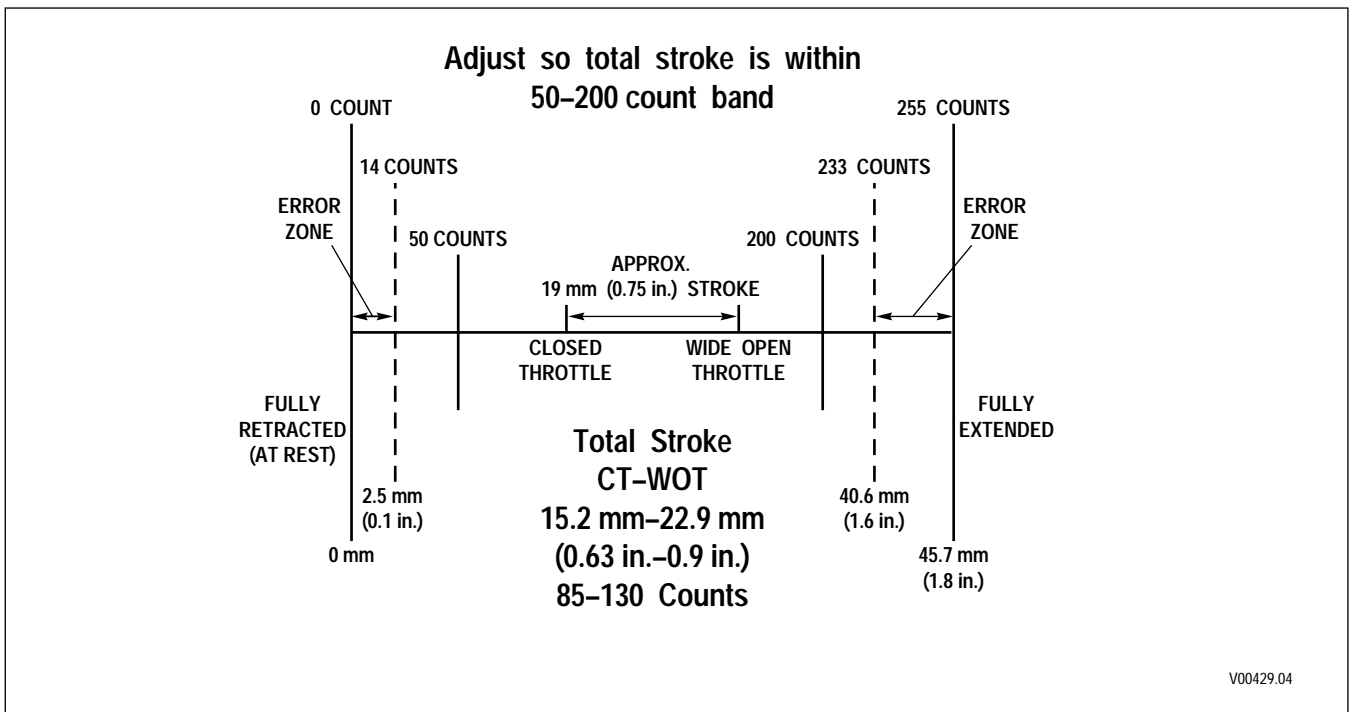


Figure F-2. Throttle Position Determination Diagram

APPENDIX F — THROTTLE POSITION SENSOR ADJUSTMENT

A. Description of Operation *(cont'd)*

3. Throttle percentage is proportional to counts; low counts correspond to low percent and high counts correspond to high percent (Table F-1, Page F-4).
4. The conversion from counts to percent throttle is performed easily once the idle and full throttle positions are set (see adjustment procedures below). The idle and full throttle positions correspond to counts which can be viewed with a diagnostic tool. The ECU determines percent throttle by the equation:

$$\% \text{ Throttle} = \frac{\text{Current Count} - \text{Idle Count}}{\text{Full Throttle Count} - \text{Idle Count}} \times 100$$

Where:

Idle Count = Count on diagnostic tool when engine is idling.

Current Count = Count on diagnostic tool at the present throttle position.

Full Throttle Count = Count on diagnostic tool at wide open throttle.

NOTE: *Refer to Appendix N for DDR information.*

5. The throttle position sensor is self-calibrating within its normal operating range. Each time the vehicle is started and the ECU is initialized, the idle counts that are used for closed throttle are increased by 15 counts from its previous lowest reading. Also, the wide open throttle counts are reduced by 15 counts from its previous highest reading. Once new counts are read from the current sensor position, the idle and wide open throttle count set points are continually readjusted to the lowest and highest counts, respectively. This compensates for fuel control system wear or previous mechanical adjustment. One area of particular concern is when the throttle sensor extends into the error zone. This indicates a TPS misadjustment to the ECU and 100 percent throttle is assumed until readjustment is performed. Simply clearing the Code 21 XX will not resolve the 100 percent (WOT) shifting situation.

NOTE: *After replacing or adjusting the throttle position sensor linkage, the technician should use the diagnostic tool to clear the throttle calibration. Go to the DDR selection menu and locate ACTION REQUESTS. Select RESET THROTTLE CALIBRATION and ENTER to set the 0 percent throttle counts. After the idle counts are established, the throttle should be moved to the Full position to establish the full or Wide Open Throttle (WOT) position (100 percent). The full throttle counts will be the same as the idle counts until the throttle is moved. The full throttle counts are set when maximum travel is reached so stopping before actual full throttle will set the 100 percent point artificially low. Refer to Figure F-2 for proper counts and percentage. Refer to Figure F-3 for illustration of throttle position adjustment.*

APPENDIX F — THROTTLE POSITION SENSOR ADJUSTMENT**B. Throttle Position Sensor (TPS) Adjustment**

When properly installed by the equipment manufacturer, the TPS should not require adjustment. Confirm that the throttle sensor is installed to manufacturer specifications before adjusting the throttle position sensor. The idle count should be 50 or higher and full throttle count 200 or lower. The TPS is self-calibrating meaning there is no optimum closed throttle or wide open throttle count value. As long as the counts are within the 50 to 200 range, the TPS is set properly. Total stroke of 85–130 counts must be maintained. Watch the movement of the throttle sensor as the controls move it through its full stroke. Be sure there is no misalignment or obstruction to smooth movement through the full stroke. Make certain the idle and full throttle positions are not in the error zones (refer to Figure F-2). The error zones occur when the idle position is less than 14 counts, or when the full throttle position is more than 233 counts. When idle or wide open throttle positions are in the error zones, Codes 21 12 and 21 23 occur, respectively. These codes cause the transmission to shift as if the throttle is fully depressed (100 percent throttle) affecting shift quality and causing decreased fuel efficiency. Code 21 XX may be caused by a short or open circuit in the chassis harness or by incorrect voltages. If this occurs, refer to Code 21 XX chart.

NOTE: Use Test Harness J 41339 for measuring voltages.

APPENDIX F — THROTTLE POSITION SENSOR ADJUSTMENT

Table F-1. Volts Versus Count for Throttle Sensor Display Reading

Counts	Volts	Counts	Volts	Counts	Volts	Counts	Volts	Counts	Volts	Counts	Volts
0	0	41		81		121		161		201	
1	0.0196	42		82		122		162		202	
2		43		83		123		163		203	
3		44		84		124		164		204	
4		45	0.882	85	1.666	125	2.451	165	3.235	205	4.019
5	0.098	46		86		126		166		206	
6		47		87		127		167		207	
7		48		88		128		168		208	
8		49		89		129		169		209	
9		50	0.98	90	1.764	130	2.549	170	3.333	210	4.117
10	0.196	51		91		131		171		211	
11		52		92		132		172		212	
12		53		93		133		173		213	
13		54		94		134		174		214	
14		55	1.078	95	1.863	135	2.647	175	3.431	215	4.215
15	0.276	56		96		136		176		216	
16		57		97		137		177		217	
17		58		98		138		178		218	
18		59		99		139		179		219	
19		60	1.176	100	1.96	140	2.745	180	3.529	220	4.313
20	0.392	61		101		141		181		221	
21		62		102		142		182		222	
22		63		103		143		183		223	
23		64		104		144		184		224	
24		65	1.274	105	2.058	145	2.843	185	3.627	225	4.411
25	0.49	66		106		146		186		226	
26		67		107		147		187		227	
27		68		108		148		188		228	
28		69		109		149		189		229	
29		70	1.372	110	2.156	150	2.941	190	3.725	230	4.509
30	0.588	71		111		151		191		231	
31		72		112		152		192		232	
32		73		113		153		193		233	
33		74		114		154		194		234	
34		75	1.47	115	2.225	155	3.039	195	3.823	235	4.607
35	0.686	76		116		156		196		236	
36		77		117		157		197		237	
37		78		118		158		198		238	
38		79		119		159		199		239	
39		80	1.568	120	2.353	160	3.137	200	3.921	240	4.705
40	0.784										

APPENDIX F — THROTTLE POSITION SENSOR ADJUSTMENT

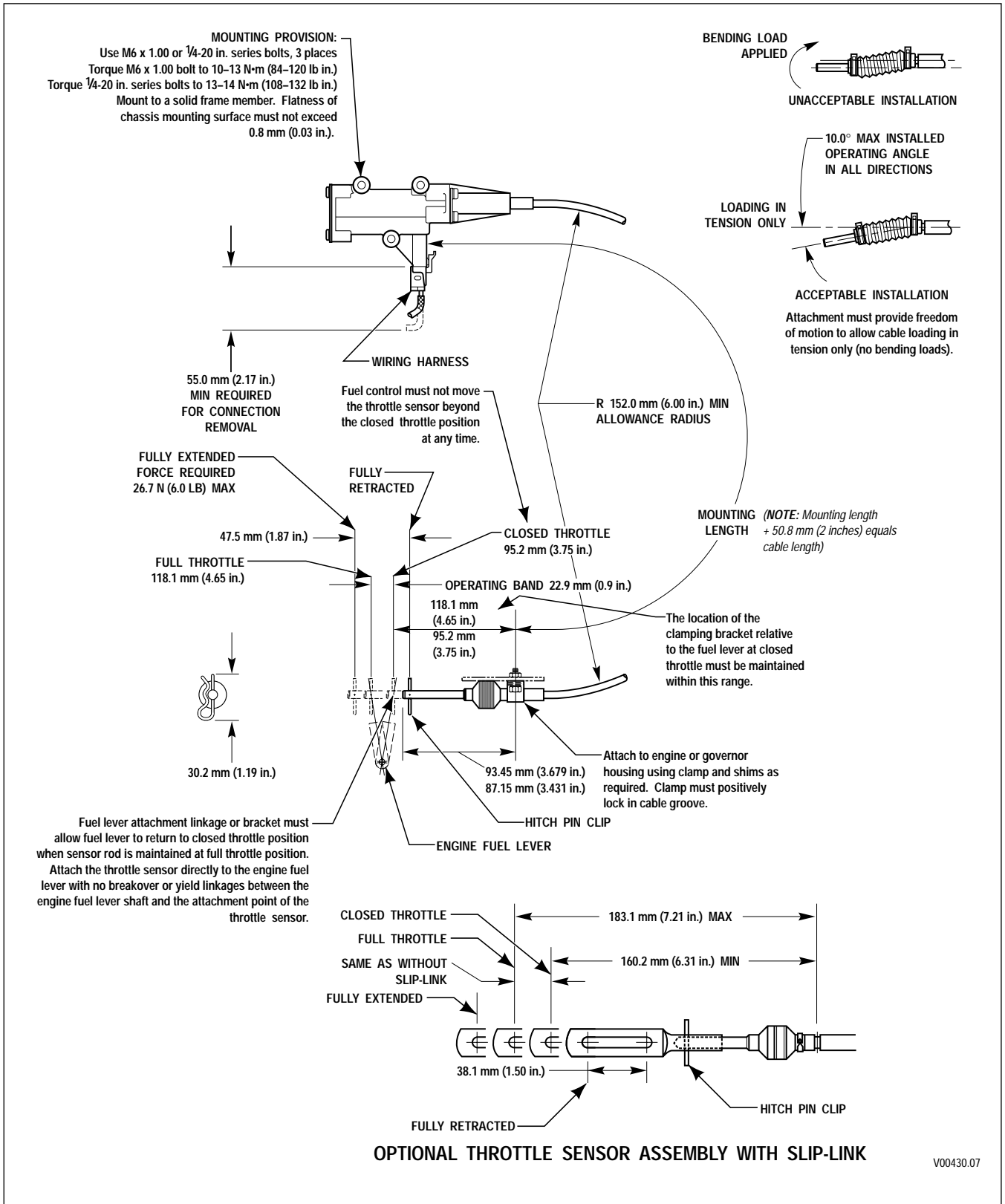


Figure F-3. Throttle Position Sensor Adjustment

APPENDIX F — THROTTLE POSITION SENSOR ADJUSTMENT

NOTES

APPENDIX G — MISCELLANEOUS ITEMS

1-1. WELDING ON VEHICLE

When frame or other welding is required on the vehicle, take the following precautions to protect the electronic control components:

1. Disconnect the wiring harness connectors at the transmission electronic control unit.
2. Disconnect the positive and negative battery connections, and any electronic control ground wires connected to the frame or chassis.
3. Cover electronic control components and wiring to protect them from hot sparks, etc.
4. Do not connect welding cables to electronic control components.

WARNING!

Do not jump start a vehicle with arc welding equipment. Arc welding equipment's dangerously high currents and voltages cannot be reduced to safe levels.

1-2. VEHICLE INTERFACE MODULE

The Allison Vehicle Interface Module (VIM) containing all Allison system relays and fuses must be used as the interface to all vehicle wiring. Refer to Figure G-2 for VIM component location and pin-out. To close an open VIM, tighten the bolts in the numerical order shown in Figure G-1 to provide a sealed, water-tight box. Torque to the bolts to 5–8 N·m (4–6 lb ft).

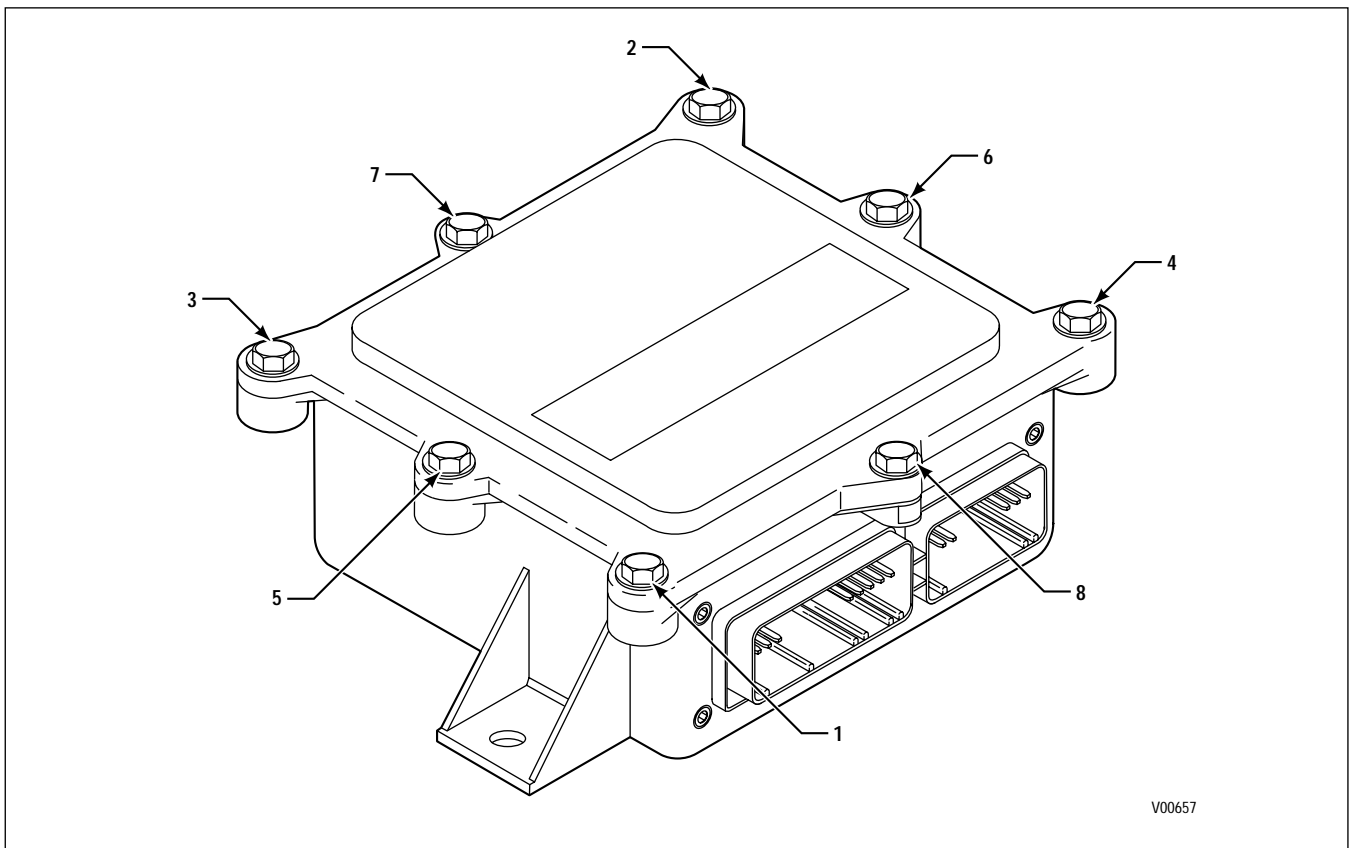
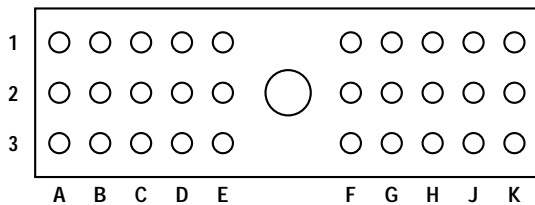
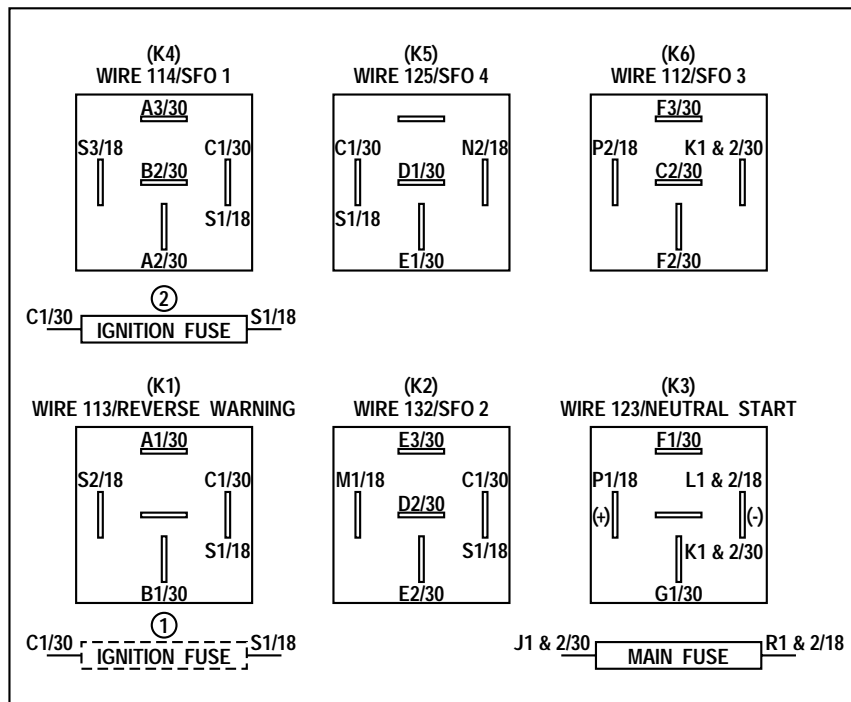
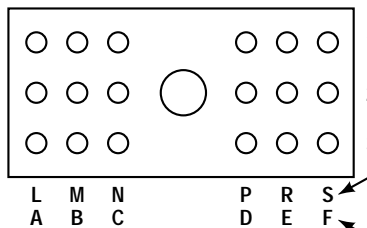


Figure G-1. Vehicle Interface Module (VIM)

APPENDIX G — MISCELLANEOUS ITEMS

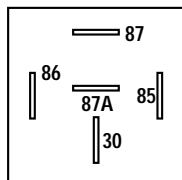


30-WAY CONNECTOR (PIN ID/30)
See page D-24 for wire/terminal usage.



18-WAY CONNECTOR (PIN ID/18)
See page D-25 for wire/terminal usage.

TERMINAL BOARD IDENTIFICATION
HARNESS CONNECTOR IDENTIFICATION



PIN NUMBERING ON BOTTOM OF RELAY

- ① Ignition fuse position in early VIM
- ② Ignition fuse must be in place and not open for there to be continuity between pins C1/30 and R1/18

V01814.01

Figure G-2. VIM Components Location and Pin-Out Diagram

APPENDIX H — HYDRAULIC SCHEMATICS

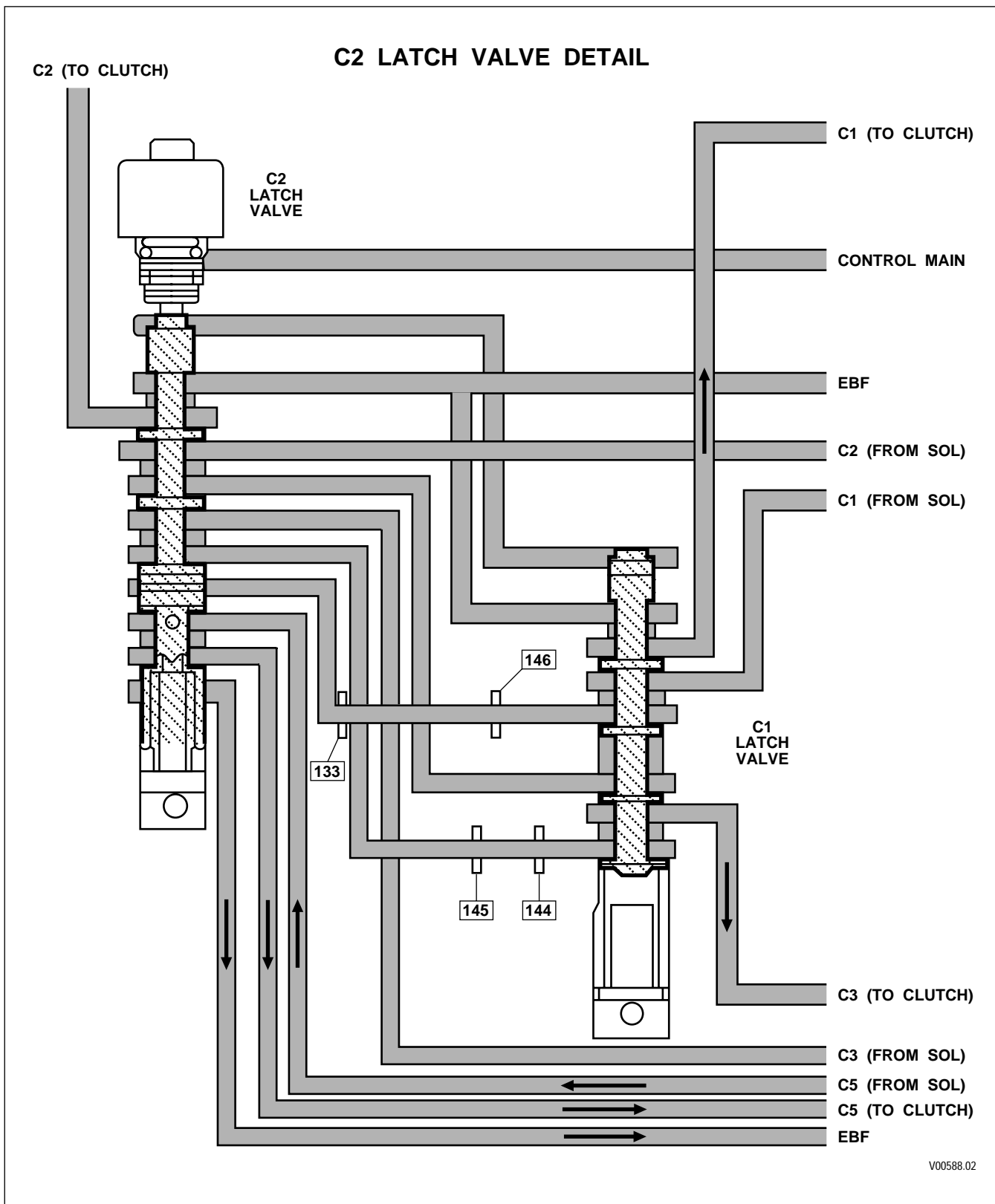
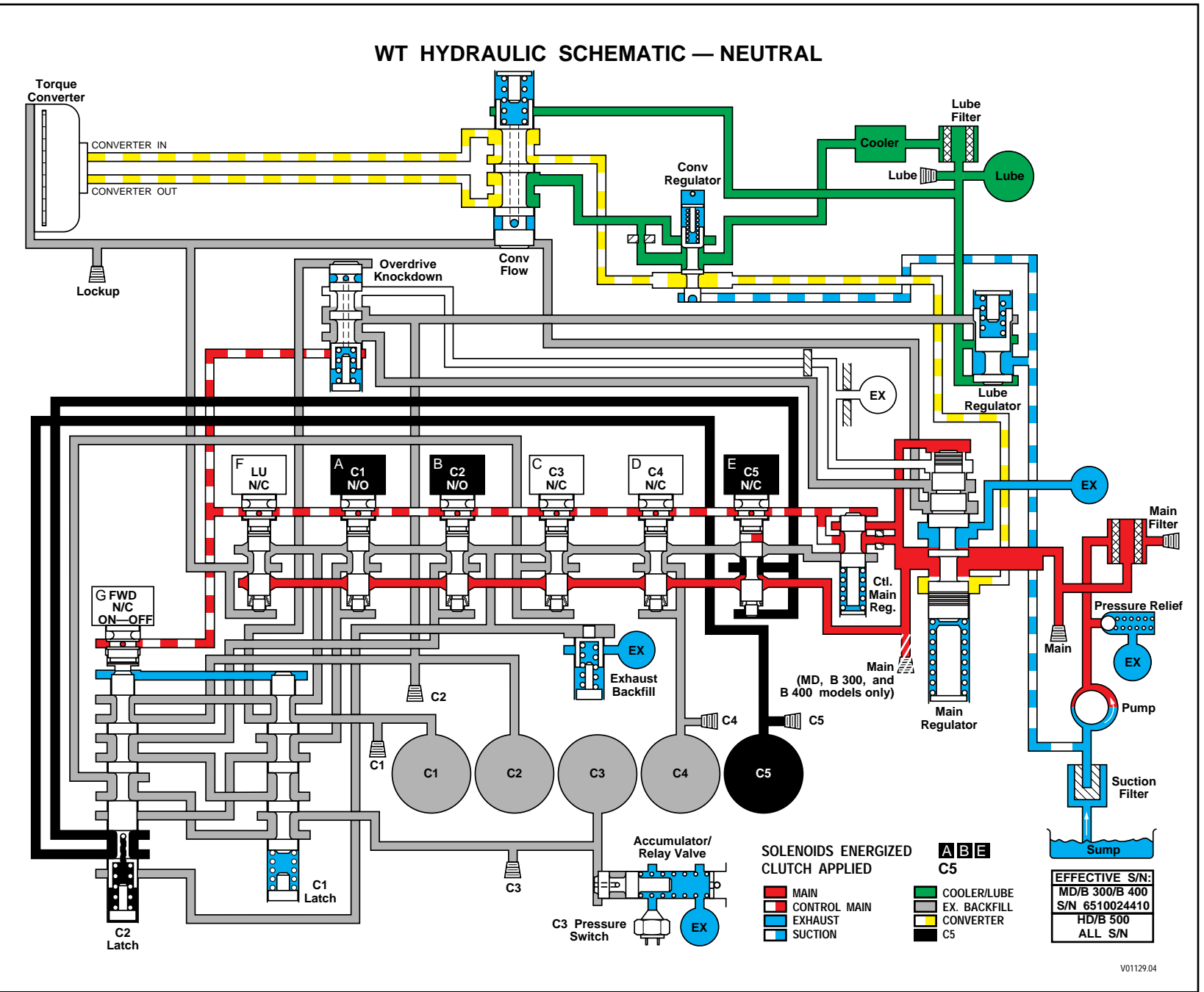


Figure H-1. C2 Latch Valve Detail

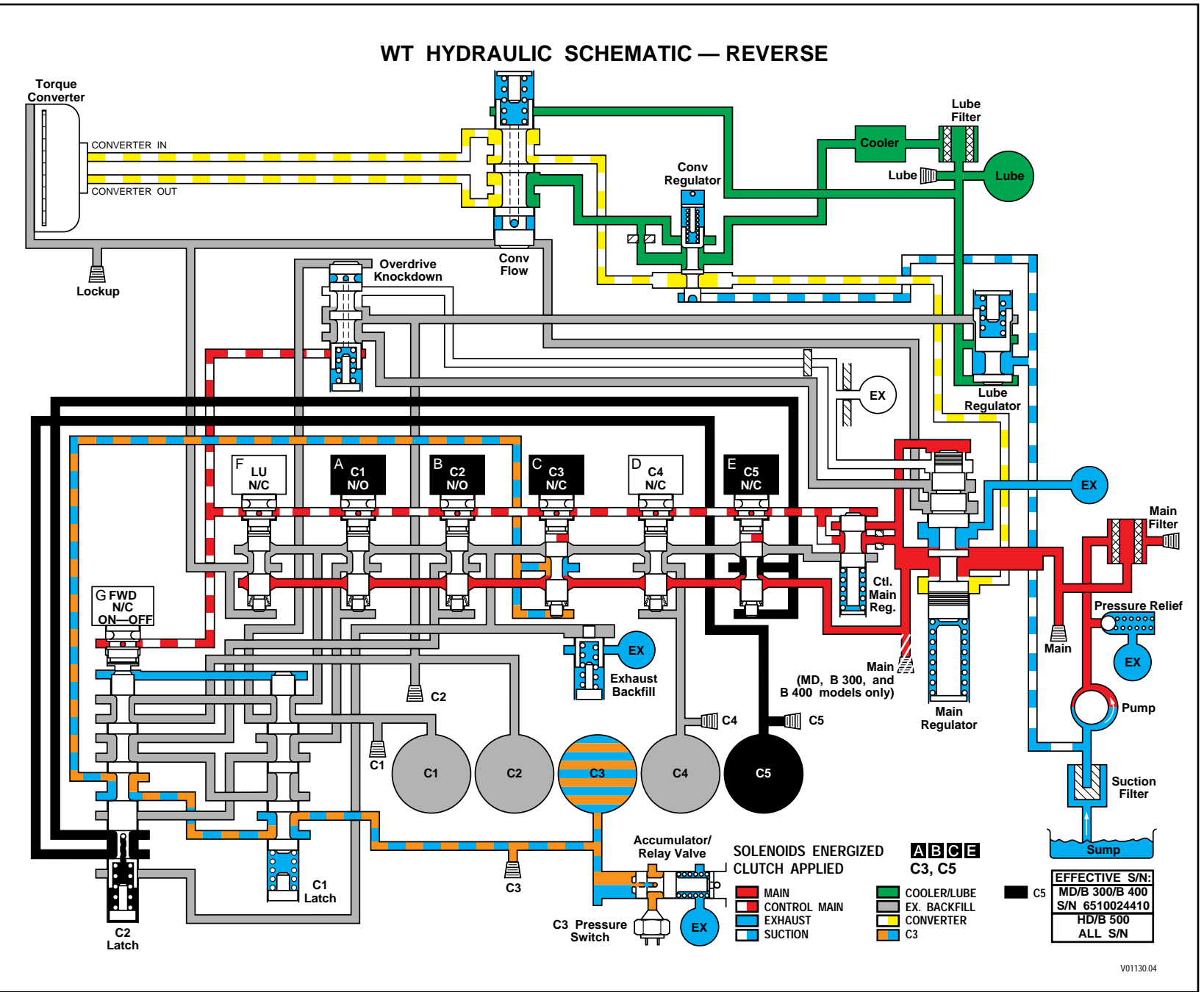
APPENDIX H — HYDRAULIC SCHEMATICS



V01129.04

Figure H-2. WT Hydraulic Schematic — Neutral

APPENDIX H — HYDRAULIC SCHEMATICS



V01130.04

Figure H-3. WT Hydraulic Schematic — Reverse

APPENDIX H — HYDRAULIC SCHEMATICS

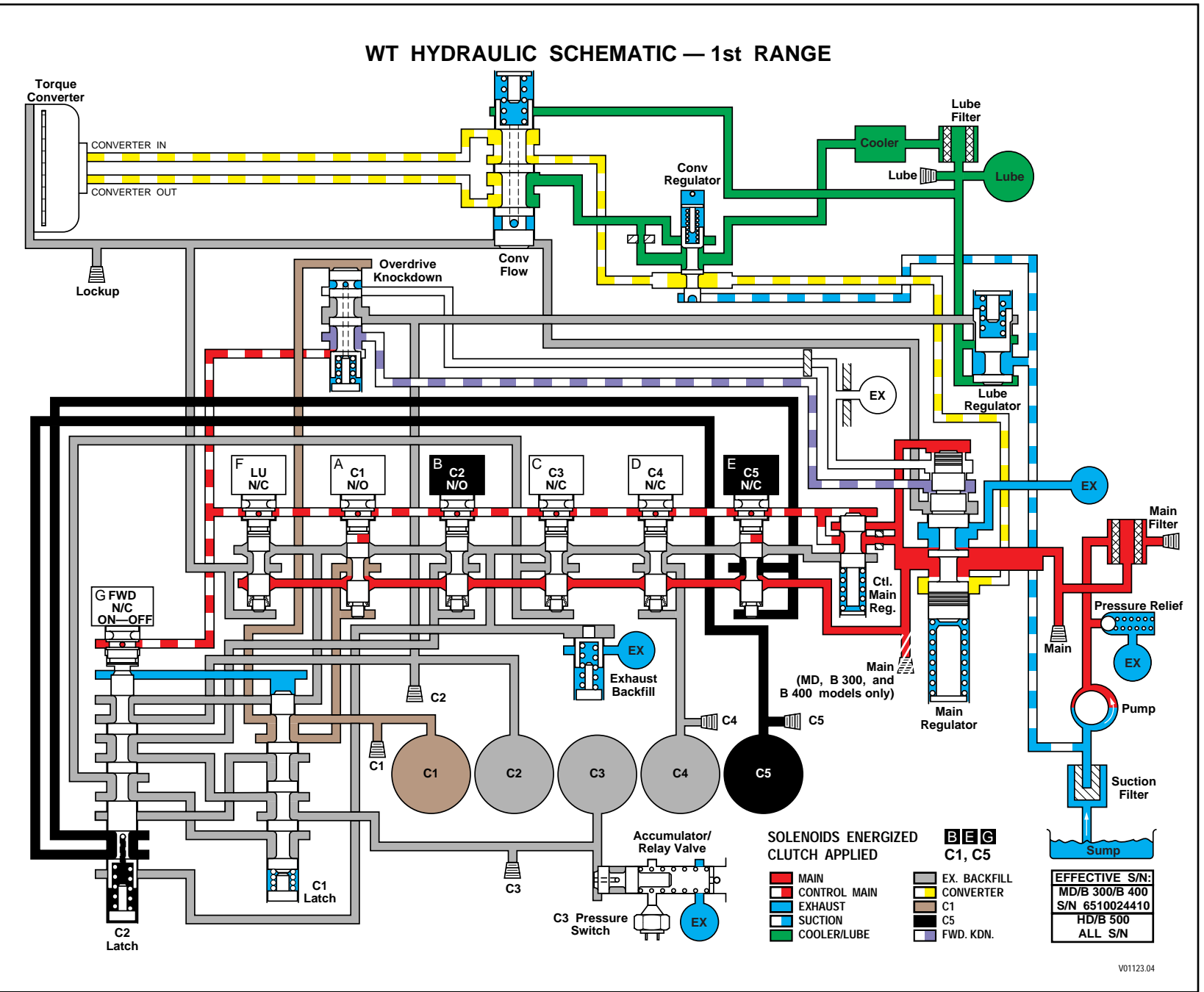


Figure H-4. WT Hydraulic Schematic — 1st Range

APPENDIX H — HYDRAULIC SCHEMATICS

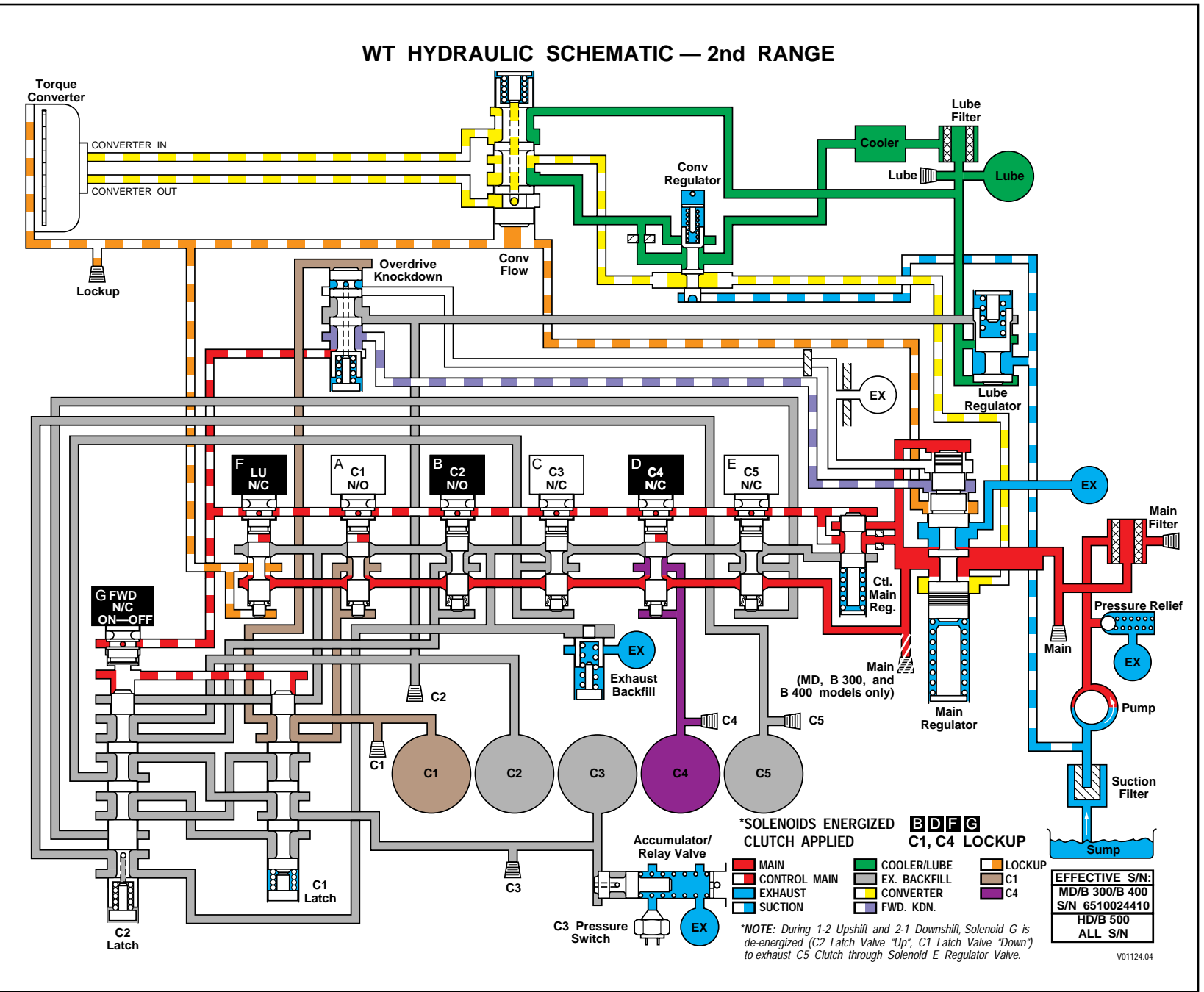


Figure H-5. WT Hydraulic Schematic — 2nd Range

APPENDIX H — HYDRAULIC SCHEMATICS

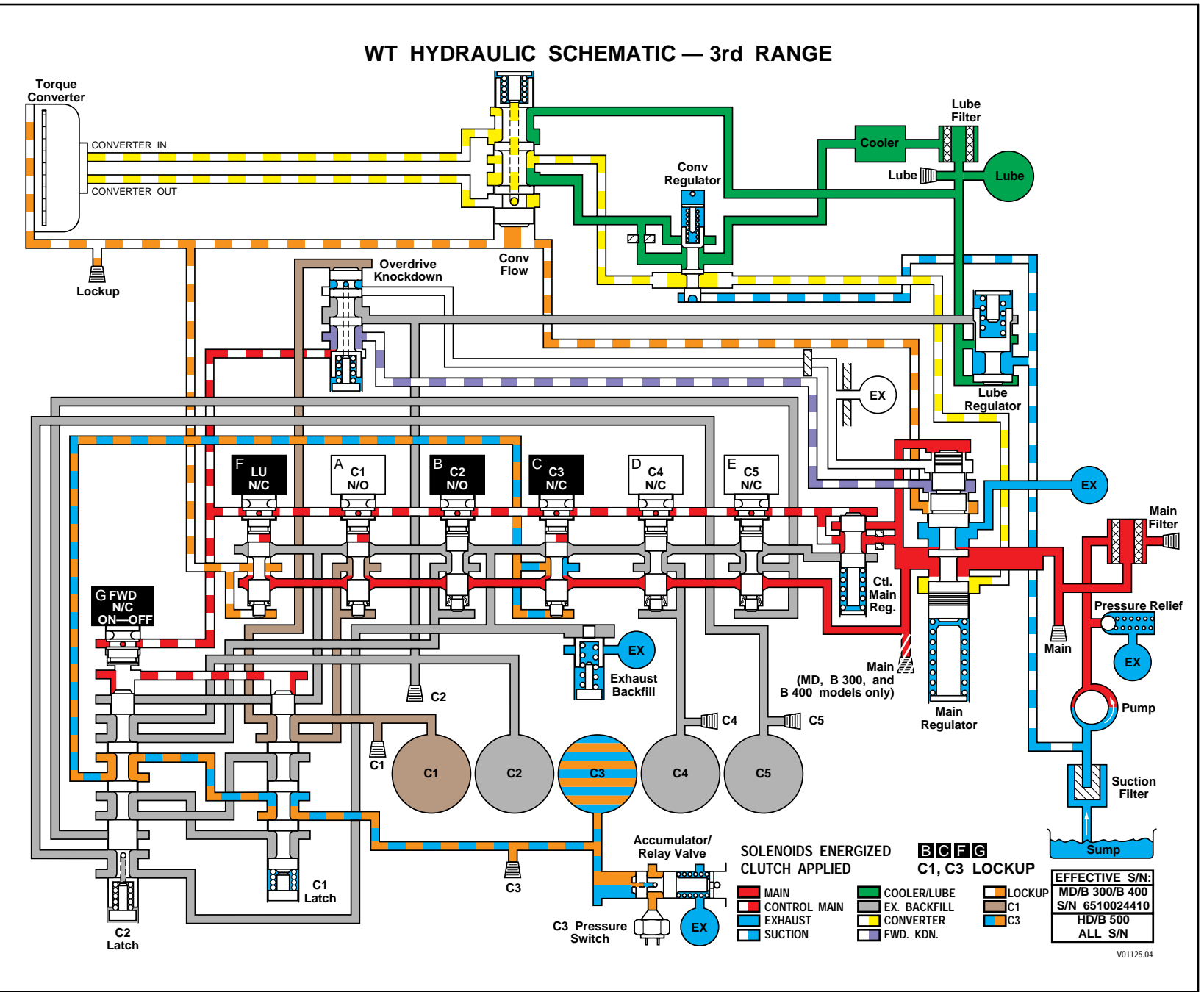


Figure H-6. WT Hydraulic Schematic — 3rd Range

APPENDIX H — HYDRAULIC SCHEMATICS

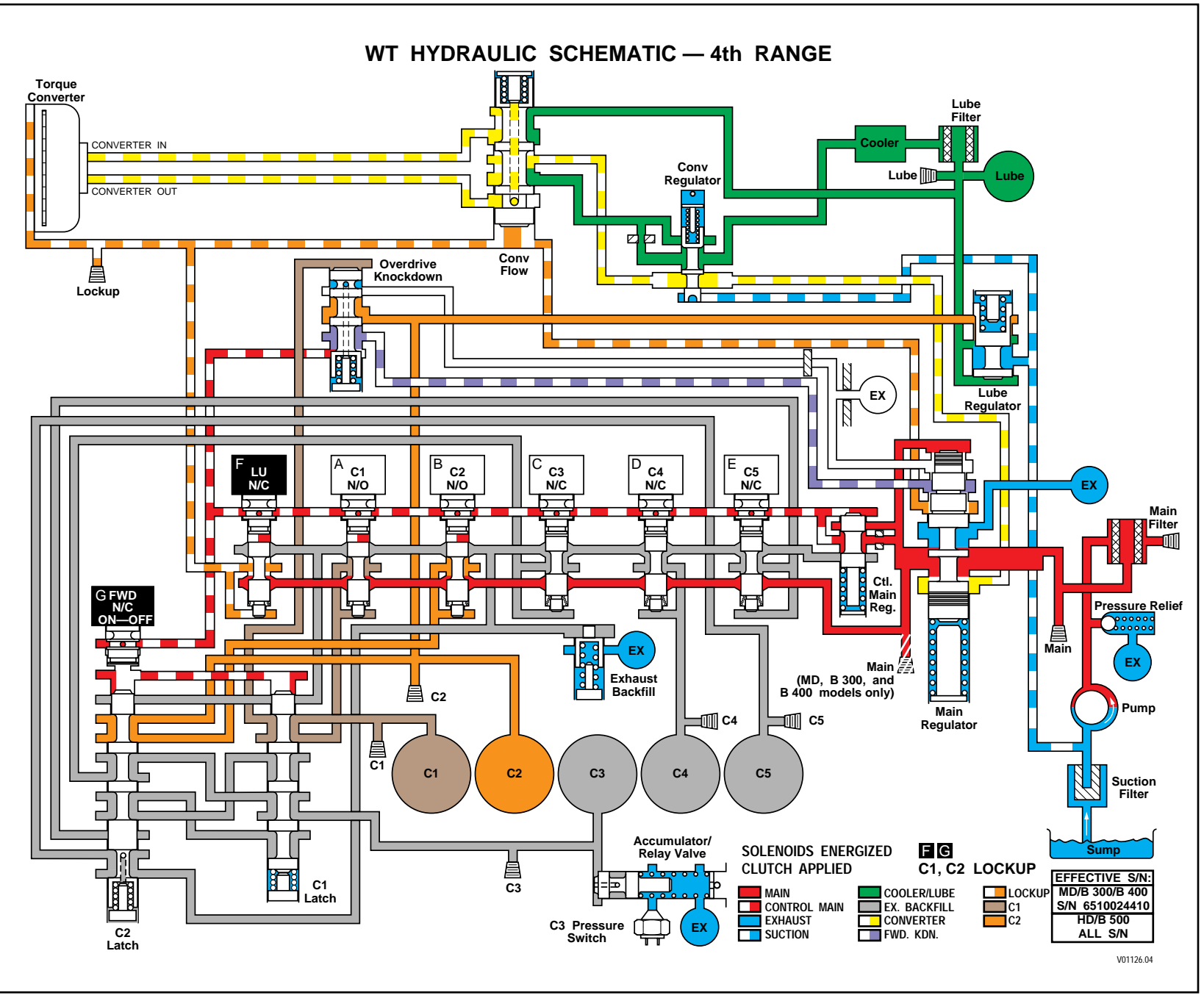


Figure H-7. WT Hydraulic Schematic — 4th Range

APPENDIX H — HYDRAULIC SCHEMATICS

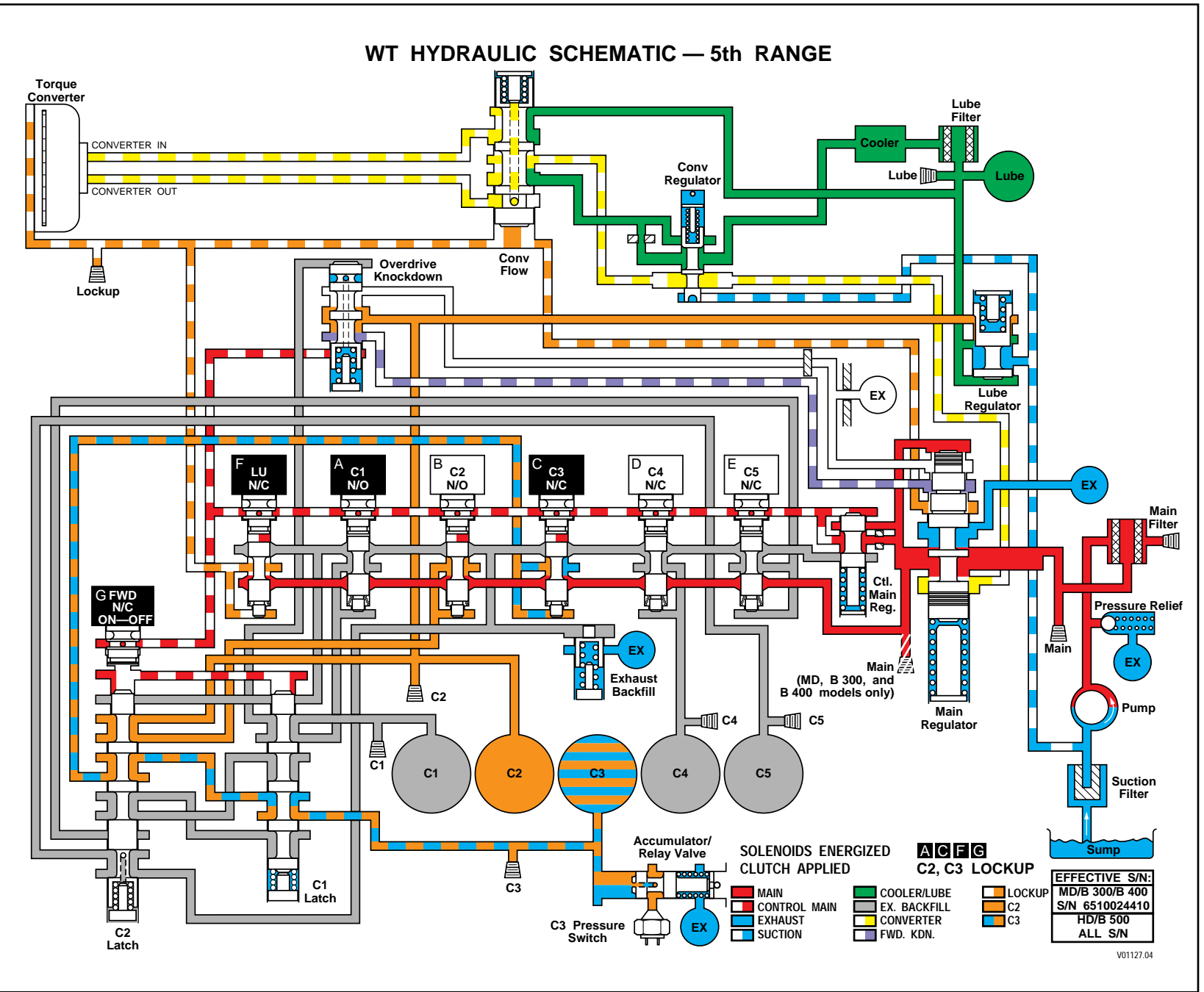


Figure H-8. WT Hydraulic Schematic — 5th Range

APPENDIX H — HYDRAULIC SCHEMATICS

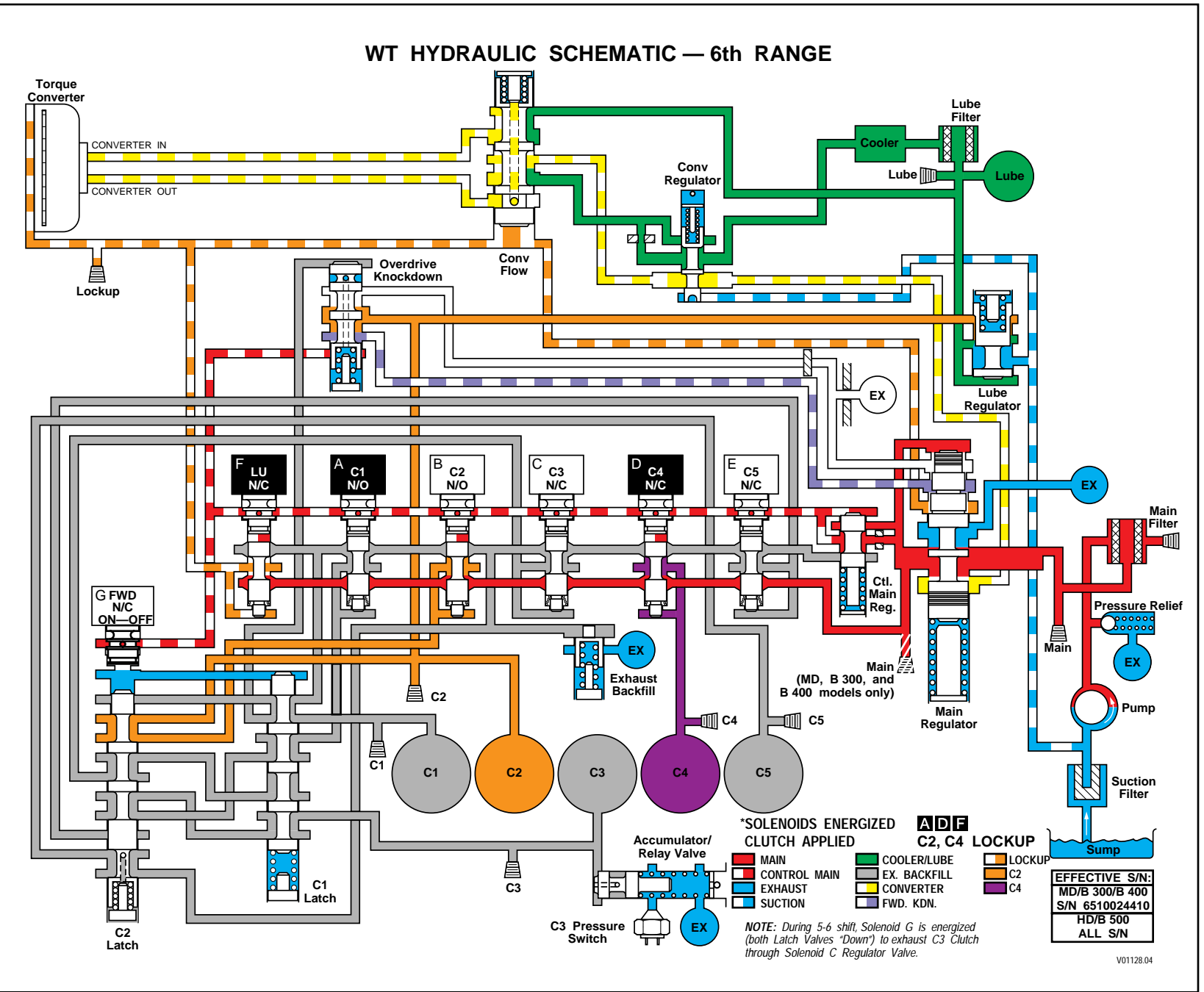
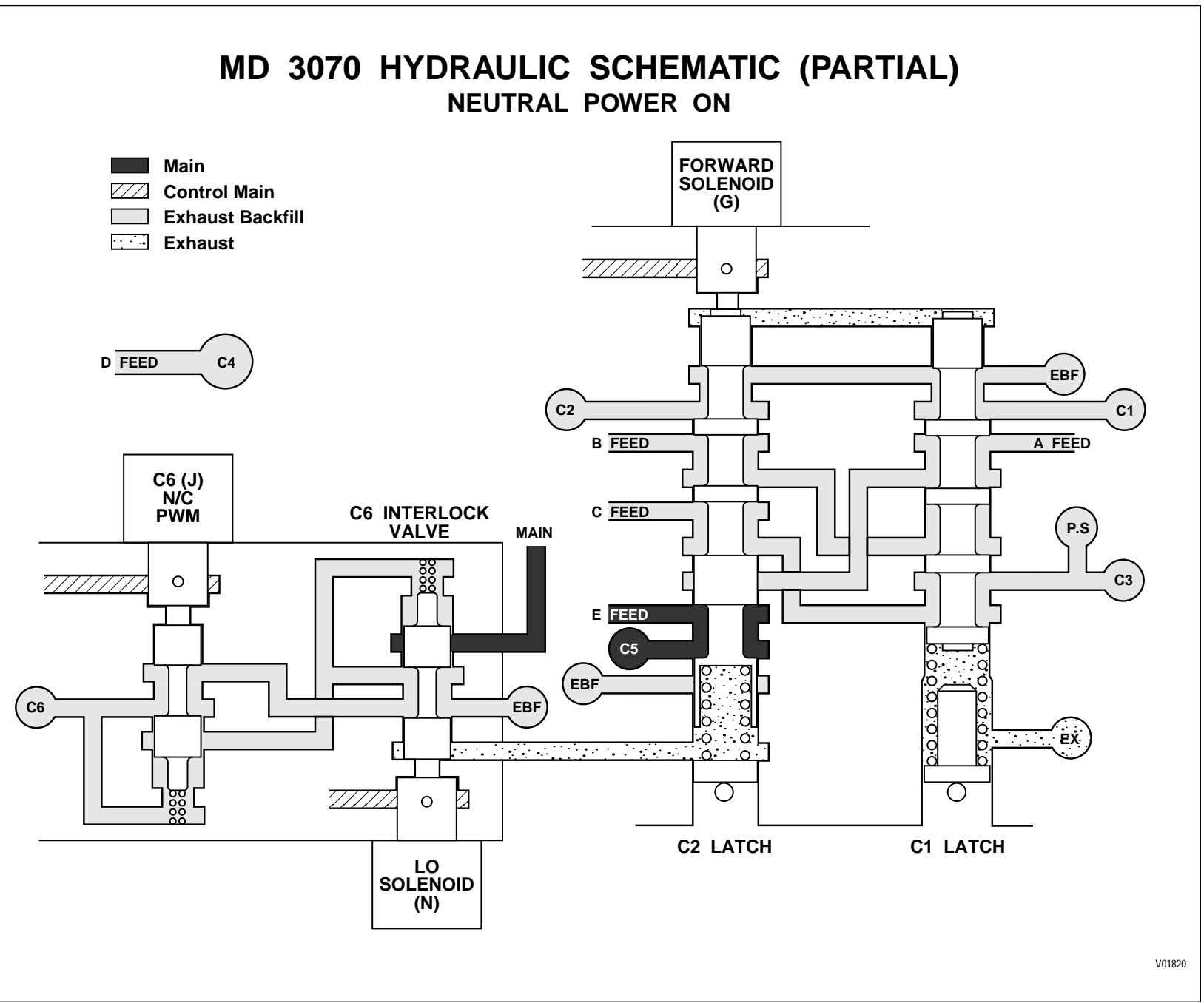


Figure H-9. WT Hydraulic Schematic — 6th Range

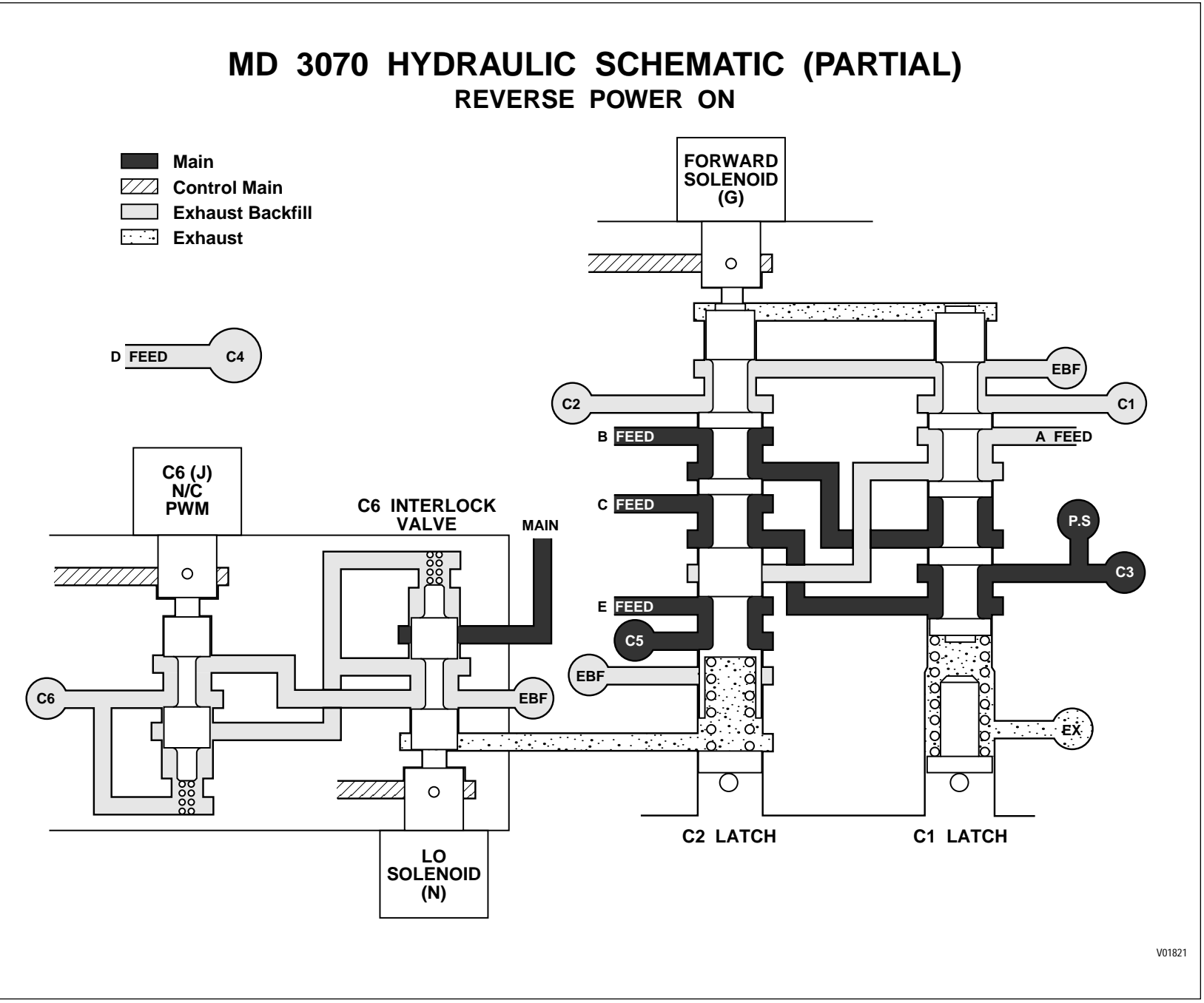
APPENDIX H — HYDRAULIC SCHEMATICS



V01820

Figure H-10. MD 3070 Hydraulic Schematic — Neutral, Power On

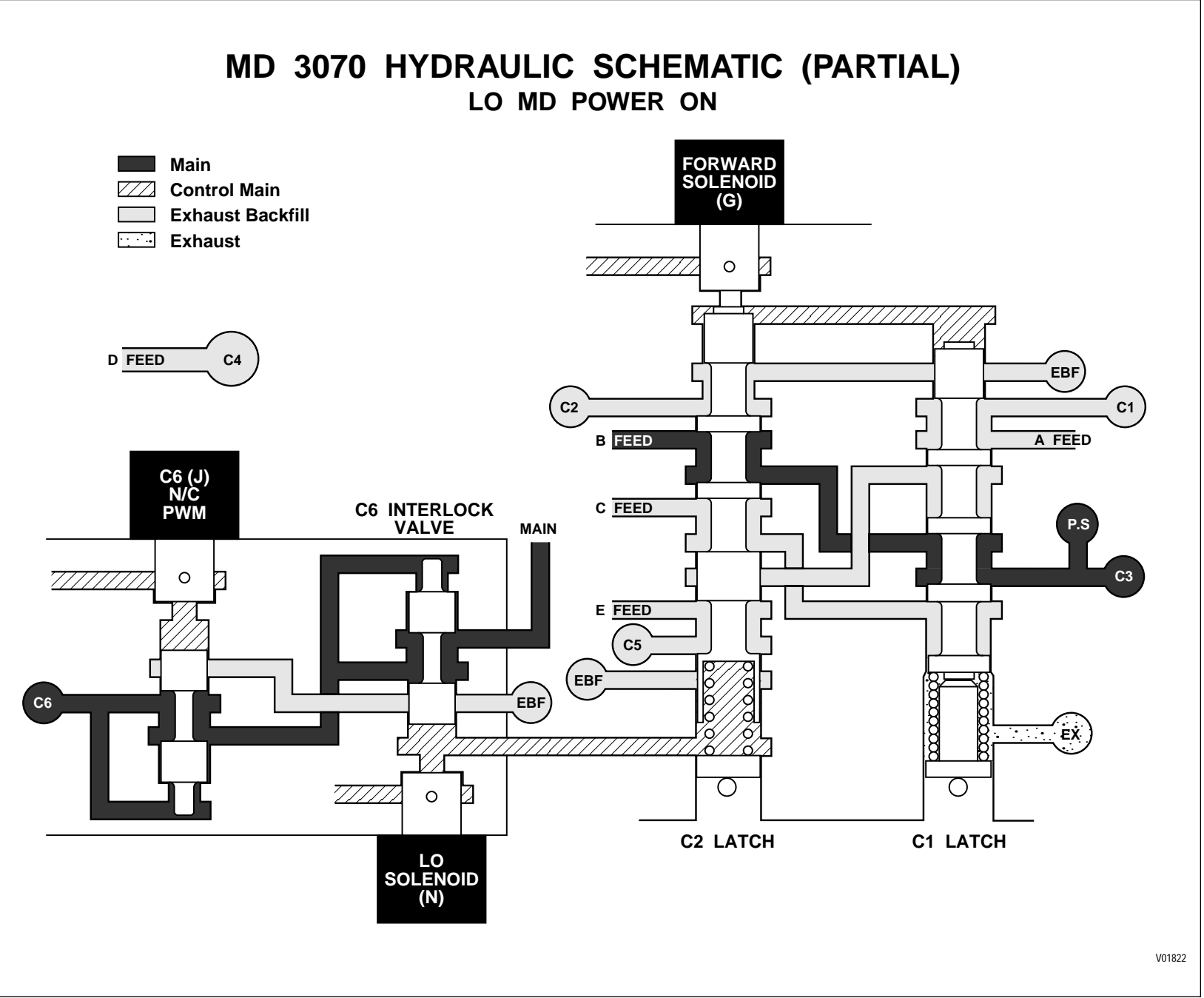
APPENDIX H — HYDRAULIC SCHEMATICS



V01821

Figure H-11. MD 3070 Hydraulic Schematic — Reverse, Power On

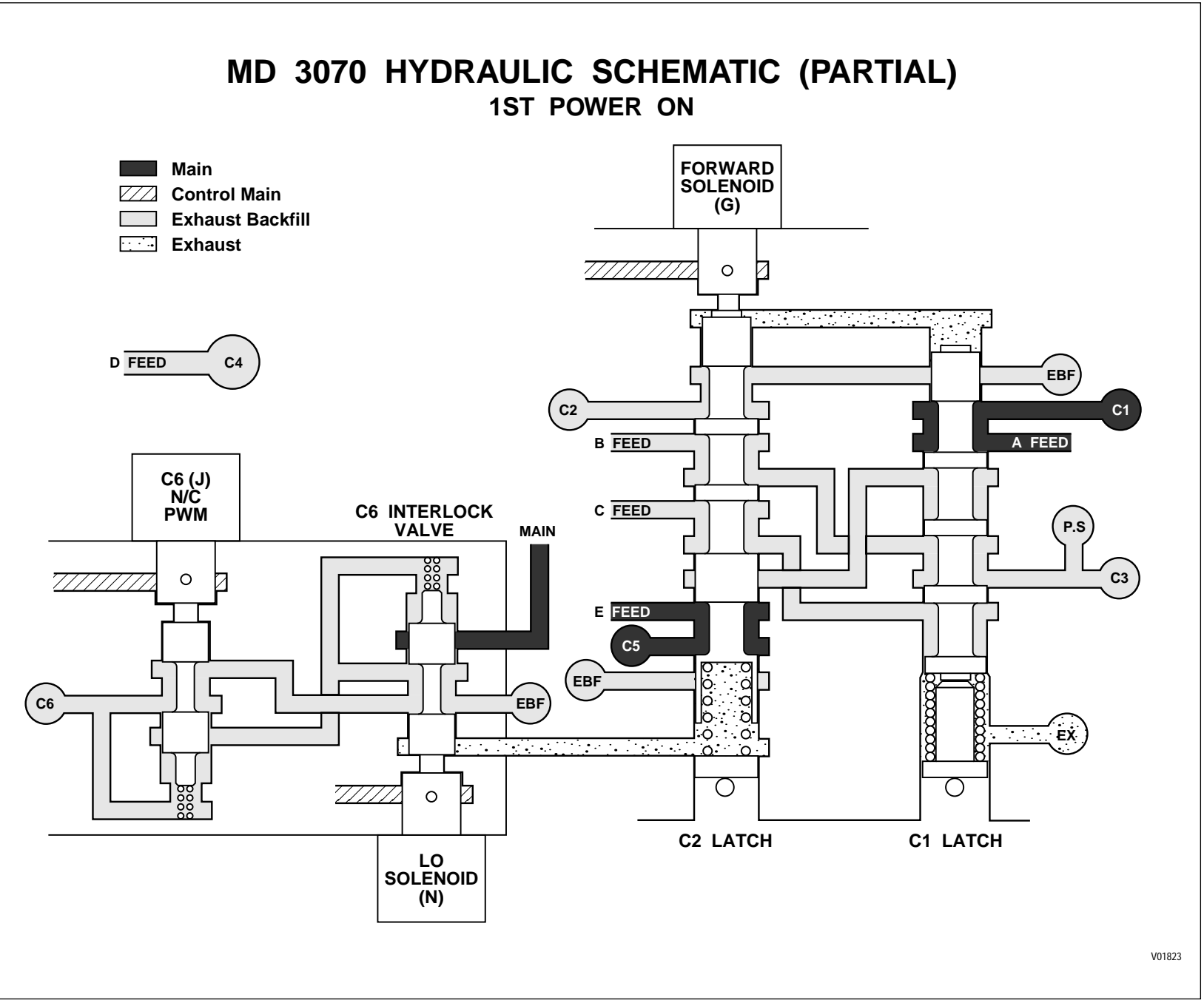
APPENDIX H — HYDRAULIC SCHEMATICS



V01822

Figure H-12. MD 3070 Hydraulic Schematic — Lo MD, Power On

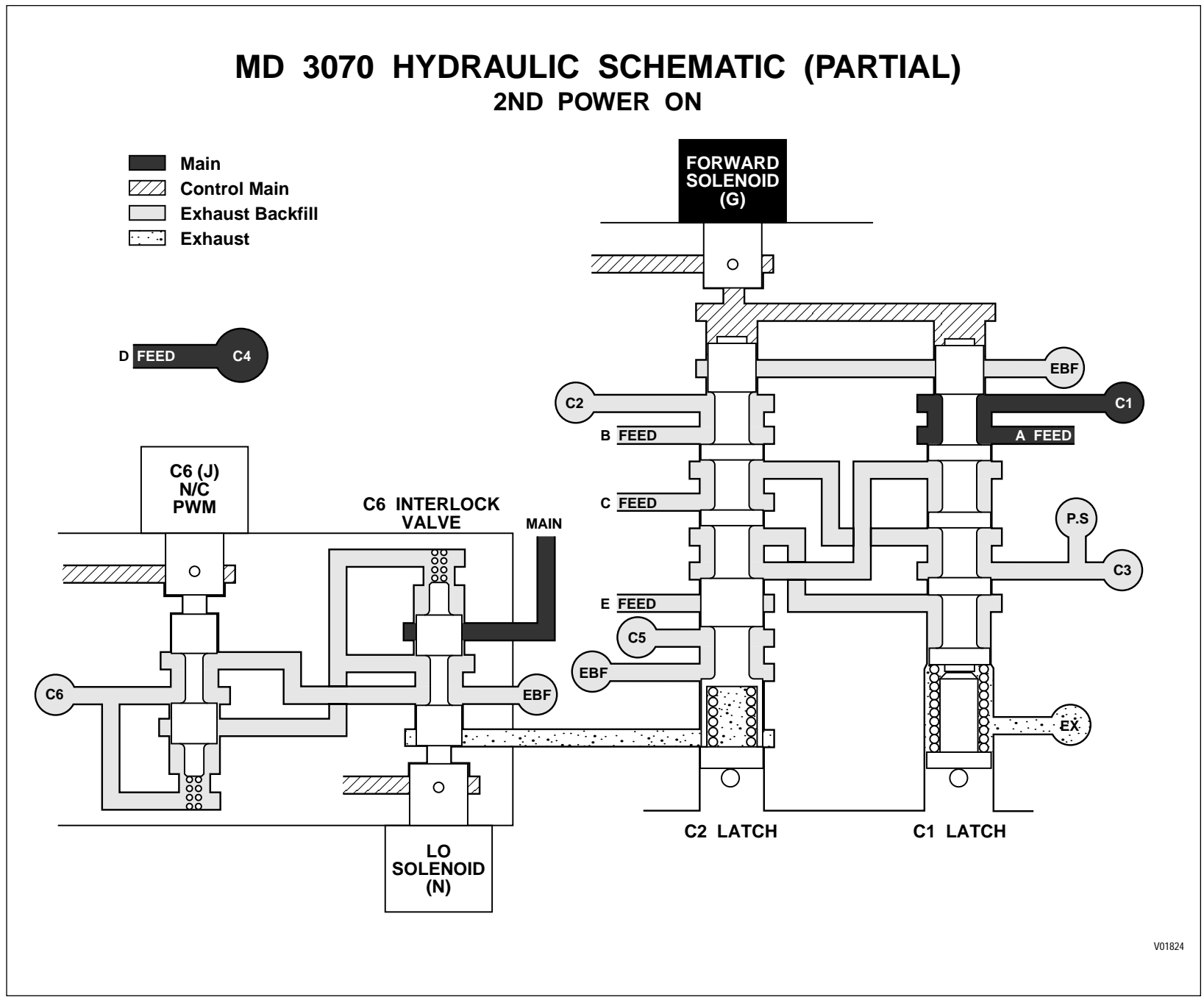
APPENDIX H — HYDRAULIC SCHEMATICS



V01823

Figure H-13: MD 3070 Hydraulic Schematic — 1st, Power On

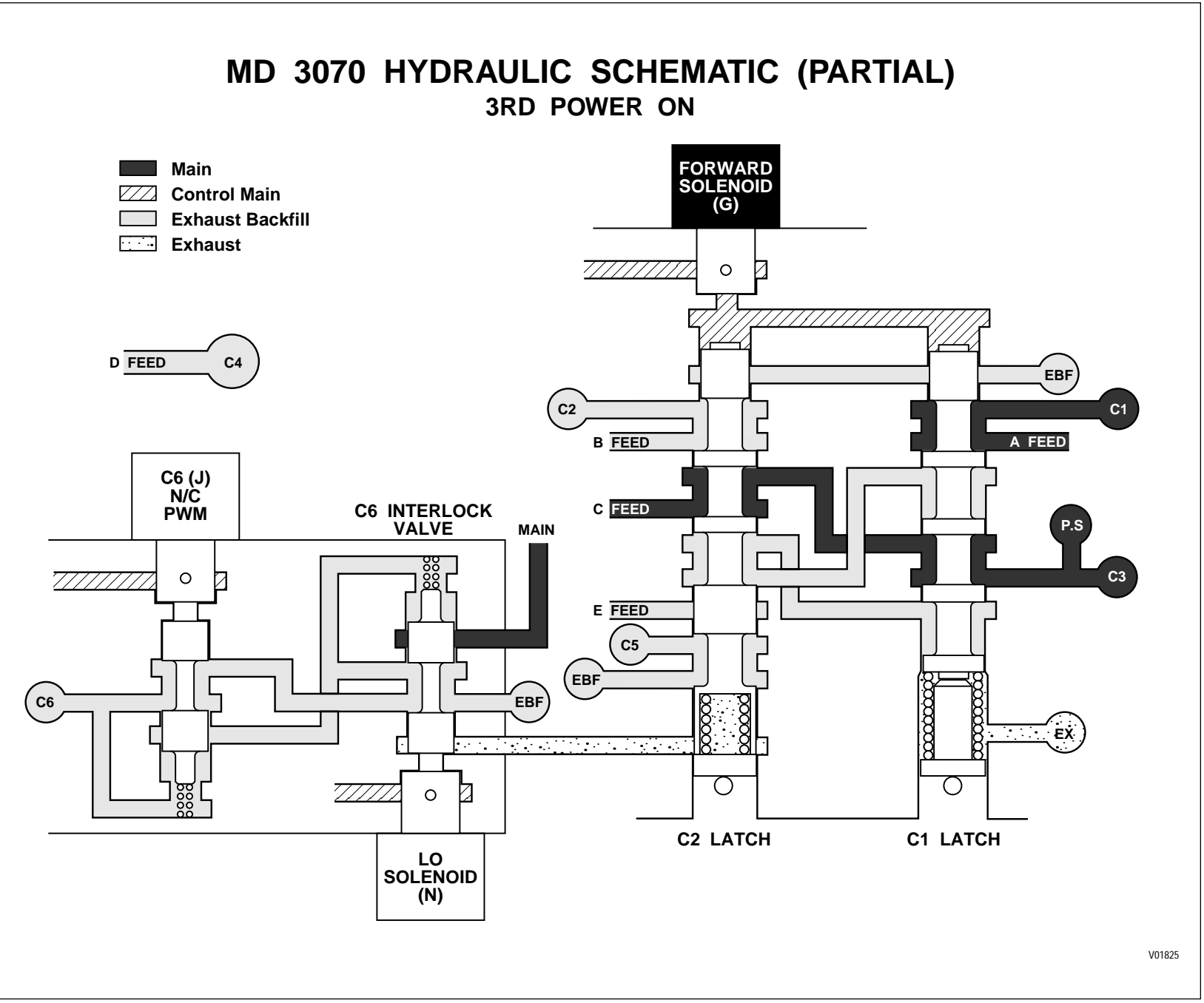
APPENDIX H — HYDRAULIC SCHEMATICS



V01824

Figure H-14. MD 3070 Hydraulic Schematic — 2nd, Power On

APPENDIX H — HYDRAULIC SCHEMATICS

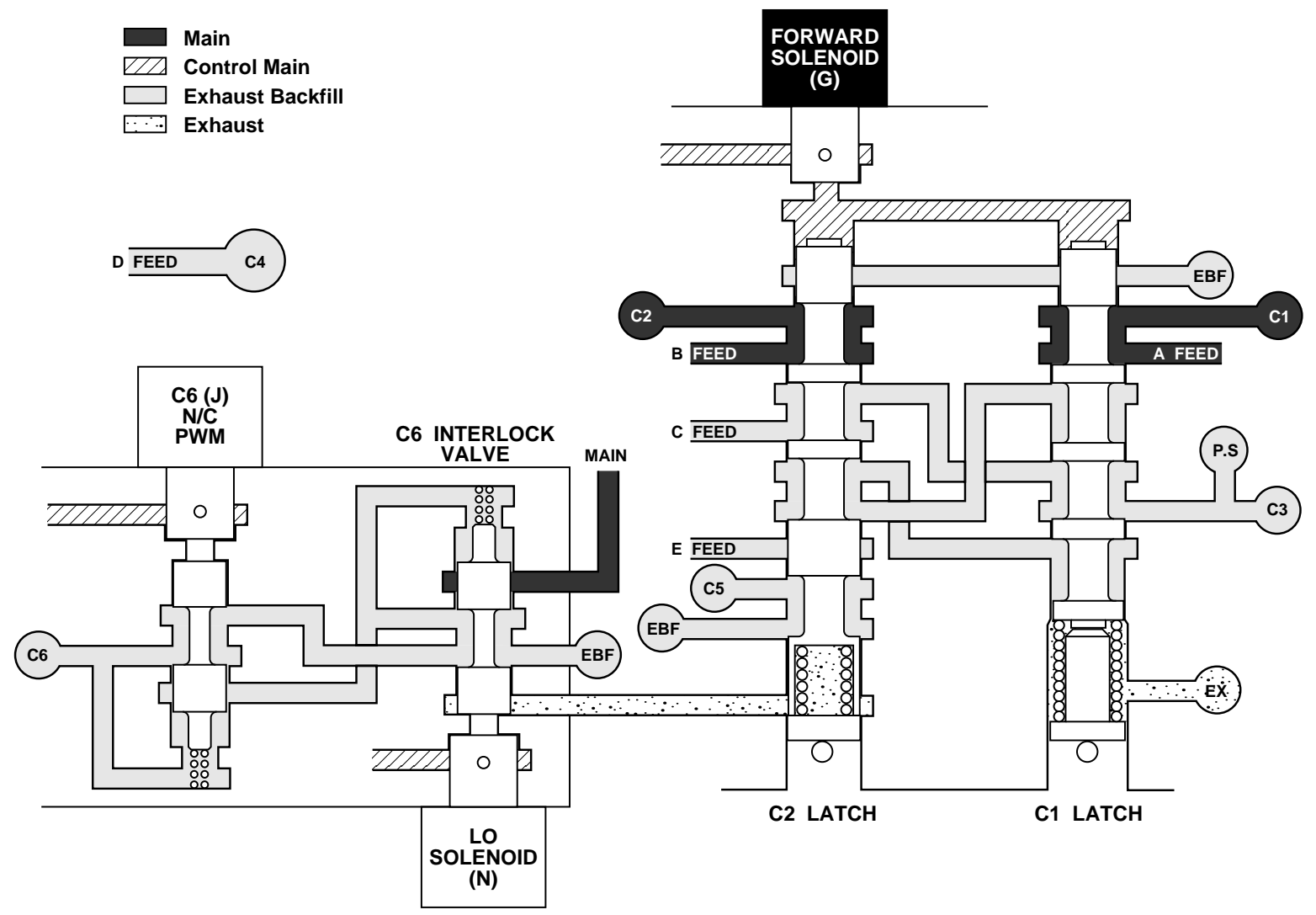


V01825

Figure H-15. MD 3070 Hydraulic Schematic — 3rd, Power On

APPENDIX H — HYDRAULIC SCHEMATICS

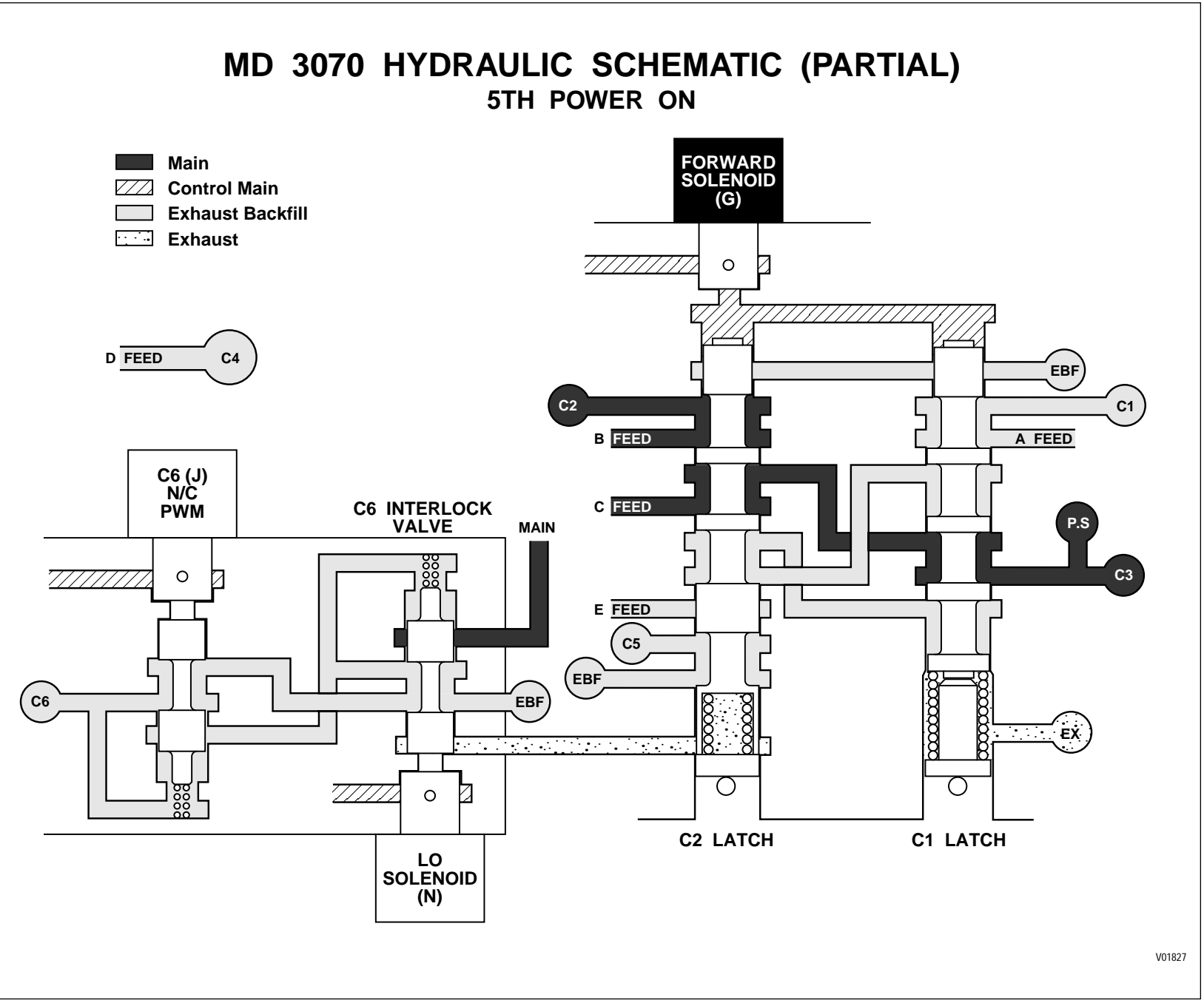
MD 3070 HYDRAULIC SCHEMATIC (PARTIAL)
4TH POWER ON



V01826

Figure H-16. MD 3070 Hydraulic Schematic — 4th, Power On

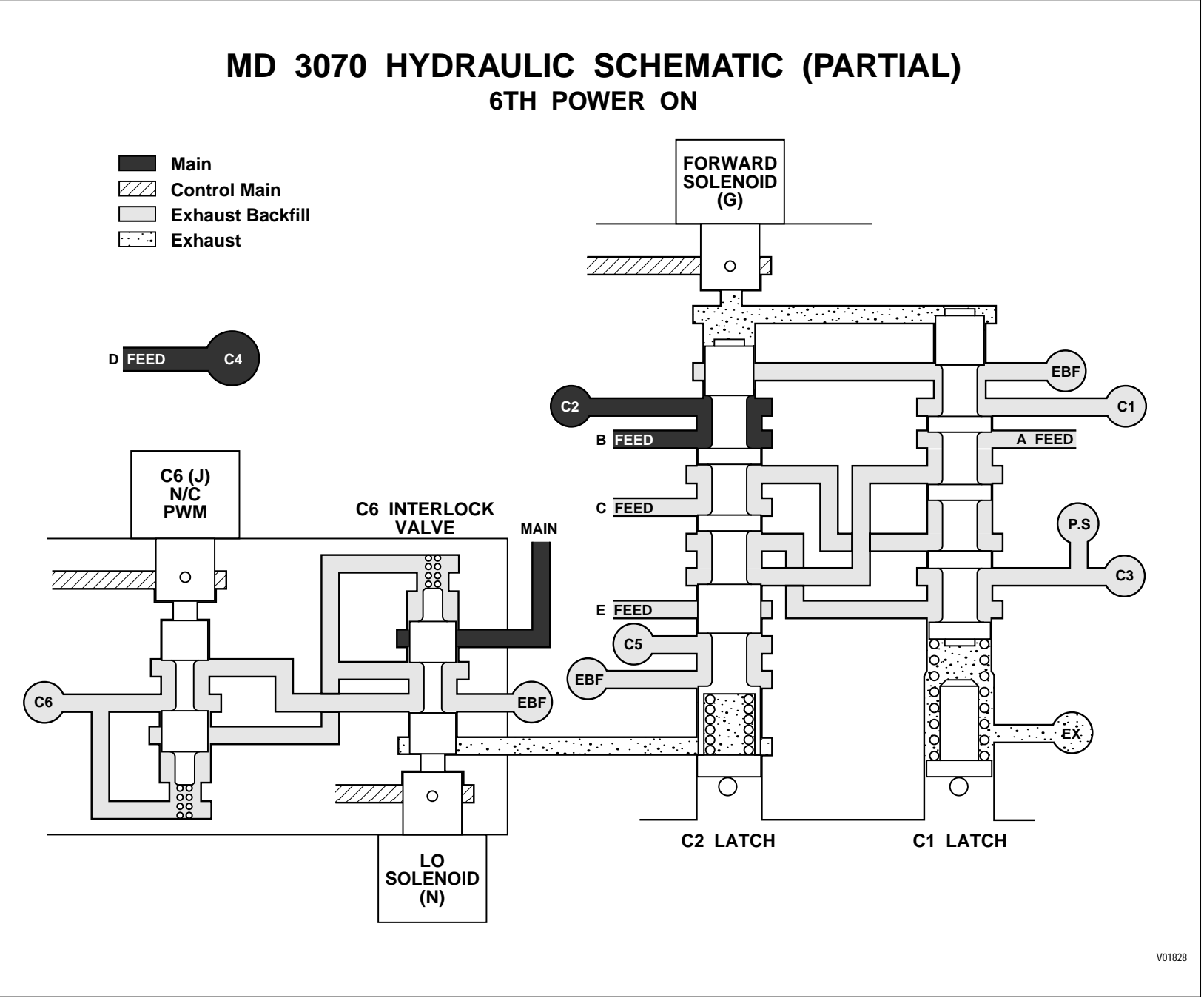
APPENDIX H — HYDRAULIC SCHEMATICS



V01827

Figure H-17. MD 3070 Hydraulic Schematic — 5th, Power On

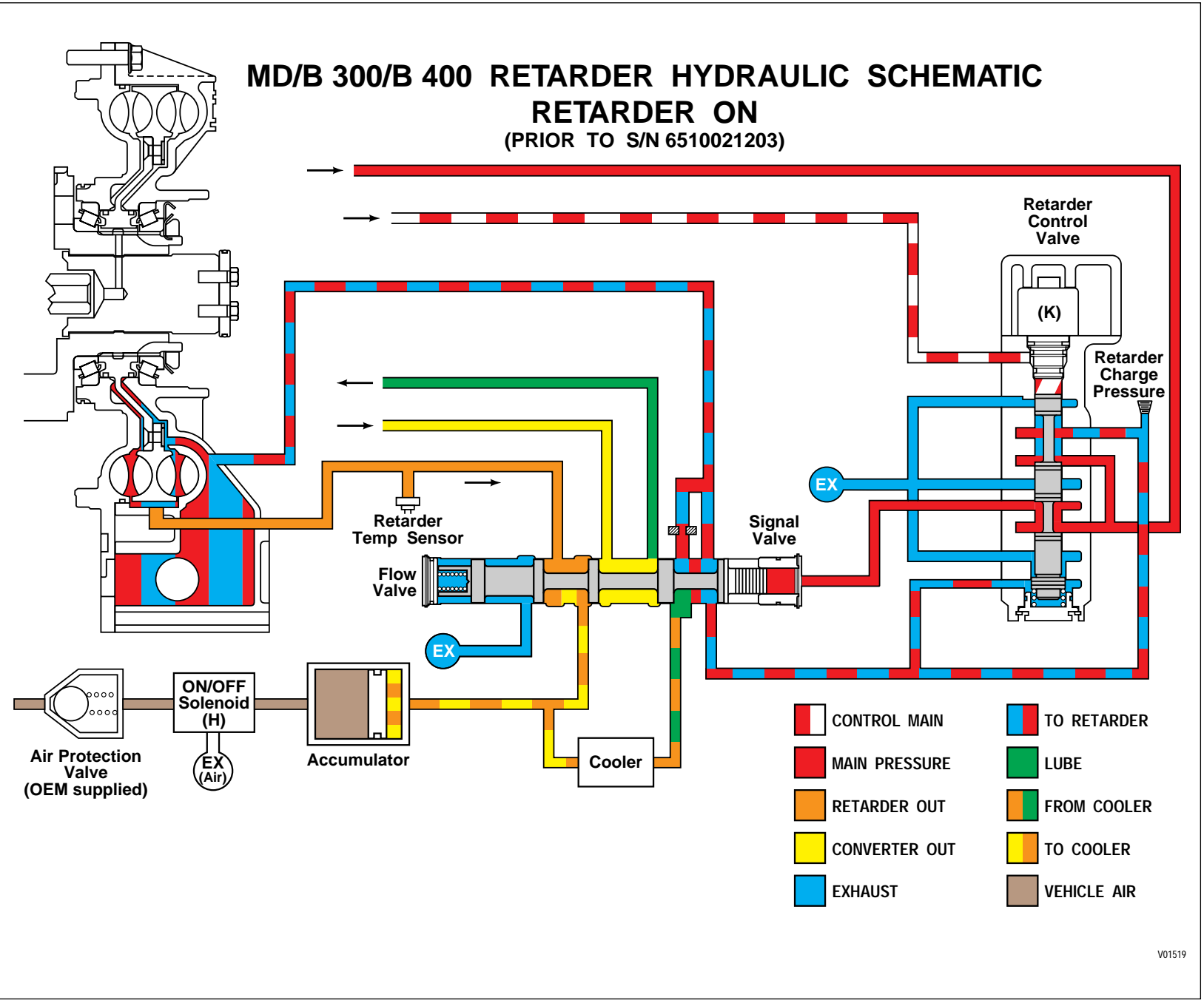
APPENDIX H — HYDRAULIC SCHEMATICS



V01828

Figure H-18. MD 3070 Hydraulic Schematic — 6th, Power On

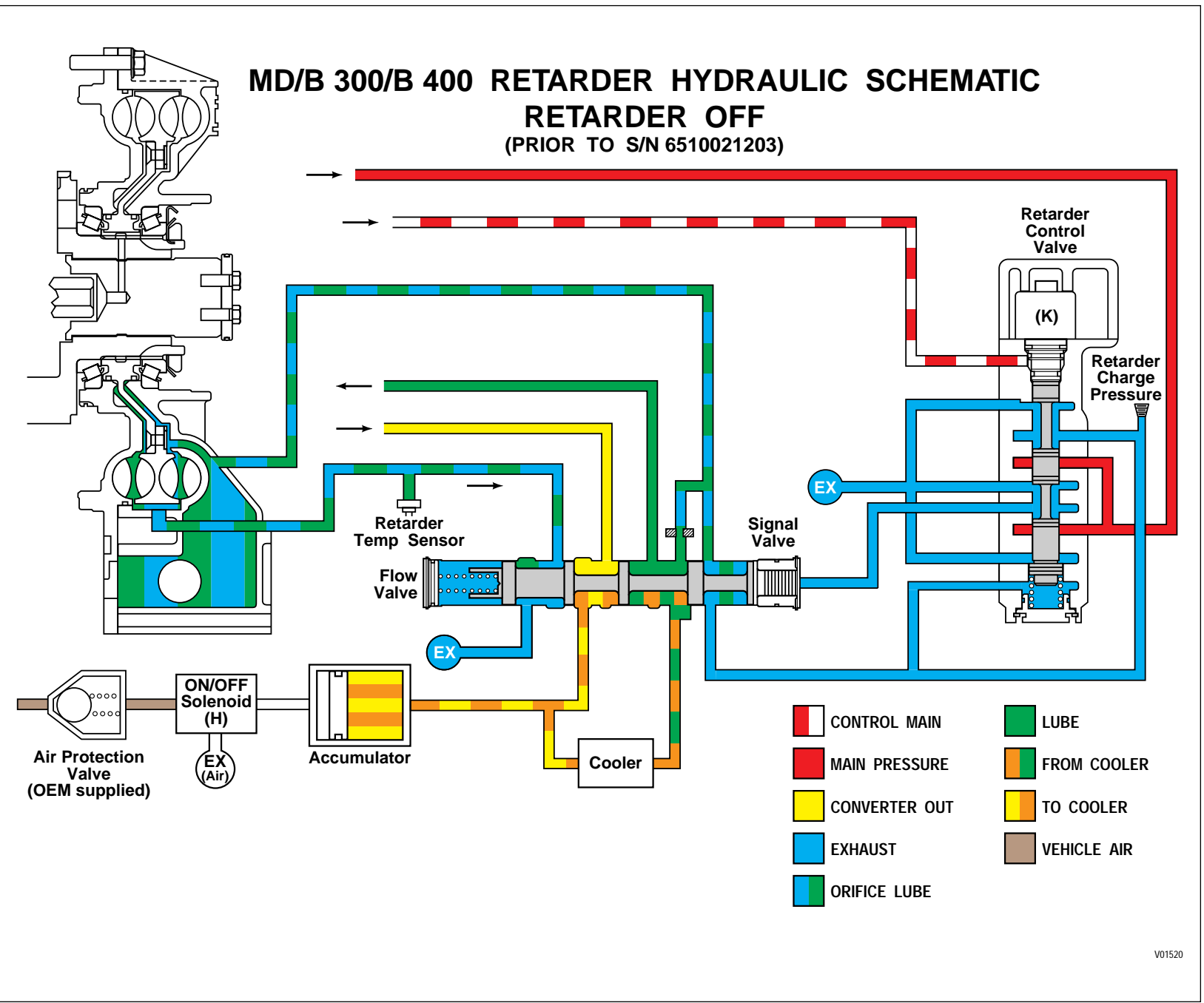
APPENDIX H — HYDRAULIC SCHEMATICS



V01519

Figure H-19. MD/B 300/B 400 Retarder Hydraulic Schematic, Retarder On (Prior To S/N 6510021203)

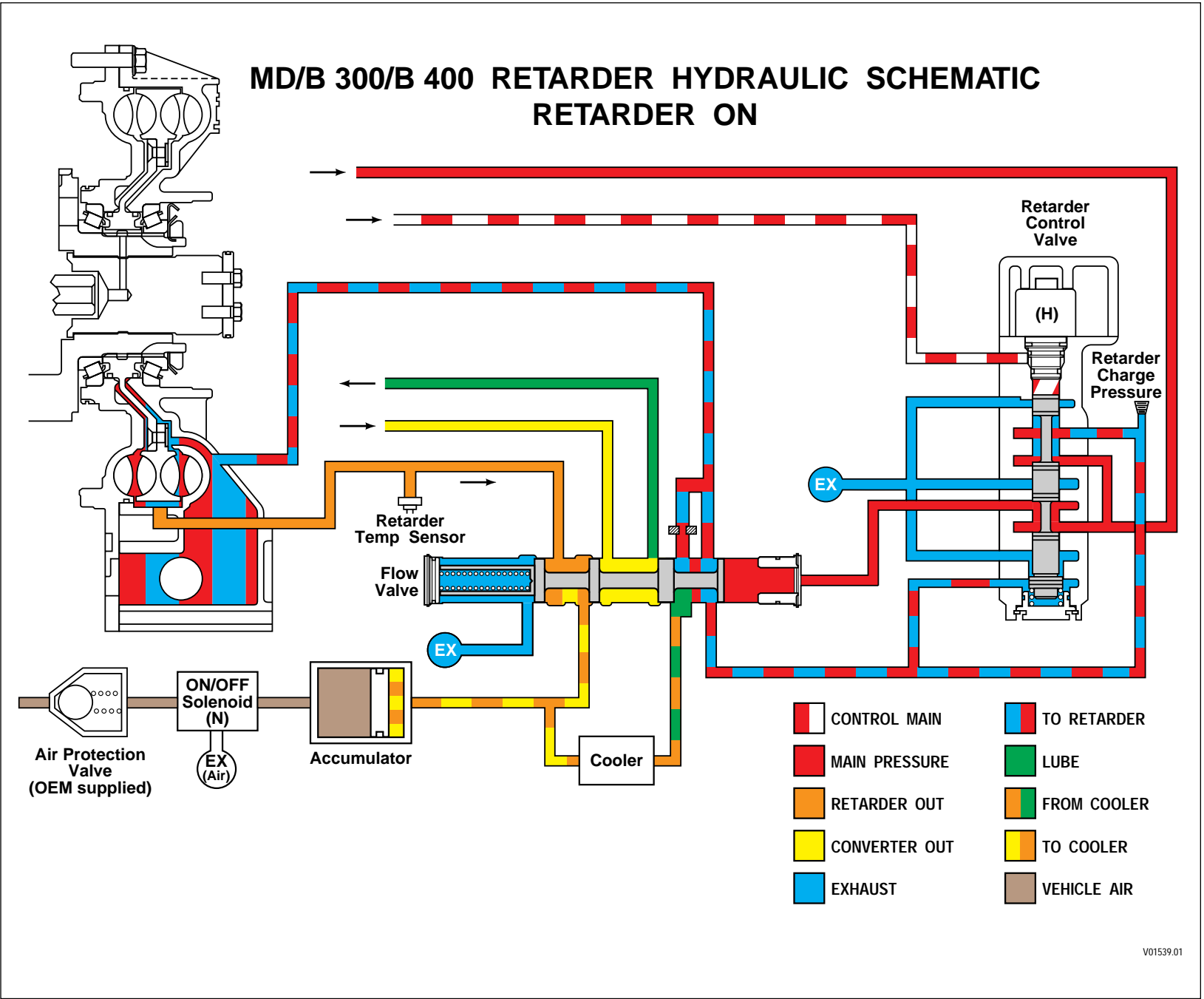
APPENDIX H — HYDRAULIC SCHEMATICS



V01520

Figure H-20. MD/B 300/B 400 Retarder Hydraulic Schematic, Retarder Off (Prior To S/N 6510021203)

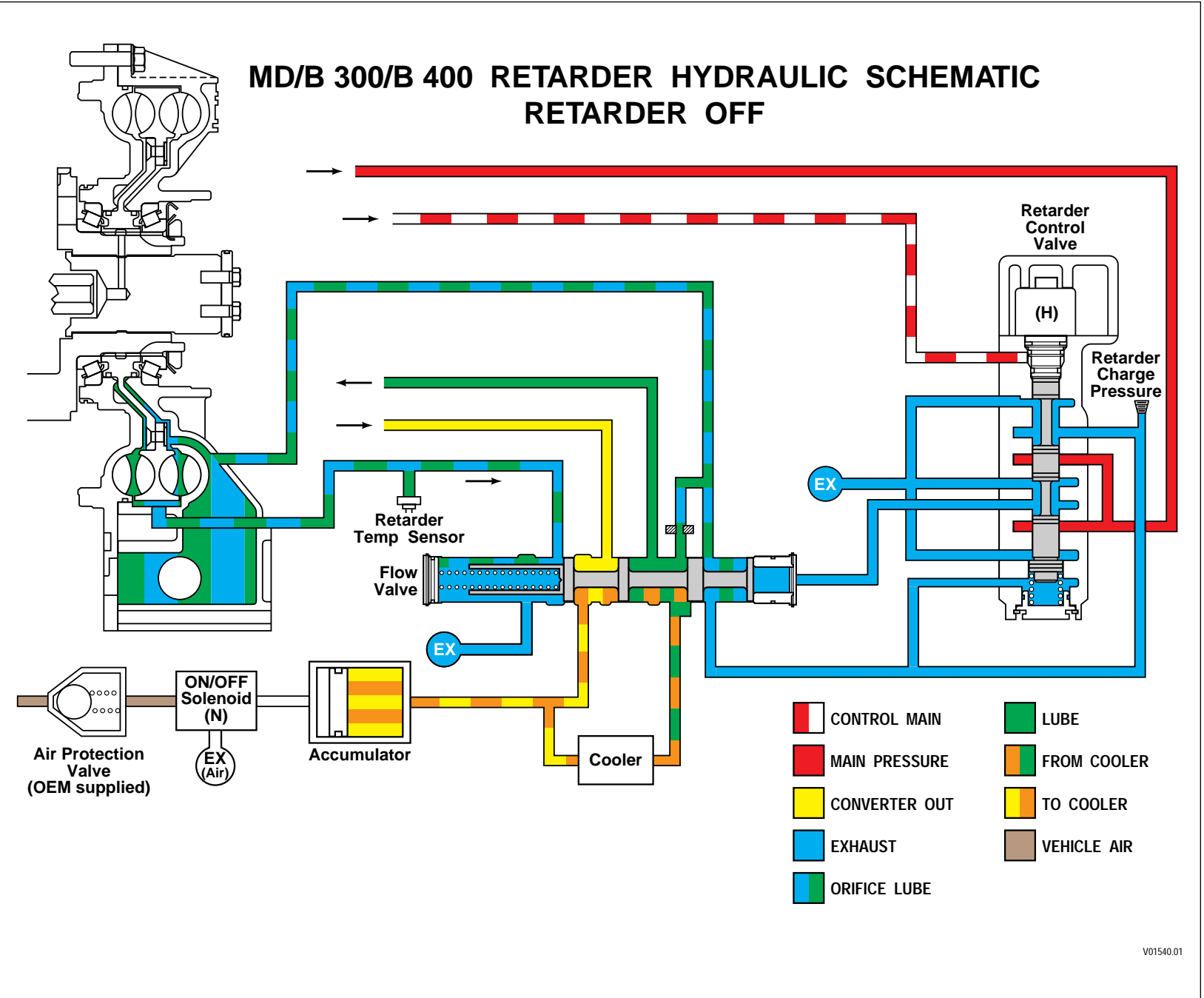
APPENDIX H — HYDRAULIC SCHEMATICS



V01539.01

Figure H-21. MD/B 300/B 400 Retarder Hydraulic Schematic, Retarder On (From S/N 6510021203 to December 31, 1997)

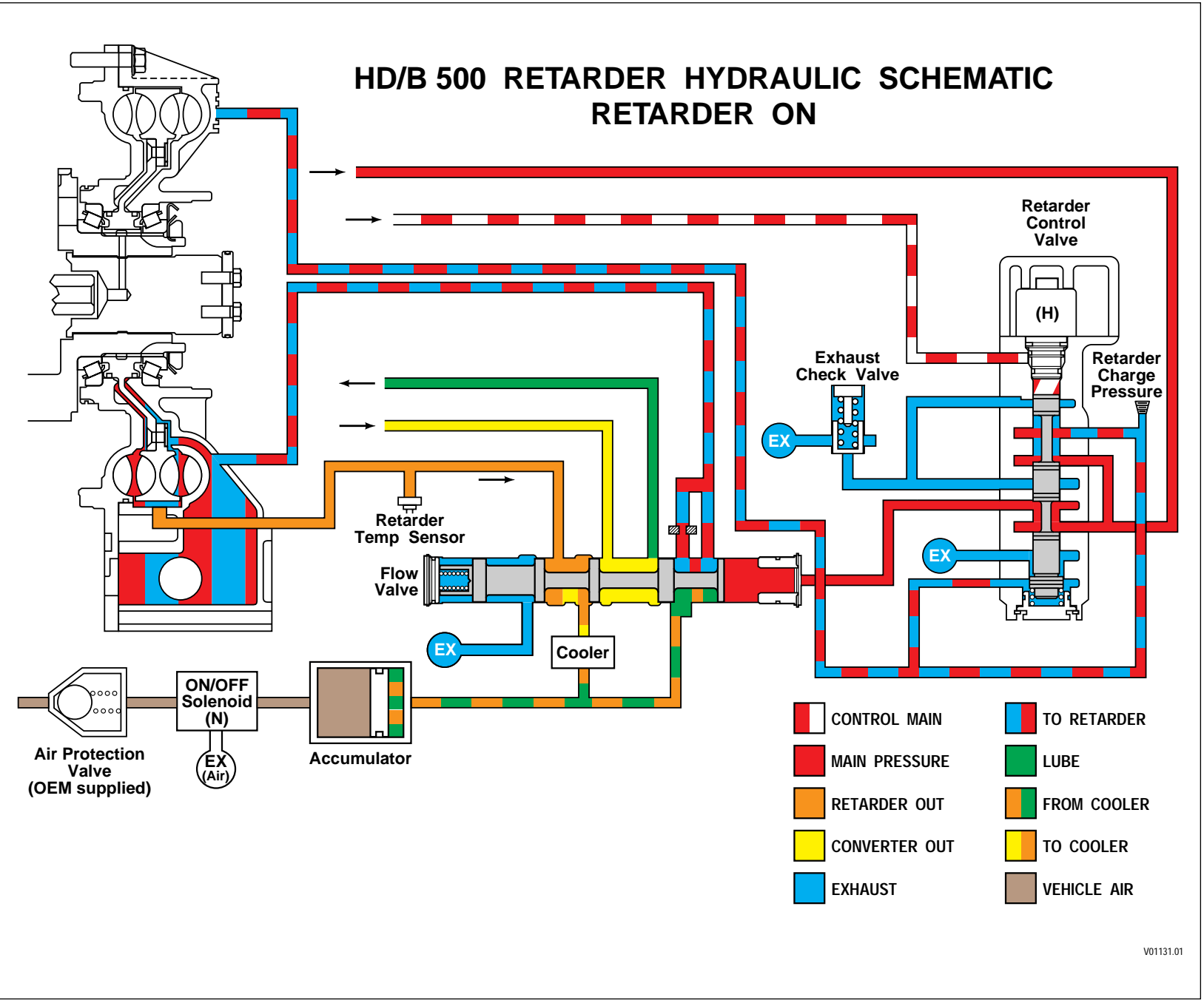
APPENDIX H — HYDRAULIC SCHEMATICS



V01540.01

Figure H-22. MD/B 300/B 400 Retarder Hydraulic Schematic, Retarder Off (From S/N 6510021203 to December 31,

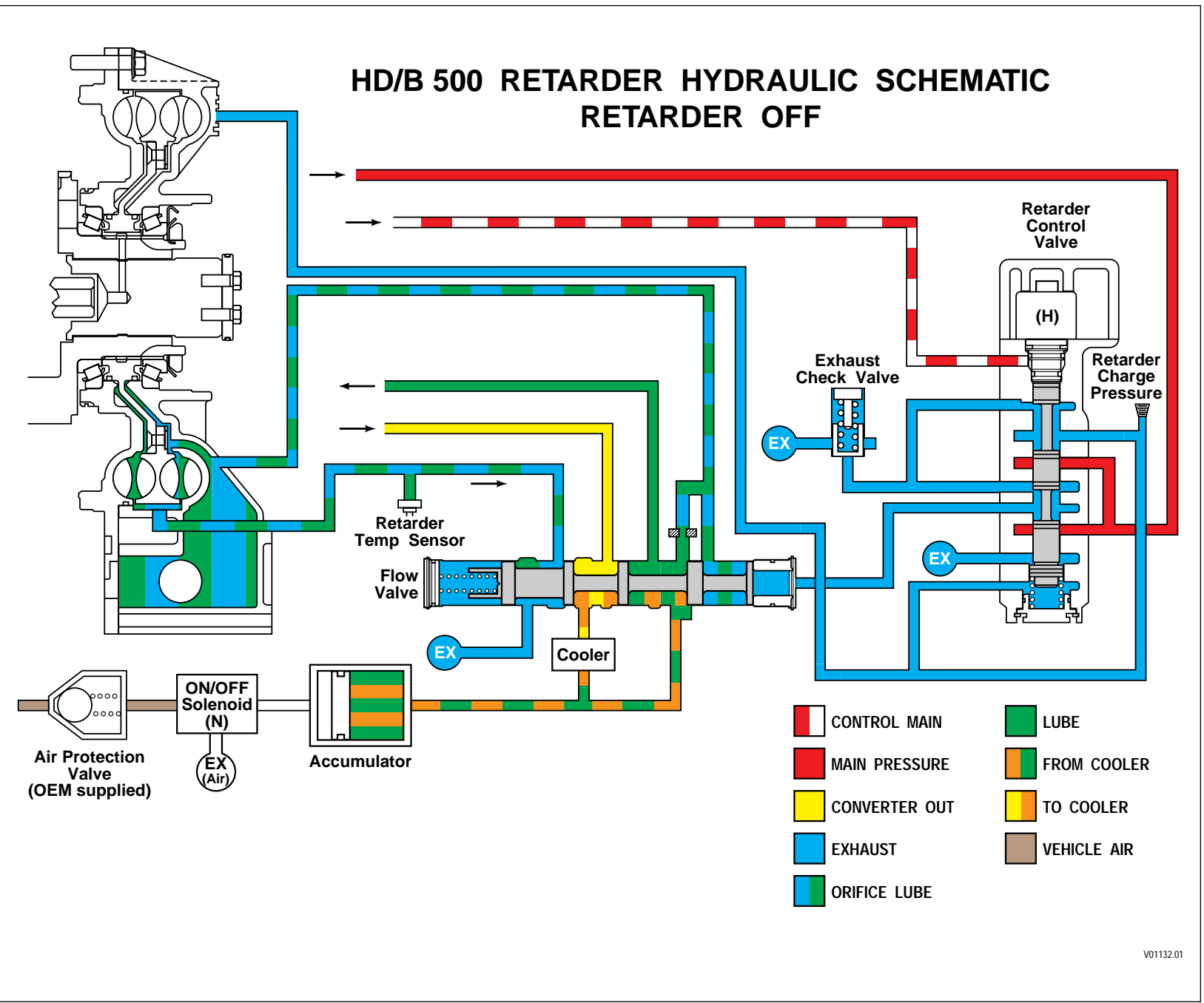
APPENDIX H — HYDRAULIC SCHEMATICS



V01131.01

1997)

APPENDIX H — HYDRAULIC SCHEMATICS



V01132.01

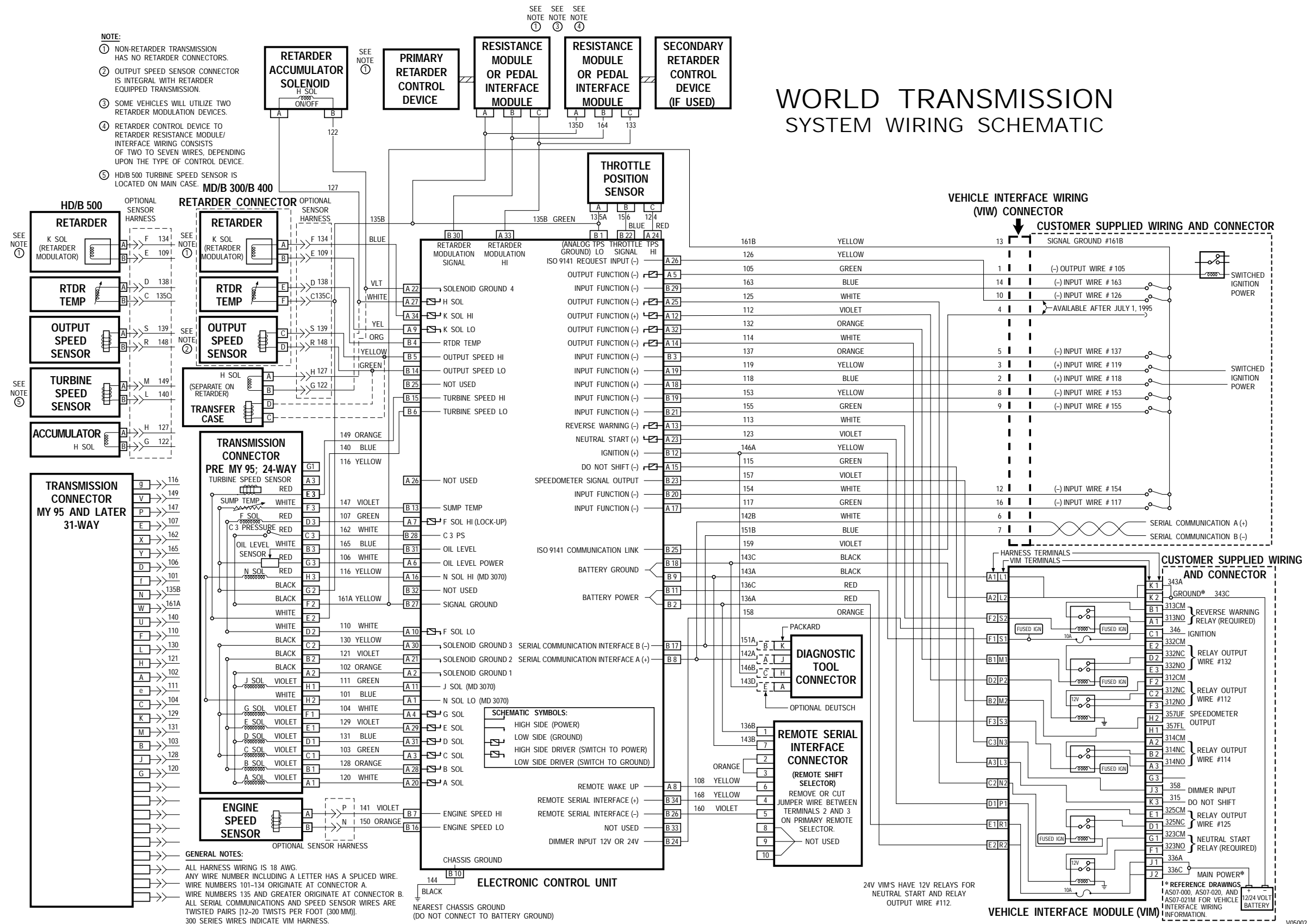
Figure H-23. HD/B 500 Retarder Hydraulic Schematic — Retarder On

APPENDIX H — HYDRAULIC SCHEMATICS

NOTES

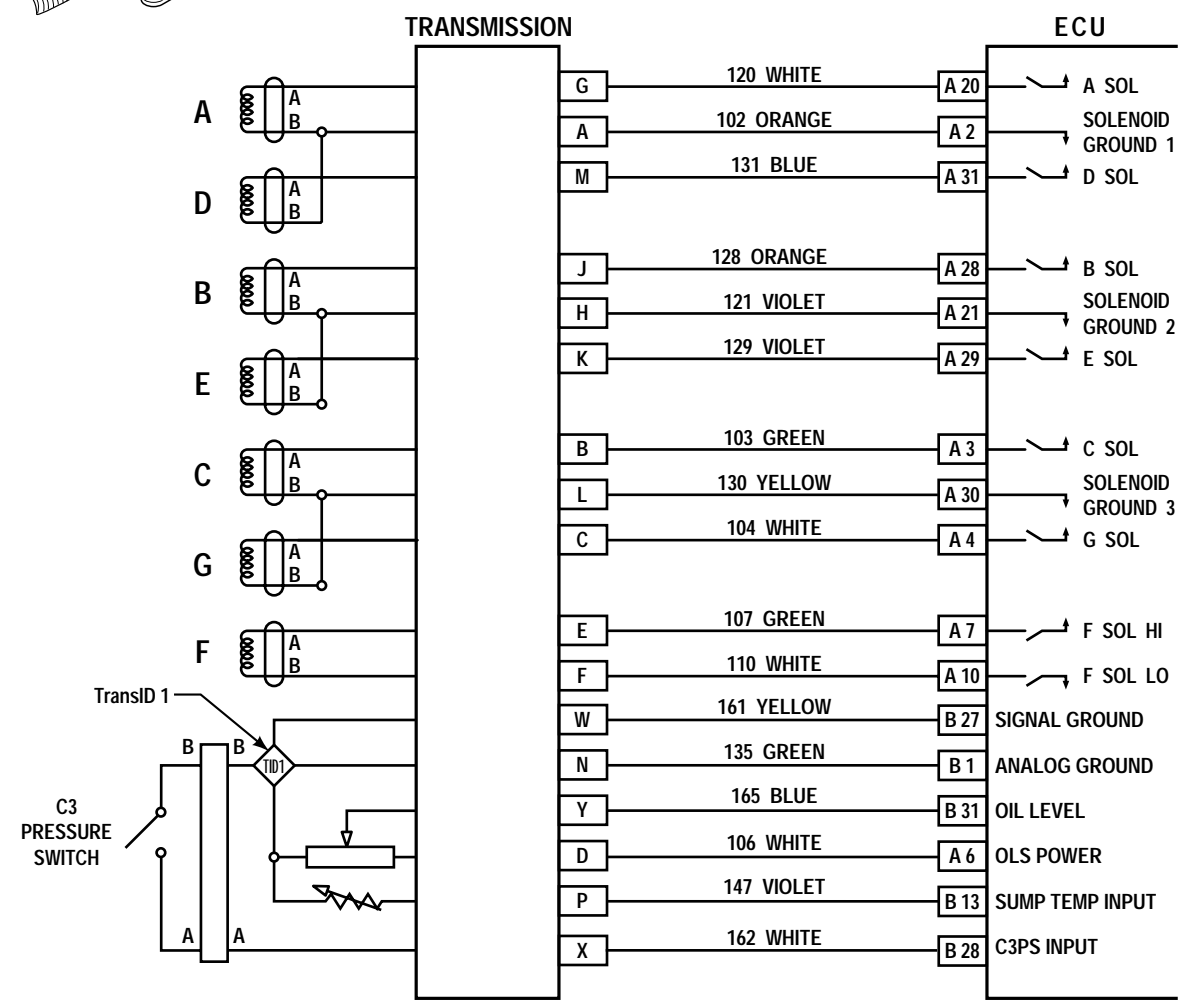
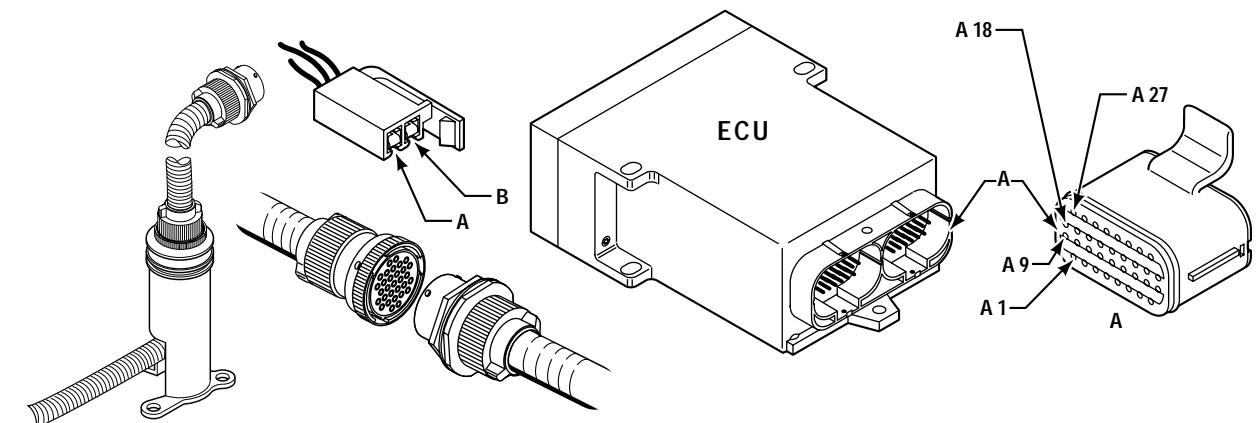
APPENDIX J — WT WIRING SCHEMATICS

WORLD TRANSMISSION SYSTEM WIRING SCHEMATIC



Foldout J-1. WT Wiring Schematic (Pre-TransID)

APPENDIX J — WT WIRING SCHEMATICS



V04680

Foldout J-2. WTEC II TransID 1 Wiring Schematic (Began September, 1996)

APPENDIX K — SOLENOID AND TEMPERATURE CHARTS

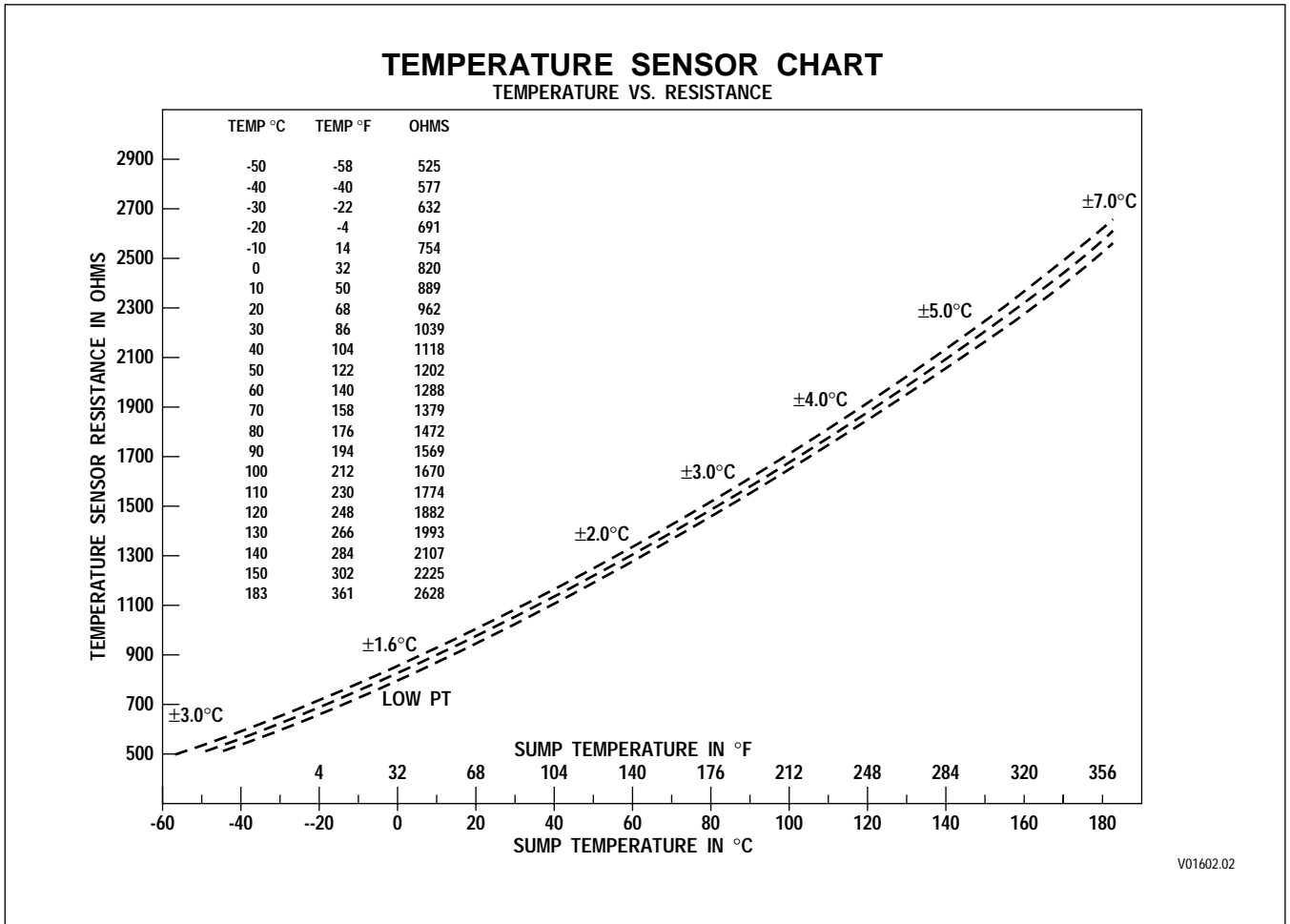


Figure K-1. Temperature Sensor Chart

APPENDIX K — SOLENOID AND TEMPERATURE CHARTS

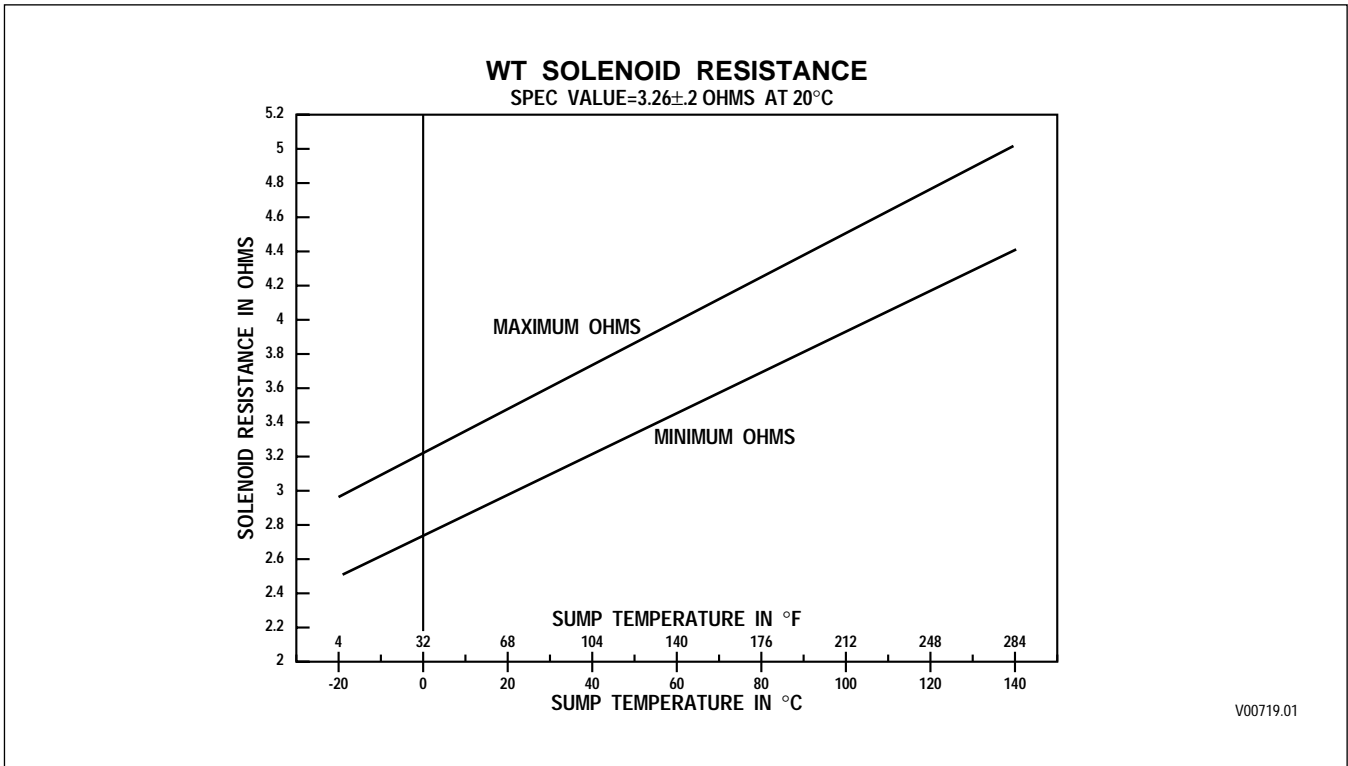


Figure K-2. Solenoid Resistance vs. Temperature Chart

APPENDIX L — EXTERNALLY-GENERATED ELECTRONIC INTERFERENCE**1-1. ELECTROMAGNETIC/RADIO FREQUENCY INTERFERENCE**

All electrical and electronic systems generate electromagnetic fields that can interfere with other electronic systems. Allison Transmission electronic transmission controls comply with Federal Communications Commission (FCC) regulations and other guidelines concerning emitted radio frequency interference for transportation electronics. The position of Allison Transmission Division of General Motors is that manufacturers and installers of EMI/RFI emitting equipments are responsible for adhering to FCC regulations and other guidelines concerning emitted radio frequency interference for transportation electronics.

Some radio-telephone or two-way communication radios (land-mobile radio), or the manner in which they are installed, can adversely affect vehicle operation or be affected by other vehicle components. Expenses incurred to protect vehicle-related systems from EMI/RFI emissions by radio-telephone or two-way communications radios (land-mobile radio) or to integrate such devices into vehicles are not the responsibility of Allison Transmission.

1-2. GENERAL GUIDELINES FOR RADIO EQUIPMENT INSTALLATION

The following general guidelines for installing radio-telephone or two-way communications radios (land-mobile radio) in a vehicle supplement, but DO NOT replace, detailed instructions provided by the radio equipment manufacturer. Detailed installation instructions are the sole responsibility of the radio equipment manufacturer.

Experience has shown that most EMI/RFI problems can be prevented or eliminated by following the guidelines. If EMI/RFI problems persist after following the guidelines and after ensuring the installation conforms to the guidelines, contact the vehicle and radio equipment manufacturers for additional installation or equipment operation instructions.

A. Transmitter Installation

1. Locate remote radio transmitters as far away from other electronic devices and as near to the side of the vehicle body as possible.
2. Mount transceivers (transmitter and receiver in one box) under the dash so as not to interfere with vehicle controls or passenger movement.

B. Antenna Installation

Each vehicle and body style react differently to radio frequency energy. When dealing with an unfamiliar vehicle, test various antenna locations by using a magnetic mount antenna and checking for adverse effects. Antenna location is a major factor in EMI/RFI problems.

C. Antenna Cable Routing

1. Use high quality, 95 percent shield coverage, coaxial (coax) cable. Route the coax well away from any electronic components.
2. Route antenna cables as far away from vehicle wiring as possible to reduce the likelihood of the vehicle wiring acting as an antenna for interference.

D. Radio Wiring and Connector Location

1. Connect transmitter power leads directly to the battery.
2. For transceivers (transmitter and receiver in one box) with ignition control, place a 12V power contactor at the vehicle battery. Drive the contactor coil, through an appropriate in-line fuse, from an ignition circuit not powered during engine cranking.

APPENDIX L — EXTERNALLY-GENERATED ELECTRONIC INTERFERENCE**D. Radio Wiring and Connector Location** (*cont'd*)

3. Any negative lead from a handset or control unit must return to battery negative.
4. Connect the positive lead from a handset or control unit directly to battery.
5. Fuse handset or control unit positive and negative leads separately from the transceiver negative and positive leads. Use correctly rated fuses.

E. Power and Ground Wire Routing

Route radio power and ground wires as far away as possible from electronic control modules.

F. Troubleshooting

The following are common causes of EMI/RFI problems:

- Power leads connected to points other than the battery
- Improper antenna location
- Poor shielding or connections to antenna cable
- Transmitter or transceiver wiring too close to vehicle electronics

1-3. EXTERNALLY-GENERATED SPEED SENSOR SIGNALS**A. Checking for Externally-Generated Speed Sensor Signals**

Use the following procedures to determine if speed sensor signals generated by a source external to the transmission or wiring harness are present:

1. Turn ignition ON.
2. Keep engine OFF.
3. If the ECU is ON (shift selector display remains illuminated), connect the Pro-Link[®] Diagnostic tool.

NOTE: *If false speed signals were present at the previous shutdown, the ECU might still be “on” even though the ignition is “off.” The Pro-Link[®] is powered by ignition power so the ignition must be “on” to use the Pro-Link[®] to read the speed signals.*

4. Read speed sensor signals.
5. If a speed sensor signal is other than one (1), then there is a short to another circuit that is carrying an AC signal.
6. Check the resistance of the sensor.
7. Check for shorts to other circuits within the harness or transmission connector.
8. Check to ensure there is no conductive material inside the connector.
9. Check to be sure speed sensor circuit wires are a twisted pair.
10. Check to ensure a properly grounded drain wire.
11. Check for the presence of a strong external AC signal.
12. Repair or replace parts as required.

APPENDIX M — DIAGNOSTIC TREE — WT HYDRAULIC SYSTEM

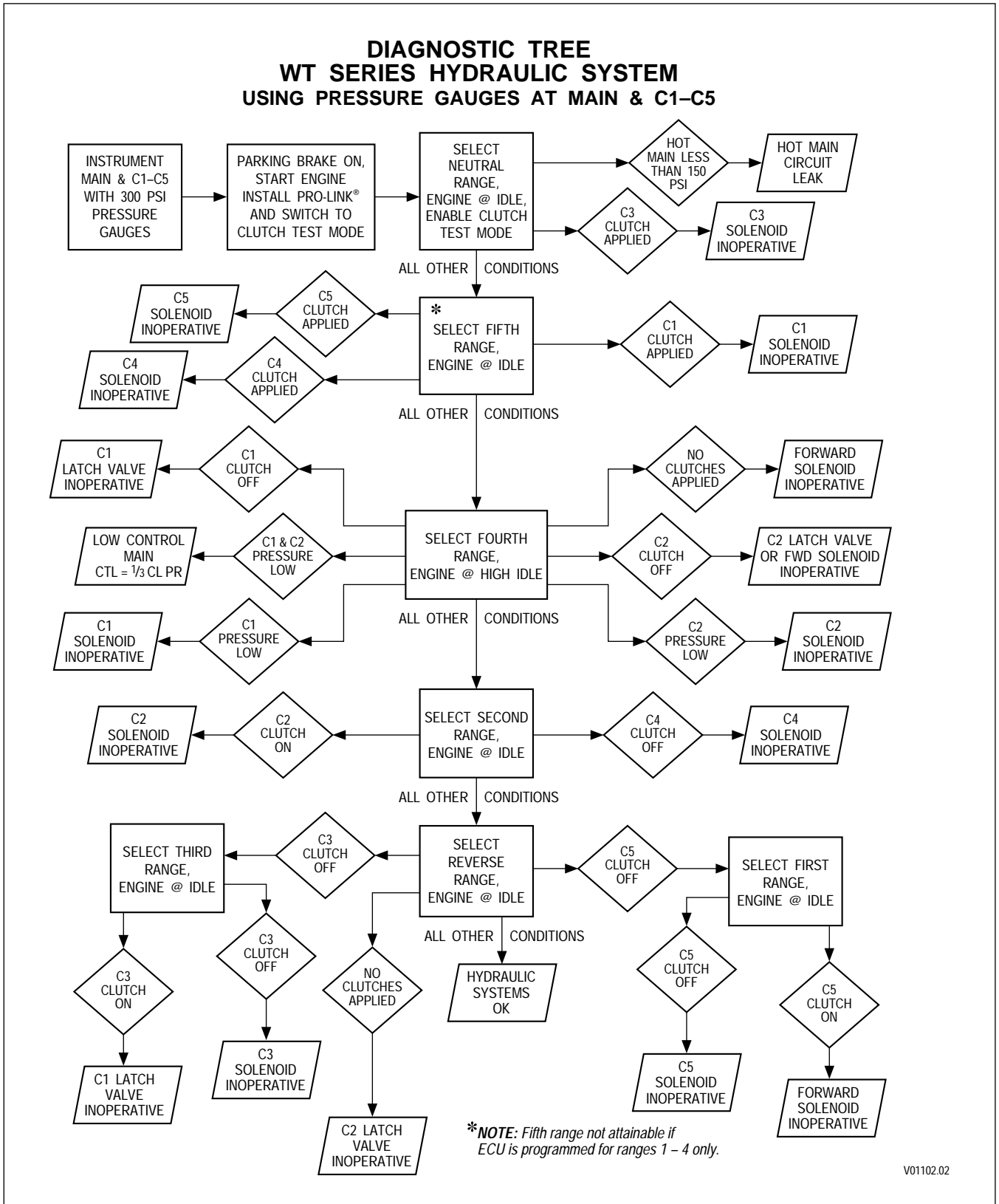


Figure M-1. Diagnostic Tree — WT Series Hydraulic System With Gauges

APPENDIX M — DIAGNOSTIC TREE — WT HYDRAULIC SYSTEM

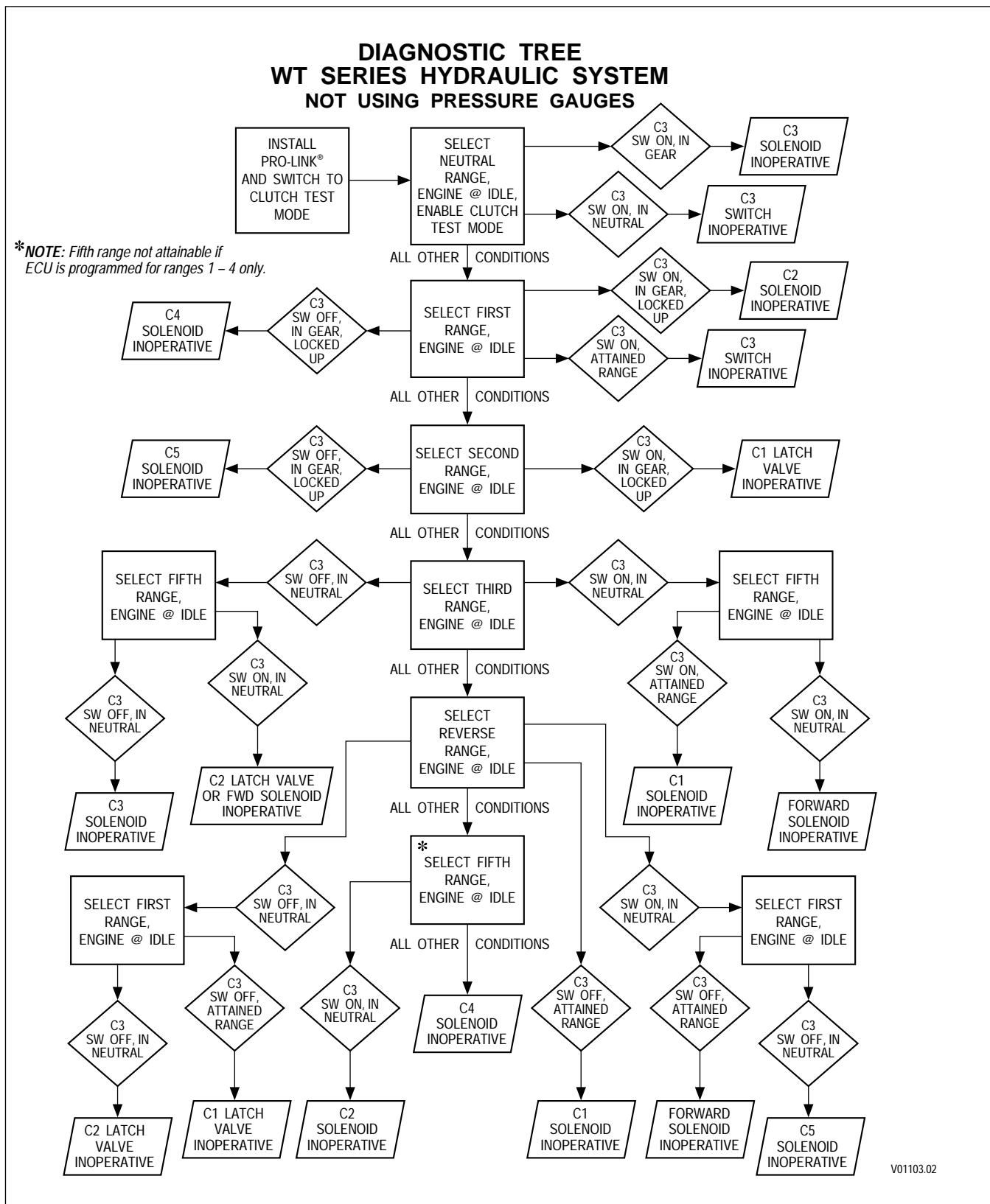


Figure M-2. Diagnostic Tree — WT Series Hydraulic System Without Gauges

APPENDIX N — PRO-LINK® 9000 DIAGNOSTIC DATA READER INFORMATION

This appendix is to assist the technician in the use of the Pro-Link® 9000 functions that are mentioned in this troubleshooting manual. For complete information on the Pro-Link® 9000, consult the manual that is furnished with each Pro-Link® 9000 (MPSI Manual No. 907005 and SW3085EN Pro-Link® Student Workbook).

A. Preparing to Use the Pro-Link® 9000 Diagnostic Data Reader

1. Connect the vehicle cable from the Pro-Link® 9000 to the diagnostic data reader connector on the Allison Transmission wiring harness. Refer to the vehicle manufacturer's manual for location of the connector.
2. Be sure that the vehicle ignition key is on. Check to see that the Pro-Link® 9000 has been energized. If power is not being supplied, turn off the vehicle ignition and recheck all cable connections.
3. Turn on ignition key and if power was still not supplied, turn off the ignition key and check the Pro-Link® 9000 cartridge installation. Carefully remove grease, oil, or other contaminants from the edgeboard using a soft cloth. Check the 2-amp fuse located in the cartridge. Replace the fuse, if necessary.

CAUTION: Never use anything but a 2-amp fuse for replacement.

4. Review the KEYPAD section of the Pro-Link® 9000 Manual.
5. Refer to Figure N-1 for a graphic representation of the Pro-Link® 9000 menu selections.

APPENDIX N — PRO-LINK® 9000 DIAGNOSTIC DATA READER INFORMATION

WORLD TRANSMISSION
FUNCTION MENU

WT REPROGRAM CARTRIDGE

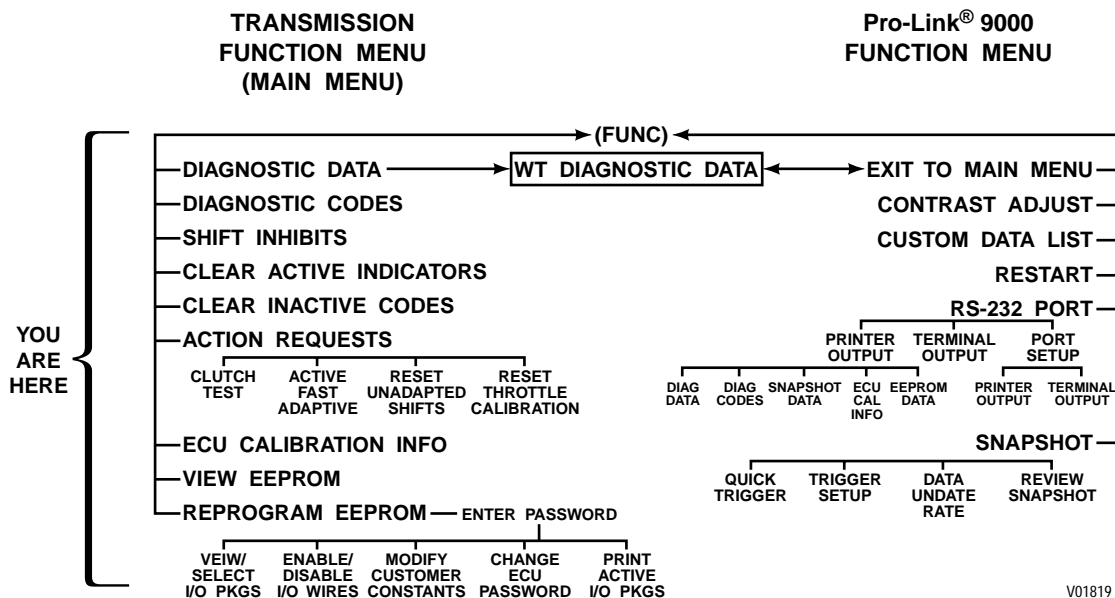


Figure N-1. Pro-Link® 9000 Menu Selections

B. Checking Transmission Fluid Level (covered in Section 5-2 of this Manual)

1. Press the **FUNC** (function) key until the screen display shows **WORLD TRANSMISSION FUNCTION MENU**.
2. Use the **UP** and **DOWN** arrow keys as needed until **DIAGNOSTIC DATA** appears in the display screen under **WORLD TRANSMISSION FUNCTION MENU**.
3. Press **ENTER**. This selects the **DIAGNOSTIC DATA LIST**. Scroll through the list using the **UP** and **DOWN** arrow keys until **OIL LVL** is reached. Fluid level will be displayed as + or - liters or quarts as long as preset conditions for the check have been met. When test conditions have not been met, a code is displayed on the DDR screen explaining why the fluid level is not being displayed.
4. The fluid level is correct when a 0 (zero) appears in front of **QT** (quarts) or **LT** (liters). Press the **FUNCTION** key to return to the menu of choice.

APPENDIX N — PRO-LINK® 9000 DIAGNOSTIC DATA READER INFORMATION

- C. Checking for Diagnostic Codes (use of the Pro-Link® 9000 mentioned, but not explained in Section 6)**
1. Press the **FUNC** (function) key until the screen display shows **WORLD TRANSMISSION FUNCTION MENU**.
 2. Use the **UP** and **DOWN** arrow keys as needed until **DIAGNOSTIC CODES** appears in the display screen under **WORLD TRANSMISSION FUNCTION MENU**.
 3. Press **ENTER**. This asks the ECU to display any diagnostic codes. If no codes are present, the display screen shows this message: **NO DIAGNOSTIC CODES [FUNC] TO EXIT**.
 4. If diagnostic codes are present, they are displayed on the screen in line two under the headings: **CODE, d1, ACTV, CTR, and IGN** (line one of the screen display). Under the **CODE** heading, the main code and sub code will appear (such as 24 12, where 24 is the main code and 12 is the sub code). Under **d1**, nothing appears; this means that this is the first code to be displayed (the second code is **d2**, up to the final code which can be displayed, **d5**). Under **ACTV**, the display will show **YES** if the code is active, or **NO** if the code is inactive. Under **CTR**, a number appears which shows how many times this code has occurred. Under **IGN**, a number appears which shows how many times the ignition switch was cycled since this code was detected.
 5. On the third and fourth lines of the screen display, an English explanation of the code is displayed (for example, code 24 12's message would read **OIL TEMPERATURE COLD**). If there are arrows at the side of line four of the display, this means that there are more codes to be displayed. Use the **UP** and **DOWN** arrow keys to display the other codes. If no arrows are present on line four of the display, there are no other codes to be displayed.
 6. Press the **FUNCTION** key to return to the menu of choice.
- D. Clearing Diagnostic Codes (covered in Section 6 of this Manual)**
1. Clear either active codes (indicators) or inactive codes as follows:
 2. Press the **FUNC** (function) key until the screen display shows **WORLD TRANSMISSION FUNCTION MENU**.
 3. Use the **UP** and **DOWN** arrow keys as needed until either **CLEAR ACTIVE INDICATORS** or **CLEAR INACTIVE CODES** appears in the display screen under **WORLD TRANSMISSION FUNCTION MENU**.
 4. Press **ENTER**. A screen display gives one of the following messages: **CLEAR ACTIVE INDICATORS ARE YOU SURE? [YES] NO**; or, **CLEAR INACTIVE CODES ARE YOU SURE? [YES] NO**. Use the left arrow key to answer yes and the right arrow key to answer no. No is the abort selection and returns to the **WORLD TRANSMISSION FUNCTION MENU** screen.
 5. When **[YES]** is selected, the display screen shows one of the following messages: **CLEARING ACTIVE INDICATORS PLEASE WAIT** or **CLEARING INACTIVE CODES PLEASE WAIT**. When the clearing is completed, one of these messages appears: **ACTIVE INDICATORS HAVE BEEN CLEARED [ENTER]** to continue or **INACTIVE CODES HAVE BEEN CLEARED [ENTER]** to continue.
 6. Pressing **ENTER** returns the display screen to the **WORLD TRANSMISSION FUNCTION MENU**.

APPENDIX N — PRO-LINK® 9000 DIAGNOSTIC DATA READER INFORMATION

E. Checking Other Troubleshooting Parameters

1. Press the **FUNC** (function) key until the screen display shows **WORLD TRANSMISSION FUNCTION MENU**.
2. Use the **UP** and **DOWN** arrow keys as needed until **DIAGNOSTIC DATA** appears in the display screen under **WORLD TRANSMISSION FUNCTION MENU**.
3. Press **ENTER**. This selects the **DIAGNOSTIC DATA LIST**. Scroll through the list using the **UP** and **DOWN** arrow keys until one of the following selections is reached. Press enter to access the data desired:

IGN VOLTS	Displays battery voltage and indicates whether ignition is turned on
BATTERY VOLTS	Displays voltage inside the ECU; used frequently in diagnostic code checking
TPS CNTS	Displays throttle position as counts; used to check throttle position sensor
INPUT SPD RPM	Displays engine speed; used during various functional checks
TURBIN SPD RPM	Displays transmission turbine speed; used during various functional checks
OUTPUT SPD RPM	Displays transmission output speed; used during various functional checks
C3 PRESSURE SW	Indicates when C3 clutch is applied
DO NOT SHIFT	Indicates status of the DO NOT SHIFT output from the ECU
RTDR REQ CNTS	Displays counts form a retarder modulation device; used to check retarder devices
RTDR	Displays temperature of fluid in the retarder cavity, not in the sump
WIRE XXX IN # OFF	Indicates what INPUT FUNCTION wire is being used, what the input function number is, if the input function is used (ON or OFF), and a second line gives an English description of the input function if it is used
WIRE XXX OUT # OFF	Same as above, only for OUTPUT FUNCTION
CLTCH TST ENABL	Shows state, either ON or OFF; must be on to conduct clutch test

F. Performing a Clutch Test (covered in Appendix B)

1. Press the **FUNC** (function) key until the screen display shows **WORLD TRANSMISSION FUNCTION MENU**.
2. Use the **UP** and **DOWN** arrow keys as needed until **ACTION REQUESTS** appears in the display screen under **WORLD TRANSMISSION FUNCTION MENU**. Use the **UP** and **DOWN** arrow keys to scroll through the selections until **CLUTCH TEST** is shown on the display screen.
3. Press **ENTER**. The display screen shows: **CLUTCH TEST [ENABLE] DISABLE [ENTER]** to continue Use the right arrow key to select **DISABLE**; this is the abort selection or the choice to make after the test is complete.
4. Press **ENTER** to select **ENABLE**. The display will show: **ENABLING CLUTCH TEST PLEASE WAIT**. Once the test is enabled, the following display screen appears: **CLUTCH TEST ENABLED TEST MAY DISABLE AUTOMATICALLY [ENTER]** to continue.

APPENDIX N — PRO-LINK® 9000 DIAGNOSTIC DATA READER INFORMATION**F. Performing a Clutch Test (covered in Appendix B) (cont'd)**

5. Press **ENTER**. Move the shift selector from **N** (Neutral) to **D** (Drive). The transmission starts out in the highest range attainable (sixth for a six-speed). Lower ranges are selected individually by moving the lever selector or by using the **DOWN** arrow on a pushbutton selector. The display screen shows various data parameters for the transmission range selected.

NOTE: *CLUTCH TEST is also useful for selecting higher ranges to conduct a torque converter stall test. Using a higher range reduces torque loads on internal transmission components.*

6. During clutch testing, it is possible to continuously monitor clutch test enable by using the following procedure:
 - Note that four lines of data parameters are shown on the display screen
 - The **UP** arrow key is used to change the data parameters that appear on the display
 - Use the **UP** arrow key until **CLTCH TST ENABL** is on the fourth line of the display screen
 - Press the numeric key 4 — **CLTCH TST ENABL** will be displayed continuously, followed by **YES** as long as it is enabled
7. Press the **FUNCtion** key to return to the **CLUTCH TEST [ENABLE] DISABLE** screen and use the **RIGHT** arrow key to select **DISABLE**.

**APPENDIX N — PRO-LINK® 9000 DIAGNOSTIC DATA READER
INFORMATION**

NOTES

APPENDIX P — INPUT/OUTPUT FUNCTIONS

The schematics which follow were taken from the Sales Tech Data Book entitled “WTEC III Controls.” These schematics provide detail information needed to correctly perform input and output function connections. For an overview of Input/Output Functions, refer to Section 7 of this Manual.

WARNING!

These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.

SECONDARY SHIFT SCHEDULE

USES: Provides operator selection of dual shift schedules. Can be used for performance/economy, loaded/empty, or other shift schedule combinations.

VARIABLES TO SPECIFY: None

VOCATIONS: Various

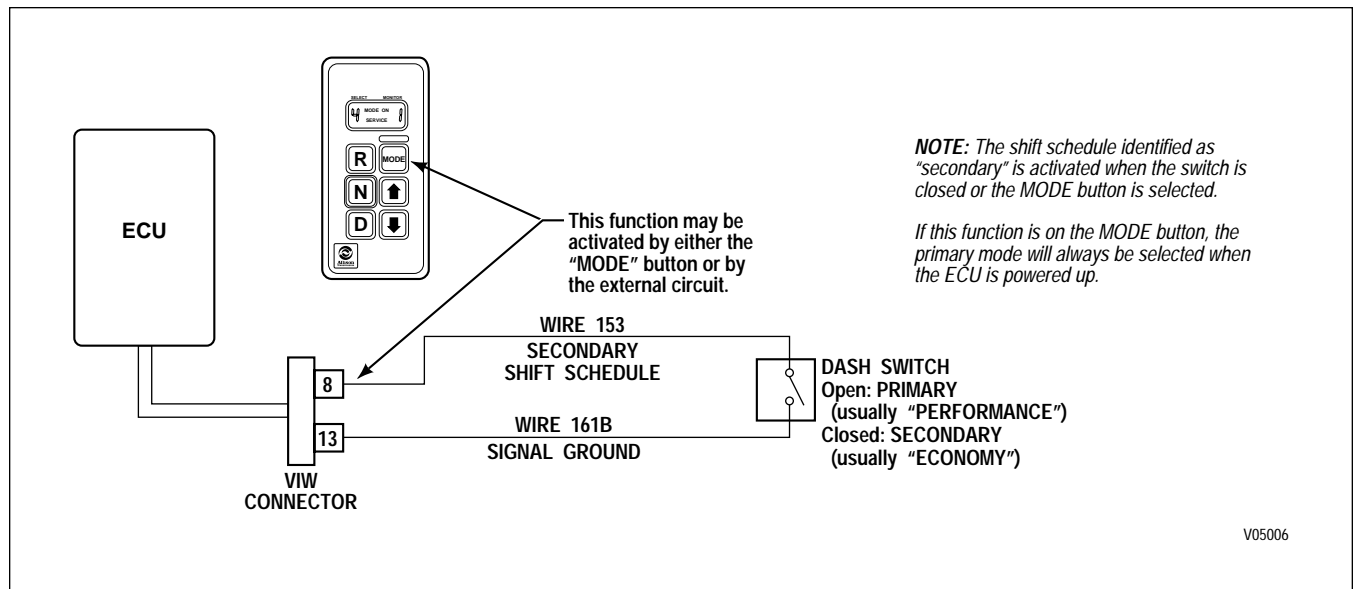


Figure P–1. Secondary Shift Schedule

APPENDIX P — INPUT/OUTPUT FUNCTIONS

WARNING!

These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.

D1 SELECTION

USES: Provides a convenient means of attaining 1st range hold for pushbutton shift selectors. Range to select is programmable for Primary and Secondary modes.

VARIABLES TO SPECIFY: Primary Mode selected range, Secondary Mode selected range (usually 1st range).
Can be used only on the MODE button.

VOCATIONS: Various

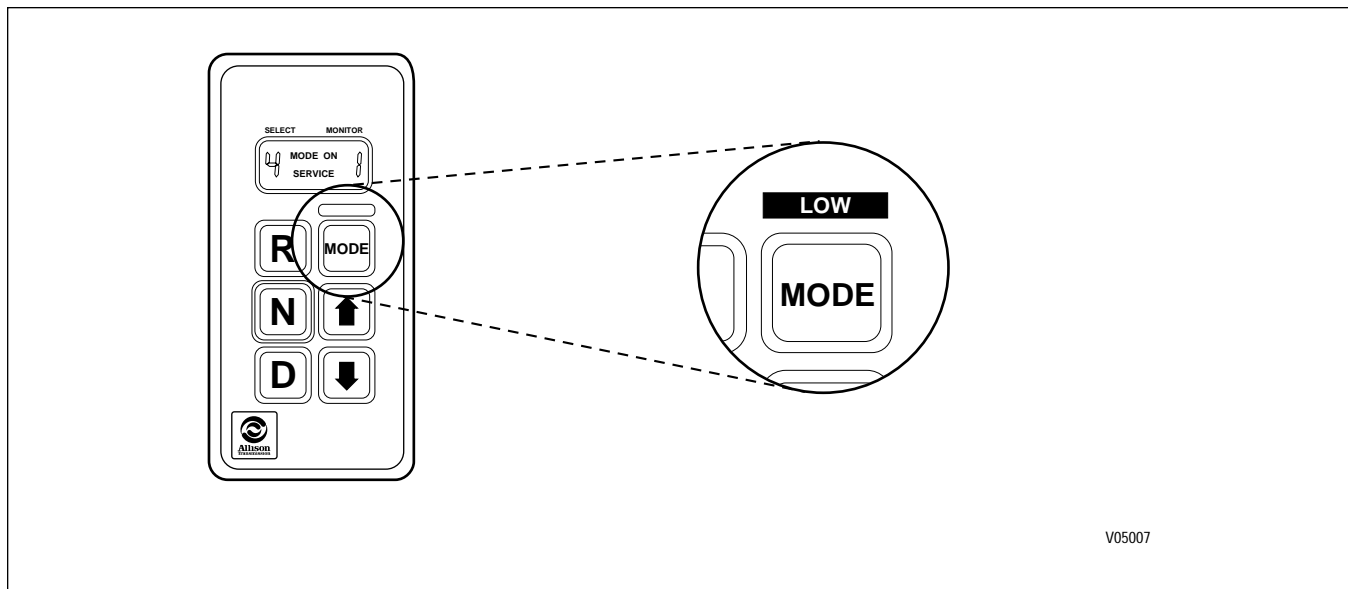


Figure P-2. D1 Selection

APPENDIX P — INPUT/OUTPUT FUNCTIONS

WARNING!

These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could cause unscheduled operation of the PTO or other unpredictable operation resulting in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.

PTO ENABLE (USING “PTO” SWITCH)

USES: Permits PTO to be engaged only when engine speed and output speed are in allowable range and throttle is low. Also disengages PTO if speeds are exceeded.

VARIABLES TO SPECIFY: Minimum and maximum engine speed for engagement, maximum engine speed for allowable operation, minimum and maximum output speed for engagement, maximum output speed for allowable operation.

VOCATIONS: Various (with usage of PTO)

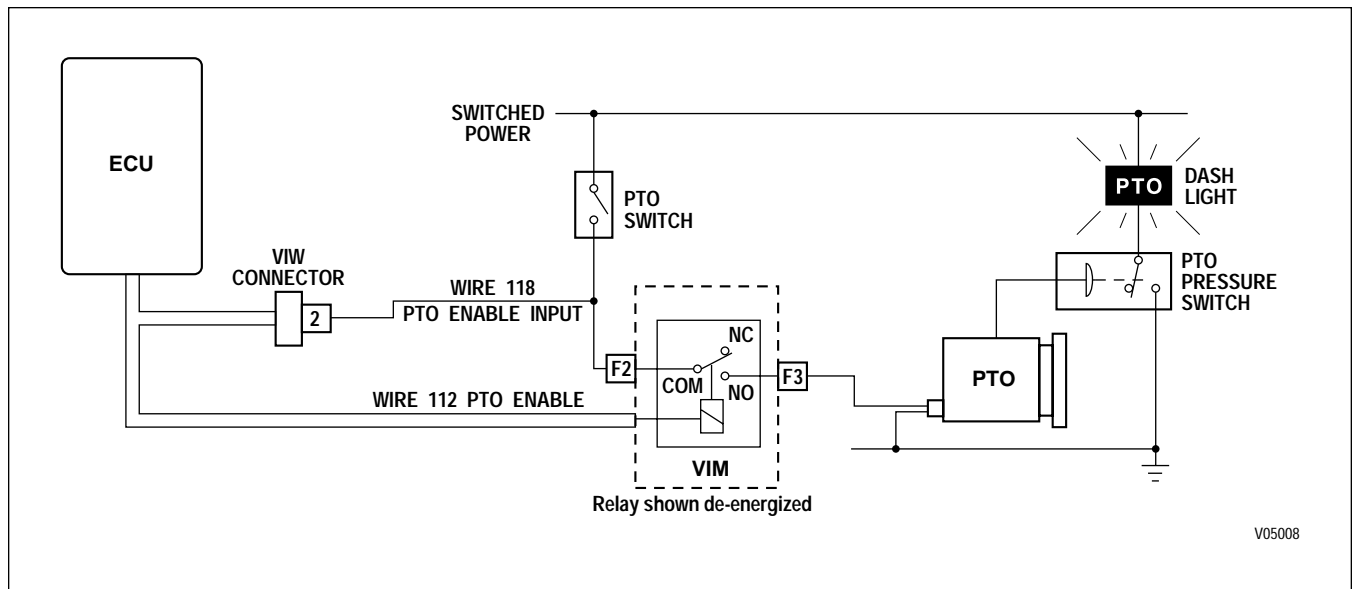


Figure P-3. PTO Enable (Using “PTO” Switch)

APPENDIX P — INPUT/OUTPUT FUNCTIONS

WARNING!

These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could cause unscheduled operation of the PTO or other unpredictable operation resulting in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.

PTO ENABLE (USING “MODE” BUTTON)

USES: Permits PTO to be engaged only when engine speed and output speed are in allowable range and throttle is low. Also disengages PTO if speeds are exceeded.

VARIABLES TO SPECIFY: Minimum and maximum engine speed for engagement, maximum engine speed for allowable operation, minimum and maximum output speed for engagement, maximum output speed for allowable operation.

VOCATIONS: Various (with usage of PTO)

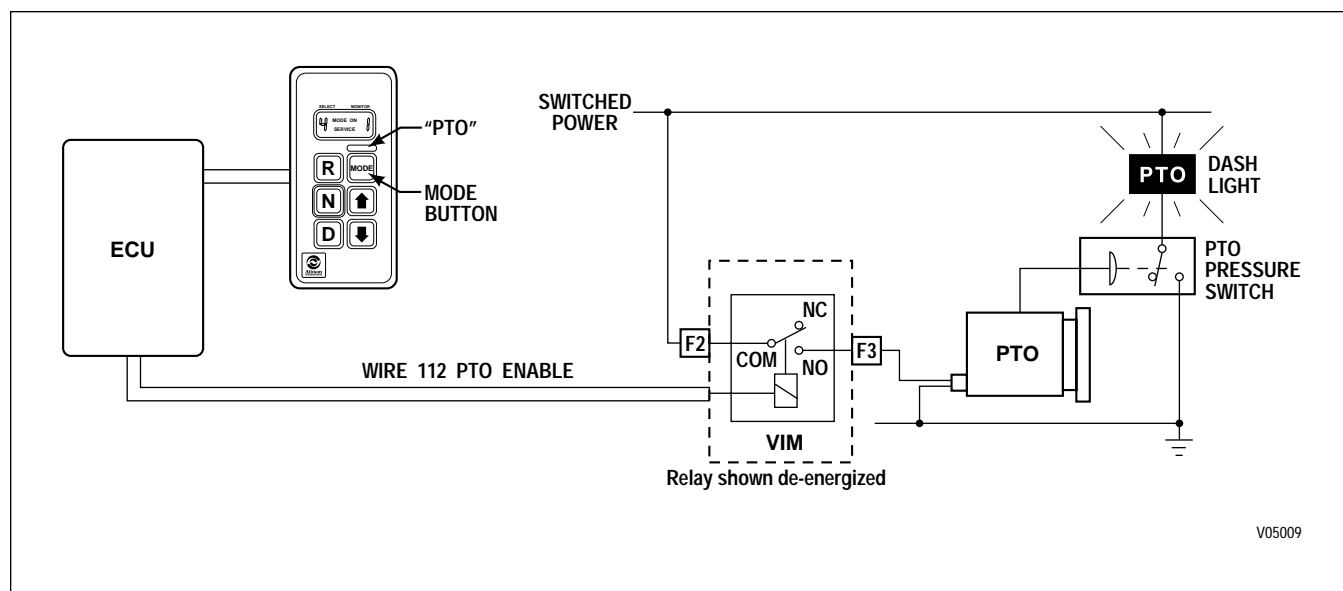


Figure P-4. PTO Enable (Using “MODE” Button)

APPENDIX P — INPUT/OUTPUT FUNCTIONS

WARNING!

These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.

SHIFT SELECTOR TRANSITION

USES: When two shift selectors are used, to select which one is active.

VARIABLES TO SPECIFY: None

VOCATIONS: Various

WARNING!

If this function is enabled in the shift calibration, the function **MUST** be integrated into the vehicle wiring. If the function is available in the shift calibration but will not be used in the vehicle, it **MUST** be disabled in the calibration.

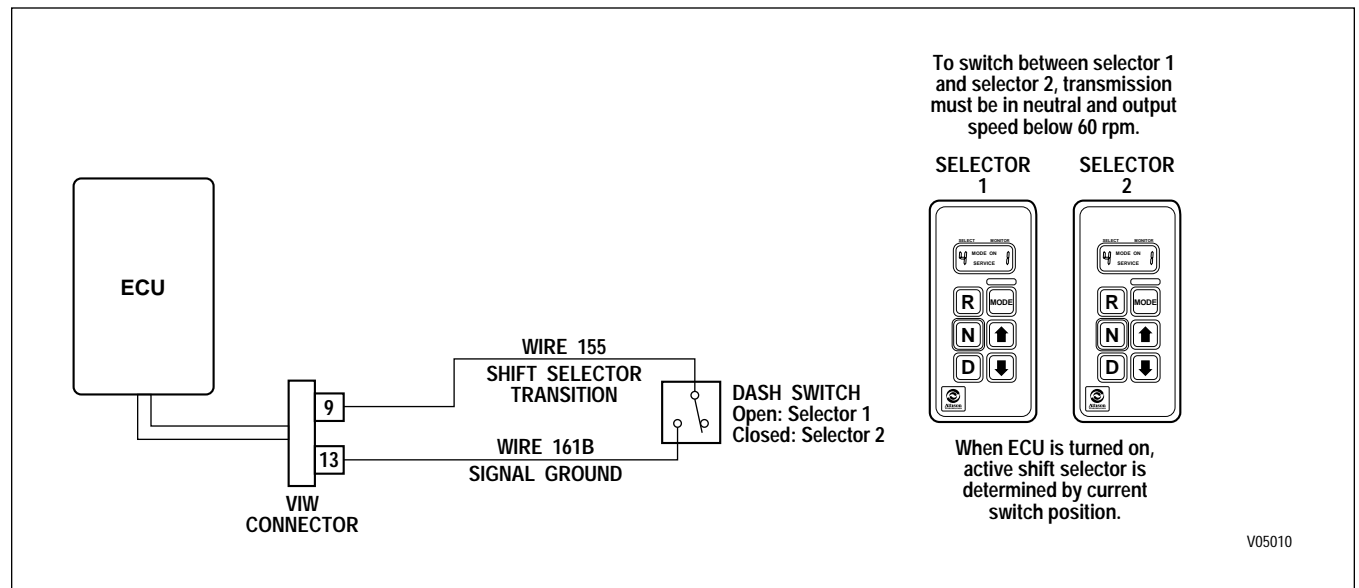


Figure P-5. Shift Selector Transition

APPENDIX P — INPUT/OUTPUT FUNCTIONS

WARNING!

These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could cause unintended selection of range or other unpredictable operation resulting in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.

AUXILIARY FUNCTION RANGE INHIBIT (STANDARD)

USES: Prevents inadvertent range selection when auxiliary equipment is operating or prevents engagement of the transmission unless brake pedal is depressed.

VARIABLES TO SPECIFY: None

VOCATIONS: Transit bus, school bus — auxiliary equipment input; various (brake pedal input)

WARNING!

If this function is enabled in the shift calibration, the function **MUST** be integrated into the vehicle wiring. If the function is available in the shift calibration but will not be used in the vehicle, it **MUST** be disabled in the calibration.

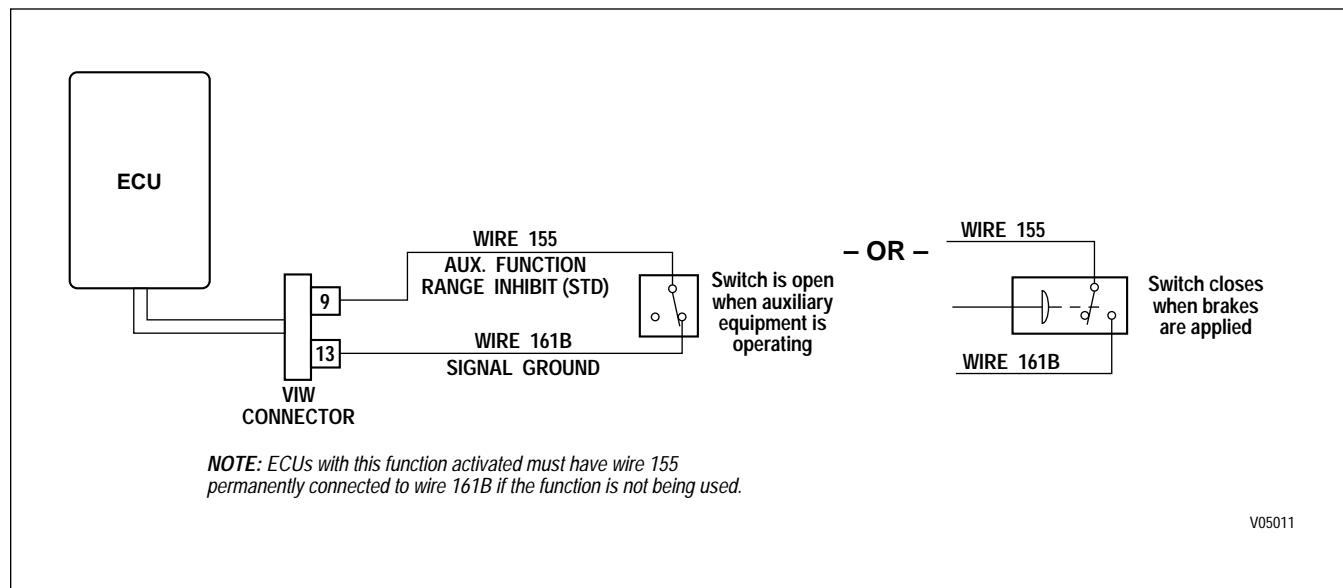


Figure P-6. Auxiliary Function Range Inhibit (Standard)

APPENDIX P — INPUT/OUTPUT FUNCTIONS

WARNING!

These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could cause unintended selection of range or other unpredictable operation resulting in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.

AUXILIARY FUNCTION RANGE INHIBIT (SPECIAL)

USES: Prevents inadvertent range selection when auxiliary equipment is operating. Used in emergency equipment to prevent inadvertent range selection from NEUTRAL.

VARIABLES TO SPECIFY: None

VOCATIONS: Fire trucks, crash trucks

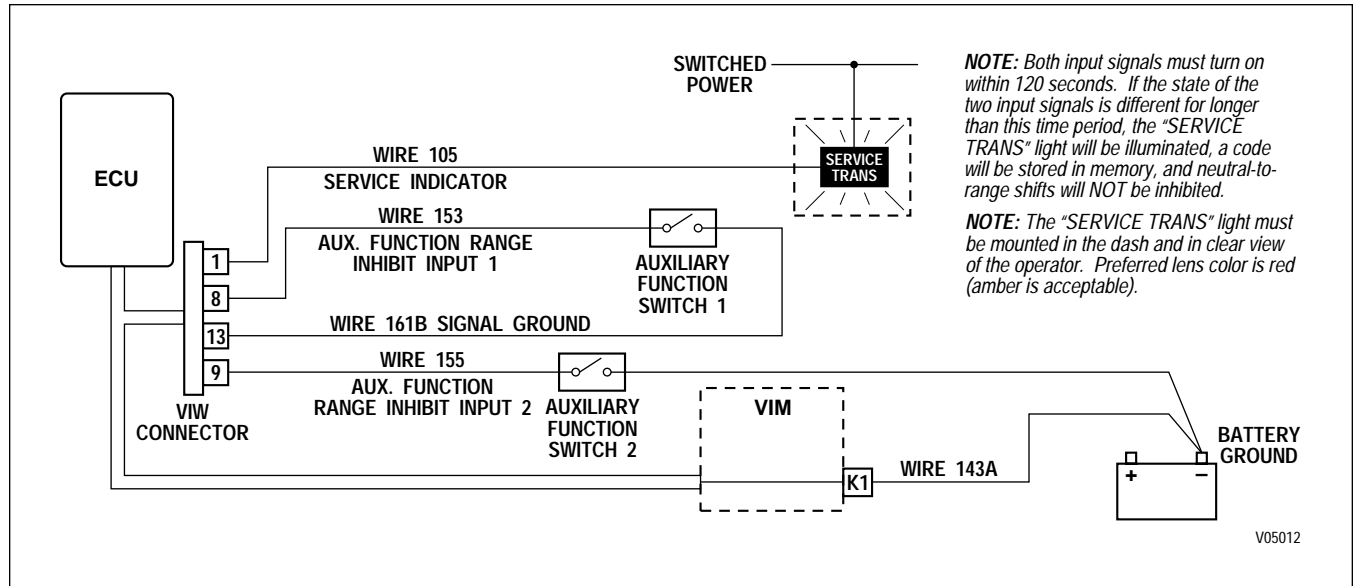


Figure P-7. Auxiliary Function Range Inhibit (Special)

APPENDIX P — INPUT/OUTPUT FUNCTIONS

WARNING!

These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. **ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.**

AUXILIARY HOLD

USES: Provide a discrete input to hold the transmission in present range.

VARIABLES TO SPECIFY: None

VOCATIONS: Various

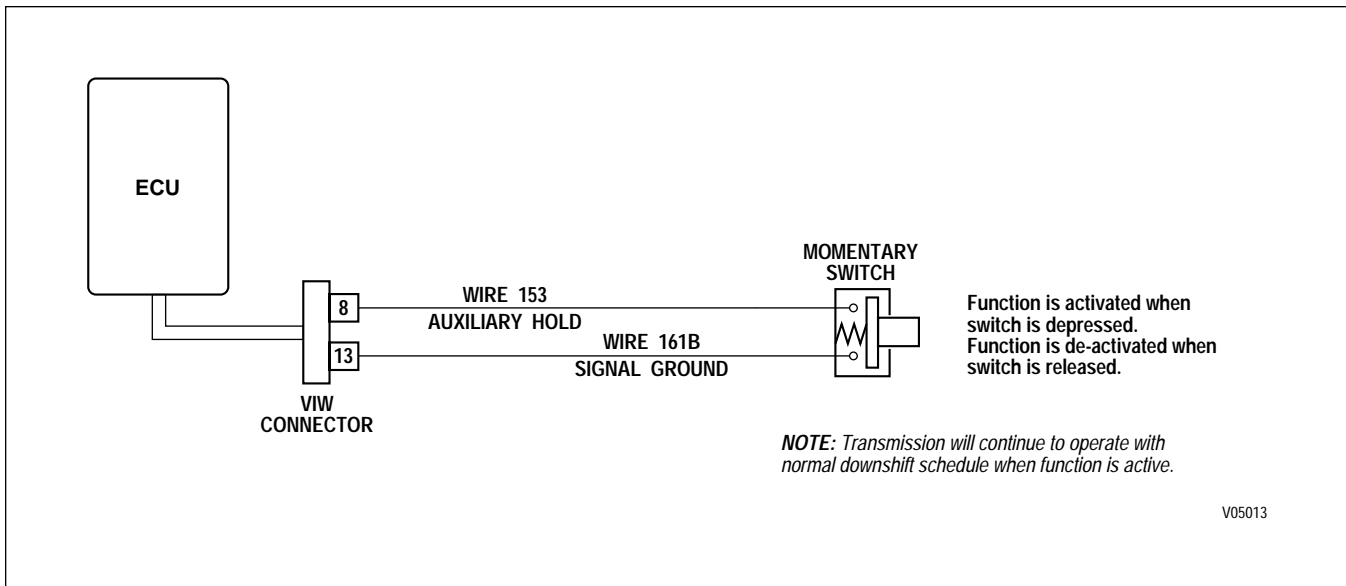


Figure P-8. Auxiliary Hold

APPENDIX P — INPUT/OUTPUT FUNCTIONS

WARNING!

These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.

ENGINE BRAKE/PRESELECT REQUEST AND ENGINE BRAKE ENABLE (STANDARD)

USES: Used with engine compression brakes to signal the ECU that the brake is active and to provide increased braking by preselecting a lower range. Also prevents engagement of engine brake with throttle > 0 or lockup OFF.

VARIABLES TO SPECIFY: Preselect range. Standard value is second range for exhaust style brakes and fourth range for compression style brakes.

VOCATIONS: Various

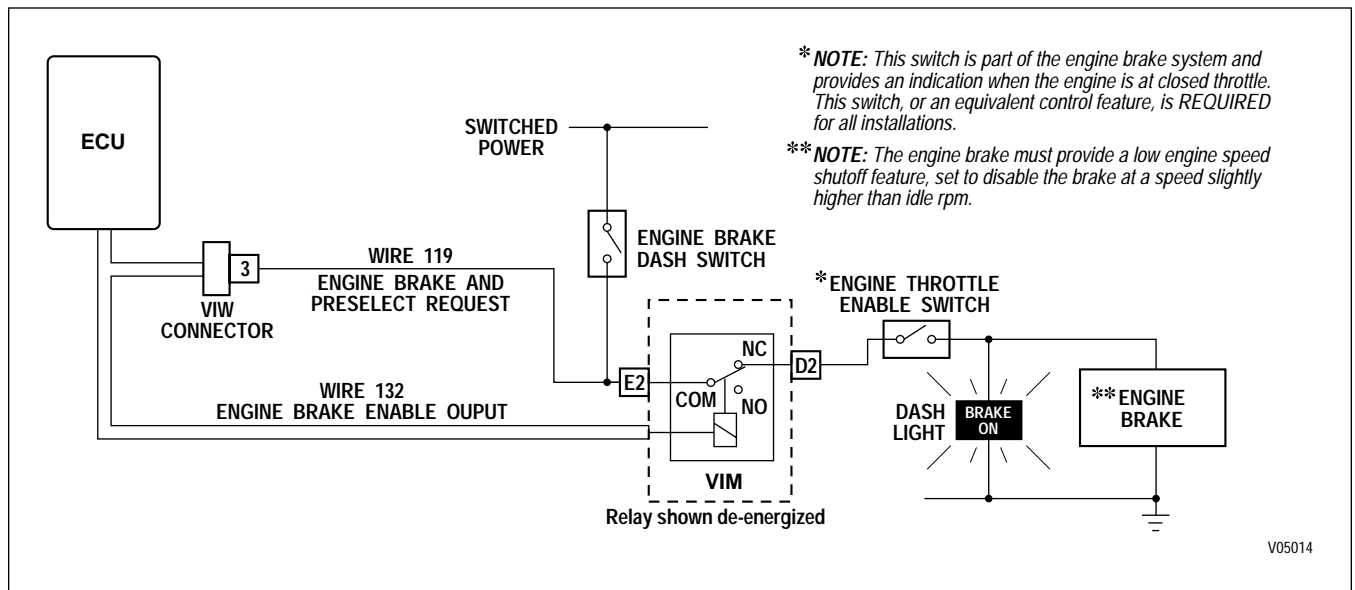


Figure P-9. Engine Brake/Preselect Request and Engine Brake Enable (Standard)

APPENDIX P — INPUT/OUTPUT FUNCTIONS

WARNING!

These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.

ENGINE BRAKE/PRESELECT REQUEST AND ENGINE BRAKE ENABLE (EUROPEAN)

USES: Used with engine exhaust brakes to provide a signal to the ECU that the brake is active and to provide increased braking by preselecting a lower range. Also prevents engagement of engine brake with throttle > 0 or lockup OFF.

VARIABLES TO SPECIFY: Preselect range. Standard value is second range for exhaust style brake and fourth for compression style brake.

VOCATIONS: Various

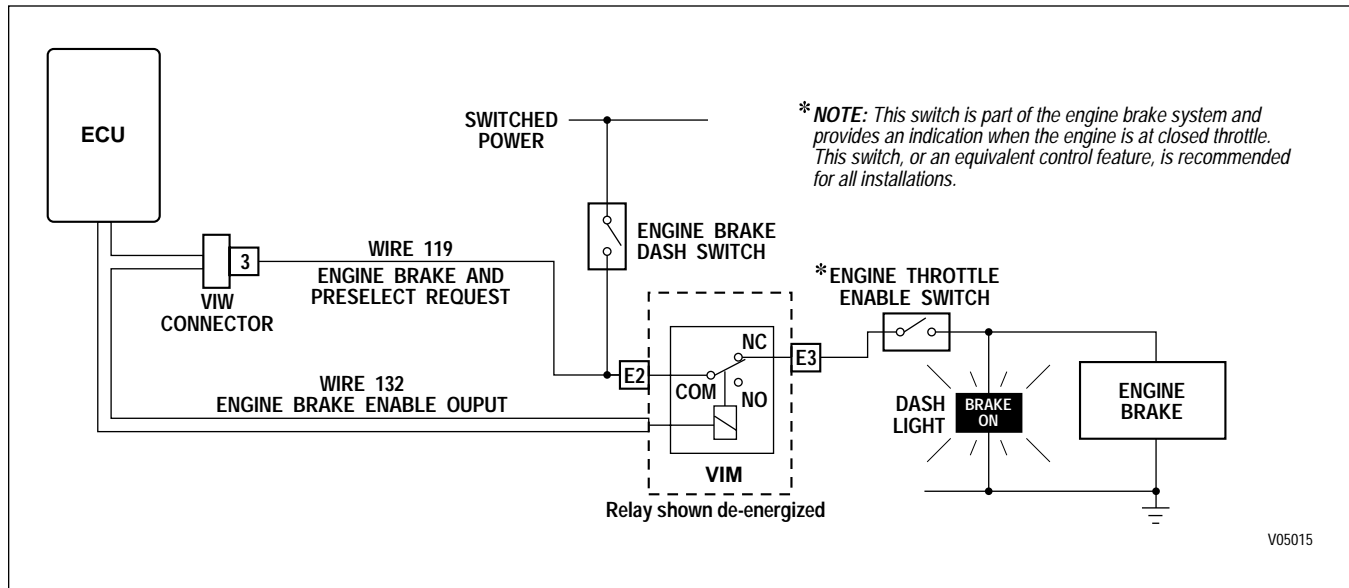


Figure P-10. Engine Brake/Preselect Request and Engine Brake Enable (European)

APPENDIX P — INPUT/OUTPUT FUNCTIONS

WARNING!

These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.

FIRE TRUCK PUMP MODE

USES: Facilitates engagement of split shaft PTO and shifts transmission to fourth range lockup.

VARIABLES TO SPECIFY: None

VOCATIONS: Fire Truck Pumpers

WARNING!

If this function is enabled in the shift calibration, the function **MUST** be integrated into the vehicle wiring. If the function is available in the shift calibration but will not be used in the vehicle, it **MUST** be disabled in the calibration.

SYSTEM OPERATION

OPERATOR ACTION — System Response

TO ENGAGE:

1. **SELECT NEUTRAL** — Transmission shifts to Neutral.
2. **APPLY PARKING BRAKE** — None
3. **SELECT PUMP** — Turns on “Pump Mode Requested” light. Stops output shaft rotation. When split-shaft engages, PPE signal and “Pump Engaged” light are turned on. Transmission output unlocks.
4. **SELECT DRIVE** — Transmission shifts to fourth lockup. “OK To Pump” light is turned on.

TO DISENGAGE:

1. **SELECT NEUTRAL** — Transmission shifts to Neutral if output rpm < 1000.
2. **SELECT ROAD MODE** — Stops output shaft rotation. PTO disengages. Transmission shifts back to Neutral.

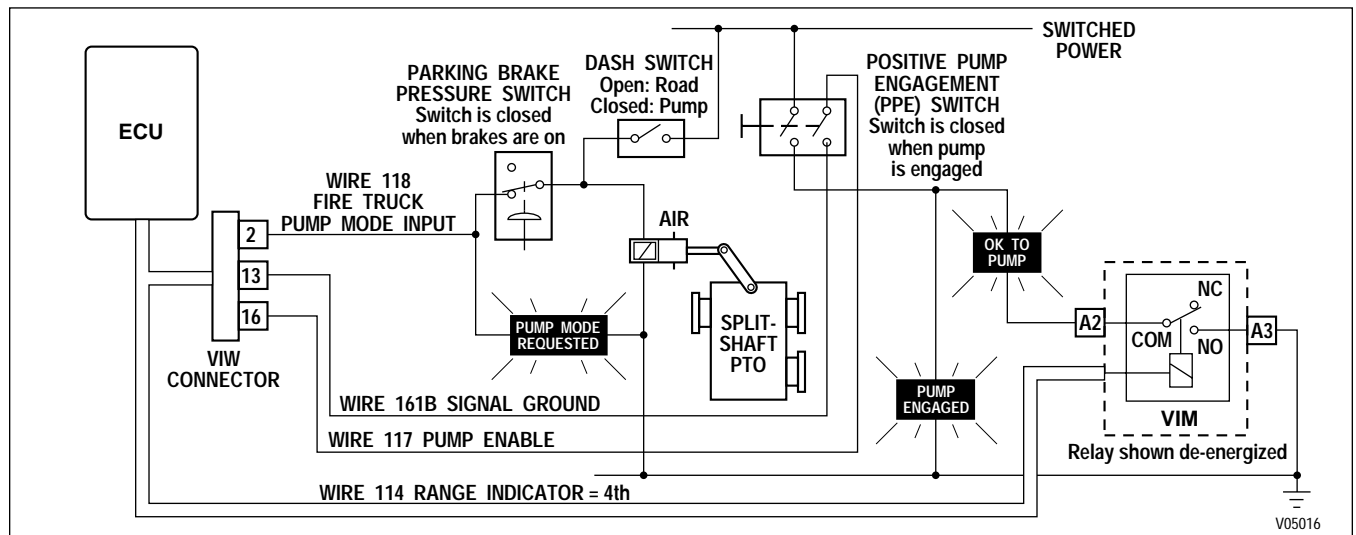


Figure P-11. Fire Truck Pump Mode

APPENDIX P — INPUT/OUTPUT FUNCTIONS

WARNING!

These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.

FIRE TRUCK PUMP MODE (OPTIONAL)

USES: Facilitates engagement of split shaft PTO and shifts transmission to fourth range lockup.

VARIABLES TO SPECIFY: None

VOCATIONS: Fire Truck Pumpers

WARNING!

If this function is enabled in the shift calibration, the function **MUST** be integrated into the vehicle wiring. If the function is available in the shift calibration but will not be used in the vehicle, it **MUST** be disabled in the calibration.

SYSTEM OPERATION

OPERATOR ACTION — System Response

TO ENGAGE:

1. SELECT NEUTRAL — Transmission shifts to Neutral.
2. APPLY PARKING BRAKE — None
3. SELECT PUMP — Turns on “Pump Mode Requested” light. Turns on both input signals to ECU (wires 117 and 118) which activates “fire truck” mode. When split-shaft shifts, “Pump Engaged” light is turned on.
4. SELECT DRIVE — Transmission shifts to fourth lockup. “OK To Pump” light is turned on.

TO DISENGAGE:

1. SELECT NEUTRAL — Transmission shifts to Neutral if output rpm < 1000.
2. SELECT ROAD MODE — PTO disengages.

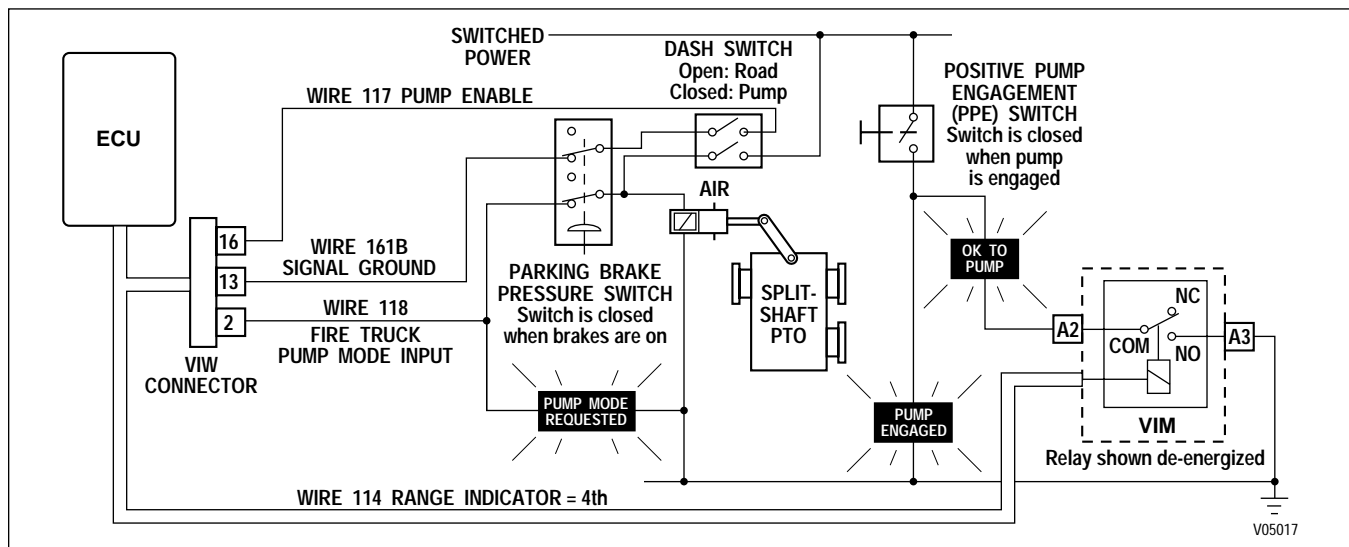


Figure P-12. Fire Truck Pump Mode (Optional)

APPENDIX P — INPUT/OUTPUT FUNCTIONS

WARNING!

These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could cause unintended selection of range or other unpredictable operation resulting in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.

QUICK-TO-NEUTRAL PUMP

USES: Automatically shifts transmission to NEUTRAL when pumped medium approaches excessive pressure levels.

VARIABLES TO SPECIFY: None

VOCATIONS: Oil field pumping

WARNING!

If this function is enabled in the shift calibration, the function **MUST** be integrated into the vehicle wiring. If the function is available in the shift calibration but will not be used in the vehicle, it **MUST** be disabled in the calibration.

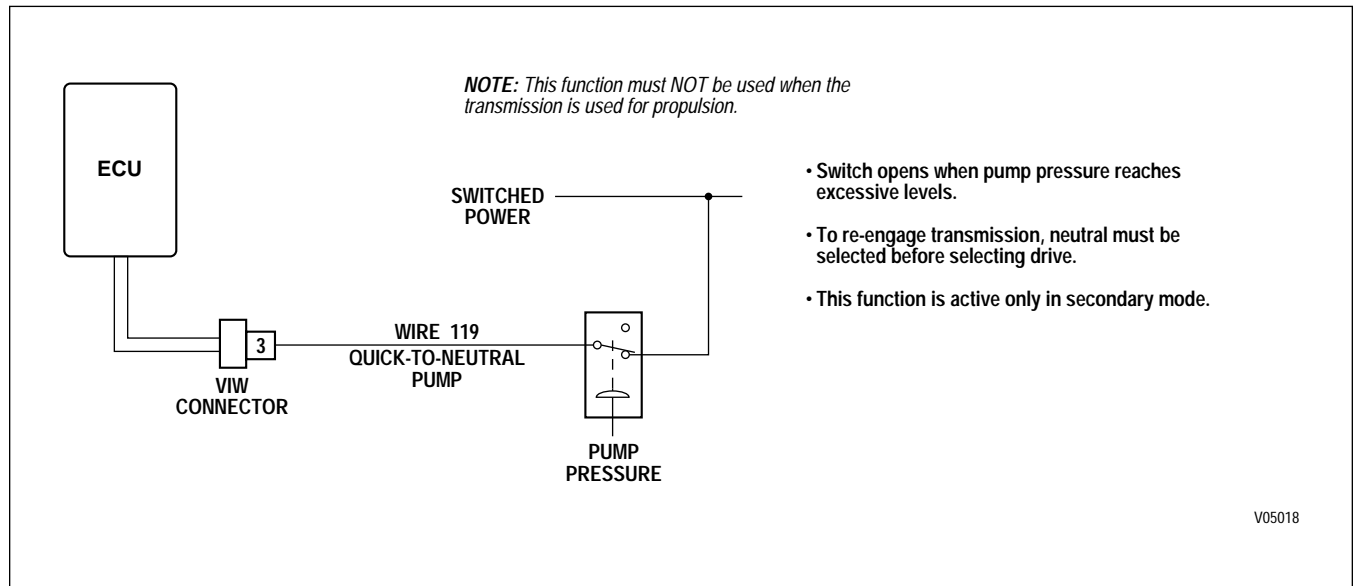


Figure P-13. Quick-To-Neutral Pump

APPENDIX P — INPUT/OUTPUT FUNCTIONS

WARNING!

These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could cause unintended selection of range or other unpredictable operation resulting in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.

AUTOMATIC NEUTRAL FOR PTO (STANDARD)

USES: Provides for automatic selection of NEUTRAL when PTO is operated regardless of range selected.
Requires re-selecting range to shift out of NEUTRAL

VARIABLES TO SPECIFY: Maximum output speed for activating this function.

VOCATIONS: Various (with usage of PTO)

WARNING!

If this function is enabled in the shift calibration, the function **MUST** be integrated into the vehicle wiring. If the function is available in the shift calibration but will not be used in the vehicle, it **MUST** be disabled in the calibration.

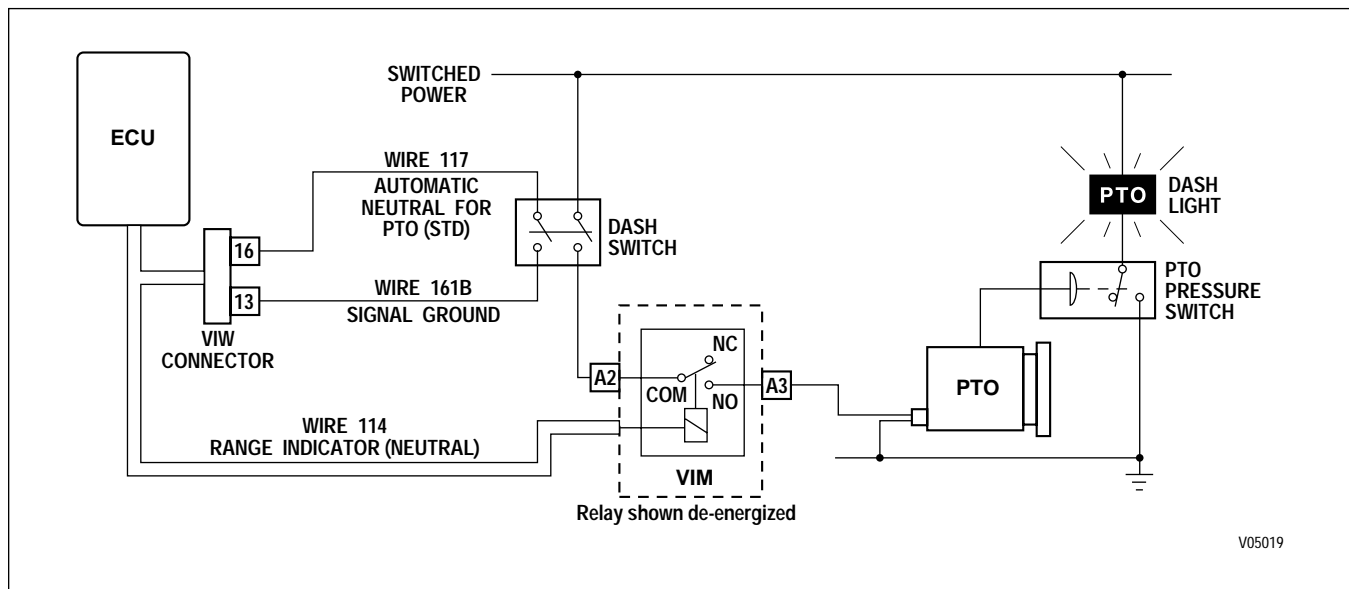


Figure P-14. Automatic Neutral for PTO (Standard)

APPENDIX P — INPUT/OUTPUT FUNCTIONS

WARNING!

These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could cause unintended selection of range or other unpredictable operation resulting in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.

AUTOMATIC NEUTRAL FOR PTO (SPECIAL)

USES: Provides for automatic selection of NEUTRAL and enables fast idle when work brake is applied. Automatic re-engagement of forward ranges occurs when packing is completed and work brake is released.

VARIABLES TO SPECIFY: Maximum output speed to activate this function.

VOCATIONS: Refuse packer

WARNING!

If this function is enabled in the shift calibration, the function **MUST** be integrated into the vehicle wiring. If the function is available in the shift calibration but will not be used in the vehicle, it **MUST** be disabled in the calibration.

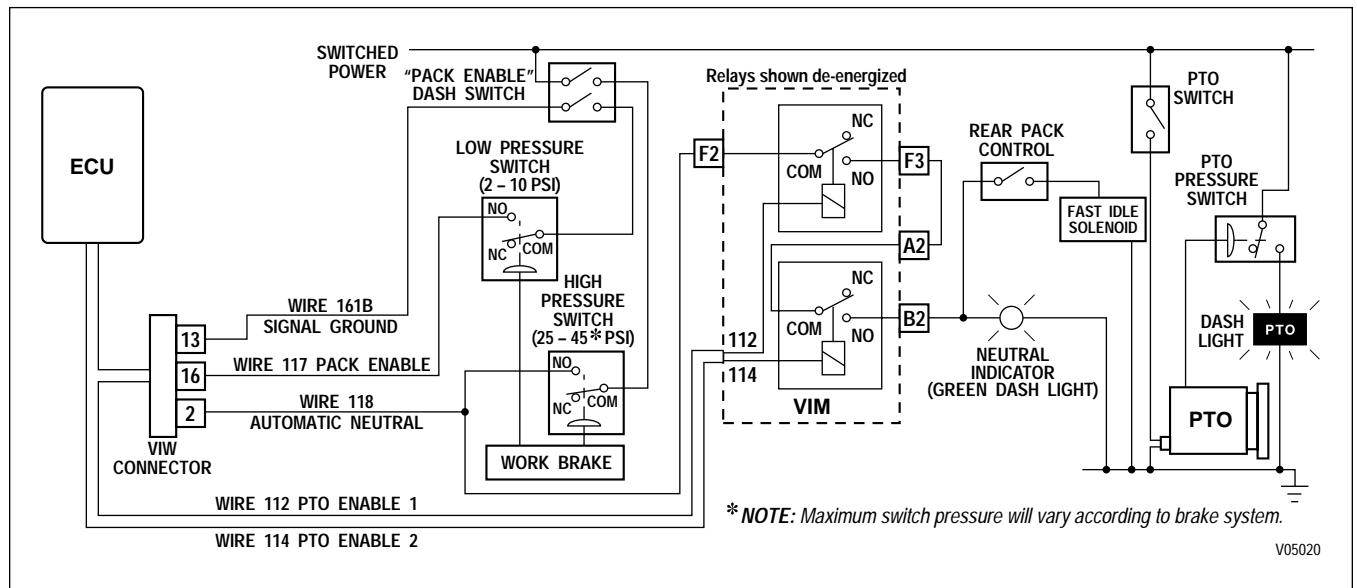


Figure P-15. Automatic Neutral for PTO (Special)

APPENDIX P — INPUT/OUTPUT FUNCTIONS

WARNING!

These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could cause unintended selection of range or other unpredictable operation resulting in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.

AUTOMATIC NEUTRAL

USES: Automatically shifts transmission to NEUTRAL when vehicle doors are opened. Re-engages transmission in DRIVE when doors are closed.

VARIABLES TO SPECIFY: None

VOCATIONS: Transit bus

WARNING!

If this function is enabled in the shift calibration, the function **MUST** be integrated into the vehicle wiring. If the function is available in the shift calibration but will not be used in the vehicle, it **MUST** be disabled in the calibration.

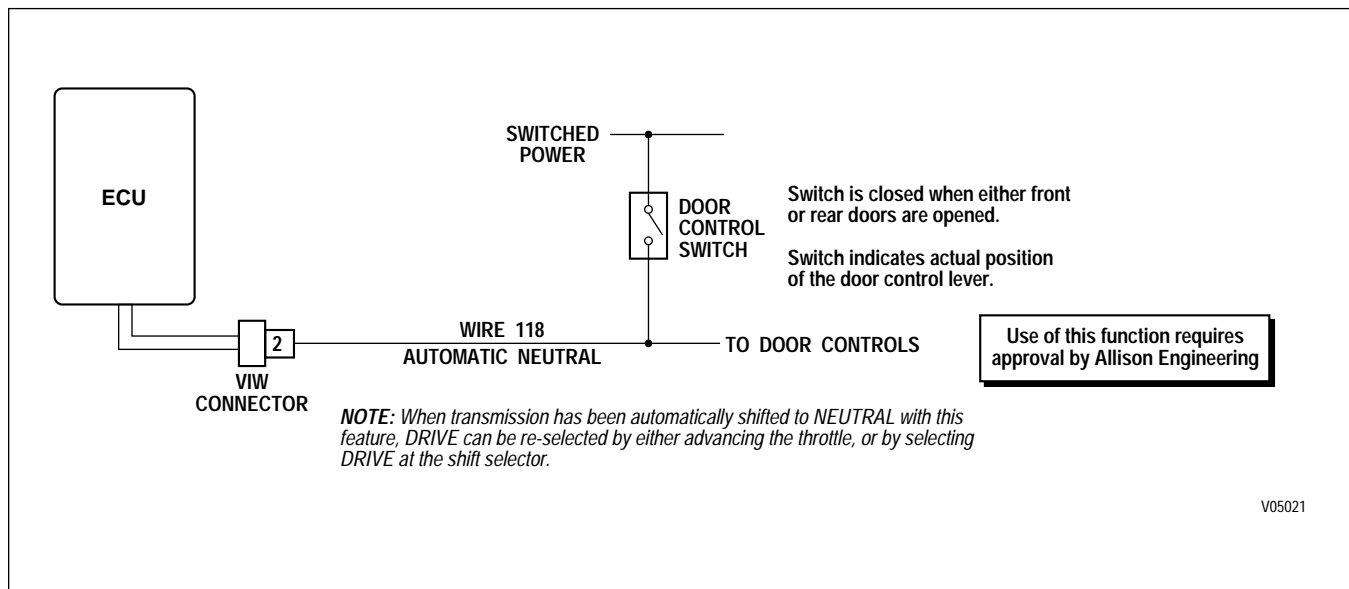


Figure P-16. Automatic Neutral

APPENDIX P — INPUT/OUTPUT FUNCTIONS

WARNING!

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TWO SPEED AXLE INPUT AND OUTPUT

USES: Provides output speed interlock for axle engagement, input to ECU, and input to speedometer to adjust for axle ratio change.

VARIABLES TO SPECIFY: Output speed to activate, output speed to deactivate

VOCATIONS: Dump truck, refuse packer, cement mixer, two-speed axle equipped vehicles

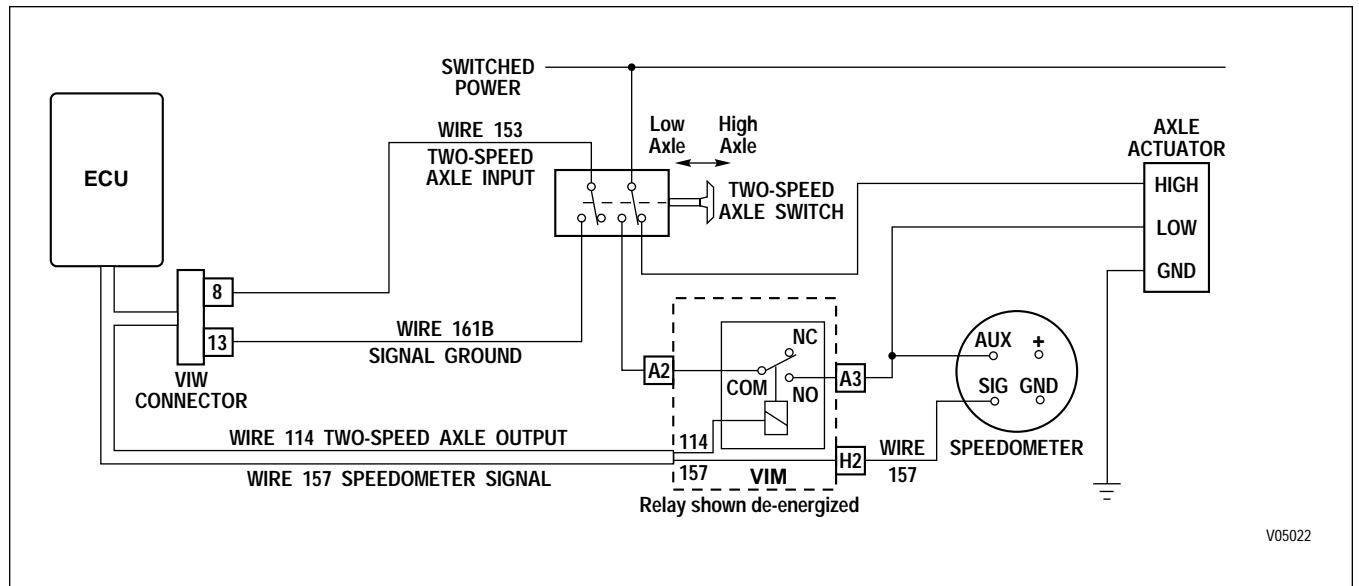


Figure P-17. Two Speed Axle Input and Output

APPENDIX P — INPUT/OUTPUT FUNCTIONS

WARNING!

These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.

MANUAL LOCKUP

USES: Provides for the manual application of the lockup clutch for non-roading applications. Uses two inputs: one to select manual versus automatic lockup shift mode, and the second as the switching mechanism to command the lockup clutch on and off.

VARIABLES TO SPECIFY: None

VOCATIONS: Oil field pumping, mud pumps, hoists, drilling

WARNING!

If this function is enabled in the shift calibration, the function **MUST** be integrated into the vehicle wiring. If the function is available in the shift calibration but will not be used in the vehicle, it **MUST** be disabled in the calibration.

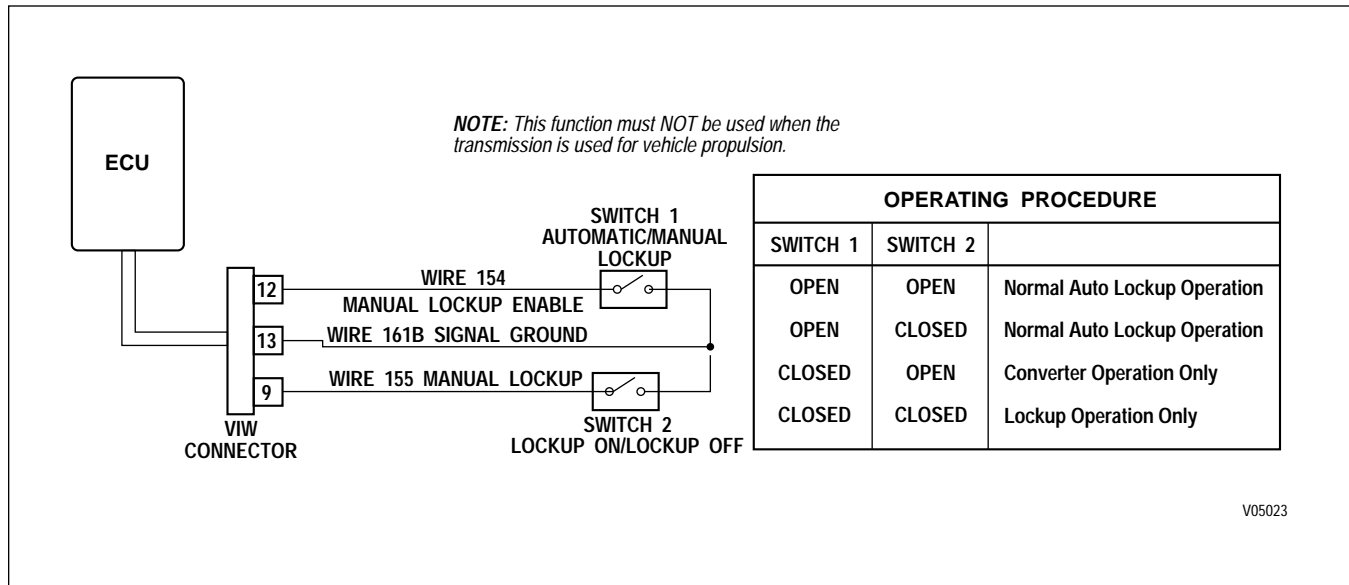


Figure P-18. Manual Lockup

APPENDIX P — INPUT/OUTPUT FUNCTIONS

WARNING!

These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could cause unintended selection of range or other unpredictable operation resulting in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.

REVERSE ENABLE

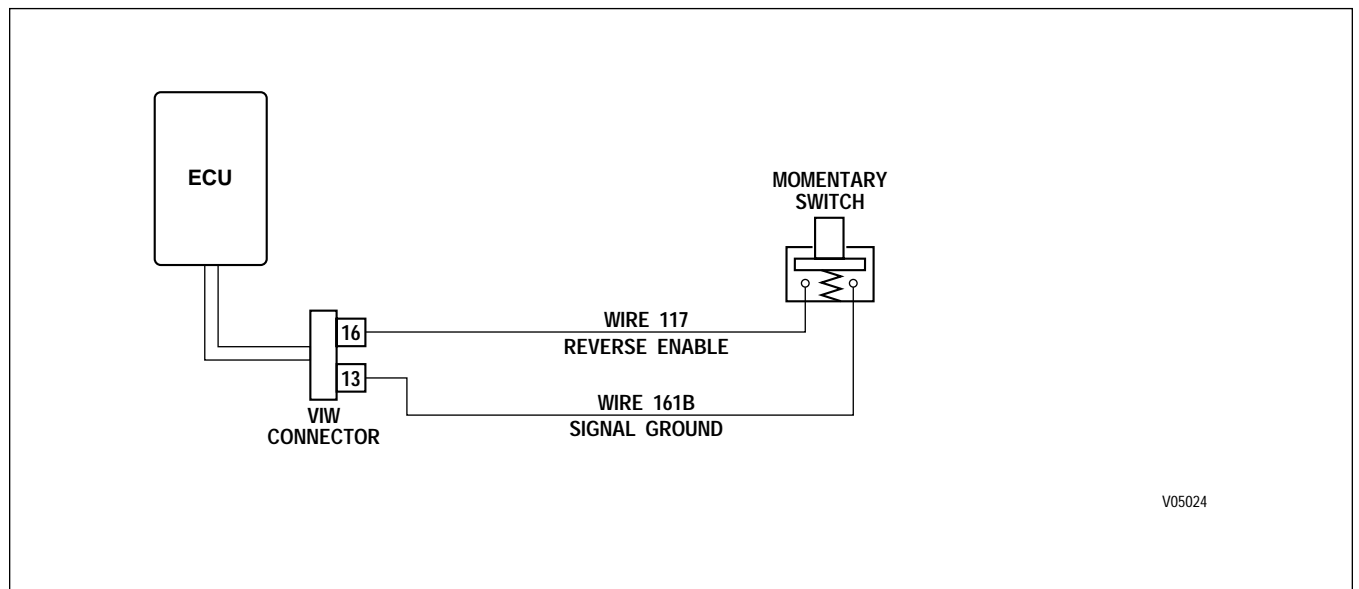
USES: Provides for a separate instrument panel-mounted switch which must be pressed simultaneously with the REVERSE button to achieve Reverse. MODE button may also be used.

VARIABLES TO SPECIFY: None

VOCATIONS: European transit buses and tour buses

WARNING!

If this function is enabled in the shift calibration, the function **MUST** be integrated into the vehicle wiring. If the function is available in the shift calibration but will not be used in the vehicle, it **MUST** be disabled in the calibration.



V05024

Figure P-19. Reverse Enable

APPENDIX P — INPUT/OUTPUT FUNCTIONS

WARNING!

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SHIFT IN PROCESS/SHIFT ENABLE

USES: Used to reduce engine power during a shift for high horsepower applications.

VARIABLES TO SPECIFY: None

VOCATIONS: Oil field pumping

WARNING!

If this function is enabled in the shift calibration, the function **MUST** be integrated into the vehicle wiring. If the function is available in the shift calibration but will not be used in the vehicle, it **MUST** be disabled in the calibration.

OPERATING PROCEDURE

1. ECU sends signal (“Shift in Process”) to powertrain module that a shift is being requested.
2. Powertrain module reduces engine power and sends a signal to ECU (“Shift Enable”) indicating that it is OK to shift.
3. ECU commands shift. When shift is completed, “Shift in Process” output turns off.
4. Powertrain module turns off the Shift Enable signal.

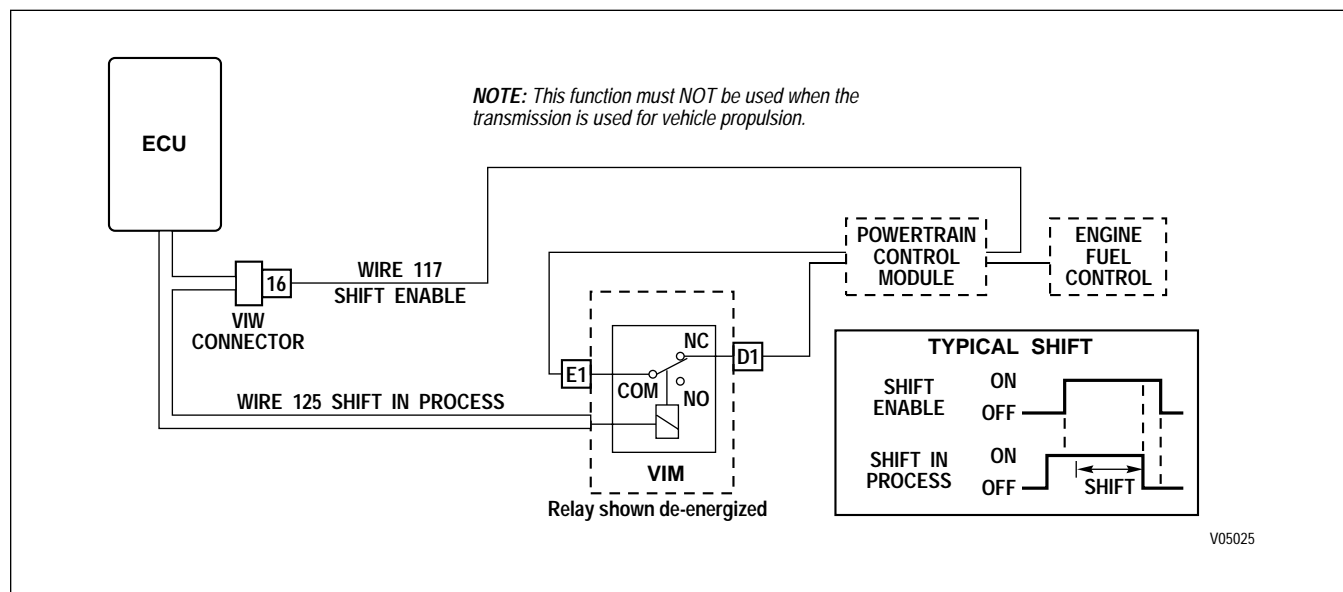


Figure P-20. Shift in Process/Shift Enable

APPENDIX P — INPUT/OUTPUT FUNCTIONS

WARNING!

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ANTI-LOCK BRAKE RESPONSE

USES: Signals the ECU when ABS function is active, so that lockup clutch and retarder will be disabled.

VARIABLES TO SPECIFY: None

VOCATIONS: Various

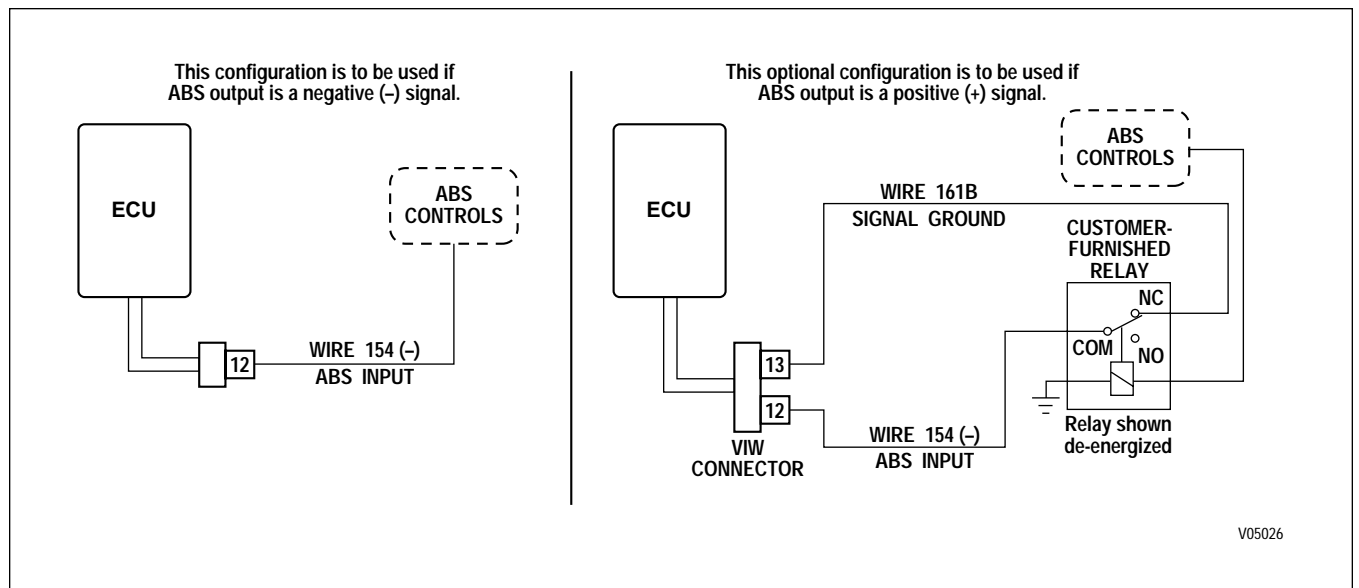


Figure P-21. Anti-Lock Brake Response

NOTE: This signal must stay constantly low during the duration of the ABS-active period. When ABS switches off, the transmission lockup clutch is re-applied, and retarder or engine-brake operation is resumed.

APPENDIX P — INPUT/OUTPUT FUNCTIONS

WARNING!

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RETARDER ENABLE

USES: Provides for operator ON/OFF control of the retarder, transmission temperature indication, and brake lights during retarder operation.

USES: None

VOCATIONS: Various. This function is **required** for retarder-equipped transmissions.

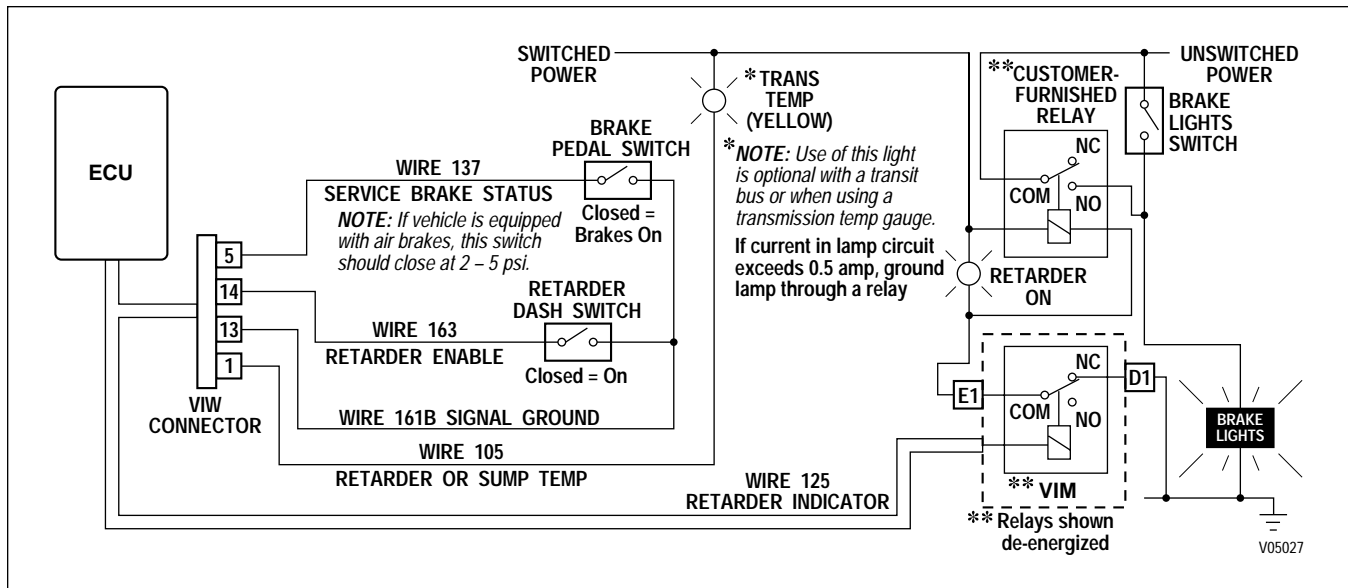


Figure P-22. Retarder Enable

APPENDIX P — INPUT/OUTPUT FUNCTIONS

WARNING!

These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could result in damage to equipment or property, personal injury, or loss of life. **ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.**

SERVICE BRAKE STATUS

USES: Indicates to the ECU whether vehicle braking is being provided by the retarder or vehicle brakes, so that the transmission controls can be adapted accordingly.

VARIABLES TO SPECIFY: None

VOCATIONS: Various. This function is **required** for retarder-equipped transmissions.

This function is used in conjunction with Retarder Enable Input Function. Refer to schematic for Input Function, noting the use of wire 137.

APPENDIX P — INPUT/OUTPUT FUNCTIONS

WARNING!

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DIFFERENTIAL CLUTCH REQUEST

USES: Provides for operator ON/OFF control of the differential locking clutch in the MD 3070PT transmission transfer case.

VARIABLES TO SPECIFY: None

VOCATIONS: Various. This function is **required** for all MD 3070PT transmissions and used only with that model.

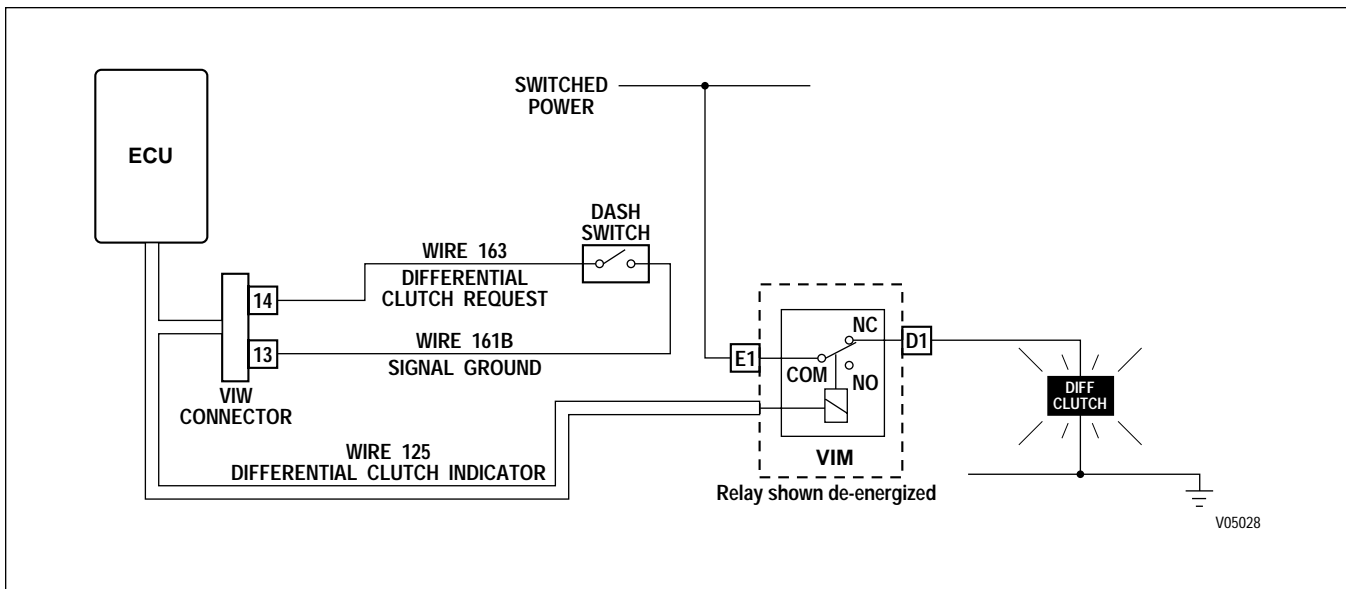


Figure P-23. Differential Clutch Request

APPENDIX P — INPUT/OUTPUT FUNCTIONS

WARNING!

These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could cause unintended selection of range or other unpredictable operation resulting in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.

AUTOMATIC NEUTRAL FOR REFUSE PACKER AND PTO ENABLE

USES: Provides for automatic selection of NEUTRAL and activation of PTO when park brake is applied. Automatically re-engages transmission when park brake is released.

VARIABLES TO SPECIFY: Max output rpm to enable Neutral, max engine rpm for PTO engagement, max engine rpm for PTO operation, max output rpm for PTO operation.

VOCATIONS: Refuse packer, recycling truck

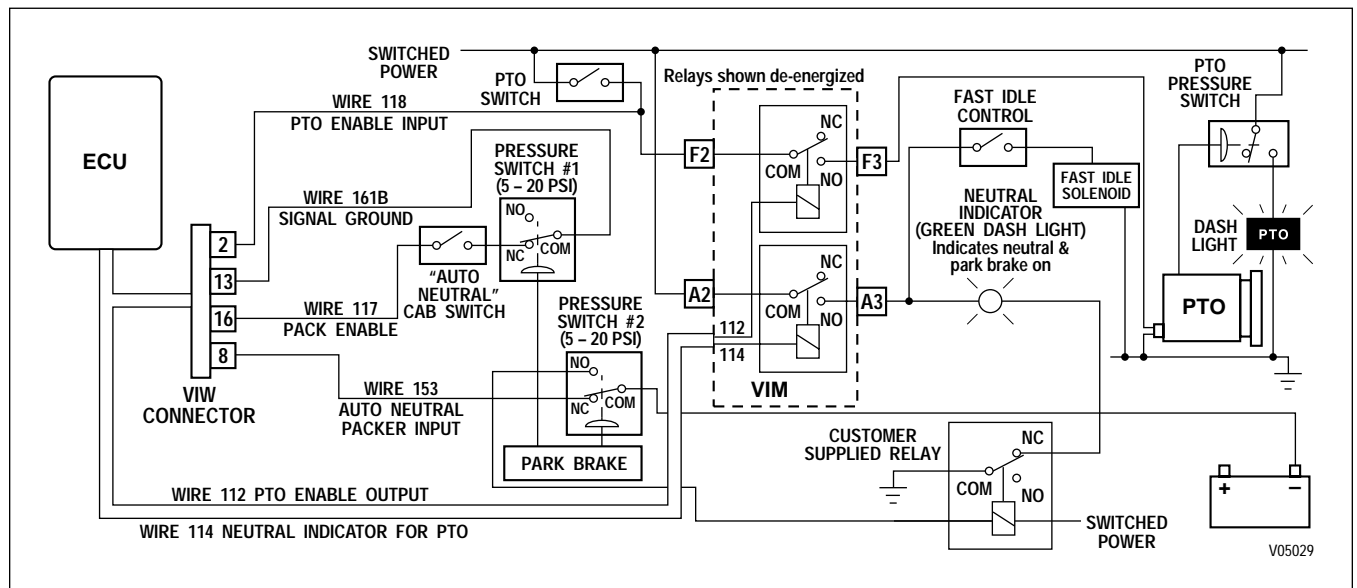


Figure P-24. Automatic Neutral for Refuse Packer and PTO Enable

APPENDIX P — INPUT/OUTPUT FUNCTIONS

WARNING!

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AUTOMATIC NEUTRAL FOR REFUSE PACKER AND PTO ENABLE (OPTIONAL)

USES: Provides for automatic selection of NEUTRAL and activation of fast idle when work brake is applied. Automatically re-engages transmission when park brake is released.

VARIABLES TO SPECIFY: Max output rpm to enable Neutral, max engine rpm for PTO engagement, max engine rpm for PTO operation, max output rpm for PTO engagement, max output rpm for PTO operation.

VOCATIONS: Refuse packer, recycling truck

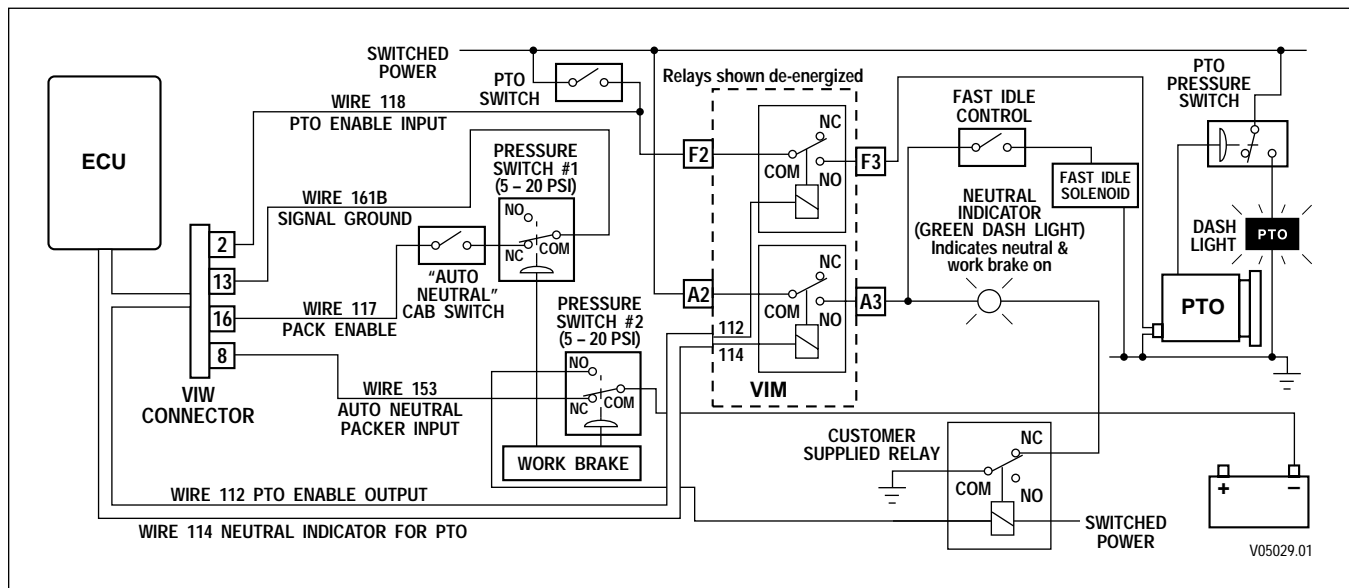


Figure P-25. Automatic Neutral for Refuse Packer and PTO Enable (Optional)

APPENDIX P — INPUT/OUTPUT FUNCTIONS

WARNING!

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KICKDOWN

USES: Provides both economy and performance shift points at full throttle. Operator changes from economy to performance by stepping through a detent at the throttle pedal.

VARIABLES TO SPECIFY: None

VOCATIONS: Various

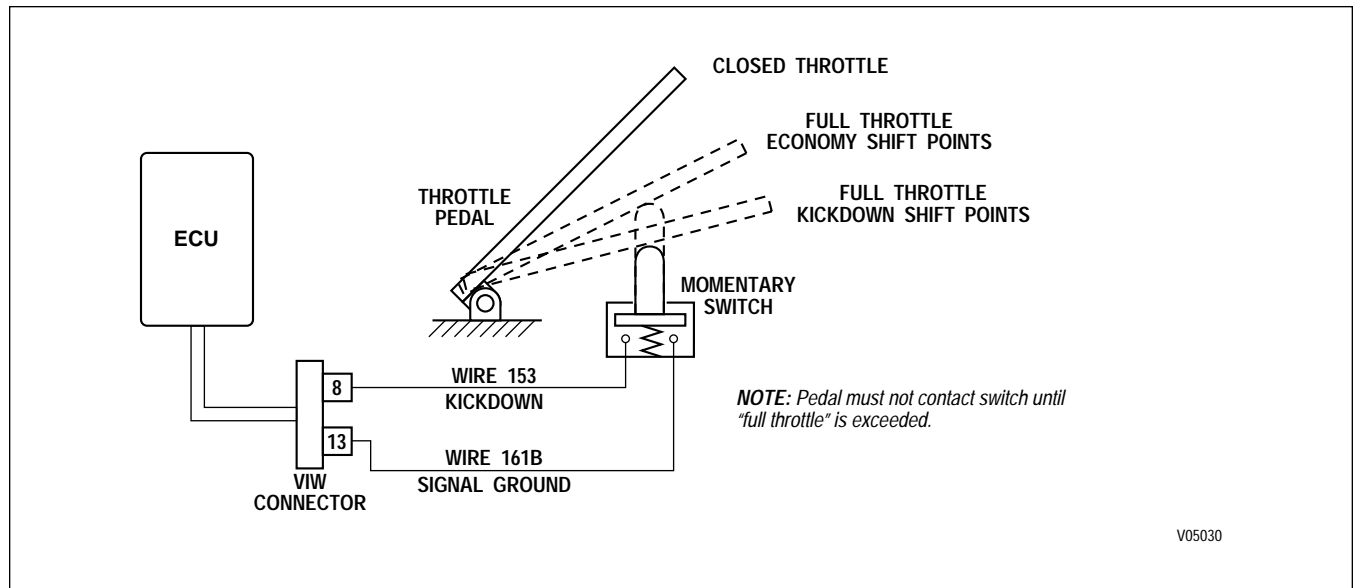


Figure P-26. Kickdown

APPENDIX P — INPUT/OUTPUT FUNCTIONS

WARNING!

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FOURTH LOCKUP PUMP MODE

USES: Facilitates engagement of split shaft PTO and shifts transmission to fourth range lockup for driving a vehicle-mounted pump.

VARIABLES TO SPECIFY: None

VOCATIONS: Street cleaners, sewer cleaners

WARNING!

If this function is turned “ON” in the shift calibration, the function **MUST** be integrated into the vehicle wiring. If the function is available in the shift calibration but will not be used in the vehicle, it **MUST** be turned “OFF” in the calibration.

SYSTEM OPERATION

OPERATOR ACTION — System Response

TO ENGAGE:

1. **SELECT NEUTRAL** — Transmission shifts to Neutral.
2. **APPLY PARKING BRAKE** — None
3. **SELECT PUMP** — Turns on “Pump Mode Requested” light. Turns on both input signals to ECU (wires 117 and 118) which activates “pump” mode. When split-shaft shifts, “Pump Engaged” light is turned on.
4. **SELECT DRIVE** — Transmission shifts to fourth lockup. “OK To Pump” light is turned on.

TO DISENGAGE:

1. **SELECT NEUTRAL** — Transmission shifts to Neutral if output rpm < 1000.
2. **SELECT ROAD MODE** — PTO disengages.

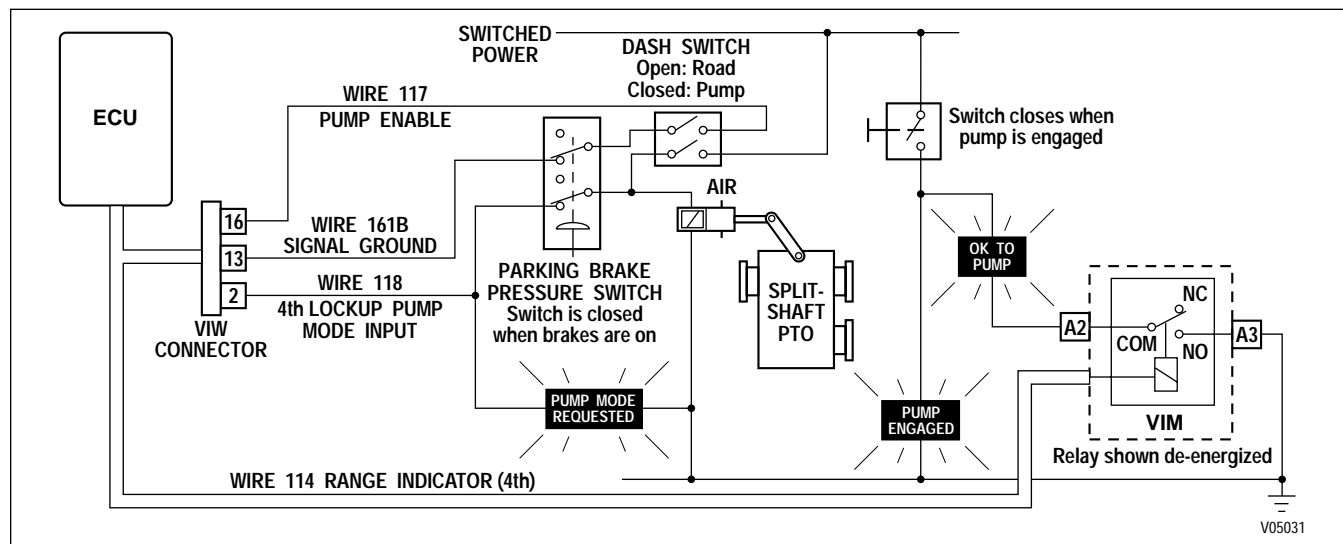


Figure P-27. Fourth Lockup Pump Mode

APPENDIX P — INPUT/OUTPUT FUNCTIONS

WARNING!

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AUTOMATIC NEUTRAL FOR REFUSE PACKER AND PTO ENABLE WITH SERVICE BRAKE STATUS

USES: Provides for automatic selection of NEUTRAL and activation of fast idle when loading arm is activated. Automatically re-engages transmission when loading arm is retracted if service brake is depressed.

VARIABLES TO SPECIFY: Max output rpm to enable Neutral, max engine rpm for PTO engagement, max engine rpm for PTO operation, max output rpm for PTO engagement, max output rpm for PTO operation.

VOCATIONS: Refuse packer, recycling truck

WARNING!

This feature is meant to be used in applications where the vehicle operator remains in the cab. If the operator leaves the vehicle, the park brake must be engaged and Neutral must be selected prior to the operator exiting the cab. In addition, vehicles using this feature must have the following Warning sticker visible in the vehicle cab: “WARNING: Set Park Brake and select Neutral before exiting cab!”

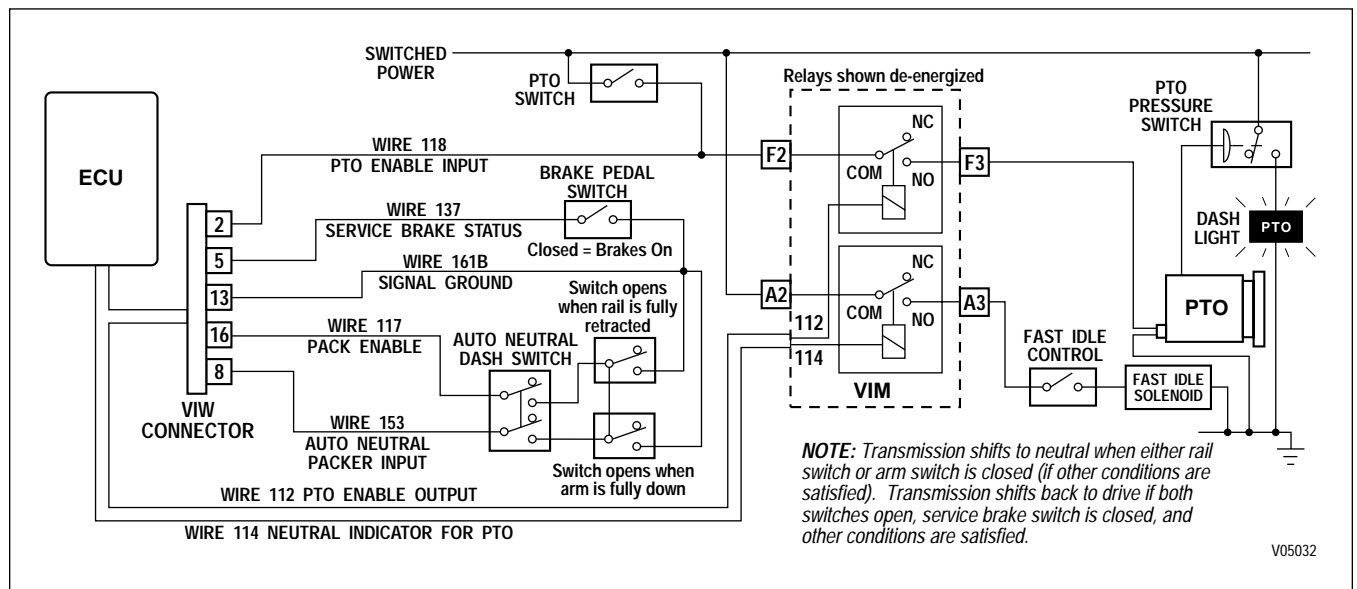


Figure P-28. Automatic Neutral for Refuse Packer and PTO Enable With Service Brake Status

APPENDIX P — INPUT/OUTPUT FUNCTIONS

WARNING!

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AUTOMATIC NEUTRAL FOR REFUSE PACKER AND PTO ENABLE WITH SERVICE BRAKE STATUS (OPTION 1)

USES: Provides for selection of NEUTRAL and enabling fast idle through activation of a dash mounted switch. Automatically re-engages transmission when switch is opened if service brake is depressed.

VARIABLES TO SPECIFY: Max output rpm to enable Neutral, max engine rpm for PTO engagement, max engine rpm for PTO operation, max output rpm for PTO engagement, max output rpm for PTO operation.

VOCATIONS: Refuse packer, recycling truck

WARNING!

This feature is meant to be used in applications where the vehicle operator remains in the cab. If the operator leaves the vehicle, the park brake must be engaged and Neutral must be selected prior to the operator exiting the cab. In addition, vehicles using this feature must have the following Warning sticker visible in the vehicle cab: "WARNING: Set Park Brake and select Neutral before exiting cab!"

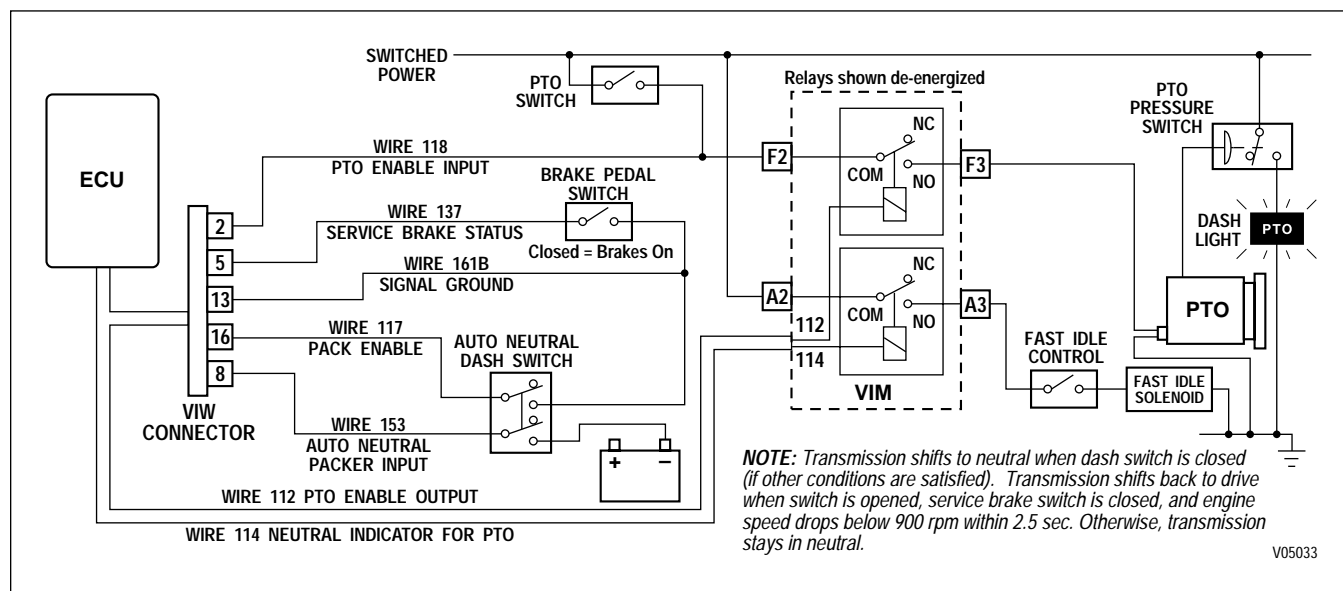


Figure P-29. Automatic Neutral for Refuse Packer and PTO Enable With Service Brake Status (Option 1)

APPENDIX P — INPUT/OUTPUT FUNCTIONS

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SUMP/RETARDER TEMPERATURE INDICATOR

USES: Turn on dash indicator when transmission sump or retarder-out temperature has exceeded specified limits.

VARIABLES TO SPECIFY: Sump temperature to turn ON, sump temperature to turn OFF.

VOCATIONS: Various

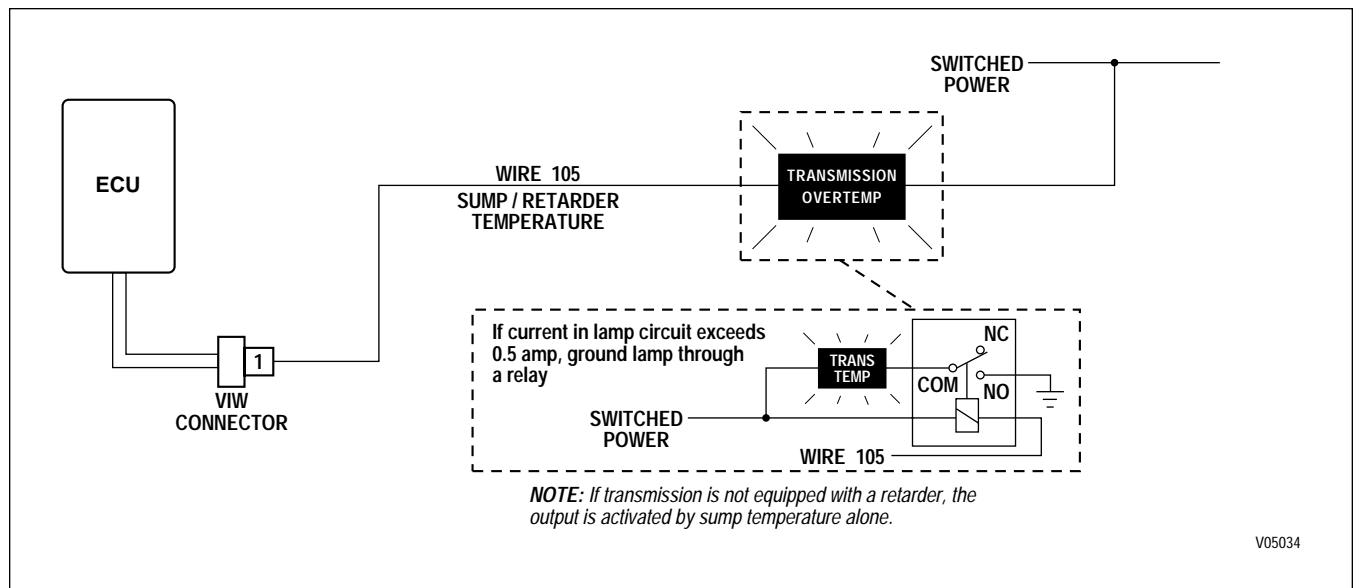


Figure P-30. Sump/Retarder Temperature Indicator

APPENDIX P — INPUT/OUTPUT FUNCTIONS

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RANGE INDICATOR

USES: Used with auxiliary vehicle systems to permit operation only in specified transmission range(s).

VARIABLES TO SPECIFY: Range or ranges to be indicated

VOCATIONS: Various

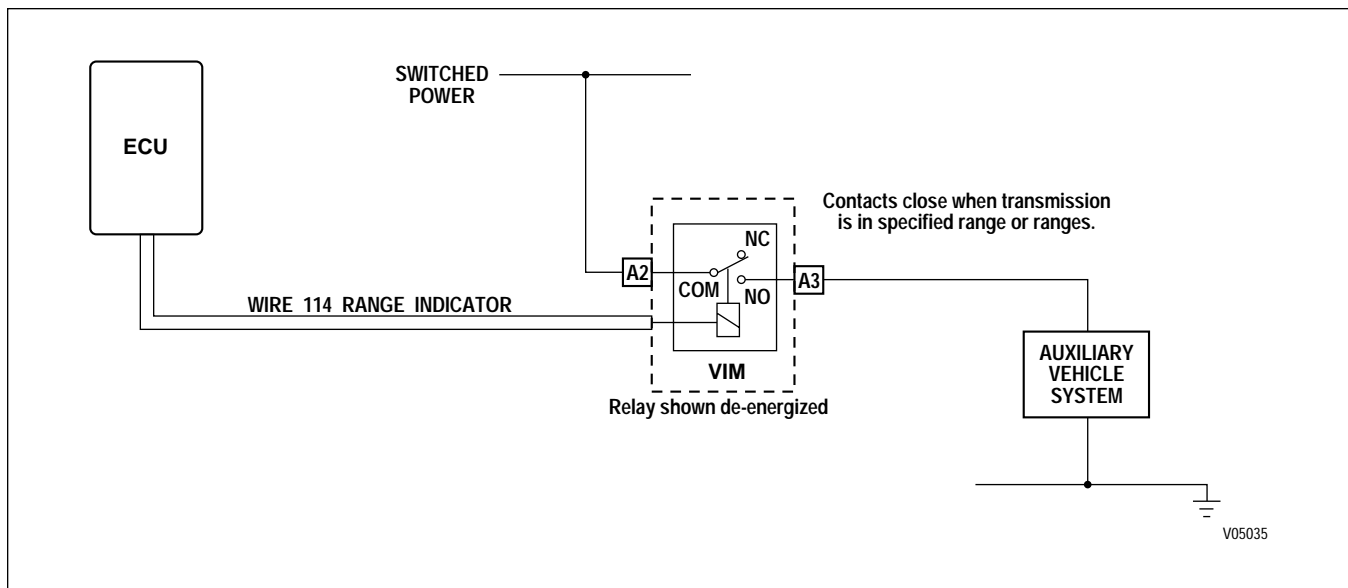


Figure P-31. Range Indicator

APPENDIX P — INPUT/OUTPUT FUNCTIONS

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OUTPUT SPEED INDICATOR — A

USES: To signal that the transmission output shaft has exceeded a specified value.

VARIABLES TO SPECIFY: Rpm to turn output ON and to turn output OFF. The ON value must be higher than the OFF value.

VOCATIONS: Various

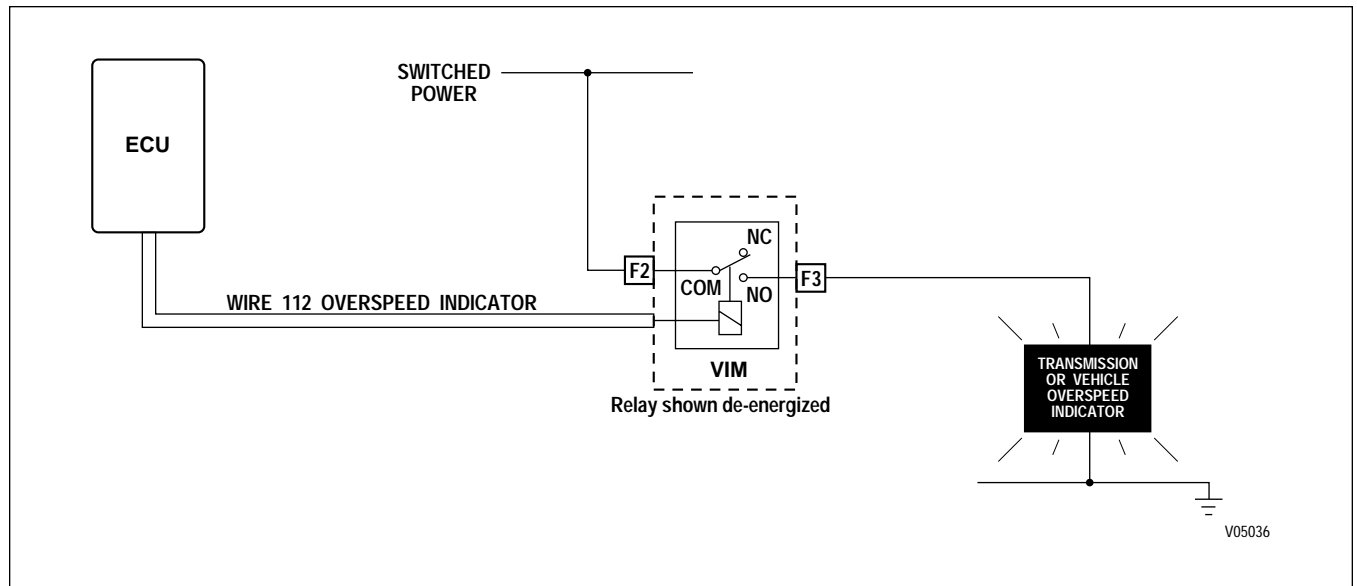


Figure P-32. Output Speed Indicator — A

APPENDIX P — INPUT/OUTPUT FUNCTIONS

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OUTPUT SPEED INDICATOR — B

USES: To signal that the transmission output shaft has exceeded a specified value.

VARIABLES TO SPECIFY: Rpm to turn output ON and to turn output OFF. The ON value must be higher than the OFF value.

VOCATIONS: Various

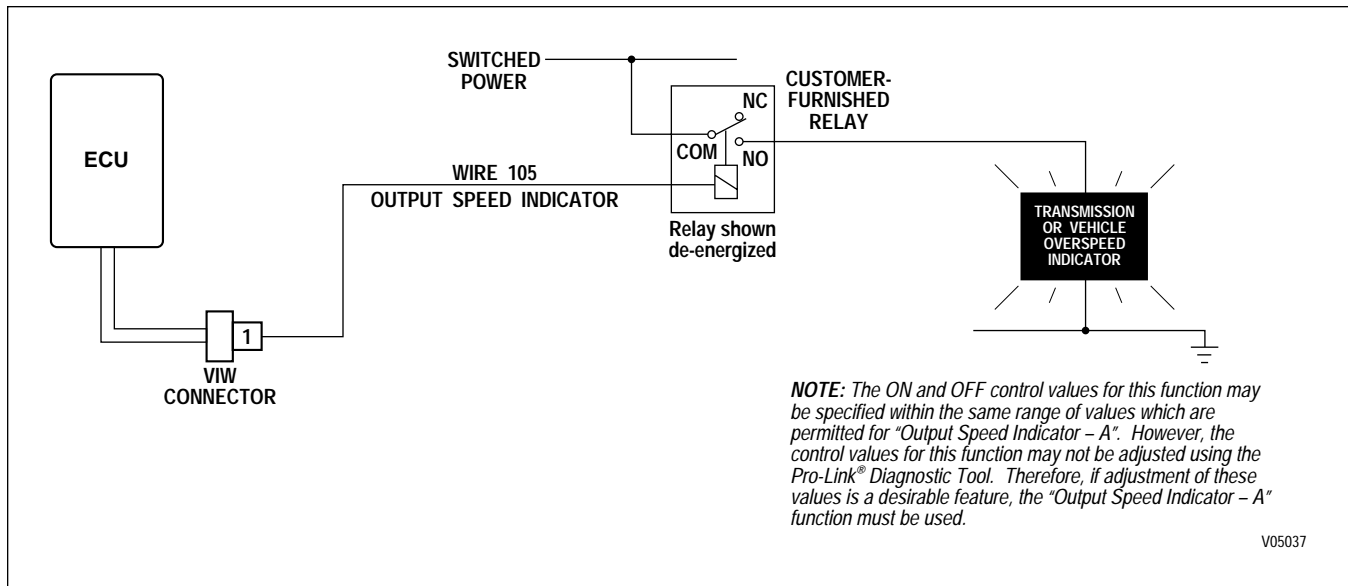


Figure P-33. Output Speed Indicator — B

APPENDIX P — INPUT/OUTPUT FUNCTIONS

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PTO OVERSPEED INDICATOR

USES: Turn on dash light when PTO reaches an overspeed condition.

VARIABLES TO SPECIFY: Rpm to turn ON; rpm to turn OFF.

VOCATIONS: Various

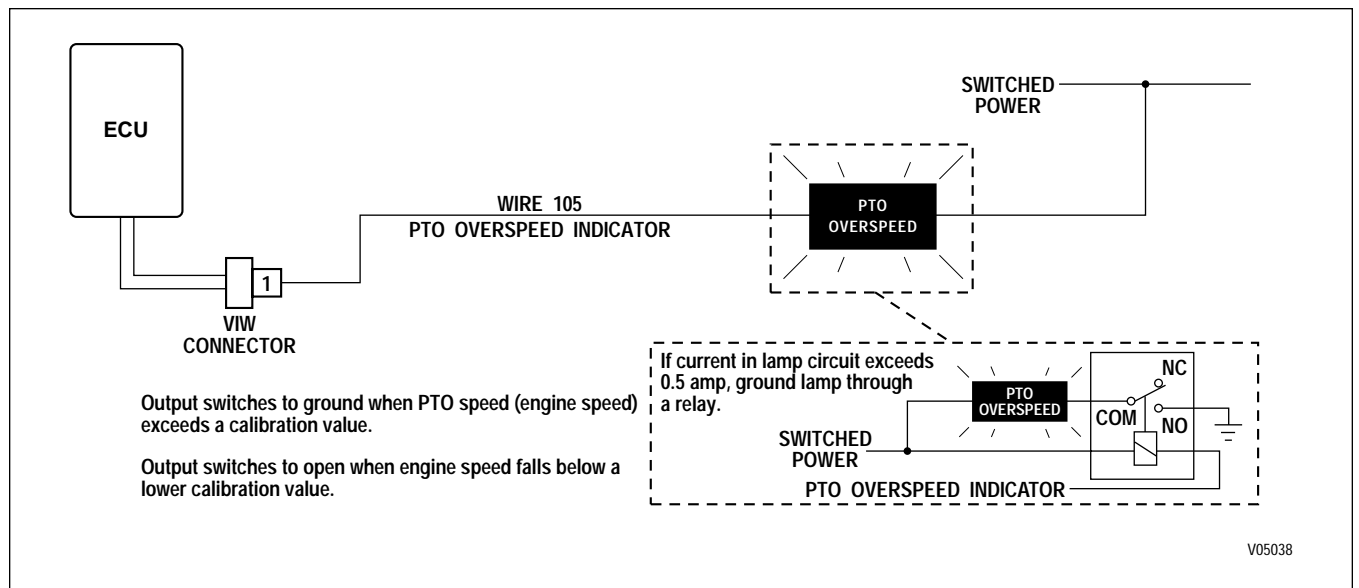


Figure P-34. PTO Overspeed Indicator

APPENDIX P — INPUT/OUTPUT FUNCTIONS

WARNING!

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ENGINE OVERSPEED INDICATOR

USES: To turn on dash light when engine reaches an overspeed condition.

VARIABLES TO SPECIFY: Rpm to turn ON; rpm to turn OFF.

VOCATIONS: Various

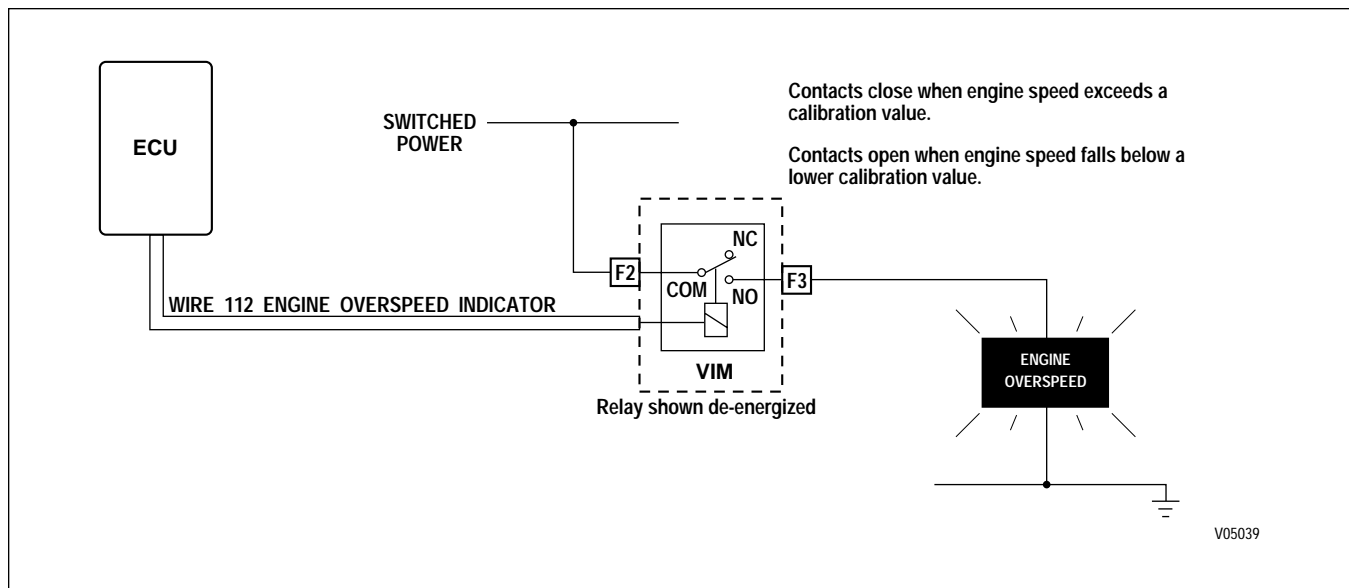


Figure P-35. Engine Overspeed Indicator

APPENDIX P — INPUT/OUTPUT FUNCTIONS

WARNING!

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LOCKUP INDICATOR

USES: Turn on dash indicator when transmission lockup clutch is engaged. Used to indicate when maximum engine braking is available.

VARIABLES TO SPECIFY: None

VOCATIONS: Various

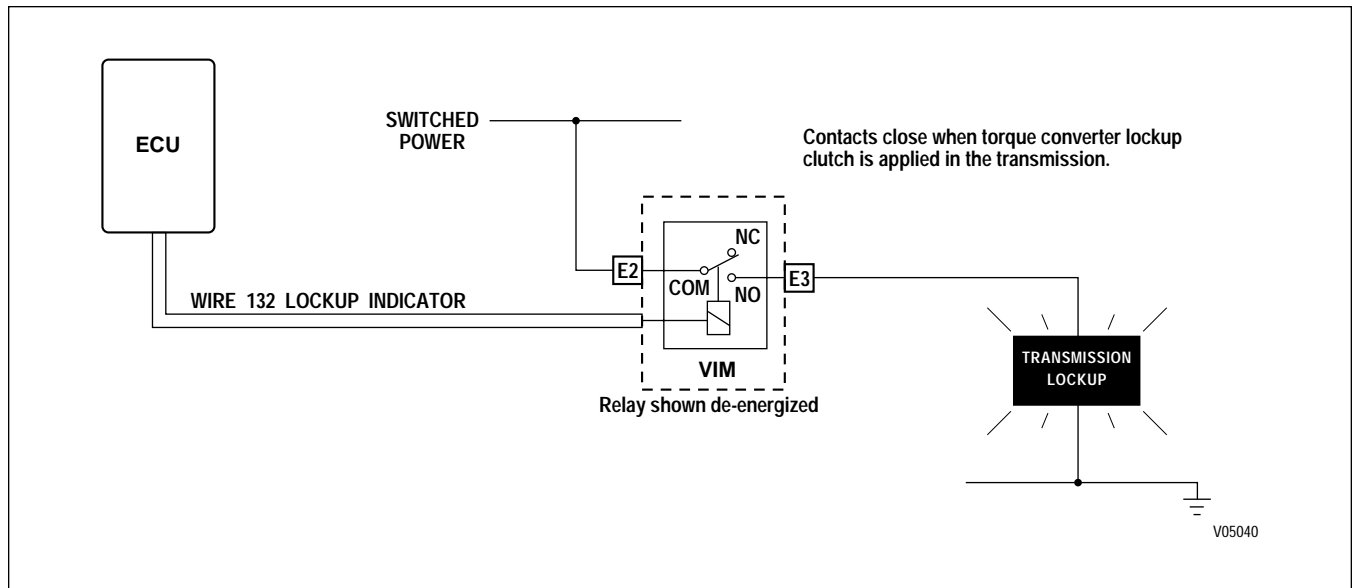


Figure P-36. Lockup Indicator

APPENDIX P — INPUT/OUTPUT FUNCTIONS

WARNING!

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SECONDARY MODE INDICATOR

USES: To indicate that Secondary Mode is active.

VARIABLES TO SPECIFY: None

VOCATIONS: Various

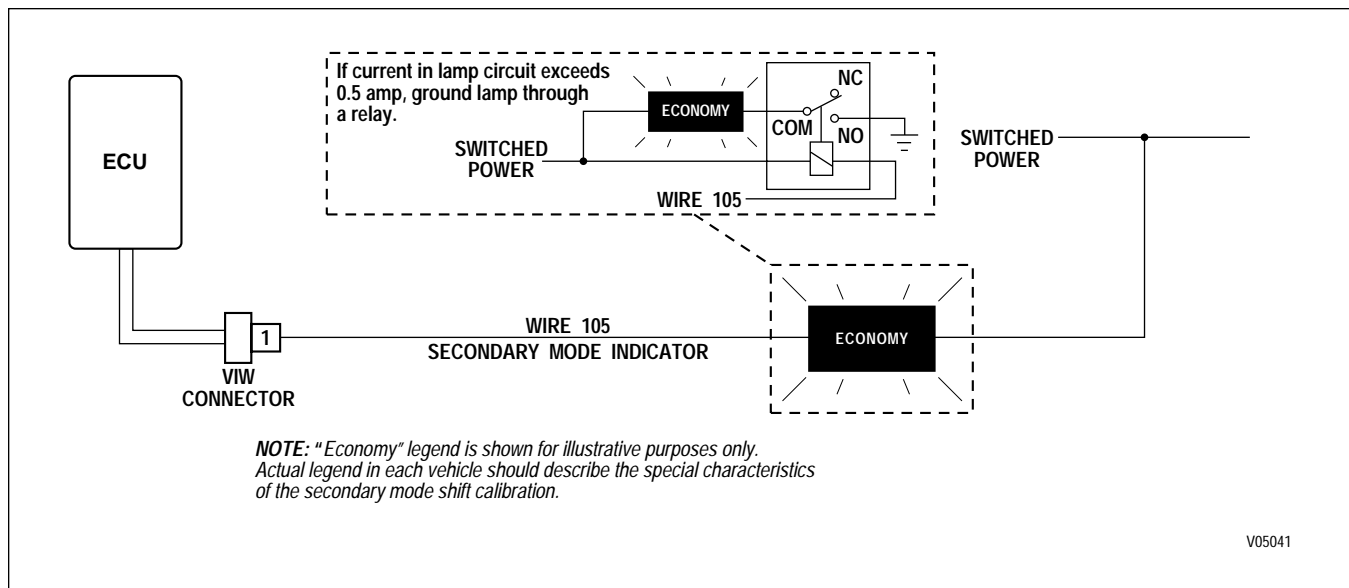


Figure P-37. Secondary Mode Indicator

APPENDIX P — INPUT/OUTPUT FUNCTIONS

WARNING!

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RETARDER INDICATOR

USES: Signals that the retarder is active. Typically used to turn on the vehicle brake lights when the retarder is in use.

VARIABLES TO SPECIFY: None

VOCATIONS: Various

This function is used in conjunction with Retarder Enable Input Function. Refer to schematic for Retarder Enable Input Function, noting the use of wire 125.

APPENDIX P — INPUT/OUTPUT FUNCTIONS

WARNING!

These schematics show the intended use of the specified controls features which have been validated in the configuration shown. Any miswiring or use of these features which differs from that shown could cause unscheduled operation of the PTO or other unpredictable operation resulting in damage to equipment or property, personal injury, or loss of life. ALLISON TRANSMISSION IS NOT LIABLE FOR THE CONSEQUENCES ASSOCIATED WITH MISWIRING OR UNINTENDED USE OF THESE FEATURES.

NEUTRAL INDICATOR FOR PTO AND PTO ENABLE

USES: Provides for fast idle operation in neutral, “pack-on-the-fly”, and PTO engagement with overspeed protection.

VARIABLES TO SPECIFY: Max engine rpm for PTO engagement, max engine rpm for PTO operation, max output rpm for PTO engagement, max output rpm for PTO operation.

VOCATIONS: Refuse packer, recycling truck.

SYSTEM OPERATION:

Operator selects NEUTRAL to enable fast idle.

Transmission shifts to neutral if throttle and output speed are low.

When DRIVE is re-selected, fast idle is interrupted and transmission shifts to drive if engine speed drops below 900 rpm within approximately two seconds.

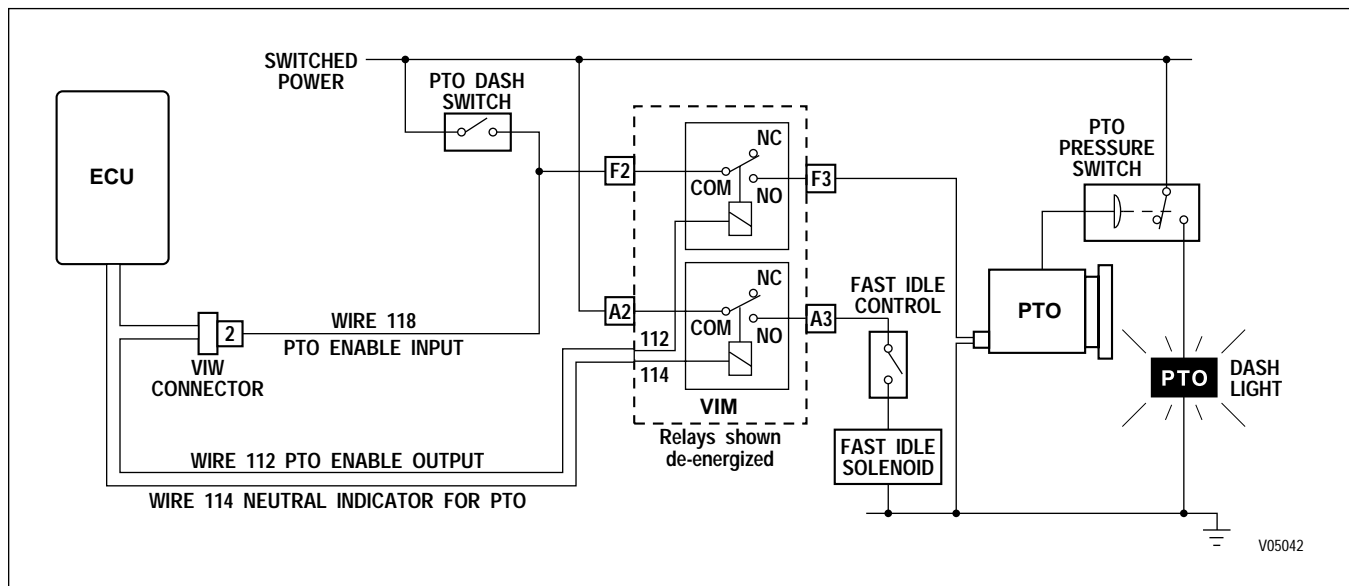


Figure P-38. Neutral Indicator for PTO and PTO Enable