Spicer® TPCS
(Tire Pressure Control System)

DANA SPICER®
Drivetrain Products

Troubleshooting Guide

AXTS0020
April 2007

Warnings and Cautions

The descriptions and specifications contained in this service publication are current at the time of printing.

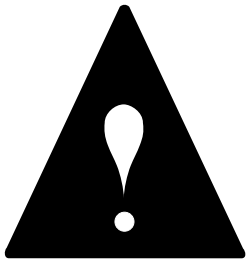
Dana reserves the right to discontinue or modify its models and/or procedures and to change specifications at any time without notice.

Any reference to brand name in this publication is made as an example of the types of tools and materials recommended for use and should not be considered an endorsement. Equivalents may be used.

IMPORTANT NOTICE

This symbol is used throughout this manual to call attention to procedures where carelessness or failure to follow specific instructions may result in personal injury and/or component damage.

Departure from the instructions, choice of tools, materials and recommended parts mentioned in this publication may jeopardize the personal safety of the service technician or vehicle operator.



WARNING: Failure to follow indicated procedures creates a high risk of personal injury to the servicing technician.

CAUTION: Failure to follow indicated procedures may cause component damage or malfunction.

IMPORTANT: Highly recommended procedures for proper service of this unit.

Note: Additional service information not covered in the service procedures.

Tip: Helpful removal and installation procedures to aid in the service of this unit.

Always use genuine Spicer replacement parts.

Every effort has been made to ensure the accuracy of all information in this guide. **However, Dana Commercial Vehicle Systems Division makes no expressed or implied warranty or representation based on the enclosed information.**

Any errors or omissions may be reported to:
Marketing Services
Dana Commercial Vehicle Systems Division
P.O. Box 4097
Kalamazoo, MI. 49003

General Information

Operator Instructions

Diagnostics

Service Codes

Service Procedures

Wire Harness

Tire Pressure Control System

Spicer Tire Pressure Control System features driver control of tire air pressure through:

- Simple push button operation.
- Independent Front, Rear, and Trailer operation.
- Electronic braking priority for air system.
- Vehicle speed sensing and response capability.
- Self-diagnostics.

Key Features

Depressurized Control Lines

The only time the system is pressurized is when changing tire pressures or during pressure checks. Wheel valves isolate the tires from the rest of the system.

Electronic Braking Priority

A pressure switch, installed in the supply tank, controls the TPCS's use of air. This optimizes and protects the brake system's primary tank pressures during system operation.

Self-Diagnostic and Auto Shut-Down

The Spicer TPCS provides self-diagnosis during operation. If the system detects a problem, it will display a service code on the driver interface to alert the driver. If necessary, it will close the wheel valves and shut down.

Diagnostic Capability

The Spicer TPCS provides for easy troubleshooting using PC-based or industry standard tools. PC-supported diagnostics improve troubleshooting, reduce maintenance time, provide manual control of TPCS test sequences, and give historical and active service code data.

Speed / Pressure Control and Warning

If truck speed exceeds the maximum allowable speed for a given setting, a warning is activated by TPCS to alert the driver. If speed is not reduced, the system automatically inflates the tires to the appropriate pressure.

Manual Tire Inflation / Deflation

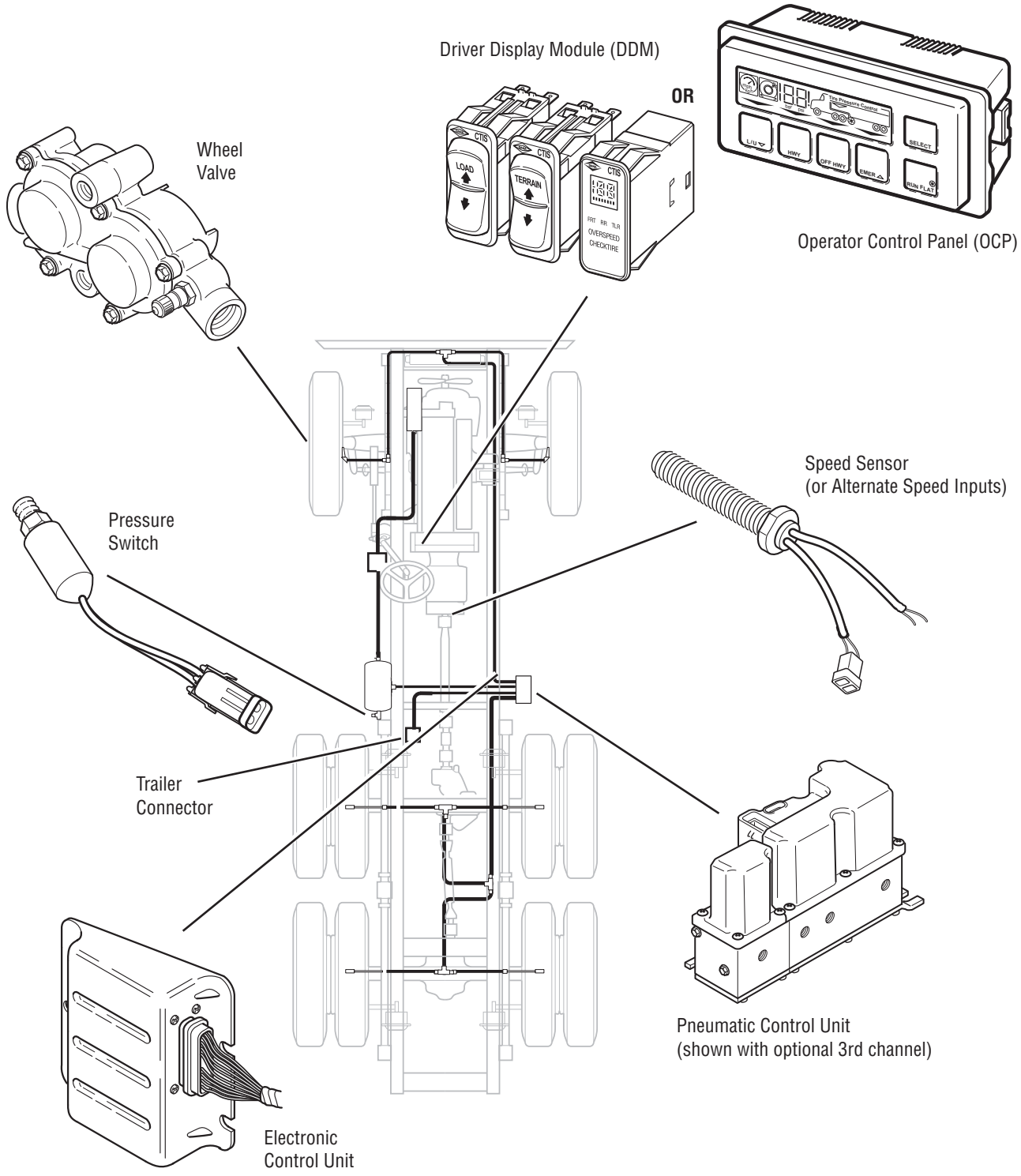
A valve stem has been included on each wheel valve and may be used for manual inflation, deflation or measurement of tire pressures.

Run Flat Operation

The TPCS normally checks tire pressures at intervals of 15 minutes. If possible tire damage is detected, the system will activate Auto RUN FLAT. RUN FLAT reduces the pressure check interval to 15 seconds, helping to assure that the tire will remain inflated despite minor tire damage.

Component Description

Tire Pressure Control System Components



Wheel Valve

All axles use a Wheel Valve (WV) at each end. Dual wheels are typically connected through one WV to provide tire pressure balance, although individual wheel valves for each tire may be installed. When the system is idle, the wheel valve isolates the tire(s), ensuring fail-safe operation. A standard valve stem is included on the WV for manual inflation / deflation / pressure checking.

Electronic Control Unit (ECU)

The Electronic Control Unit (ECU) is the control center for the entire Tire Pressure Control System. The ECU receives commands from the driver through the Driver Display Module (DDM) or Operator Control Panel (OCP) and transmits and monitors appropriate signals throughout the system.

Driver Interface

Options are available for the TPCS driver interface. The Driver Display Module (DDM) includes two rocker switches and a multi-function display. The Operator Control Panel (OCP) uses a six-button keypad and graphic display.

Pneumatic Control Unit (PCU)

The Pneumatic Control Unit (PCU) is a solenoid controlled manifold that controls the air system. It also contains the Pressure Sensor (transducer) which reads tire pressures.

Vehicle Speed

Speed is read from the vehicle data link or a separate speed sensor.

Pressure Switch

The Pressure Switch (PS) acts as an electronic brake priority switch. It prevents the Tire Pressure Control System from using air from the supply tank until the brake system is fully charged. The PS also ensures that enough pressure exists for the system to operate properly.

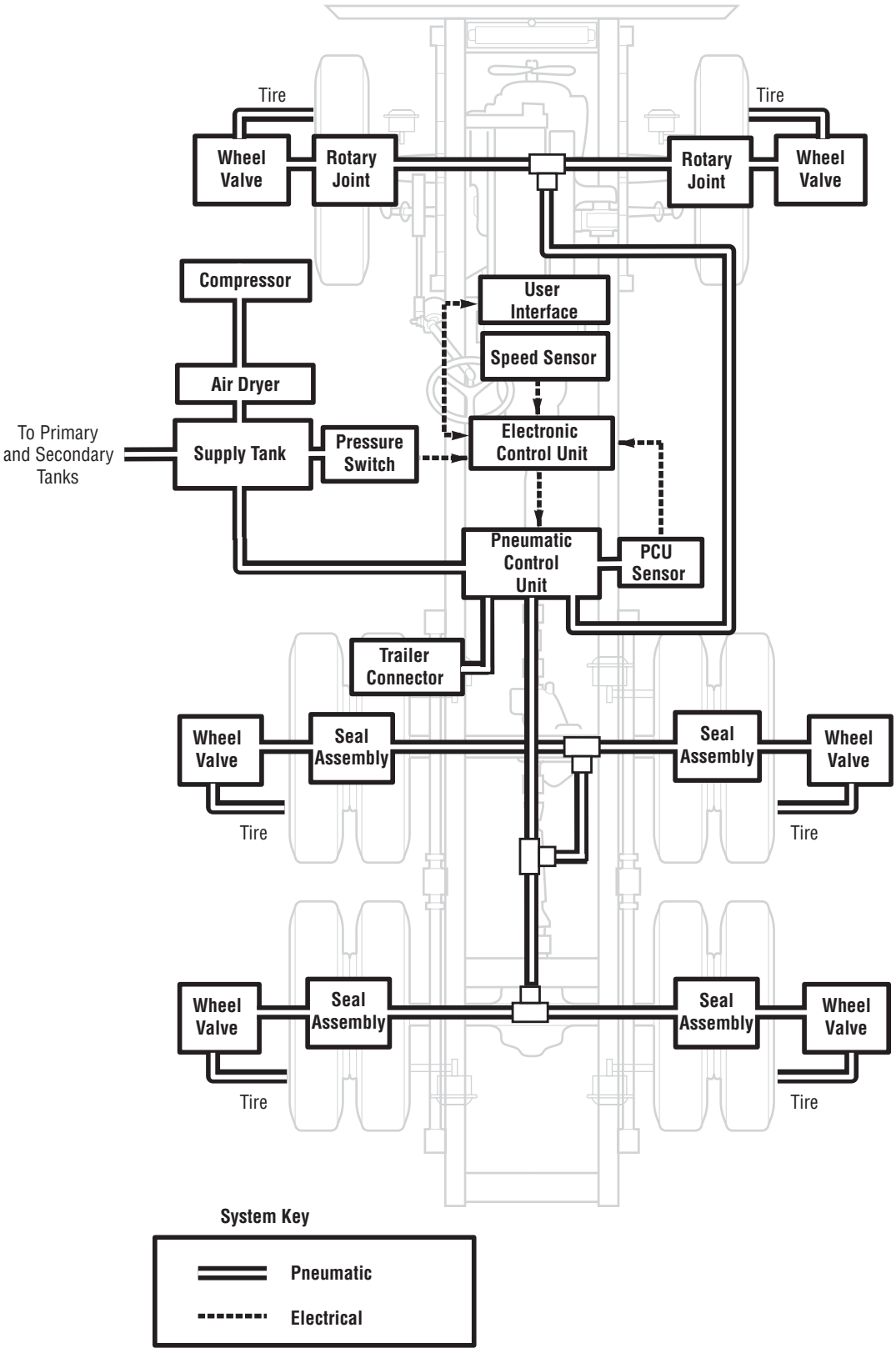
Air Lines

The Tire Pressure Control System uses a dedicated pneumatic system plumbed from the vehicle's existing supply tank.

Wiring

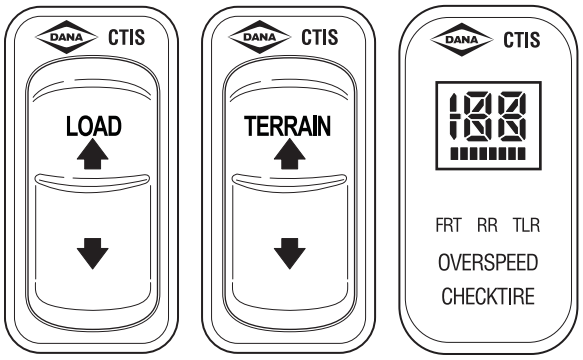
A wiring harness (Dana or OEM supplied) provides for electrical signals between appropriate components.

Simplified System Schematic



Operator Instructions - Driver Display Module (DDM)

TPCS may be equipped with one of two driver interface devices: a Driver Display Module (DDM) or an Operator Control Panel (OCP). The Driver Display Module (DDM) is illustrated below and the following section explains the features and use.



Warning Icons

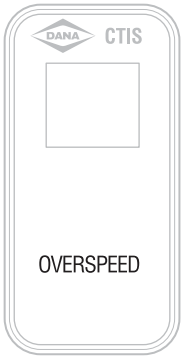
TPCS includes two distinct warnings to report possible tire problems and inappropriate vehicle operation. You must take immediate action to either reduce vehicle speed or check tire condition whenever these warnings are displayed.

Reduce Vehicle Speed

⚠ CAUTION

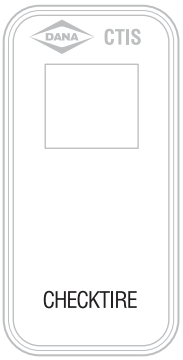
Failure to respond may result in overheated tires and possible tire failure.

This signal reports that the vehicle speed is too fast for the pressure selected. You must either reduce speed or select a higher pressure by pressing the appropriate key. Continued operation in this mode will result in the system automatically selecting a more appropriate pressure setting.



Check Tire Condition

This signal reports that one or more tires may be at a significantly lower pressure than the others and could indicate that a tire is not holding pressure. Stop the vehicle immediately in a safe place and identify the extent of tire damage.



⚠ IMPORTANT

Tires can still go flat! Although the Tire Pressure Control System is designed to identify under-inflated tires and fill these tires to the desired operating pressure, you can still expect that tires will occasionally be punctured or otherwise damaged during normal use and no longer retain air reliably. A daily walk-around inspection of the vehicle at the start of the day, including a manual check of the tires, is still an important responsibility of the vehicle operator. Tire damage is more apparent after the vehicle has been idle overnight and will be more difficult to detect visually once the TPCS equipped vehicle is in operation. Although observation of excessive inflation periods through the driver interface can help identify a tire problem, you should have damaged tires replaced prior to placing the vehicle in operation.

Terrain and Load Pressure Selection

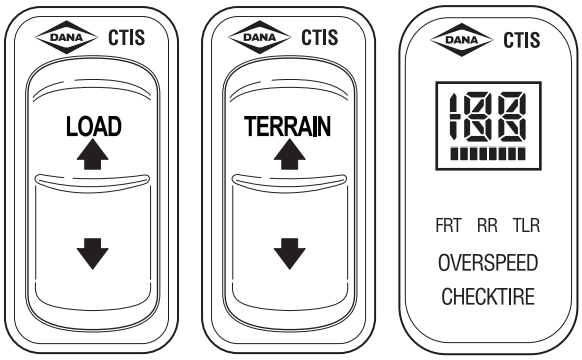
TPCS displays both the selected terrain and load, and may be configured to display numerical tire pressures in PSI, if desired. Tire pressures for the following terrain modes can be programmed and may be selected by the operator:

- **Highway (Hy)** - For travel on paved surfaces at higher speeds.
- **Off Highway (OH)** - For reduced speed operation on secondary roads and unpaved surfaces.
- **Emergency (E)** - For selection of extremely low tire pressures to help free a stuck vehicle.

⚠ CAUTION

The Emergency selection is for extreme conditions only and should not be used for normal driving.

System Operation



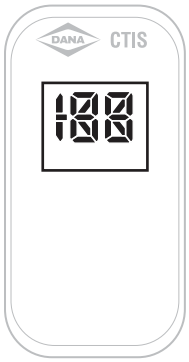
- **Display** - The DDM uses a multi-function display to indicate the current selections. The display will show HY for highway pressures, OH for off-highway pressures, and E for emergency pressures.
- **Terrain Selection** - The terrain selection is changed by depressing the terrain rocker switch, up to increase pressures and down to decrease pressures. Any switch operation which does not change pressures will command the system to do a pressure check.
- **Load Selection** - Vehicle load selection is represented by a horizontal bar graph under the mode display. Depress the load rocker switch to change the selection, up for increasing load and down for decreasing load.

⚠ CAUTION

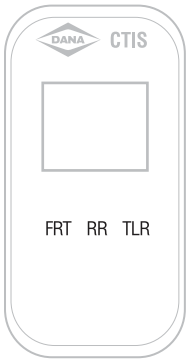
Operating a loaded vehicle at unloaded tire pressures may result in tire overheating and reduced tire life or blowout.

- **Pressure Display** - If the terrain switch is held in the up position for >5 seconds, numerical tire pressures (in PSI) for each channel will alternate in the display with the selected mode.

Note: The system is designed to allow tire pressure increase due to heat buildup during vehicle use. This system will not automatically deflate these pressure buildups—lower pressure mode selection by the operator must be selected to initiate a deflate.



- **Channel Indicators** - The DDM indicates FRT, RR or TLR respectively for front, rear or trailer axle groups. If a channel indicator is on continuously, that channel has achieved the target pressure.

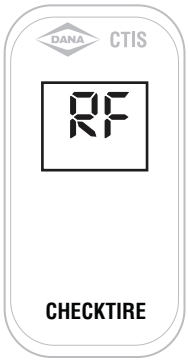


- **Service Code Indication** - The DDM will not display service codes directly but will exhibit two dashes if service is required. (Accessing the service codes will require a diagnostic tool).

Note: See the Service Codes Section to diagnose and repair.

- **RUN FLAT Indicator** - If the TPC System determines that a tire or tires may not be holding air, it may reduce the pressure check interval to minimize the possibility of air loss from the tire by switching to RUN FLAT operation. (See RUN FLAT in the Key Features section).

  If RUN FLAT is activated, the DDM will alternate the display of the terrain setting and RF and the CHECK TIRE indicator will be illuminated.



Tire Pressure Control System Programming

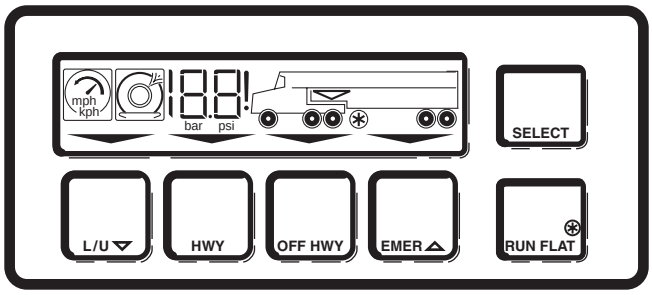
Spicer's Tire Pressure Control System is fully programmable, allowing the technician to program tire pressures for each channel (axle group) and maximum speeds for each terrain mode. If equipped with the Driver Display Module (DDM), programming must be done with a diagnostic tool.

Programmable settings include:

- Individual pressure settings for the front, rear, and trailer axle groups.
- Loaded and unloaded axle group programming for highway, off-highway, and emergency conditions.
- Over speed warning threshold for highway, off-highway and emergency conditions.

Operator Instructions - Operator Control Panel (OCP)

TPCS may be equipped with one of two driver interface devices: a Driver Display Module (DDM) or an Operator Control Panel (OCP). The Operator Control Panel (OCP) is illustrated below and the following section explains the features and use.



Warning Icons

TPCS includes two distinct warnings to report possible tire problems and inappropriate vehicle operation. You must take immediate action to either reduce vehicle speed or check tire condition whenever these warnings are displayed.

Reduce Vehicle Speed

⚠ CAUTION

Failure to respond may result in overheated tires and possible tire failure.

This signal reports that the vehicle speed is too fast for the pressure selected. You must either reduce speed or select a higher pressure by pressing the appropriate key. Continued operation in this mode will result in the system automatically selecting a more appropriate pressure setting.

Check Tire Condition

This signal reports that one or more tires may be at a significantly lower pressure than the others and could indicate that a tire is not holding pressure. Stop the vehicle immediately in a safe place and identify the extent of tire damage.

⚠ IMPORTANT

Tires can still go flat! Although the Tire Pressure Control System is designed to identify under-inflated tires and fill these tires to the desired operating pressure, you can still expect that tires will occasionally be punctured or otherwise damaged during normal use and no longer retain air reliably. A daily walk-around inspection of the vehicle at the start of the day, including a manual check of the tires, is still an important responsibility of the vehicle operator. Tire damage is more apparent after the vehicle has been idle overnight and will be more difficult to detect visually once the TPCS equipped vehicle is in operation. Although observation of excessive inflation periods through the driver interface can help identify a tire problem, you should have damaged tires replaced prior to placing the vehicle in operation.

Terrain and Load Pressure Selection

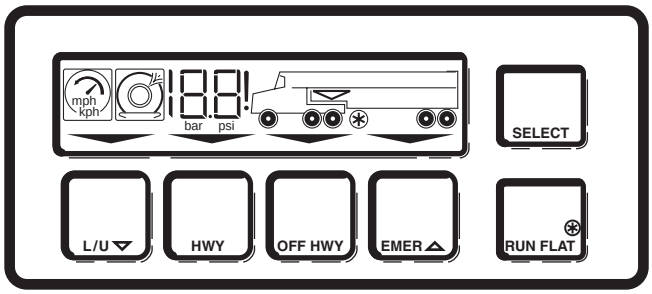
TPCS displays both the selected terrain and load, and may be configured to display numerical tire pressures in PSI, if desired. Tire pressures for the following terrain modes can be programmed and may be selected by the operator:

- **HWY** - For travel on paved surfaces at higher speeds.
- **OFF HWY** - For reduced speed operation on secondary roads and unpaved surfaces.
- **EMER** - For selection of extremely low tire pressures to help free a stuck vehicle.

⚠ CAUTION

The EMER key is for extreme conditions only and should not be used for normal driving.

System Operation



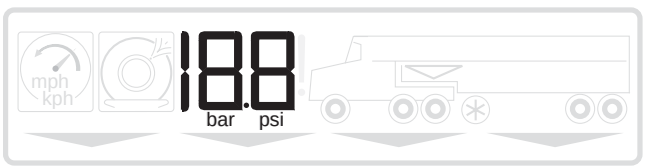
- **Display** - The OCP uses a graphic display to indicate the selection for both terrain mode and vehicle load. Above the selector keys labeled HWY (highway), OFF HWY (off-highway), and EMER (emergency), an illuminated arrow designates the current selection.
- **Terrain Selection** - The terrain selection is changed by depressing the desired mode on the keypad. When the system is actively changing tire pressure, the arrow above the target mode will flash. Pressing the key for a current mode will command a pressure check.
- **Load Selection** - Vehicle load selection is represented by an arrow above the rear wheels in the graphic display. Depress the keypad button labeled L/U to change from loaded to unloaded.

⚠ CAUTION

Operating a loaded vehicle at unloaded tire pressures may result in tire overheating and reduced tire life or blowout.

- **Pressure Display** - If the keypad button labeled Select is pressed after vehicle start, numerical pressures will be displayed sequentially for each active channel. Subsequent actuation of the Select key will lock the display on individual channels, or turn it off again.

Note: The system is designed to allow tire pressure increase due to heat buildup during vehicle use. This system will not automatically deflate these pressure buildups—lower pressure mode selection by the operator must be selected to initiate a deflate.



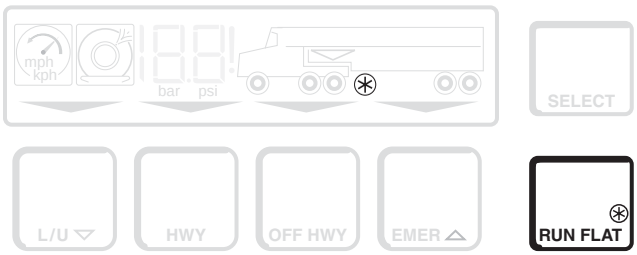
- **Channel Indicators** - The OCP display includes rings inside the tires of the truck graphic. The pressure shown in the display reflects the channel with the lighted rings.

- **Service Code Indication** - The OCP will display service codes using a number and letter combination followed by an exclamation point (!).

Note: See the Service Codes Section to diagnose and repair.

- **Metric/English Indicator** - The OCP may be programmed to display pressure in metric (BAR) or English (PSI) units (see Programming section).
- **RUN FLAT Indicator** - If the TPC System determines that a tire or tires may not be holding air, it may reduce the pressure check interval to minimize the possibility of air loss from the tire by switching to RUN FLAT operation. (See RUN FLAT in the Key Features section).

  If RUN FLAT is activated, an asterisk (*) will be illuminated in the display of the OCP. This asterisk matches the symbol on the RUN FLAT key and it indicates that the RUN FLAT feature is selected. The OCP also allows the driver to select RUN FLAT, by depressing that key, to manually reduce the pressure check interval. This may be desirable when operating under conditions (i.e. sharp rocks or construction debris) where tire punctures may be anticipated. The RUN FLAT feature will automatically de-select after 10 minutes, but may be re-selected.



Tire Pressure Control System Programming

Spicer's Tire Pressure Control System is fully programmable, allowing the technician to program tire pressures for each channel (axle group) and maximum speeds for each terrain mode. The system allows programming directly through the Operator Control Panel, or with a diagnostic tool.

Programmable settings include:

- Individual pressure settings for the front, rear, and trailer axle groups.
- Loaded and unloaded axle group programming for highway, off-highway, and emergency conditions.
- Over speed warning threshold for highway, off-highway and emergency conditions.

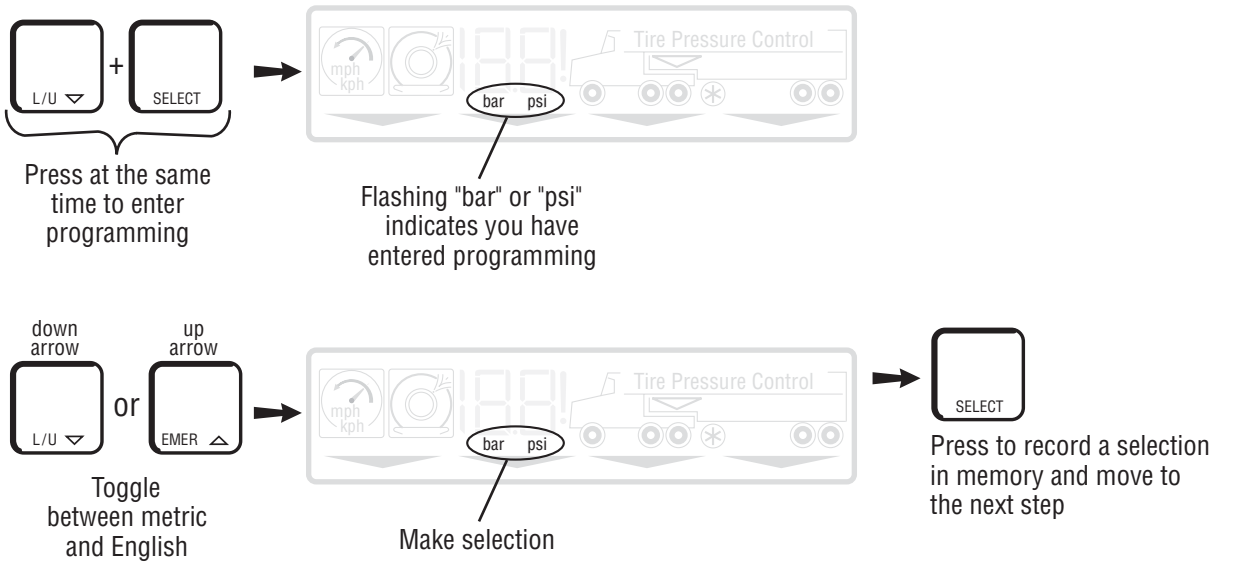
To program the system, follow these steps:

1. Enter the Tire Pressure Control System programming sequence by pressing the SELECT and L/U buttons at the same time. A flashing bar or PSI verifies that you are in the programming mode and also indicates that the first selection, English or metric values, is ready for programming. Refer to "Operator Control Panel Programming Sequence" for sample procedure.
2. Press the up/down arrows (on the L/U and EMER keys) to select options or change settings (pressure or speed) and press the SELECT button to record a selection in memory and move to the next step.
3. Press the SELECT button repeatedly to move through the program steps, one step for each time the SELECT button is pressed. Refer to the programming reference chart for specific Tire Pressure Control System pressure and speed programming steps.
4. To complete the programming sequence, or exit the programming mode, continue to press the SELECT button to step through to the end of the procedure, or press the SELECT and L/U buttons at the same time.

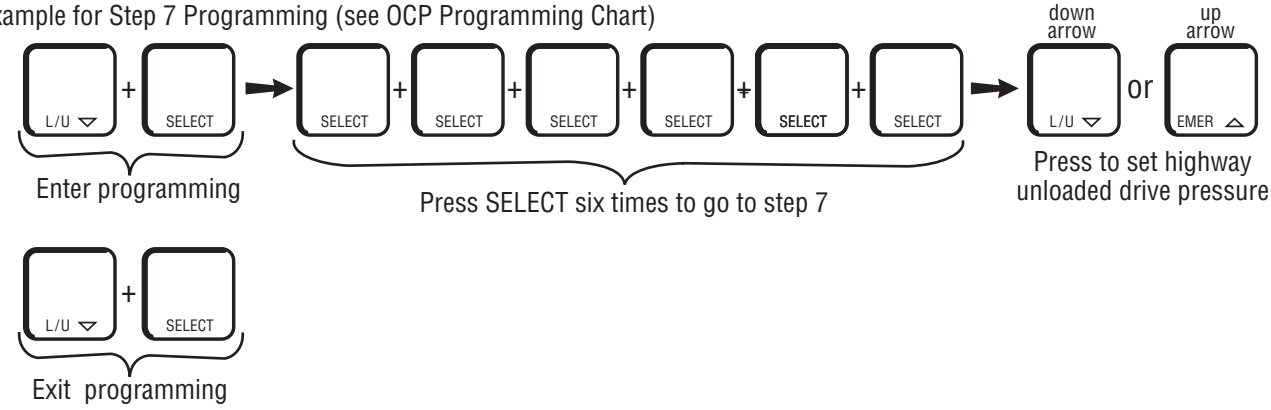
Note: If no buttons are pressed for more than one minute, the Operator Control Panel will end the programming sequence, saving any changes made during programming.

Operator Control Panel Programming Sequence

Example for Step 1 Programming (see OCP Programming Chart)



Example for Step 7 Programming (see OCP Programming Chart)



OCP Programming Chart

Step	Setting	Metric English Indicator	Speed-Indicator	Terrain Arrows			Loaded Arrow	OCP Channel Indicator		
				HWY	OFF HWY	EMER		Front	Rear	Trailer
1	Metric / English	On								
2	Highway Over Speed		On	On						
3	Highway Loaded Front Pressure			On			On	On		
4	Highway Loaded Rear Pressure			On			On		On	
5*	Highway Loaded Trailer Pressure			On			On			On
6	Highway Unloaded Front Pressure			On				On		
7	Highway Unloaded Rear Pressure			On					On	
8*	Highway Unloaded Trailer Pressure			On						On
9	Off-Highway Over Speed		On		On		On	On		
10	Off-Highway Loaded Front Pressure				On		On		On	
11	Off-Highway Loaded Rear Pressure				On		On			On
12*	Off-Highway Loaded Trailer Pressure				On			On		
13	Off-Highway Unloaded Front Pressure				On				On	
14	Off-Highway Unloaded Rear Pressure				On					On
15*	Off-Highway Unloaded Trailer Pressure				On					
16	Emergency Over Speed		On			On				
17	Emergency Loaded Front Pressure					On	On	On		
18	Emergency Loaded Rear Pressure					On	On		On	
19*	Emergency Loaded Trailer Pressure					On	On			On
20	Emergency Unloaded Front Pressure					On		On		
21	Emergency Unloaded Rear Pressure					On			On	
22*	Emergency Unloaded Trailer Pressure					On				On
* 3 Channel Only										

Diagnostics

This section covers the equipment and procedures used to find and correct Tire Pressure Control System problems.

Test Equipment

Tire Pressure Control System troubleshooting can be performed at three levels:

1. PC diagnostics.
2. Handheld tester.
3. Operator Control Panel service codes (if vehicle is equipped with an OCP).

Regardless of the testing equipment used, the troubleshooting procedures will be based upon the diagnostic service codes. Diagnostic tools offer the advantages of computer-aided testing without interpreting service codes.

Tire Pressure Control System Diagnostics

The onboard system diagnostics are an important feature of Spicer's Tire Pressure Control System. This section describes the use of service codes to identify Tire Pressure Control System operating problems.

The Tire Pressure Control System uses a code to identify service issues. The codes can be extracted from the ECU memory using a diagnostic service tool equipped with the appropriate software. In addition, systems equipped with an Operator Control Panel (OCP) will report codes directly on the display. Refer to the service code chart for more detailed information on service codes.

Historical Service Codes

Any time a fault occurs the system will log a fault in memory of the ECU. If the system becomes inoperative, the Driver Display Module (DDM) will report two dashes (- -) or an actual service code will be displayed on the Operator Control Panel. (Only the most recent code is displayed by the Operator Control Panel). Historical codes are stored in memory. Historical codes can only be accessed by a diagnostic tool. Historical codes are automatically cleared after 50 ECU resets with no active faults.

Service Codes

The Service Codes are described in the Troubleshooting section. Some service codes also identify the component that is associated with the problem. A list of possible causes is shown in order of most likely occurrence.

Test Modes

Diagnostic tools allow the system to be placed in several diagnostic modes:

Info - Display ECU information and configuration.

Codes - Active and historic codes are listed as reported by the ECU.

Monitor (Normal) - TPCS operates normally, while status of system components is observed.

Test - The following operations can be performed on each channel (axle group):

- **Check & Hold** - System checks and displays the pressures, then holds pressure in air lines (quick test of control line and seal integrity).
- **Deflate** - System "manually" deflates (test the deflation signal).
- **Inflate** - System "manually" inflates (test for large leaks).
- **Hold** - Pressure is held in control lines (test for small leaks).

Setup - Allows the technician to modify parameters such as target tire pressures, etc.

PC Diagnostics

⚠ CAUTION

A battery charger is not an adequate source of power.

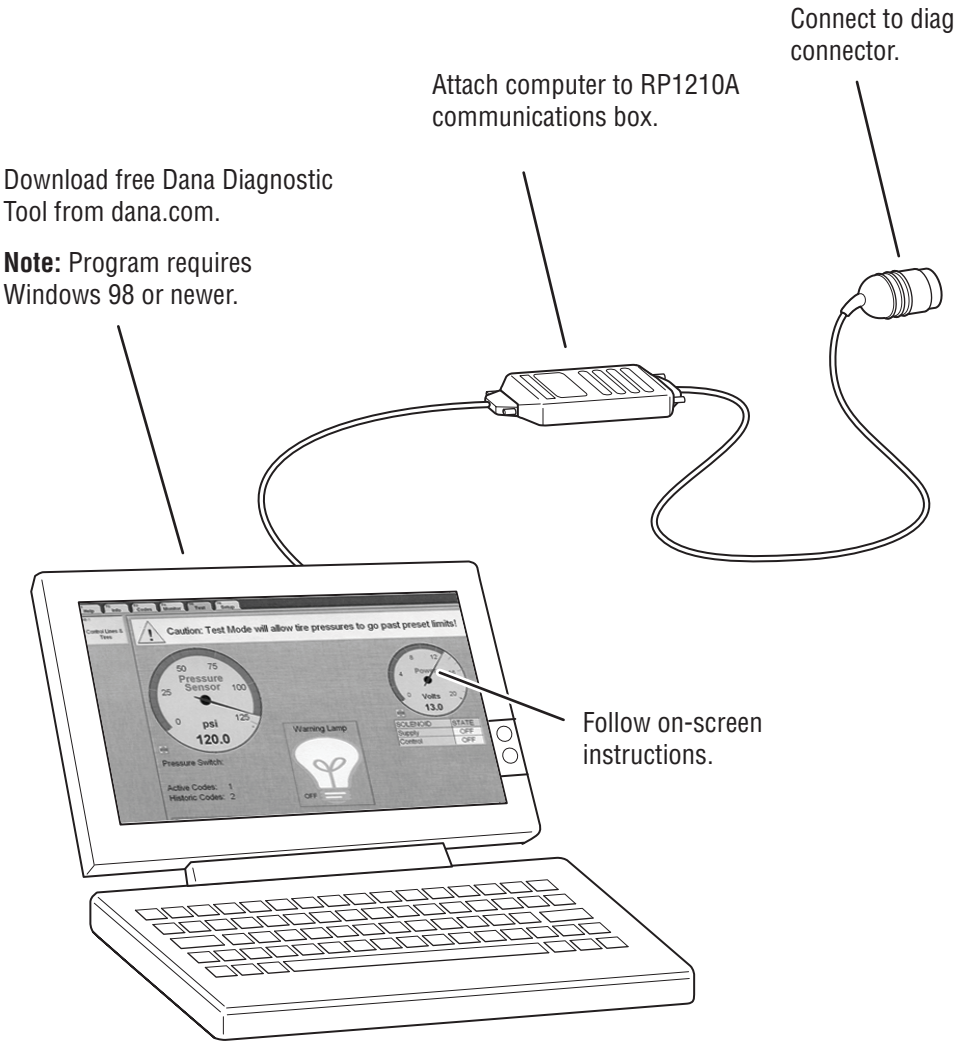
Visit www.dana.com for free download of Dana Diagnostic Tool (DDT).

PC diagnostics are easy to use and provide the quickest diagnostic capabilities.

- Retrieve historical data, faults and tire pressures.
- Pressurize system to detect leaks.
- Access troubleshooting flowcharts and service procedures.

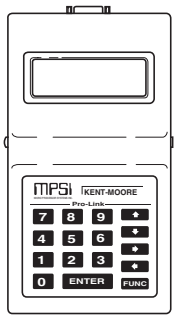
To use this program, an RP1210A compatible interface box and cables are needed to connect the PC to the vehicle.

For these types of interface boxes to work with the Dana Diagnostic Tool program, you must install a "RP1210 driver" program provided by the manufacturer of the interface box. If you do not have this program, it can normally be obtained from the manufacturer's web site. Please contact the manufacturer of your interface box if you have any questions regarding this process.



Handheld Tester

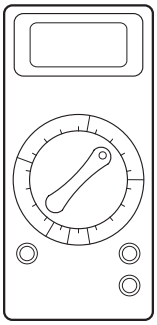
A Prolink handheld tester may be used to read and clear service codes and to obtain a short description of failures. The tester can initiate test sequences for controller outputs and can also read system parameters when equipped with the Dana program card.



Multimeter

Based upon system schematics and aided by component specific service codes, a multimeter can be used to check sensor and solenoid resistances and to find wiring harness faults. The multimeter can be used to check the Tire Pressure Control System wiring and components for:

- Continuity
- Ground
- Broken wires
- Open circuits
- Shorted circuits
- Incorrect battery voltage



Troubleshooting Tips

This checklist outlines some general hints and guidelines that will be helpful in tracking down and correcting operating problems.

Operator Control Panel only displays one active code.
Only the most recent service code displays on the Operator Control Panel. In troubleshooting, be alert for related codes. Use of a diagnostic tool offers the advantages of spotting multiple active codes as well as retrieving historical codes.

A cleared code alone does not indicate a corrected problem.
A code is set by a specific fault condition and may be cleared by switching the ignition off. It's possible to clear a code (i.e., remove it from the driver interface) only to have it display again when the fault condition reoccurs. To ensure that a problem is fixed, you must run the system through the same operating modes that caused the problem and verify that the service code does not appear.

Disconnect the Electronic Control Unit connector with ignition off.
To avoid setting electrical service codes, make sure that the ignition is off before unplugging the wire harness connection at the Electronic Control Unit module.

Reconnect the connector before switching on the ignition.

C! Service Codes are often connection problems.
The most likely cause of component faults will be damaged wires or connections. As a first step in troubleshooting all C! service codes, switch off vehicle ignition, then disconnect applicable connectors and inspect for damage. (Switching off the ignition is required before disconnecting the harness at the Electronic Control Unit, but is also a recommended practice before all other electrical system disconnections.) Clean or repair all suspicious connections before proceeding.

System is not continually pressurized.
When troubleshooting P! service code faults, keep in mind that the air system is only pressurized as needed (for example, in the inflate mode). This means that such procedures as checking for leaks require the system to be in an active, pressurized state. This can be accomplished most easily by using a diagnostic tool.

Basic vehicle air and power systems are not covered in this guide.
The Tire Pressure Control System requires air pressure and electrical power supply from the base vehicle systems. Diagnosis and service of these systems is outside the scope of this manual.

Some faults will halt inflate or deflate sequences.
Upon sensing some service codes, the Tire Pressure Control System will immediately go to the "maintain" mode. This may cause mode arrows to stop flashing before the system has actually attained the pressures for the indicated mode.

Service Code Summary

Group	Code	System Status	Description
1C!	17	No Operation	Power - battery voltage out of range at the ECU
3C!	18	Normal Operation	Speed Signal - no speed detected during multiple ignition cycles
	76	Normal Operation	J1587 Speed Message - not receiving expected messages on J1708 data link
	77	Normal Operation	J1939 Speed Message - not receiving expected messages on data link
4C!	15	Inflate Only	Display Control Communications - ECU not receiving communications from user interface
5C!	33	No Operation	PCU Sensor - signal voltage too high
	34	No Operation	PCU Sensor - connector unplugged; signal voltage too low
12C!	51	No Operation	PCU Solenoid, Front - connector unplugged; faulty wiring or solenoid
	52	No Operation	PCU Solenoid, Rear - connector unplugged; faulty wiring or solenoid
	53	No Operation	PCU Solenoid, Trailer - connector unplugged; faulty wiring or solenoid
	54	No Operation	PCU Supply Solenoid - connector unplugged; faulty wiring or solenoid
	55	No Operation	PCU Deflate Solenoid - connector unplugged; faulty wiring or solenoid
	56	No Operation	PCU Control Solenoid - connector unplugged; faulty wiring or solenoid
1P!	11	No Deflation	Deflate Signal, Front - could not generate a vacuum in control lines
	12	No Deflation	Deflate Signal, Rear - could not generate a vacuum in control lines
	13	No Deflation	Deflate Signal, Trailer - could not generate a vacuum in control lines
	16	Normal Operation	Deflate Signal - could not generate a vacuum in one or more channel's control lines
	22	Inflate Only	Deflate Signal, PCU - could not generate a vacuum in pneumatic control unit
2P!	14	Inflate Only	Deflate Trend - tire pressure did not decrease properly during deflate
3P!	21	Inflate Only	Vacuum - unintentional vacuum in PCU
4P!	23	Pressure Check Only	Between Modes, Front - inflated or deflated too slowly
	24	Pressure Check Only	Between Modes, Rear - inflated or deflated too slowly
	25	Pressure Check Only	Between Modes, Trailer - inflated or deflated too slowly
5P!	26	Pressure Check Only	Low Pressure, Front - open line or large seal leak
	27	Pressure Check Only	Low Pressure, Rear - open line or large seal leak
	28	Pressure Check Only	Low Pressure, Trailer - open line or large seal leak
7P!	31	Pressure Check Only	Pressure Switch - failed closed or wiring shorted
	32	Pressure Check Only	Low Air Supply - pressure switch did not close
8P!	35	Pressure Check Only	Atmospheric - PCU sensor reading out of range
9P!	36	Channel Inoperative	Inflate Trend, Front - tire pressure decreased during an inflate
	37	Channel Inoperative	Inflate Trend, Rear - tire pressure decreased during an inflate
	38	Channel Inoperative	Inflate Trend, Trailer - tire pressure decreased during an inflate

Group	Code	System Status	Description
10P!	41	Inflate Only	Tire Leak, Front - not passing tire pressure confirm check (multiple attempts)
	42	Inflate Only	Tire Leak, Rear - not passing tire pressure confirm check (multiple attempts)
	43	Inflate Only	Tire Leak, Trailer - not passing tire pressure confirm check (multiple attempts)
11P!	44	Pressure Check Only	Tire Leak, Front - tire pressure imbalance or line leak
	45	Pressure Check Only	Tire Leak, Rear - tire pressure imbalance or line leak
	46	Pressure Check Only	Tire Leak, Trailer - tire pressure imbalance or line leak
12P!	61	Normal Operation	Sluggish Shut Off, Front - lost minor pressure during wheel valve shut off
	62	Normal Operation	Sluggish Shut Off, Rear - lost minor pressure during wheel valve shut off
	63	Normal Operation	Sluggish Shut Off, Trailer - lost minor pressure during wheel valve shut off
	64	Normal Operation	Shut Off Failure, Front - cannot close wheel valve(s) and vent lines
	65	Normal Operation	Shut Off Failure, Rear - cannot close wheel valve(s) and vent lines
	66	Normal Operation	Shut Off Failure, Trailer - cannot close wheel valve(s) and vent lines
-	47-48		Reserved (47, 48)
	57		Spare #1 - connector unplugged; faulty wiring or component
	58		Spare #2 - connector unplugged; faulty wiring or component
	67-68		Reserved (67, 68)
	71-75		Reserved (71-75)
	78		Reserved (78)

Group: 1C! (Code 17)

Type: Power

System Mode	Condition	Possible Causes (Listed in Likely Order of Occurrence)
No Operation	Power out of range	- Low battery voltage. - Poor ground connection to Electronic Control Unit. - Poor switched ignition connection to Electronic Control Unit. - High vehicle electrical system voltage. - Faulty Electronic Control Unit.

Code Description

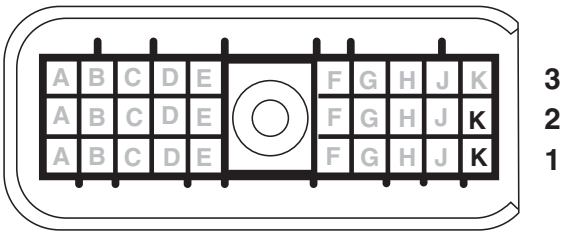
Group 1C! (17) indicates a power fault and sets when the system power is outside the acceptable range of 9 to 32 volts. The fault could be caused by low battery power or some other problem with the basic vehicle electrical system.

If the vehicle power system checks out satisfactorily, other possible causes include bad Electronic Control Unit (ECU) connections, or a faulty Electronic Control Unit.

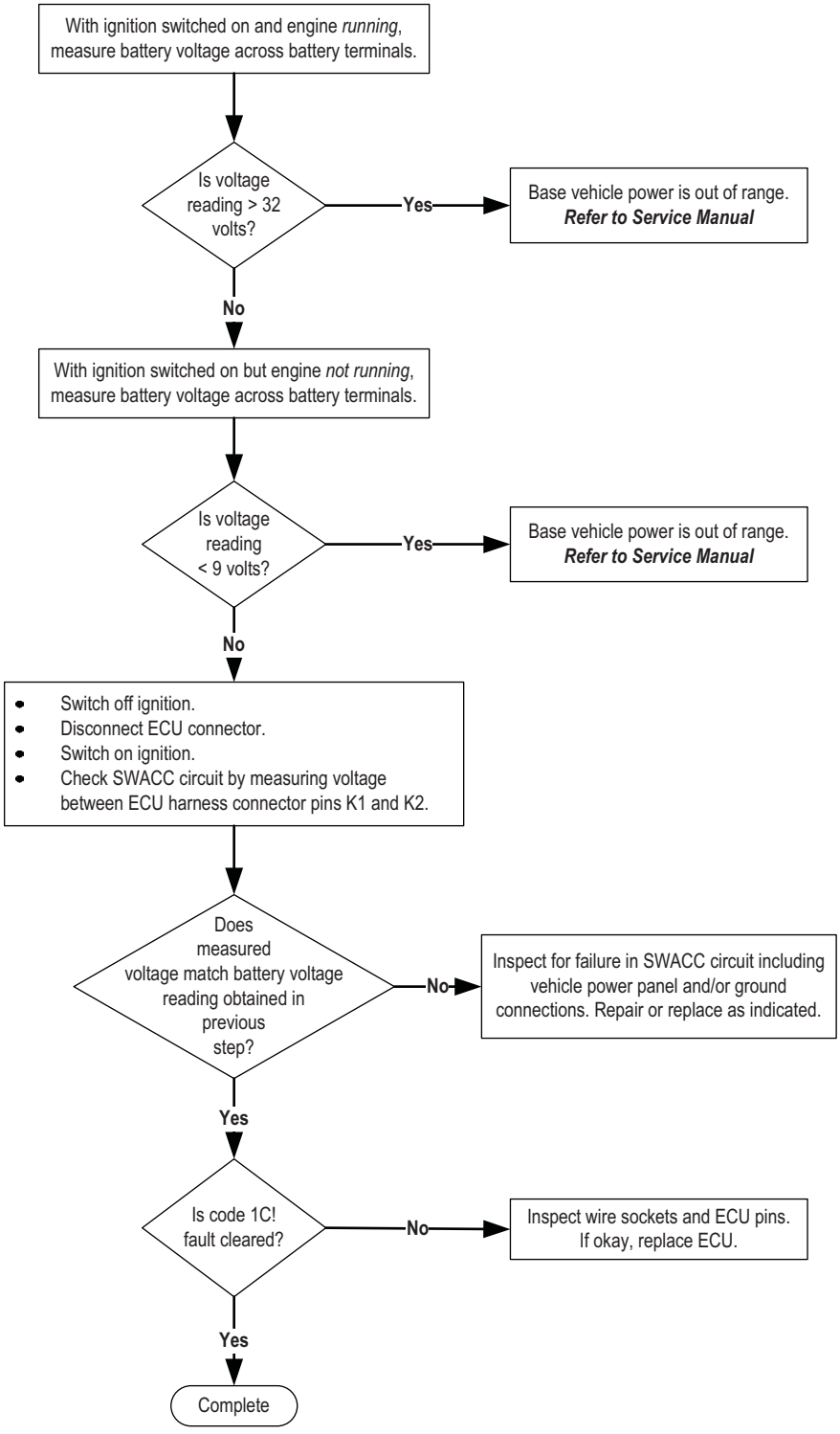
In inspecting circuits and connections for a Code 1C! fault, pay particular attention to a bad ground connection that could be causing the fault.

See "Troubleshooting Tips" for general guidelines on system diagnostics.

ECU Harness Connector



Power (Code 17)



Group: 3C! (Codes 18, 76, 77)

Type: Speed Signal

System Mode	Condition	Possible Causes (Listed in Likely Order of Occurrence)
Normal Operation	No speed signal	- ECU power cycled 50 times without vehicle being moved. - Sensor disconnected or loose plug. - Either speed sensor wire is open (broken wire). - Either speed sensor wire is shorted to ground (bare wire is touching the frame). - Faulty speed sensor. - Sensor actuation failure. - Tang drive broken/disconnected on mechanical sensor. - Gap not adjusted correctly on pole sensor. - Sensor wires shorted together.

Code Description

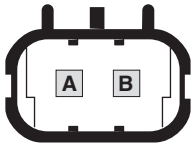
Group 3C! indicates a faulty speed sensor signal. In general, the system is configured to accept speed signals from any one of several sources (analog or digital; J1708/J1587, J1939). In this standard configuration, a loss of speed signal fault is indicated by code 18. In some specific instances, a vehicle may be configured to only accept speed from a specific data link. In these cases, codes 76 (SAE J1708/J1587) and code 77 (SAE J1939) may be used to indicate a speed signal fault.

- A wiring or sensor connection.
- A misadjusted or faulty sensor.
- A missing data link speed signal. (J1939 or J1708/J1587)

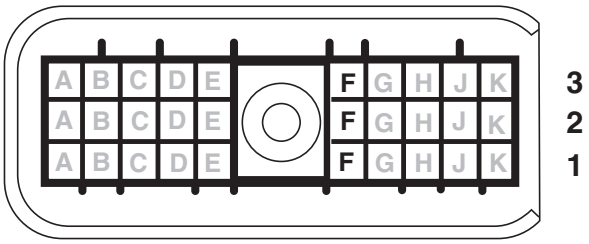
Note: These codes will occur if ECU power has been cycled 50 times and no speed signal is received. Fifty power cycles can occur after 25 engine starts without moving the vehicle, however the code will clear as soon as a speed signal is received.

See "Troubleshooting Tips" for general guidelines on system diagnostics.

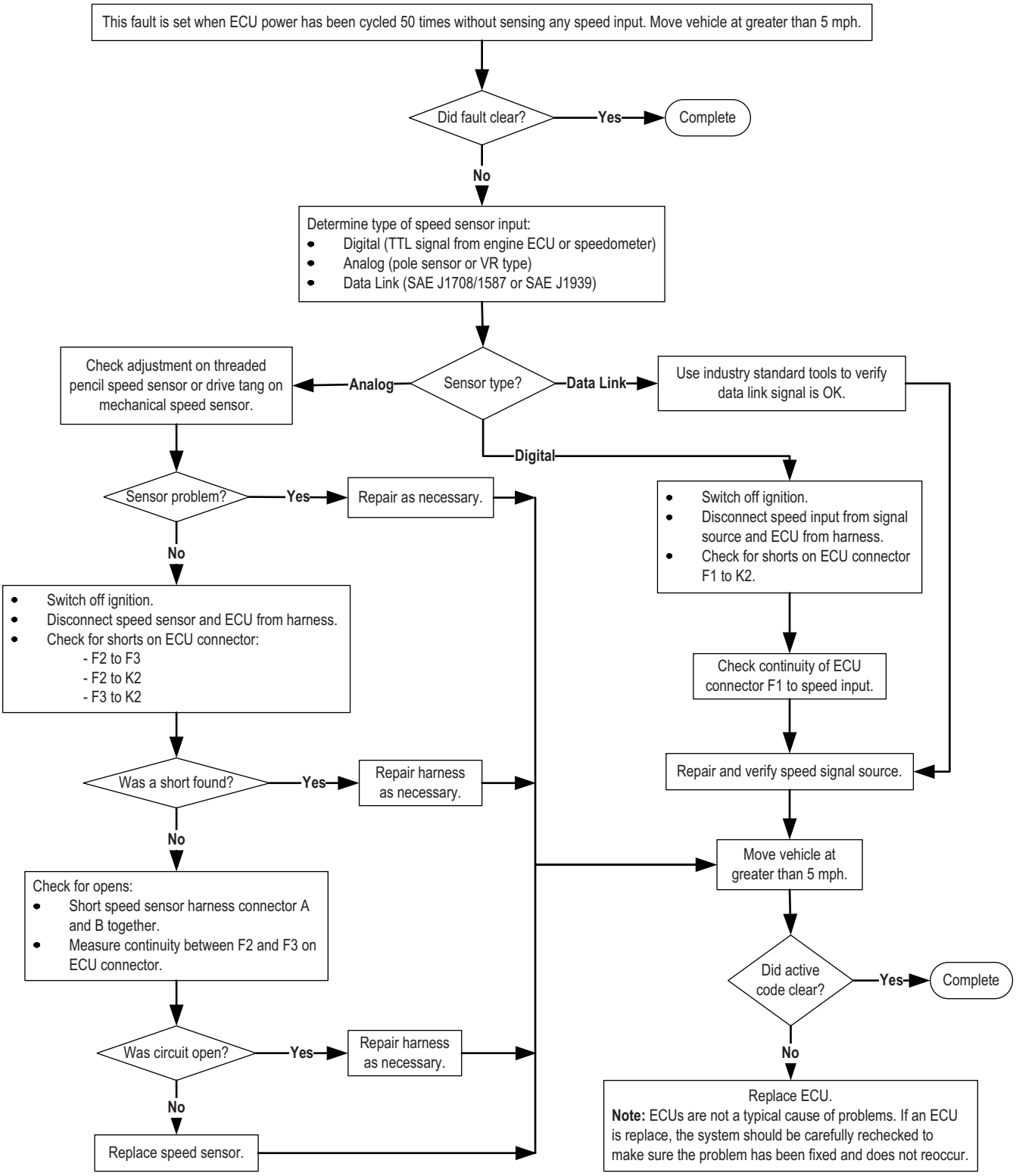
Speed Sensor Harness Connector



ECU Harness Connector



Speed Signal (Codes 18, 76, 77)



Group: 4C! (Code 15)

Type: Display Control Communications

System Mode	Condition	Possible Causes (Listed in Likely Order of Occurrence)
Inflate Only	Blank Display	- No power to Driver Interface. - No ground connection to Driver Interface. - System voltage out of range (9-19 volts DC).
Inflate Only	Operator Control Panel displays logo only DDM displays dash dash (nothing else on display)	- No power or ground to ECU. - Driver Interface to Electronic Control Unit lines open. - Driver Interface to Electronic Control Unit lines shorted to ground. - Driver Interface to Electronic Control Unit lines shorted to power. - Driver Interface to Electronic Control Unit lines shorted together. - Faulty Driver Display Module/Operator Control Panel. - Faulty Electronic Control Unit.

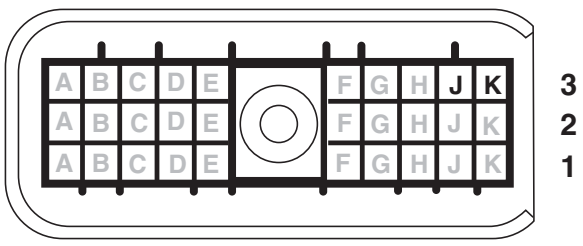
Code Description

Group 4C! indicates a communication problem between the Electronic Control Unit (ECU) and the driver interface (either the Driver Display Module or Operator Control Panel). Code 4C! will only be observable on a diagnostic tool as code 15. It will not show on the Operator Control Panel. Instead, the Operator Control Panel may be blank (indicating a power problem).

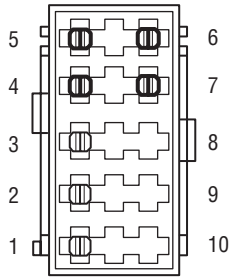
All of the troubleshooting steps for code 4C! involve checking the condition of Electronic Control Unit and driver interface circuits. If no circuit problems are found, Code 4C! indicates either a faulty driver interface or a faulty Electronic Control Unit.

See "Troubleshooting Tips" for general guidelines on system diagnostics.

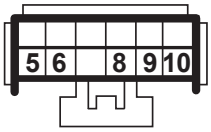
ECU Harness Connector



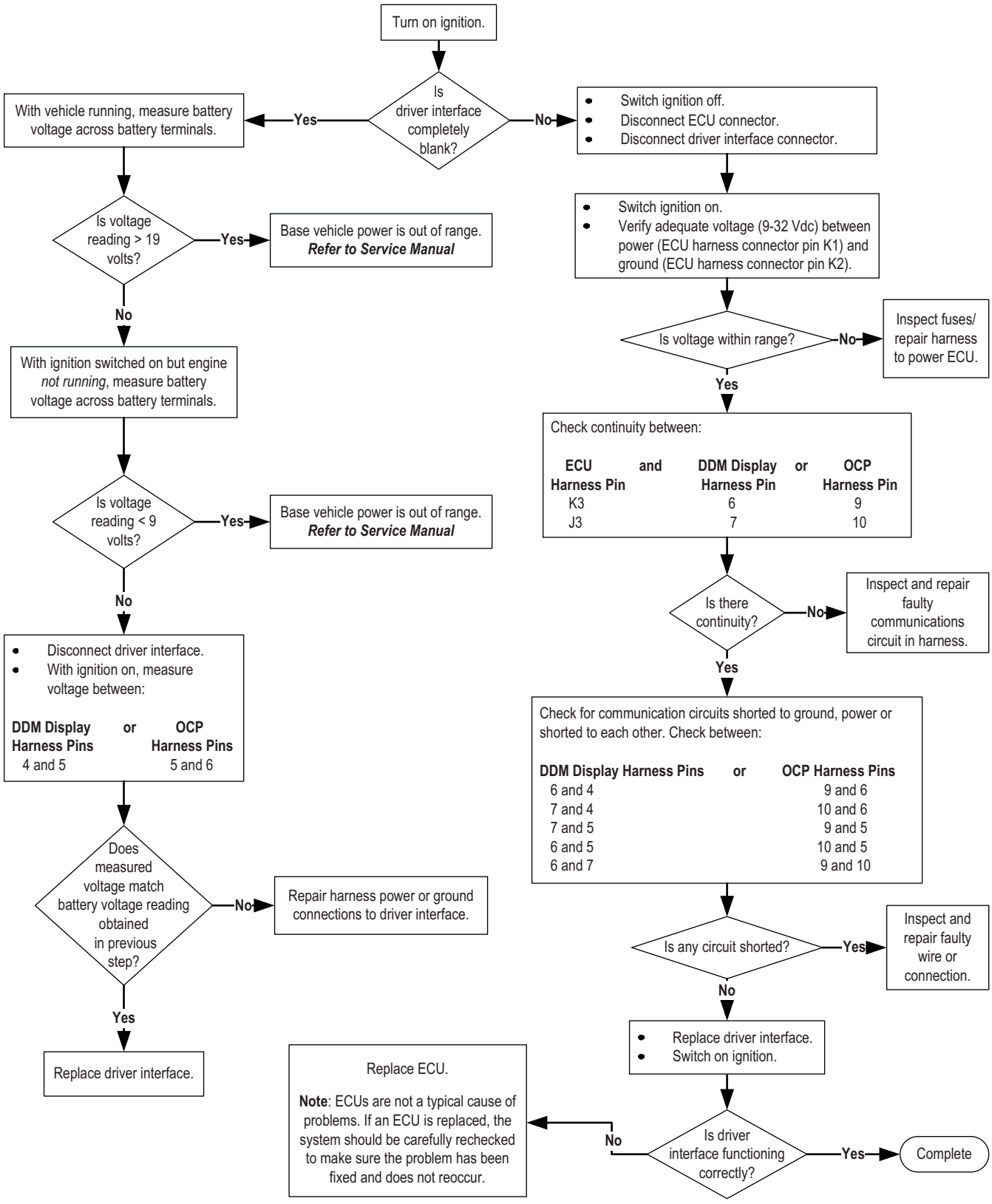
DDM Display Harness Connector



OCP Harness Connector



Display Control Communications (Code 15)



Group: 5C! (Codes 33, 34)

Type: PCU Sensor

System Mode	Condition	Possible Causes (Listed in Likely Order of Occurrence)
No operation	No PCU sensor reading	- PCU Sensor electrically disconnected. - PCU Sensor signal wire open. - PCU Sensor signal wire shorted to ground. - PCU Sensor XDCR VREF wire open. - PCU Sensor XDCR VREF wire shorted to ground. - PCU Sensor XDCR COMMON wire open. - Faulty PCU Sensor. - Faulty Electronic Control Unit.
No operation	High pressure transducer reading	- PCU Sensor signal wire shorted to VBATT or XDCR VREF. - Faulty PCU Sensor. - Faulty Electronic Control Unit.

Code Description

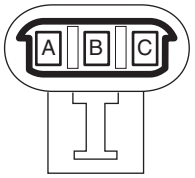
Group 5C! displays when the Electronic Control Unit (ECU) receives an unusually high or low reading from the PCU Sensor. A diagnostic tool will specify 33 for a high reading and 34 for a low reading.

Initial troubleshooting steps involve checking for a shorted-to-ground or an open PCU Sensor circuit.

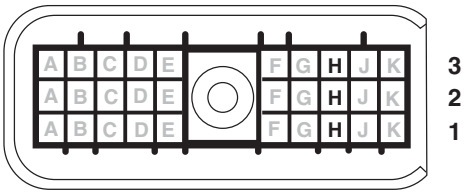
If the circuits check out OK, secondary causes could involve a faulty transducer or a faulty Electronic Control Unit.

See "Troubleshooting Tips" for general guidelines on system diagnostics.

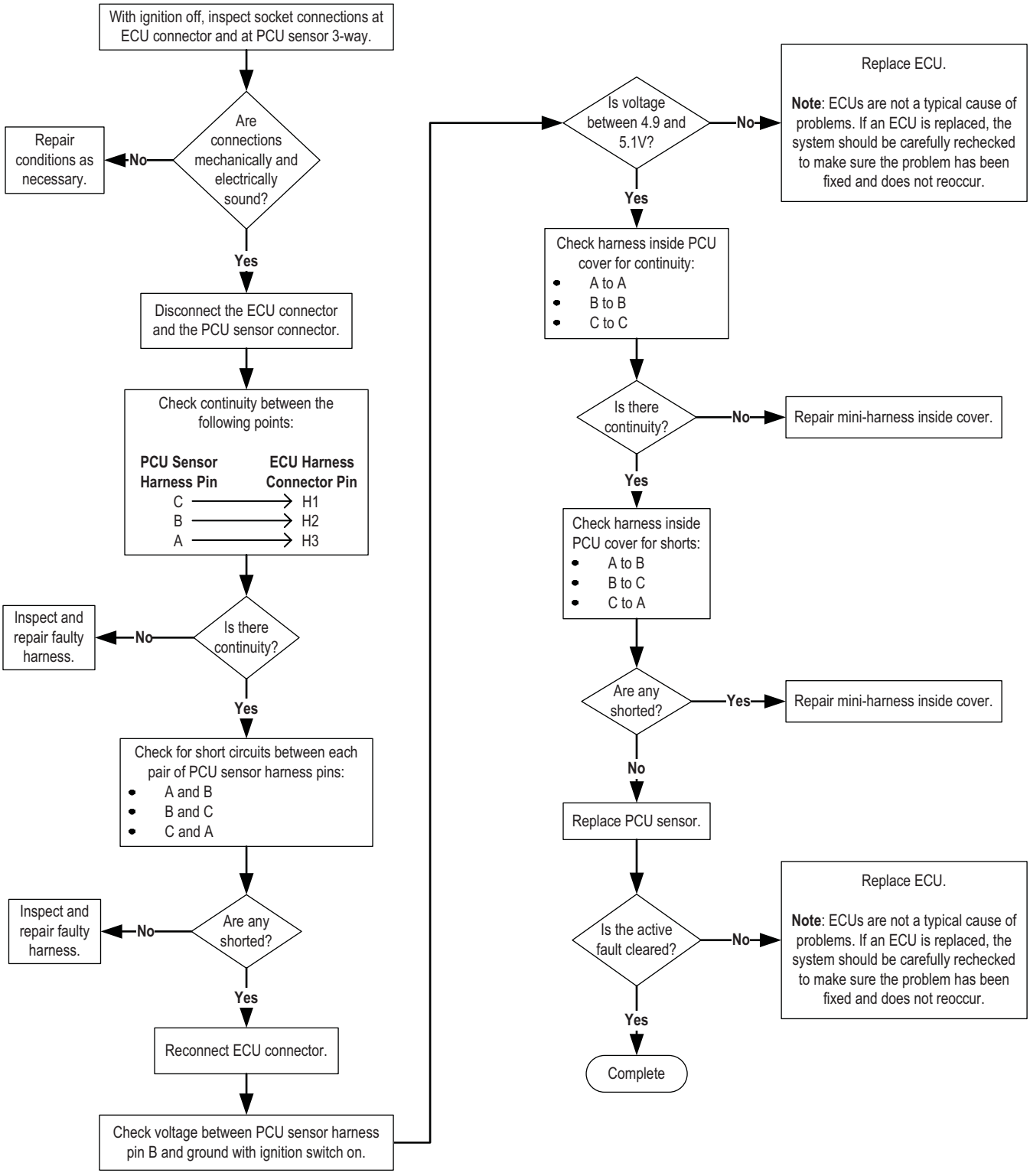
PCU Sensor Harness Connector



ECU Harness Connector



PCU Sensor (Codes 33, 34)



Group: 12C! (Codes 51, 52, 53, 54, 55, 56)

Type: PCU Solenoids

- Front (51)
- Rear (52)
- Trailer (53)
- Supply (54)
- Deflate (55)
- Control (56)

System Mode	Condition	Possible Causes (Listed in Likely Order of Occurrence)
No operation	Pneumatic Control Unit solenoid failed electrical diagnostic test	- Connector unplugged or faulty wiring. - Solenoid wire open. - Solenoid wire shorted to ground. - Solenoid wire shorted to power. - Faulty solenoid. - Faulty Electronic Control Unit.

Code Description

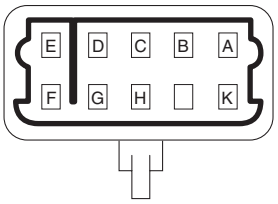
Group 12C! indicates an electrical fault in the Pneumatic Control Unit (PCU). Codes 51 through 56 specifically designate which solenoid in the PCU is faulty. System operation is disabled when this fault is detected.

The system shuts down in a fail-safe mode and turns off power to the solenoids.

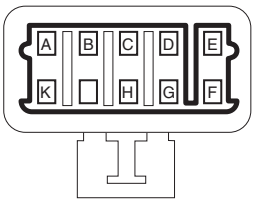
The troubleshooting tree first tests internal solenoid circuitry. Resistance outside the specified range of 7 to 25 ohms indicates a defective solenoid. Successive steps check continuity of the wire harness circuits between the Pneumatic Control Unit and the Electronic Control Unit (ECU). If the problem can be traced to a faulty circuit or connector, make the necessary repairs. If the troubleshooting routine leads to a problem with the solenoid itself, the Pneumatic Control Unit must be repaired or replaced. If both the solenoid and the circuitry check out, the Electronic Control Unit is faulty.

See "Troubleshooting Tips" for general guidelines on system diagnostics.

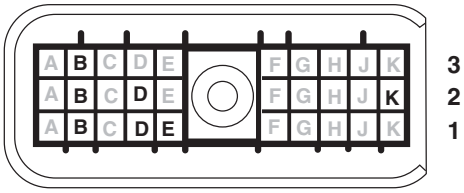
PCU Connector



PCU Harness Connector



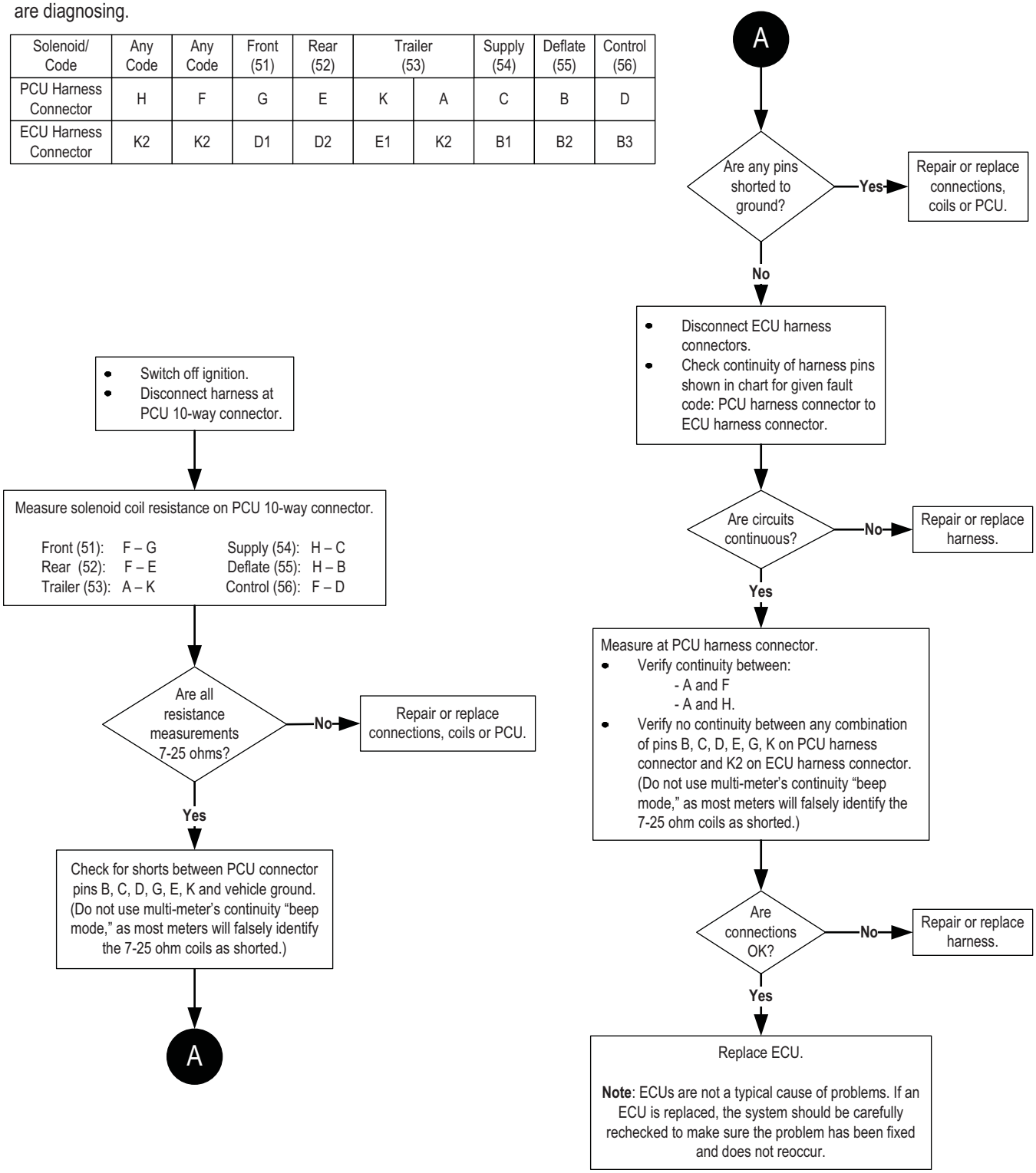
ECU Harness Connector



PCU Solenoids (Codes 51, 52, 53, 54, 55, 56)

Code 12C! Indicates one or more solenoid faults. Use service tool to determine the specific solenoid. When the troubleshooting instructions refer to connector test points, use chart select the pin test point for use with the particular fault code you are diagnosing.

Solenoid/ Code	Any Code	Any Code	Front (51)	Rear (52)	Trailer (53)		Supply (54)	Deflate (55)	Control (56)
PCU Harness Connector	H	F	G	E	K	A	C	B	D
ECU Harness Connector	K2	K2	D1	D2	E1	K2	B1	B2	B3



Group: 1P! (Codes 11, 12, 13, 16, 22)

Type: No Deflate Signal

System Mode	Condition	Possible Causes (Listed in Likely Order of Occurrence)
Inflate Only	Inadequate vacuum in the Pneumatic Control Unit	- Plugged or restricted Pneumatic Control Unit vent line. - Faulty Pneumatic Control Unit.
Inflate Only	No sustained vacuum in control lines	- Line leaks. - Air seals, oil lip seals.

Code Description

Group 1P! indicates inadequate vacuum in the Pneumatic Control Unit (PCU) prior to channel selection, or failure to sustain a vacuum in the control lines following channel selection. These codes will be set when the nominal vacuum of 26" Hg drops to 17" Hg. Codes can be generated by one channel, multiple channels or a combination of channels.

When a deflate is requested, the system first shuts off all the channel control lines and generates a vacuum in the Pneumatic Control Unit alone. A failure to generate this vacuum will result in Diagnostic Code 22.

Once the vacuum has been established in the Pneumatic Control Unit, the individual channel control line(s) are opened and a vacuum is routed to them. If a vacuum is not sustained in the control lines, a 1P! fault is logged as follows:

11 - Front Channel

12 - Rear Channel

13 - Trailer Channel

16 - Individual channels OK but a combination of channels results in low vacuum.

Note: If a vacuum loss occurs during an attempt to deflate two or more channels at the same time, the system will halt the deflate and re-attempt it one channel at a time. This will result in a Code 16 being stored in the ECU.

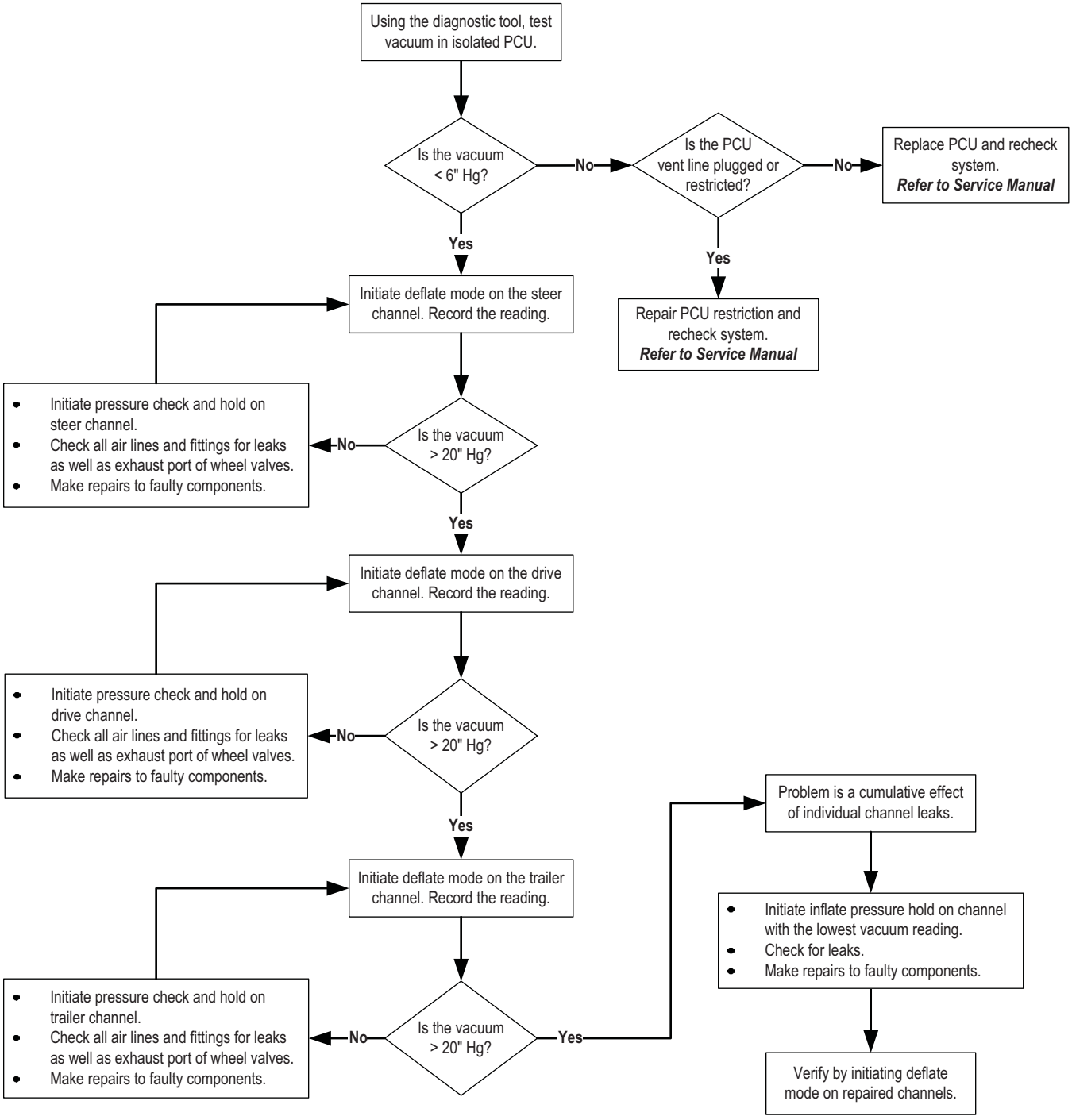
Group1P! can be caused by:

- Line leak.
- Air seal or oil lip seal leaks.
- Plugged or restricted Pneumatic Control Unit vent line.
- Faulty Pneumatic Control Unit.

To identify the root cause of the problem, connect the diagnostic tool (see Diagnostic Section for test equipment and descriptions) and follow the procedure in the 1P! Troubleshooting Tree.

See "Troubleshooting Tips" for general guidelines on system diagnostics.

No Deflate Signal (Codes 11, 12, 13, 16, 22)



Note: Line leakages occasionally occur which are unidirectional; i.e., they might occur under vacuum and not pressure (or vice-versa). Inability to determine the cause of vacuum loss on an individual channel may dictate replacement of air lines and/or fittings on that channel. Be sure all replaced air lines and fittings are identical in all respects, including length, to the parts replaced.

Group: 2P! (Code 14)

Type: Deflate Trend

System Mode	Condition	Possible Causes (Listed in Likely Order of Occurrence)
Inflate Only	Pressure increased or failed to drop appropriately	- Plugged or restricted control lines. - Plugged or restricted Pneumatic Unit vent line. - Plugged or restricted wheel valve exhaust port. - Faulty Pneumatic Control Unit.

Code Description

Group 2P! is the result of a deflate that did not occur properly. The system measures tire pressure before and after each deflate. If the pressure readings indicate that the pressure either increased or failed to drop properly, the system shuts down the deflate sequence.

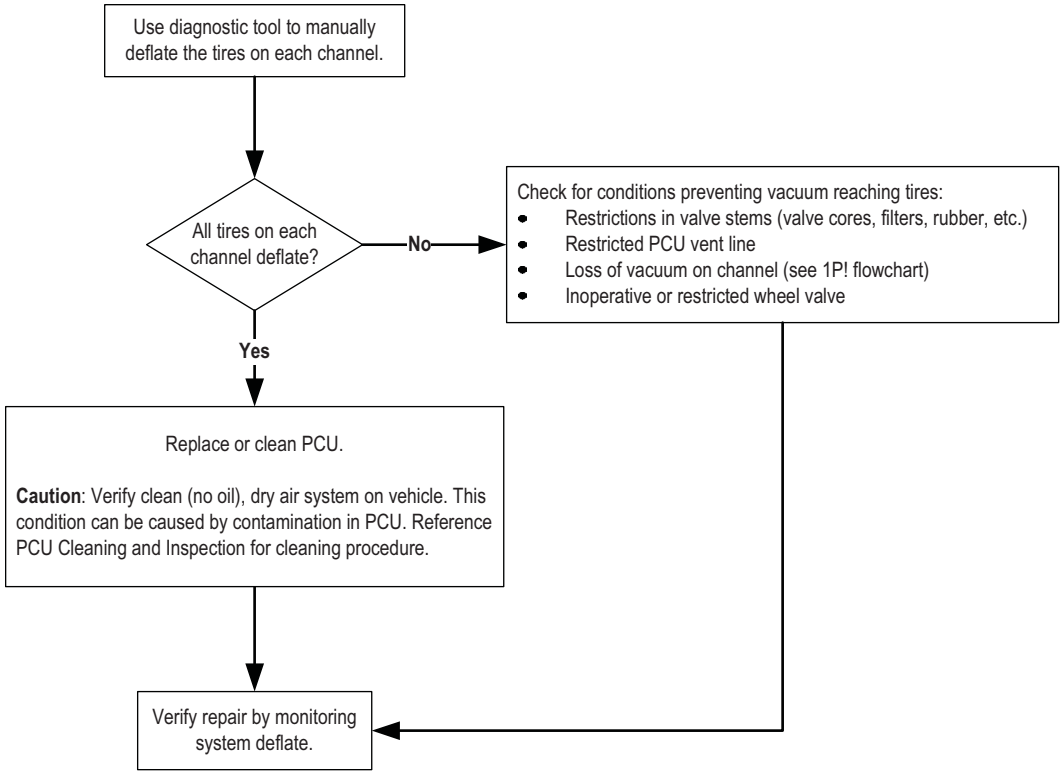
Group 2P! can be caused by:

- Plugged or restricted control lines.
- Plugged or restricted Pneumatic Control Unit vent line.
- Contaminated or faulty Pneumatic Control Unit.

To identify the root cause of the problem, connect the diagnostic tool (see Diagnostics Section for test equipment and descriptions) and follow the procedure in the 2P! Troubleshooting Tree.

See "Troubleshooting Tips" for general guidelines on system diagnostics.

Deflate Trend (Code 14)



Group: 3P! (Code 21)

Type: Vacuum Fault

System Mode	Condition	Possible Causes (Listed in Likely Order of Occurrence)
Inflate Only	Inappropriate vacuum generation	- Faulty or contaminated Pneumatic Control Unit.

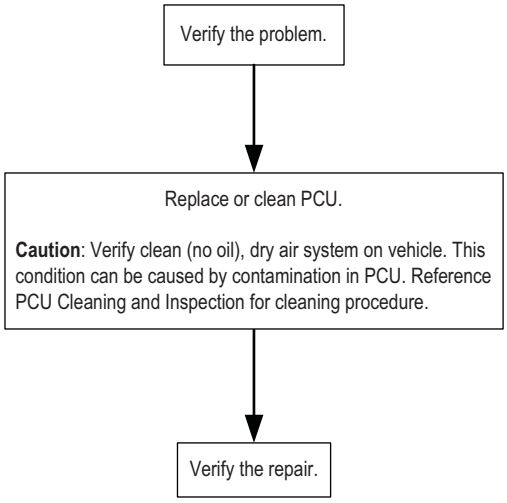
Code Description

Group 3P! displays when the system is generating a vacuum at a time when the Electronic Control Unit (ECU) is not requesting a vacuum. Creation of an unexpected vacuum is highly unlikely.

The most likely cause of an unexpected vacuum is a contaminated or faulty Pneumatic Control Unit (PCU). Verify the problem before replacing the Pneumatic Control Unit. See the procedure in the 3P! Troubleshooting Tree.

See "Troubleshooting Tips" for general guidelines on system diagnostics.

Vacuum Fault (Code 21)



Group: 4P! (Codes 23, 24, 25)

Type: Channel Between Modes

System Mode	Condition	Possible Causes (Listed in Likely Order of Occurrence)
Pressure Check Only	Slow Inflate	- Faulty compressor. - Restricted flow at wheel valve air filters or tire valve stems. - Crimped or plugged lines.
	Slow Deflate	- Restricted flow at wheel valve air filters or tire valve stems. - Plugged or restricted Pneumatic Control Unit vent port. - Leaking lines. - Plugged or restricted wheel valve exhaust port.

Code Description

Group 4P! displays if any channel inflates or deflates too slowly as shown below:

- 23 - Front Channel
- 24 - Rear Channel
- 25 - Trailer Channel

The maximum allotted time for each channel is 40 minutes for an inflate, or 20 minutes for a deflate. The most likely cause is a faulty compressor or similar problem resulting in inadequate air supply to the Tire Pressure Control System.

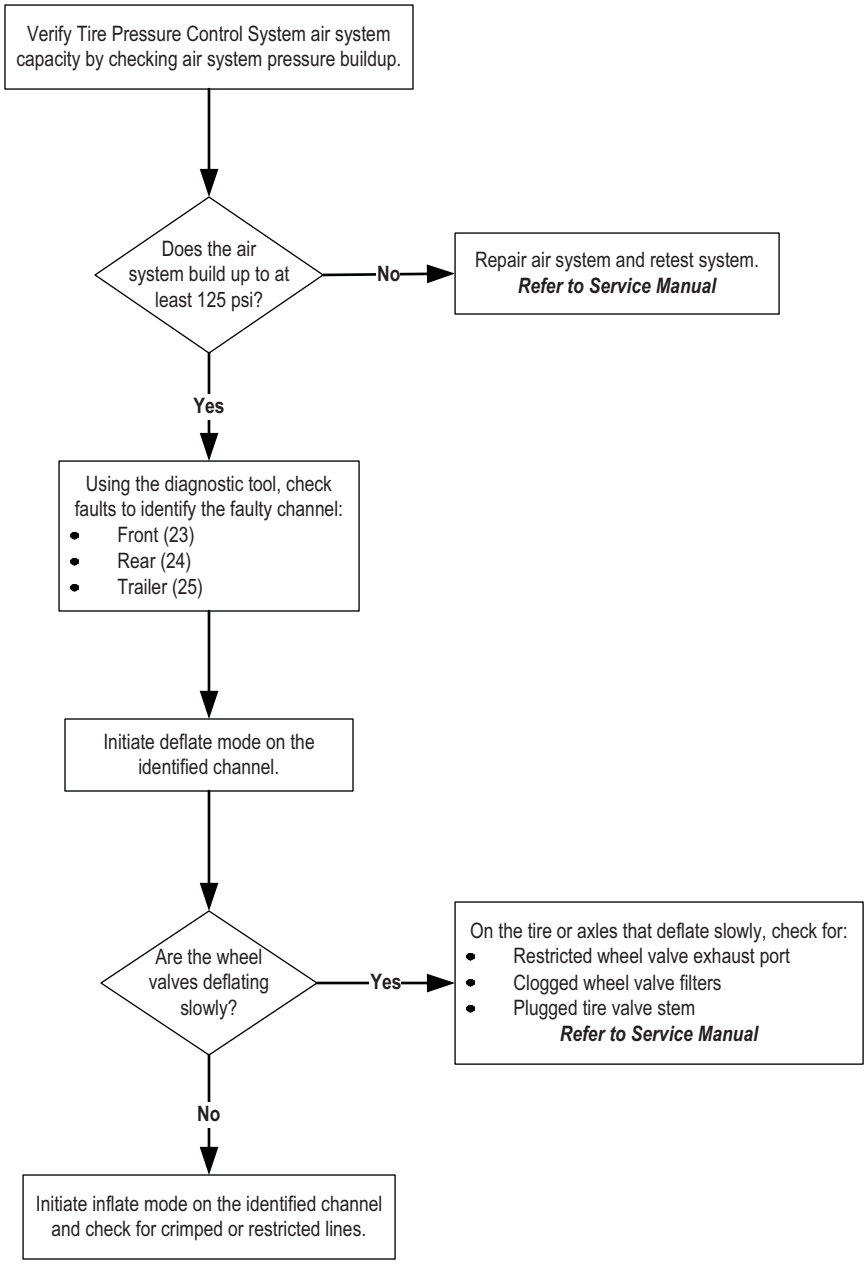
If the system air supply is functioning properly, code group 4P! may indicate that a leak or restriction exists in an air passage. The components that may contain a restricted or leaking air passage include:

- Wheel valve air filters.
- Pneumatic Control Unit (PCU) vent port restriction.
- Air supply lines.
- Wheel valve exhaust port (deflate mode only).

To identify the root cause of the problem, connect the diagnostic tool (see Diagnostics Section for test equipment and descriptions) and follow the procedure in the 4P! Troubleshooting Tree.

See "Troubleshooting Tips" for general guidelines on system diagnostics.

Channel Between Modes (Codes 23, 24, 25)



Group: 5P! (Codes 26, 27, 28)

Type: Low Pressure Reading

System Mode	Condition	Possible Causes (Listed in Likely Order of Occurrence)
Pressure Check Only	Extreme pressure loss	- Leaking axle seals. - Open line between Pneumatic Control Unit to channel. - Crimped or plugged line between supply tank and Pneumatic Control Unit. - Pressure switch failure, shorted closed. - Pneumatic Control Unit failure, supply or control off. - Faulty pressure transducer.

Air Pressure Check

The Tire Pressure Control System is not continuously pressurized; pressure checks occur on a periodic basis. During tire pressure checks, the system delivers compressed air to each channel for approximately two seconds while monitoring the pressure in that channel.

Code Description

Group 5P! indicates an extreme pressure loss on the front (26), rear (27), or trailer (28) channels. Possible causes are leaking axle air seals or an open line, which would be clearly audible during pressure measurements.

Note: In extremely cold conditions, air seals will sometimes leak, resulting in a code 5P!. This code may clear by simply driving the vehicle for a few minutes to "warm up" the seals allowing proper system operation.

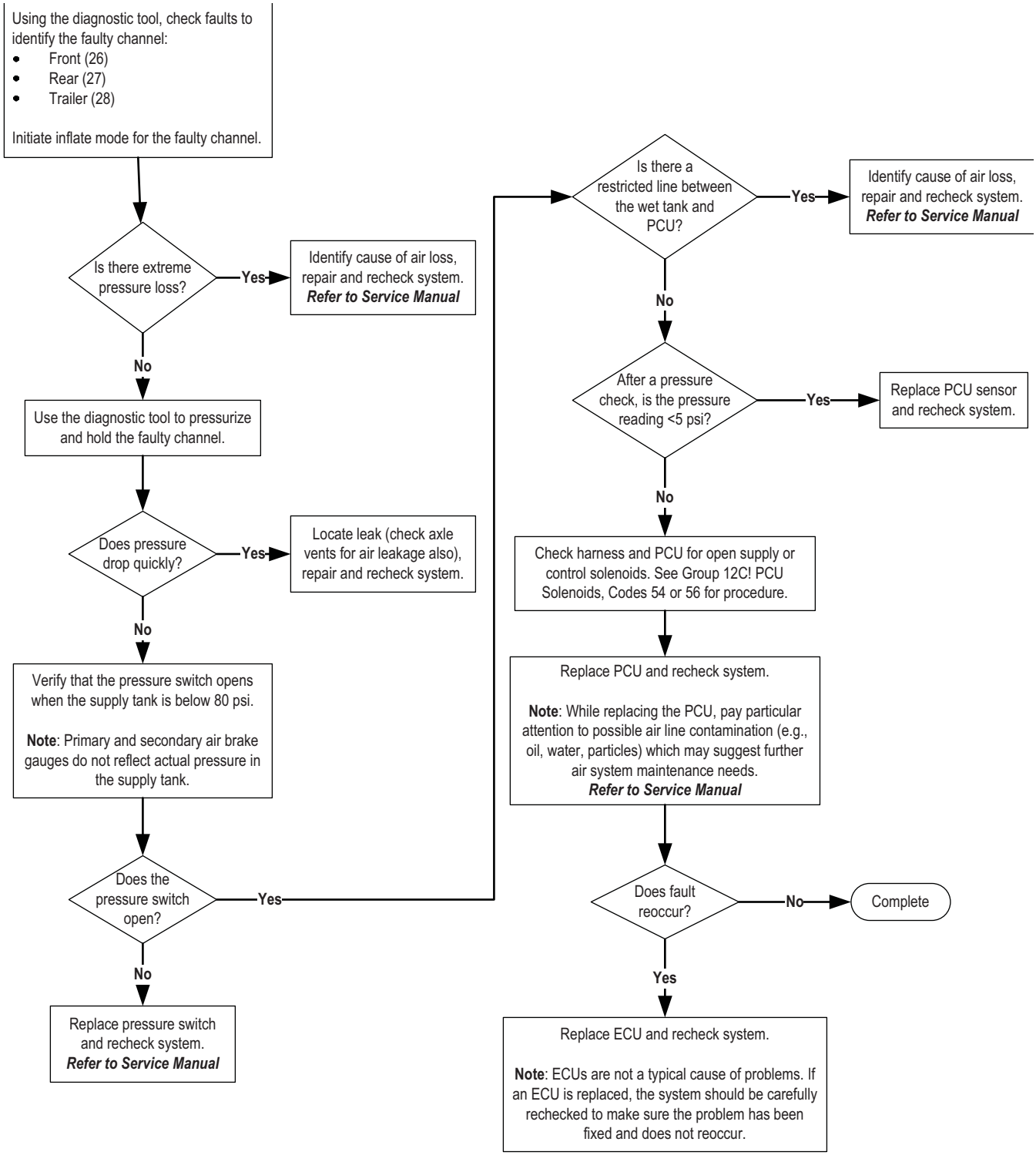
Other possible causes of a group 5P! are:

- Open line from Pneumatic Control Unit (PCU) to channel.
- Restricted line between the supply tank and Pneumatic Control Unit.
- Faulty PCU Sensor.
- Faulty PCU.

To identify the root cause of the problem, connect the diagnostic tool (see Diagnostics Section for test equipment and descriptions) and follow the procedure in the 5P! Troubleshooting Tree.

See "Troubleshooting Tips" for general guidelines on system diagnostics.

Low Pressure Reading (Codes 26, 27, 28)



Group: 7P! (Codes 31, 32)

Type: Low Air Supply

System Mode	Condition	Possible Causes (Listed in Likely Order of Occurrence)
Pressure check only	Pressure switch won't close (32)	- Compressor governor cut-out set too low. - Air dryer needs service. - Pressure switch unplugged. - Open or broken line from supply tank to Pneumatic Control Unit. - Crimped or plugged line from supply tank to Pneumatic Control Unit. - Faulty pressure switch. - Faulty compressor.
	Supply Tank pressure too low (32)	- Governor cut-in too low. - Faulty compressor. - Leaking lines.
	Pressure switch failed closed (31)	- Wiring to pressure switch shorted together. - Faulty pressure switch.

Air Pressure Check

The Tire Pressure Control System is not continuously pressurized; pressure checks occur on a periodic basis. During tire pressure checks, the system delivers compressed air to each channel for approximately two seconds while monitoring the pressure in that channel.

Code Description

Group 7P! displays if the system air pressure supply is too low to perform a valid tire pressure check.

This may occur because the pressure switch will not close (inadequate air supply, code 32) or because the pressure switch or its wiring is shorted, allowing the actual supply pressure to be lower than anticipated by the system.

Note: To assure a nominal compressor output, code 32 will not be set unless the pressure switch does not close for a preset period while the vehicle is being driven at a speed of over 20 mph.

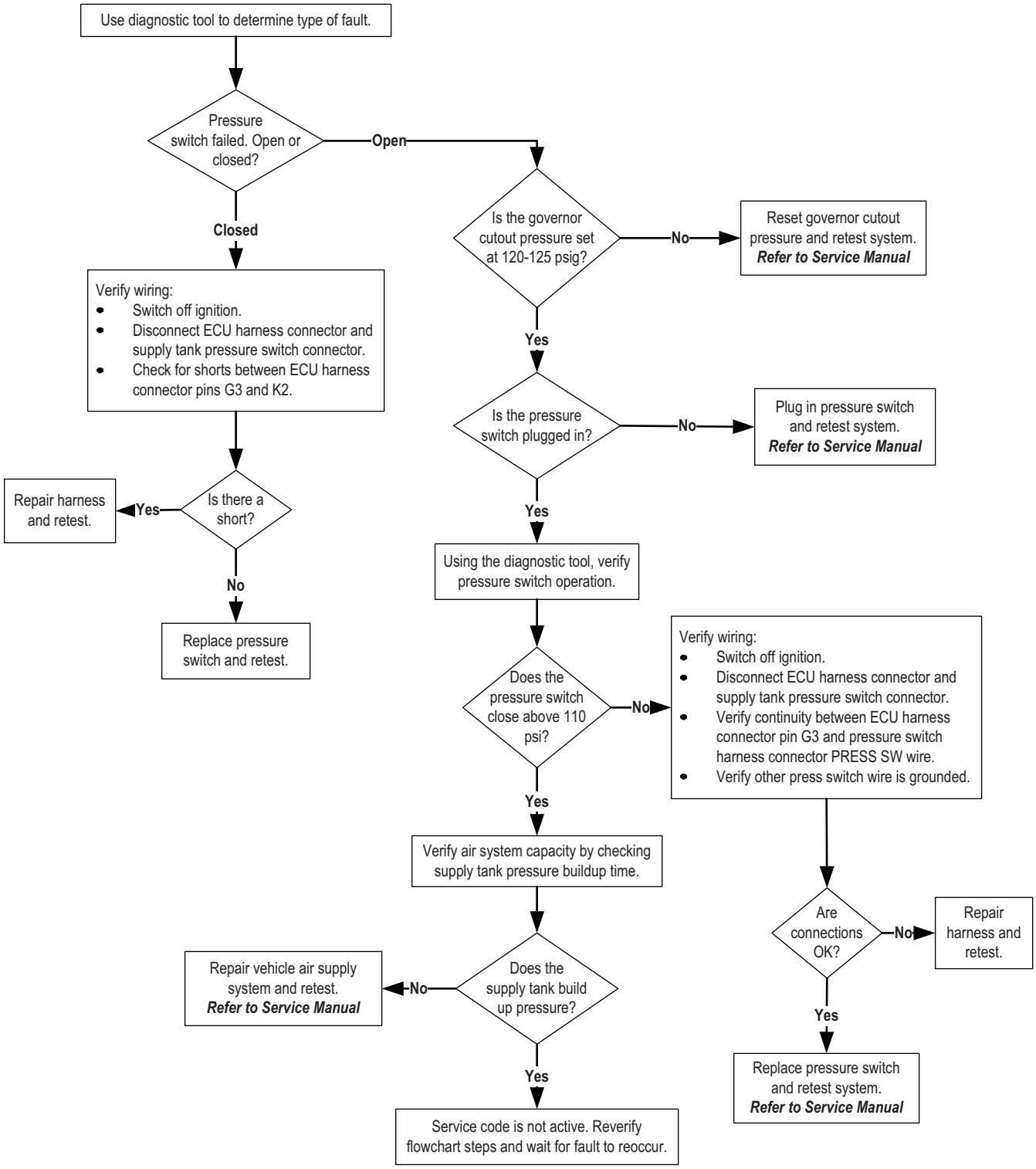
The components that can cause the pressure switch to remain open include:

- Air dryer needs service.
- Pressure switch unplugged or damaged wire harness.
- Faulty pressure switch.
- Faulty compressor.
- Open or broken line from supply tank to Pneumatic Control Unit.
- Crimped or plugged line from supply tank to Pneumatic Control Unit.
- Faulty Electronic Control Unit.

To identify the root cause of the problem, connect the diagnostic tool (see Diagnostics Section for test equipment and descriptions) and follow the procedure in the 7P! Troubleshooting Tree.

See "Troubleshooting Tips" for general guidelines on system diagnostics.

Low Air Supply (Codes 31, 32)



Group: 8P! (Code 35)

Type: Atmospheric

System Mode	Condition	Possible Causes (Listed in Likely Order of Occurrence)
Pressure check only	Pneumatic Control Unit pressure out of range	- Faulty PCU Sensor. - Faulty Pneumatic Control Unit. - Faulty Electronic Control Unit.

Air Pressure Check

The Tire Pressure Control System is not continuously pressurized; pressure checks occur on a periodic basis. During tire pressure checks, the system delivers compressed air to each channel for approximately two seconds while monitoring the pressure in that channel.

Code Description

When the system measures tire pressures it also uses the pressure sensor in the PCU to read atmospheric pressure. Group 8P! displays if the atmospheric pressure reading is out of range.

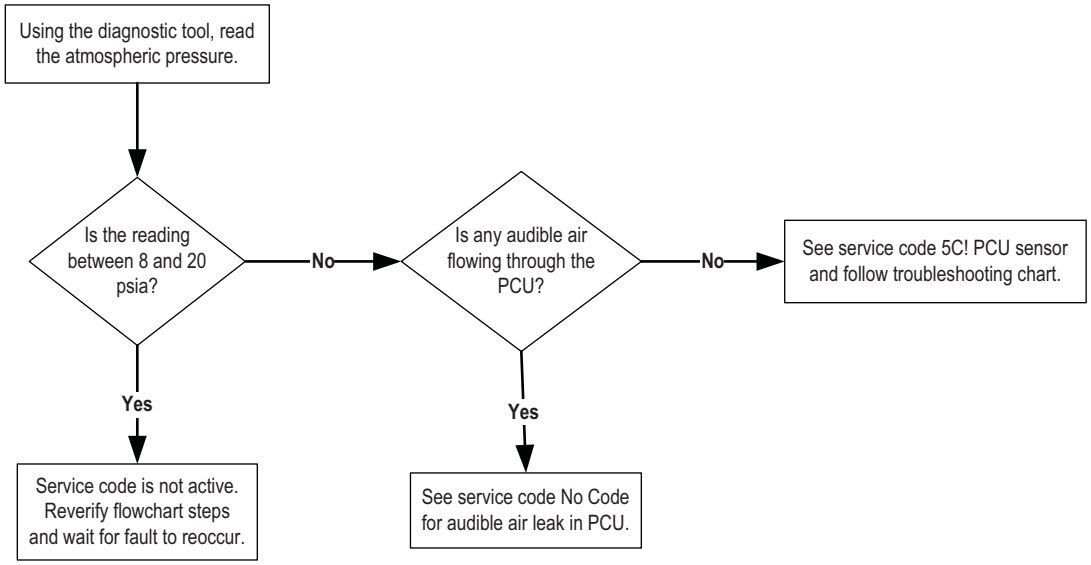
The components that can cause a group 8P! to be set include:

- Faulty PCU Sensor or wiring.
- Faulty Pneumatic Control Unit.
- Faulty Electronic Control Unit (ECU).

To identify the root cause of the problem, connect the diagnostic tool (see Diagnostics Section for test equipment and descriptions) and follow the procedure in the 8P! Troubleshooting Tree.

See "Troubleshooting Tips" for general guidelines on system diagnostics.

Atmospheric (Code 35)



Group: 9P! (Codes 36, 37, 38)

Type: Inflate Trend

System Mode	Condition	Possible Causes (Listed in Likely Order of Occurrence)
Channel inoperative	Loss of channel pressure in inflate mode	- Damaged or leaking tire. - Leaking lines. - Leaking seals. - Leaking wheel valve. - Faulty Pneumatic Control Unit. - Faulty Electronic Control Unit.

Code Description

Group 9P! displays when system pressure is dropping while in inflate mode. This can occur when air is leaking from the tire(s) or the system more quickly than the compressor can replace it. The air leak that is causing a code 9P! is often audible. Codes 36, 37 and 38 designate the condition on the front, rear or trailer channel respectively.

The air leak can be located either before or after the wheel valve location. The components located before the wheel valve that may cause a group 9P! include:

- Leaking control lines between the PCU and the wheel ends.
- Leaking axle air seals.
- Leaking wheel valve inlet lines or exhaust port.

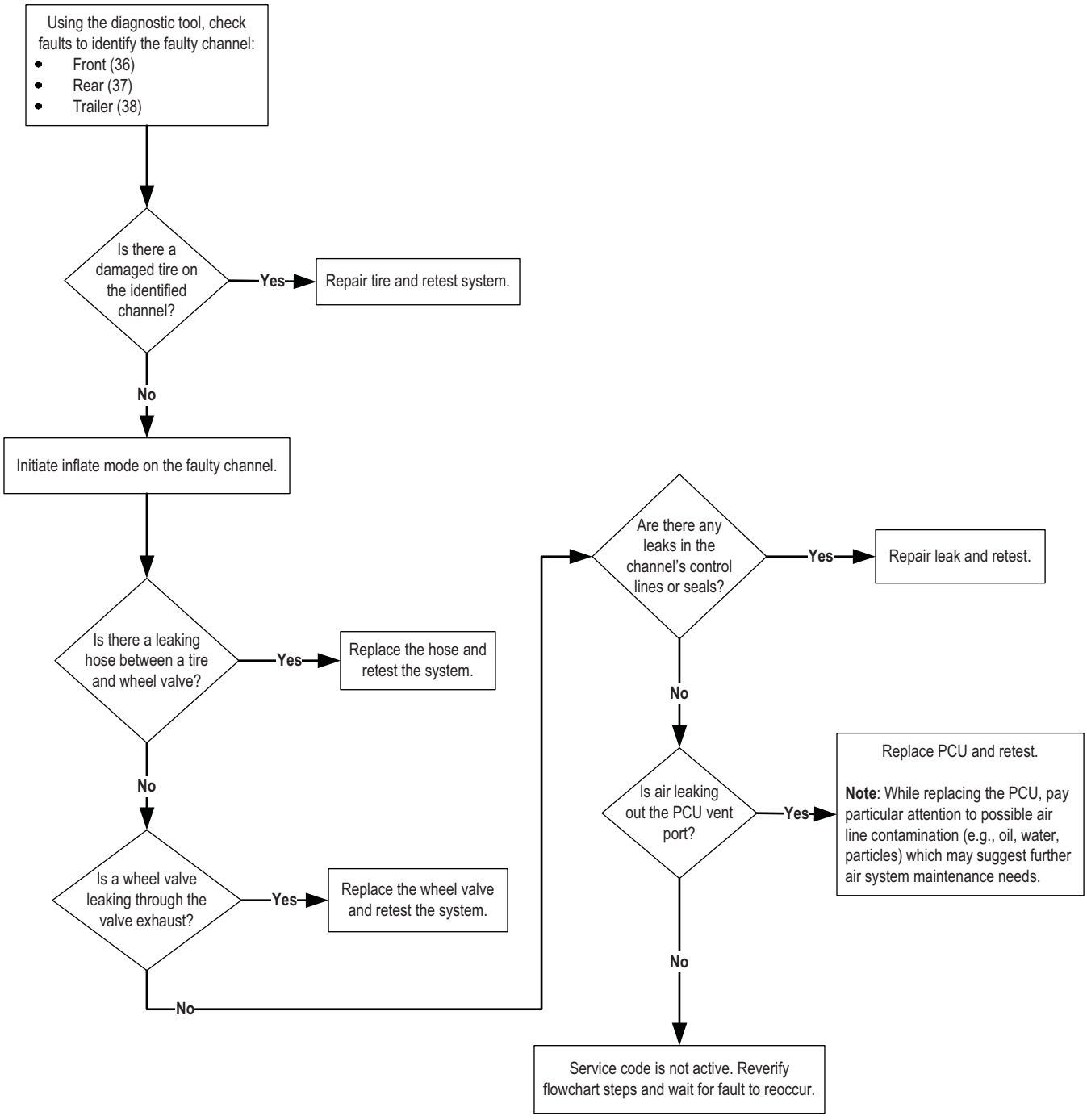
Components located after the wheel valve that may cause a code 9P! include:

- Tire damage.
- Rim leaks.
- Valve stem leaks.
- Leaking air lines from the wheel valve.
- Faulty wheel valve.

To identify the root cause of the problem, connect the diagnostic tool (see Diagnostics Section for test equipment and descriptions) and follow the procedure in the 9P! Troubleshooting Tree.

See "Troubleshooting Tips" for general guidelines on system diagnostics.

Inflate Trend (Codes 36, 37, 38)



Group: 10P! (Codes 41, 42, 43)

Type: Tire Leak (Confirm)

System Mode	Condition	Possible Causes (Listed in Likely Order of Occurrence)
Inflate only	Channel confirmation failure	- Damaged or leaking tire. - Leaking line between wheel valve and tire. - Air passage restriction. - Wheel Valve shut off failure.

Air Pressure Check

The Tire Pressure Control System is not continuously pressurized; pressure checks occur on a periodic basis. During tire pressure checks, the system delivers compressed air to each channel for approximately two seconds while monitoring the pressure in that channel.

Code Description

Group 10P! code indicates that the system is unable to confirm that tires on a given channel are able to sustain the target pressure when the channel is depressurized. After any change of pressure on a given channel, the Tire Pressure Control System will return to that channel to confirm, or "double-check" the new pressure before returning to the periodic check interval. If the pressure is not the same, or more than the last reading, the system will inflate again, and then reconfirm that channel. After 7 - 10 confirmation attempts, the system will log a 10P! code, and complete operations on any remaining channel. It will then illuminate the "check tires" warning (or code 10P! on the OCP), and the appropriate channel indicator and continuously pressurize the subject channel to inflate the tire(s) and sustain the tire pressure. In this manner, the system will determine whether the failure to confirm was due to tire or air line leakages (codes 41, 42, and 43 on front, rear, and trailer respectively) or failure of the wheel valve to properly close.

Note: Leaks from the tire(s) may be noted after the truck has been idle overnight, as the tire(s) lose(s) air when the truck is off and the system inoperative. By observing the time required to achieve normal tire pressures after starting the vehicle, many tire punctures can be identified well before the tire incurs non-repairable damage.

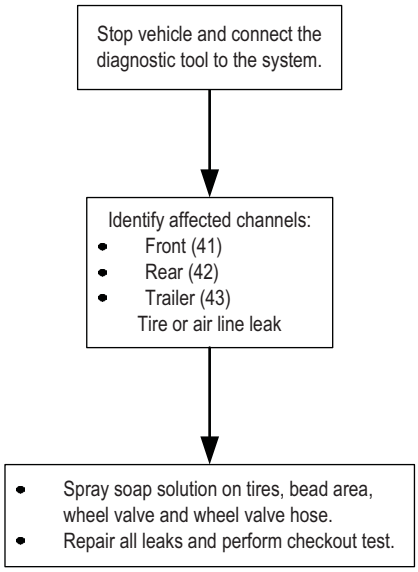
A confirmation failure can be caused by:

- Damaged or leaking tire(s).
- Leaking air line between the wheel valve and tire.
- Air passage restriction between the PCU and the wheel valve.
- Wheel valve contamination or failure.

To identify the root cause of the problem, connect the diagnostic tool (see Diagnostics Section for test equipment and descriptions) and follow the procedure in the 10P! Troubleshooting Tree.

See "Troubleshooting Tips" for general guidelines on system diagnostics.

Tire Leak (Confirm) (Codes 41, 42, 43)



Group: 11P! (Codes 44, 45, 46)

Type: Tire Leak (Imbalance)

System Mode	Condition	Possible Causes (Listed in Likely Order of Occurrence)
Channel only checks pressure	Tire pressure lower on one tire than others on same channel	- Minor tire leakage at start-up (leaked down overnight). - Severe tire damage or leaks. - Leaking lines. - Contaminated wheel valve filters. - Restricted tire valve stem. - Leaking seals. - Leaking wheel valve. - Crimped or restricted control lines.

Air Pressure Check

The Tire Pressure Control System is not continuously pressurized; pressure checks occur on a periodic basis. During tire pressure checks, the system delivers compressed air to each channel for approximately two seconds while monitoring the pressure in that channel.

Code Description

Group 11P! indicates that pressure imbalance may exist between the tires on the front (44), rear (45), or trailer (46) channel after the system has achieved the target pressure.

This code can be caused by:

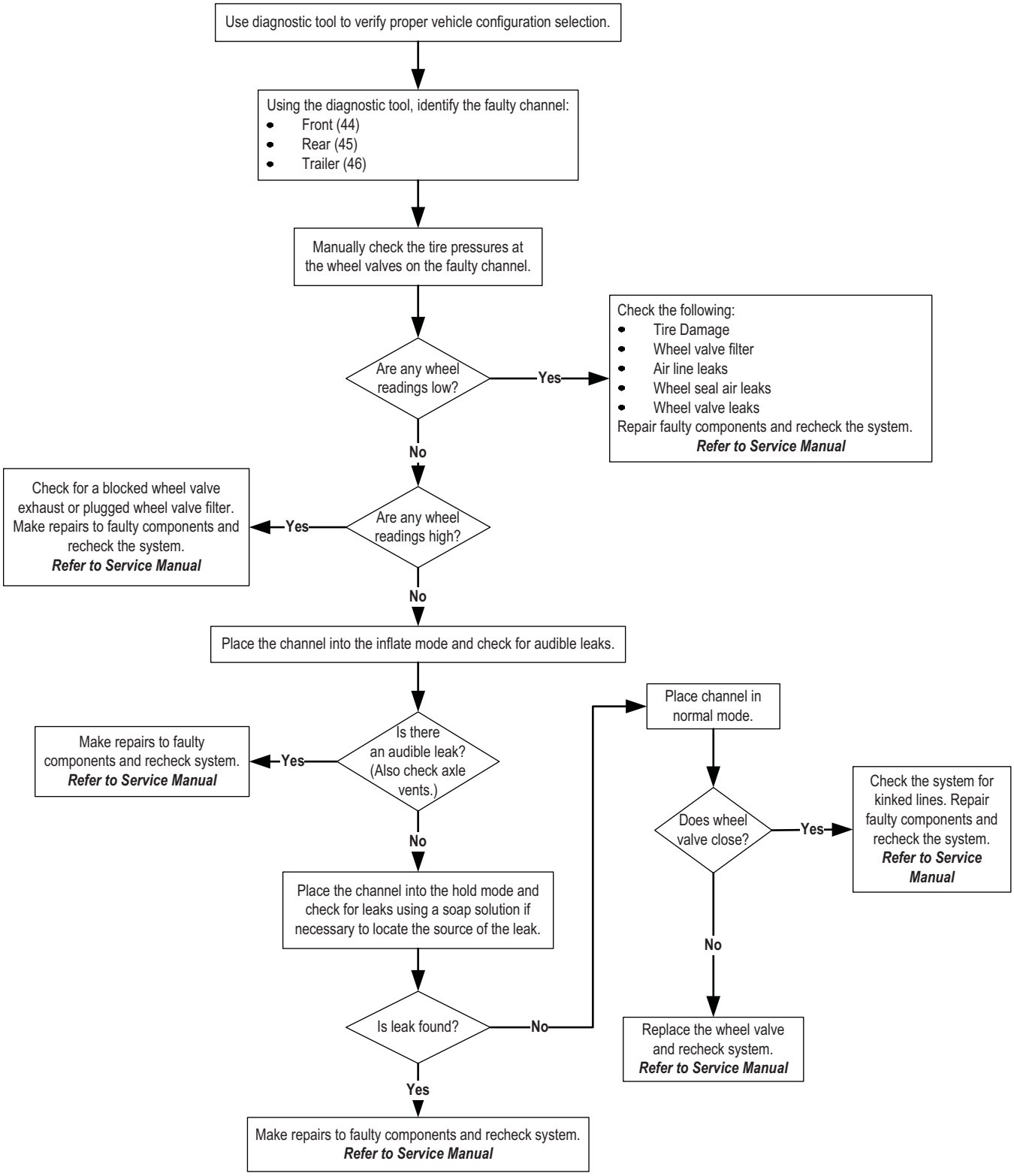
- Damaged tire(s) - (tires will continue to lose air after the vehicle is shut off).
- Leaking air lines between the wheel valve and tire - (tires will continue to lose air after the vehicle is shut off).
- Plugged or contaminated wheel valve filter(s) - one tire of an axle group will deflate slower than others and 11P! will be set after completion of the deflate sequence due to one tire being higher in pressure.
- Leaking air lines between the PCU and wheel valve - tires may not exhibit actual imbalance; air line leaks between PCU and wheel valve resulted in pneumatic signature which imitated the fault.

Using a tire pressure gauge to manually compare tire pressures on the indicated channel will allow you to identify the specific tire involved. Very slow leaks may require that you allow the vehicle sit overnight for sufficient air loss to occur.

To identify the root cause of the problem, connect the diagnostic tool (see Diagnostics Section for test equipment and descriptions) and follow the procedure in the 11P! Troubleshooting Tree.

See "Troubleshooting Tips" for general guidelines on system diagnostics.

Tire Leak (Imbalance) (Codes 44, 45, 46)



Group: 12P! (Codes 61, 62, 63, 64, 65, 66)

Type: Wheel Valve Shut Off

System Mode	Condition	Possible Causes (Listed in Likely Order of Occurrence)
Normal Operation	Loss of pressure during shut off	- Wheel Valve shut off failure. - Air passage restriction.

Air Pressure Check

The Tire Pressure Control System is not continuously pressurized; pressure checks occur on a periodic basis. During tire pressure checks, the system delivers compressed air to each channel for approximately two seconds while monitoring the pressure in that channel.

Code Description

Group 12P! code indicates that the system is unable to confirm that tires on a given channel are able to sustain the target pressure when the channel is depressurized. After any change of pressure on a given channel, the Tire Pressure Control System will return to that channel to confirm, or "double-check" the new pressure before returning to the periodic check interval. If the pressure is not the same, or more than the last reading, the system will inflate again, and then reconfirm that channel. After 7 - 10 confirmation attempts, the system will log a 12P! code, and complete operations on any remaining channel. The system will classify the loss of air due to wheel valve closure as minor (codes 61, 62, and 63 on front, rear, and trailer respectively) or major (codes 64, 65, and 66 on front, rear, and trailer respectively).

Note: Leaks from the tire(s) may be noted after the truck has been idle overnight, as the tire(s) lose(s) air when the truck is off and the system inoperative. By observing the time required to achieve normal tire pressures after starting the vehicle, many tire punctures can be identified well before the tire incurs non-repairable damage.

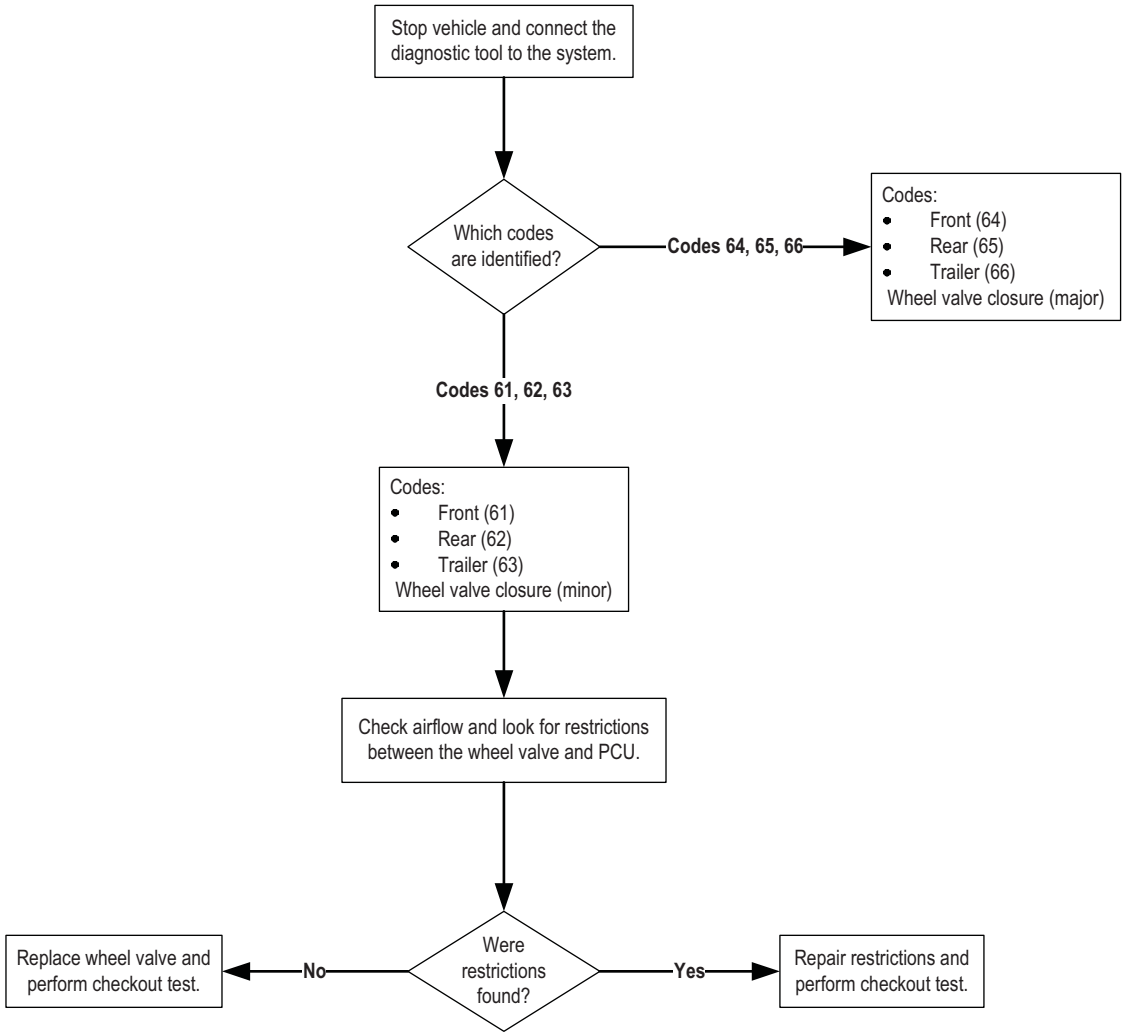
A confirmation failure can be caused by:

- Damaged or leaking tire(s).
- Leaking air line between the wheel valve and tire.
- Air passage restriction between the PCU and the wheel valve.
- Wheel valve contamination or failure.

To identify the root cause of the problem, connect the diagnostic tool (see Diagnostics Section for test equipment and descriptions) and follow the procedure in the 10P! Troubleshooting Tree.

See "Troubleshooting Tips" for general guidelines on system diagnostics.

Wheel Valve Shut Off (Codes 61, 62, 63, 64, 65, 66)



Code: No Code

Type: Miscellaneous

Although the Tire Pressure Control System is self-diagnosing, there are some problems that may not trigger a service code. The following chart lists these conditions along with possible causes and solutions:

Condition **Operating problems that do not trigger a service code.**	**Possible Causes*** **Since a service code was not set, these conditions may be universal and not call for a troubleshooting routine.**	**Service** **Where fault codes appear, refer to the troubleshooting procedures listed under that code.**
DRIVER INTERFACE (DDM or OCP)		
Intermittent Driver Interface operation.	Intermittent ground or power connection to Driver Interface or Electronic Control Unit.	Follow troubleshooting for 4C! group.
No operation (blank display).	- Fuses. - Faulty ground or power connection.	- Check fuses. - Repair power/ground.
Blank Driver Interface.	- No power to Driver Interface. - Bad ground to Driver Interface. - Bad switched ignition line to Driver Interface. - Faulty Driver Interface. - Voltage out of range (9-18 volts).	Follow troubleshooting for 4C! group.
Operator Control Panel display is always dim and no backlighting on Operator Control Panel buttons.	Lamp 2 wire is disconnected. It should be grounded for "bright" and tied to +12V for "dim" and backlight.	See wiring schematic or Installation Guide.
System loses programmed tire pressure settings.	- Intermittent connection at config connector. - Improperly followed programming procedure. - Faulty Electronic Control Unit.	- See wiring schematic. - Reference programming procedure. - Replace Electronic Control Unit.
No display of pressures on Operator Control Panel.	Operator Control Panel is in Quiet Mode.	Refer to "Select Key" in section 3 of Operator Instructions.
No display of pressures and no apparent inflate or deflate.	Pressure switch not closed.	Follow troubleshooting for 7P! group.
	ECU left in DIAGNOSTIC mode.	Move vehicle > 5mph.
* Possible causes are listed in order of likely occurrence.		

Condition **Operating problems that do not trigger a service code.**	**Possible Causes*** **Since a service code was not set, these conditions may be universal and not call for a troubleshooting routine.**	**Service** **Where fault codes appear, refer to the troubleshooting procedures listed under that code.**
TIRE PRESSURE		
Display shows tires at higher pressure than target, yet system does not attempt to deflate. No apparent inflate or deflate.	Tire pressure rises due to temperature are not bled off by the Tire Pressure Control System. This is normal operation.	System will only initiate a deflate if a mode with a lower target pressure than current target is selected.
Pressure imbalance (tires on same channel at different pressures).	- Defective hose. - Clogged filters.	Follow troubleshooting for 11P! group.
No inflate or deflate of particular tire.	Valve stem core not removed on tire.	Remove hose from tire valve stem and remove core. Replace hose.
Inaccurate tire pressures.	- Leaking control lines. - Faulty pressure transducer.	Follow troubleshooting for 8P! and 11P! group.
	- Incorrect config. connector or bad connection. - Faulty Electronic Control Unit.	See wiring schematic.
AIR LEAKS		
Air bleeding from rear axle vents.	Air Seal degradation.	Refer to Service Manual.
Tires fail to deflate when lower pressures are requested.	Pneumatic system problem.	Follow troubleshooting for 3P! group.
Leaking tires.	- Damaged tire. - Loose connection between wheel valve and tire. - Loose/leaking tire valve stem. - Faulty wheel valve.	Refer to Service Manual.
Air bleeding (audible) through Pneumatic Control Unit when ignition is turned off.	Wheel valve is leaking back through control lines.	Identify tire with low pressure and determine obstruction or replace wheel valve.
* Possible causes are listed in order of likely occurrence.		

Condition **Operating problems that do not trigger a service code.**	**Possible Causes*** **Since a service code was not set, these conditions may be universal and not call for a troubleshooting routine.**	**Service** **Where fault codes appear, refer to the troubleshooting procedures listed under that code.**
OTHER		
Apparent continuous operation, or slow inflates or deflates.	- Tire(s) leakage. - Between mode. - Trend fault.	Follow troubleshooting for 4P!, 9P!, and 10P! group.
System stopped in middle of inflate or deflate (display shows completion before reaching targeted pressures).	Intermittent Pneumatic Control Unit sensor, short, or open.	Follow troubleshooting for 5C! group.
Wheel end oil leak.	Faulty air or oil seal.	Refer to Service Manual.
Trailer present, not detected.	- Disconnected trailer air line connector. - Clogged trailer air lines. - Crimped control line on trailer channel.	Refer to Service Manual.
Trailer detected, not present.	- Trailer connector on tractor side doesn't seal when disconnected. - Leaking line between Pneumatic Control Unit and trailer air line connector.	Refer to Service Manual.
High reading (>100 psi) on trailer channel with no trailer connected.	Leaking trailer connector.	Refer to Service Manual.
No communications by the PC diagnostic or handheld tool.	- No power to the communication interface box (comm. box). - No communications to comm. box. - Faulty comm. box.	- Verify power to the communication interface box (comm. box). - Verify ECU connection to data link (see wiring diagram). - Try different comm. box.
* Possible causes are listed in order of likely occurrence.		

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Final System Checkout

Test Requirements

This test requires use of a diagnostic tool (PC or handheld) to control and monitor the functions of the Spicer TPCS, and an accurate tire pressure gauge.

Select Highway-Loaded. Upon successfully achieving Highway-Loaded, verify tire pressures are within ± psig of desired pressure. If significant tire imbalance exists, balance should be achieved by using the system to generate a short deflate, followed by re-inflating the tires, or by manually adjusting.

Verify governor cut-out pressure: _____ (Acceptance criteria: 120-125 psig)

Verify the Pressure Switch cycles open & closed during inflation: Yes / No

Use Diagnostic tool to verify proper configuration: _____
If downloadable configuration is used, verify proper pressure settings, speeds, etc. have been set.

Use Diagnostic tool to DISPLAY SERVICE CODES.

- Clear any existing historical codes.

Use Diagnostic tool to PERFORM DIAGNOSTIC TESTS.

- Select channel and "Pressure Check Tires and Hold" option to pressurize each individual channel. Check for air leaks; record the initial pressure and then the stabilized pressure 10 seconds later.

System Pressure:	Front	Rear	Trailer
Initial Pressure			
Pressure after 10 sec.			

Acceptance criteria: Pressure should not drop.

- Select item "Pneumatic Control Unit," then "Read Isolated PCU Vacuum" and record PCU vacuum. Next, individually select each channel and record System Pressure while deflating:

Isolated PCU Vacuum		Front	Rear	Trailer
(PSIA)	(inHg)	(inHg)	(inHg)	(inHg)

Acceptance criteria: Isolated PCU < 22 inHg, Individual channels ±1 inHg of Isolated PCU

Use Diagnostic tool to MONITOR SYSTEM.

- Deflate the system by selecting Highway-Unloaded. Upon successfully achieving Highway-Unloaded, use pressure gauge to verify tire pressures are within ±3 psig of desired pressure.
- Select Highway-Loaded. Upon successfully achieving Highway-Loaded, use pressure gauge to verify tire pressures are within ±3 psig of desired pressure.
- Drive vehicle and verify diagnostic tool display coincides with vehicle speedometer. If not, recalibrate the pulse/mile count in the "Modify System Data" section of the diagnostic tool.

Is the vehicle speed calibrated? Yes / No

Use Diagnostic tool to DISPLAY SERVICE CODES.

- Verify no codes have been set during checkout process (clear if necessary). Exit diagnostics.

Note: If any suspected issues arise, inflation and deflation to other mode settings is appropriate to aid diagnosis.

Pneumatic Control Unit - Cleaning and Inspection

The following describes the procedure for disassembly, cleaning, and inspection of the Spicer Tire Pressure Control System Pneumatic Control Unit (P/N 673336, and 673316). Components requiring replacement can be found in the Illustrated Parts List (AXIP-0010).

⚠ CAUTION

Do not use cleaning solvents which are not compatible with elastomer or rubber components. Use of Brake Cleaners, or solvents containing Xylene or Methyl Ketone, is not recommended.

1. Remove unit from the vehicle (refer to Service Manual AXSM-0010).
2. Remove bottom cover plate screws (10e), cover plate (10a), and gasket (10b). If the unit has a trailer module, remove screws (10e), plate (10c), and gasket (10d).
3. All cartridges (8) are normally open units with the exception of the supply channel (9) which is normally closed. Ensure the normally closed cartridge (9) is reinstalled in the supply port following cleaning. The cartridges can be removed by pulling them from the bottom of the PCU.
4. If the unit is a 3-channel system, remove 6 solenoid cover screws (3c) and 4 trailer module cover screws (7c).
5. Lift solenoid cover and trailer module cover together to clear solenoids.
6. Remove solenoids from operators by removing 9/16" hex nuts on top of solenoids.
7. Remove solenoid operators from PCU body using a 1" wrench on the brass base (13).

Note: All operators with the exception of the deflate operator are 3 way (indicated by threaded port in top of part). Do not mix deflate operator or its internal plunger (15) with other operators, or plungers (14). Ensure that both O-rings (11,12) in operator bases are not lost.

8. Remove operator stem from base (13) on all operators using spanner wrench (16). If spanner wrench is not available, double nutting the operator stem (with the 9/16" hex nuts) will enable disassembly.
9. Inspect condition of poppets (14,15) inside operator.

Note: Deflate plunger (15) is specific to the deflate operator, and is identified by its solid metal top. If poppets appear in good condition, thoroughly clean poppet and operator assembly. Verify the absence of any "sticky" residue from oil contamination.

10. Reassemble each operator with the base. Do not install assemblies on PCU body until it is completely cleaned.
11. Spray cleaning solvent on cartridge bores within PCU body to remove debris and oil residue. Thoroughly dry cartridge bores prior to further assembly.
12. Replacing cartridges is not typically required; however, it may be desirable to replace the 3 outer O-rings on each or any individual cartridge. These are standard nitrile O-rings and the sizes are provided on the following page. Replacement cartridges are available if required. See Illustrated Parts List (AXIP-0010).
13. Lightly lube cartridge O-rings with silicone grease and install cartridges in body, verifying that the one normally closed cartridge (9) is installed in the Supply (IN) port.

Note: Excess lube on piston O-rings can block hole from solenoid to top of piston. Be careful only to wipe lube on O-rings. Do not pack grooves.

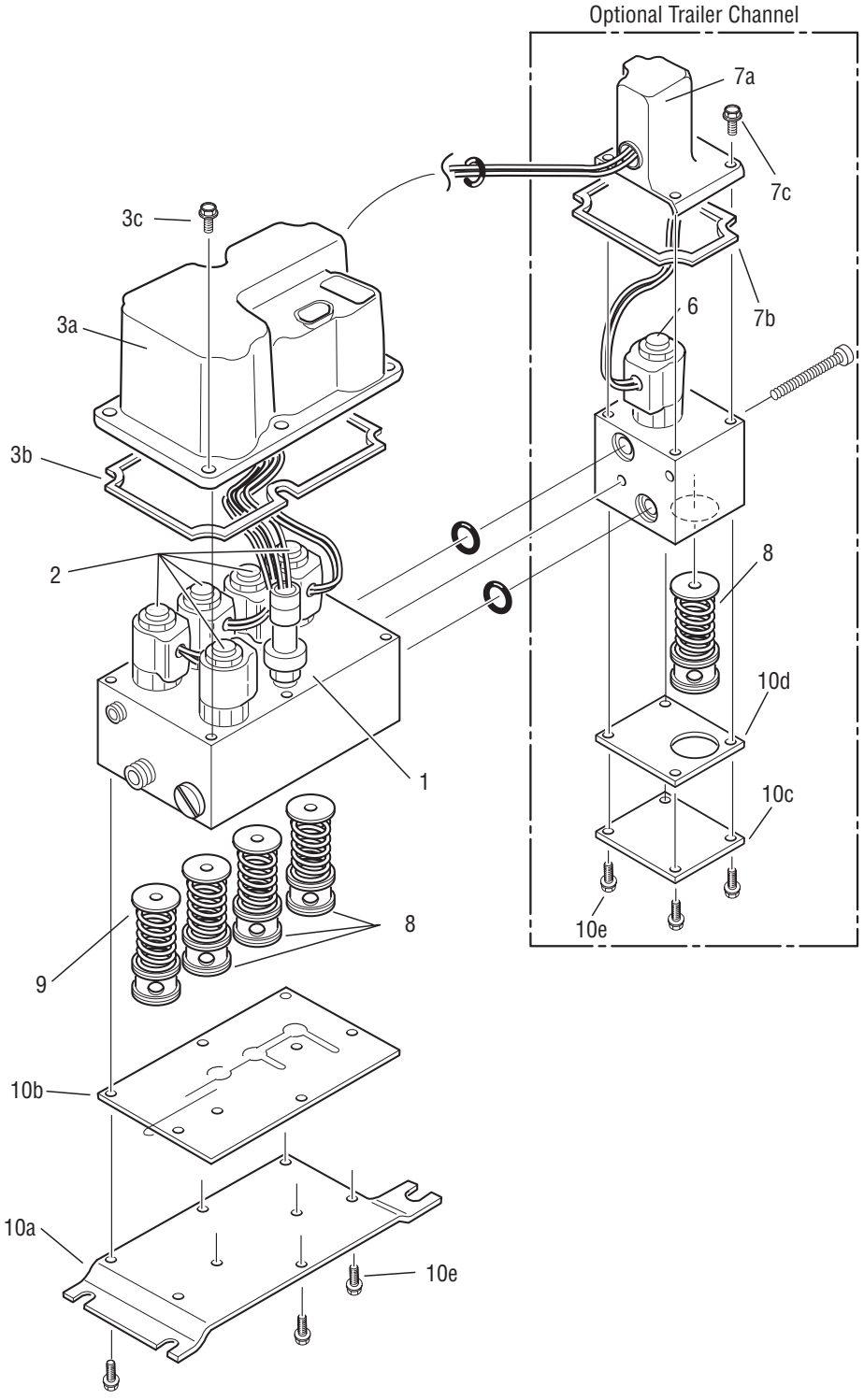
14. Install base gasket (10b), base cover plate (10a), and screws (10e). If 3-channel Pneumatic Control Unit, install gasket (10d), plate (10c), and screws (10e). Torque screws 40 to 45 in. lbs.
15. Verify presence of O-rings in bases of solenoid operator assemblies and reinstall operators onto Pneumatic Control Unitbody. Verify 2-way operator (solid metal top) is in Deflate location. Specific location of other operators (3-way) is not important.
16. Install solenoids on operators verifying proper location per labels on solenoids and Pneumatic Control Unit body.
17. Carefully tuck solenoid wires in area between transducer and solenoids while reinstalling the solenoid covers.

Note: It is necessary to position both covers on the body at the same time.

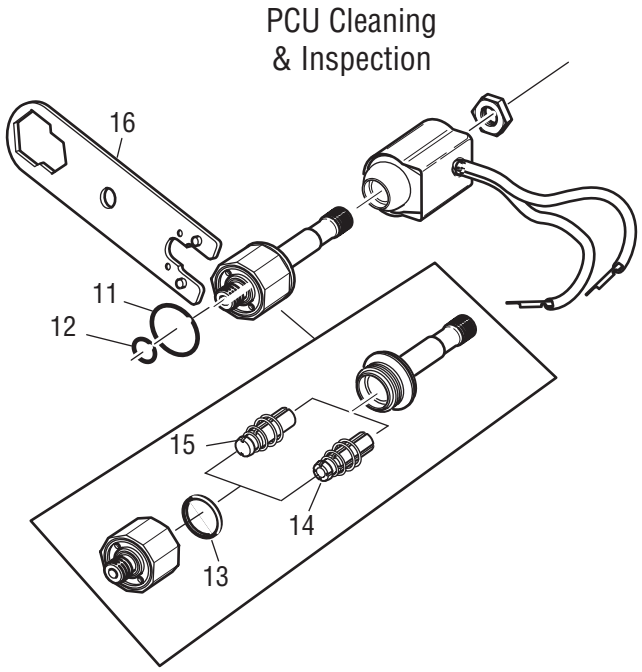
18. Carefully tighten cover screws ensuring that wires are not pinched between cover and body. Torque screws 40 to 45 in. lbs.
19. Reinstall Pneumatic Control Unit in vehicle.
20. Conduct TPC system checkout to verify integrity of cleaning/assembly.

Solenoid Assembly and Cartridge

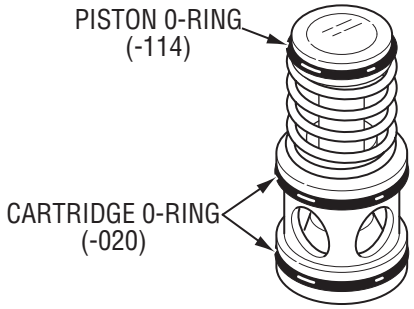
Typical Pneumatic Control Unit Assembly



Typical Solenoid Assembly



Typical Cartridge



Service Guidelines

The Tire Pressure Control System requires normal maintenance much the same as other systems on the vehicle. Following are some general rules that apply to Tire Pressure Control System service:

Clean and Dry Air Supply

The Spicer Tire Pressure Control System requires a constant supply of clean dry air. An adequately sized and properly maintained air dryer is critical for continued proper operation of the Tire Pressure Control System. Even though the air dryer may be working properly, moisture can accumulate in the supply tank during normal operation due to the increase in air consumption. It is important to drain the supply tank daily. Draining the supply tank completely when the truck is not in use will also help keep moisture under control.

Line Replacement and Routing

When replacing air lines, do not allow kinks, sharp bends or stretching in order to tighten joints. If any tube or hose segment does not appear to fit easily, it could mean you are not using the proper part or that you are not following service procedures properly. Ensure that replacement lines are the correct length and size. Be cautious of any contaminants (rubber flash, plastic particles, etc.) getting into the lines when replacing them.

Each segment of the pneumatic system must be secured to the vehicle frame or other installed line. After completing assembly of each segment, use cable ties to anchor the segment at approximately 18" intervals.

⚠ CAUTION

Proper Tire Pressure Control System operation requires correct air line diameters and lengths for each channel. Incorrect air line replacement can affect both performance and operation of the system. Refer to the Tire Pressure Control System service manual for length and diameter information.

Joint Compounds and Fittings

Here are some important "DO's" and "DON'Ts" regarding the use of thread sealant:

- Do apply a thin coating of PTFE based compound on male threads of pipe joints, tubing connections, and other system fittings.
- Don't use any compound on O-ring, compression, or flare fitting connections. Instead, apply a thin coat of silicone grease to O-rings and flares.
- Don't use Teflon thread tape anywhere in the air system. (Teflon tape shreds can become lodged in valves and cause malfunctions.)
- Do follow manufacturer recommended guidelines when tightening fittings.

Air Filter Change

The "Air Filter Change" illustration shows the location of the air filter in each wheel valve. This filter must be replaced whenever the tire or wheel valve is serviced. Use the illustration as a reference in completing the air filter replacement as follows:

⚠ WARNING

Be sure to use appropriate eye and ear protection.

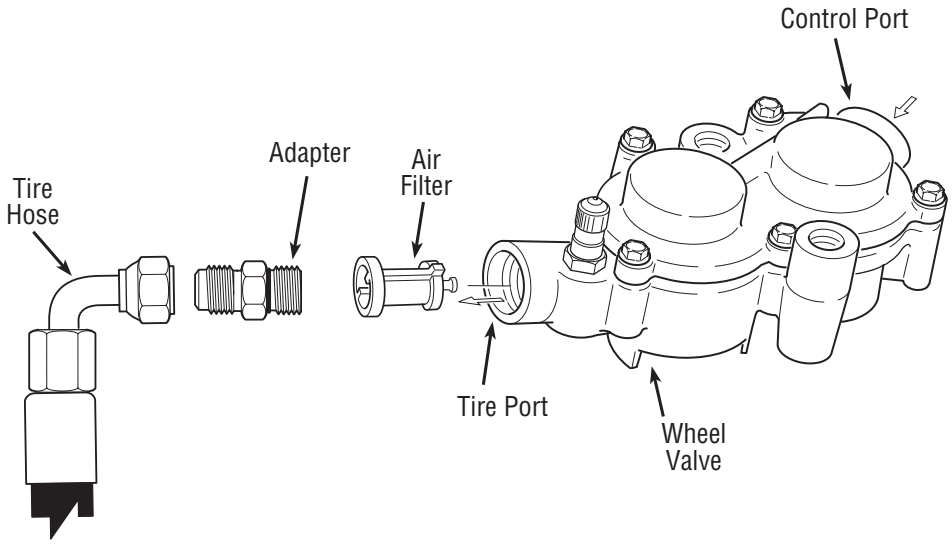
⚠ CAUTION

Do not crush the air filter when installing adjustable straight thread O-ring adapters.

Note: Air filters should not be cleaned or reused. Always replace with a new air filter.

1. Working quickly to prevent air loss, remove the tire hose assembly from the fitting on the tire port (nearest the tire fill valve) of the wheel valve. Plug hose to prevent air loss (SAE 37 degree flare plug, 3/8" tube size, 9/16-18 thread).
2. Remove the adapter fitting from the tire port.
3. Use a flat blade screwdriver to remove (unscrew counterclockwise) the air filter from the wheel valve. Discard the used air filter.
4. Install a new air filter by pressing it straight into wheel valve tire port.
5. Clean the adapter, replace and lubricate the O-ring if necessary and reinstall the adapter in the wheel valve tire port. Tighten to 16-19 lbs. ft.
6. Remove the plug and reinstall the tire hose assembly to the adapter on the wheel valve tire port. Torque to 16-19 lbs. ft.

Note: For installation of adjustable straight thread O-ring adapters, follow instructions in the service manual to prevent crushing the filter.



Troubleshooting Wheel End Seals

Perform an air seal pressure check as follows (refer to "Wheel End Seals" illustration).

1. Connect a hose from a pressure reservoir, 2" ID x 12" long with 2' long 3/8" hose (or equivalent volume), to the inlet tube.
2. Plug hub air port with a 3/8" pipe plug or 9/16-18 straight thread O-ring plug, as appropriate.
3. Open the valve from the air supply line and stabilize the pressure in the reservoir to 100 PSI minimum.

Close air supply valve. Rotate the hub assembly while monitoring the pressure gauge. The pressure reading should not drop more than 15 PSI in 20 seconds.

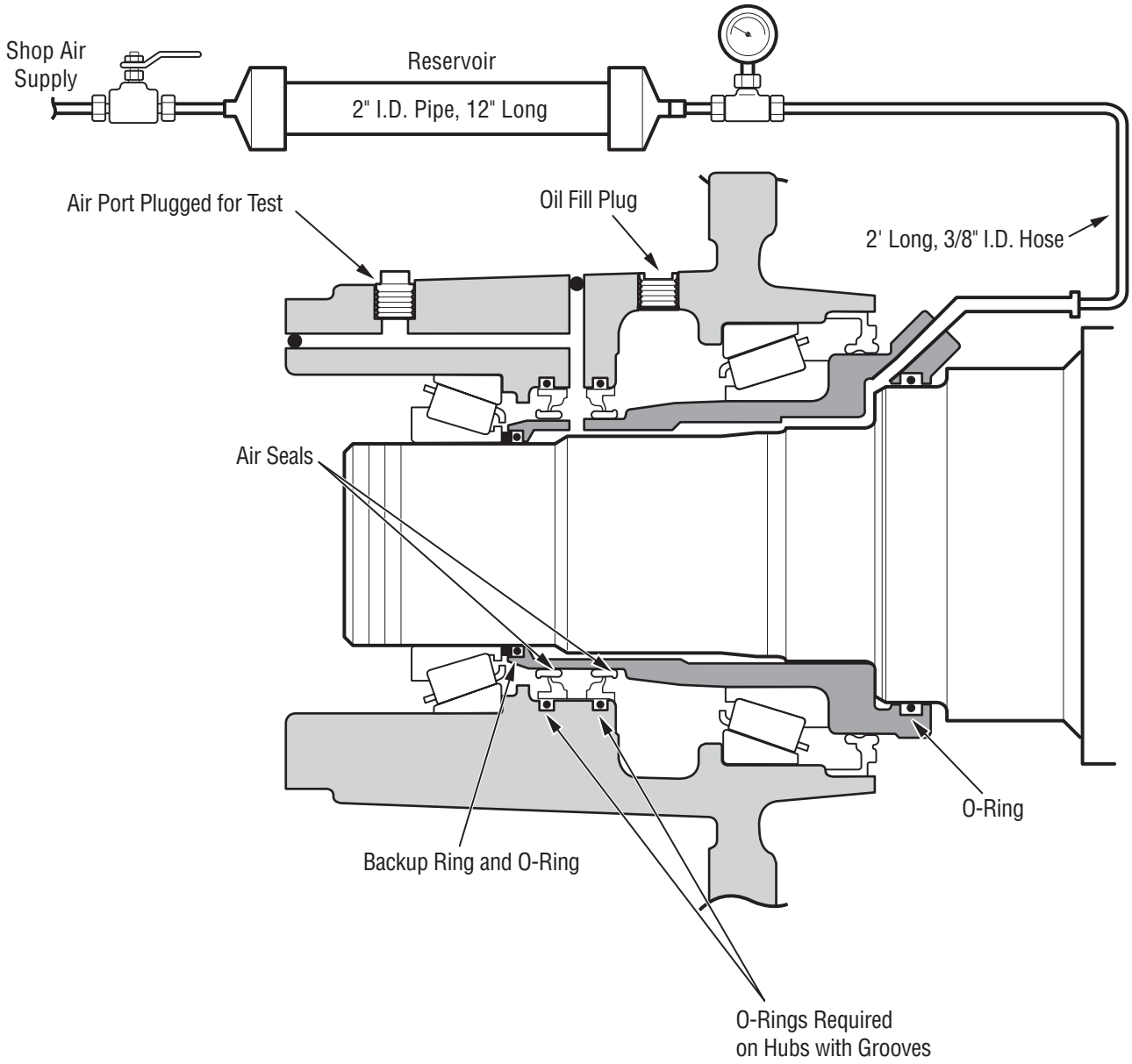
Note: If the air leakage exceeds 15 PSI in 20 seconds, the hub may need to be rotated several times to ensure a complete pressure seal.

If air leakage rate remains outside of accepted limit, locate source of leak:

- Loose Fittings.
- Spindle/Sleeve Outer O-ring.
- Air Seals.

Refer to the Service Manual for replacement procedure.

Wheel End Seals



Hose and Supply Tank Selection Chart

⚠ CAUTION

The following hose lengths and sizes are necessary for correct TPCS operation.

Any deviations may cause the system to function incorrectly and may reduce the ability to detect low tires.

Front Channel Plumbing Requirements

	Min. Tank Size	Main Run	Jounce
Standard Front (1 Axle)	1400 in3 (6 gal.)	18' to 20' 5/8" OD	6' to 8' per axle 5/16" ID Only
		21' to 23' 13/32" ID	6' to 8' per axle 5/16" ID Only
		25' to 27' 1/2" OD	6' to 8' per axle 5/16" ID Only
Dual Front (2 Axle) Both Non-Driven	1400 in3 (6 gal.)	18' to 21' 5/8" OD	6' to 8' per axle 5/16" ID Only
		21' to 25' 13/32" ID	6' to 8' per axle 5/16" ID Only
		25' to 29' 1/2" OD	6' to 8' per axle 5/16" ID Only
Dual Front (2 Axle) 1 Driven, 1 Non-Driven	2800 in3 (12 gal.)	18' to 21' 5/8" OD	6' to 8' per axle 5/16" ID Only
		21' to 25' 13/32" ID	6' to 8' per axle 5/16" ID Only
		25' to 29' 1/2" OD	6' to 8' per axle 5/16" ID Only

Rear Channel Plumbing Requirements

	Min. Tank Size	Main Run	Jounce
Single Rear (1 Axle)	1400 in3 (6 gal.)	15' to 17' 5/8" OD	7' to 9' per axle 5/16" ID Only
		18' to 20' 13/32" ID	7' to 9' per axle 5/16" ID Only
		21' to 24' 1/2" OD	7' to 9' per axle 5/16" ID Only
Tandem Rear (2 Axle)	1400 in3 (6 gal.)	14' to 17' 5/8" OD	7' to 9' per axle 5/16" ID Only
		16' to 20' 13/32" ID	7' to 9' per axle 5/16" ID Only
		18' to 24' 1/2" OD	7' to 9' per axle 5/16" ID Only
Tridem Rear (3 Axle)	2800 in3 (12 gal.)	16' to 20' 13/32" ID	5' to 7' per axle 5/16" ID Only
		18' to 24' 1/2" OD	5' to 7' per axle 5/16" ID Only

Trailer Channel Plumbing Requirements

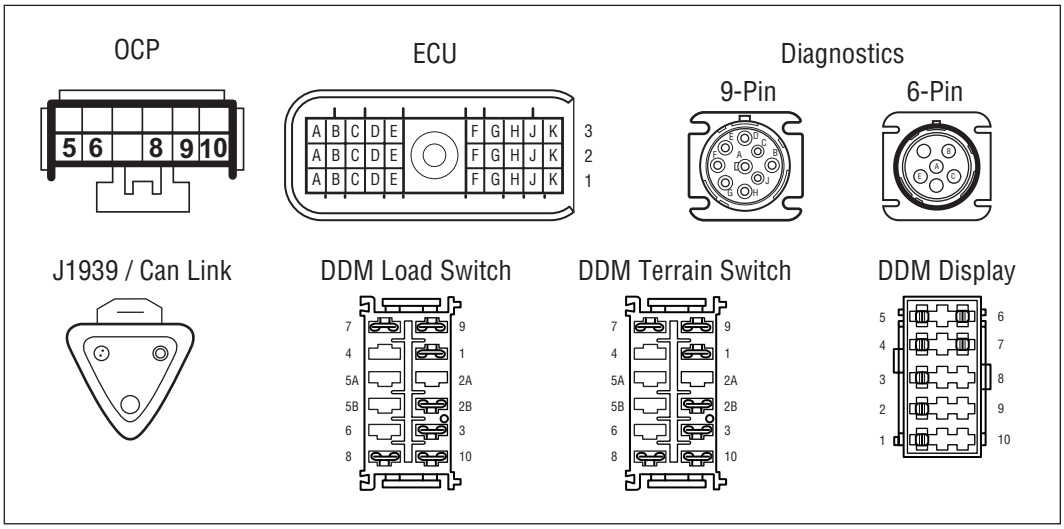
	Min. Tank Size	Main Run	Jounce
(Tractor) PCU to Glad Hand*	N/A	16' to 22' 5/8" OD	
		19' to 25' 13/32" I D	
		22' to 30' 1/2" OD	
Single Trailer (2 to 3 Axles)	1400 in3	35' to 40' 1/2" OD	7' to 9' per axle 5/16" ID Only
	(6 gal.)	40' to 50' 5/16" ID	7' to 9' per axle 5/16" ID Only
Dual Trailers (4 to 5 Axles)	2800 in3	60' to 85' 1/2" OD	7' to 9' per axle 5/16" ID Only
	(12 gal.)	75' to 100' 5/16" ID	7' to 9' per axle 5/16" ID Only

Notes:

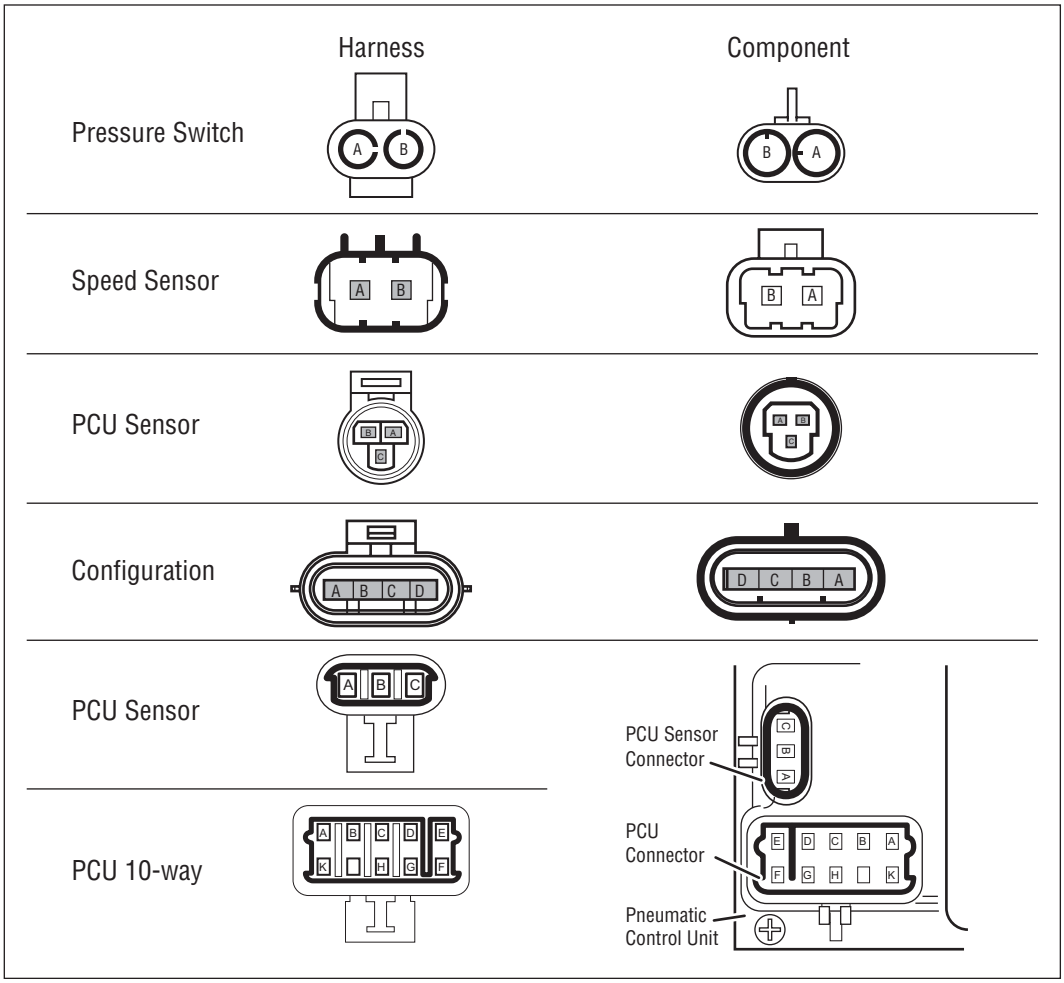
1. Air line sizes shown with an outer diameter measurement are for DOT approved nylon air brake tubing meeting SAE J844. Air line sizes shown with an inner diameter measurement are for DOT approved reinforced rubber hose meeting SAE J1402.
2. For Pneumatic Control Unit to Glad Hand plumbing when using a coiled hose, include the coiled hose length in the overall measurement. Example: A 22' coil air hose with a 15' working length is actually 22' in length.
3. Wire braid hose diameter is inside diameter (I.D.). Nylon hose diameter is outside diameter (O.D.).

Connector Illustrations (All views shown looking into connector)

Harness Connectors

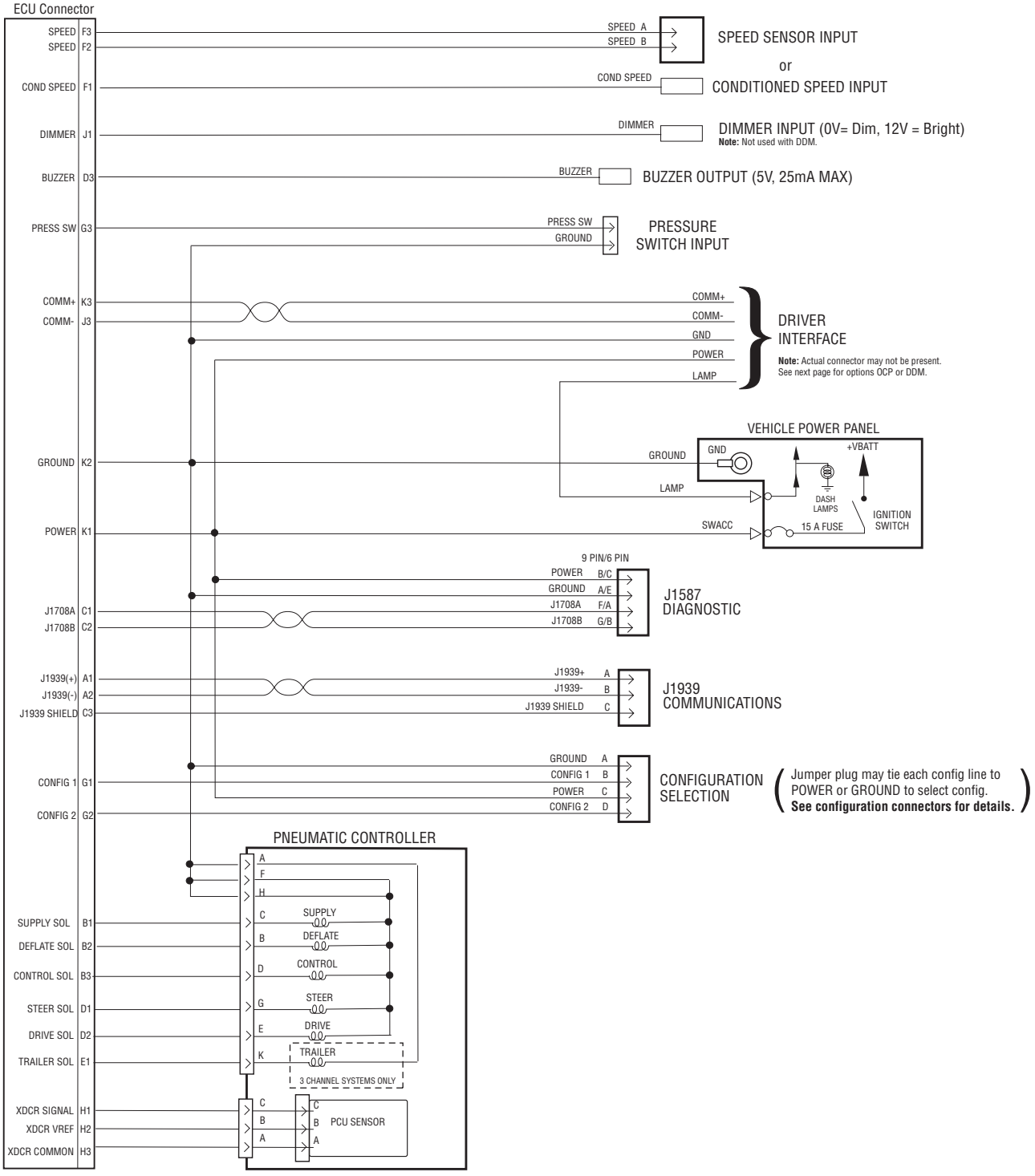


Harness and Component Connectors



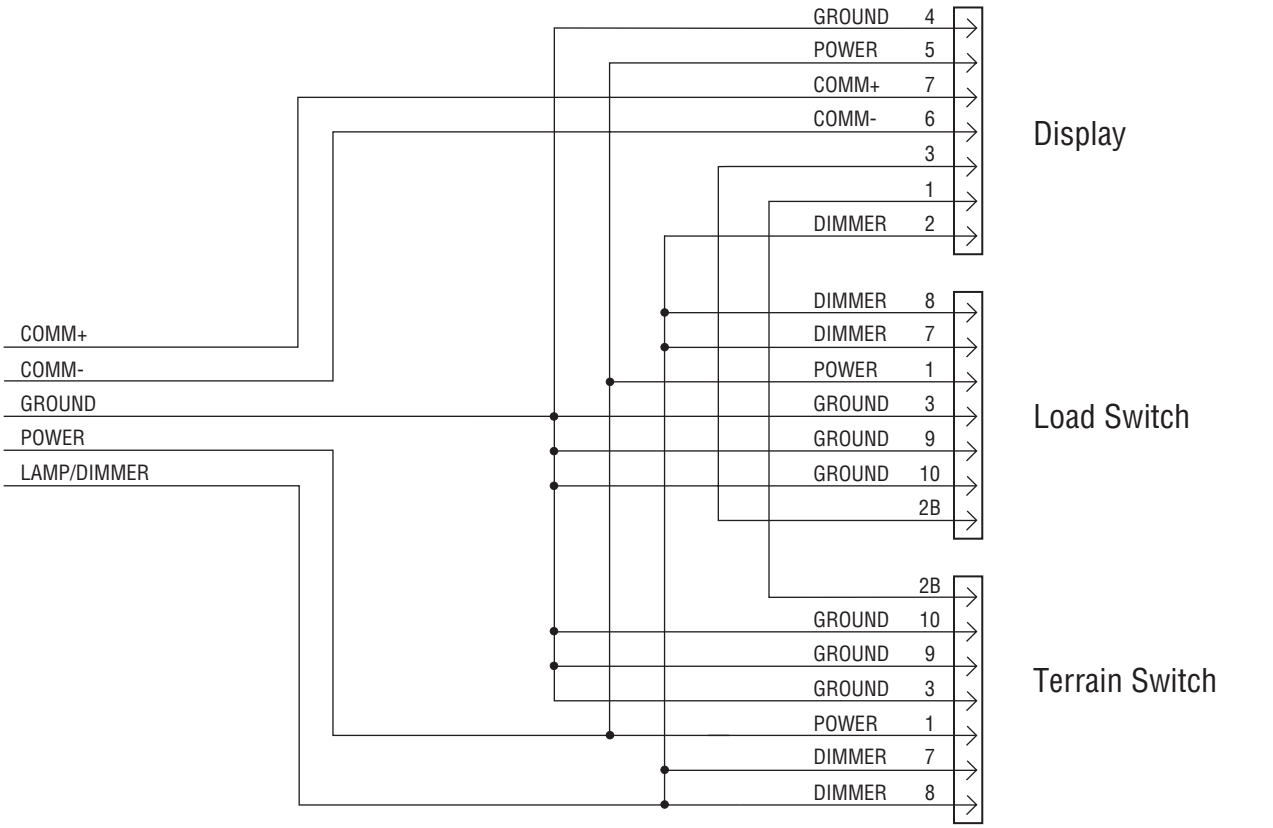
Electrical Schematic

Note: Schematic is shown for "point- to-point" troubleshooting only. Actual OEM implementations may vary with bulkhead connectors, etc.



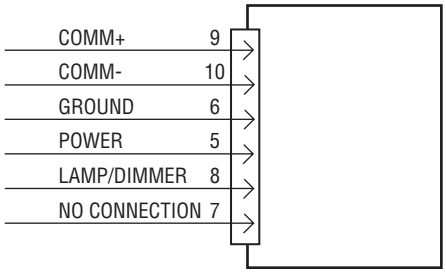
Driver Interface Options

Driver Display Module (DDM)



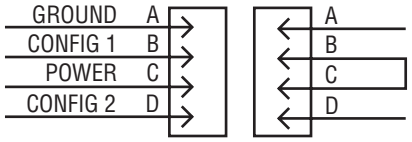
Or

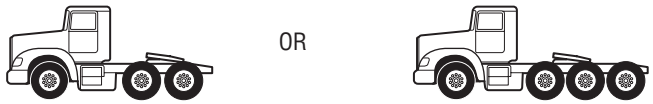
Operator Control Panel (OCP)



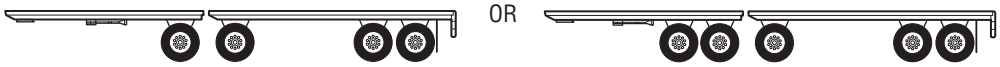
Configuration Connections

CONFIG 0

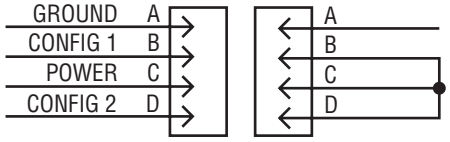




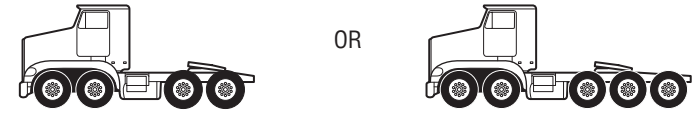
WITH OPTIONAL TRAILER:



CONFIG 1

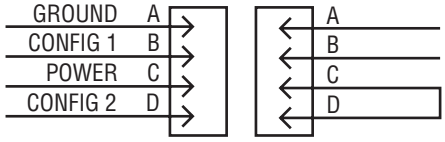


(BOTH STEERS NON-DRIVEN)

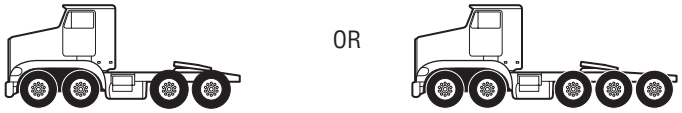


WITH OPTIONAL TRAILER:

CONFIG 2



(1 STEER DRIVEN, 1 STEER NON-DRIVEN)



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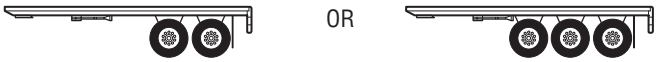
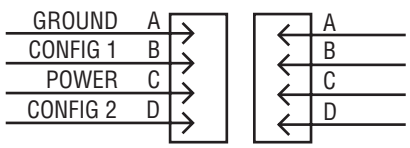
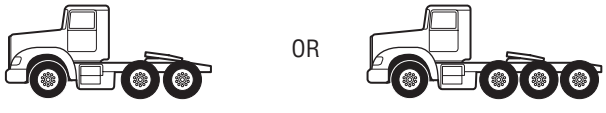


CONFIG 3





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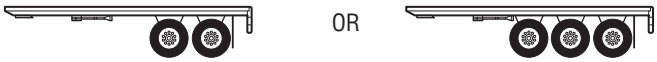

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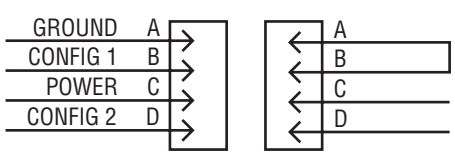
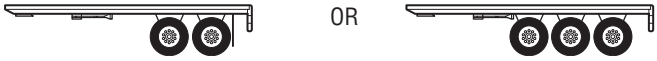
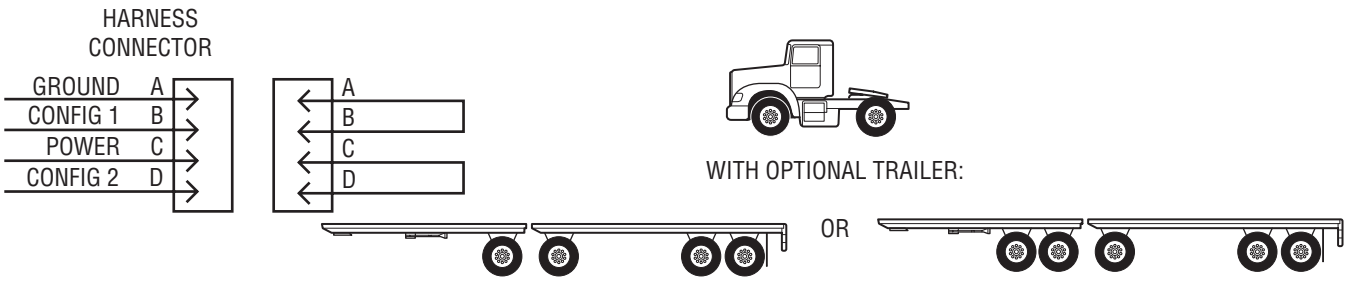


WITH OPTIONAL TRAILER:

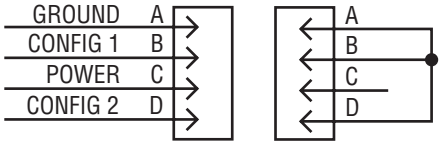


Configuration Connections

CONFIG 5

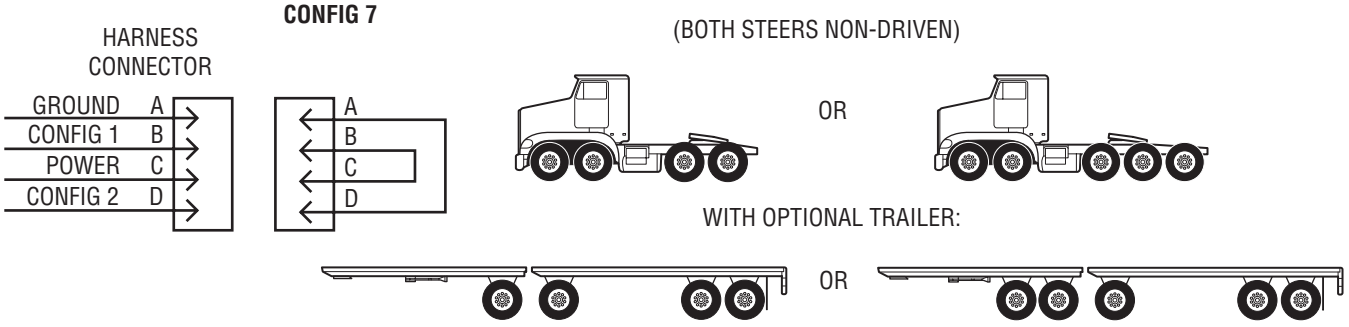


CONFIG 6

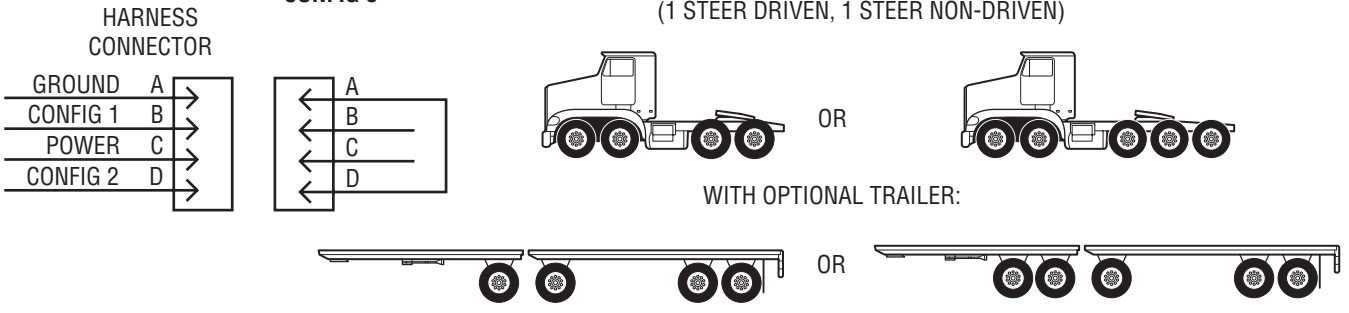


(Reserved)

CONFIG 7



CONFIG 8



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