WESTERN SNOWPLOWS

March 15, 2016
Lit. No. 48163, Rev. 00

MECHANIC'S GUIDE

PRO PLUS® MIDWEIGHT™

PRO-PLOW® Series 2, POLY PRO-PLOW® Series 2, PRO PLUS® & MIDWEIGHT™ SNOWPLOWS

Featuring the FloStat® Hydraulic System

3-Plug Electrical System • 2-Plug FLEET FLEX Electrical System

UltraMount® SYSTEM

UltraMount® 2 SYSTEM

⚠ CAUTION
Read this manual before servicing the snowplow.

TABLE OF CONTENTS

SAFETY INFORMATION **5–7**
Torque Chart 7
INTRODUCTION **8**
Recommended Tools 8
WESTERN® Service Kits Available 8
PRODUCT SPECIFICATIONS **9–10**
Electrical System – Approximate Values 9
FloStat® Hydraulic System 9
Hydraulic Fastener Torque Specifications 10
Relief Valve Specifications 10
BLADE, A-FRAME & LIFT FRAME **11–13**
Pivot Plate Configuration – UltraMount® 11
Stand Shoe Height Adjustment – UltraMount 11
Attaching A-Frame to Lift Frame – UltraMount® 2 12
Stand Shoe Height Adjustment – UltraMount 2 13
OPERATIONAL ADJUSTMENTS **14–17**
Filling the Hydraulic Unit 14
Blade Drop Speed Adjustment 15
Vehicle Lighting Check 16
Headlamp Beam Aiming 17
HYDRAULIC SYSTEM OVERVIEW **18–24**
FloStat Hydraulic Unit Components 18
Pilot-Operated (Poppet-Style) Check Valves 19
Hose Routing 19
Hoses and Fittings Installation 20
Ram Seal Installation 20
Cartridge and Check Valve Removal 21
CONTROLS **22–30**
Overview 22
Solenoid Joystick Control 23
CabCommand Hand-Held Control 24
Joystick Control – FLEET FLEX System 25
CabCommand Hand-Held Control – FLEET FLEX System 27
SECURITY GUARD™ Snowplow Anti-Theft System 28
THEORY OF OPERATION **31–33**
Snowplow Hydraulics 31
3-Port Module Electrical 31
Green Label Module (PN 29070-1) 32
Blue Label Module (PN 29760-1) 33
ELECTRICAL & HYDRAULIC SCHEMATICS **35–74**
Legend 37
3-Plug System – Wiring Overview 38
3-Plug System – Electrical Connectors 39
3-Plug System Schematics 40
Electrical Schematic 40
Low-Beam Headlamps with Snowplow Connected to Vehicle 41
High-Beam Headlamps with Snowplow Connected to Vehicle 42
Hydraulic Schematic 43
Raise – Electrical 44
Raise – Hydraulic 45
Lower/Float – Electrical 46
Lower/Float – Hydraulic 47
Angle Right – Electrical 48
Angle Right – Hydraulic 49
Angle Left – Electrical 50
Angle Left – Hydraulic 51
Hold in Raise Position – Hydraulic 52
Striking an Object While Plowing – DS 53
Striking an Object While Plowing – PS 54

TABLE OF CONTENTS

ELECTRICAL & HYDRAULIC SCHEMATICS, continued

- 2-Plug System (FLEET FLEX) – Wiring Overview 55
- 2-Plug System (FLEET FLEX) – Connectors 56
- 2-Plug System (FLEET FLEX) Schematics 57
  - Electrical Schematic 57
  - Low-Beam Headlamps with Snowplow Connected to Vehicle 58
  - High-Beam Headlamps with Snowplow Connected to Vehicle 59
  - Hydraulic Schematic 60
  - Raise – Electrical 61
  - Raise – Hydraulic 62
  - Lower/Float – Electrical 63
  - Lower/Float – Hydraulic 64
  - Angle Right – Electrical 65
  - Angle Right – Hydraulic 66
  - Angle Left – Electrical 67
  - Angle Left – Hydraulic 68
  - Hold in Raise Position 69
  - Striking an Object While Plowing – DS 70
  - Striking an Object While Plowing – PS 71

HYDRAULIC PUMP REPAIRS 72–77

- Replacing Pump Shaft Seals 73
- Pump Installation and Alignment 74
- Hydraulic Unit Assembly 75
- Replacing Damaged Bearing Sleeves 76

TROUBLESHOOTING **78–102**

- How to Use This Troubleshooting Guide 79
- Electrical Testing 79
- Before You Begin 80
- Vehicle Headlamps 81
- Snowplow Headlamps 82
- Snowplow Park/Turn Lamps 83
- Snowplow DRL Lamps 84
- Vehicle Lighting Check 85
- Cartridge Coil Activation Test 86
- Vehicle Harness Test – Cartridge Coils 87
- Solenoid Coil Activation Test (SCAT) – FLEET FLEX System 88
- Individual Solenoid Coil Test 91
- Solenoid Cartridge Valve Inspection 91
- Control/Cable/Plow Module Test – FLEET FLEX System 92
- Motor and Motor Relay Tests 93
- Vehicle Harness Test – Motor Relay 95
- Control Test – Hand-Held or Solenoid Control 96
- Motor and Motor Relay Tests – FLEET FLEX System 98
- Pump Pressure Test 99
- Hydraulic System Test 100
- Crossover Relief Valve Inspection and Adjustment 101
- Pilot-Operated (Poppet-Style) Check Valves 102

SAFETY DEFINITIONS

⚠ WARNING

Indicates a potentially hazardous situation that, if not avoided, could result in death or serious personal injury.

⚠ CAUTION

Indicates a potentially hazardous situation that, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.

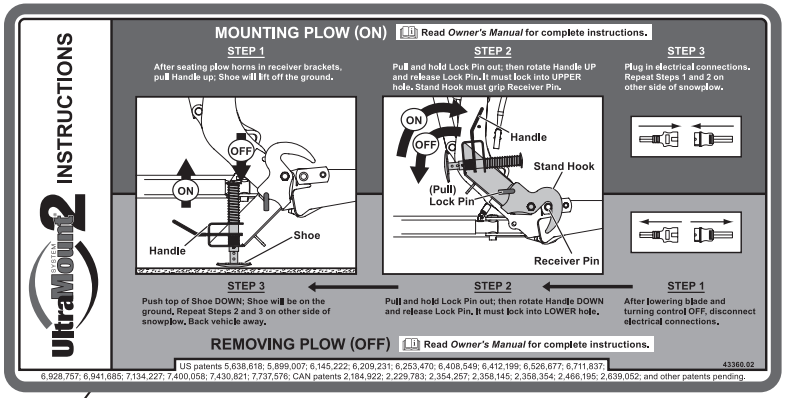
NOTE: Indicates a situation or action that can lead to damage to your snowplow and vehicle or other property. Other useful information can also be described.

WARNING/CAUTION AND INSTRUCTION LABELS

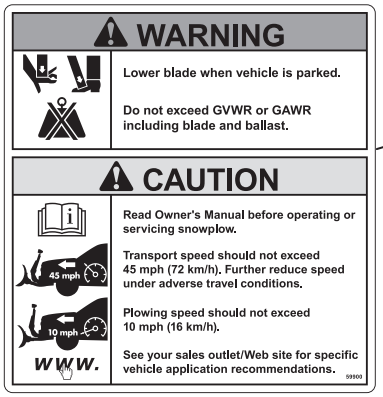
Become familiar with and inform users about the warning and instruction labels on the back of the blade.

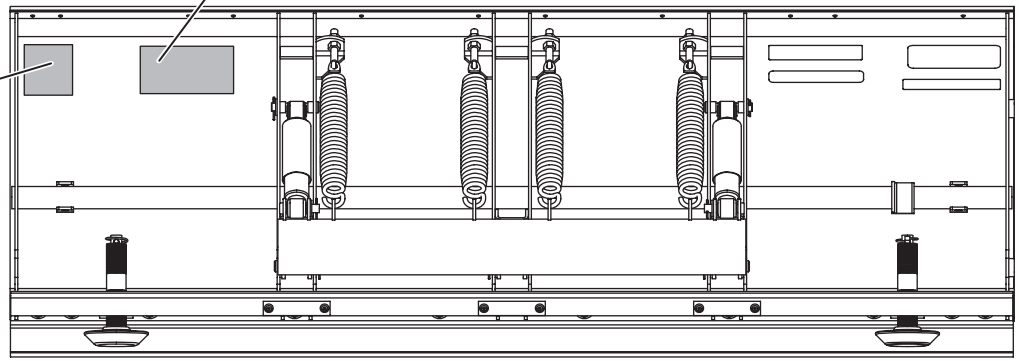
NOTE: If labels are missing or cannot be read, see your sales outlet.

Instruction Label



Warning/Caution Label





SAFETY PRECAUTIONS

Improper installation and operation could cause personal injury, and/or equipment and property damage. Read and understand labels and the Owner's Manual before installing, operating, or making adjustments.

⚠ WARNING

Lower the blade when the vehicle is parked. Temperature changes could change hydraulic pressure, causing the blade to drop unexpectedly or damaging hydraulic components. Failure to do this could result in serious personal injury.

⚠ WARNING

The driver shall keep bystanders clear of the blade when it is being raised, lowered or angled. Do not stand between vehicle and blade or within 8 feet of a moving blade. A moving or falling blade could cause personal injury.

⚠ WARNING

Keep hands and feet clear of the blade and A-frame when mounting or removing the snowplow. Moving or falling assemblies could cause personal injury.

⚠ WARNING

Do not exceed GVWR or GAWR, including blade and ballast. The rating label is found on driver-side vehicle door cornerpost.

⚠ WARNING

To prevent accidental movement of the blade, always turn the control OFF whenever the snowplow is not in use. The power indicator light will turn OFF.

⚠ WARNING

Remove blade assembly before placing vehicle on hoist.

⚠ CAUTION

Refer to the current Selection List for minimum vehicle recommendations and ballast requirements.

HYDRAULIC SAFETY

⚠ WARNING

Hydraulic fluid under pressure can cause skin injection injury. If you are injured by hydraulic fluid, get medical attention immediately.

- Always inspect hydraulic components and hoses before using. Replace any damaged or worn parts immediately.
- If you suspect a hose leak, DO NOT use your hand to locate it. Use a piece of cardboard or wood.

FUSES

The WESTERN® electrical and hydraulic systems contain several blade-style automotive fuses. If a problem should occur and fuse replacement is necessary, the replacement fuse must be of the same type and amperage rating as the original. Installing a fuse with a higher rating can damage the system and could start a fire. Fuse replacement information, including fuse ratings and locations, is located in the Maintenance section of the Owner's Manual.

PERSONAL SAFETY

- Remove ignition key and put the vehicle in park or in gear to prevent others from starting the vehicle during installation or service.
- Wear only snug-fitting clothing while working on your vehicle or snowplow.
- Do not wear jewelry or a necktie, and secure long hair.
- Wear safety goggles to protect your eyes from battery acid, gasoline, dirt and dust.
- Avoid touching hot surfaces such as the engine, radiator, hoses and exhaust pipes.
- Always have a fire extinguisher rated BC handy, for flammable liquids and electrical fires.

FIRE AND EXPLOSION

⚠ WARNING

Gasoline is highly flammable and gasoline vapor is explosive. Never smoke while working on vehicle. Keep all open flames away from gasoline tank and lines. Wipe up any spilled gasoline immediately.

Be careful when using gasoline. Do not use gasoline to clean parts. Store only in approved containers away from sources of heat or flame.

CELL PHONES

A driver's first responsibility is the safe operation of the vehicle. The most important thing you can do to prevent a crash is to avoid distractions and pay attention to the road. Wait until it is safe to operate Mobile Communication Equipment such as cell phones, text messaging devices, pagers or two-way radios.

VENTILATION

⚠ WARNING

Vehicle exhaust contains lethal fumes. Breathing these fumes, even in low concentrations, can cause death. Never operate a vehicle in an enclosed area without venting exhaust to the outside.

BATTERY SAFETY

⚠ CAUTION

Batteries normally produce explosive gases, which can cause personal injury. Therefore, do not allow flames, sparks or lit tobacco to come near the battery. When charging or working near a battery, always cover your face and protect your eyes, and also provide ventilation.

- **Batteries contain sulfuric acid, which burns skin, eyes and clothing.**
- **Disconnect the battery before removing or replacing any electrical components.**

NOISE

Airborne noise emission during use is below 70 dB(A) for the snowplow operator.

VIBRATION

Operating snowplow vibration does not exceed 2.5 m/s^2 to the hand-arm or 0.5 m/s^2 to the whole body.

TORQUE CHART

⚠ CAUTION

Read instructions before assembling. Fasteners should be finger tight until instructed to tighten according to torque chart. Use standard methods and practices when attaching snowplow, including proper personal protective safety equipment.

Recommended Fastener Torque Chart

Inch Fasteners Grade 5 and Grade 8

Size	Torque (ft-lb) Grade 5	Torque (ft-lb) Grade 8	Size	Torque (ft-lb) Grade 5	Torque (ft-lb) Grade 8
1/4-20	8.4	11.9	9/16-12	109	154
1/4-28	9.7	13.7	9/16-18	121	171
5/16-18	17.4	24.6	5/8-11	150	212
5/16-24	19.2	27.3	5/8-18	170	240
3/8-16	30.8	43.6	3/4-10	269	376
3/8-24	35.0	49.4	3/4-16	297	420
7/16-14	49.4	69.8	7/8-9	429	606
7/16-20	55.2	77.9	7/8-14	474	669
1/2-13	75.3	106.4	1-8	644	909
1/2-20	85.0	120.0	1-12	704	995

Metric Fasteners Class 8.8 and 10.9

Size	Torque (ft-lb) Class 8.8	Torque (ft-lb) Class 10.9	Size	Torque (ft-lb) Class 8.8	Torque (ft-lb) Class 10.9
M6 x 1.00	7.7	11.1	M20 x 2.50	325	450
M8 x 1.25	19.5	26.9	M22 x 2.50	428	613
M10 x 1.50	38.5	53.3	M24 x 3.00	562	778
M12 x 1.75	67	93	M27 x 3.00	796	1139
M14 x 2.00	107	148	M30 x 3.50	1117	1545
M16 x 2.00	167	231	M33 x 3.50	1468	2101
M18 x 2.50	222	318	M36 x 4.00	1952	2701

These torque values apply to fasteners except those noted in the instructions.

INTRODUCTION

This guide has been prepared to assist the trained mechanic in the service of WESTERN® straight blade snowplows. It also provides safety information and recommendations.

We urge all mechanics to read this manual carefully before attempting to service the WESTERN snowplow equipment covered by this guide.

Service of your WESTERN snowplow equipment is best performed by your local Western Products outlet. They know your snowplow best and are interested in your complete satisfaction.

Recommended Tools

- Long/slender needle-nose pliers
- Flat screwdriver
- 12V test light
- Torque wrench
- Allen wrench set, including 3/8"
- Combination standard wrench set
- 1/4" drive ratchet set with 6" extension
- 3/8" drive ratchet set
- Deep socket: 7/8"
- Standard socket: 1"
- 11/16" tappet wrench
- 1-1/2" socket and wrench
- Angle-head wrenches: 15° & 60°
- Digital volt/ohmmeter
- Ammeter
- Flashlight
- Pick set
- Hammer
- Pencil magnet
- TORX® drivers: T20 & T30
- Mini fuses: 4 amp (all)
- 10-amp (3-port module)
- Vacuum pump w/3/8" NPT barbed fitting
- 3/8" NPT plug

WESTERN Service Kits Available:

- Hydraulic Pressure Test Kit (PN 56679)
- Motor Bearing Sleeve Repair Kit, PN 64589 (Requires 3/8-24 x 4 hex cap screw, not included.)
- Pump Shaft Seal Repair Kit (PN 28856) (Requires 1/4-28 x 4-1/2 hex cap screw, not included.)
- Isolation Module 10-Pin Test Connector (PN 28957)
- Plow Module Diagnostic Harness Kit (PN 29290-1)
- Poppet Seat Service Tool (PN 28530)

ELECTRICAL SYSTEM — APPROXIMATE VALUES

- **Solenoid Coil Resistance** = 7 ohm at room temperature
- **Solenoid Coil amp Draw** = 1.5 amp
- **Motor Relay Coil Resistance**
  Continuous Duty = 16–17 ohm
  Intermittent Duty = 5.5 ohm
- **Motor Relay amp Draw**
  Continuous Duty = 0.7 amp
  Intermittent Duty = 2.2 amp
- **Motor amp Draw** (± 50 psi)
  UltraMount® system – 205 amp at 2250 psi
  UltraMount® 2 system – 205 amp at 2250 psi
- **Switched Accessory Lead Draw** = 0.75 amp

Fuses

- 3-Port Module Vehicle Control Harness
  Module – 10 amp (Mini)
  Control – 10 amp (Mini)
- Plow Module (Qty 2)
  4 amp (Mini)

FloStat® HYDRAULIC SYSTEM

⚠ CAUTION

Do not mix different types of hydraulic fluid. Some fluids are not compatible and may cause performance problems and product damage.

NOTE: Remove the breather/fill plug slowly to relieve any pressure in reservoir.

Hydraulic Fluid

- WESTERN® High Performance Fluid to –25°F (–32°C) or other fluid conforming to Military Specification MIL-H-5606A, such as Mobil Aero HFA or Shell AeroShell® Fluid 4.

Fluid Capacity

- Unit reservoir = 1-3/4 quarts
- System total = 2-3/8 to 2-3/4 quarts

Solenoid valve spool travel = 0.07" (1.8 mm) for 3- and 4-way valves (S2, S3). Travel of 2-way valve (S1) spool is not detectable with voltage applied to coil.

Fluid Level

With the system attached to the vehicle, activate the control. Activate the control FLOAT function and manually collapse the lift ram all the way. Remove the fill plug. Fill the reservoir to the top of the fill hole. Replace the fill plug.

HYDRAULIC FASTENER TORQUE SPECIFICATIONS

Multiplex Straight Blade Hydraulic Unit Torque Chart		
Location	**Fastener Size**	**Torque**
Pump Cap Screws	5/16-18 x 2-1/4	150–160 in-lb
Motor Terminals (+ and –)	5/16 Nut	50–60 in-lb
Motor to Manifold Cap Screws	1/4-20	55–65 in-lb*
Reservoir Screws	#10-24 x 5/16	30–35 in-lb*
Solenoid Valves	7/8 Hex Head	19–21 ft-lb
Coil Nuts	3/4 Hex Head Jam Nut	48–60 in-lb
SAE O-Ring Plugs	1/8 or 5/32 Internal Hex	7–9 ft-lb
Hydraulic Unit Mount Bolts	3/8-16 x 1	22–27 ft-lb
Motor Relay Small Terminals	10-32 Nut	15 in-lb max
Motor Relay Large Terminals	5/16-24 Nut	35 in-lb max
Motor Relay Mount Screws	1/4-20 x 1/4	55–65 in-lb
Plow Module Mount Screws	1/4-20 x 3/8	60–70 in-lb
Module Plate to Manifold	1/4-20 x 5/8	60–70 in-lb
Cartridge Coil Cover Screws	8/32 Stand-Off Screw	15–20 in-lb
Angle Ram Gland Nut	2-3/16 Hex Head	150–180 in-lb

* Torque with low-strength threadlocker

RELIEF VALVE SPECIFICATIONS

Snowplow	Crossover Relief Valve Pressure (± 100 psi)	No. of Turns Crossover Relief Valve Is Backed Off (CCW) from Fully Seated*	Pump Relief Valve Pressure (± 50 psi)	No. of Turns Pump Relief Valve Is Backed Off (CCW) from Fully Seated*	Max. Motor Amp Draw at Relief Pressure**
PRO-PLOW® Series 2, PRO PLUS®, MIDWEIGHT™	4000 psi	1 to 1-1/4 turns	2250 psi	2-1/4 to 2-1/2 turns	205 amp

* Settings are approximate.

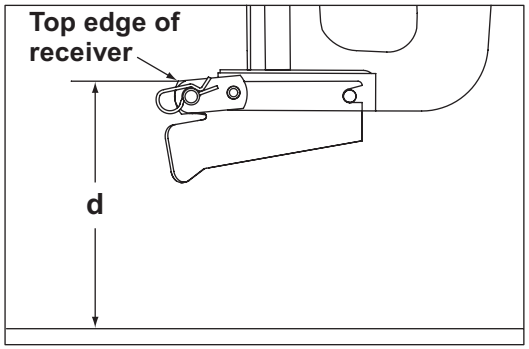
** Actual readings may vary due to vehicle battery voltage and oil temperature.

PIVOT PLATE CONFIGURATION

IMPORTANT! Before assembling the lift frame to the A-frame, pivot plate orientation and pivot hole position must be determined using the following procedure. (If the truck is unavailable, use configuration 2. Adjustments can be made later.)

Before measuring the vehicle mount height, the vehicle mount and receiver brackets must be installed, ballast must be installed, if required, and the vehicle must be parked on a level surface.

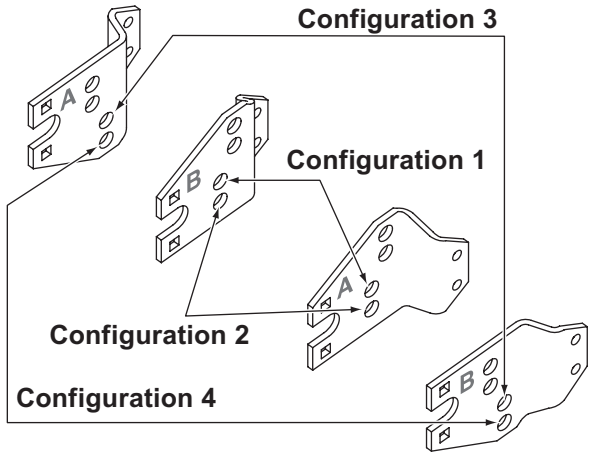
1. Measure the distance "d" from the ground to the top edge of the receiver bracket. Measure both sides and determine the average value for "d."



2. Use distance "d" from Step 1 and the Pivot Plate Configuration Chart to determine the proper pivot plate mounting position and pivot hole selection.

Pivot Plate Configuration Chart	
Distance "d"	**Configuration**
13.0"–14.5"	1
14.5"–16.0"	2
16.0"–17.5"	3
17.5"–19.0"	4

3. The two pivot plates, A and B, are mirror images of each other. They may be turned over and switched from one side of the lift frame to the other to provide two different mounting positions.



In each pivot plate mounting position, the pivot bar pins may be installed through either of the **lower** holes in the pivot plates, providing four different height adjustment positions. **The pivot bar pins are never installed in either of the two upper holes in the pivot plates.**

STAND SHOE HEIGHT ADJUSTMENT

⚠ WARNING

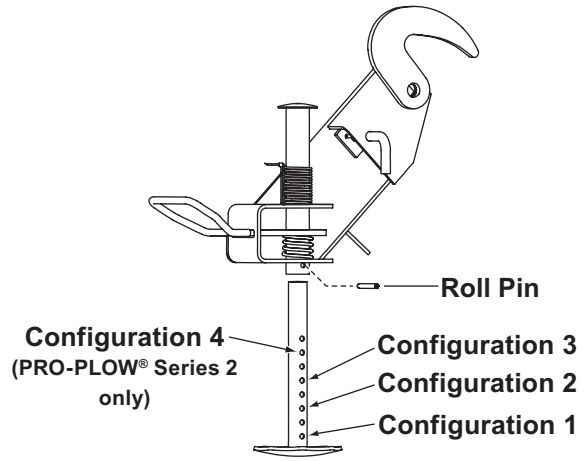
The stand plunger spring is shipped compressed and tied. Do not cut the spring tie until final stand shoe adjustment is complete and the roll pin is installed.

Initial stand shoe height adjustment is based on the configuration determined by the Pivot Plate Configuration Chart. Final adjustment will be made after attaching the snowplow to the vehicle.

1. Slide the stand shoe into the stand tube and align the 1/4" hole in the stand tube with the 1/4" hole in the stand shoe determined from the illustration.

2. Insert a 1/4" roll pin.

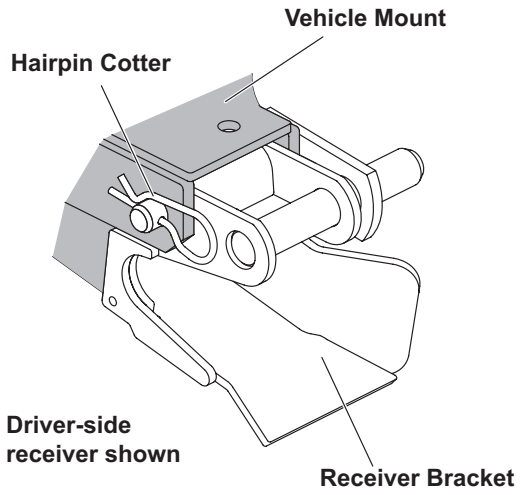
3. Do not cut the spring tie until after the final stand shoe adjustment.



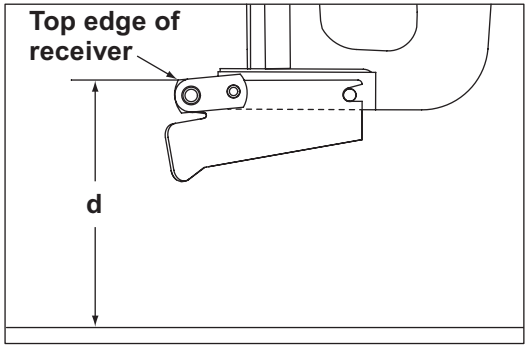
ATTACHING A-FRAME TO LIFT FRAME

Determine Pivot Plate Hole Position

Before measuring the vehicle mount height, the vehicle must be parked on a level surface, ballast must be installed, if required, and the vehicle mount and receiver brackets must be installed.

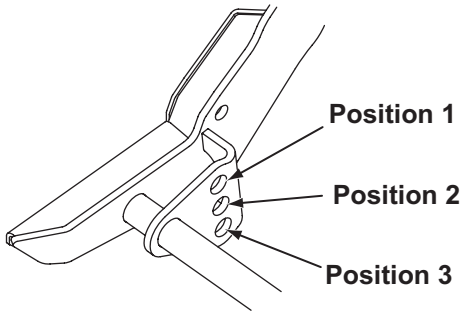


1. Measure the distance "d" from the ground to the top edge of the receiver bracket. Measure both sides and determine average value for "d."



2. Use distance "d" from Step 1 and the following chart to determine the proper pivot plate hole position.

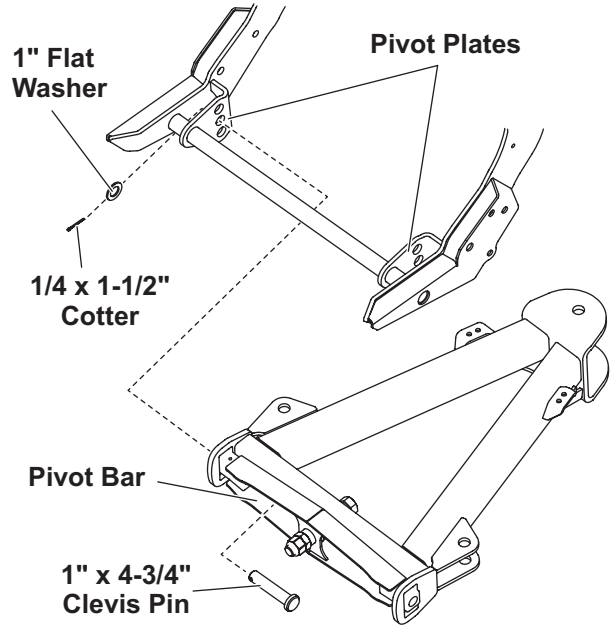
Pivot Plate Hole Position Chart	
Distance "d"	**Hole Position**
13.0" – 14.5"	1
14.5" – 16.0"	2
16.0" – 19.0"	3



Install Pivot Bar to Pivot Plates

1. Position the A-frame and pivot bar between the pivot plates, aligning the hole at each end of the pivot bar with the appropriate hole in the pivot plate as determined by distance "d."

2. On each side, insert 1" x 4-3/4" clevis pins from the inside of the pivot bar through the correct pivot plate holes. Secure the clevis pins with 1" flat washers and 1/4" x 1-1/2" cotter pins.



Excerpted from MIDWEIGHT™, PRO-PLOW® Series 2, and POLY PO-PLOW® Series 2 Snowplow Installation Instructions (Lit. No. 43183, Rev. 00).

STAND SHOE HEIGHT ADJUSTMENT

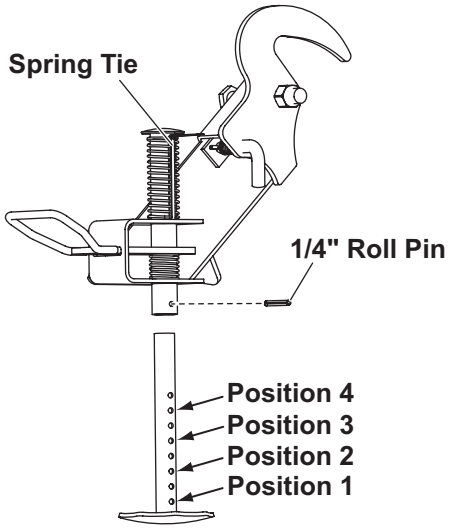
⚠ WARNING

The stand plunger spring is shipped compressed and tied. Do not cut the spring tie until final stand shoe adjustment is complete and the roll pin is installed.

Initial stand shoe height adjustment is based on the receiver height measurement (distance "d") determined in Step 1 under "Determine Pivot Plate Hole Position" on previous page. A final adjustment of the stand shoe will be made after attaching the snowplow to the vehicle.

1. Slide the stand shoe into the stand tube and align the 1/4" hole in the stand tube with the 1/4" hole in the stand shoe as determined from the chart and illustration.

Stand Shoe Position Chart	
Distance "d"	**Position**
13.0" – 14.5"	1
14.5" – 16.0"	2
16.0" – 17.5"	3
17.5" – 19.0"	4



2. Insert the 1/4" roll pin.

3. Do not cut the spring tie until after the final stand shoe adjustment.

FILLING THE HYDRAULIC UNIT

⚠ WARNING

Keep 8' clear of the blade when it is being raised, lowered or angled. Do not stand between the vehicle and the blade or directly in front of the blade. If the blade hits or drops on you, you could be seriously injured.

1. Attach the snowplow to the vehicle according to the instructions on the back of the blade.

⚠ WARNING

To prevent accidental movement of the blade, always turn the control OFF whenever the snowplow is not in use. The power indicator light will turn OFF.

2. Turn the control ON and completely angle blade to the left and right several times. Turn the control OFF.

⚠ CAUTION

DO NOT raise blade during fill process as this may cause pump cavitation.

⚠ CAUTION

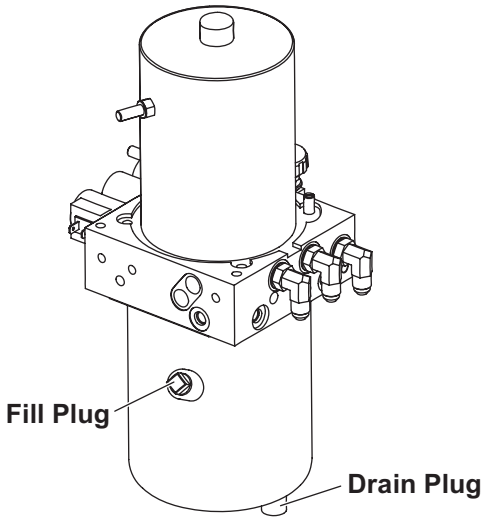
Do not mix different types of hydraulic fluid. Some fluids are not compatible and may cause performance problems and product damage.

3. Fill the reservoir to the top of the fill hole and replace the fill plug.

NOTE: Loosen the fill plug slowly to relieve any pressure in the reservoir.

4. Turn the control ON and raise and lower the snowplow several times. Activate the control FLOAT function and manually collapse the lift ram all the way after each lowering of the blade. Turn the control OFF.

5. Fill the reservoir to the top of the fill hole and replace the fill plug.



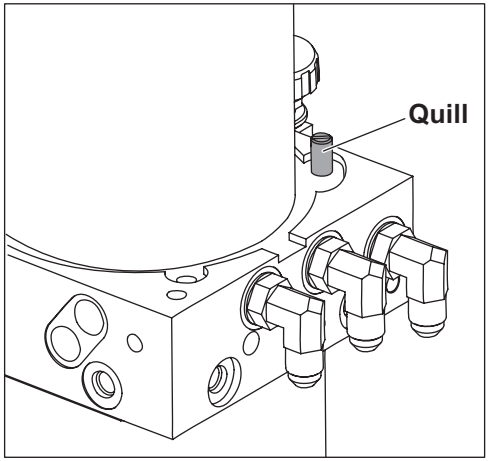
Fluid Capacity	
FloStat® Unit Reservoir	**FloStat System Total**
1-3/4 quarts	2-3/8 to 2-3/4 quarts

BLADE DROP SPEED ADJUSTMENT

⚠ WARNING

Keep 8' clear of the blade when it is being raised, lowered or angled. Do not stand between the vehicle and the blade or directly in front of the blade. If the blade hits or drops on you, you could be seriously injured.

The quill in the top of the valve manifold on the passenger-side front corner of the hydraulic unit adjusts the blade drop speed.



1. Lower the blade to the ground before making adjustment. Turn the control OFF.
2. Turn the quill IN (clockwise) to decrease the drop speed.

   Turn the quill OUT (counterclockwise) to increase the drop speed.
3. Stand clear of the blade when checking adjustment.

VEHICLE LIGHTING CHECK

1. Verify the operation of all vehicle front lighting prior to connecting the snowplow harness.

2. Check the operation of the snowplow lights with snowplow mounted to vehicle and all harnesses connected.

   Turn signals and parking lamps

   Parking lamps ON:

   - Both vehicle and snowplow parking lamps should be ON at the same time.

   Driver-side turn signal ON:

   - Both vehicle and snowplow driver-side turn signal lamps should flash at the same time.

   Passenger-side turn signal ON:

   - Both vehicle and snowplow passenger-side turn signal lamps should flash at the same time.

   Headlamps

   Move the vehicle headlamp switch to the "ON" position. Connecting and disconnecting the snowplow lighting harness plug should switch the lights between vehicle and snowplow as follows:

   Snowplow lighting harness DISCONNECTED:

   - Vehicle headlamps should be ON.
   - Snowplow headlamps should be OFF.

   Snowplow lighting harness CONNECTED:

   - Snowplow headlamps should be ON.
   - Vehicle headlamps should be OFF.

   The dimmer switch should toggle the headlamps between high and low beam. The high beam indicator on the dash should light when headlamps are placed in high beam.

   Daytime Running Lamps (DRLs)

   An operational check of the vehicle and snowplow DRLs will depend on the vehicle model, vehicle DRL system and type of Isolation Module installed. Due to the variations in the OEM DRL systems and the different Isolation Module options available, checking the functionality of the snowplow DRLs will depend on the type of module installed on the vehicle.

   With the headlamp switch OFF, activate the vehicle DRLs.

   Snowplow lighting harness DISCONNECTED:

   - Vehicle DRLs should be ON.
   - Snowplow headlamps should be OFF.

   Snowplow lighting harness CONNECTED and vehicle in DRL mode:

   - Check snowplow DRL function per the type of Isolation Module installed.

   Joystick Control or CabCommand Control

   The snowplow plugs **do** need to be connected to the vehicle harness connectors. The control power indicator light should light whenever the control ON/OFF switch and the ignition (key) switch are both in the "ON" position.

3. Connect all snowplow and vehicle harnesses. Raise the snowplow and aim the snowplow headlamps according to the Snowplow Headlamp Beam Aiming Instructions included with the headlamps, and any state or local regulations.

⚠ CAUTION

On 2-plug electrical systems, plug covers shall be used whenever snowplow is disconnected. Vehicle Battery Cable is 12-volt unfused source.

4. Check the aim of the vehicle headlamps with the snowplow removed.

5. When the snowplow is removed from the vehicle, install plug covers on the vehicle battery cable and lighting harness. Insert the snowplow battery cable and lighting harness into the cable boot on the snowplow.

HEADLAMP BEAM AIMING

Torque headlamp fasteners to 45 ft-lb once correct visual aim is achieved.

1. Park the vehicle on a level surface 25 feet in front of a matte-white screen, such as a garage door. The screen should be perpendicular both to the ground and to the vehicle centerline.

2. The vehicle should be equipped for normal operation. The snowplow blade should be in place and in raised position.

   Below are steps listed by the Society of Automotive Engineers (SAE) pertinent to headlamp aiming in specification #SAE J599d.

3. Prepare the vehicle for headlamp aiming or inspection. Before checking beam aim, the inspector will:

   a. Remove ice or mud from under fenders.

   b. Set tire inflation pressures to the values specified on the vehicle information label.

   c. Check the springs for sag or broken leaves.

   d. See that there is no load in the vehicle other than the driver and ballast as specified in the Selection List.

   e. Check the functioning of any automatic vehicle leveling systems and manufacturer's specific instructions pertaining to vehicle preparation for headlamp aiming.

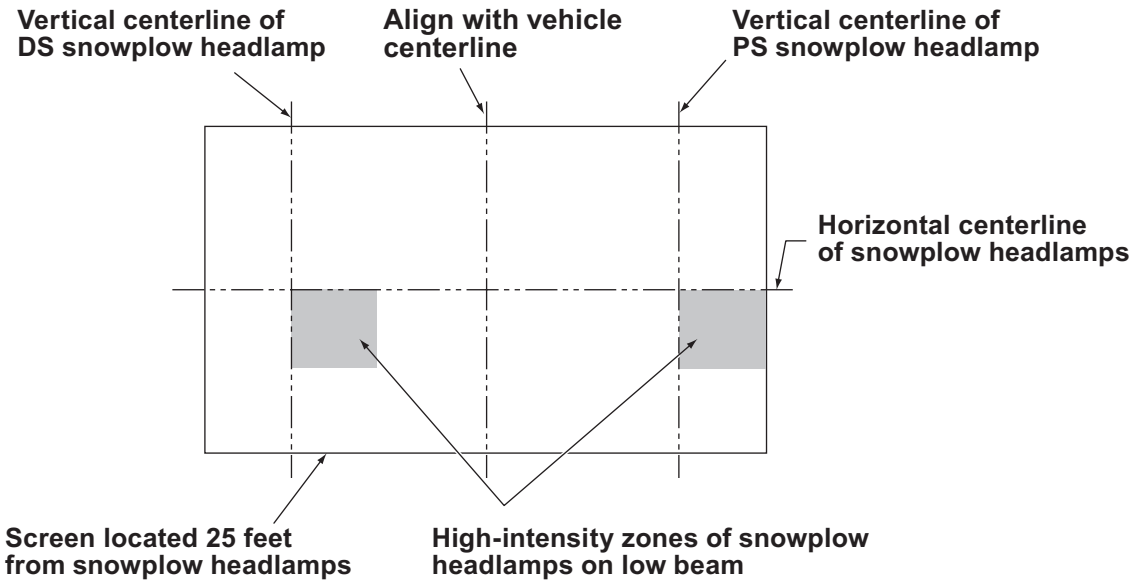
   f. Clean the headlamp lenses.

   g. Check for bulb burnout and proper beam switching.

   h. Stabilize the vehicle suspension by rocking the vehicle sideways.

4. Mark (or tape) the vertical centerline of the snowplow headlamps and the vertical centerline of the vehicle on the screen. Mark the horizontal centerline of the snowplow headlamps on the screen (distance from ground to snowplow headlamp centers).

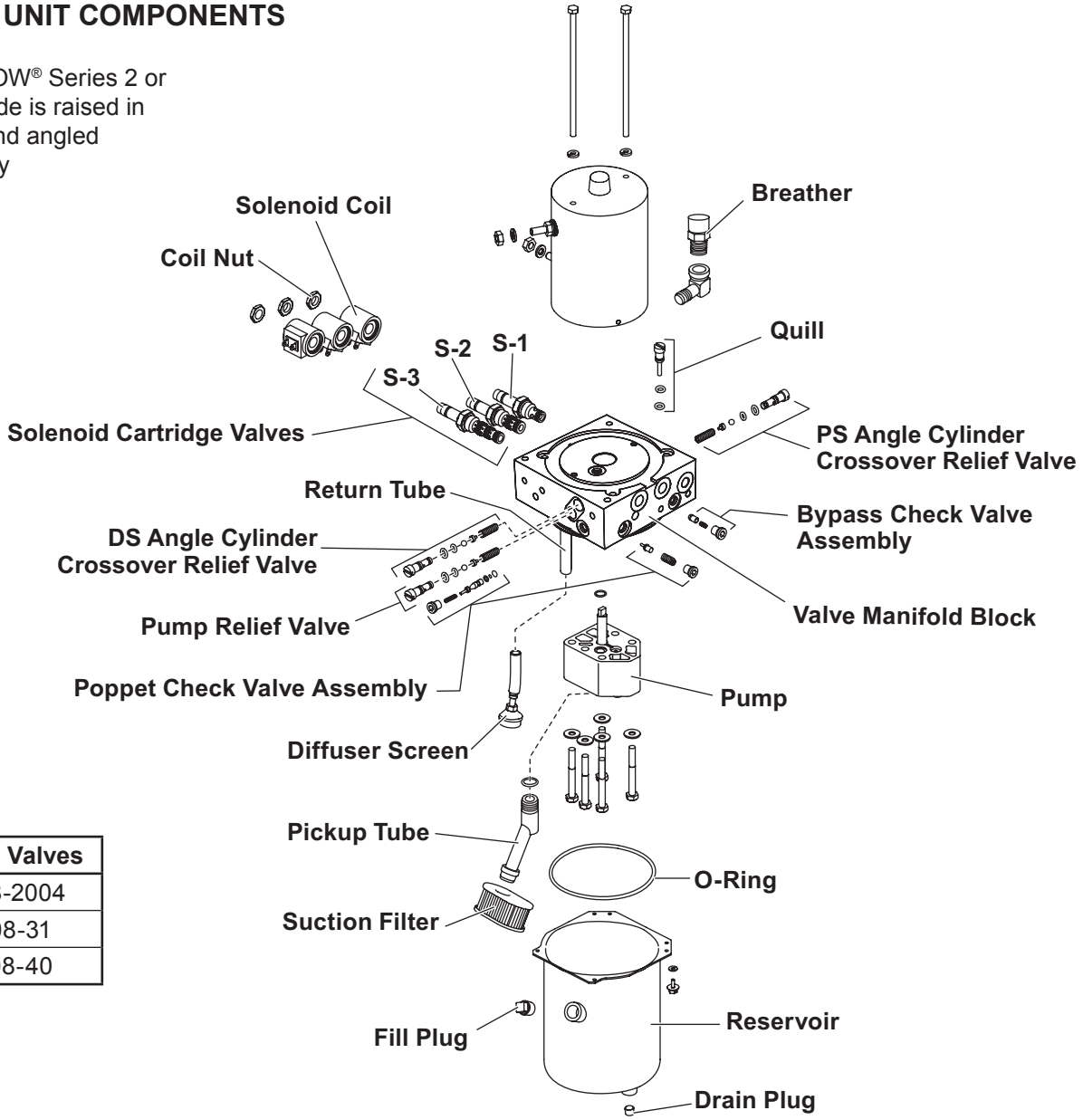
5. Align the top edge of the high-intensity zone of the snowplow lower beam below the horizontal centerline and the left edge of the high-intensity zone on the vertical centerline for each snowplow headlamp. (Refer to the diagram below.)



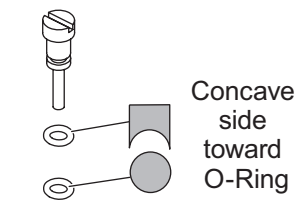
Excerpted from UltraMount® 2 Owner's Manual (Lit. No. 43181, Rev. 01).

FloStat® HYDRAULIC UNIT COMPONENTS

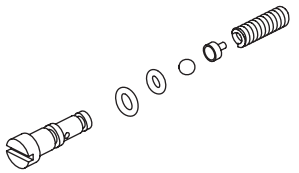
The PRO PLUS®, PRO-PLOW® Series 2 or MIDWEIGHT™ straight blade is raised in approximately 3 seconds and angled side to side in approximately 5.5 seconds.



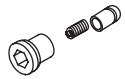
Solenoid Cartridge Valves	
S-1	SV08-2004
S-2	SV08-31
S-3	SV08-40



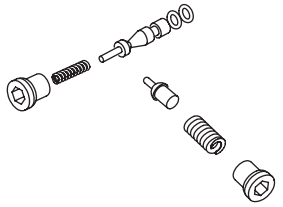
Quill



Relief Valve

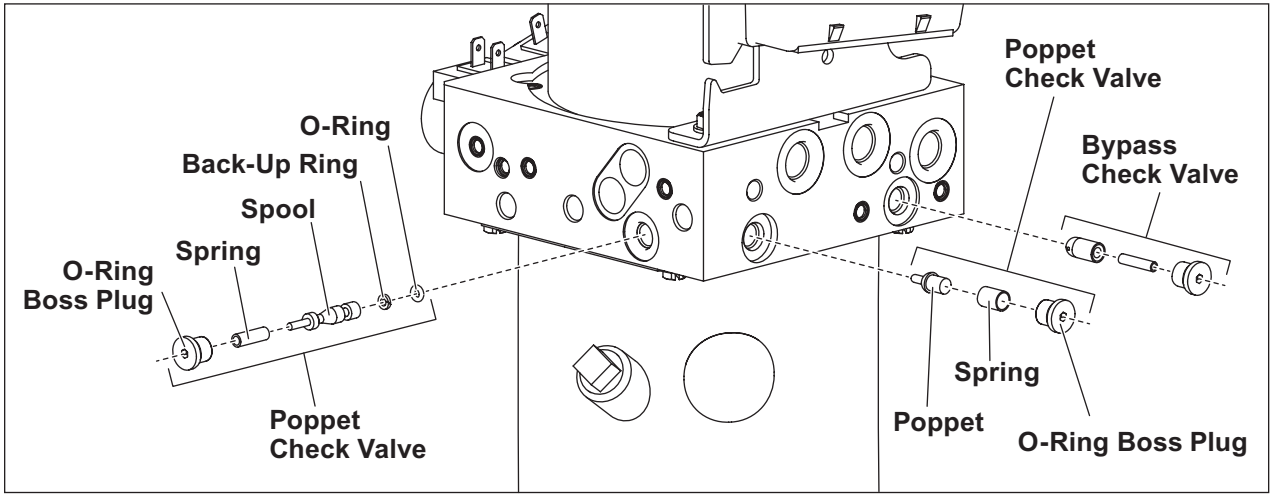


Bypass Check Valve Assembly

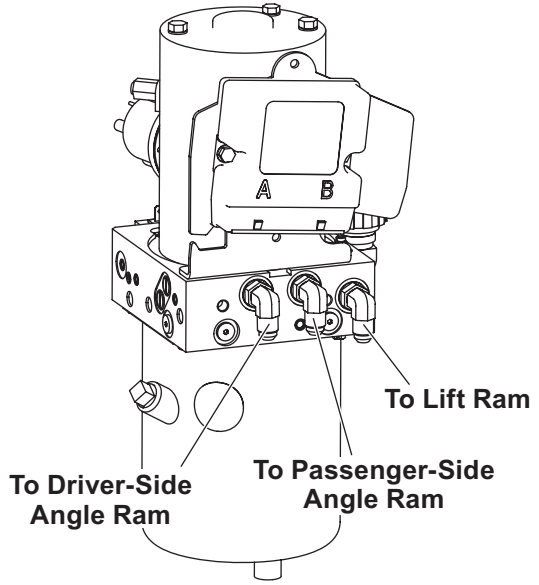


Poppet Check Valve Assembly

PILOT-OPERATED (POPPET-STYLE) CHECK VALVES



HOSE ROUTING



HOSES AND FITTINGS INSTALLATION

Do not use thread sealant/tape on hoses or fittings. These materials could damage the product.

To Install SAE O-Ring Fittings in Valve Blocks and Rams:

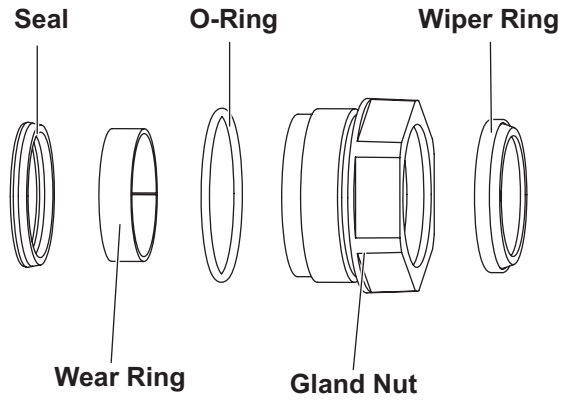
1. Back off the jam nut. Hand tighten the fitting into the port until the washer contacts the port face, then back out to position.
2. Using two wrenches, hold the fitting body in position and tighten the jam nut until the washer again contacts the port face, then tighten an additional 1/8 to 1/4 turn to lock the fittings in place. Final torque on the jam nut should be approximately 20 ft-lb.

To Install Hydraulic Hoses:

Using two wrenches, hold the hose in position and tighten the flare nut 1/8 to 1/4 turn beyond hand tight. Final torque on the flare nut should be approximately 20 ft-lb.

RAM SEAL INSTALLATION

1. Lubricate the seals and O-rings with hydraulic fluid.
2. Slide the gland nut over the split-bearing end of the rod to prevent damaging the seals.
3. Carefully reassemble the ram.
4. Insert a 0.012" feeler gauge between the front surface of the cylinder tube face and the hex of the gland nut. Tighten the gland nut until it is snug against the feeler gauge.
5. Remove the feeler gauge and tighten the gland nut an additional **1/4 turn.** This adjustment procedure will provide a torque of 150–180 ft-lb.



CARTRIDGE AND CHECK VALVE REMOVAL

It is possible to remove cartridges and check valves from a hydraulic unit without draining the hydraulic fluid from the reservoir.

1. Install the Diagnostic Harness (PN 29290-1) following the instructions included with the kit.
2. Cycle through the control functions twice to remove pressure in the hydraulic unit.
3. Slowly remove the breather from the top of the hydraulic unit.
4. Either (a) completely drain the reservoir and skip to Step 9, or (b) proceed with the following instructions for removing hydraulic components without completely draining the reservoir.
5. Install a 3/8" barb fitting into the top of the reservoir tank.
6. Attach a hand-operated vacuum pump to the barb fitting.
7. Using the vacuum pump, pull a vacuum of approximately 5"–10" Hg.
8. You should now be able to remove cartridges and check valves from the hydraulic unit with minimal fluid loss. Maintain the vacuum until the replacement cartridge/check valve has been installed. Once the replacement part has been installed, release the vacuum and remove the 3/8" barb fitting.
9. Reinstall the breather and remove the Diagnostic Harness according to the instructions included with the kit.

Excerpted from Gland Nut Ram Seal Kits Service Literature (Lit. No. 28944, Rev. 01).

OVERVIEW

⚠ WARNING

To prevent accidental movement of the blade, always push the ON/OFF button to switch the control OFF whenever the snowplow is not in use. The power indicator light will turn OFF.

The snowplow can be operated by a hand-held control or by a joystick-style control.

Each control is equipped with an ON/OFF button or switch and an indicator light to show when the control is powered ON or OFF. The controls are powered by the vehicle's battery, so the vehicle ignition (key) switch must be ON to use the controls.

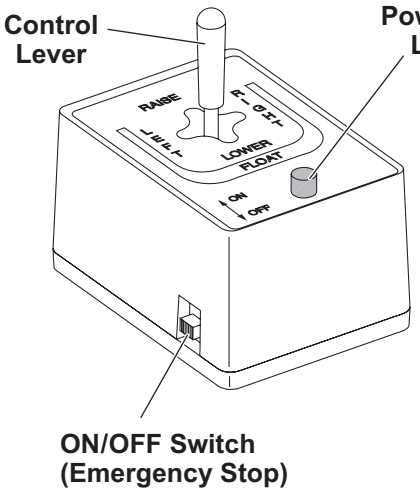
The ON/OFF button or switch on the cab control allows you to turn OFF the control and prevent blade movement even when the vehicle ignition switch is ON.

The control ON/OFF button or switch serves as an emergency stop, if required.

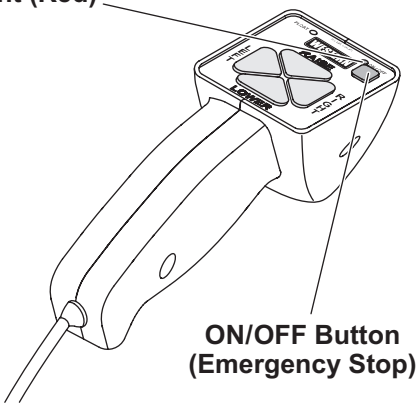
All controls are protected by a replaceable fuse located in the under-hood snowplow electrical system. See "Fuse Replacement" in the Maintenance section of the Owner's Manual.

FLEET FLEX electrical system controls are able to sense a lack of communication with the electrical system. Should the indicator light start to flash, refer to "Control/Cable/Plow Module Test" in the Troubleshooting section of this manual.

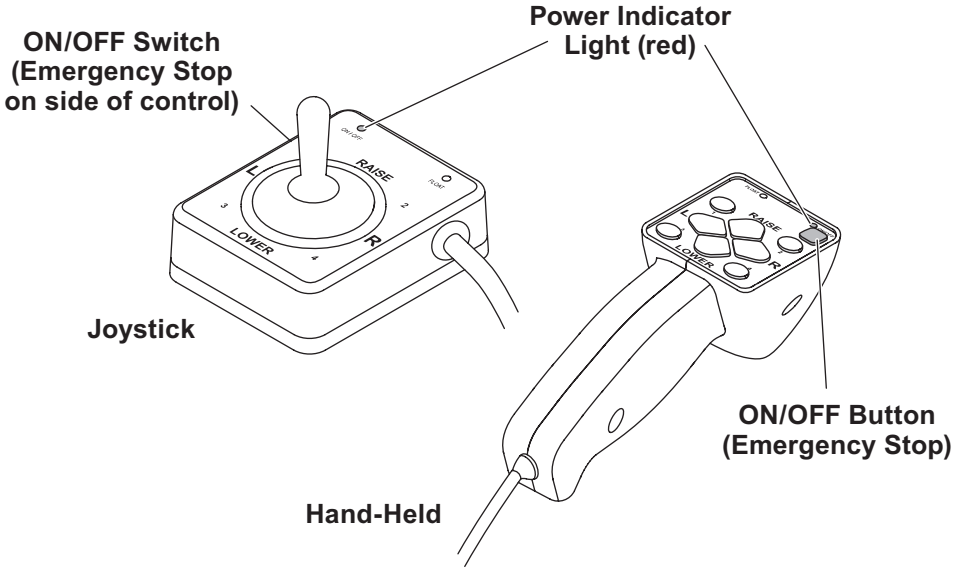
Solenoid Joystick Control



Hand-Held Control



FLEET FLEX System Controls



SOLENOID JOYSTICK CONTROL

⚠ WARNING

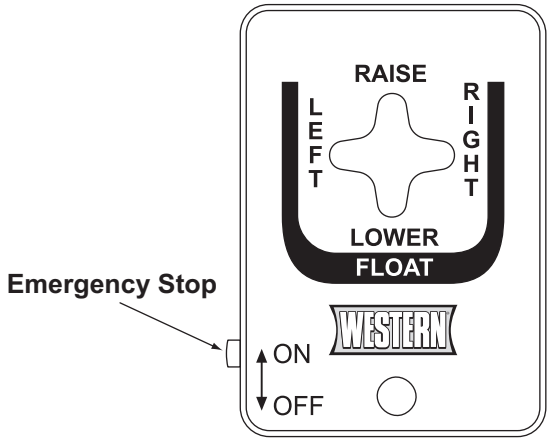
Keep 8' clear of the blade when it is being raised, lowered or angled. Do not stand between vehicle and blade or directly in front of the blade. If the blade hits or drops on you, you could be seriously injured.

⚠ WARNING

To prevent accidental movement of the blade, always move the ON/OFF switch to OFF whenever the snowplow is not in use. The power indicator light will turn OFF.

Turn the vehicle ignition switch to the ON or the ACCESSORY position. Move control ON/OFF switch to the ON position. The control indicator light (red) should light whenever the control ON/OFF switch and the ignition (key) are both turned ON.

Turn the vehicle ignition switch ON. Turn the control ON. The control indicator light should be ON.	
Action	**Description of Operation**
ON/OFF	Slide the control power switch ON to activate the hydraulic system. Turn the control OFF to lock the blade in place. This will prevent accidental movement of the blade.
RAISE	Move the control lever up (forward) to raise the blade to the desired height.
LOWER/FLOAT	Move the control lever down (back) to lower the blade and activate the FLOAT mode.
Cancel FLOAT	The FLOAT mode can be canceled by either momentarily placing the control in the RAISE position, turning the control OFF or turning the vehicle ignition OFF. Angling left or right will not cancel FLOAT.
RIGHT	Move the control lever right to angle the blade to the right.
LEFT	Move the control lever left to angle the blade to the left.



CabCommand HAND-HELD CONTROL

⚠ WARNING

To prevent accidental movement of the blade, always push the ON/OFF button to switch the control OFF whenever the snowplow is not in use. The power indicator light will turn OFF.

1. Turn the vehicle ignition switch to the ON or ACCESSORY position. The control logo area will become illuminated.

2. Press the ON/OFF button on the control. The control indicator light will glow red, indicating that the control is ON. The control indicator light will glow red whenever the control ON/OFF switch and the vehicle ignition switch are both ON.

3. Pressing the LOWER button for 0.75 seconds will engage the FLOAT mode. The control indicator FLOAT light will glow. Cancel the FLOAT mode by momentarily pressing the RAISE button.

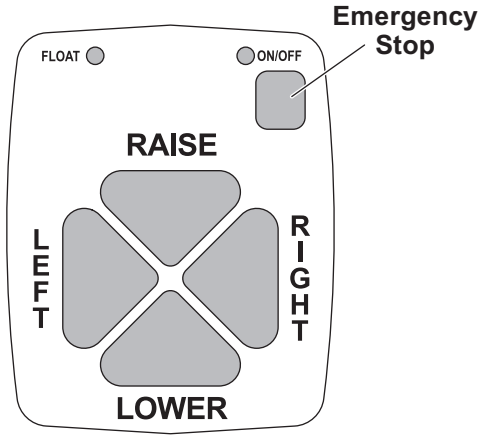
Function Time Outs

All control functions, except for LOWER, automatically time out (stop) after a period of time. This is to prevent unnecessary battery drain. The time-out period for the RAISE function is 3.0 seconds, while the angle function time-out period is 5.5 seconds.

The control will automatically turn OFF after being idle for 20 minutes.

Smooth Stop

The control automatically allows the blade to coast to a stop. This results in smoother operation, reduces the shock to the hydraulic system and increases hose and valve life.



Button	Description of Operation
RAISE	Press this button to raise the snowplow and to cancel the FLOAT mode. Function times out after 4.8 seconds. To resume raising the snowplow, release the button and press again.
LOWER/FLOAT	Press this button to lower the snowplow. After reaching the desired height, release the button. Holding the button down for more than 0.75 seconds activates the FLOAT mode, indicated by green FLOAT lamp.
Cancel FLOAT	Cancel the FLOAT mode by momentarily pressing the RAISE button, turning control OFF, or turning vehicle ignition OFF. Angling left or right momentarily cancels FLOAT.
RIGHT	Press this button to angle blade to the right.
LEFT	Press this button to angle blade to the left.

JOYSTICK CONTROL — FLEET FLEX SYSTEM

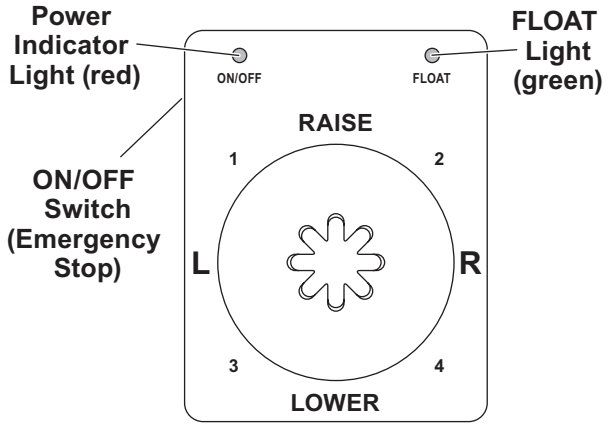
⚠ WARNING

To prevent accidental movement of the blade, always move the ON/OFF switch to OFF whenever the snowplow is not in use. The power indicator light will turn OFF.

1. Turn the vehicle ignition switch to the "ON" or "ACCESSORY" position.

2. Slide the switch on the side of the control to the "ON" position. The power indicator light glows red, indicating that the control is ON. The indicator light glows red whenever the control and the vehicle ignition switch are both ON and the electrical connections to the snowplow are completed.

   The ON/OFF switch operates as an emergency stop, if required.



Function Time-Outs

All control functions, except LOWER/FLOAT, time out (stop) automatically after a period of time. This is to limit the amount of electrical energy required from the vehicle.

NOTE: If a control function times out before the desired blade movement is complete, release the lever to the center position, then move it back into the desired function.

Automatic Shutdown

The control will automatically turn OFF after being idle for 20 minutes. To reactivate the control after a shutdown, move the ON/OFF switch to OFF, then back to ON.

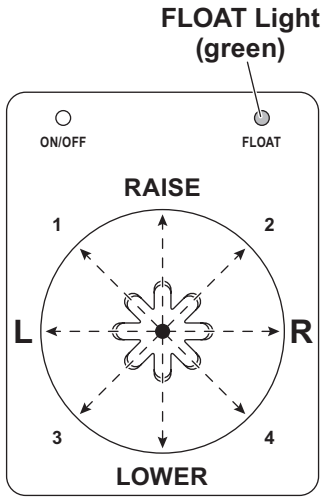
Smooth Stop

The control automatically allows the blade to coast to a stop when the lever returns to center position. To enable this feature, move the lever to the R position and hold it there while turning the control ON. The power indicator light will turn ON and the FLOAT light will flash. Performing the sequence multiple times will toggle the feature between enabled and disabled.

JOYSTICK CONTROL — FLEET FLEX SYSTEM, continued

Joystick Control Lever Movement

From the center position, the control lever can be moved in one of eight directions to control various movements of the snowplow blade. To change from one movement of the blade to another, the control lever must be moved back to the center position before selecting the desired function. Whenever the lever is released, it should spring back into the center position to stop any blade movement.



Moving the control lever diagonally from the center position toward any of the four digits on the face of the control body will operate the SECURITY GUARD system. For instructions, see the "SECURITY GUARD System" section.

Control Functions

Raise, Lower, Float, Angle

Moving the control lever straight up and down or from side to side on the control body will result in the blade movements described in the table.

Function	Description of Operation
RAISE	Move the control lever toward the top of the control body to raise the blade and cancel the FLOAT mode. Function times out after 3.0 seconds.
LOWER	Move the control lever toward the bottom of the control body to lower the blade. Release the lever to stop the blade at desired height.
FLOAT†	Move the control lever to the **LOWER** position and hold 3/4 second to activate this mode. The FLOAT light in the upper right corner of the control face will illuminate. The blade will lower to the ground surface and follow the contour of the surface as it dips or rises. Function does not time out; however, the control will shut down after 20 minutes of nonuse. Move the lever to the **RAISE** position momentarily to cancel FLOAT. Angling left or right will interrupt (pause) the FLOAT function, but the FLOAT light will stay illuminated and FLOAT will resume when angling is complete.
L (Angle Left)	Move the control lever straight to the left to angle the blade left. Function times out after 5.5 seconds.
R (Angle Right)	Move the control lever straight to the right to angle the blade right. Function times out after 5.5 seconds.

NOTE: If a control function times out before the desired blade movement is complete, release the button and press it again.

† FLOAT mode activates immediately when the One-Touch FLOAT feature is enabled. See "One-Touch FLOAT" in this section for more information.

Excerpts taken from UltraMount® 2 Owner's Manual (Lit. No. 43181, Rev. 01).

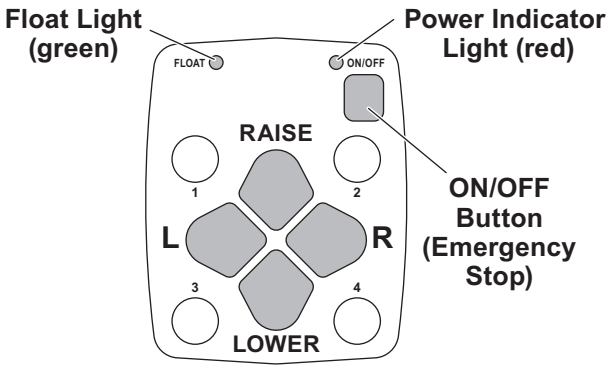
CabCommand HAND-HELD CONTROL — FLEET FLEX SYSTEM

⚠ WARNING

To prevent accidental movement of the blade, always push the ON/OFF button to switch the control OFF whenever the snowplow is not in use. The power indicator light will turn OFF.

1. Turn the vehicle ignition switch to the "ON" or "ACCESSORY" position.

2. Press the ON/OFF button on the control. The power indicator light glows red, indicating that the control is ON. The power indicator light glows red whenever the control and vehicle ignition switch are both ON and the electrical connections to the snowplow are completed. The ON/OFF button operates as an emergency stop, if required.



The four round buttons numbered 1, 2, 3 and 4 operate the SECURITY GUARD™ system. See the "SECURITY GUARD Snowplow Anti-theft System" section for instructions.

Function Time-Outs

All control functions, except LOWER/FLOAT, time out (stop) automatically after a period of time. This is to limit the amount of electrical energy required from the vehicle.

NOTE: If a control function times out before the desired blade movement is complete, release the button and press it again.

Automatic Shutdown

The control will automatically turn OFF after being idle for 20 minutes. To reactivate the control after a shutdown, press the ON/OFF button.

Smooth Stop

The control automatically allows the blade to coast to a stop when a control button is released. To enable this feature, press and hold the R button while turning the control ON. The power indicator light will turn ON and the FLOAT light will flash. Performing the sequence multiple times will toggle the feature between enabled and disabled.

Control Functions

Raise, Lower, Float, Angle

Pressing the four diamond-shaped buttons in the center of the control face will result in the blade movements described in the table.

Function	Description of Operation
RAISE	Press this button to raise the blade and cancel the FLOAT mode. Function times out after 3.0 seconds.
LOWER	Press this button to lower the blade. Release the button to stop the blade at desired height.
FLOAT†	Press the **LOWER** button and hold 3/4 second to activate this mode. The FLOAT light in the upper left corner of the control face will illuminate. The blade will lower to the ground surface and follow the contour of the surface as it dips or rises. Function does not time out; however, the control will shut down after 20 minutes of nonuse. Press the **RAISE** button momentarily to cancel FLOAT. Angling left or right will interrupt (pause) the FLOAT function, but the FLOAT light will stay illuminated and FLOAT will resume when angling is complete.
L (Angle Left)	Press this button to angle the blade left. Function times out after 5.5 seconds.
R (Angle Right)	Press this button to angle the blade right. Function times out after 5.5 seconds.

NOTE: If a control function times out before the desired blade movement is complete, release the button and press it again.

† FLOAT mode activates immediately when the One-Touch FLOAT feature is enabled. See "One-Touch FLOAT" in this section for more information.

Excerpts taken from UltraMount® 2 Owner's Manual (Lit. No. 43181, Rev. 01).

SECURITY GUARD™ SNOWPLOW ANTI-THEFT SYSTEM

Activation & Establishing a 4-Digit Security Code

NOTE: The snowplow must be attached to the vehicle, and all the electrical connections must be connected prior to activating the security code function.

1. Turn the vehicle ignition switch to the "ON" or "ACCESSORY" position. (It is not necessary to start the vehicle.)

2. Verify that the control power indicator is OFF. If the power indicator light is red, the control is ON. Move the ON/OFF switch to "OFF" or push the ON/OFF button to turn the control OFF.

3. To activate the SECURITY GUARD mode, move the control lever to the #1 position or press the #1 button four consecutive times, and then move the lever to the #4 position or press the #4 button four consecutive times (sequence: 1, 1, 1, 1, 4, 4, 4, 4). The green FLOAT light will flash quickly and the red power indicator light will turn ON, indicating that the system is ready to accept your 4-digit security code.

   Enter your 4-digit security code by moving the control lever to (or pressing the button for) any 4 of the 8 following positions: UP, DOWN, LEFT, RIGHT, 1, 2, 3 or 4.

   Once you have entered your security code, the FLOAT light will stop flashing and The power indicator light will turn OFF. This indicates that your security code is entered and stored in the SECURITY GUARD system.

4. Once a 4-digit security code is established, the SECURITY GUARD system will recognize any FLEET FLEX control that has been programmed with the same 4-digit security code. If a control not programmed with the correct 4-digit security code is connected to the system, the established security code will have to be entered manually before the snowplow can be activated (see the Manual Unlock procedure).

NOTE: If the control is turned ON prior to completing the programming procedure, your 4-digit security code will be cancelled.

Manual Unlock

If the SECURITY GUARD system is activated and you are using a FLEET FLEX control with a different 4-digit code than the established security code, you will be required to manually enter the 4-digit security code before operating a locked snowplow.

1. Turn the vehicle ignition to the "ON" or "ACCESSORY" position.

2. Move the ON/OFF switch to the "ON" position or push the ON/OFF button to switch the control ON.

3. The power indicator light will flash rapidly, indicating that the snowplow is locked.

4. Enter the 4-digit security code.

5. After the correct security code is entered, the power indicator light will change from flashing rapidly to a solid light to indicate that the snowplow has been successfully unlocked.

NOTE: If the plow/vehicle electrical connection is lost or disconnected, the SECURITY GUARD system will reset, requiring any FLEET FLEX control that is not programmed with the established 4-digit security code to manually re-enter the security code to activate the snowplow.

SECURITY GUARD™ SNOWPLOW ANTI-THEFT SYSTEM, continued

Clearing an Established 4-Digit Security Code

1. Turn the vehicle ignition switch to the "ON" or "ACCESSORY" position.

2. If the snowplow is locked (the control power indicator light will be flashing rapidly), unlock the snowplow by following the Manual Unlock procedure described above.

3. Move the ON/OFF switch to the "OFF" position or push the ON/OFF button to switch the control OFF. Verify that the power indicator light is OFF.

4. With the control OFF, move the control lever to the #2 position or press the #2 button four consecutive times, then move the lever to the #3 position or press the #3 button four consecutive times. This sequence (2, 2, 2, 2, 3, 3, 3, 3) will clear the 4-digit security code from the SECURITY GUARD system. The FLOAT light will flash to indicate that the 4-digit security code was cleared.

NOTE: To enter a new 4-digit security code, see Activation & Establishing a 4-Digit Security Code.

Light Flash Indicators

POWER – Red	Function
OFF	Control is OFF
Solid ON	Control is ON and active
Slow Flash	No communication
Fast Flash	Snowplow is locked—enter 4-digit security code to unlock

FLOAT – Green	Function
Solid ON	FLOAT function is active
Fast Flash	Security code activation in progress

Additional Notes

- The SECURITY GUARD system requires any control (other than the one with the assigned 4-digit security code) to enter the security code before the snowplow can be activated. Once the security code is established, the SECURITY GUARD system recognizes that a control with the same security code is attached, and **does not** require a manual unlock to activate the snowplow. The system will recognize the control as "safe" and will automatically unlock.

- The SECURITY GUARD system is only fully functional with joystick control PN 96800, and hand-held control PN 96900.

- In the event that a snowplow is locked and cannot be manually unlocked or reset, contact your Authorized Dealer.

- REMINDER: Record your security code for future reference.

SECURITY GUARD™ SNOWPLOW ANTI-THEFT SYSTEM, continued

Hand-Held Master Control

Universal Clear Security

Perform the following steps to unlock and clear an established security code without using the original control that was used to establish the code. This procedure should be used to reset the module if the security code is unknown.

IMPORTANT: The following steps must be performed using the Distributor Master Control (PN 48800). Only the Distributor Master Control can clear an established code within a snowplow module without using the original control used to establish the code.

⚠ WARNING

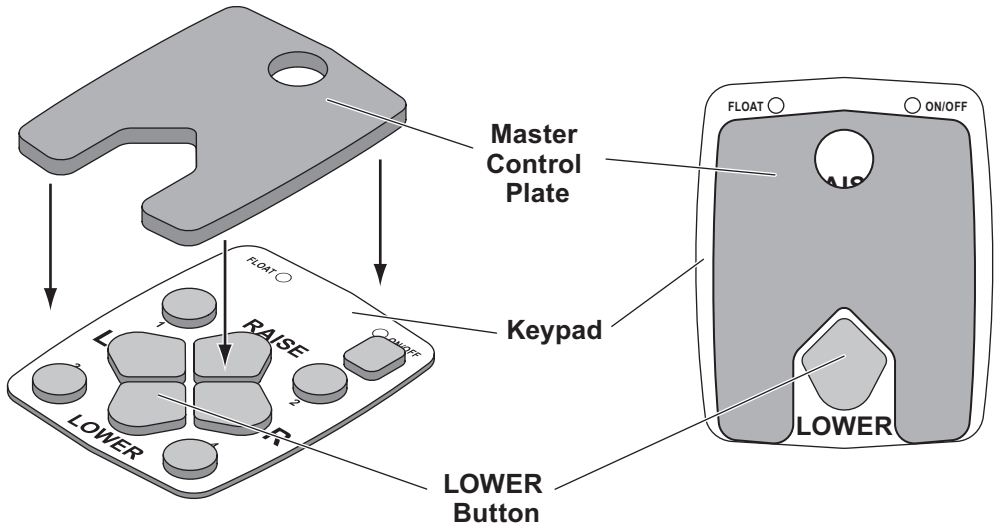
To prevent accidental movement of the blade, always push the ON/OFF button to switch the control OFF whenever the snowplow is not in use. The power indicator light will turn OFF.

1. Turn the vehicle ignition to the "OFF" position.
2. With the control power OFF, using the tool that was included in the Distributor Master Control box, place the tool over the keypad and push down on the plate.

NOTE: The only button that should be exposed is the LOWER button. All other buttons should be engaged and pressed down.

3. While pushing down on the plate, turn the ignition ON.
4. Upon turning the ignition to the "ON" position, the system will reset and no security code will be associated with the snowplow.

Position the Master Control Plate on the keypad so that only the LOWER button is exposed.



SNOWPLOW HYDRAULICS

The straight blade snowplow hydraulic system performs four blade movement functions.

All functions require the vehicle ignition (key) switch to be in the "ON" or "ACCESSORY" position and the power to be activated on the snowplow cab control.

Three of the four hydraulic functions require energizing the electric motor and appropriate solenoid cartridge valves. The fourth function, LOWER, does not energize the motor but requires activating a cartridge valve.

BLADE MOVEMENT	RAISE	LOWER	ANGLE RIGHT	ANGLE LEFT

Power from the vehicle battery is supplied to the solenoid coils and the motor relay via the Plow Module. The solenoid cartridge valves operate in various combinations, directed by the cab control, to send hydraulic fluid to the snowplow lift and angle rams or back to the reservoir. (Power is supplied to the Plow Module via the battery cable and motor relay connection.)

3-PORT MODULE ELECTRICAL

Overview

The Isolation Module acts as an electrical hub, automatically directing vehicle power to the appropriate vehicle or snowplow lighting devices, while also supplying battery power to the snowplow control.

The vehicle high and low beams enter and exit the Isolation Module through positions B (left side lighting) and position C (right side lighting). Park, turn, and DRL signals also enter through positions B and C.

The output of the vehicle high beam/low beam select switch is directed to the Isolation Module via the plug-in harness. When the snowplow is not attached to the vehicle, the signal passes through the normally closed relay contacts to the vehicle headlamps. During this time, the Isolation Module is inactive, placing no current draw on the vehicle's electrical system.

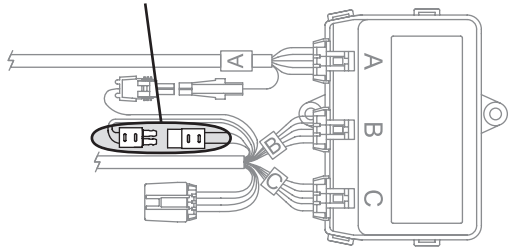
With the snowplow attached, the Isolation Module is still inactive until either the vehicle parking lights are turned ON or the vehicle ignition switch is turned ON.

Turning ON the vehicle parking lights activates a series of relays, automatically transferring the vehicle high and low beams to the snowplow while supplying battery power directly to the snowplow parking lights. All snowplow lighting exits the Isolation Module through position A.

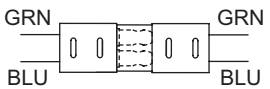
Turning ON the vehicle ignition switch energizes a snowplow control relay, supplying vehicle battery power directly to the control via the vehicle control harness and plug-in harness. The vehicle ignition switch also supplies power to the vehicle turn signals. Activating the vehicle turn signals energizes turn signal circuit, which supplies vehicle battery power directly to the snowplow turn signals.

NOTE: References to "left" and "right" are correct for modules located on the driver's side of the vehicle. The reversible turn signal plug must be reversed for passenger-side installations.

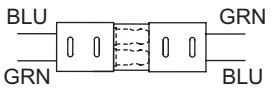
Turn Signal Configuration Plug



Driver-Side Module



Passenger-Side Module



3-PORT MODULE ELECTRICAL

Green Label Module (PN 29070-1)

Snowplow not attached to vehicle:

System is inactive. Vehicle lighting system functions normally. Reason: No ground to module.

Snowplow attached to vehicle:

System is inactive until either the switched accessory wire or the vehicle parking lights are activated. Vehicle and snowplow lighting systems function as outlined in the Theory of Operation Overview. Reason: ground path is established from battery common to Pin C on Port A of the 3-port module via the following harnesses: vehicle battery cable, vehicle control harness, adapter, plug-in harness, vehicle lighting harness and snowplow lighting harness.

- Activating a **switched accessory** wire (a key-controlled power source) applies battery voltage to the VACC input of the module. A control circuit senses the voltage and energizes the coil of the control power relay (part of the 3-port module). Energizing the coil of the control power relay causes the relay contacts to shift from the "N.O." (normally opened) position to the "N.C." (normally closed) position, which supplies battery voltage to the snowplow control via the plug-in harness and the vehicle control harness. The switched accessory wire only controls battery voltage to the snowplow control.

- Activating the vehicle **park light** circuit applies voltage to the module park circuit input. A control circuit senses the voltage and turns ON a solid state power device, which applies battery voltage to the snowplow park lamp filaments via the vehicle and snowplow lighting harnesses.

- With the park light circuit energized, the control circuit monitors the **vehicle high and low beam** inputs. When battery voltage is sensed, the appropriate solid state power devices are turned ON, supplying battery voltage to the snowplow headlamps via the vehicle and snowplow lighting harnesses. Toggling the dimmer switch between high and low beam will toggle the snowplow high and low beams.

- Activating the **turn signal** applies voltage to the module turn signal circuit input. A control circuit senses the voltage and turns ON a solid state power device, which applies battery voltage to the snowplow turn signal lamp filaments via the vehicle and snowplow lighting harnesses.

- **PN 29070-1 Only:** On vehicles equipped with **DRLs integrated into the vehicle headlamps.** Activation of the switched accessory wire (a key-controlled power source) Port C, Position C, applies battery voltage to the module's high and low beam relay coils, which causes the relay contacts to shift from the "vehicle" to the "snowplow" position. **This module will transfer the vehicle headlamp DRLs to the snowplow (turns off vehicle DRLs).**

- **On vehicles equipped with dedicated DRL bulbs or vehicles using the turn signals as DRLs, this module *will not* turn OFF the vehicle bulbs. While the vehicle is in the DRL mode, this module will illuminate the snowplow light turn signal filaments.**

Excerpts taken from UltraMount® HTS™ Mechanic's Guide (Lit. No. 41467, Rev. 00).

3-PORT MODULE ELECTRICAL

Blue Label Module (PN 29760-2)

NOTE: Limited vehicle application.

Certain model year 2014 and newer GMC and Chevy trucks require this DRL module. Refer to the online QuickMatch resource at *www.westernproducts.com* **for full details.**

According to the vehicle manufacturer, all 2008 Ford Super Duty F-250/350/450/550 trucks built before 04/18/2007 require this module. Trucks built after that date and having the Plow Prep Package use the green label DRL module (PN 29070-1) described on the previous page.

Snowplow not attached to vehicle:

System is inactive. Vehicle lighting system functions normally. Reason: No ground to module.

Snowplow attached to vehicle:

System is inactive until either the switched accessory wire or the vehicle parking lights are activated. Vehicle and snowplow lighting systems function as outlined in the Theory of Operation Overview. Reason: Ground path is established from battery common to Pin C on Port A of the 3-port module via the following harnesses: vehicle battery cable, vehicle control harness, adapter, plug-in harness, vehicle lighting harness and snowplow lighting harness.

- Activating a **switched accessory** wire (a key-controlled power source) applies battery voltage to the VACC input of the module, which energizes the coil of the control power relay (part of the 3-port module). Energizing the coil of the control power relay causes the relay contacts to shift from the "N.O." (normally opened) position to the "N.C." (normally closed) position, which supplies battery voltage to the snowplow control via the plug-in harness and the vehicle control harness.

- Activating the vehicle **park light** circuit applies battery voltage to the module park circuit input. The voltage is applied to a solid state power device, which causes the device to turn ON and apply battery voltage to the snowplow park lamp filaments via the vehicle and snowplow lighting harnesses. Voltage is also applied to the module's high and low beam relay coils, which causes the relay contacts to shift from the "vehicle" to the "snowplow" position.

- With the four headlamp relays shifted to the "snowplow" position, the **vehicle high and low beams** are now directed to the snowplow headlamps via the vehicle and snowplow lighting harnesses. Toggling the dimmer switch between high and low beam will toggle the snowplow high and low beams.

- Activating the **turn signal** applies battery voltage to the module turn signal circuit input. The voltage is applied to a solid state power device, which causes the device to turn ON and apply battery voltage to the snowplow turn signal lamp filaments via the vehicle and snowplow lighting harnesses.

- On vehicles equipped with **DRLs** integrated into the vehicle headlamps, activating a **switched accessory** wire (a key-controlled power source) applies battery voltage to the module's **high and low beam** relay coils, which causes the relay contacts to shift from the "vehicle" to the "snowplow" position. This module *will* transfer the vehicle DRLs to the snowplow.

This page intentionally left blank.

Electrical & Hydraulic Schematics

This page intentionally left blank.

ELECTRICAL LEGEND


CROSSING WIRE


WIRE SPLICE

IN-LINE CONNECTOR


FUSE

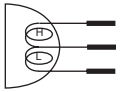

SOLENOID COIL

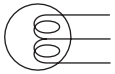

CIRCUIT GROUND


MOTOR RELAY


BATTERY


MOTOR


HEADLAMP


PARK/TURN LAMP


PRINTED CIRCUIT BOARD


COMPONENT ENCLOSURE

HYDRAULIC LEGEND

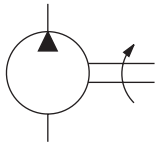
WORKING LINE (MAIN)

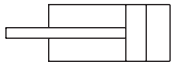

LINES JOINING


LINES CROSSING

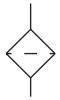
FLOW, DIRECTION OF HYDRAULIC FLUID


LINE, TO RESERVOIR BELOW FLUID LEVEL


HYDRAULIC PUMP FIXED DISPLACEMENT


CYLINDER

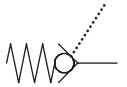
ELECTRIC MOTOR

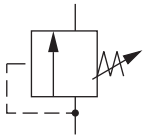

FILTER, STRAINER, DIFFUSER


COMPONENT ENCLOSURE

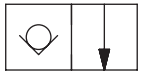
SPRING

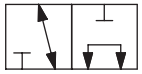

SOLENOID, SINGLE WINDING

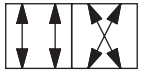

PILOT OPERATED (P/O) CHECK VALVE

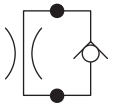

VALVE, ADJUSTABLE PRESSURE RELIEF


VALVE, FLOW CONTROL, ADJUSTABLE-NON-COMPENSATED


VALVE, TWO POSITION, TWO CONNECTION (TWO-WAY)


VALVE, TWO POSITION, THREE CONNECTION (THREE-WAY)

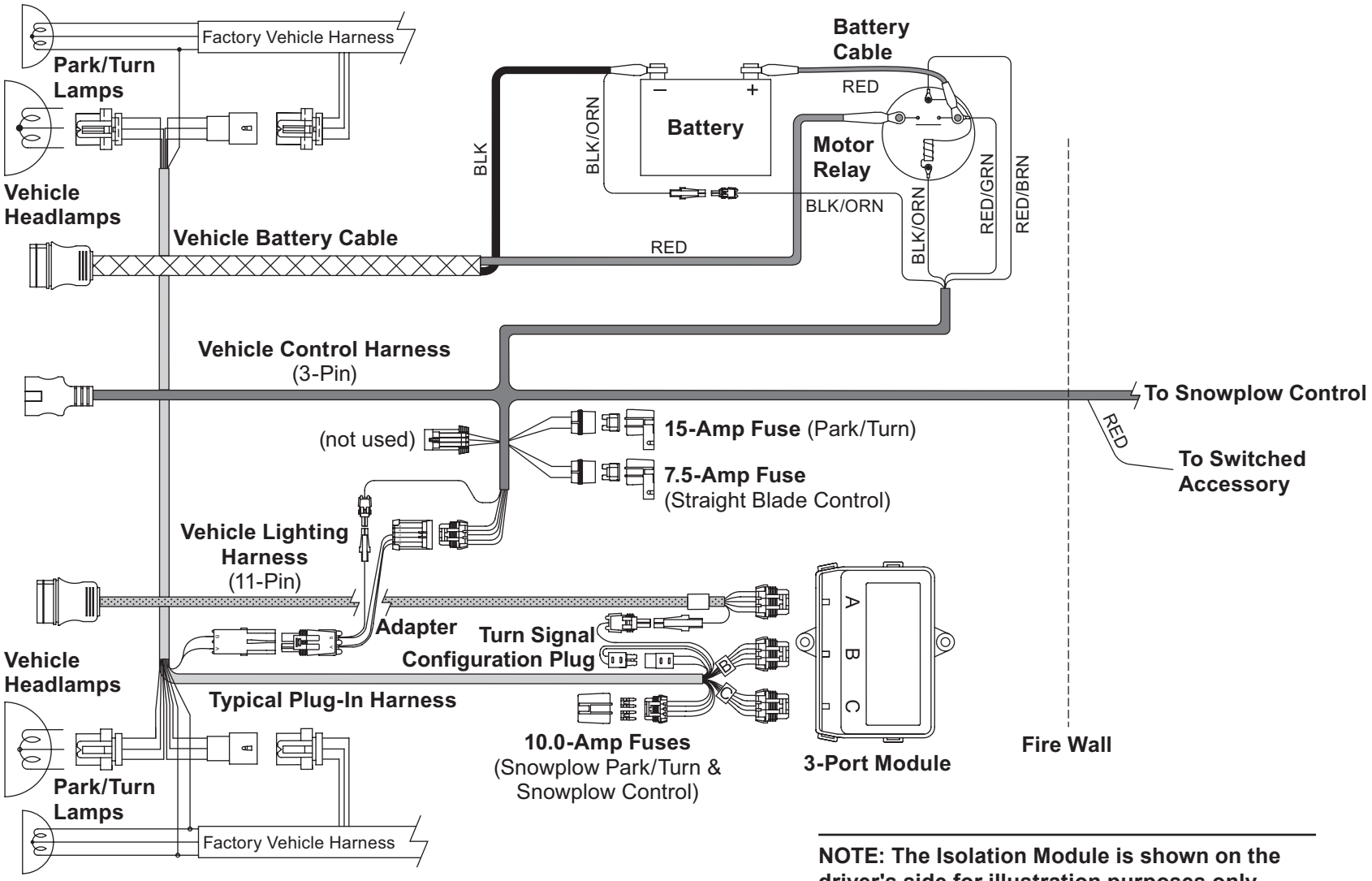

VALVE, TWO POSITION, FOUR CONNECTION (FOUR-WAY)


ORIFICE PLATE


CHECK VALVE

Left side = Driver's side (DS); Right side = Passenger's side (PS).

3-PLUG SYSTEM — WIRING OVERVIEW

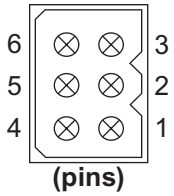


NOTE: The Isolation Module is shown on the driver's side for illustration purposes only. Location may be different for the vehicle.

3-PLUG SYSTEM – ELECTRICAL CONNECTORS

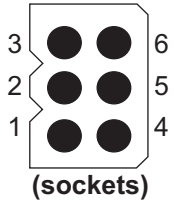
Solenoid Control Connectors

Control Side (end view)



Pin No.	Solenoid Control Wire Color Only
1	White
2	Green
3	Brown
4	Black
5	Blue
6	Red

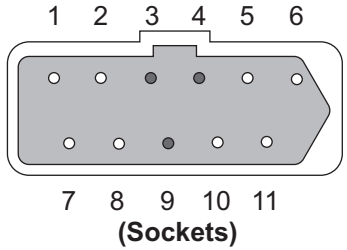
Vehicle Side (end view)



Pin No.	Wire Color	Control Function
1	Red/Yellow	+12V
2	Light Green	Valve S2
3	Orange/Black	Ground
4	Brown/Red	Motor Relay
5	Light Blue	Valve S3
6	White/Yellow	Valve S1

Plow Control Harnesses

Plow (End View)

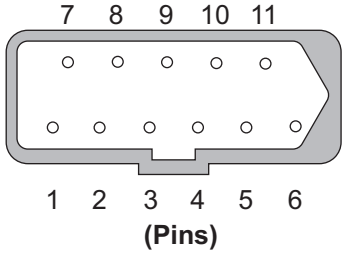


3-Pin

Pin No.	Wire Color	Control Function
1	—	—
2	—	—
3	Light Blue	Valve S3
4	Light Green	Valve S2
5	—	—
6	—	—
7	—	—
8	—	—
9	White/Yellow	Valve S1
10	—	—
11	—	—

Plow Lighting Harness

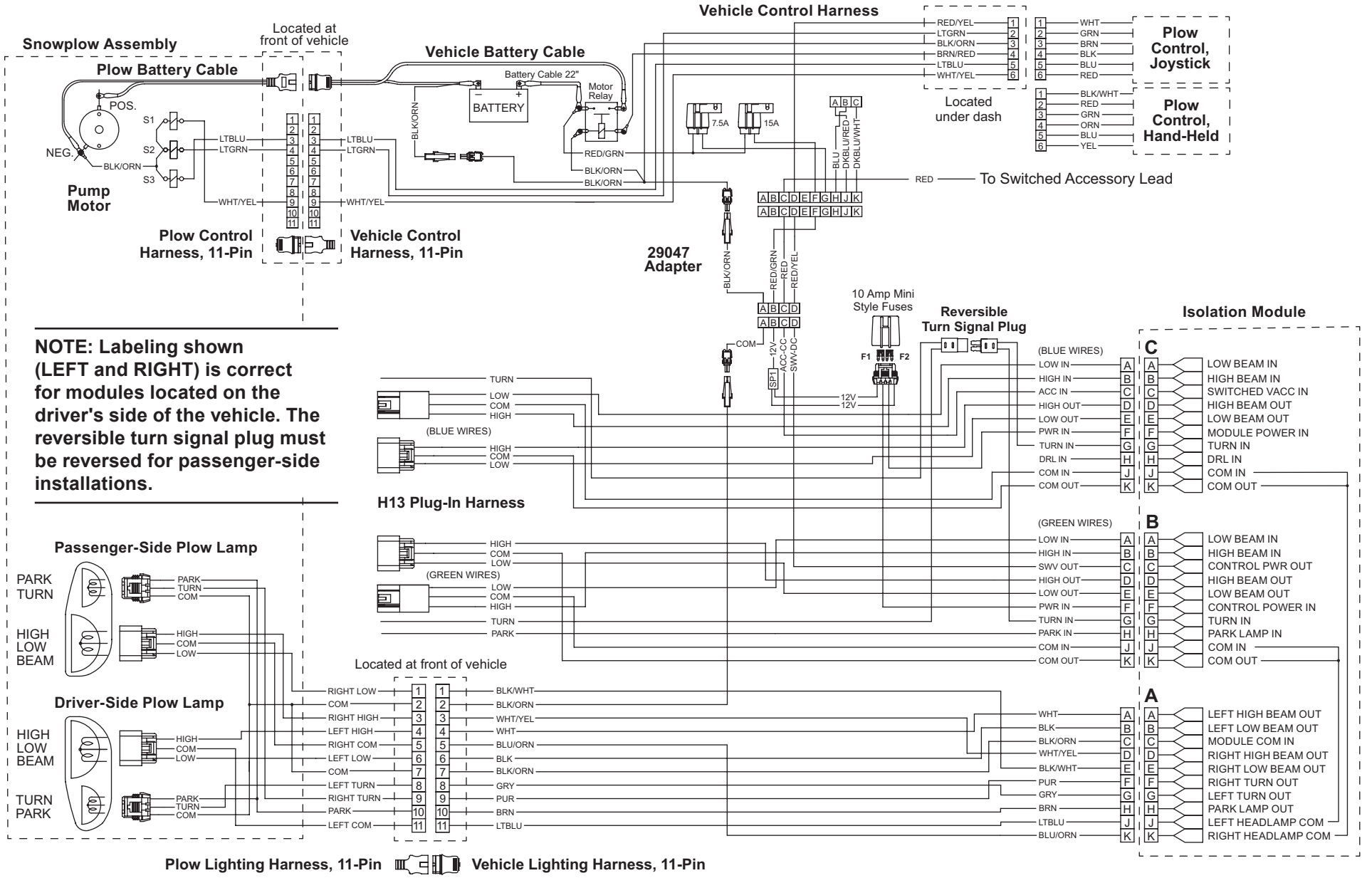
Plow (End View)



11-Pin

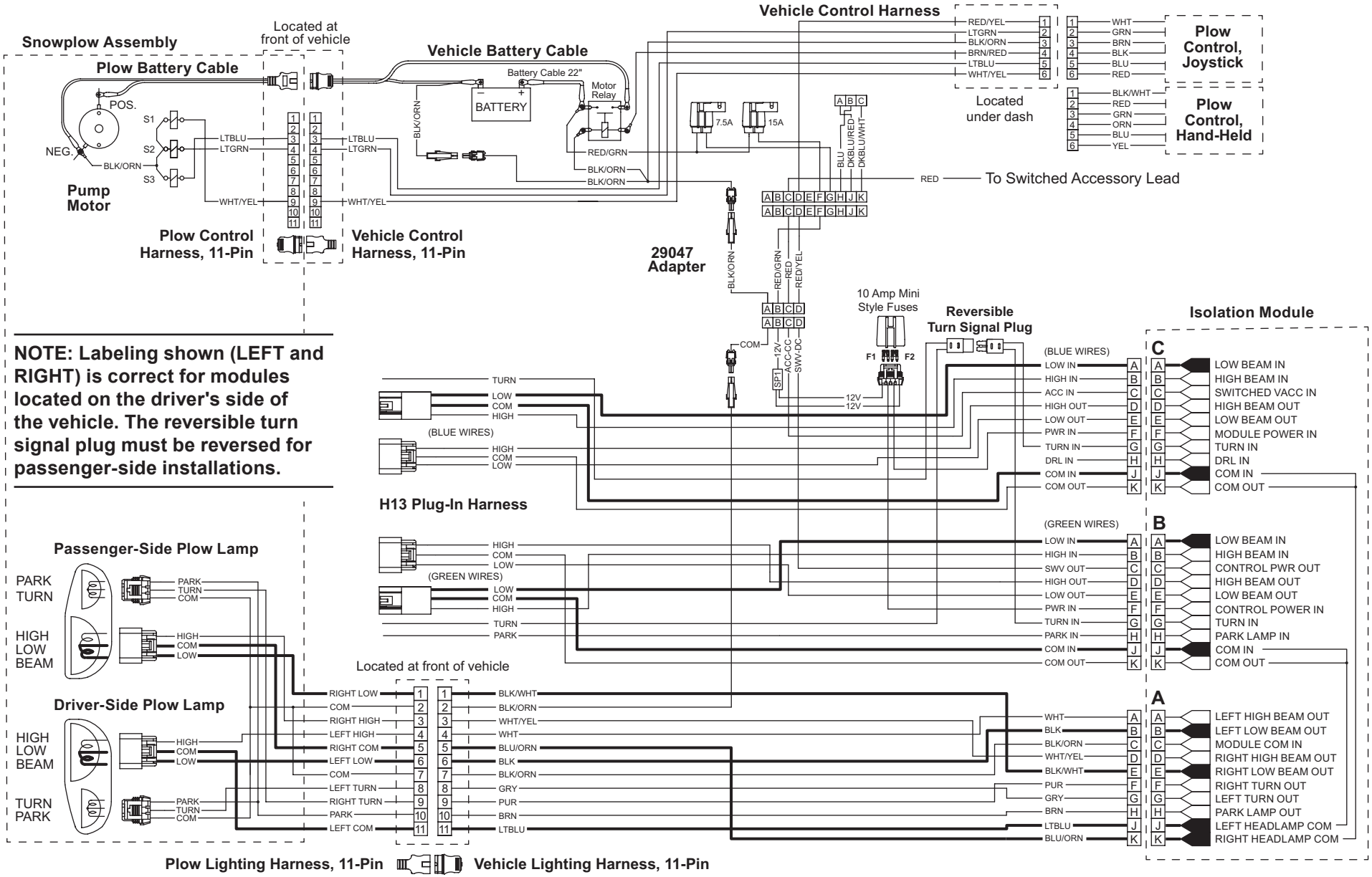
Pin No.	Wire Color	Control Function
1	Black/White	PS Low Beam
2	Black/Orange	Ground
3	White/Yellow	PS High Beam
4	White	DS High Beam
5	Blue/Orange	PS Common
6	Black	DS Low Beam
7	Black/Orange	Ground
8	Gray	Left Directional
9	Purple	Right Directional
10	Brown	Parking Lights
11	Light Blue	DS Common

3-PLUG SYSTEM — ELECTRICAL SCHEMATIC

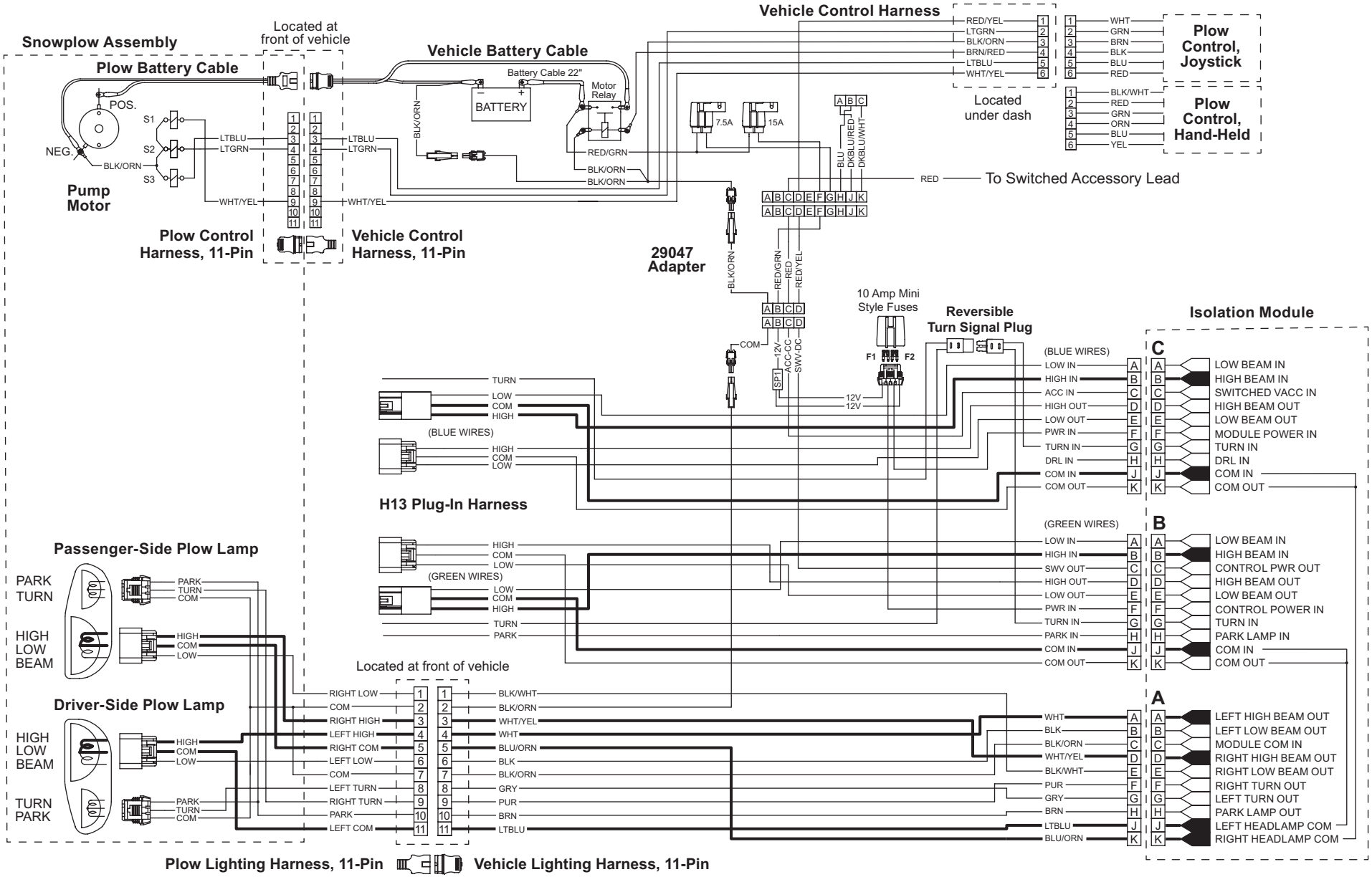


NOTE: Labeling shown (LEFT and RIGHT) is correct for modules located on the driver's side of the vehicle. The reversible turn signal plug must be reversed for passenger-side installations.

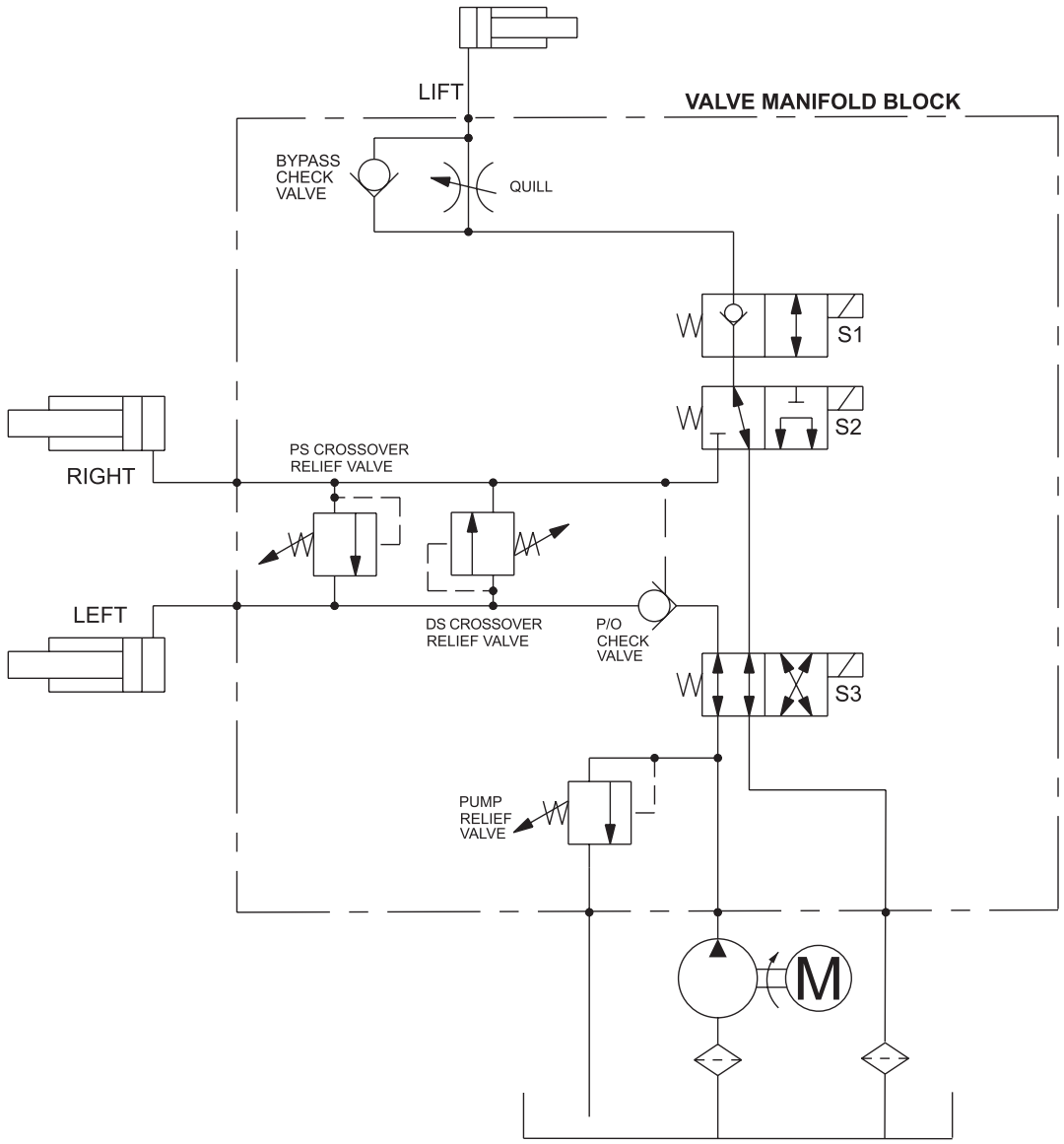
3-PLUG SYSTEM — LOW-BEAM HEADLAMPS WITH SNOWPLOW CONNECTED TO VEHICLE



3-PLUG SYSTEM — HIGH-BEAM HEADLAMPS WITH SNOWPLOW CONNECTED TO VEHICLE

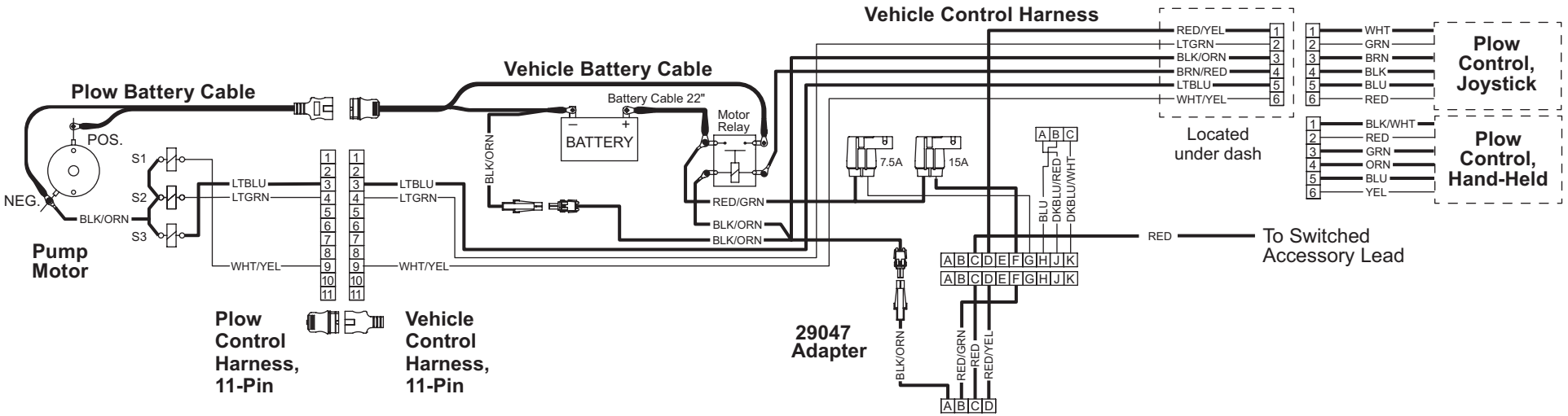


3-PLUG SYSTEM — HYDRAULIC SCHEMATIC



BLADE MOVEMENT		RAISE ↑	LOWER ↓	ANGLE RIGHT	ANGLE LEFT
MOTOR	M	ON		ON	ON
SV08-2004	S1		ON		
SV08-31	S2			ON	ON
SV08-40	S3	ON			ON

RAISE – ELECTRICAL



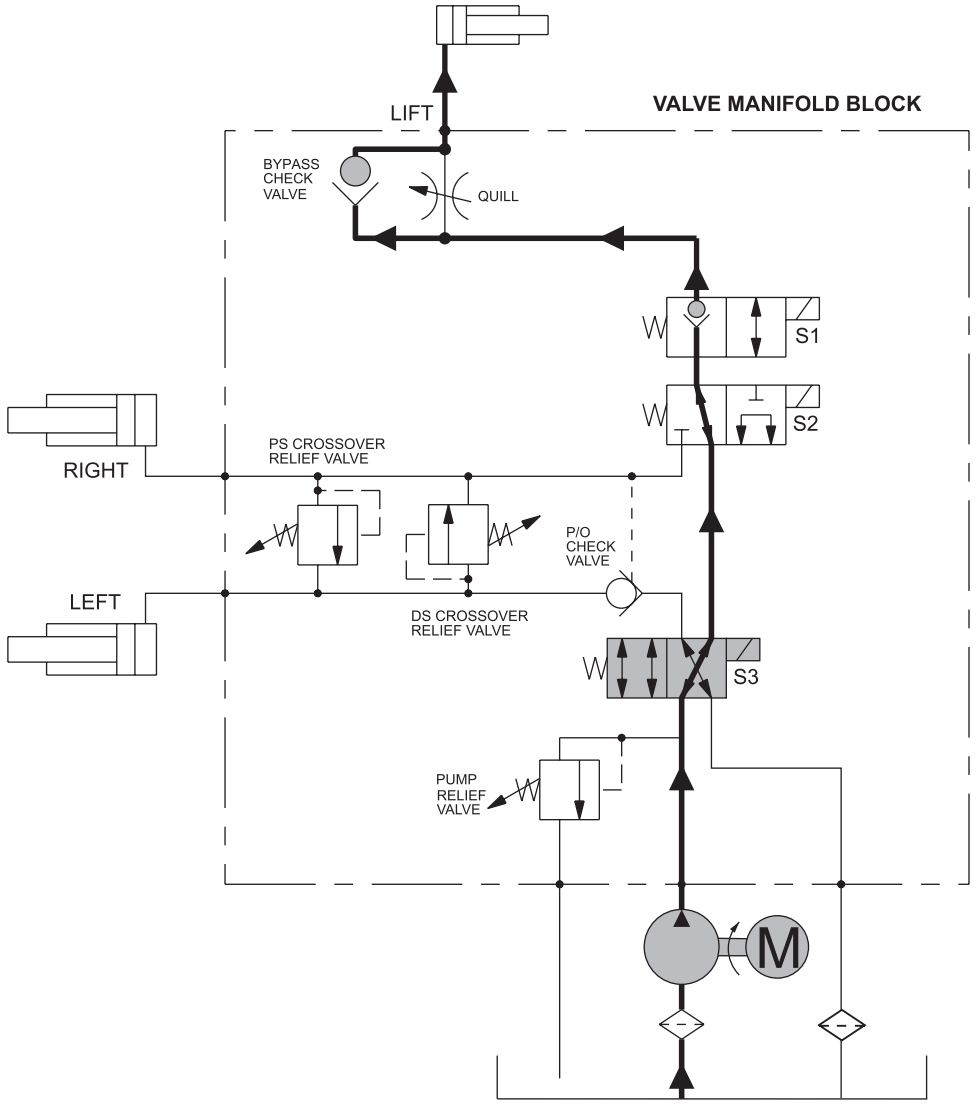
System Response

1. By activating the RAISE function on the cab control, the circuit board within the cab control supplies power for the electrical circuits.

2. Electrical current flows through the motor relay, activating the pump motor and solenoid cartridge valve S3, shifting the spool.

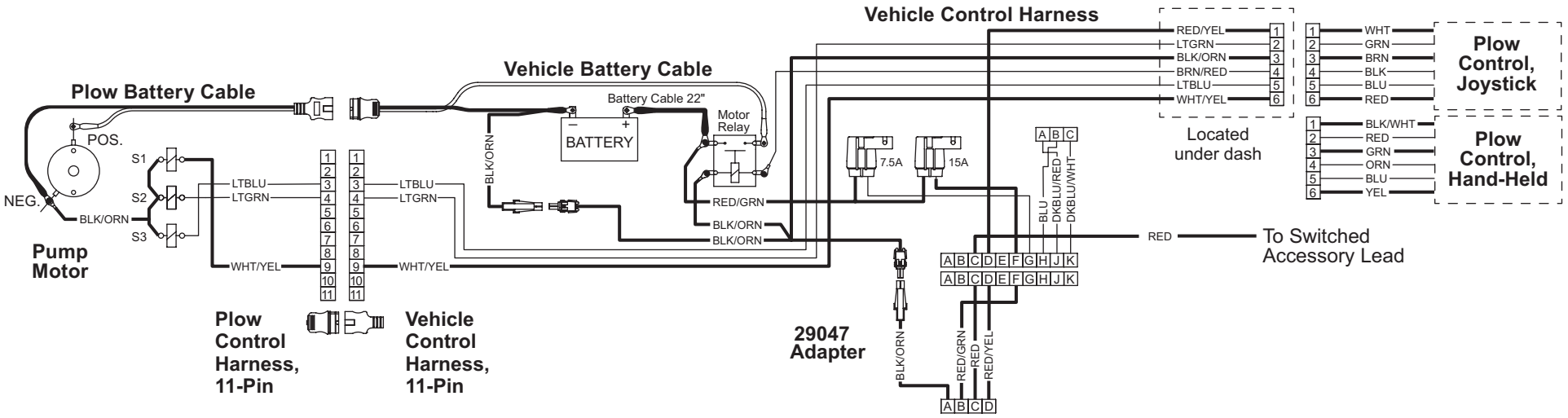
3. Hydraulic fluid from the pump flows through the solenoid cartridge valves S3 & S2 and the internal check valve in solenoid cartridge valve S1, and into the lift cylinder, causing it to extend.

RAISE – HYDRAULIC



BLADE MOVEMENT		RAISE ↑	LOWER ↓	ANGLE RIGHT	ANGLE LEFT
MOTOR	M	ON		ON	ON
SV08-2004	S1		ON		
SV08-31	S2			ON	ON
SV08-40	S3	ON			ON

LOWER/FLOAT – ELECTRICAL



System Response

1. By activating the LOWER/FLOAT function on the cab control, the circuit board within the cab control supplies power for the electrical circuits.

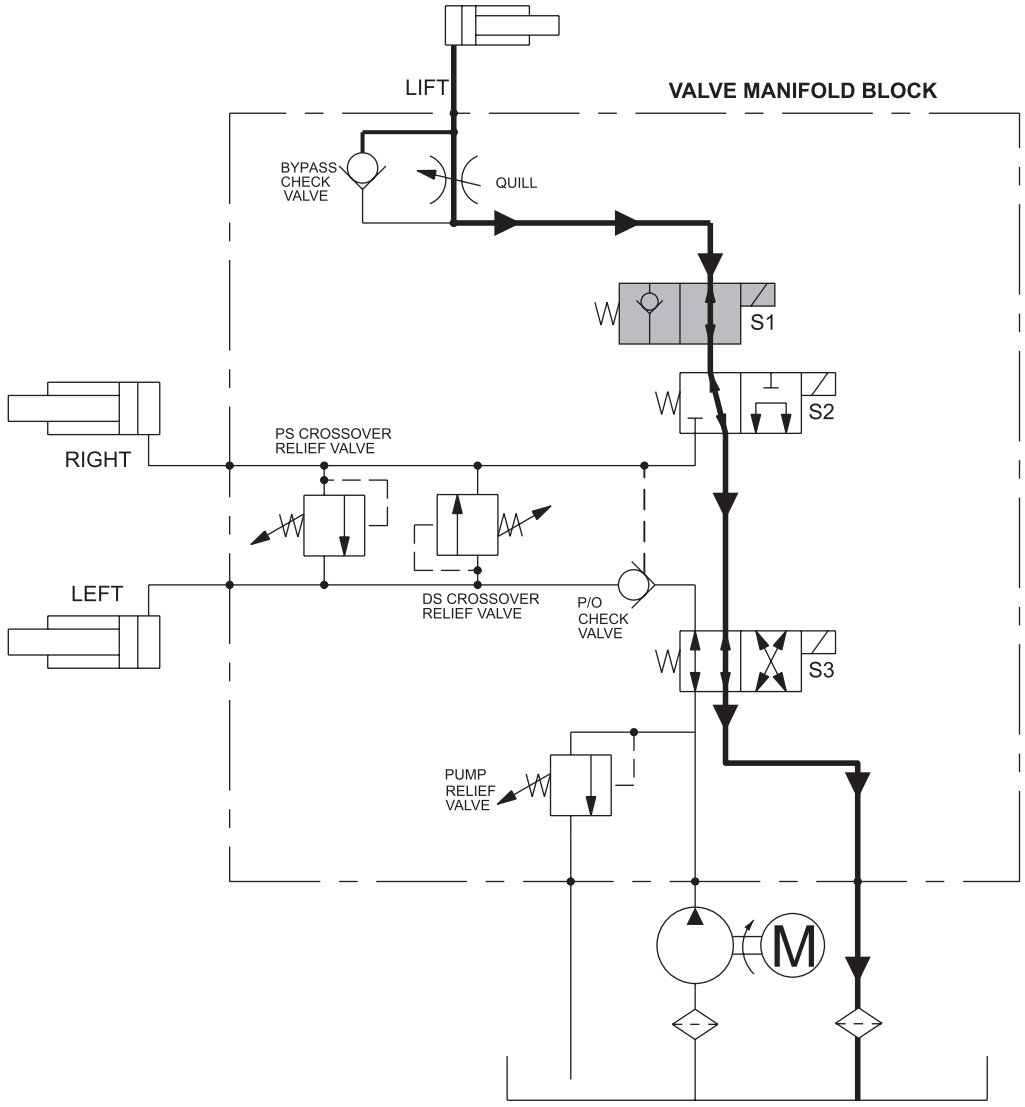
2. Electrical current flows through solenoid cartridge valve S1, shifting the spool.

3. The weight of the plow forces the lift cylinder to retract. The retracting lift cylinder pushes the hydraulic fluid through solenoid cartridge valves S1 & S2 & S3, and back to the reservoir.

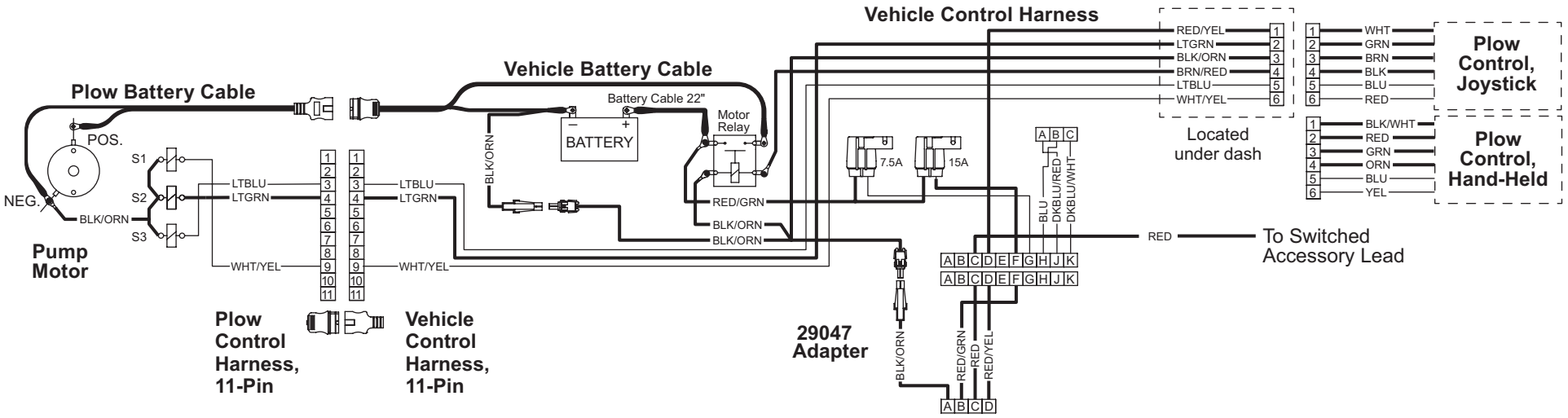
NOTE: For the CabCommand hand-held control only, angling right or left while in FLOAT will temporarily cancel FLOAT (turn OFF solenoid cartridge valve S1) until the angle button is released.

LOWER/FLOAT – HYDRAULIC

BLADE MOVEMENT		RAISE	LOWER	ANGLE RIGHT	ANGLE LEFT
MOTOR	M	ON		ON	ON
SV08-2004	S1		ON		
SV08-31	S2			ON	ON
SV08-40	S3	ON			ON



ANGLE RIGHT – ELECTRICAL



System Response

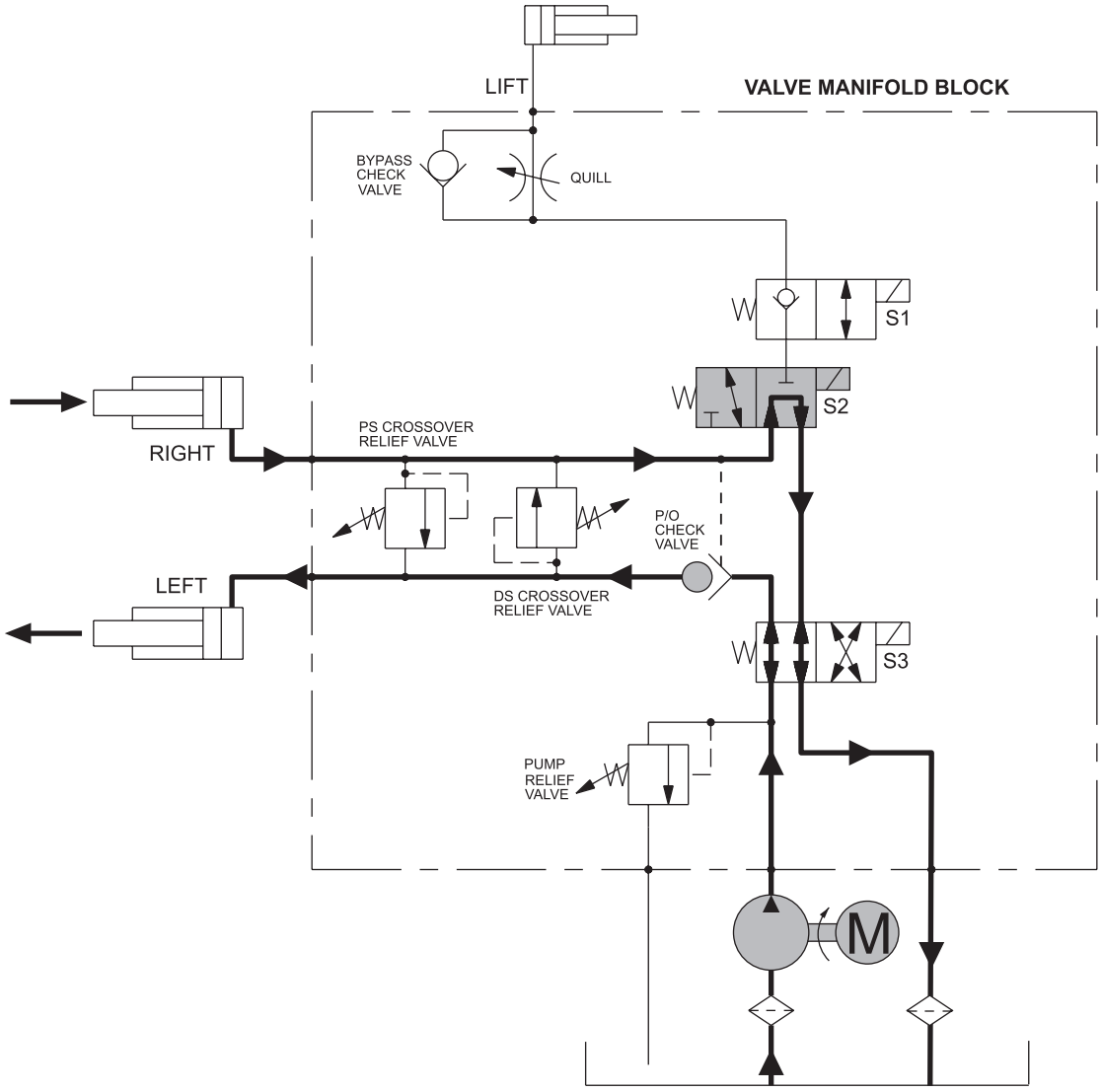
1. By activating the RIGHT function on the cab control, the circuit board within the cab control supplies power for the electrical circuits.

2. Electrical current flows through the motor relay, activating the pump motor, and solenoid cartridge valve S2, shifting its spool.

3. Hydraulic fluid from the pump flows through the solenoid cartridge valve S3 and the poppet check valve, and into the base end of the left cylinder, causing it to extend.

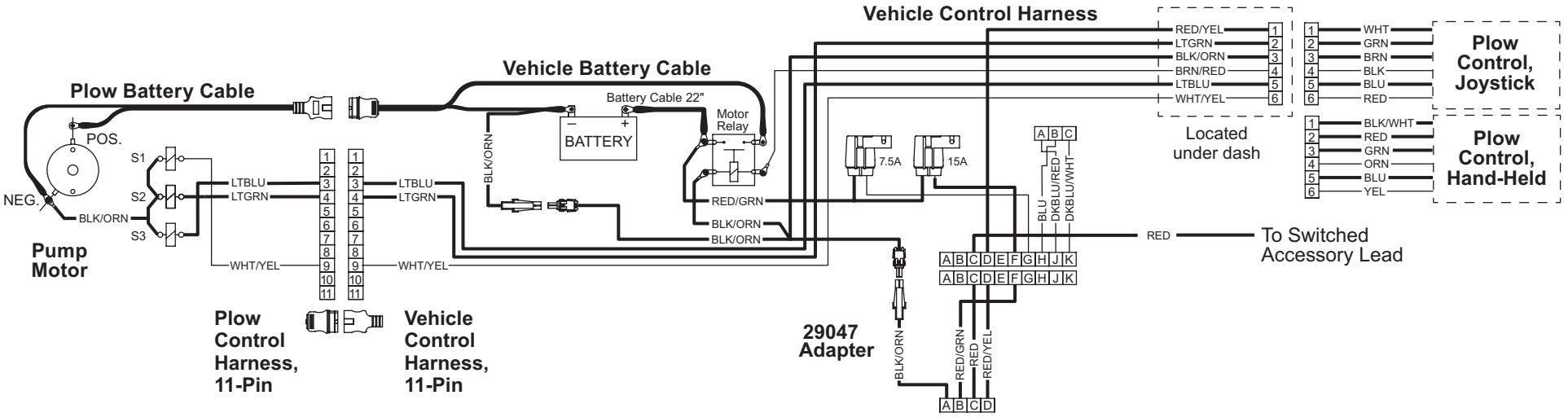
4. The retracting right cylinder pushes the hydraulic fluid out of its base end, through solenoid cartridge valves S2 & S3 back to the reservoir.

ANGLE RIGHT – HYDRAULIC



BLADE MOVEMENT		RAISE ↑	LOWER ↓	ANGLE RIGHT	ANGLE LEFT
MOTOR	M	ON		ON	ON
SV08-2004	S1		ON		
SV08-31	S2			ON	ON
SV08-40	S3	ON			ON

ANGLE LEFT – ELECTRICAL



System Response

1. By activating the LEFT function on the cab control, the circuit board within the cab control supplies power for the electrical circuits.

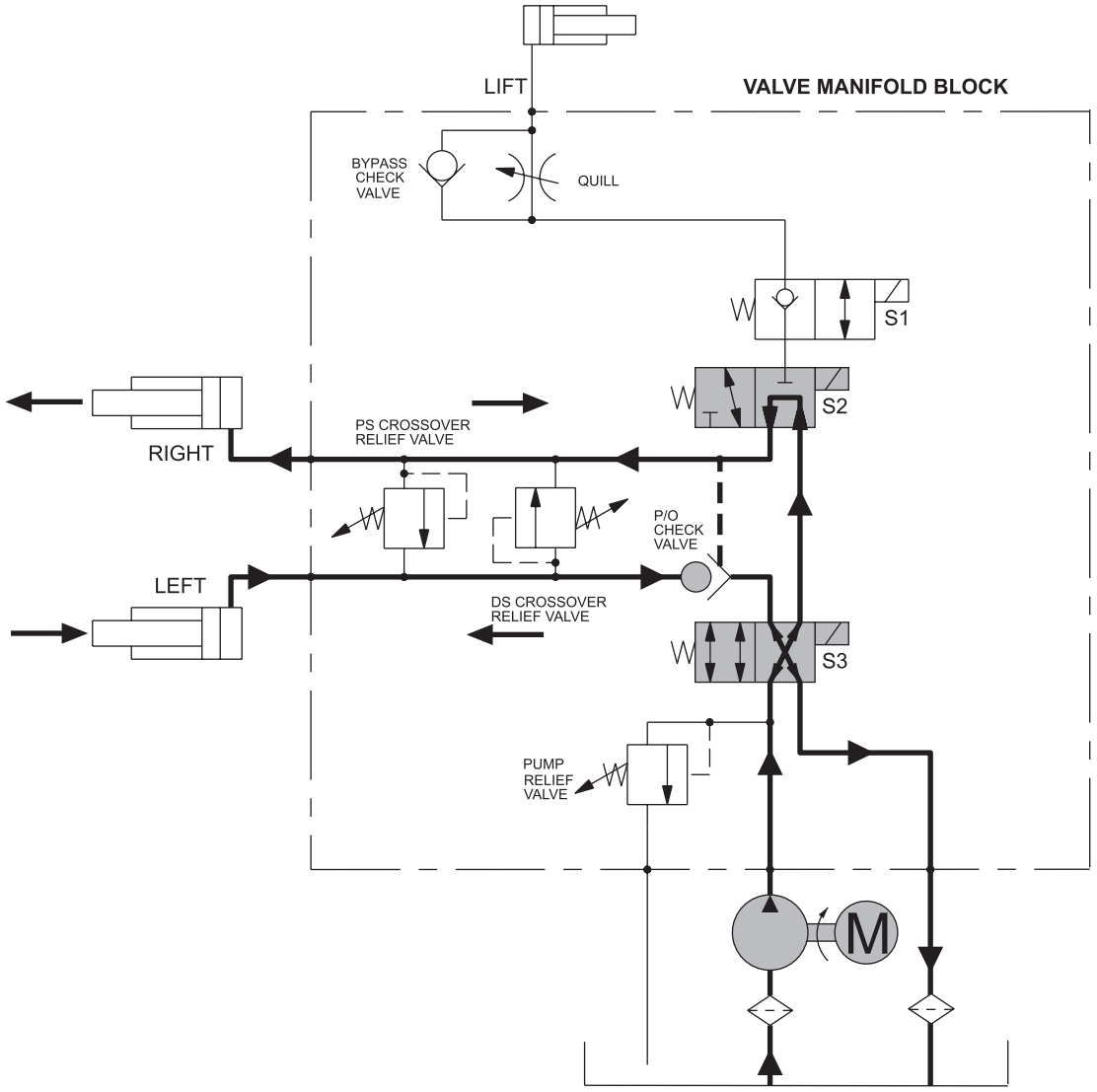
2. Electrical current flows through the motor relay, activating the pump motor, and solenoid cartridge valves S2 & S3, shifting both spools.

3. Hydraulic fluid from the pump flows through the solenoid cartridge valves S3 & S2, and into the base end of the right cylinder, causing it to extend.

4. Pressure within the hydraulic circuit shifts the spool, opening the poppet check valve.

5. The retracting left cylinder pushes the hydraulic fluid out of its base end, through the open poppet check valve and solenoid cartridge valve S3 and back to the reservoir.

ANGLE LEFT – HYDRAULIC

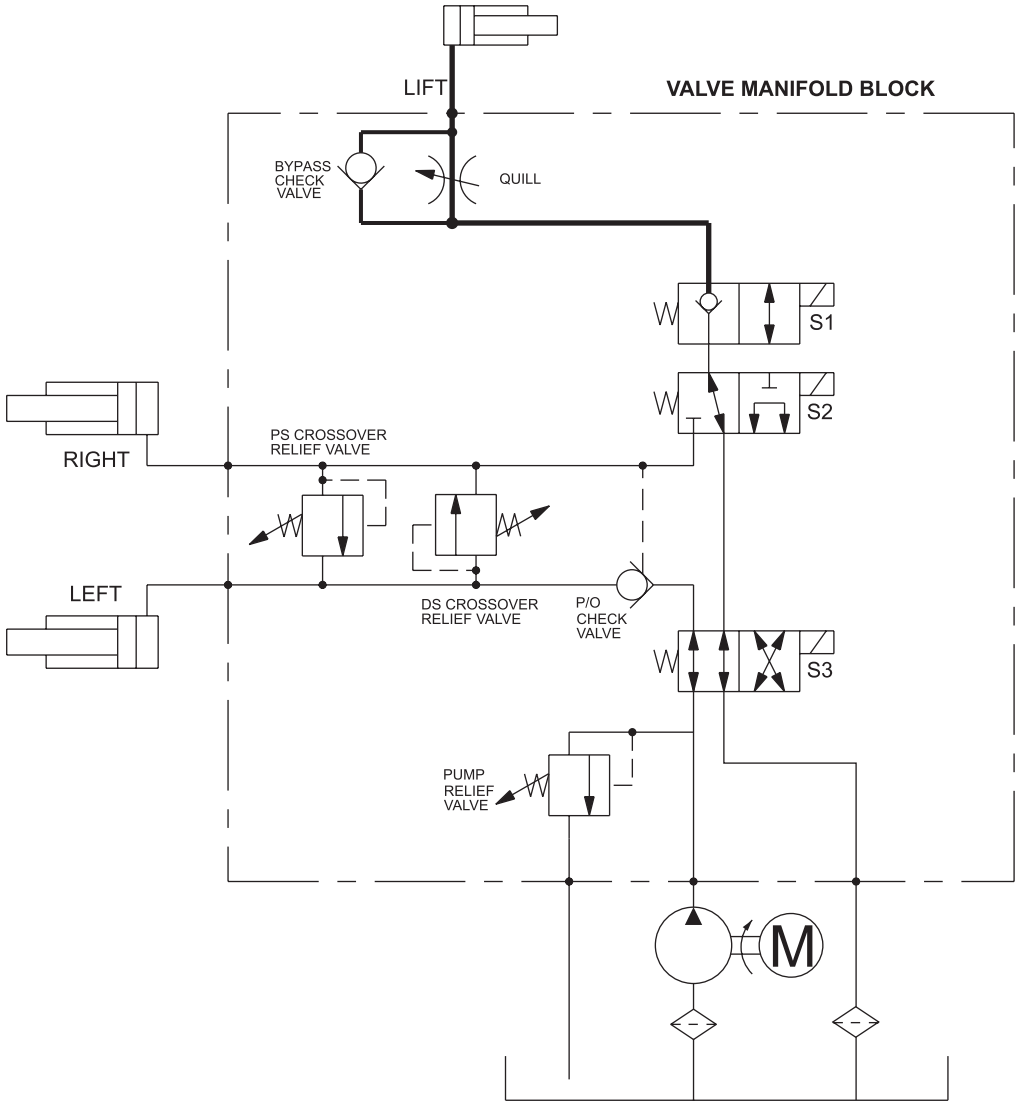


BLADE MOVEMENT		RAISE ↑	LOWER ↓	ANGLE RIGHT	ANGLE LEFT
MOTOR	M	ON		ON	ON
SV08-2004	S1		ON		
SV08-31	S2			ON	ON
SV08-40	S3	ON			ON

HOLD IN RAISE POSITION – HYDRAULIC

System Response

Hydraulic fluid is trapped in the lift cylinder by the internal check valve in solenoid cartridge valve S1.



BLADE MOVEMENT		RAISE ↑	LOWER ↓	ANGLE RIGHT	ANGLE LEFT
MOTOR	M	ON		ON	ON
SV08-2004	S1		ON		
SV08-31	S2			ON	ON
SV08-40	S3	ON			ON

STRIKING AN OBJECT WHILE PLOWING – DS

Blade Movement

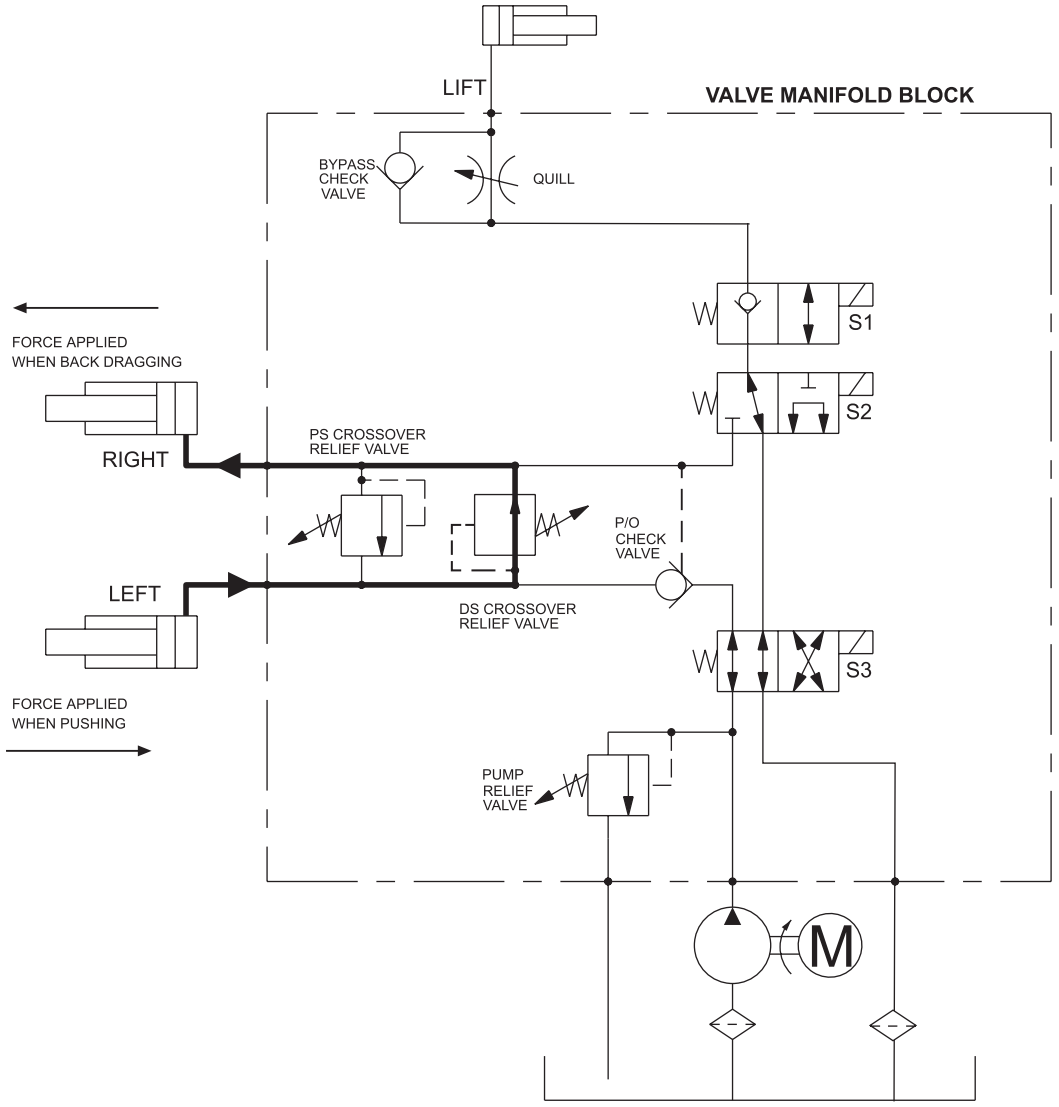
Striking an object with the driver's side of the blade while plowing, or with the passenger's side of the blade while back dragging.

System Response

1. Hydraulic fluid is trapped in the base end of the cylinders by the relief valves, the poppet check valve and solenoid cartridge valve S2.

2. When the plow contacts an object, the force of the impact increases the hydraulic pressure in the base end of the cylinder. When the pressure exceeds the relief valve pressure setting, the relief valve opens allowing hydraulic fluid to flow to the base of the opposite cylinder.

BLADE MOVEMENT		RAISE ↑	LOWER ↓	ANGLE RIGHT	ANGLE LEFT
MOTOR	M	ON		ON	ON
SV08-2004	S1		ON		
SV08-31	S2			ON	ON
SV08-40	S3	ON			ON



STRIKING AN OBJECT WHILE PLOWING – PS

Blade Movement

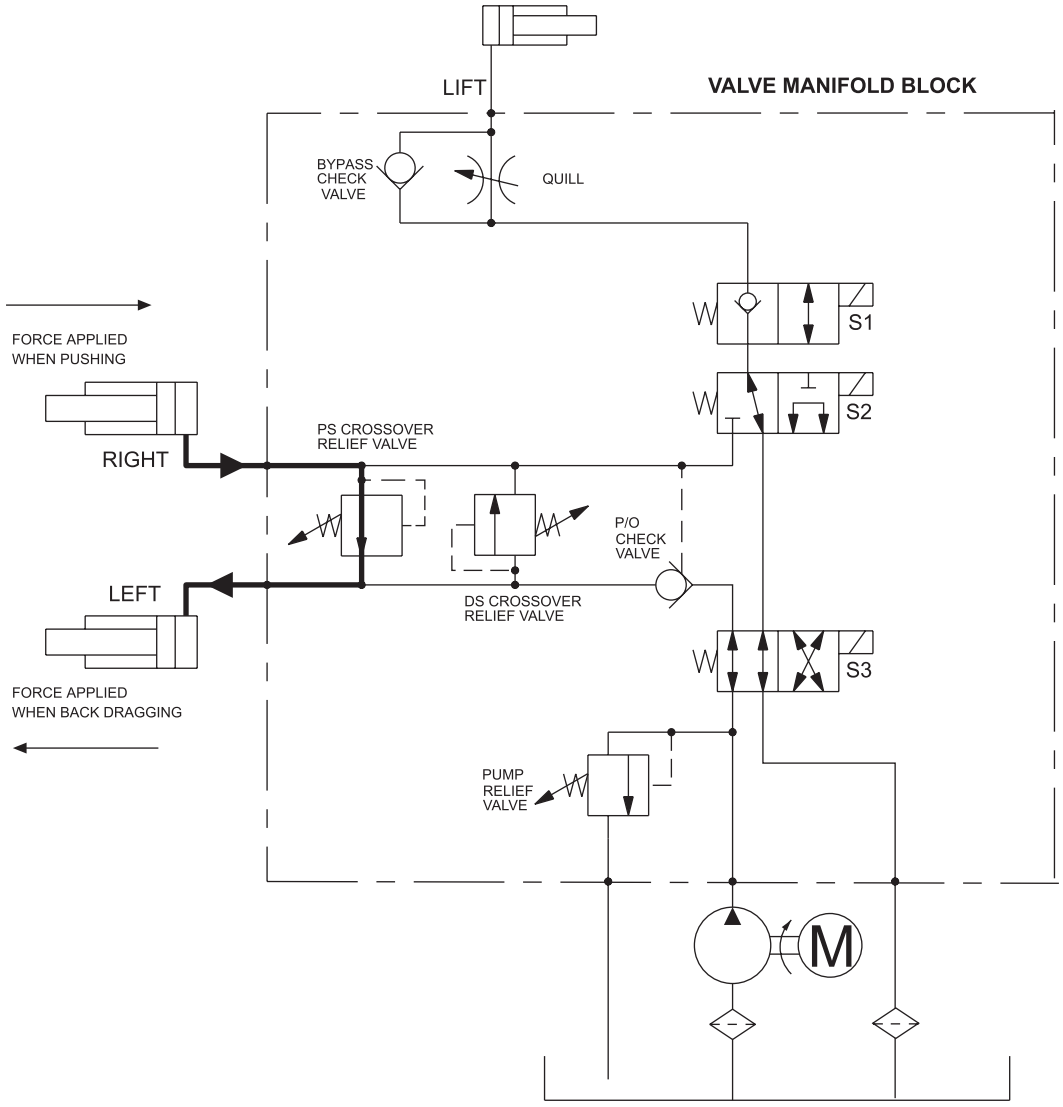
Striking an object with the passenger's side of the blade while plowing or with the driver's side of the blade while back dragging.

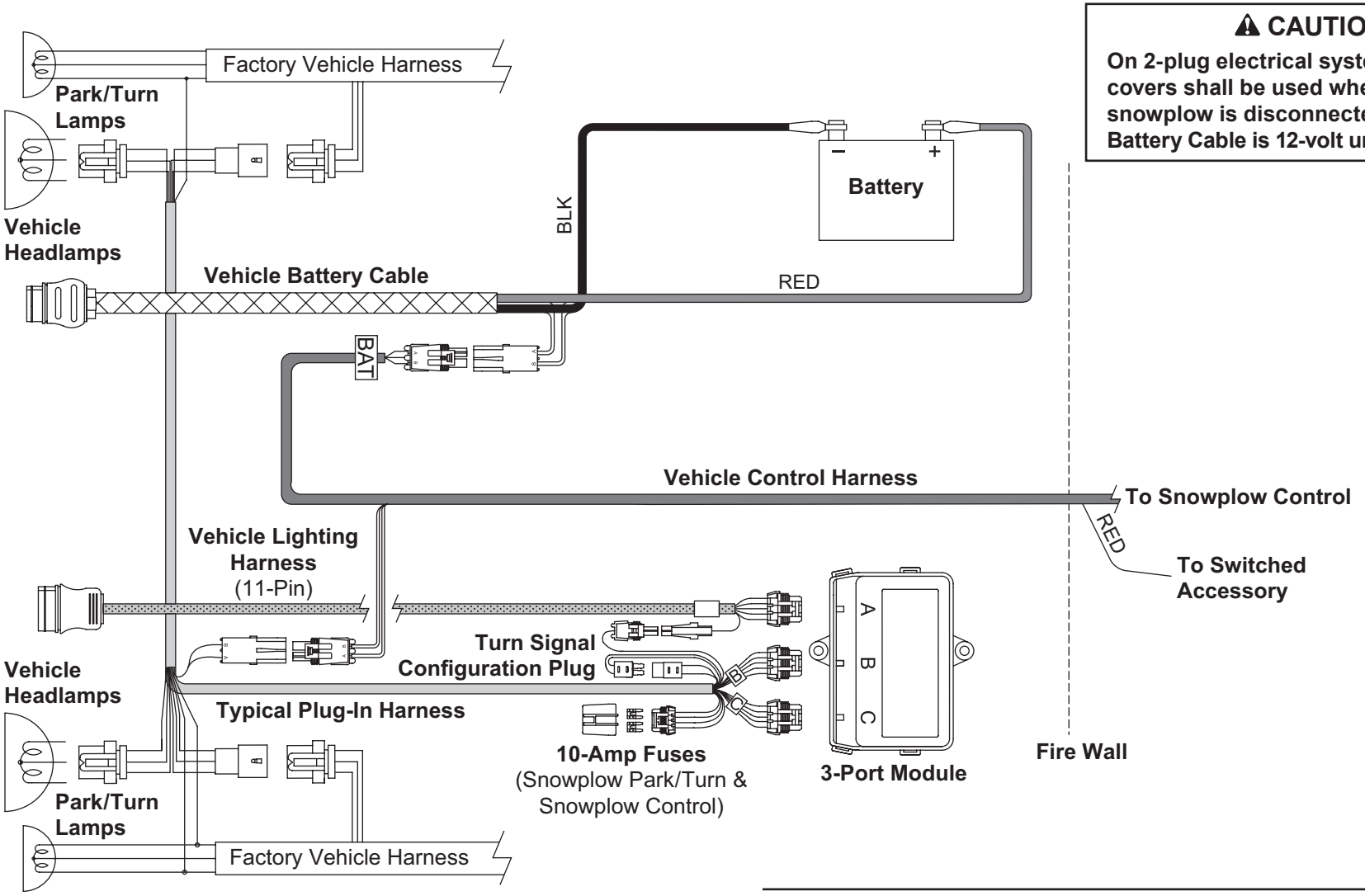
System Response

1. Hydraulic fluid is trapped in the base end of the cylinders by the relief valves, the poppet check valve and solenoid cartridge valve S2.

2. When the plow contacts an object, the force of the impact increases the hydraulic pressure in the base end of the cylinder. When the pressure exceeds the relief valve pressure setting, the relief valve opens allowing hydraulic fluid to flow to the base of the opposite cylinder.

BLADE MOVEMENT		RAISE ↑	LOWER ↓	ANGLE RIGHT	ANGLE LEFT
MOTOR	M	ON		ON	ON
SV08-2004	S1		ON		
SV08-31	S2			ON	ON
SV08-40	S3	ON			ON





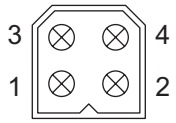
⚠ CAUTION

On 2-plug electrical systems, plug covers shall be used whenever snowplow is disconnected. Vehicle Battery Cable is 12-volt unfused source.

NOTE: The Isolation Module shown on the driver's side for illustration purposes only. Location may be different for the vehicle.

Solenoid Control Connectors

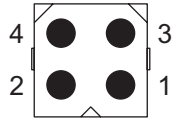
Control Side (end view)



(pins)

Pin No.	Solenoid Control Wire Color Only
1	Red
2	Green
3	White
4	Black

Vehicle Side (end view)

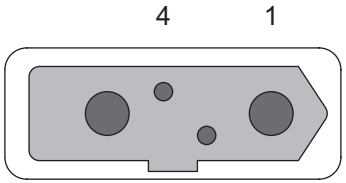


(sockets)

Pin No.	Wire Color	Control Function
1	Red	+12V
2	Red	Signal
3	Black	Signal
4	Black	Ground

Multiplex Harnesses

Plow (End View)



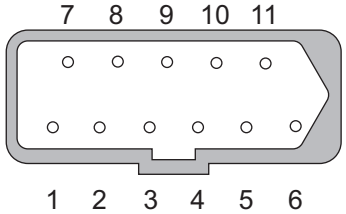
(Sockets)

4-Pin

Pin No.	Wire Color	Control Function
1	Red	+12V
2	Black	Ground
3	Tan	Signal
4	White	Signal

Plow Lighting Harness

Plow (End View)

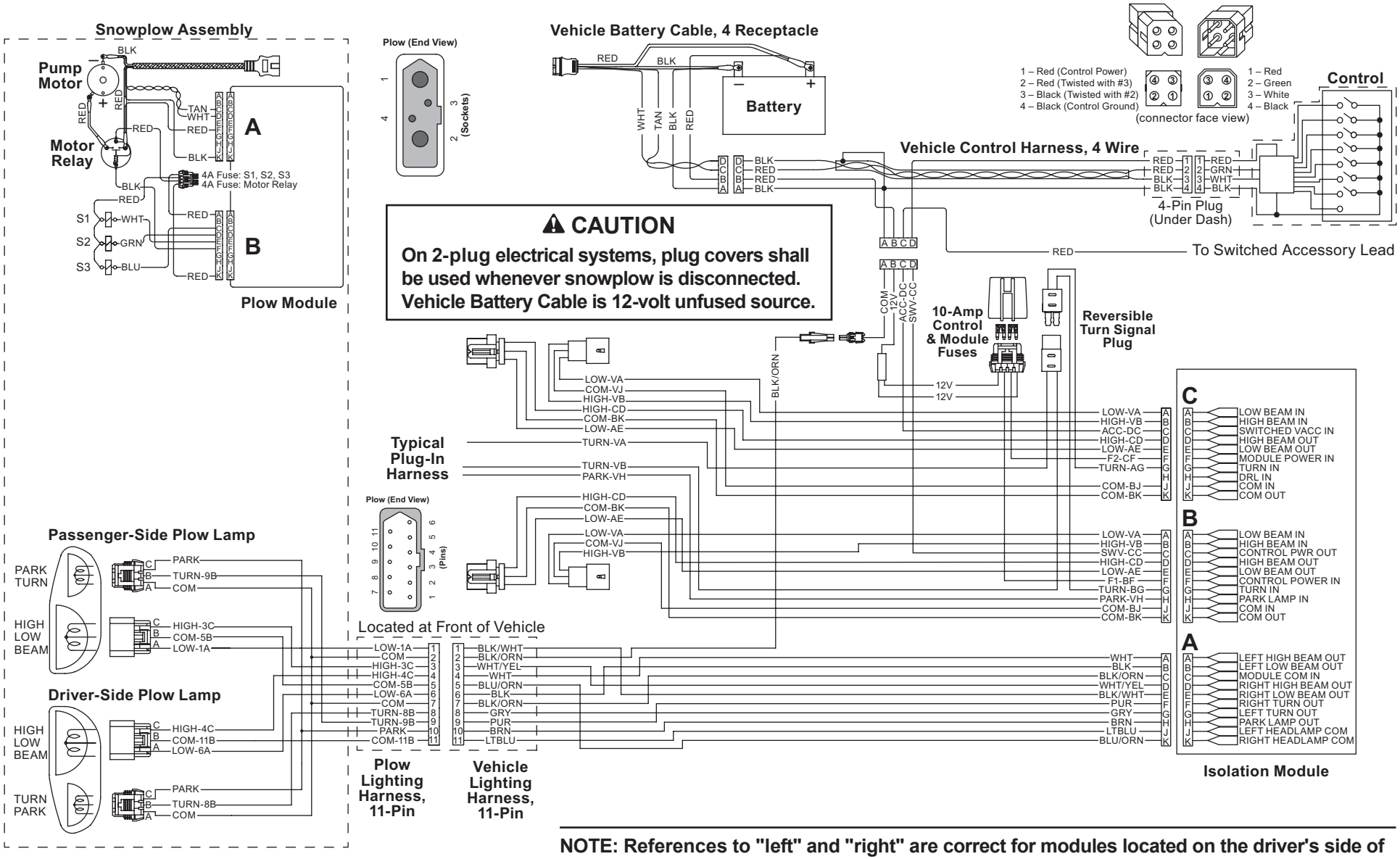


(Pins)

11-Pin

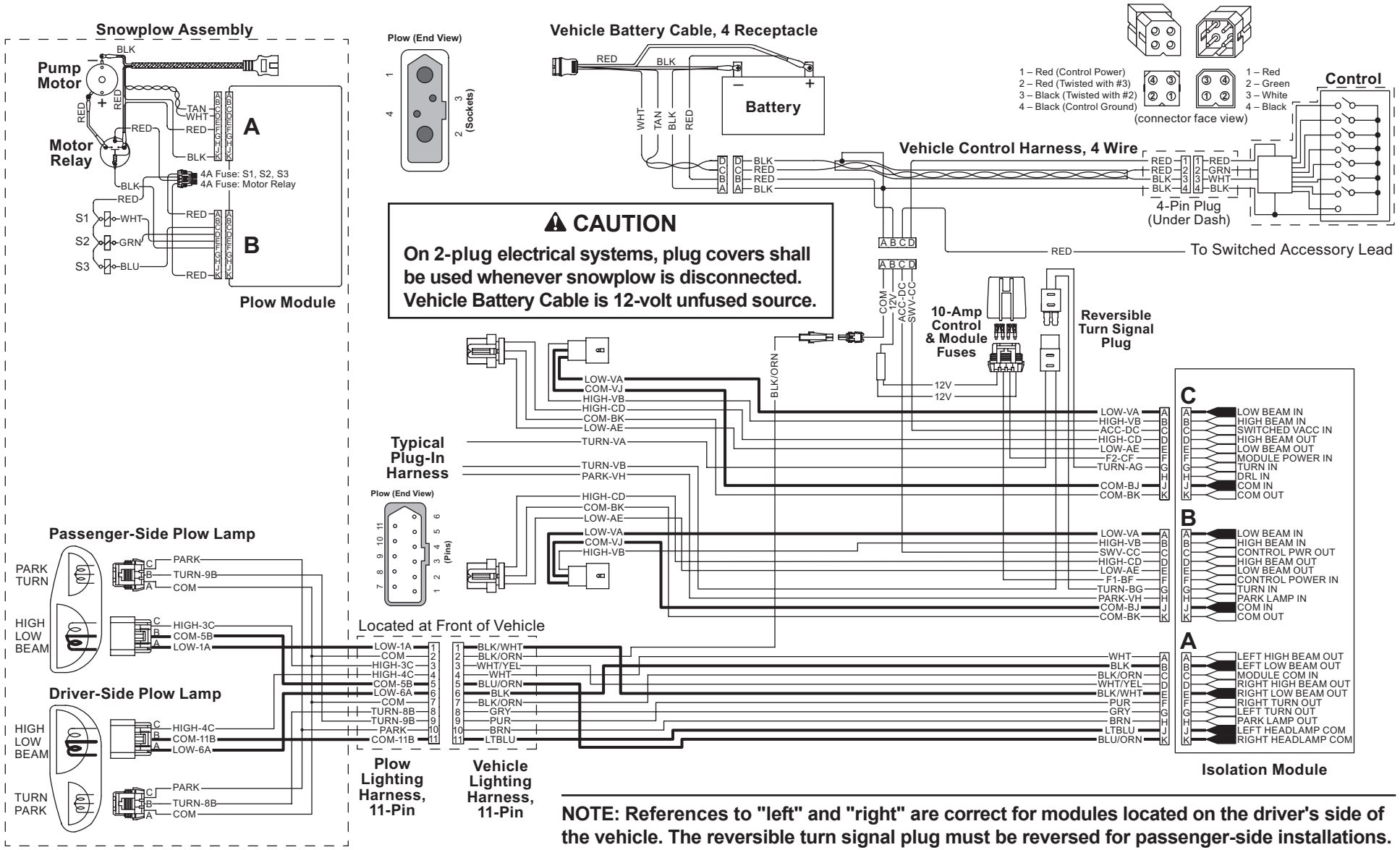
Pin No.	Wire Color	Control Function
1	Black/White	PS Low Beam
2	Black/Orange	Ground
3	White/Yellow	PS High Beam
4	White	DS High Beam
5	Blue/Orange	PS Common
6	Black	DS Low Beam
7	Black/Orange	Ground
8	Gray	Left Directional
9	Purple	Right Directional
10	Brown	Parking Lights
11	Light Blue	DS Common

2-PLUG SYSTEM — ELECTRICAL SCHEMATIC



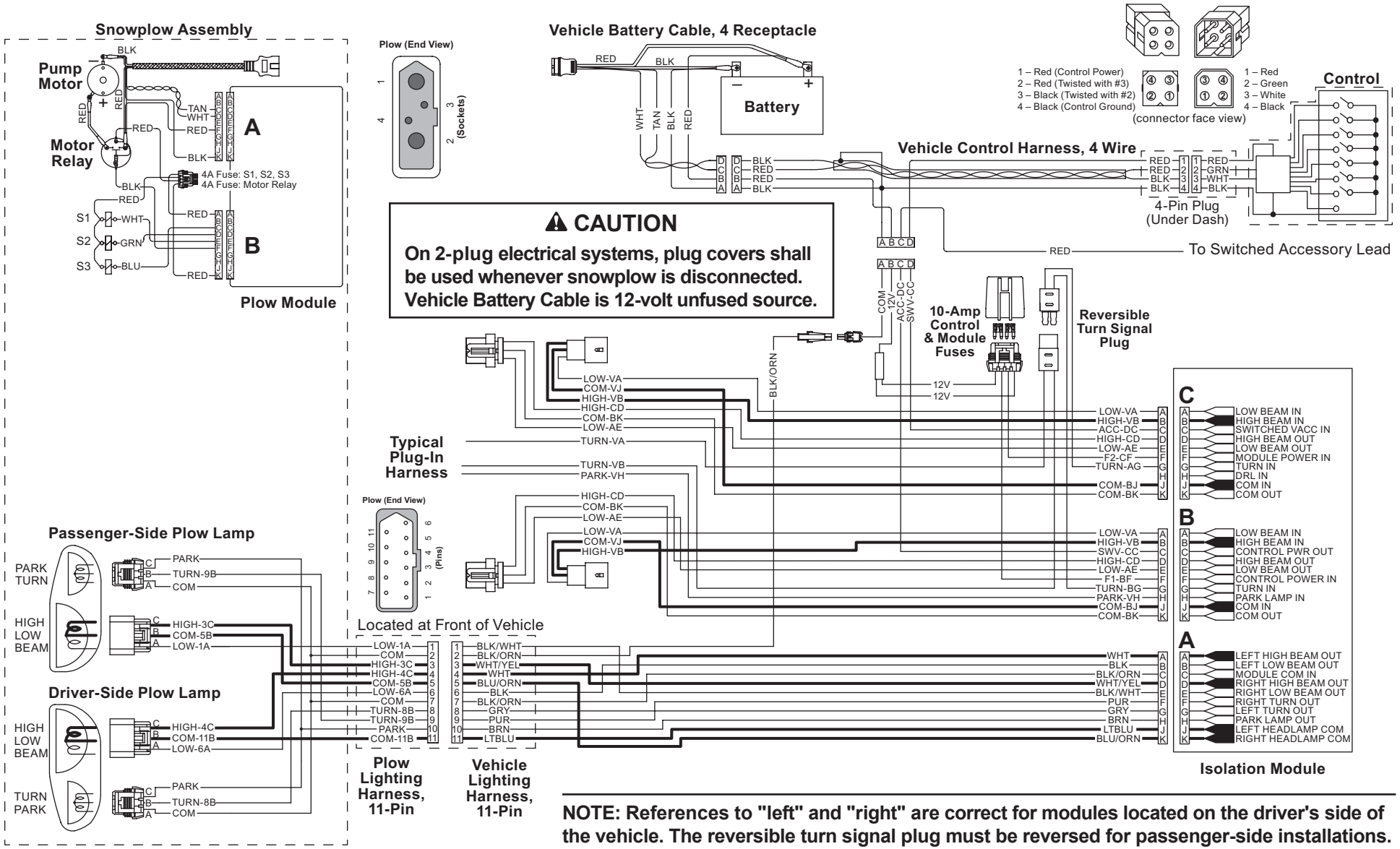
NOTE: References to "left" and "right" are correct for modules located on the driver's side of the vehicle. The reversible turn signal plug must be reversed for passenger-side installations.

2-PLUG SYSTEM — LOW-BEAM HEADLAMPS WITH SNOWPLOW CONNECTED TO VEHICLE

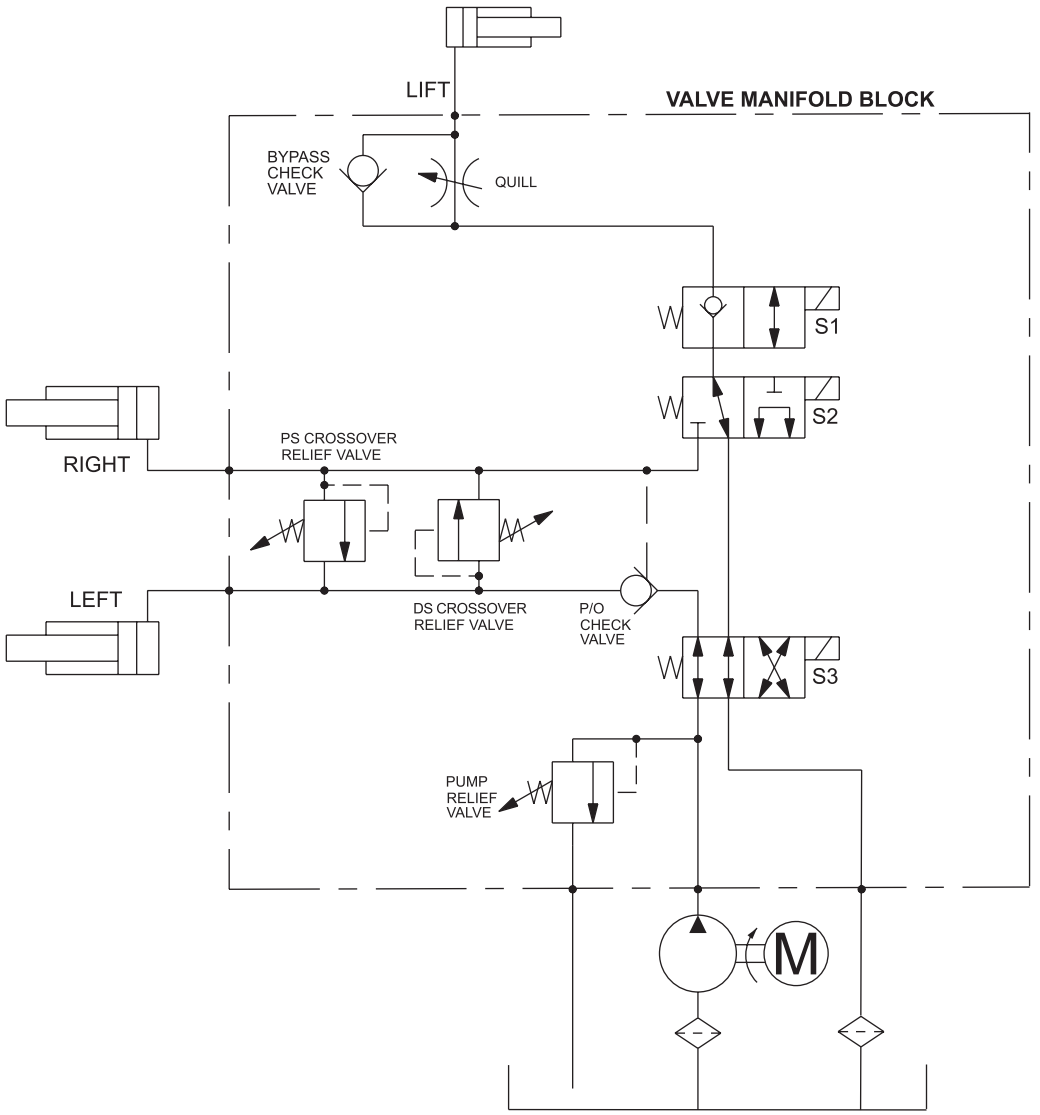


NOTE: References to "left" and "right" are correct for modules located on the driver's side of the vehicle. The reversible turn signal plug must be reversed for passenger-side installations.

2-PLUG SYSTEM — HIGH-BEAM HEADLAMPS WITH SNOWPLOW CONNECTED TO VEHICLE



NOTE: References to "left" and "right" are correct for modules located on the driver's side of the vehicle. The reversible turn signal plug must be reversed for passenger-side installations.



BLADE MOVEMENT		RAISE ↑	LOWER ↓	ANGLE RIGHT	ANGLE LEFT
MOTOR	M	ON		ON	ON
SV08-2004	S1		ON		
SV08-31	S2			ON	ON
SV08-40	S3	ON			ON

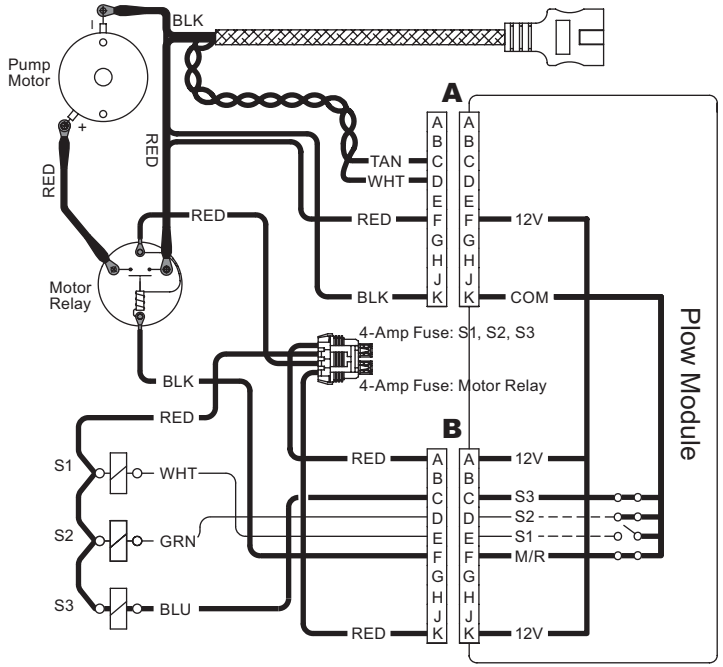
RAISE — ELECTRICAL

System Response

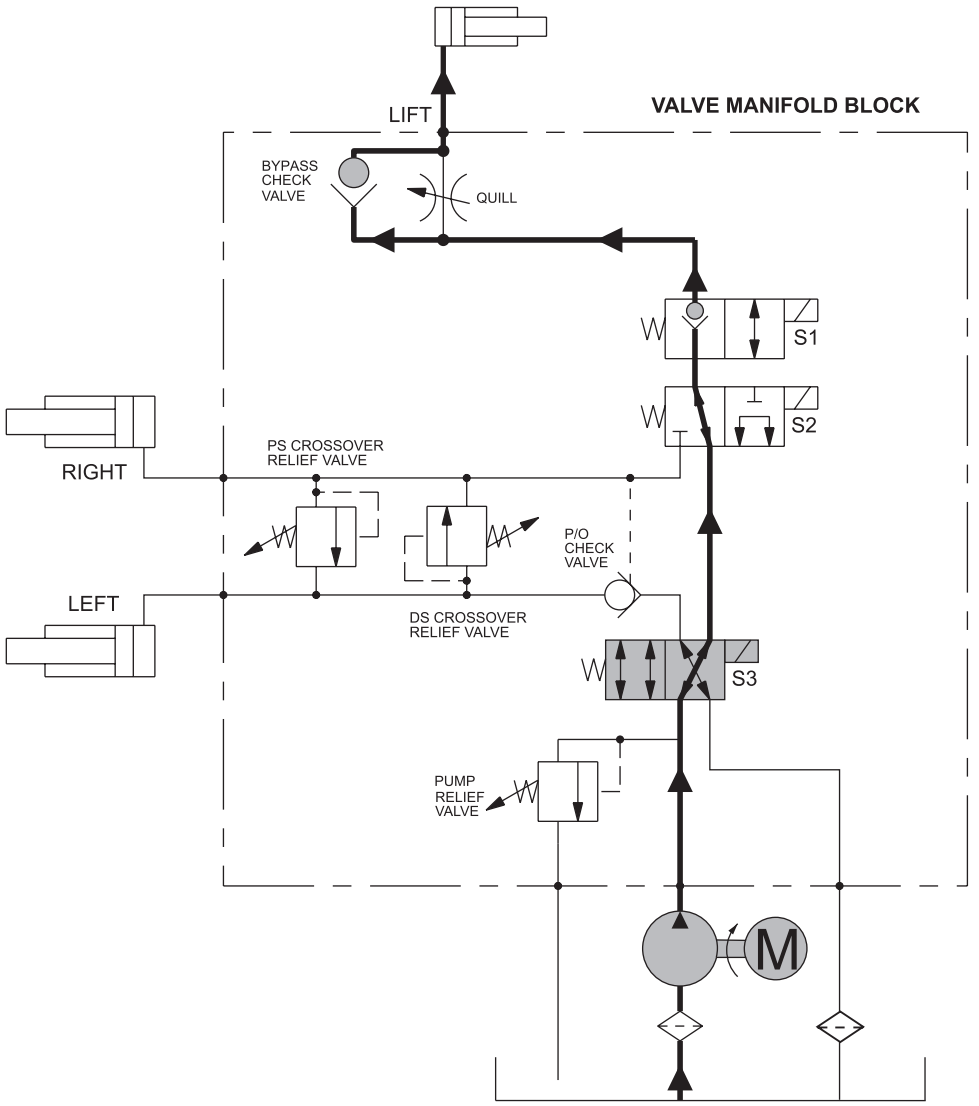
1. By activating the RAISE function on the cab control, the control sends a signal to the Plow Module to complete the **ground path** for the electrical circuit, activating the motor relay and solenoid cartridge valve S3.

2. Hydraulic fluid from the pump flows through the activated S3 and unactivated S2, through the internal check valve in S1, into the rod end of the lift ram, causing it to retract. At the same time, hydraulic fluid is being forced out of the base of the ram, through the scrape lock (RV4) relief valve and returned to the reservoir.

NOTE: Battery voltage is supplied to the plow module, the motor relay and the 3 solenoid coils when the snowplow is connected to the vehicle.



RAISE — HYDRAULIC



BLADE MOVEMENT		RAISE ↑	LOWER ↓	ANGLE RIGHT	ANGLE LEFT
MOTOR	M	ON		ON	ON
SV08-2004	S1		ON		
SV08-31	S2			ON	ON
SV08-40	S3	ON			ON

LOWER/FLOAT — ELECTRICAL

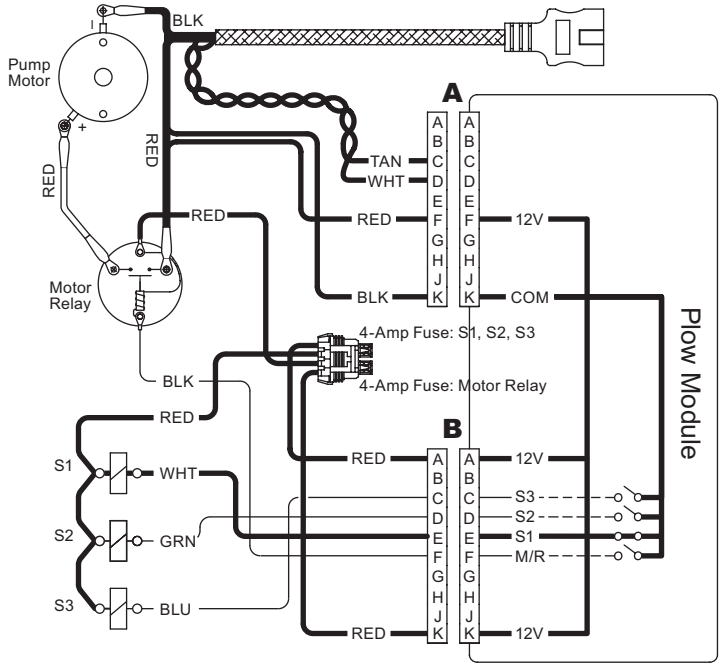
System Response

1. By activating the LOWER function on the cab control, the control sends a signal to the Plow Module to complete the **ground path** for the electrical circuit, activating solenoid cartridge valve S1.

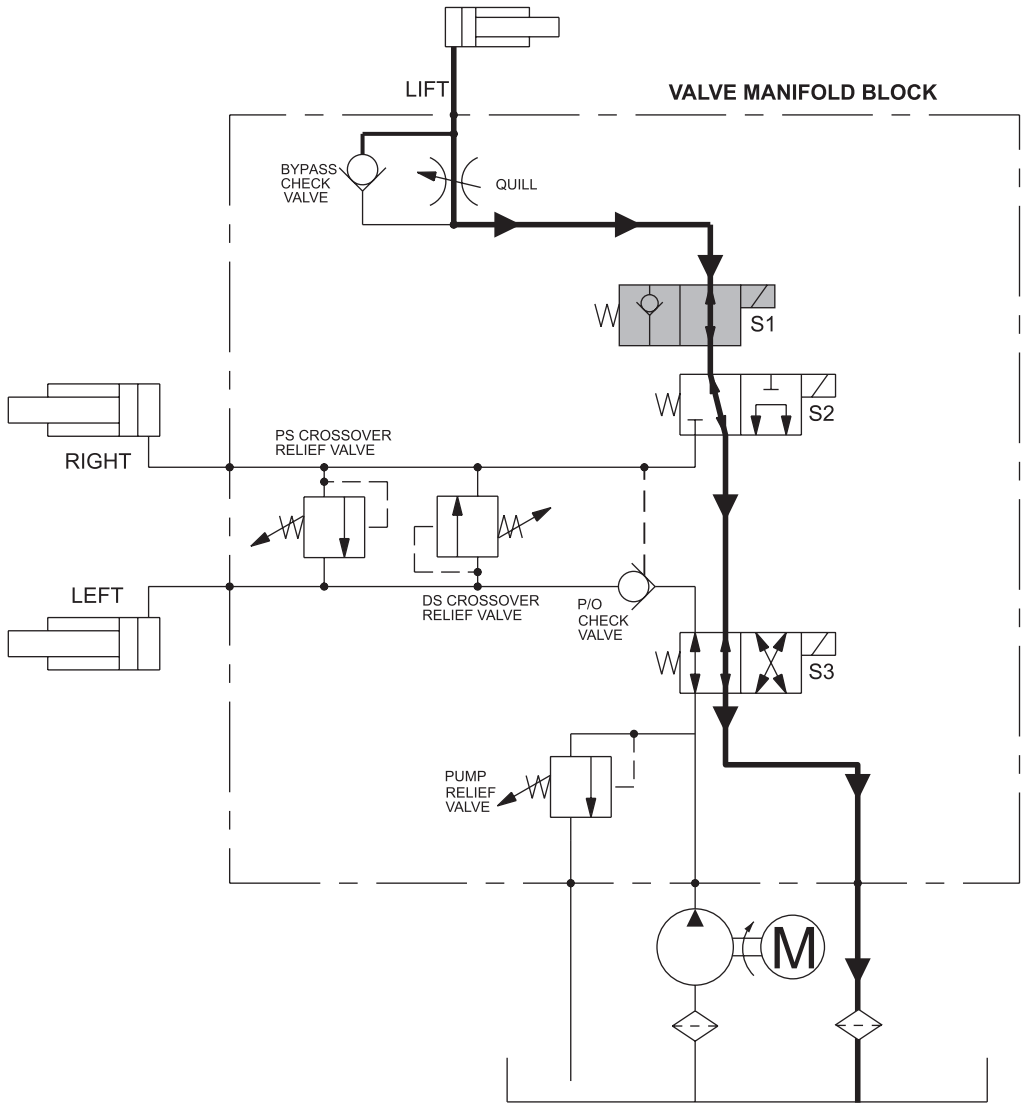
2. With the weight of the snowplow on the rod end of the lift ram and S1 cartridge valve shifted, the lift ram extends. Hydraulic fluid is pushed out of the rod end, through activated S1, unactivated S2 and S3, and back to the reservoir. At the same time, hydraulic fluid is being drawn through CV2 into the base end of the ram from the reservoir.

NOTE: When activating Float mode, the S1 cartridge stays open until the Raise function is activated.

NOTE: Battery voltage is supplied to the plow module, the motor relay and the 3 solenoid coils when the snowplow is connected to the vehicle.



LOWER/FLOAT — HYDRAULIC



BLADE MOVEMENT		RAISE ↑	LOWER ↓	ANGLE RIGHT	ANGLE LEFT
MOTOR	M	ON		ON	ON
SV08-2004	S1		ON		
SV08-31	S2			ON	ON
SV08-40	S3	ON			ON

ANGLE RIGHT — ELECTRICAL

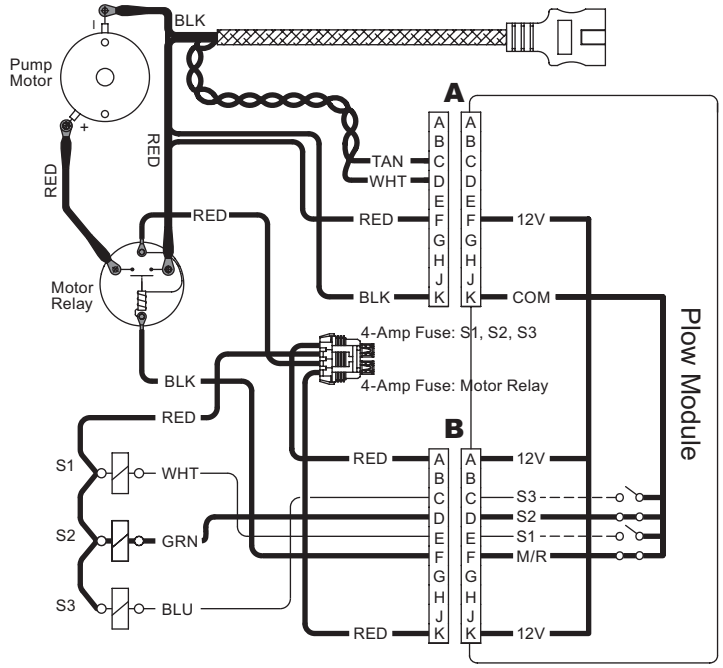
System Response

1. By activating the angle right (R on the control face) function on the cab control, the control sends a signal to the Plow Module to complete the **ground path** for the electrical circuit, activating the motor relay and solenoid cartridge valve S2.

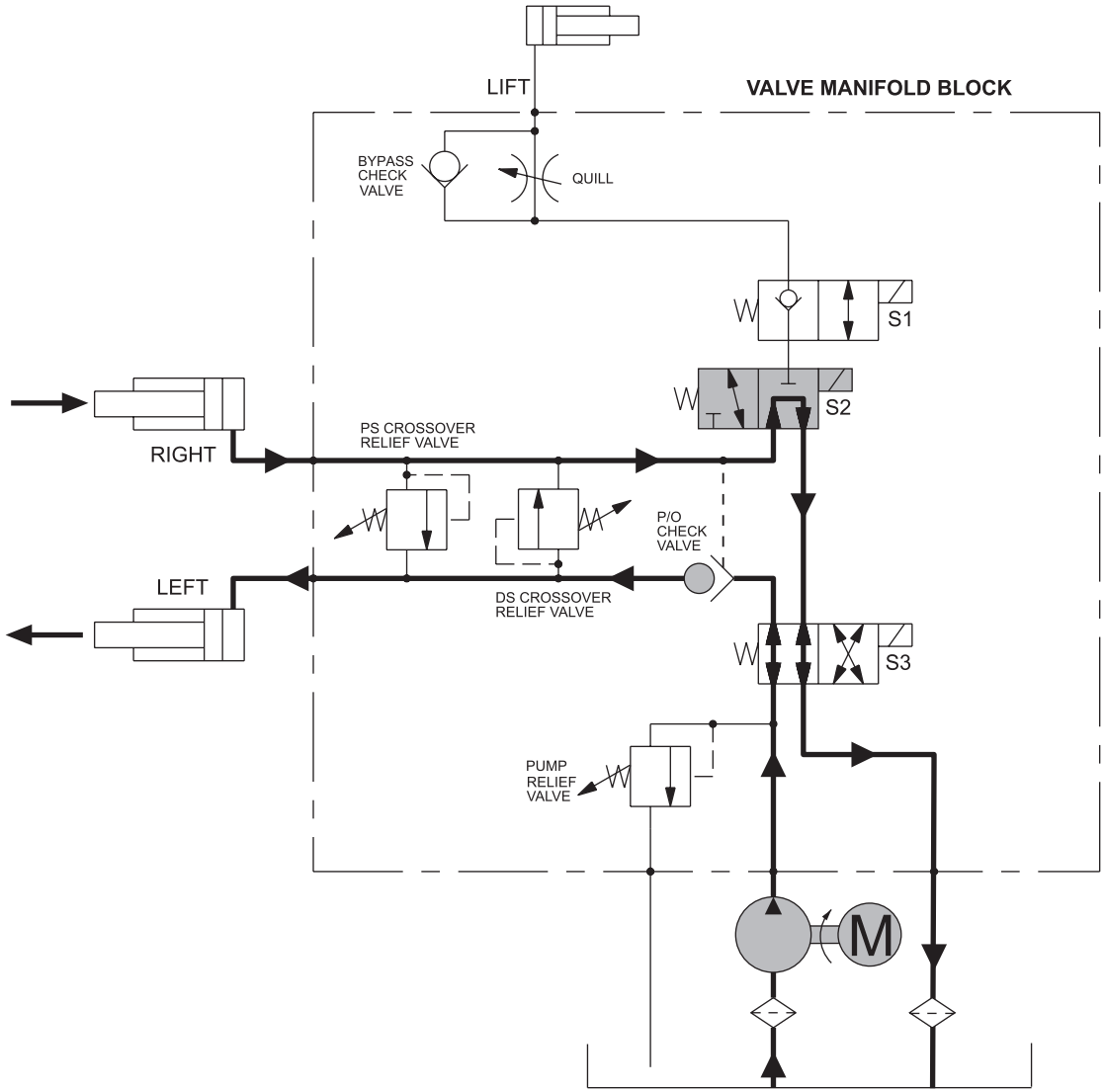
2. Hydraulic fluid from the pump flows through unactivated S3, through PC1, into the base of the DS ram, causing it to extend.

3. The retracting PS ram pushes the hydraulic fluid out of its base end through the activated S2 cartridge and unactivated S3, back to the reservoir.

NOTE: Battery voltage is supplied to the plow module, the motor relay and the 3 solenoid coils when the snowplow is connected to the vehicle.



ANGLE RIGHT — HYDRAULIC



BLADE MOVEMENT		RAISE ↑	LOWER ↓	ANGLE RIGHT	ANGLE LEFT
MOTOR	M	ON		ON	ON
SV08-2004	S1		ON		
SV08-31	S2			ON	ON
SV08-40	S3	ON			ON

ANGLE LEFT — ELECTRICAL

System Response

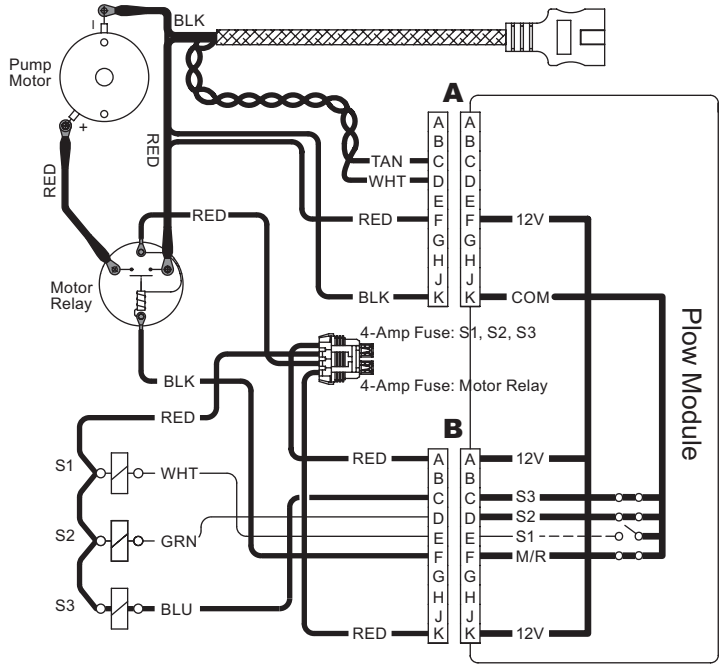
1. By activating the angle left (L on the control face) function on the cab control, the control sends a signal to the Plow Module to complete the **ground path** for the electrical circuit, activating the motor relay and solenoid cartridge valves S2 and S3.

2. Hydraulic fluid from the pump flows through activated S3 and S2 and into the base end of the PS ram, causing it to extend.

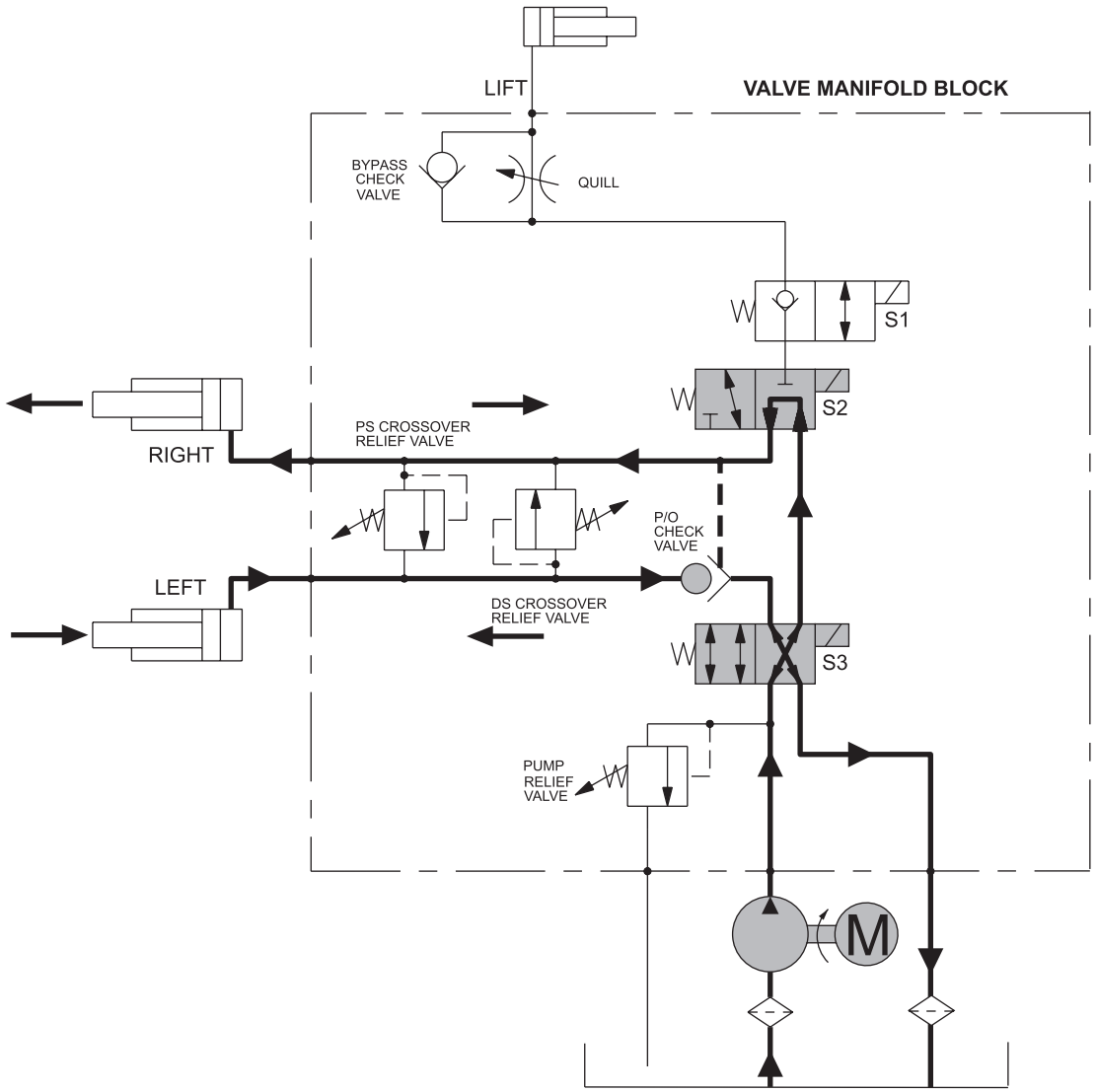
3. Pressure within the hydraulic circuit causes the P/O check valve (PC1) to open.

4. The retracting DS ram pushes the hydraulic fluid out of its base end through the open P/O check valve, through activated S3, and back to the reservoir.

NOTE: Battery voltage is supplied to the plow module, the motor relay and the 3 solenoid coils when the snowplow is connected to the vehicle.



ANGLE LEFT — HYDRAULIC



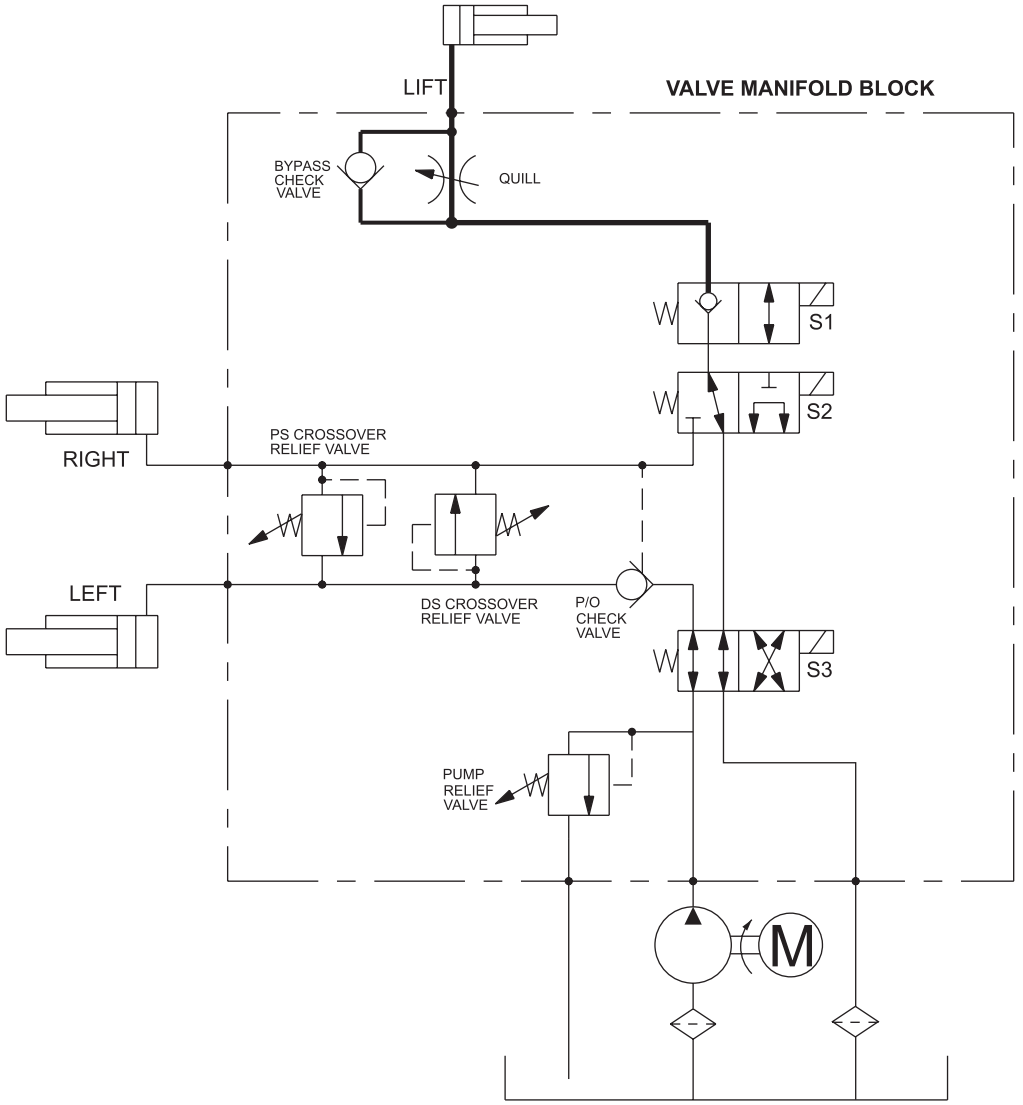
BLADE MOVEMENT		RAISE ↑	LOWER ↓	ANGLE RIGHT	ANGLE LEFT
MOTOR	M	ON		ON	ON
SV08-2004	S1		ON		
SV08-31	S2			ON	ON
SV08-40	S3	ON			ON

HOLD IN RAISE POSITION — HYDRAULIC

Control: None

System Response

Hydraulic fluid is trapped in the rod end of the lift ram by the internal check valve in solenoid cartridge valves S1.



BLADE MOVEMENT		RAISE ↑	LOWER ↓	ANGLE RIGHT	ANGLE LEFT
MOTOR	M	ON		ON	ON
SV08-2004	S1		ON		
SV08-31	S2			ON	ON
SV08-40	S3	ON			ON

STRIKING AN OBJECT WHILE PLOWING (DS)

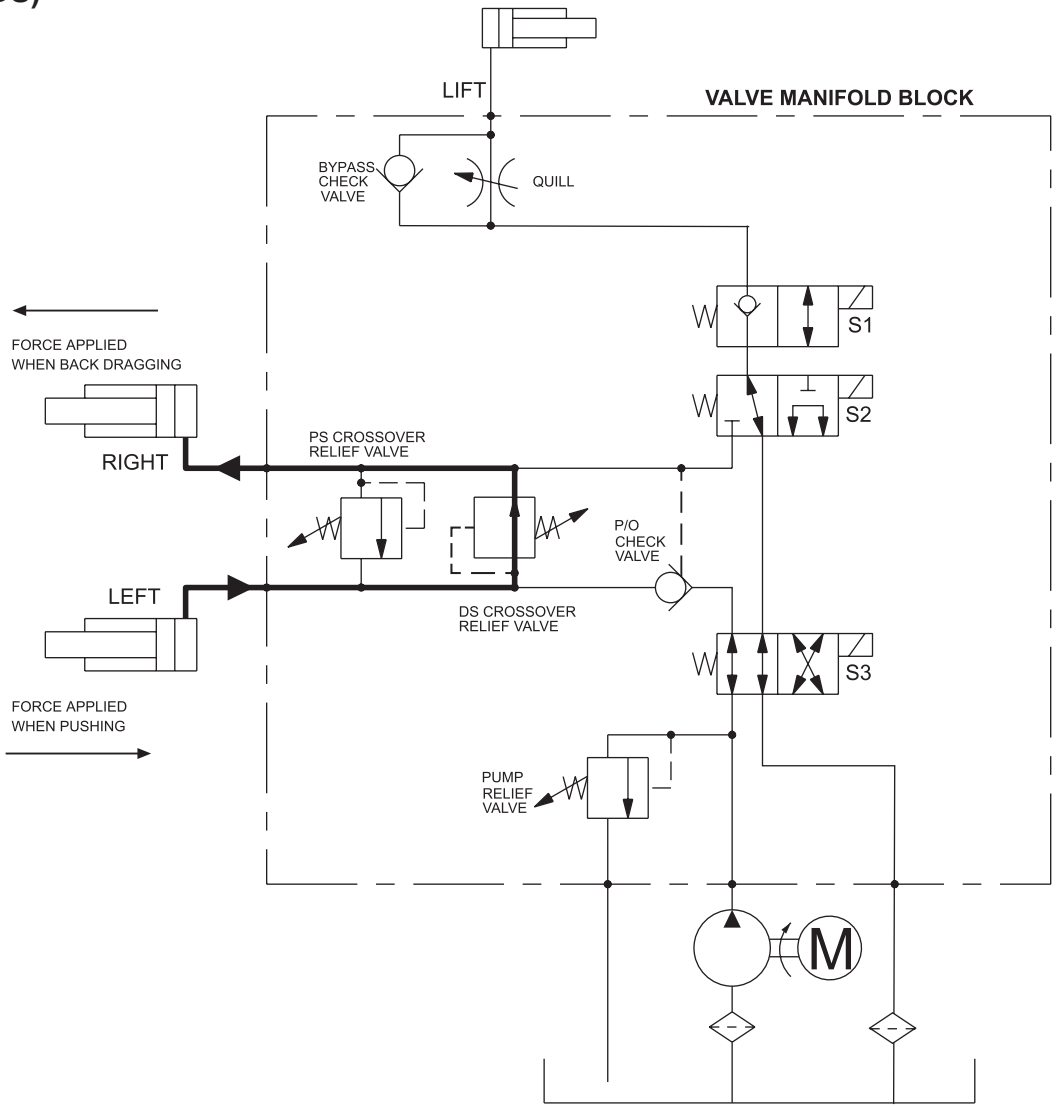
Control: None

System Response

1. Hydraulic fluid is trapped in the base end of the cylinders by the relief valves, the P/O check valve (PC1) and solenoid cartridge valve S2.

2. When the snowplow contacts an object, the force of the impact increases the hydraulic pressure in the base end of the cylinder. When the pressure exceeds the relief valve pressure setting, the relief valve opens allowing oil to flow to the base of the opposite cylinder.

BLADE MOVEMENT		RAISE ↑	LOWER ↓	ANGLE RIGHT	ANGLE LEFT
MOTOR	M	ON		ON	ON
SV08-2004	S1		ON		
SV08-31	S2			ON	ON
SV08-40	S3	ON			ON



STRIKING AN OBJECT WHILE PLOWING (PS)

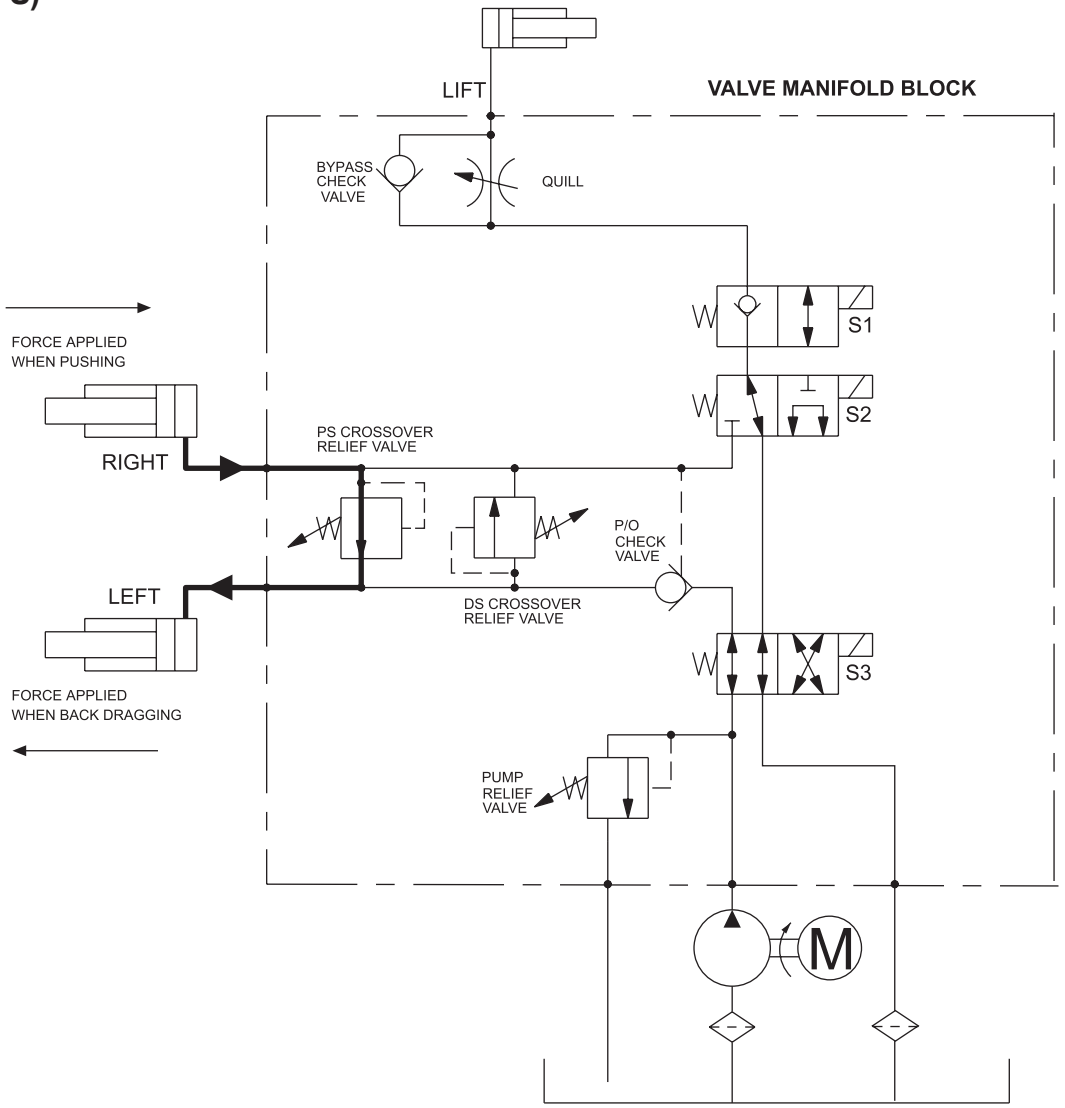
Control: None

System Response

1. Hydraulic fluid is trapped in the base end of the cylinders by the relief valves, the P/O check valve (PC1) and solenoid cartridge valve S2.

2. When the snowplow contacts an object, the force of the impact increases the hydraulic pressure in the base end of the cylinder. When the pressure exceeds the relief valve pressure setting, the relief valve opens allowing oil to flow to the base of the opposite cylinder.

BLADE MOVEMENT		RAISE ↑	LOWER ↓	ANGLE RIGHT	ANGLE LEFT
MOTOR	M	ON		ON	ON
SV08-2004	S1		ON		
SV08-31	S2			ON	ON
SV08-40	S3	ON			ON



Hydraulic Pump Repairs

REPLACING PUMP SHAFT SEALS

Removing Damaged Seals

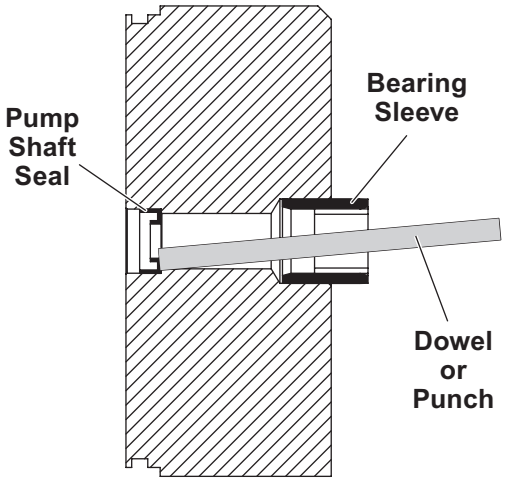
1. Remove the reservoir, pump, pump alignment ring and motor from the hydraulic manifold.

NOTE: Not all hydraulic units use an alignment ring.

⚠ CAUTION

Use care when removing the pump shaft seal. Any damage to the ID of the bearing sleeve or the pump shaft seal bore will degrade the performance and life of your hydraulic system.

2. From the motor side of the manifold, insert a nonmetal dowel or punch. Use a lightweight hammer to gently drive the seal out of the bore.



Inserting New Seals

⚠ CAUTION

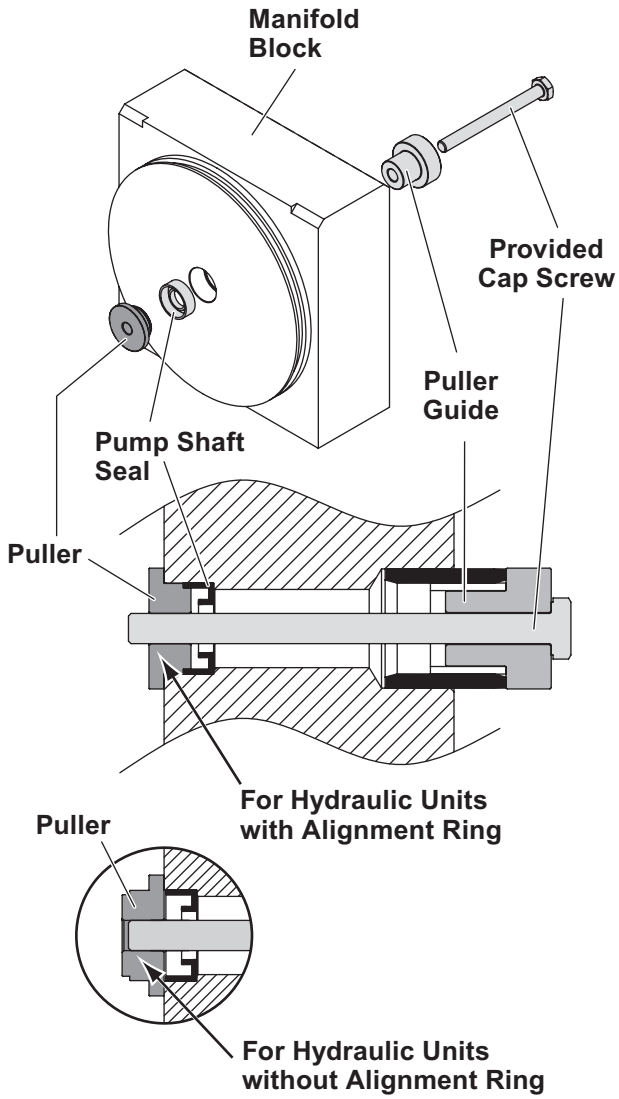
Once this procedure has been completed, make sure that the pump shaft seal hasn't been damaged before reassembling the hydraulic unit.

1. After the damaged pump shaft seal has been removed, install the new pump shaft seal onto the puller as shown, and place it into the bore on the reservoir side of the manifold block.

2. Install the puller guide onto the supplied cap screw, and hand turn the cap screw into the puller from the motor side of the manifold.

3. Turn the cap screw into the puller until the puller contacts the manifold block.

4. Remove the cap screw, puller and puller guide.



Excerpted from Pump Shaft Seal Repair Kit Service Literature (Lit. No. 28855, Rev. 01).

PUMP INSTALLATION AND ALIGNMENT

1. Place the pump alignment ring into the pump shaft seal bore of the manifold.

NOTE: Not all hydraulic units use an alignment ring.

2. Install the pump shaft seal bullet onto the tang of the pump shaft.

3. Generously coat the bullet and pump shaft with the recommended hydraulic fluid, and insert the pump shaft into the manifold block.

4. Remove the pump shaft bullet, and install the pump fasteners, but do not tighten.

⚠ CAUTION

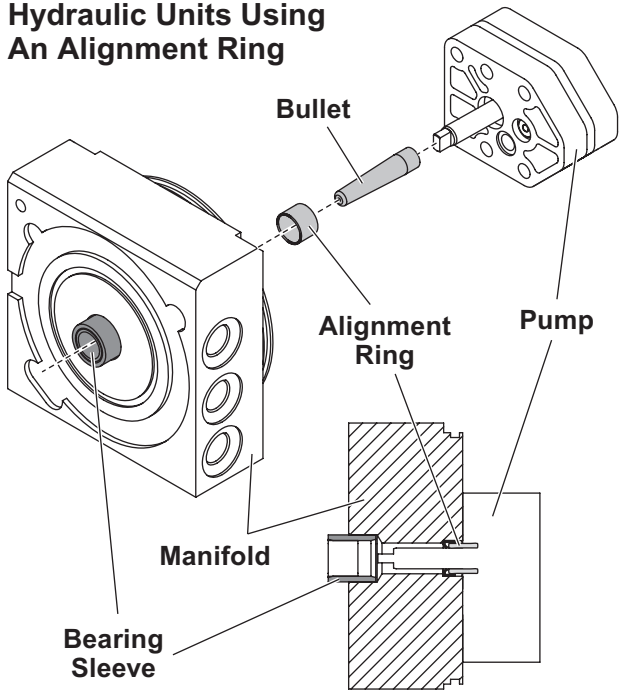
If the OD of the alignment tool is marred, it will damage the motor bearing sleeve. Store the tool in the supplied rubber tubing.

5. **For hydraulic units using an alignment ring:** Alternately tighten the pump fasteners to 150–160 in-lb.

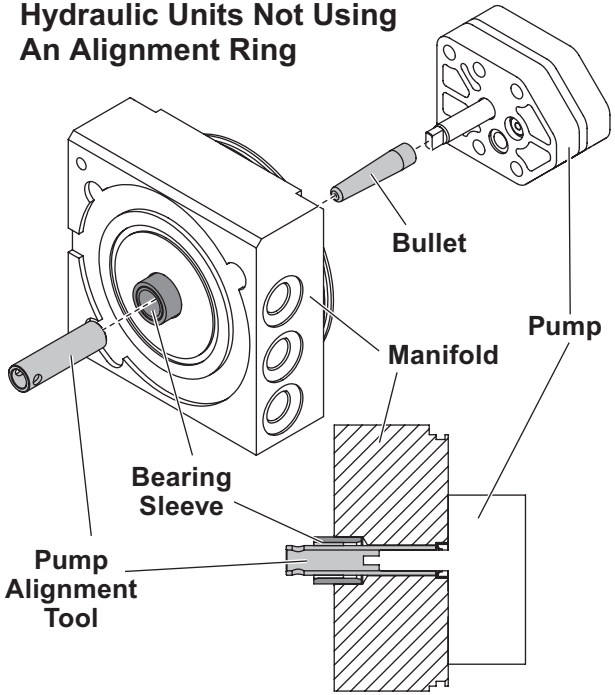
   For hydraulic units not using an alignment ring: Insert the pump alignment tool into the bearing sleeve and over the pump shaft. With the alignment tool in place, alternately tighten the pump fasteners to 150–160 in-lb, then remove the pump alignment tool.

NOTE: Refer to the information on the following page for hydraulic assembly information.

Hydraulic Units Using An Alignment Ring

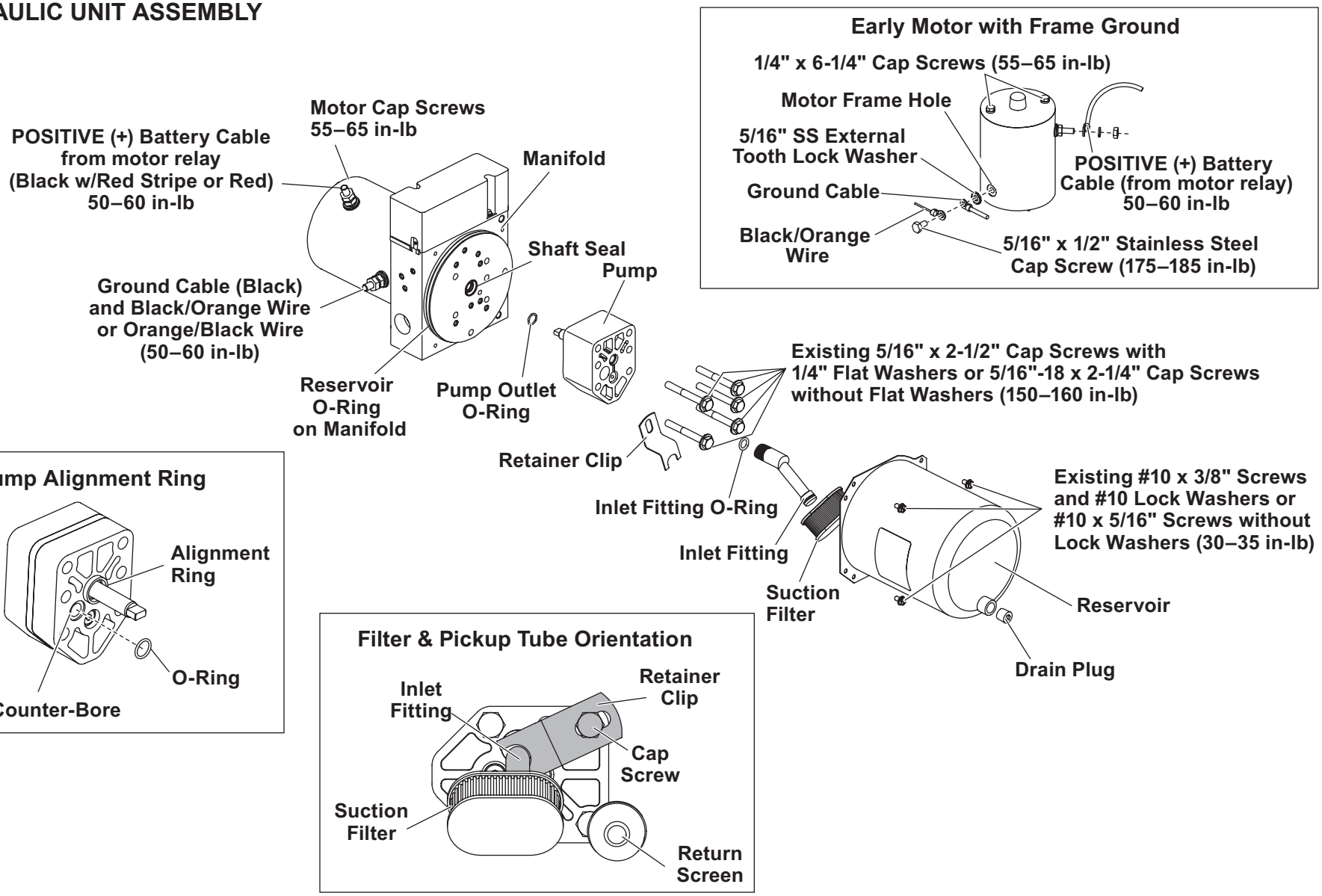


Hydraulic Units Not Using An Alignment Ring



Excerpted from Pump Shaft Seal Repair Kit Service Literature (Lit. No. 28855, Rev. 01).

HYDRAULIC UNIT ASSEMBLY



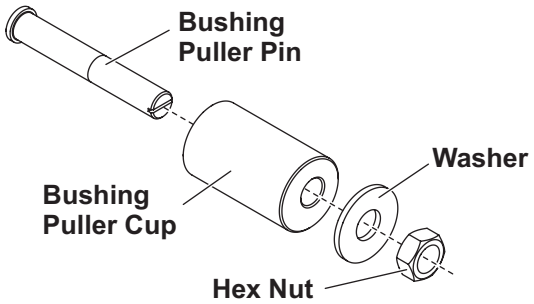
Adapted from Pump Shaft Seal Repair Kit Service Literature (Lit. No. 28855, Rev. 01).

REPLACING DAMAGED BEARING SLEEVES (Bearing Sleeve Repair Kit PN 64589)

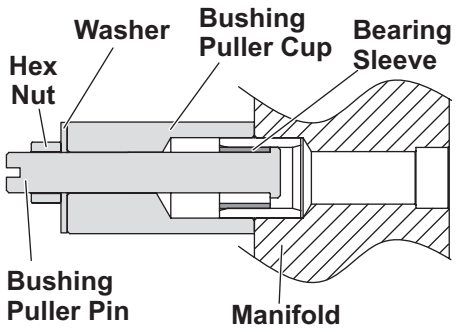
Remove Damaged Bearing Sleeve

1. Remove the reservoir, pump, and motor from the hydraulic manifold.

2. Insert the bushing puller pin into the bore end of the bushing puller cup, install the washer, and hand turn the hex nut onto the pin 2 to 3 full rotations.



3. Insert the head of the puller pin into the bearing sleeve.



4. Turn the hex nut onto the bushing puller pin until the underside of the pin head is snug against the end of the bearing sleeve.

5. With a box wrench, slowly turn the hex nut until the bearing sleeve is removed from the aluminum bushing in the manifold. Use a flathead screwdriver in the bushing puller pin slot to keep it from rotating during the removal of the bearing sleeve.

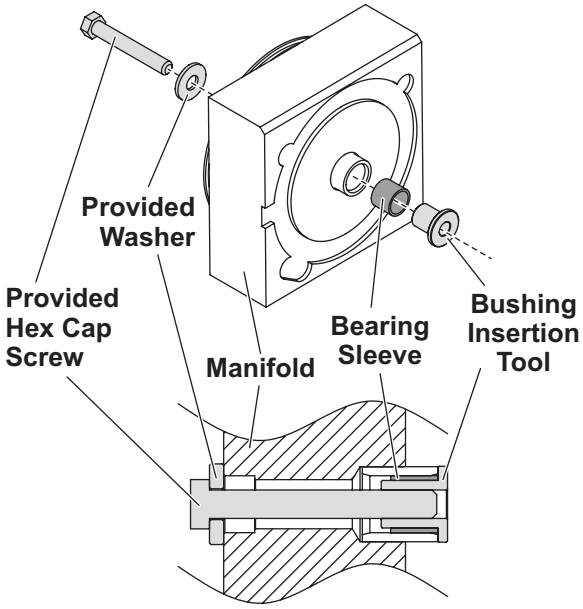
Insert New Bearing Sleeve

1. After the damaged bearing sleeve has been removed, install the new bearing sleeve onto the bushing insertion tool as shown, and place it into the chamfer of the aluminum bushing in the manifold.

2. Install the supplied washer onto the supplied hex cap screw, and hand turn the cap screw into the bushing insertion tool from the pump side of the manifold.

3. Turn the cap screw into the insertion tool until the insertion tool contacts the aluminum bushing.

4. To remove the insertion tool, turn the cap screw 3 full turns counterclockwise, then lightly tap with a hammer. Repeat until the insertion tool is free from the bearing sleeve.



NOTE: Once this procedure has been completed, make sure that the pump shaft seal hasn't been damaged before reassembling the hydraulic unit.

NOTE: The bushing insertion tool sizes the ID of the bearing sleeve. Store the tool in the supplied bushing to prevent damage.

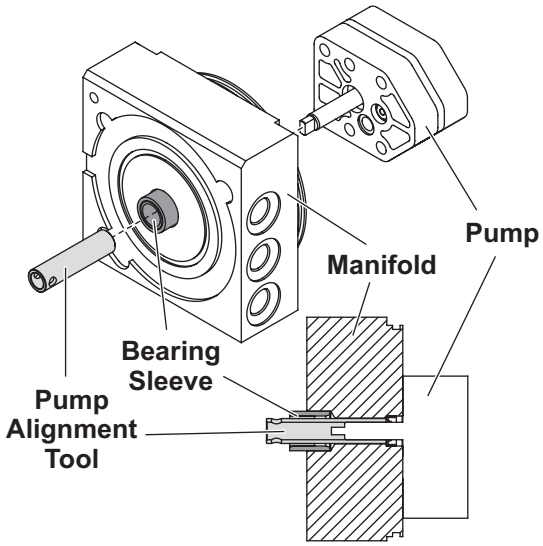
Excerpted from Motor Bearing Sleeve Repair Kit Service Literature (Lit. No. 64595, Rev. 02).

Pump Alignment

NOTE: The hydraulic pump may contain a .75" OD alignment ring that fits in a counter-bore around the shaft. This pump alignment procedure is necessary only for hydraulic pumps that do *not* utilize this alignment ring (as in the illustration) or if the alignment ring has been lost.

1. After the new bearing sleeve has been inserted, install the pump and pump fasteners, but do not tighten them yet.
2. Insert the pump alignment tool into the bearing sleeve and over the pump shaft.
3. With the pump alignment tool in place, alternately tighten the pump fasteners to 150–160 in-lb.
4. Remove the pump alignment tool.

NOTE: If the surface of the alignment tool is marred, it will damage the motor bearing sleeve. Store the tool in the supplied rubber tubing to prevent damage.



Excerpted from Motor Bearing Sleeve Repair Kit Service Literature (Lit. No. 64595, Rev. 02).

Troubleshooting

HOW TO USE THIS TROUBLESHOOTING GUIDE

All malfunctions of a snowplow can be categorized as structural, electrical or hydraulic. Structural issues are generally related to the blade, A-frame, lift frame and mount components, and are usually easily identified by visual inspection. However, electrical and hydraulic issues can be difficult to trace.

Read and understand the Theory of Operation section of this manual before attempting to troubleshoot.

Because of the relative complexity of the snowplow electrical and hydraulic systems, some conditions must be met in order to develop valid tests. *If the listed conditions are not met, the procedure can result in inaccurate results and wasted time.*

Troubleshooting Procedure

1. Go to "Before You Begin" (next page) and satisfy the listed conditions. These conditions ***must*** be met before proceeding to the troubleshooting tables and performing any tests. In many cases, satisfying the listed conditions alone solves the problem.

2. If a lighting problem exists, proceed to the relevant troubleshooting tables for vehicle headlamps, snowplow headlamps, snowplow park/turn lamps, or snowplow DRLs. Each table presents a list of basic test questions and solutions to common problems.

3. If the problem is not related to the headlamps, park/turn lamps or DRLs, skip the lighting system troubleshooting pages and go to the hydraulic system troubleshooting pages.

4. Follow along sequentially through the tables and tests, referring to the Hydraulic & Electrical Schematics and System Overview sections of this manual as needed.

ELECTRICAL TESTING

Read and understand the electrical circuit operation information in the Theory of Operation section. A simple 12-volt (12V) test light with a ground lead can be used for circuit testing in most cases. The exception is the paired multiplex wiring, which carries a low-level signal from the control to the Plow Module. In this case, an ohmmeter may be used to check continuity.

When directed to check for 12V, ground the test lamp lead and probe the terminal. When asked to check for ground, attach the test lamp lead to +12V and probe the terminal.

NOTE: 12V is a nominal value. If using a voltmeter, actual voltage will vary with the vehicle and presence of loads in tested circuits. Continuity alone does not guarantee a good circuit. Poor connectors or damaged wires may have continuity but be unable to carry sufficient current.

BEFORE YOU BEGIN

Before proceeding, or carrying out any tests, you *must* perform the following steps:

1. **Verify** that the customer has accurately and completely described the problem. **Observe** all lighting and snowplow functions.

2. **Check the obvious**, to confirm that:

   a. The snowplow is attached to the vehicle and all harnesses are connected.

   b. The ignition is turned ON (or the engine is running, if operating the control from within the cab).

   c. The control is connected in the cab and turned ON. The control power LED is in a steady state and is not flashing.

   d. The fuses are good.

   e. The vehicle battery and charging system are in good condition, and battery connections are clean and tight.

   f. Harness connector pins and terminals are free of corrosion, ensuring good connections, and coated with dielectric grease.

⚠ CAUTION

Fill the reservoir to the fill level only. Do not overfill. Overfilling could damage the unit.

⚠ CAUTION

Do not mix different types of hydraulic fluid. Some fluids are not compatible and may cause performance problems and product damage.

   g. The hydraulic reservoir is filled to the proper level with recommended fluid when the lift ram is fully retracted. (See "FloStat® Hydraulic System" in the Product Specifications section of this manual.)

   h. There are no fluid leaks from hoses, fittings, rams or the hydraulic unit.

   i. All hoses are routed correctly.

   j. Coil wire connections are secure and correct.

   k. Correct cartridges are installed in the proper locations.

VEHICLE HEADLAMPS

Incorrect Operation or No Headlamps

	BASIC CHECK QUESTIONS	SOLUTIONS
1	DRL mode/automatic headlamp function	Fully understand OEM headlamp operation; refer to vehicle owner's manual.
2	Correct Isolation Module kit installed for application	Verify per Quick Match at *www.westernplows.com*.
3	OEM lights operating correctly prior to installation	OEM headlamps must be fully operational for correct Isolation Module operation.
4	OEM fuse tests good	Replace with proper fuse.
5	OEM headlamp bulb operational	Replace with proper bulb.
6	Plugged into OEM headlamp correctly	Connect per Isolation Module Installation Instructions.
7	Harnesses in correct location at Isolation Module and installed per Installation Instructions	Install using Isolation Module Installation Instructions.
8	Harnesses configured correctly for HB-1/HB-5 and/or kits using adapters	Install using Isolation Module Installation Instructions.
9	Correct harnesses and/or Isolation Module in kit	Refer to Isolation Module Parts List.
10	Harness wired per drawing	See electrical schematics in this guide.
11	Verify that power and ground are in proper pin locations at Isolation Module	See electrical schematics in this guide.
12	Verify that power and ground are in proper pin locations to vehicle headlamp	See electrical schematics in this guide.

SNOWPLOW HEADLAMPS

Incorrect Operation or No Headlamps

	BASIC CHECK QUESTIONS	SOLUTIONS
1	Automatic headlamp function	Fully understand OEM headlamp operation; refer to vehicle owner's manual.
2	All harnesses connected at vehicle and snowplow	Harnesses must be connected for all snowplow and headlamp functions.
3	Corrosion at harness connectors	Replace as needed.
4	Ignition ON	Ignition switch or vehicle park lights must be ON for snowplow headlamps to operate.
5	Control powers up with key ON	Go to **Control/Cable/Plow Module Test**.
6	Correct Isolation Module kit installed for application	Verify per Quick Match at *www.westernplows.com*.
7	OEM lights operating correctly prior to installation	OEM headlamps must be fully operational for correct Isolation Module operation.
8	OEM fuse tests good	Replace with proper fuse.
9	Bulb burned out	Replace with proper bulb.
10	Plugged into OEM headlamp correctly	Connect per Isolation Module Installation Instructions.
11	Harnesses in correct location at Isolation Module and installed per Installation Instructions	Install using Isolation Module Installation Instructions.
12	Harnesses configured correctly for HB-1/HB-5 and/or kits using adapters	Install using Isolation Module Installation Instructions.
13	Correct harnesses and/or Isolation Module in kit	Refer to Isolation Module parts list.
14	Harness wired per drawing	See electrical schematics in this guide.
15	Verify that power and ground are in proper pin locations at Isolation Module	See electrical schematics in this guide.
16	Verify that power and ground are in proper pin locations to vehicle headlamp	See electrical schematics in this guide.

SNOWPLOW PARK/TURN LAMPS*

Incorrect Operation or No Park/Turn Lamps

	BASIC CHECK QUESTIONS	SOLUTIONS
1	OEM park/turn lamps working	Refer to vehicle owner's manual for fuse location and size.
2	All harnesses connected at vehicle and snowplow	Harnesses must be connected for all snowplow and headlamp functions.
3	Corrosion at harness connectors	Replace as needed.
4	Ignition ON	Ignition must be ON for snowplow turn lamps to operate.
5	Control powers up with key ON	Go to **Control/Cable/Plow Module Test.**
6	Spliced into OEM park/turn circuit correctly	Refer to Isolation Module Installation Instructions.
7	Harnesses in correct location at Isolation Module and installed per Installation Instructions	Install using Isolation Module Installation Instructions.
8	Harness wired per drawing	See electrical schematics in this guide.
9	Verify that power and ground are in proper pin locations at Isolation Module	See electrical schematics in this guide.
10	Verify that power and ground are in proper pin locations to vehicle headlamp	See electrical schematics in this guide.
11	Bulb burned out	Replace with proper bulb.

* Some applications may use the turn circuit for DRLs.

SNOWPLOW DRL LAMPS*

Incorrect Operation or No DRL Lamps

	BASIC CHECK QUESTIONS	SOLUTIONS
1	Fully understand OEM DRL operation	Refer to vehicle owner's manual for DRL operation.
2	OEM headlamps and DRLs operating correctly	OEM headlamps must be fully operational for correct Isolation Module operation.
3	OEM DRL fuse tests good	Refer to vehicle owner's manual for fuse location and size.
4	All harnesses connected at vehicle and snowplow	Harnesses must be connected for all snowplow and headlamp functions.
5	Corrosion at harness connectors	Replace as needed.
6	Ignition ON	Ignition must be ON for snowplow DRL operation.
7	Does control power up with key ON	Go to **Control/Cable/Plow Module Test.**
8	Snowplow headlamp and park/turn lamps all working correctly	See electrical schematics in this guide.
9	Correct Isolation Module kit installed for application	Verify per Quick Match at *www.westernplows.com*.
10	Isolation Module and harnesses correctly installed per Installation Instructions	Refer to Isolation Module Installation Instructions.
11	Harness wired per drawing	See electrical schematics in this guide.
12	Bulb burned out	Replace with proper bulb.

* Snowplow DRLs operate as a series circuit and will illuminate bulb at half-intensity. In some applications, the OEM DRLs will stay illuminated with snowplow attached. See Theory of Operation section for DRL operation.

VEHICLE LIGHTING CHECK

1. Verify the operation of all vehicle front lighting prior to connecting the snowplow harness.

2. Check the operation of the snowplow lights with snowplow mounted to vehicle and all harnesses connected.

   Turn signals and parking lamps

   Parking lamps ON:
   - Both vehicle and snowplow parking lamps should be ON at the same time.

   Driver-side turn signal ON:
   - Both vehicle and snowplow driver-side turn signal lamps should flash at the same time.

   Passenger-side turn signal ON:
   - Both vehicle and snowplow passenger-side turn signal lamps should flash at the same time.

   Headlamps

   Move the vehicle headlamp switch to the "ON" position. Connecting and disconnecting the snowplow lighting harness plug should switch the lights between vehicle and snowplow as follows:

   Snowplow lighting harness DISCONNECTED:
   - Vehicle headlamps should be ON.
   - Snowplow headlamps should be OFF.

   Snowplow lighting harness CONNECTED:
   - Snowplow headlamps should be ON.
   - Vehicle headlamps should be OFF.

   The dimmer switch should toggle the headlamps between high and low beams. The high beam indicator on the dash should light when headlamps are placed in high beam.

   Daytime Running Lamps (DRLs)

   An operational check of the vehicle and snowplow DRLs will depend on the vehicle model and DRL system.

   With headlamp switch OFF, activate the vehicle DRLs.

   Snowplow lighting harness DISCONNECTED:
   - Vehicle DRLs should be ON.
   - Snowplow headlamps should be OFF.

   Snowplow lighting harness CONNECTED and vehicle in DRL mode:
   - Check snowplow DRL function per type of Isolation Module installed.

   Joystick Control or CabCommand Hand-Held Control

   The snowplow plugs **do** need to be connected to the vehicle harness connectors. The control power indicator light should light whenever the control ON/OFF switch and the ignition (key) switch are both in the "ON" position.

3. Connect all snowplow and vehicle harnesses. Raise the snowplow and aim the snowplow headlamps according to the Snowplow Headlamp Beam Aiming instructions included with the headlamps, and any state or local regulations.

4. Check the aim of the vehicle headlamps with the snowplow removed.

> **⚠ CAUTION**
>
> **On 2-plug electrical systems, plug covers shall be used whenever snowplow is disconnected. Vehicle Battery Cable is 12-volt unfused source.**

5. When the snowplow is removed from the vehicle, install plug covers on the vehicle battery cable and lighting harness. Insert the snowplow battery cable and lighting harness into the cable boot on the snowplow.

Excerpts taken from PRO PLUS® Snowplow Installation Instructions (Lit. No. 43184, Rev. 00).

CARTRIDGE COIL ACTIVATION TEST

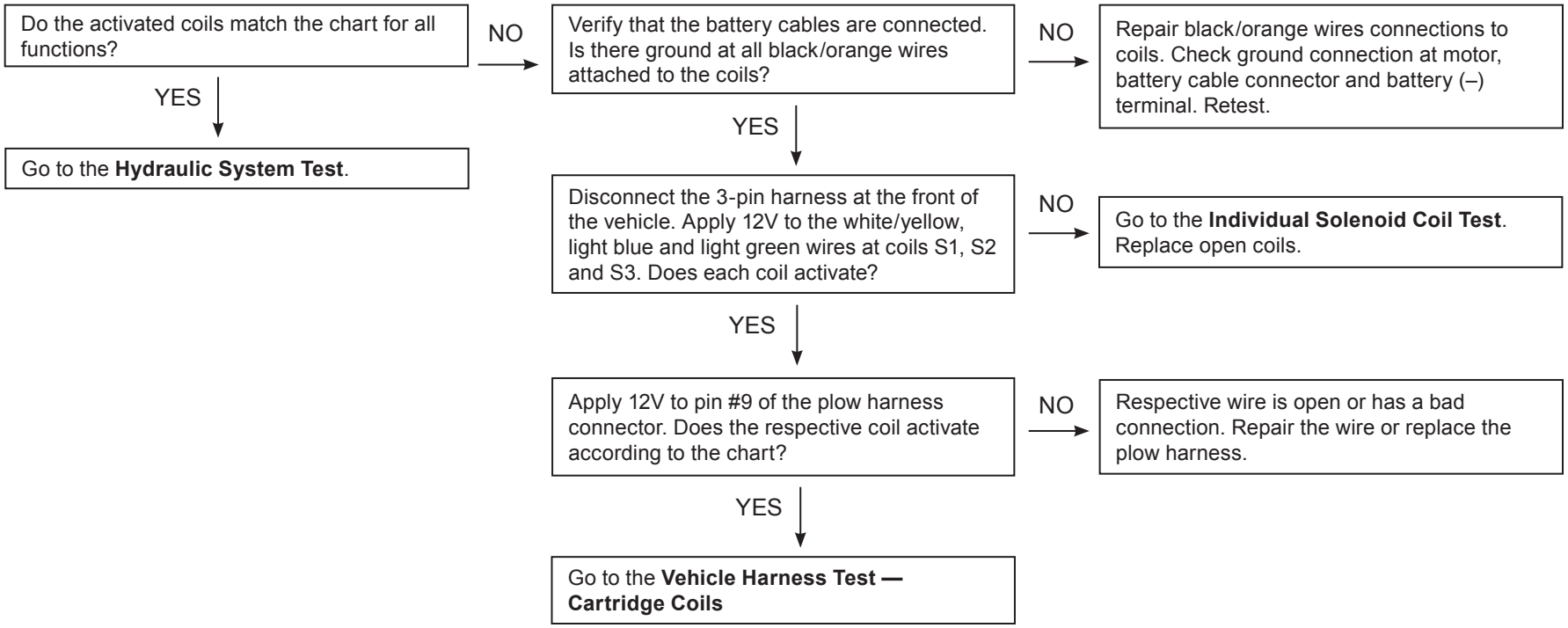
1. Disconnect the black/red (+) battery cable from the motor and isolate it.
2. Remove the solenoid valve cover.
3. Verify that the wires are properly attached to the solenoid coils as specified the Wire Connection Table on this page. Also refer to the Electrical and Hydraulic Schematics section of this guide and the FloStat Hydraulic Unit Components illustration in the Hydraulic System Overview section.
4. Activate the control for each function and check for magnetic pull at all three solenoid valve coils. Only the coils designated as "ON" in the Wire Connection Table should activate for each function. After noting which coils are energized, proceed to the flow chart below.

Wire Connection Table – Cartridge Coil Wiring and Activation

Solenoid Coil	Plow Harness Pin	Wire Color	Angle Right	Angle Left	Raise	Lower
S1 (2-way)	9	White/ Yellow	*	*	*	ON
S2 (3-way)	4	Light Green	ON	ON		
S3 (4-way)	3	Light Blue		ON	ON	

* S1 output will be ON for all functions if the control is in FLOAT. Activate the RAISE function to cancel FLOAT.

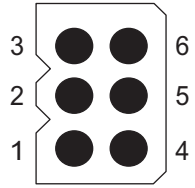
Hand-Held Control Only: While in FLOAT, pressing and holding the RIGHT or LEFT button will turn off the solenoid cartridge valve S1 until the button is released.



VEHICLE HARNESS TEST — CARTRIDGE COILS

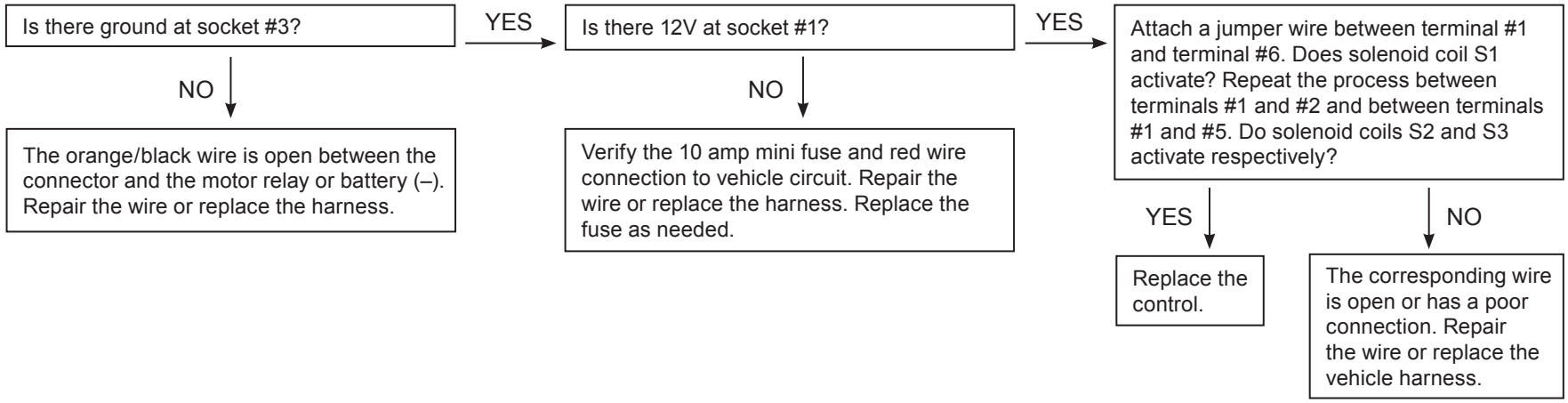
1. Disconnect the black/red (+) battery cable from the motor and isolate it.
2. Perform the **Cartridge Coil Activation Test** on preceding page.
3. Connect all harness connectors at the front of the vehicle.
4. Refer to the 6-Pin Connector diagram for socket location.

White 6-Pin Connector on vehicle harness, located in cab (end view)



(sockets)

Pin #	Wire Color
1	Red/Yellow
2	Lt Green
3	Orange/Black
4	Brown/Red
5	Lt Blue
6	White/Yellow



SOLENOID COIL ACTIVATION TEST (SCAT) — Snowplows with FLEET FLEX Electrical System

NOTE: See the Controls section for details on control time-outs and blade functions.

The main purpose of the SCAT test is to narrow down a problem as either being electrical or hydraulic. Follow the steps below to diagnose the problem, then go to the appropriate test as directed.

1. Verify that harness B is properly attached to the solenoid coils. Refer to the labels on the hydraulic unit and the electrical schematics in this guide for details.

2. Install the Diagnostic Harness (PN 29290-1) according to the instructions on the following pages.

NOTE: The 29290-1 Diagnostic Harness Kit can be used with or without the snowplow connected to a vehicle. Follow the appropriate instructions for each testing situation.

3. When instructed to do so, perform the SCAT test by activating the control for each function and checking for magnetic pull at all three solenoid coils. A solenoid coil is magnetized if a screwdriver held nearby is attracted.

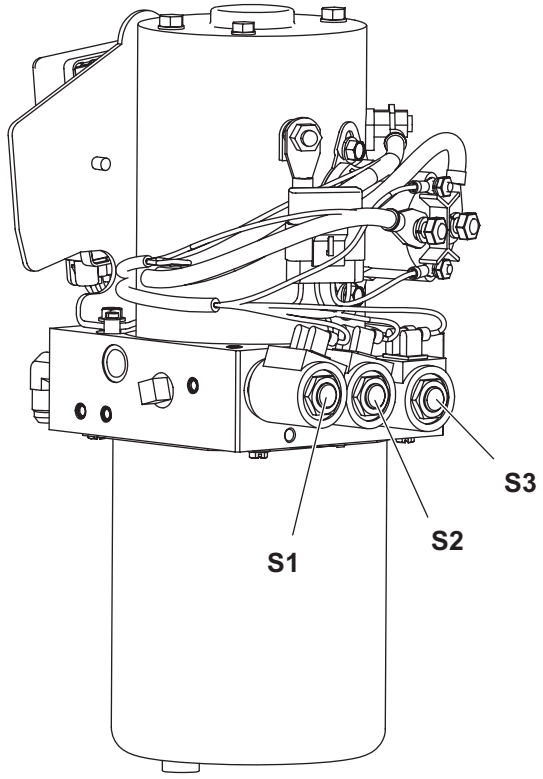
4. Compare the SCAT test results with the testing charts on the following pages.

5. If the motor relay LED is not activating when it should, go to the **Motor and Motor Relay Test**.

6. If one or more coils are not magnetizing when they should be, you have an electrical problem. Using a test light, check the ground wires (not red) attached to the improperly acting coil(s) for switched ground while activating the function that should energize the coil(s). If switched ground is not present, go to the **Control/ Cable/Plow Module Test**. If switched ground is present, go to the **Individual Solenoid Coil Test**.

7. If the motor relay and all coils are working properly, you have a hydraulic problem. Go to the **Hydraulic System Test**.

Solenoid Coils



SOLENOID COIL ACTIVATION TEST (SCAT), continued

⚠ WARNING

Lower the blade when the vehicle is parked. Temperature changes could change hydraulic pressure, causing the blade to drop unexpectedly or damaging hydraulic components. Failure to do this could result in serious personal injury.

On-Truck Testing

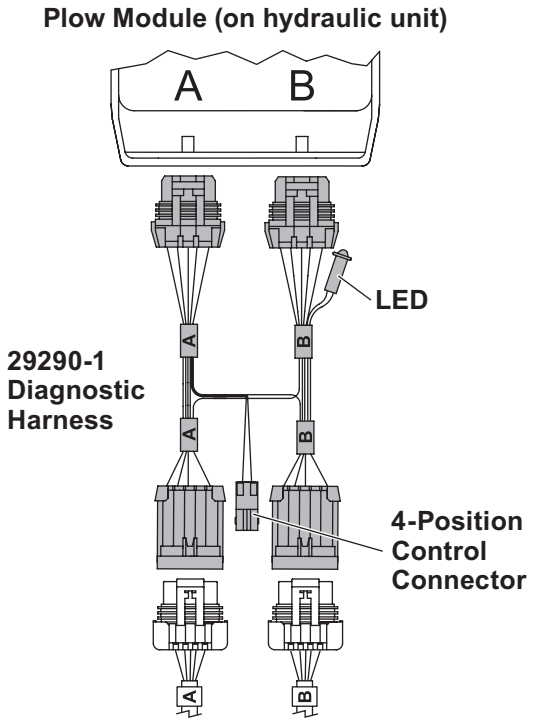
Remove the vehicle ignition key and put the vehicle in park or in gear to prevent others from starting the vehicle during testing.

1. Disconnect the snowplow and vehicle battery cables, then remove the hydraulic unit covers.

2. Unplug the snowplow connectors from ports A and B of the Plow Module.

3. Connect the diagnostic harness connectors A and B to the matching ports on the Plow Module (A to A and B to B).

4. Plug the connectors removed from the Plow Module into the matching connectors on the diagnostic harness (A to A and B to B).



5. Connect the snowplow control to the 4-position control connector either in the cab of the vehicle or on the diagnostic harness.

6. Reconnect the snowplow and vehicle battery cables.

NOTE: If you connect the control inside the cab of the vehicle, the engine does not need to be running, but the vehicle ignition key must be turned to the "ON" position before proceeding. If you connect the control to the diagnostic harness, the key should be left out of the ignition.

7. Turn the snowplow control ON and perform a Solenoid Coil Activation Test (SCAT). See the table for solenoid numbers and functions.

Solenoid Coil Activation Test (SCAT)	
Control Function	**Solenoid Coil(s) Activated**
Raise	S3, Motor Relay
Lower	S1
Angle Right	S2, Motor Relay
Angle Left	S2, S3, Motor Relay

NOTE: The green LED on the diagnostic harness will illuminate when the motor relay function is activated. This light only tests the Plow Module's motor relay output. Refer to the *Motor and Motor Relay Test* later in this section for instructions on properly testing a motor relay.

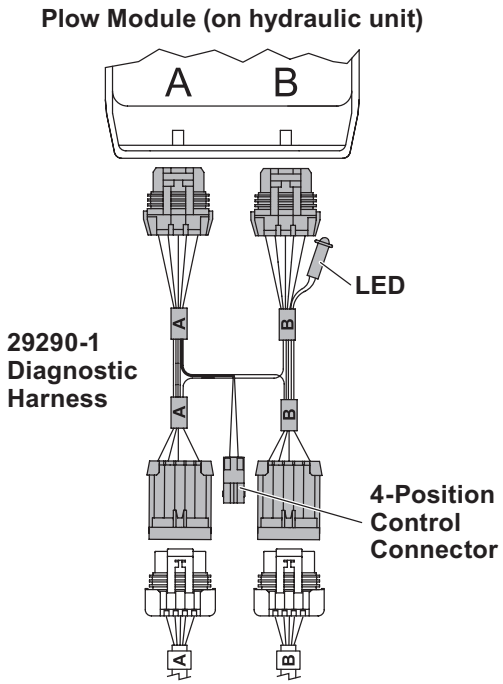
8. After completing the SCAT test, turn the snowplow control and the vehicle ignition OFF, then disconnect the snowplow and vehicle battery cables.

9. Perform any required repairs and re-test as needed. Always disconnect the snowplow and vehicle battery cables before removing the diagnostic harness.

SOLENOID COIL ACTIVATION TEST (SCAT), continued

Off-Truck Testing

1. Remove the hydraulic unit covers.
2. Remove the short red cable from the motor relay.
3. Unplug the snowplow connectors from Ports A and B of the Plow Module.
4. Connect the diagnostic harness connectors A and B to the matching ports on the Plow Module (A to A and B to B).



5. Plug the connectors removed from the Plow Module into the matching connectors on the diagnostic harness (A to A and B to B).
6. Connect the snowplow control into the 4-position control connector on the diagnostic harness.
7. Connect a 12V power source to the snowplow battery cable (POSITIVE [+] 12V to the red wire and NEGATIVE [–] to the black wire). Turn ON the power source.
8. Turn the snowplow control ON and perform a Solenoid Coil Activation Test (SCAT). See the table for solenoid numbers and functions.

Solenoid Coil Activation Test (SCAT)	
Control Function	**Solenoid Coil(s) Activated**
Raise	S3, Motor Relay
Lower	S1
Angle Right	S2, Motor Relay
Angle Left	S2, S3, Motor Relay

NOTE: The green LED on the diagnostic harness will illuminate when the motor relay function is activated. This light only tests the Plow Module's motor relay output.

9. After completing the SCAT test, turn the snowplow control OFF and disconnect the power source.
10. Perform any required repairs and re-test as needed. Always disconnect the snowplow and vehicle battery cables before removing the diagnostic harness.
11. Reconnect the short red cable assembly to the motor relay.

INDIVIDUAL SOLENOID COIL TEST

1. Remove both wires from coil terminals.
2. Attach an ohmmeter across the coil terminals.
3. A reading that is not approximately 7 ohms indicates coil is damaged and must be replaced.
4. Attach an ohmmeter to one coil terminal and to the steel washer at the end of the coil.
5. A reading that is not "open" indicates that the coil has internal shorts and needs to be replaced.
6. If both readings are OK (i.e., approximately 7 ohms across terminals *and* "open" between terminal and washer), then the coil is good.

NOTE: A good coil will draw approximately 1.5 amps.

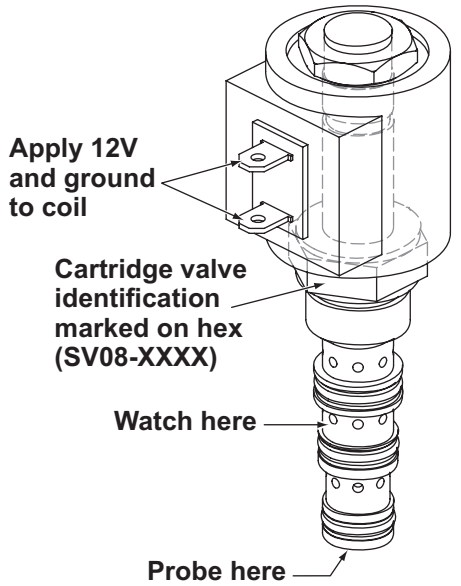
SOLENOID CARTRIDGE VALVE INSPECTION

1. Remove the coils from the solenoid cartridge valves and remove the cartridge valves from the manifold. Look for visible contamination or damaged seals.
2. Check for stuck spools with a plastic, aluminum, or soft brass probe by pushing on the spring-loaded internal spool from the end of the valve. The spool should move freely through its entire travel. Spool travel is approximately 0.07".

NOTE: Using the probe to move the spool may shear the contamination that was affecting spool movement.

3. Bench test the cartridge valve by installing a coil on the stem and applying 12V and ground. Watch through the side ports for internal spool travel.
4. If the cartridge valve spool is stuck or its travel is restricted, replace the cartridge. If the cartridge valve appears to be in good condition, clean it with parts cleaning solvent and dry with compressed air, being careful not to damage the seals.
5. Check the spool travel again in case any internal contaminants were dislodged during cleaning. Re-oil the cartridge valve seals and O-rings and reinstall the cartridge valve, torquing to 10 ft-lb). Install the coils and torque the retaining nuts to 4 ft-lb.

NOTE: If contamination is seen in more than one component, it is reasonable to assume that the entire system is contaminated. In order to perform a proper repair, the entire hydraulic unit, including hoses and cylinders, must be disassembled and cleaned. The source of the contamination must be located and repaired before reassembly.



CONTROL/CABLE/PLOW MODULE TEST — Snowplows with FLEET FLEX Electrical System

CONDITION	POSSIBLE CAUSE	CORRECTIVE ACTION
Control power light is not ON.	Snowplow is not connected	Make sure grille plugs between snowplow and truck are properly connected.
	Incomplete harness connection(s) or damaged harness(es)	With the vehicle switched accessory ON, test the 4-pin connector inside the cab. If pin 1 does not have 12V and/or if pin 4 does not have ground, use the electrical schematic in this guide to trace the wires from the connector back to their source. Complete any incomplete connections and repair or replace any damaged wires and harnesses.
	Single-pin connector on vehicle lighting harness is not connected	Make sure the single-pin connector on the vehicle lighting harness is properly connected.
	Harnesses connected to Isolation Module incorrectly	Using the electrical schematic in this guide, verify that the Isolation Module and harnesses are properly connected.
	Control fuse is blown	Replace all blown fuses in under-hood electrical harnesses.
Control power light is blinking.	***Slow flash:*** Poor connection, damaged control or damaged Plow Module	Make sure all plugs (control, between the snowplow and truck, on the snowplow, etc.) are properly connected.
		If all plugs are properly connected, install a properly working control. If problem is corrected, replace PC board and/or coiled cord in the damaged control.
		If problem is not corrected with a properly working control, replace the Plow Module.
	Fast flash: Snowplow is locked.	Enter a 4-digit security code to unlock the snowplow.
Control power light is ON, but snowplow does not respond.	Harnesses connected to Isolation Module incorrectly	Using the electrical schematic in this guide, verify that the Isolation Module and harnesses are properly connected.
	Blown fuse or damaged Plow Module	Replace all blown fuses on vehicle and snowplow.
		If the fuses are all okay, check for 12V at all coils and primary terminal of motor relay. If 12V is missing from any coil or relay, replace the Plow Module. If 12V is present, go to next Possible Cause.
	Damaged harness(es) or cable(s)	Perform a **Solenoid Coil Activation Test (SCAT)** according to the instructions in this guide. Replace/repair any damaged harnesses and cables.
	Damaged control or Plow Module	Install a properly working control. If the problem is corrected, replace the PC board and/or coiled cord in the damaged control.
		If problem is not corrected with a properly working control, replace the Plow Module.

Safe Handling of the Printed Circuit Board

⚠ CAUTION

The circuit board may be damaged by static electricity. Always touch ground before handling the PC board.

Before disassembling the control and touching the PC board, be sure to remove any static charge from yourself. Static charge can build up as a technician works on the control.

Best practice is for the technician to work at a properly grounded work station and wear a grounded wrist strap. In place of a proper work station, the technician should work in an oil- and solvent-free area and touch a good ground each time before touching the PC board while servicing the unit.

Handle the PC board by the edges only. Do not touch the carbon (black) areas of the keypad. Skin oils will deteriorate the contact area.

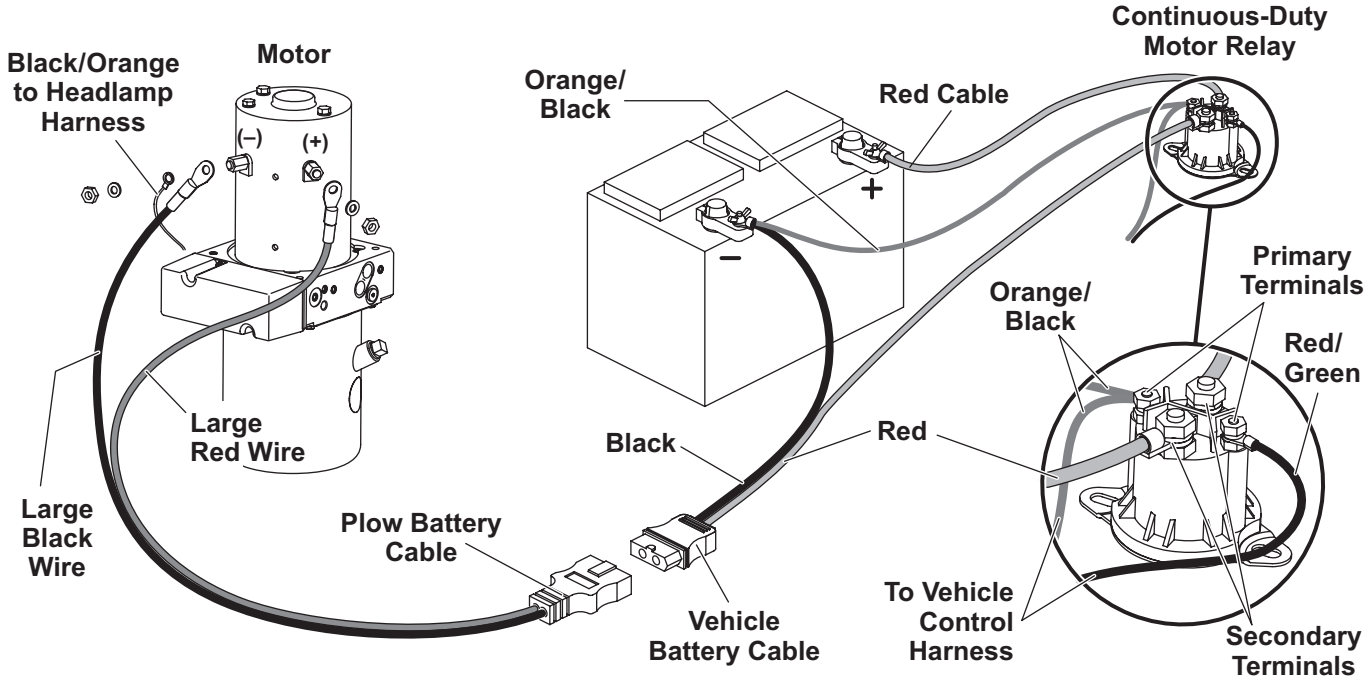
MOTOR AND MOTOR RELAY TESTS – Snowplows without FLEET FLEX Electrical System

For snowplows using the FLEET FLEX electrical system, follow the Motor and Motor Relay Test instructions on page 98.

Motor Test

⚠ WARNING

Keep 8' clear of the blade when it is being raised, lowered or angled. Do not stand between vehicle and blade or directly in front of the blade. If the blade hits or drops on you, you could be seriously injured.



Momentarily attach jumper cables from battery to respective (+) and (–) motor teminals. Does motor run?

YES → Re-test with jumper cable from battery (+) to (+) motor terminal. Does motor run?

YES → Momentarily attach (+) jumper cable between battery and motor side of motor relay secondary. Does motor run?

YES → Go to **Motor Relay Test** on next page.

NO → Check for binding in pump, or repair/replace motor.

NO → Repair ground (black) wire in vehicle battey cable or snowplow battery cable.

NO → Repair (+) black/red wire in vehicle battery cable or snowplow battery cable.

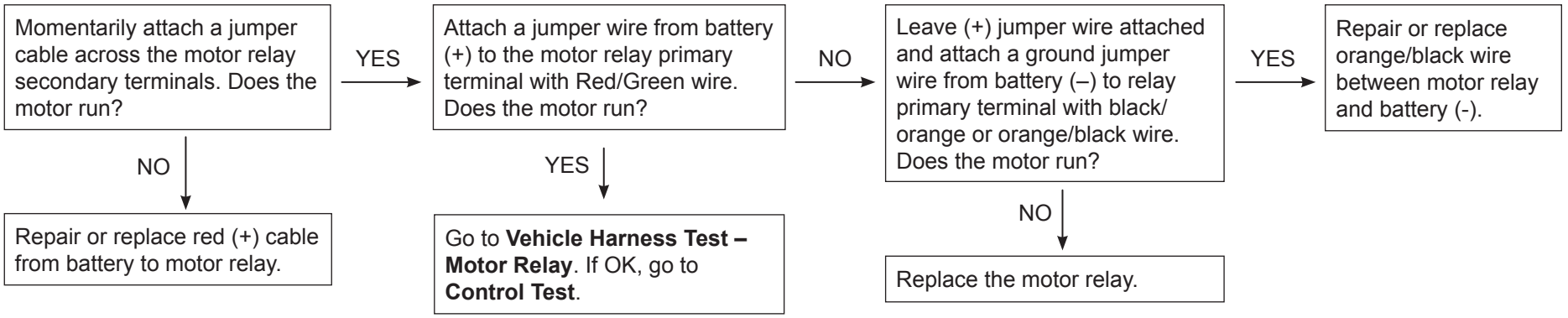
Motor Relay Test

⚠ WARNING

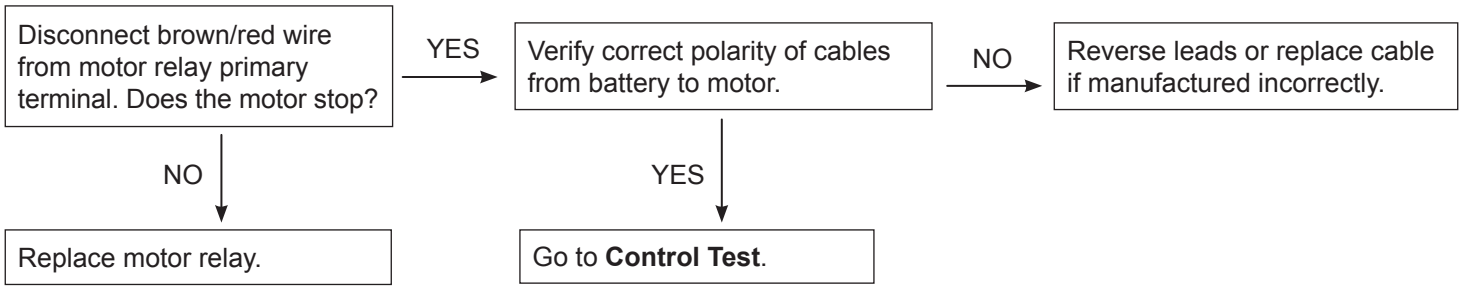
Keep 8' clear of the blade when it is being raised, lowered or angled. Do not stand between vehicle and blade or directly in front of the blade. If the blade hits or drops on you, you could be seriously injured.

1. Momentarily jump power and ground directly from battery to motor to verify that the motor runs. Make final connection at the motor.
2. Refer to the Motor and Motor Relay Test Diagram on preceding page.

MOTOR DOES NOT RUN:



MOTOR RUNS CONTINUOUSLY:



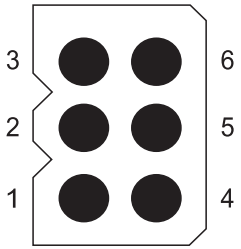
VEHICLE HARNESS TEST – MOTOR RELAY

⚠ WARNING

Keep 8' clear of the blade when it is being raised, lowered or angled. Do not stand between vehicle and blade or directly in front of the blade. If the blade hits or drops on you, you could be seriously injured.

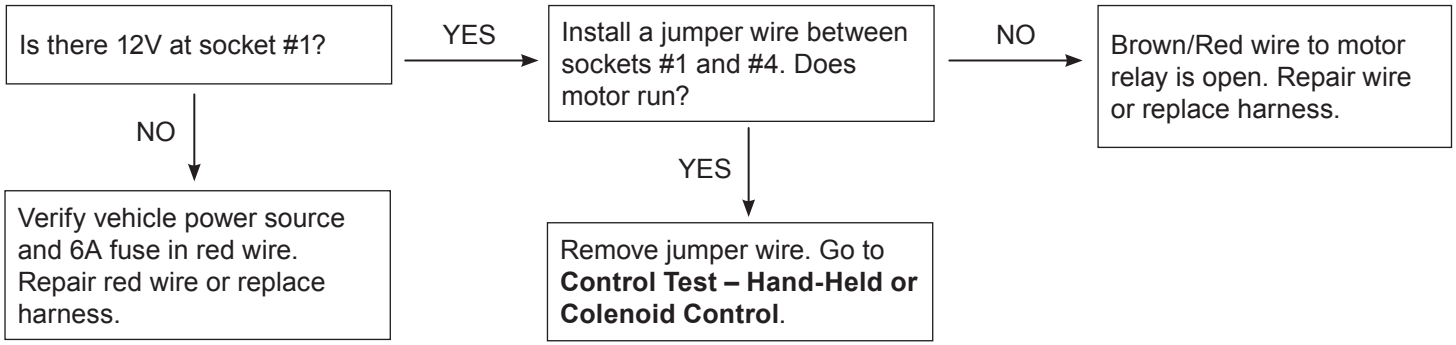
1. Perform the **Motor Test** and **Motor Relay Test** first, as described on preceding pages.
2. Disconnect the control in the cab.
3. Refer to the 6-pin connector diagram. Test the vehicle side of the connector in the cab as follows.

White 6-Pin Connector on vehicle harness– located in cab (end view)



(sockets)

Pin #	Wire Color
1	Red
2	Lt Green
3	Orange/Black
4	Brown/Red
5	Lt Blue
6	White/Yellow



CONTROL TEST – HAND-HELD OR SOLENOID CONTROL

1. Disconnect the control in the cab and remove to the work bench.
2. Refer to the 6-pin connector diagram and the table.
3. Using a 12V power source with a 6 amp fuse in the positive lead, carefully apply +12V to pin #1 and ground to pin #3 of the 6-pin connector.
4. Turn the control ON. Power indicator lamp should be lit. Using a grounded test light, check for 12V at each of pins #2, 4, 5, 6 when the control is activated for each function. Footnotes in the table indicate special conditions of control operation.
5. Compare the control outputs for all functions with the table and proceed to the flow chart on the following page.

Pin #	Purpose	Angle R (c)	Angle L (c)	Raise (d)	Lower/Float (e)
1	12V input				
2	S2 output (3-way)	ON	ON		
3	Ground				
4	Motor relay output	ON (b)	ON (b)	ON (b)	
5	S3 output (4-way)		ON	ON	
6	S1 output (2-way)	(a)	(a)		ON

a. S1 output will be ON if control is in Float. Activate Raise function to cancel Float. If hand-held control is in Float, S1 output will turn OFF while angle button is pressed and ON when the button is released.

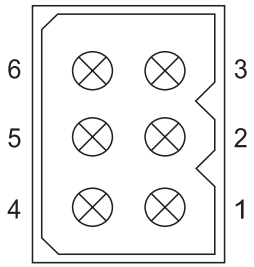
b. For hand-held control, motor relay output turns OFF before solenoid coil outputs when button is released.

c. For hand-held control, outputs turn OFF after button is held for approximately 9.6 seconds.

d. For hand-held control, outputs turn OFF after button is held for approximately 4.8 seconds.

e. Solenoid control activates S1 output in Float when lever is moved to lower position. Hand-held control activates Float when lower button is held for .75 second.

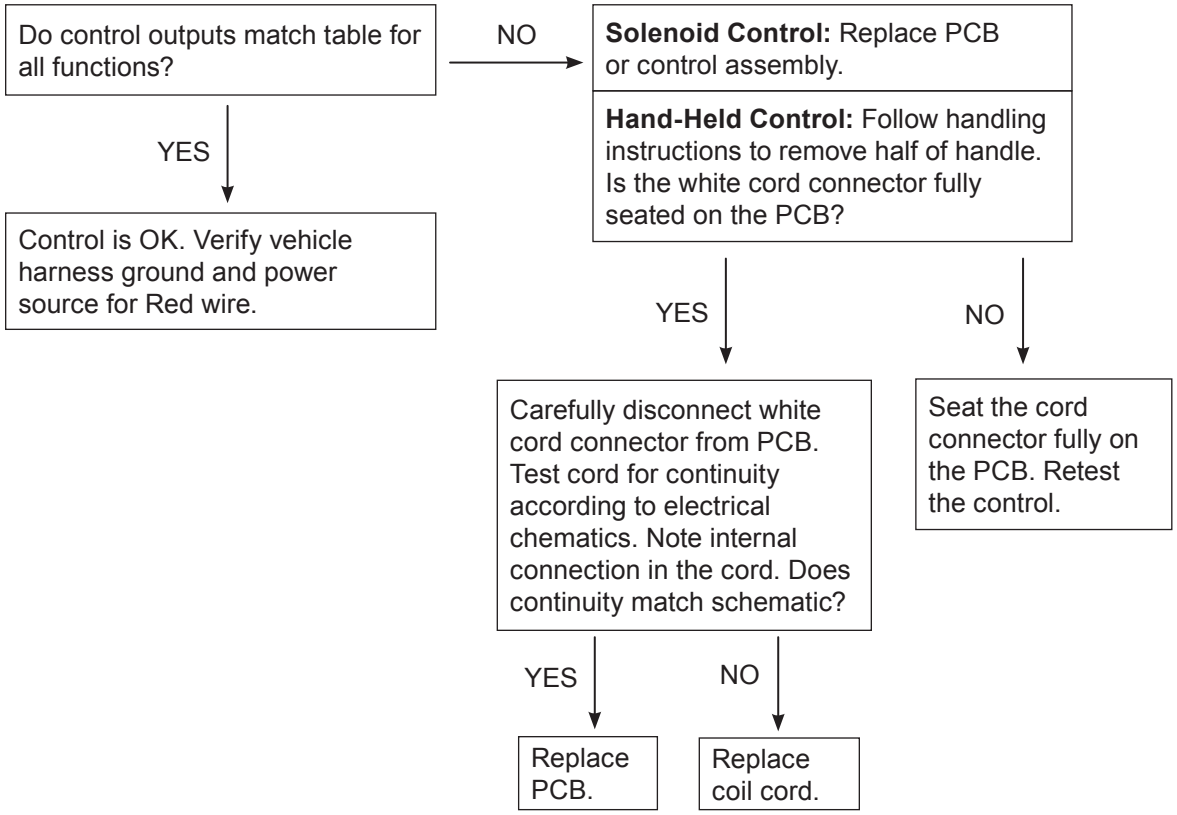
Control Side (end view)



(pins)

	Wire Color	
Pin #	Solenoid Control	CabCommand
1	White	Black/White
2	Green	Red
3	Brown	Green
4	Black	Orange
5	Blue	Blue
6	Red	Yellow

Control Test, continued



NOTE: For hand-held control, poor ground connections or high or low voltage will shut the control off.

To Safely Handle the Hand-Held Control PCB

1. Disconnect the control in the cab and remove it to a workbench.
2. Place control on its left side and remove right side of handle, leaving the keypad/circuit board assembly in left half.
3. Touch hand to any grounded metal object to discharge possible static buildup.
4. Remove keypad/circuit board assembly from housing by only touching the edges of the keypad/circuit board assembly.
5. The keypad/circuit board assembly can be handled safely as long as contact with it is maintained.

MOTOR AND MOTOR RELAY TEST – Snowplows with FLEET FLEX Electrical System

*For snowplows **not** equipped with the FLEET FLEX electrical system, follow the Motor and Motor Relay Tests instructions beginning on p. 93.*

⚠ WARNING

Keep 8' clear of the blade when it is being raised, lowered or angled. Do not stand between vehicle and blade or directly in front of the blade. If the blade hits or drops on you, you could be seriously injured.

Perform this test if the control lights up and turns ON, but the motor does not run when any function but LOWER is selected.

1. Check the F2 fuse* on harness B. Replace if fuse is blown, then retest snowplow function.

2. Remove the 8" red battery cable from the large terminal of the motor relay and isolate it. Isolating the cable will eliminate the possibility of accidental blade movement during testing.

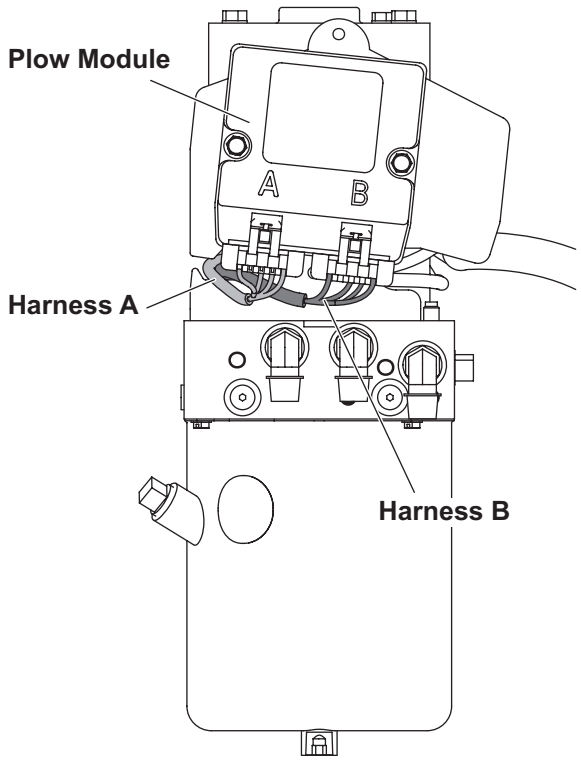
3. Check for 12V at the small terminal of the motor relay with the red wire attached to it. If 12V is not present, recheck the coil fuse F2 in harness B. If the fuse is good, check the red wire and harness B. Replace/repair either the wire or the harness as needed.

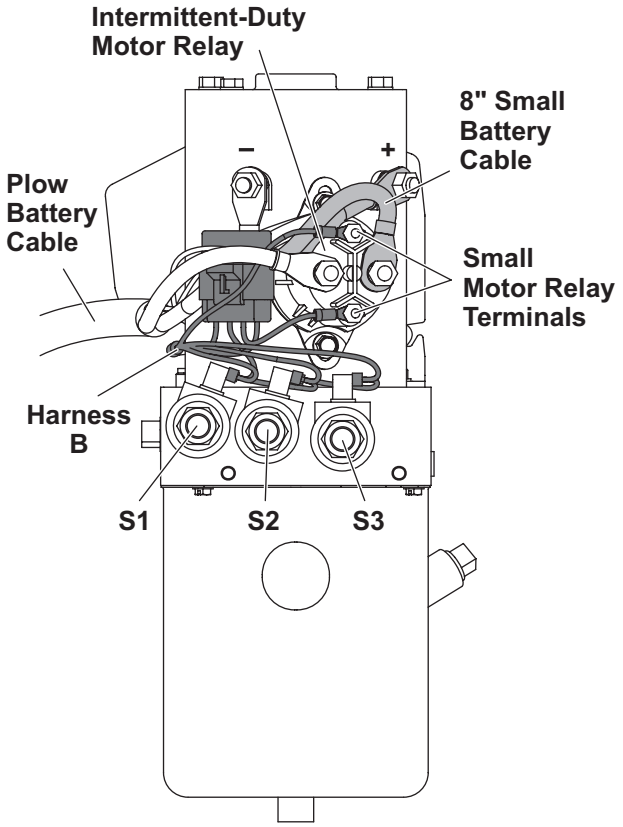
4. If 12V is present at the small relay terminal with the red wire, turn the control ON, then check for switched ground on the small terminal with the black wire attached to it while activating any function except LOWER. If switched ground is not present, check the black wire and harness B of the plow module. Replace/repair either the wire or the harness as needed.

5. Check for switched 12V at the empty large motor relay terminal while activating any control function except LOWER. The empty terminal is the terminal that would normally connect the 8" red battery cable. If switched 12V is not present, replace the motor relay.

6. If switched 12V is present at the empty large motor relay terminal, replace the motor.

7. Once testing is complete, reinstall the 8" red battery cable, then recheck the snowplow functions.





* See wire stamping for fuse identification.

PUMP PRESSURE TEST

⚠ WARNING

Keep 8' clear of the blade when it is being raised, lowered or angled. Do not stand between vehicle and blade or directly in front of the blade. If the blade hits or drops on you, you could be seriously injured.

1. Lower blade to the ground, place the control in FLOAT mode and fully collapse the lift ram.
2. Carefully disconnect either of the angle hoses from the angle ram 90° fitting and install Pressure Test Kit #56679 according to the kit instructions.
3. Route the end of the hose with the gauge up to the headlamp crossbar and secure it prior to testing.
4. Tighten the hydraulic fittings to approximately 20 ft-lb.

⚠ CAUTION

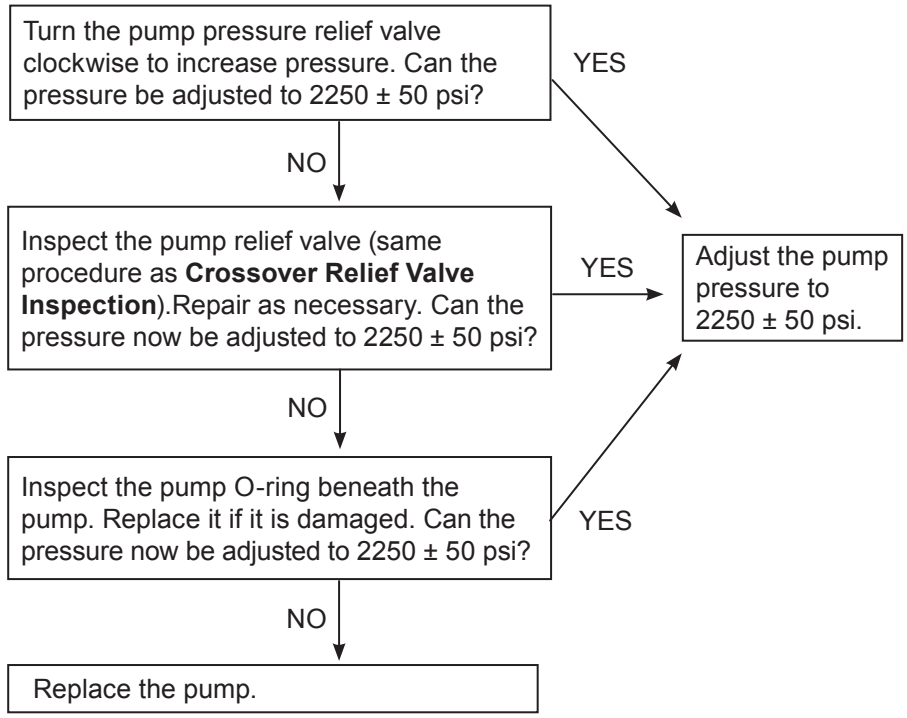
Do not adjust the relief valve while it is under pressure.

5. Activate the appropriate angle function with the control and read the pump relief pressure when the blade is fully angled.
6. Refer to the Valve Locations illustrations in the Hydraulic System Overview section of this manual for pump relief valve locations. Adjust the pump relief valve pressure as shown in the table.

Snowplow Type	Pump Relief Valve Pressure	No. of Turns Pump Relief Valve Is Backed Off (CCW) from Fully Seated*	Motor Amp Draw at 12.2 Volts w/Warm Oil
PRO-PLOW® Series 2 PRO PLUS® MIDWEIGHT™	2250 ± 50 psi	2-1/4 to 2-1/2 turns	205 amp

*Settings are approximate.

7. Proceed through the steps of the flow chart:



HYDRAULIC SYSTEM TEST

This test consists of trying all the plow functions and comparing the plow reaction to the action requested. The following table will help you pinpoint a solenoid valve or poppet check valve problem accurately if *only one* component is malfunctioning.

If the plow reaction for a given function is not listed in the table, the problem may be caused by a crossover relief or poppet check valve that is stuck open or contaminated, or by missing or damaged O-rings or backing rings on a cartridge, crossover relief or poppet check valve spool.

Another possibility is that there are *two or more* malfunctioning components. In this case, use the specific function hydraulic schematic and carefully inspect each component in the flow circuit. If contamination is evident in more than one component, the hydraulic unit, hoses and cylinders must be completely disassembled, inspected and cleaned.

1. Perform the **Cartridge Coil Activation Test** first.

2. Verify that hydraulic hose installation is correct.

3. Test all of the plow functions. IMPORTANT: When testing the plow functions, be sure the control is *not* in FLOAT.

4. Inspect and clean or replace the suspected component. Refer to the FloStat® Hydraulic Unit Hydraulic Components diagram in the Hydraulic System Overview section.

5. Refer to the following pages for instructions on testing, inspection and adjustment of solenoid cartridge valves, poppet check valves and crossover relief valves.

Action Requested	Plow Reaction	Possible Cause
Raise	None	S3 not shifted
	Angle left	S2 stuck shifted
Lower	None	S1 not shifted
		S2 stuck shifted
		S3 stuck shifted
Angle right	Angle left	S3 stuck shifted
	None	S2 not shifted
	Slow	Poppet check valve not opening
Angle left	Angle right	S3 not shifted
	Raise	S2 not shifted
	None	S2 and S3 not shifted
	Slow	Poppet check valve not opening
None (blade raised)	Lowers	S1 stuck shifted or has leaking internal check valve
None	Drifts right	S2 stuck shifted
		Contamination, bad valve stem seat, or damaged O-rings in crossover relief valve
	Drifts left	Poppet check valve open
		Contamination, bad valve stem seat, or damaged O-rings in crossover relief valve

CROSSOVER RELIEF VALVE INSPECTION AND ADJUSTMENT

Inspection

1. Remove the valve stem, ball, spacer and spring.

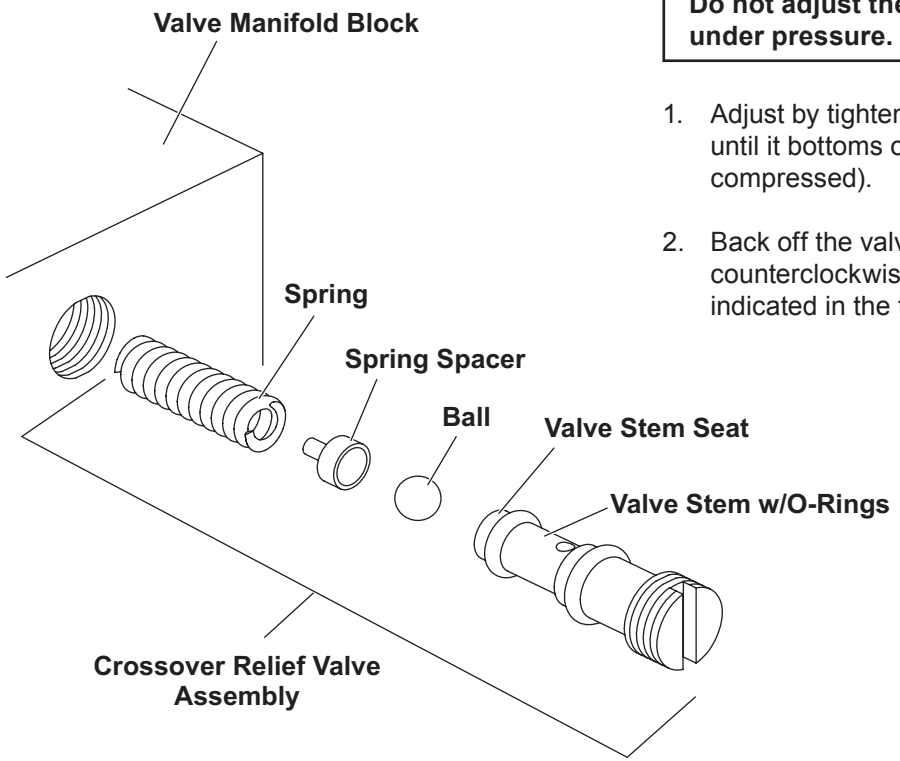
2. Look for broken or damaged parts, contamination, or missing or damaged O-rings.

⚠ CAUTION

Be careful to strike the stem squarely. You can bend the stem if you do not strike it squarely.

3. If the parts are in good condition, place the ball on a hardwood block, hold the stem seat on the ball and lightly strike the top of the stem with a hammer to seat the ball and valve stem.

4. Apply a light coat of anti-seize or grease to the stem threads. Lubricate the O-rings with hydraulic fluid. Reassemble the components into the valve block.



Adjustment

⚠ CAUTION

Do not adjust the relief valve while it is under pressure.

1. Adjust by tightening the relief valve stem until it bottoms out (until the spring is fully compressed).

2. Back off the valve stem by rotating it counterclockwise (CCW) the number of turns indicated in the table.

Snowplow Type	No. of Turns Backed Off (CCW) from Fully Seated*	Crossover Relief Valve Pressure
PRO-PLOW® Series 2, PRO PLUS®, MIDWEIGHT™	1 to 1-1/4	4000 ± 100 psi

*Settings are approximate.

PILOT-OPERATED (POPPET-STYLE) CHECK VALVE TEST AND INSPECTION

1. Strike the boss plugs squarely with a hammer to facilitate removal.

2. Remove the O-ring boss plug, spring and poppet.

3. Reinstall the boss plug and test the snowplow.

   If the problem still occurs, it is not caused by the pilot-operated check valve. Reinstall the poppet and spring.

   If the problem does not occur, follow Steps 4 through 8.

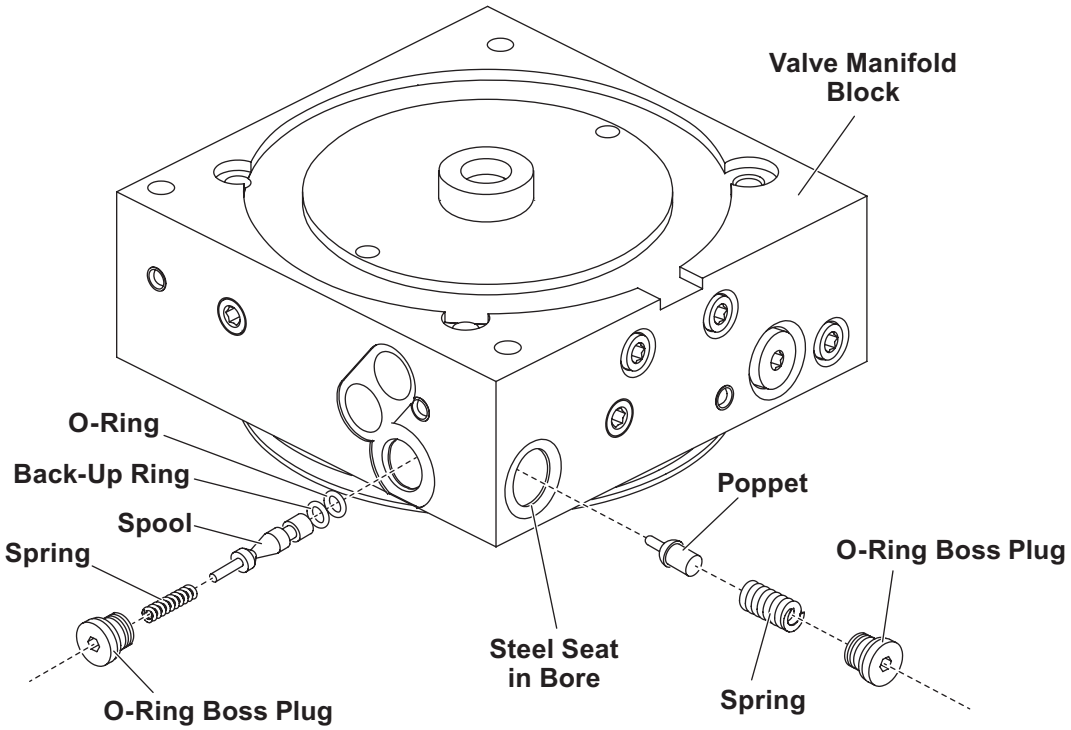
4. Remove the O-ring boss plug, spring, and spool with O-ring. Use long, slender needle-nose pliers to remove the spool.

5. Inspect the springs, poppet, spool, O-rings and poppet seat for wear, damage or contamination. Replace worn parts.

6. The valve manifold block has a pressed-in steel poppet seat. Use a strong pencil magnet to push and pull on the seat. If the seat moves, reset the poppet using the Poppet Seat Service Tool (PN 28530). Never hammer on the seat.

7. Re-oil the O-rings. Install the spool fully into the bore. The spool must insert smoothly.

8. Install the poppet, springs and O-ring boss plugs. Torque the O-ring boss plug to 60 in-lb.



Western Products
P.O. Box 245038
Milwaukee, WI 53224-9538
www.westernplows.com

A DIVISION OF DOUGLAS DYNAMICS, INC.

Western Products reserves the right under its product improvement policy to change construction or design details and furnish equipment when so altered without reference to illustrations or specifications used. Western Products or the vehicle manufacturer may require or recommend optional equipment for snow removal. Do not exceed vehicle ratings with a snowplow. This product is manufactured under the following US patents: 6,145,222; 6,209,231; 6,253,470; 6,526,677; 6,711,837; 6,928,757; 6,941,685; 7,400,058; 7,430,821; 7,737,576; CAN patents 2,354,257; 2,639,052 and other patents pending. Western Products offers a limited warranty for all snowplows and accessories. See separately printed page for this important information. The following are registered (®) or unregistered (™) trademarks of Douglas Dynamics, LLC: MIDWEIGHT™, POLY PRO-PLOW® Series 2 , PRO-PLOW® Series 2, PRO PLUS®, SECURITY GUARD™, UltraMount®, UltraMount® 2, WESTERN®.

Printed in U.S.A.

Lit. No. 48163, Rev. 00

March 15, 2016