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MECHANIC'S GUIDE



SNOWPLOWS

Featuring the
**FloStat® PRODIGY™ Hydraulic System &
Isolation Module Light System**

⚠ CAUTION

Read this manual before servicing the snowplow.

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INTRODUCTION

This guide has been prepared to assist the trained mechanic in the service of WESTERN® 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" Allen wrench
- 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
- Pressure test kit
- Flashlight
- Pick set
- Hammer
- Pencil magnet
- TORX® drivers: T20 & T30
- Mini fuses: 5-amp (all)
10-amp (3-port module)
- Vacuum pump w/3/8" NPT barbed fitting
- 3/8" NPT plug

AVAILABLE SERVICE ITEMS

- Motor Bearing Sleeve Repair Kit, PN 64589
(Requires 3/8-24 x 4 hex cap screw, not included.)
- Pressure Test Kit, PN 56679
- Diagnostic Harness, PN 29290-1
- Pump Shaft Seal Repair Kit, PN 28856
(Requires 1/4-28 x 4-1/2 hex cap screw, not included.)
- PRODIGY™ Wing Spring Removal Tool, PN 69780
- Isolation Module Test Connector, PN 28957

SAFETY INFORMATION

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.

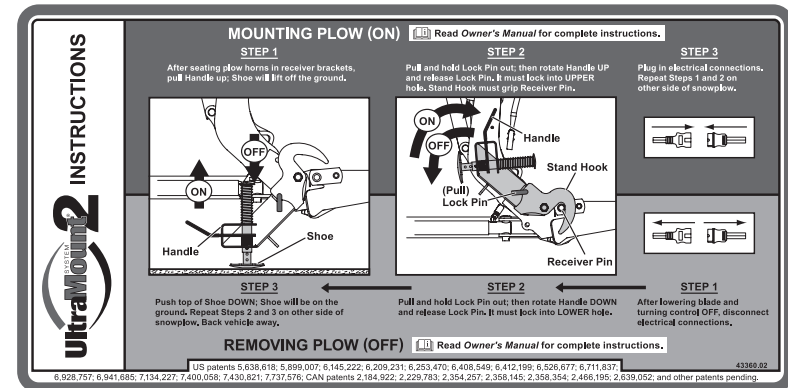
NOTE: Indicates a situation or action that can lead to damage to your snowplow and vehicle or other property. Other useful information can also be described.

WARNING/CAUTION AND INSTRUCTION LABELS

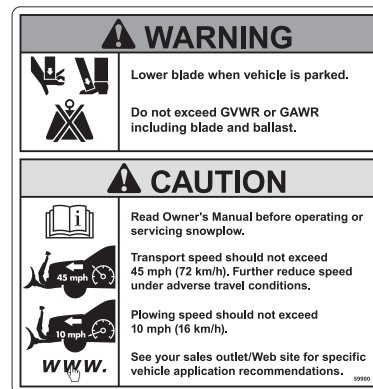
Become familiar with and inform users about the warning and instruction labels on the back of the blade.

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

Instruction Label



Warning/Caution Label



SAFETY INFORMATION

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, 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.

SAFETY INFORMATION

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/s² to the hand-arm or 0.5 m/s² to the whole body.

SAFETY INFORMATION

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.

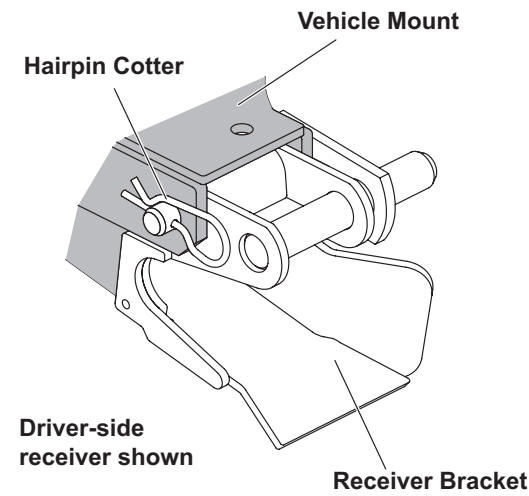
Recommended Fastener Torque Chart					
Inch Fasteners Grade 5 and Grade 8					
Size	Torque (ft-lb)		Size	Torque (ft-lb)	
	 Grade 5	 Grade 8		 Grade 5	 Grade 8
1/4-20	8.4	11.9	9/16-12	109	154
1/4-28	9.7	13.7	9/16-18	121	171
5/16-18	17.4	24.6	5/8-11	150	212
5/16-24	19.2	27.3	5/8-18	170	240
3/8-16	30.8	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)		Size	Torque (ft-lb)	
	 Class 8.8	 Class 10.9		 Class 8.8	 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.					

BLADE, A-FRAME & LIFT FRAME

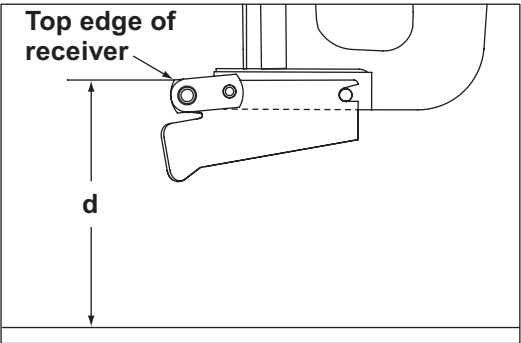
ATTACHING A-FRAME TO LIFT FRAME

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.

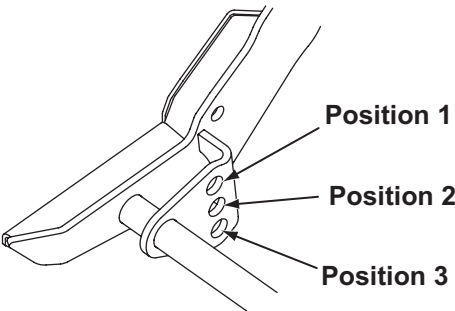


1. Measure the distance "d" from the ground to the top edge of the receiver bracket. Measure both sides and determine average value for "d."



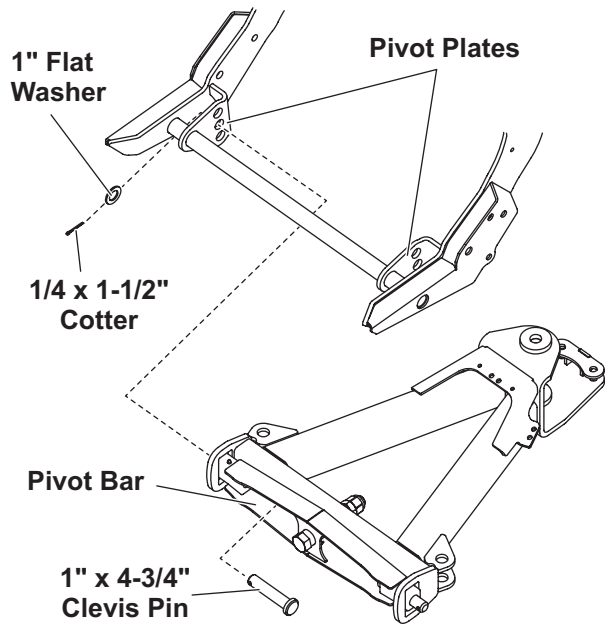
2. Use distance "d" from Step 1 and the following chart to determine the proper pivot plate hole position.

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.



BLADE, A-FRAME & LIFT FRAME

STAND SHOE HEIGHT ADJUSTMENT

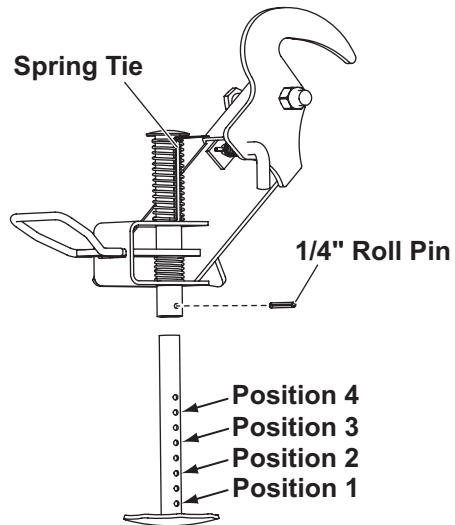
⚠ WARNING

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 "Pivot Plate Hole Position." 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

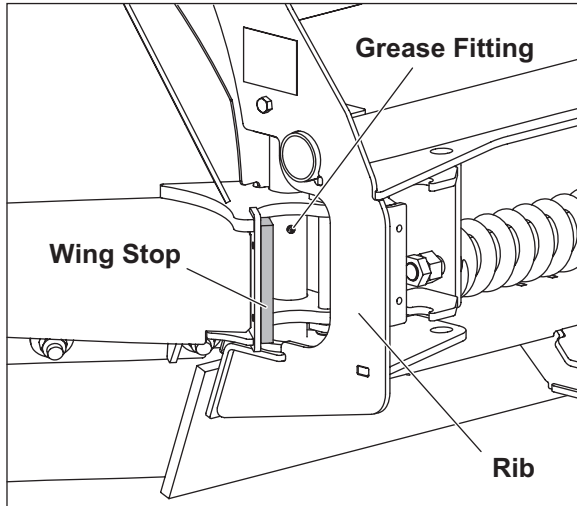


2. Insert the 1/4" roll pin.
3. Do not cut the spring tie until after the final stand shoe adjustment.

BLADE, A-FRAME & LIFT FRAME

CABLE ADJUSTMENT

1. Angle the blade fully left and inspect the area between the driver-side wing stop and the driver-side blade rib.

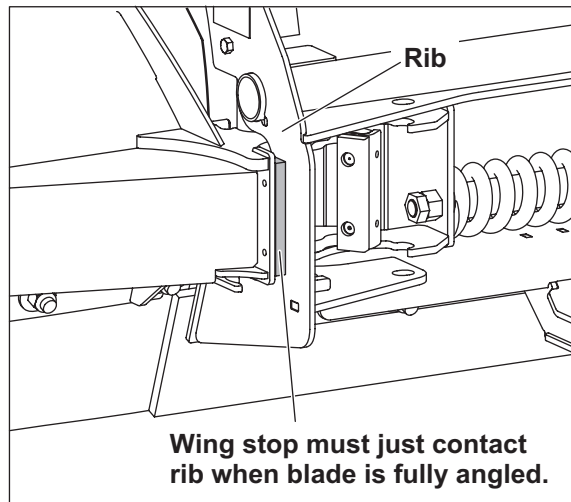


2. If there is a gap between the wing stop and the rib, skip to Step 3.

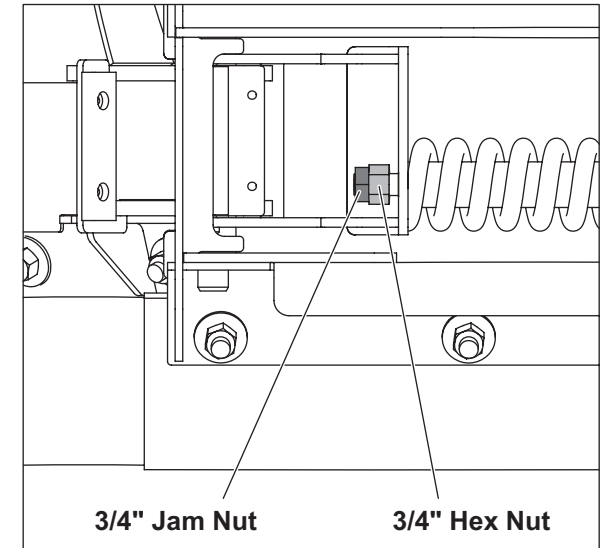
If there is no gap, return the blade to the straight position and loosen the 3/4" jam nut and 3/4" hex nut on the end of the cable 1/4 turn. Repeat this adjustment until a gap can be seen.

3. Return the blade to the straight position and adjust the hex nut 1/4 turn clockwise. Angle the blade fully left and inspect the area between the wing stop and the rib again.

4. Continue making this adjustment until the wing stop just contacts the rib when the blade is fully angled left.



5. Once the stop is making contact with the rib, lock the hex nut into position with the 3/4" jam nut.



6. Repeat Steps 1–5 on the passenger's side of the blade assembly, this time angling the blade fully to the right.

NOTE: Adjusting the 3/4" hex nut inward too far will cause the wing stop to contact the blade rib before the blade is fully angled. This condition can stretch the cables and shorten their service life.

7. Grease the fittings on the wing hinges.

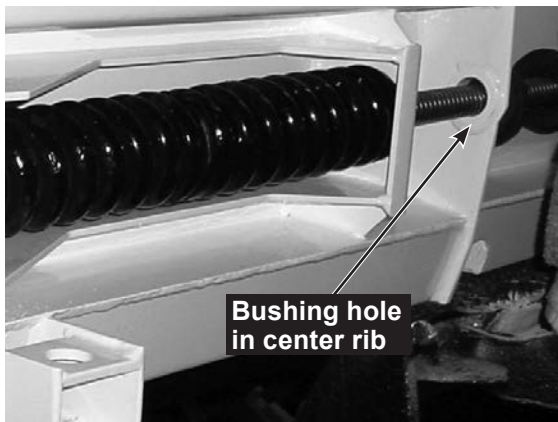
BLADE, A-FRAME & LIFT FRAME

USING THE WING SPRING REMOVAL TOOL (PN 69780)

⚠ WARNING

The wing spring removal tool must be used by qualified personnel to remove preloaded spring. Read and follow all instructions. Disconnect plow from vehicle before doing this repair.

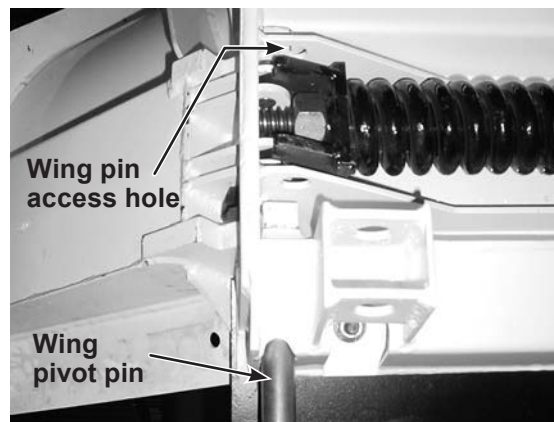
1. Park the vehicle on a smooth, level, hard surface, such as concrete. Lower the blade to the ground and turn the control OFF. Disconnect the snowplow from the vehicle, or turn the vehicle ignition to the "OFF" position and remove the key.
2. Unhook the trip springs and cable assemblies. Remove the moldboard from the quadrant.
3. Insert the threaded rod from the wing spring removal tool through the moldboard bushing hole in the center rib, through the spring and wing spring guide. Secure the rod with the 1" nut approximately 2" from the end.



The nut threaded onto the rod keeps the springs compressed. The tool must remain in place until the wing is removed. This tool is designed for use with an air impact gun on the socket to compress the springs.

4. Attach the washer, thrust bearing (inserted into bearing nut) and bearing nut to the threaded rod. The plastic washer reduces the friction between the socket and the bearing and also protects the paint on the blade.
5. Attach the socket to the bearing nut and tighten to compress the spring and relieve tension on the wing pivot pin.
6. **If the wing pivot pin head is up**, the wing pivot pin can be extracted from the top. Remove the stop bolt and pull the pin out from the top.

If the wing pivot head is down, the pin will be extracted from below. Remove the spring pin from the end of the wing pivot pin. Remove the

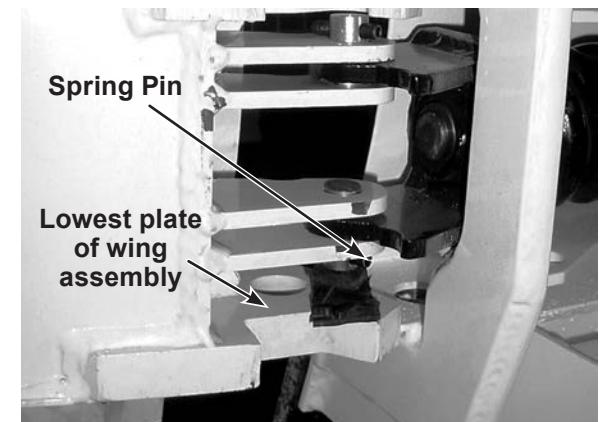


wing pivot pin access cover from the top of the moldboard and tap the pin out the bottom.

7. Using the socket, loosen the bearing nut to release the tension on the spring while manipulating the wing past the end moldboard rib.
8. Remove the wing assembly and spring guide. Release the spring tension and remove the tool.

To install the spring, reverse the above procedure.

- The nut must be flush with the end of the threaded rod for installation.
- The wing must be manipulated into proper position by pulling the wing back, then pushing it forward to align the wing pin mount holes.
- The spring pin in the wing pin should be aligned above the lowest plate of the wing assembly.



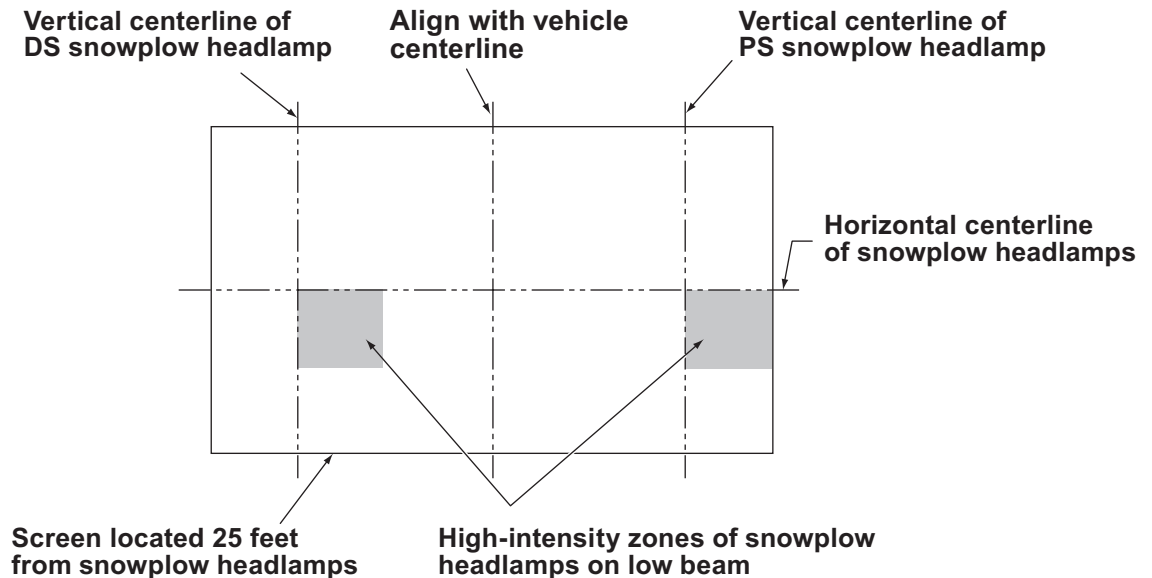
Excerpts taken from Wing Spring Removal Tool Parts List & Installation Instructions (Lit. No. 68335, Rev. 01).

BLADE, A-FRAME & LIFT FRAME

AIMING HEADLAMP BEAMS

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

1. Place 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.
 - e. Check the functioning of any automatic vehicle leveling systems and specific manufacturer's instructions pertaining to vehicle preparation for headlamp aiming.
 - f. Clean the lenses.
 - g. Check for bulb burnout and proper beam switching.
 - h. Stabilize the vehicle suspension by rocking the vehicle sideways.
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.
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 diagram below.)



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HYDRAULIC SYSTEM

PRODIGY™ FloStat® HYDRAULIC SYSTEM SPECIFICATIONS

Pump Relief Valve Setting

- 2250 psi
- 2-1/2 turns CCW from fully seated

System Capacity

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

Hydraulic Fluid

⚠ CAUTION

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

Use WESTERN® Hydraulic Fluid to –40°F (–40°C) or other fluid conforming to military specification MIL-H-5606 A, such as Mobil Aero HFA or Shell AeroShell® Fluid 4. Use of products other than these recommended fluids may cause poor hydraulic system performance and damage to internal components.

Motor/Hydraulic Specifications

12V DC with +/– connection
4.5" dia 1.5 kW motor
2200–2300 psi pump relief valve
4000 psi angling relief valve
.000477 gal/rev pump
Hydraulic Hose 1/4 SAE 100R1 and 3/8 SAE 100R17

Electrical System (Approximate)

- Solenoid Coil Resistance = 7 ohm
- Solenoid Coil Amp Draw = 1.5 Amp
- Motor Relay Coil Resistance = 6–7 ohm
- Motor Relay Amp Draw = 0.7 Amp
- Maximum Motor Amp Draw = 250 Amps over relief at 2250 psi
- Switch Accessory Lead Draw = 0.75 Amp

Vehicle Control Harness Fuses

3-Port Module (Mini)

- Control and Park/Turn = 10 Amp

Hydraulic Unit Harness Fuses

All (Mini)

- 5 Amp

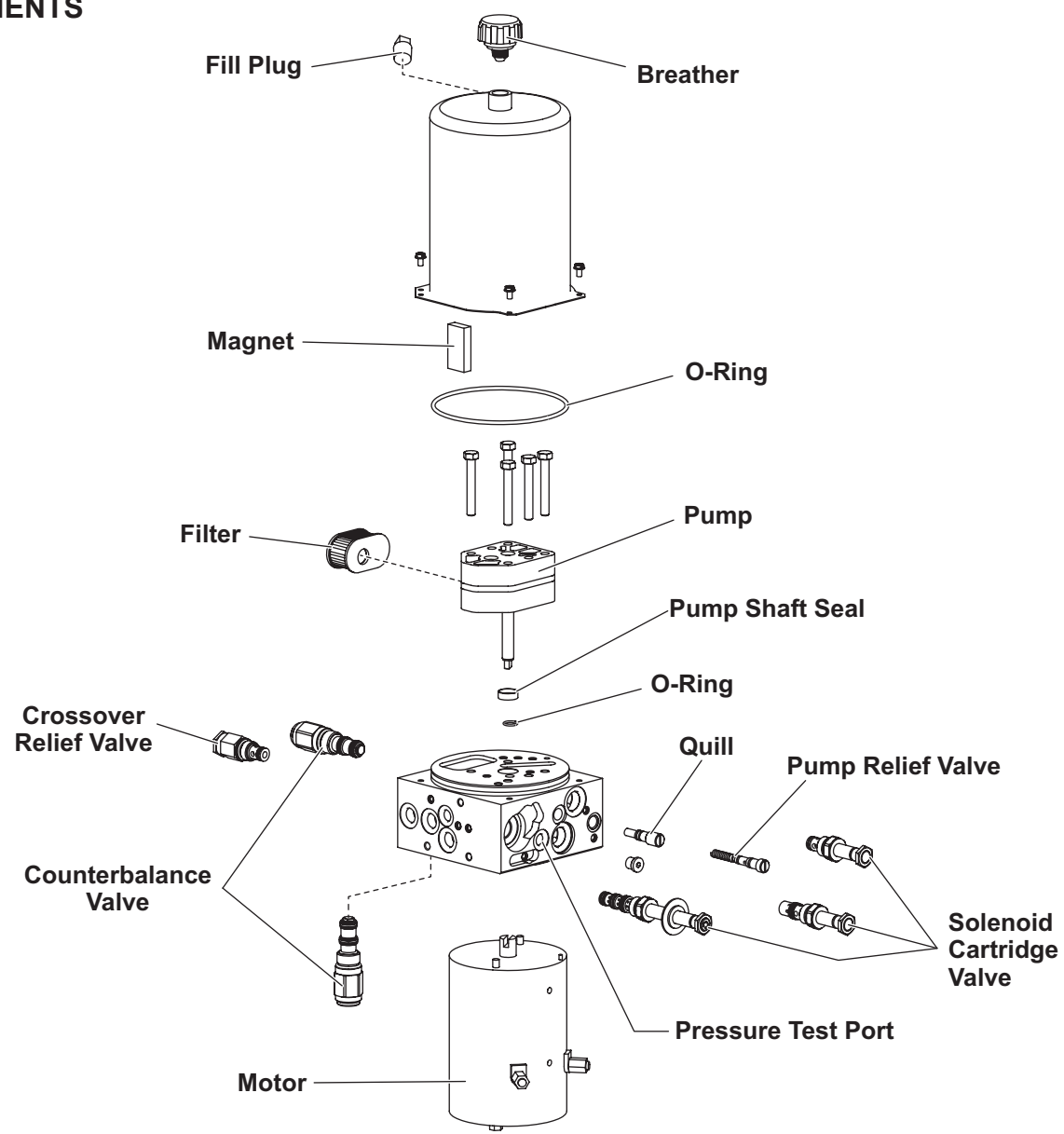
Fastener Torque Specifications

Pump Cap Screws	5/16-18 x 2-1/2	150–160 in-lb
Motor Terminals (+ and –)	5/16-18 Nut	50–60 in-lb
Motor to Manifold Cap Screws	1/4-20 x 6-1/4	30–40 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	40–60 in-lb
Cover Screws	1/4-20 x 1/2 Shoulder Screw	60–80 in-lb
SAE O-Ring Plugs	1/8 or 5/32 Internal Hex	55–65 in-lb
Hydraulic Unit Mount Bolts	3/8-16 x 1	25–33 ft-lb
Check Valves	7/8 Hex Head	19–21 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	90–100 in-lb
Plow Module Mount Screws	1/4-20 x 5/8	60–70 in-lb
Angle Ram Gland Nuts		150–180 ft-lb

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HYDRAULIC SYSTEM

HYDRAULIC UNIT COMPONENTS

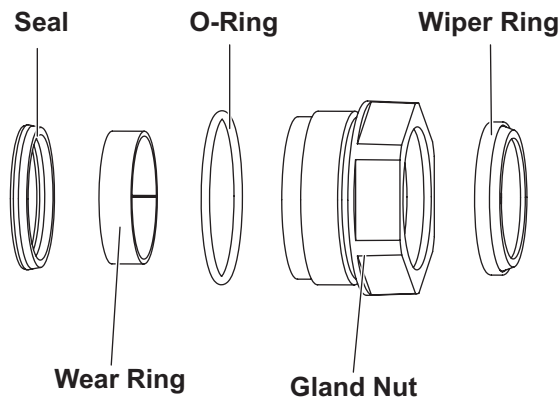


HYDRAULIC SYSTEM

HYDRAULIC COMPONENT INSTALLATION

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.



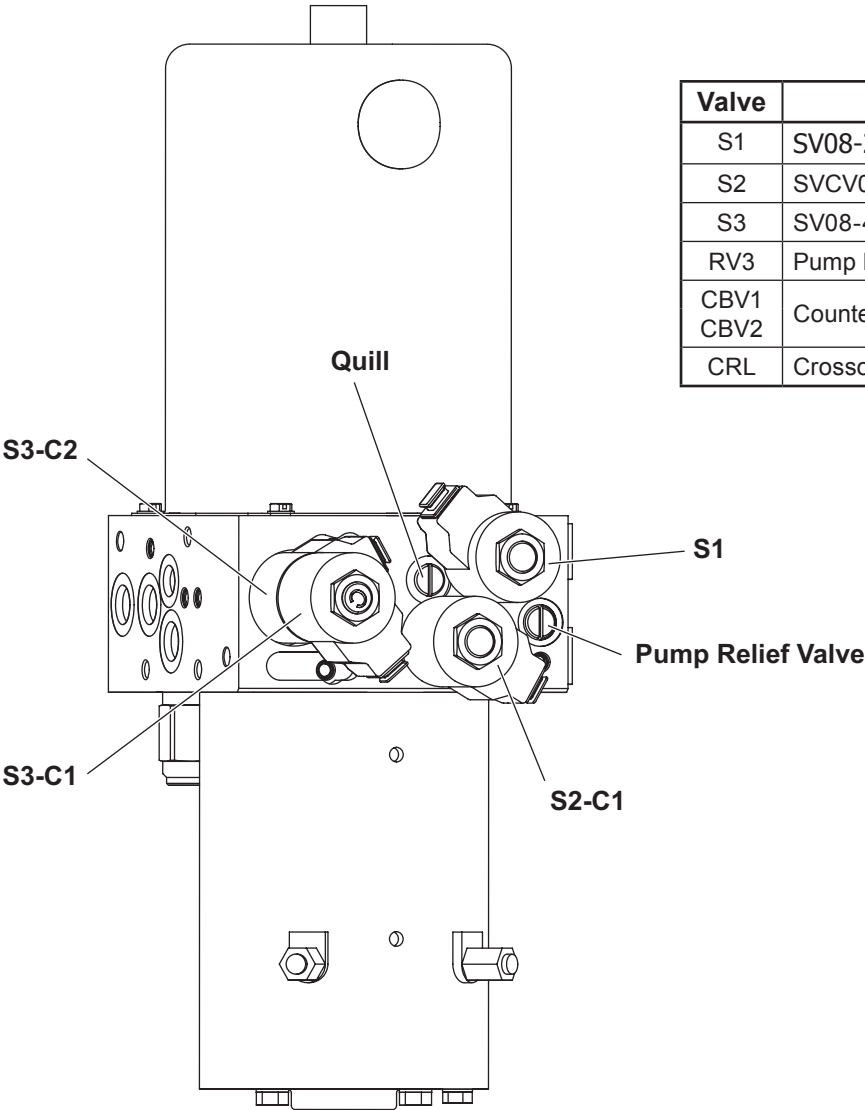
Cartridge & Check Valve Removal

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

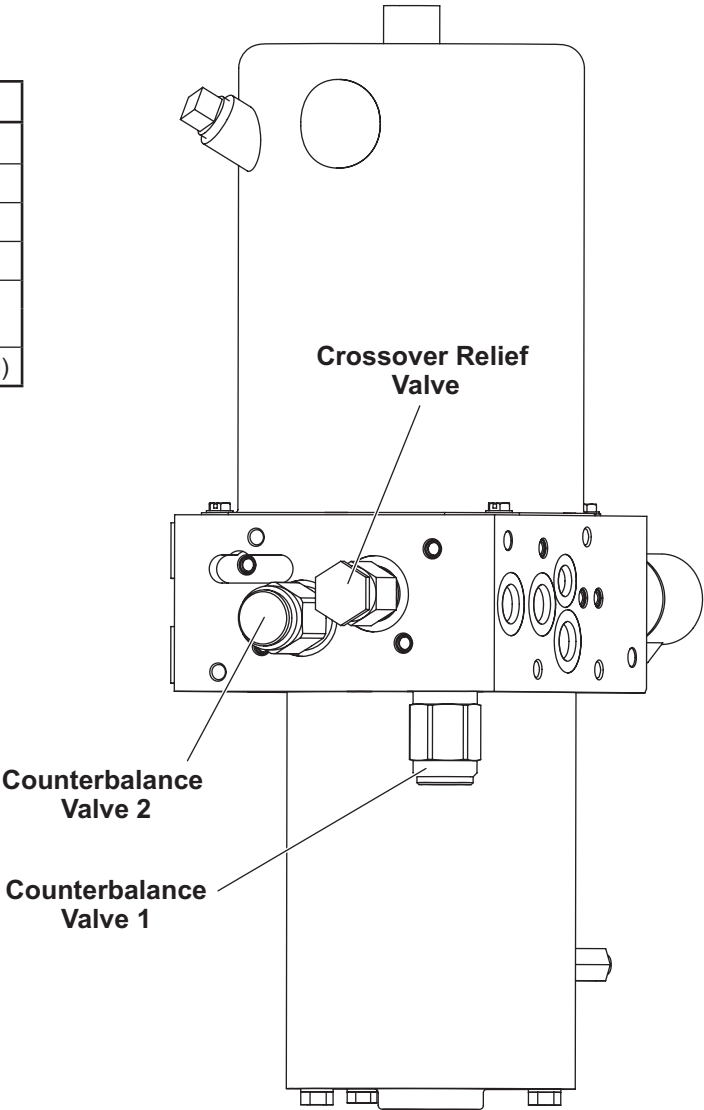
1. Install the Diagnostic Harness (PN 29290-1) following the instructions included with the kit.
2. Cycle through the control functions twice to remove pressure in the hydraulic unit.
3. Slowly remove the breather from the top of the hydraulic unit.
4. Either (a) completely drain the reservoir and skip 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.

HYDRAULIC SYSTEM

VALVE LOCATIONS

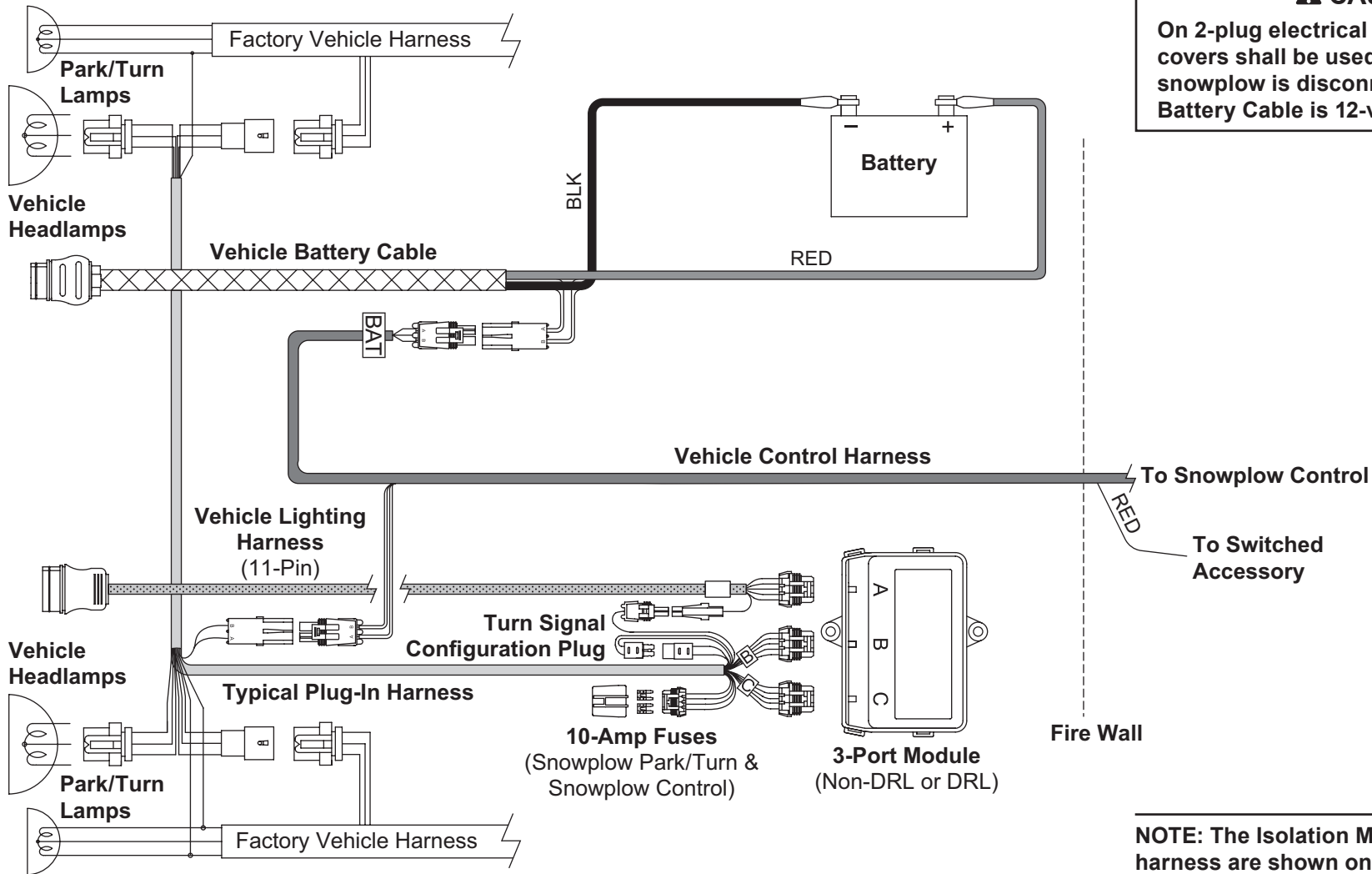


Valve	Type
S1	SV08-2004
S2	SVCV08-20
S3	SV08-47C
RV3	Pump Relief Valve (2250 psi)
CBV1 CBV2	Counterbalance Valve CB10-30
CRL	Crossover Relief Valve (4000 psi)



ELECTRICAL SYSTEM

WIRING – 3-PORT MODULE



⚠ CAUTION

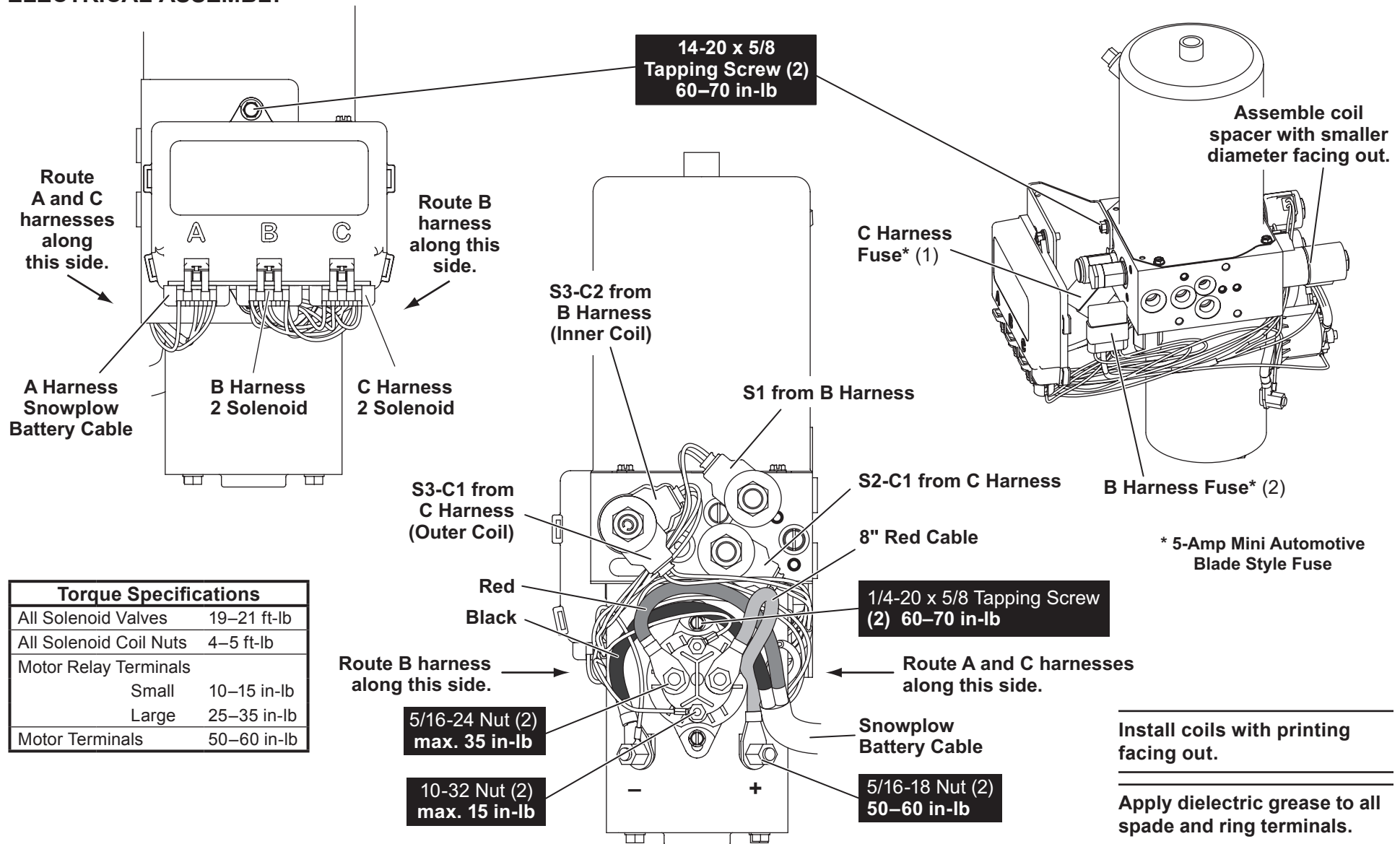
On 2-plug electrical systems, plug covers shall be used whenever the snowplow is disconnected. Vehicle Battery Cable is 12-volt unfused source.

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NOTE: The Isolation Module and plug-in harness are shown on the driver's side for illustration purposes only. Location may be different for the vehicle.

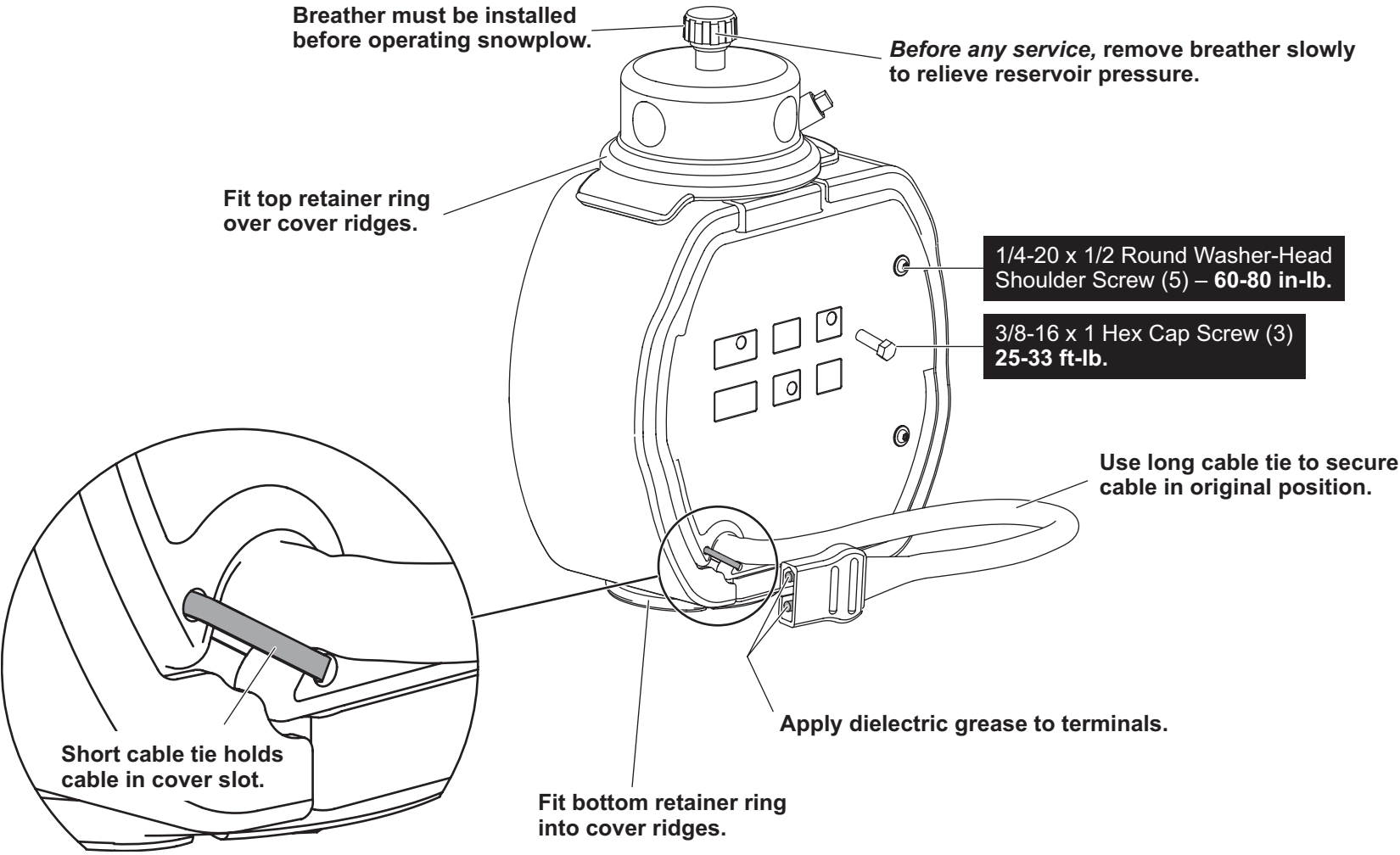
ELECTRICAL SYSTEM

ELECTRICAL ASSEMBLY



ELECTRICAL SYSTEM

COVER AND FINAL ASSEMBLY



CONTROLS

GENERAL INFORMATION

⚠ 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 PRODIGY™ snowplow can be operated by the CabCommand 9-button hand-held control or by a joystick-style control. The control allows you to raise, lower, and angle the blade, all at the touch of a button or with one movement of the joystick lever.

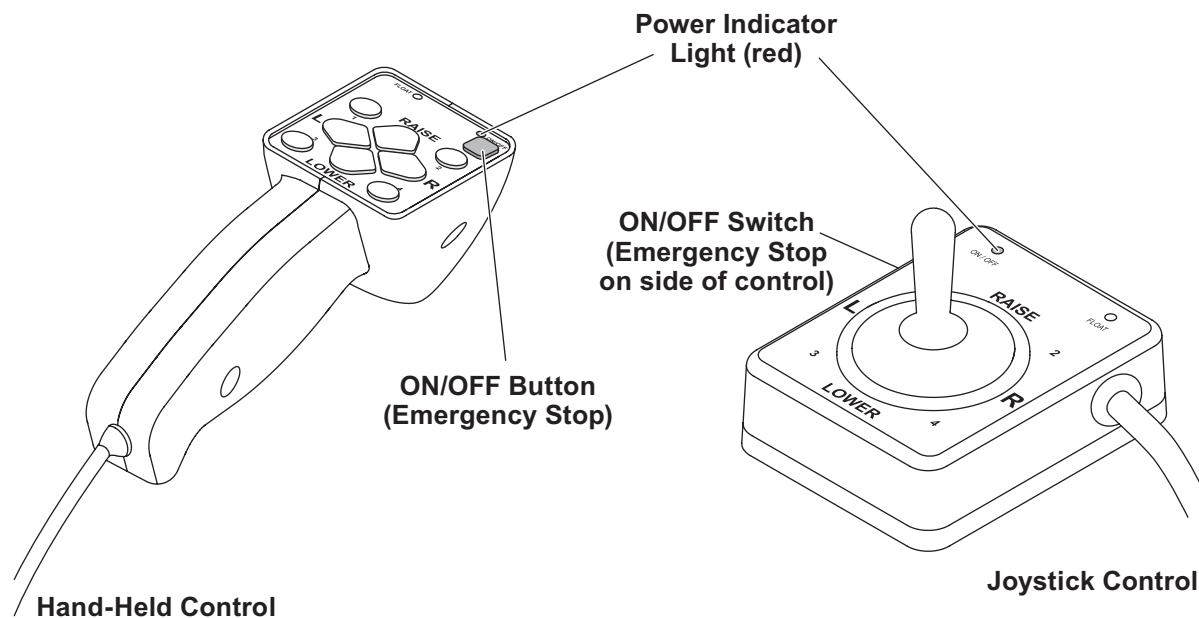
Each control is equipped with an ON/OFF button or switch and an indicator light to show when the control is powered ON or OFF. The controls are powered by the vehicle's battery, so your vehicle ignition (key) switch must be ON to use the controls.

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.

The control is 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 Guide section of this manual.



CONTROLS

CabCommand HAND-HELD FLEET FLEX CONTROL

 **WARNING**

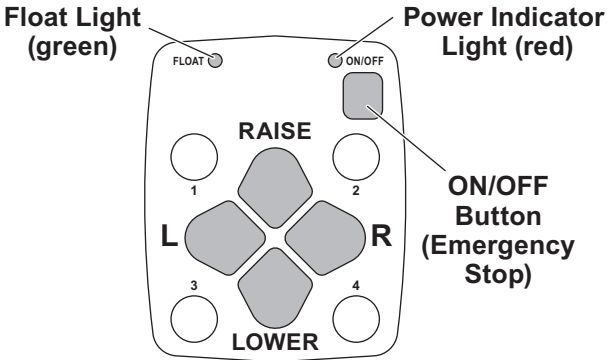
To prevent accidental movement of the blade, always push the ON/OFF button to switch the control OFF whenever the snowplow is not in use. The power indicator light will turn OFF.

1.

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

CONTROLS

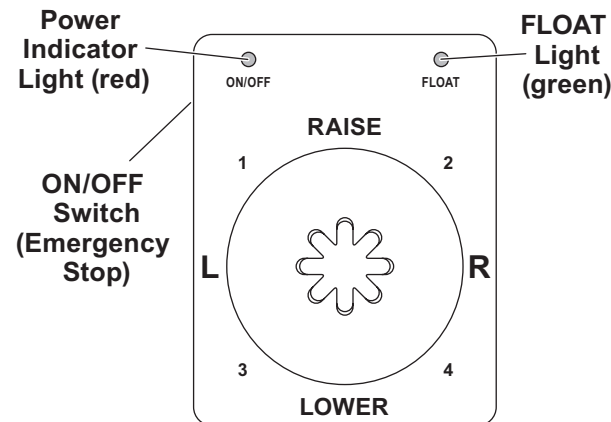
JOYSTICK FLEET FLEX CONTROL

⚠ 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.

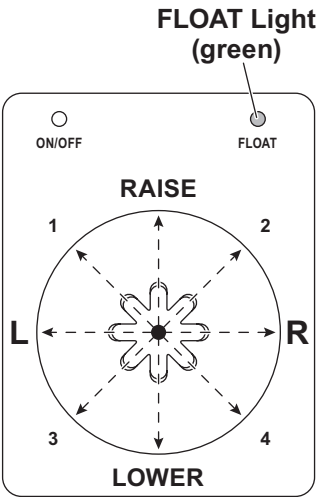
Smooth Stop

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.

CONTROLS

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.

Function	Description of Operation
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.

CONTROLS

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.

CONTROLS

SECURITY GUARD™ SNOWPLOW ANTI-THEFT SYSTEM

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.

CONTROLS

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.

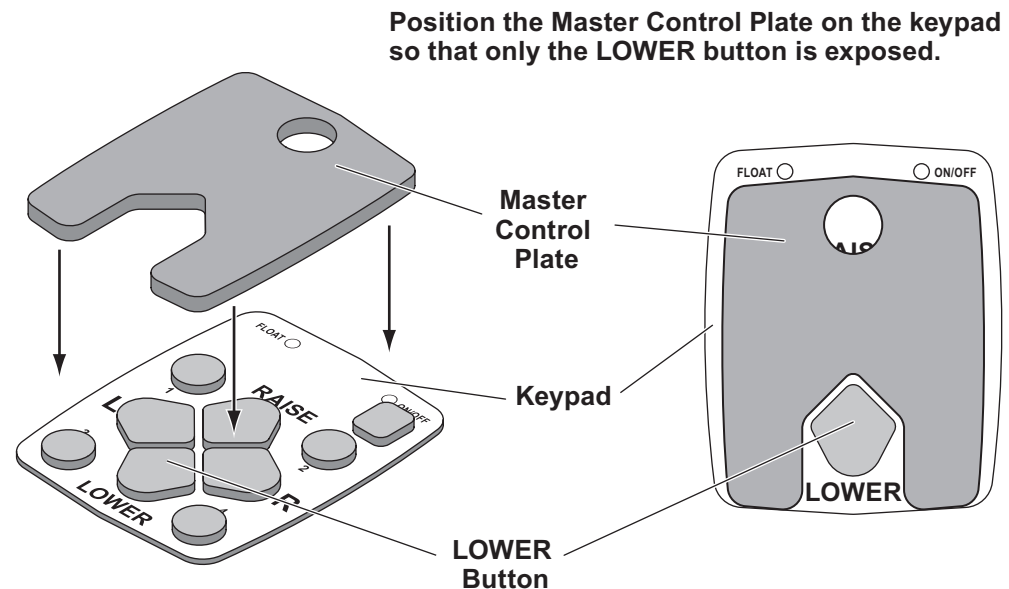
IMPORTANT: The following steps must be performed using the Distributor Master Control (PN 48800). Only the Distributor Master Control can clear an established code within a snowplow module without using the original control used to establish the code.

⚠ 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.
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.

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



THEORY OF OPERATION

SNOWPLOW HYDRAULICS

The PRODIGY™ 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.



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.

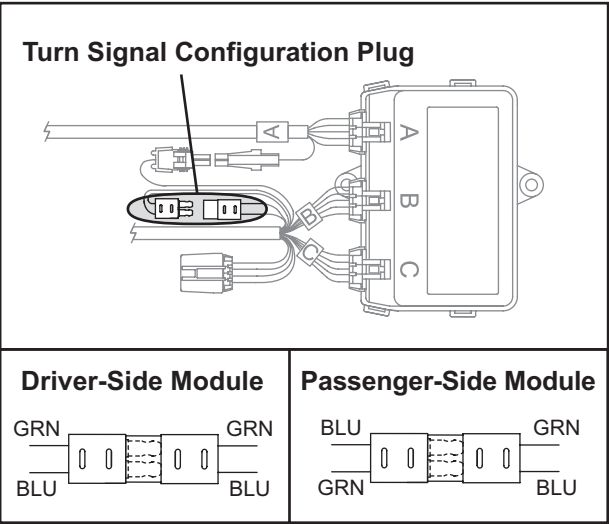
The output of the vehicle high beam/low beam select switch is directed to the Isolation Module via the plug-in harness. When the snowplow is not attached to the vehicle, the signal passes through the normally closed relay contacts to the vehicle headlamps. During this time, the Isolation Module is inactive, 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.



THEORY OF OPERATION

Green Label DRL 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.**

THEORY OF OPERATION

Blue Label DRL Module (PN 29760-1)

NOTE: Limited vehicle application.

Model year 2014 GMC and Chevy 1500 pickups require this DRL module.

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.

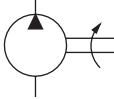
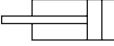
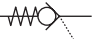
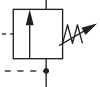
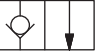
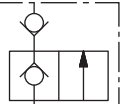
- Activating a **switched accessory** wire (a key-controlled power source) applies battery voltage to the VACC input of the module, which energizes the coil of the control power relay (part of the 3-port module). Energizing the coil of the control power relay causes the relay contacts to shift from the "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.

ELECTRICAL & HYDRAULIC SCHEMATICS

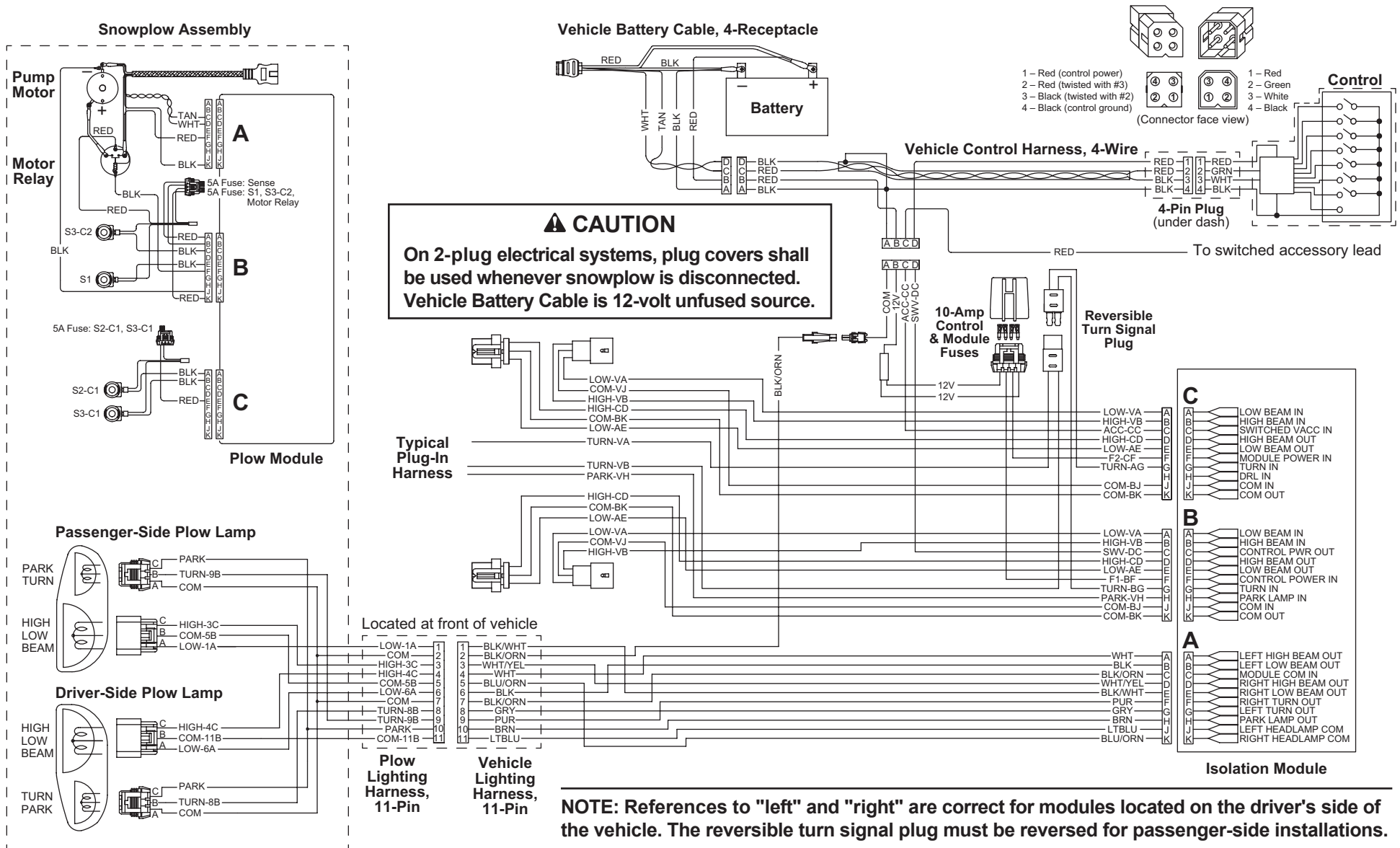
The following section contains hydraulic and electrical schematics to help explain how the hydraulic unit performs the different functions. A schematic is an abstract drawing showing the *purpose* of each of the components in the system. Each component is represented by a graphical symbol. The hydraulic and electrical legends describe each of the symbols used in the schematics for this guide.

The first two schematics show a general overview of the complete hydraulic and electrical systems. Other schematics highlight the flow of hydraulic fluid and electrical current for each function the hydraulic unit performs, as well as the flow of electrical current for snowplow and vehicle lights.

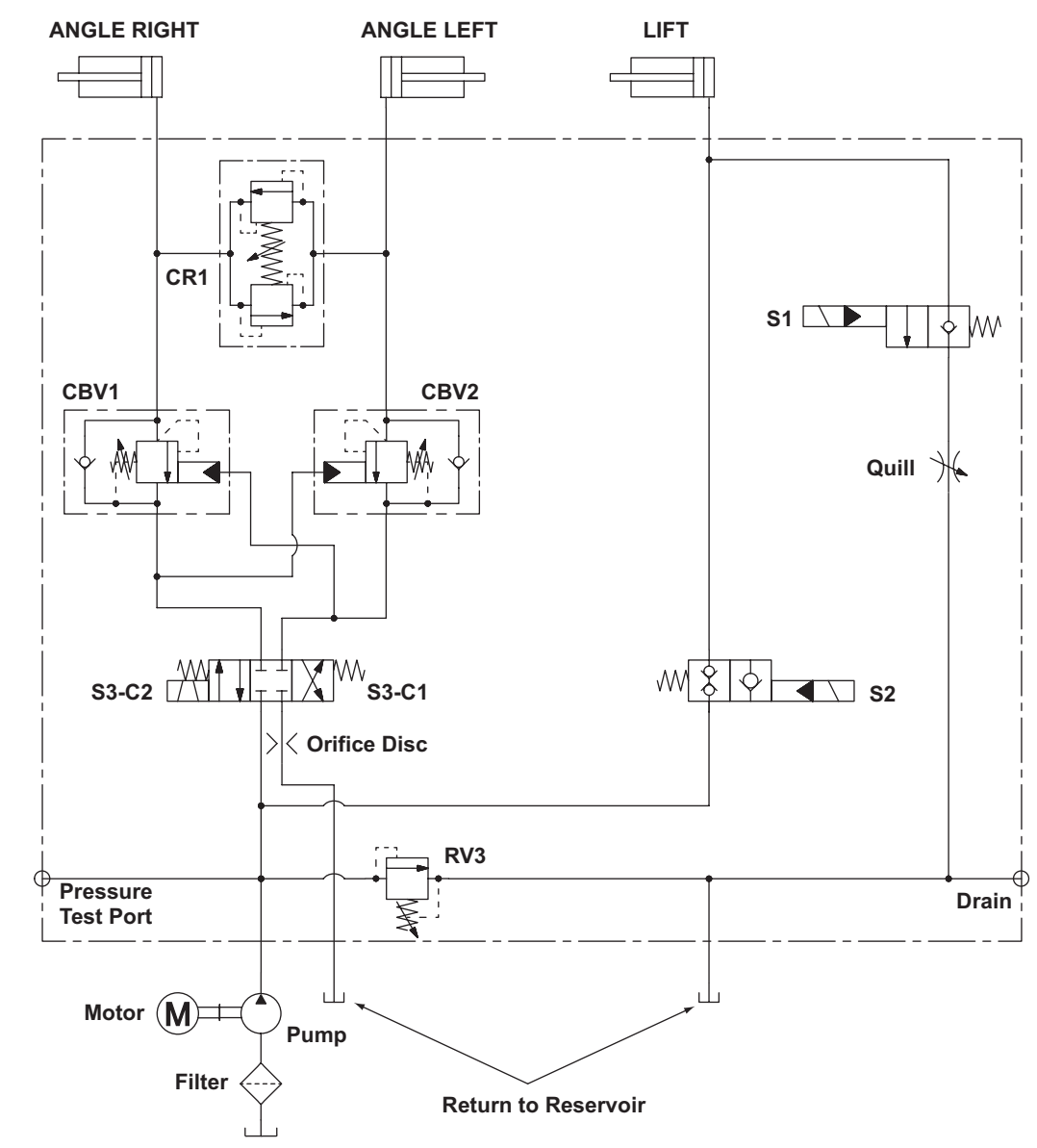
- Bold lines represent the circuit being activated.
- Shaded components are either activated or shifted from their normal position.

ELECTRICAL LEGEND		HYDRAULIC LEGEND	
	CROSSING WIRE		LINE, WORKING (MAIN)
	WIRE SPLICE		LINES JOINING
	IN-LINE CONNECTOR		LINES CROSSING
	FUSE		FLOW, DIRECTION OF HYDRAULIC FLUID
	SOLENOID COIL		LINE, TO RESERVOIR BELOW FLUID LEVEL
	CIRCUIT GROUND		HYDRAULIC PUMP FIXED DISPLACEMENT
	MOTOR RELAY		RAM
	BATTERY		ELECTRIC MOTOR
	MOTOR		FILTER, STRAINER, DIFFUSER
	HEADLAMP		COMPONENT ENCLOSURE
	PARK/TURN LAMP		ORIFICE PLATE
	PRINTED CIRCUIT BOARD		ORIFICE DISC
	COMPONENT ENCLOSURE		SPRING
			SOLENOID, SINGLE WINDING
			CHECK VALVE
			PILOT-OPERATED CHECK VALVE
			VALVE, ADJUSTABLE PRESSURE RELIEF
			VALVE, FLOW CONTROL, ADJUSTABLE NON-COMPENSATED
			VALVE, 2 POSITION, 2 CONNECTION (2-WAY)
			VALVE, 2 POSITION, 2 CONNECTION (2-WAY) WITH INTEGRAL CHECK VALVE
			VALVE, 2 POSITION, 3 CONNECTION (3-WAY)
			VALVE, 2 POSITION, 4 CONNECTION (4-WAY)

ELECTRICAL SCHEMATIC — 3-PORT MODULE

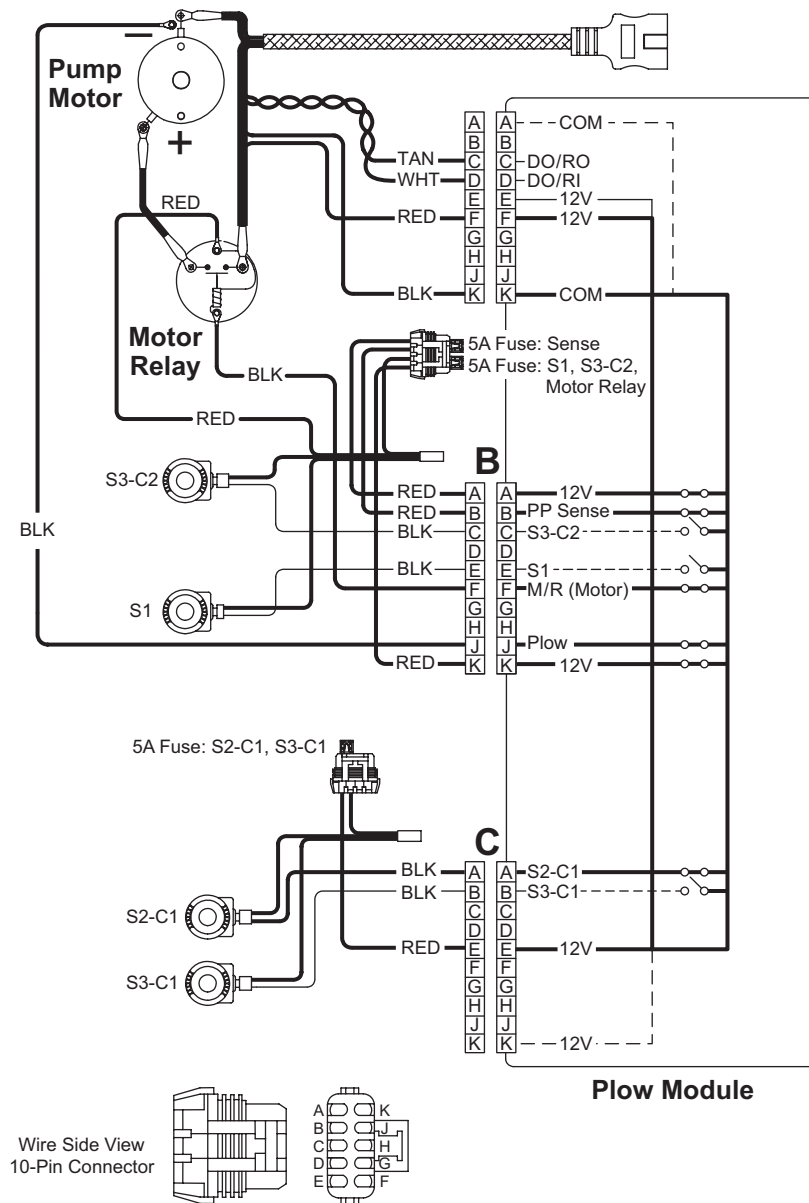


HYDRAULIC SCHEMATIC



BLADE MOVEMENT		SOLENOID	RAISE ↑	LOWER ↓	ANGLE RIGHT ↘	ANGLE LEFT ↙
MOTOR	MOTOR	M	ON		ON	ON
SV08-2004	SV1	S1		ON		
SVCV08-20	SVCV1	S2	ON			
SV08-47C	SV3	S3-C1 Top				ON
	SV3	S3-C2 Bottom			ON	

RAISE — ELECTRICAL

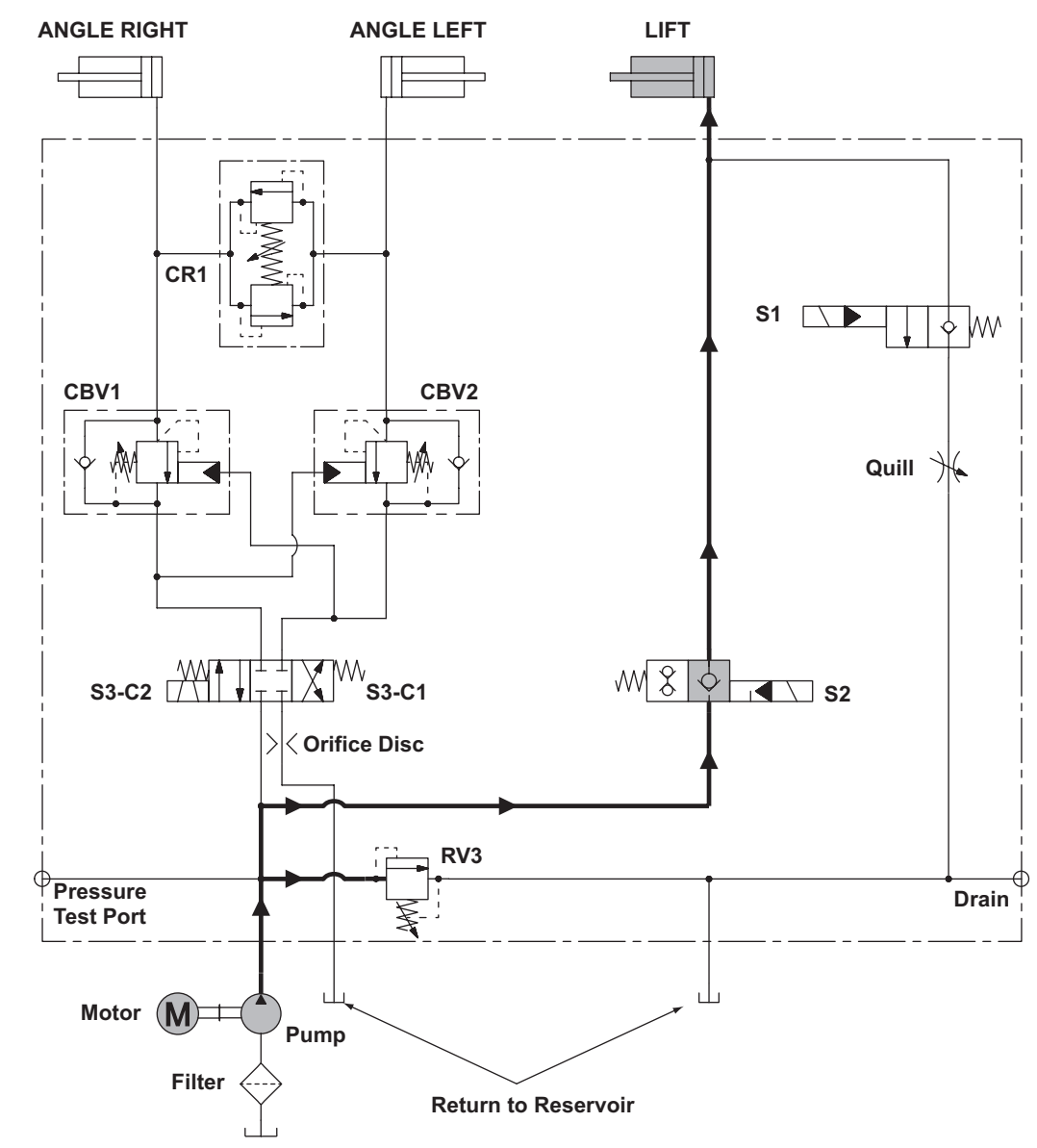


System Response

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 S2.
2. Hydraulic fluid from the pump flows through S2 and fills the base end of the lift ram, extending the rod.

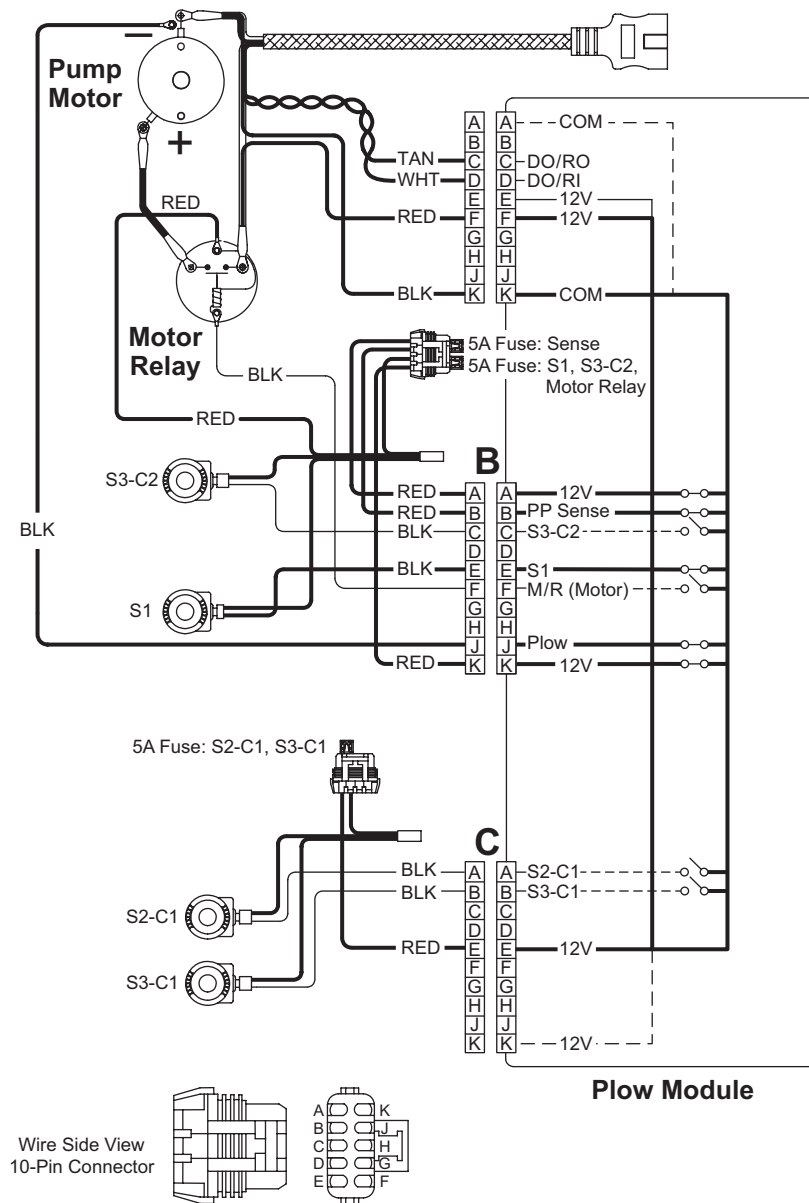
NOTE: Battery voltage is supplied to the Plow Module, the motor relay and the 4 solenoid coils when the snowplow is connected to the vehicle.

RAISE — HYDRAULIC



BLADE MOVEMENT		SOLENOID	RAISE	LOWER	ANGLE RIGHT	ANGLE LEFT
			↑	↓	↘	↙
MOTOR	MOTOR	M	ON		ON	ON
SV08-2004	SV1	S1		ON		
SVCV08-20	SVCV1	S2	ON			
SV08-47C	SV3	S3-C1 Top				ON
	SV3	S3-C2 Bottom			ON	

LOWER — ELECTRICAL

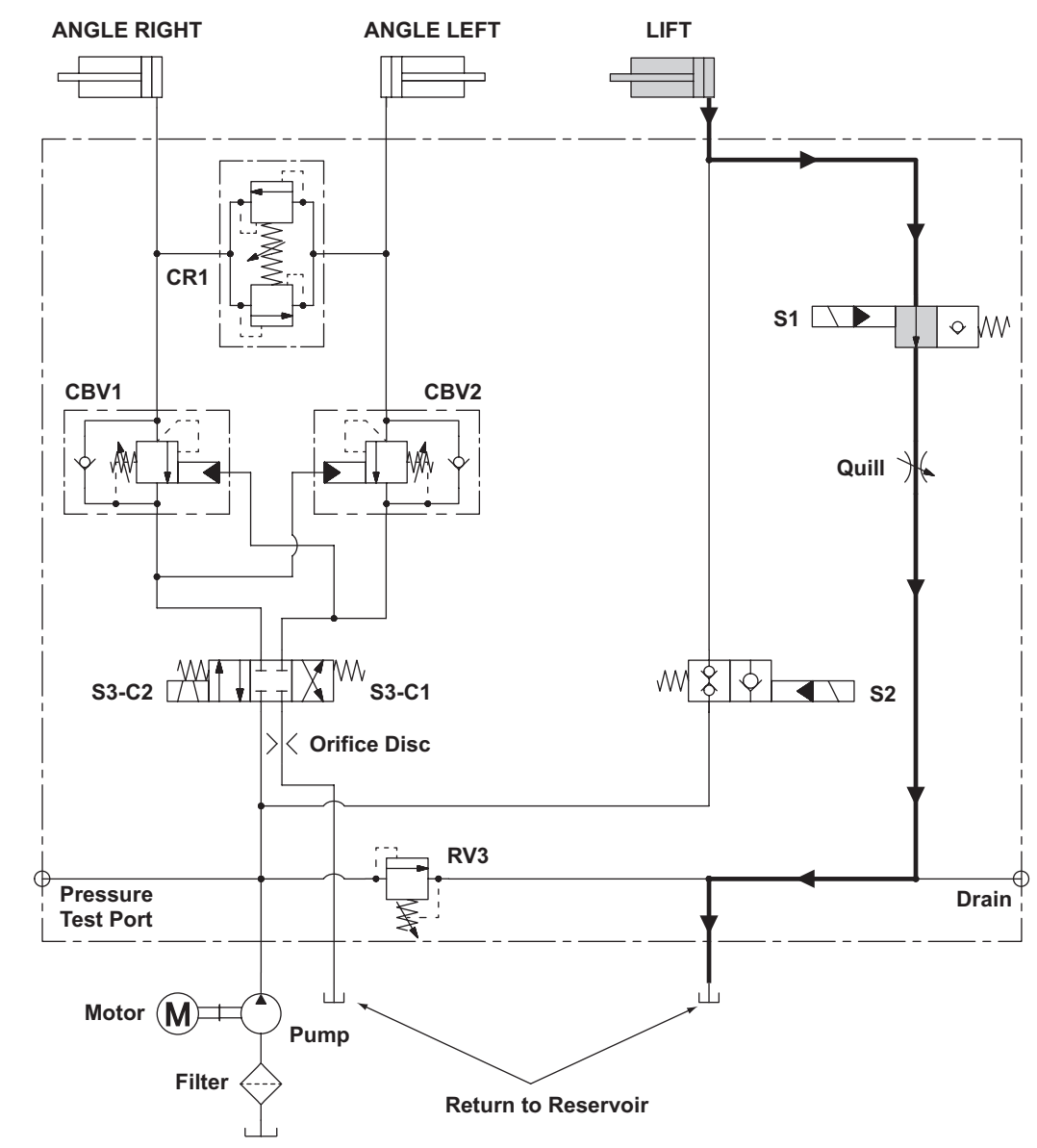


System Response

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 retracts. Hydraulic fluid is pushed out of the base end, through S1 and the quill and back to the reservoir.

NOTE: Battery voltage is supplied to the Plow Module, the motor relay and the 4 solenoid coils when the snowplow is connected to the vehicle.

LOWER — HYDRAULIC



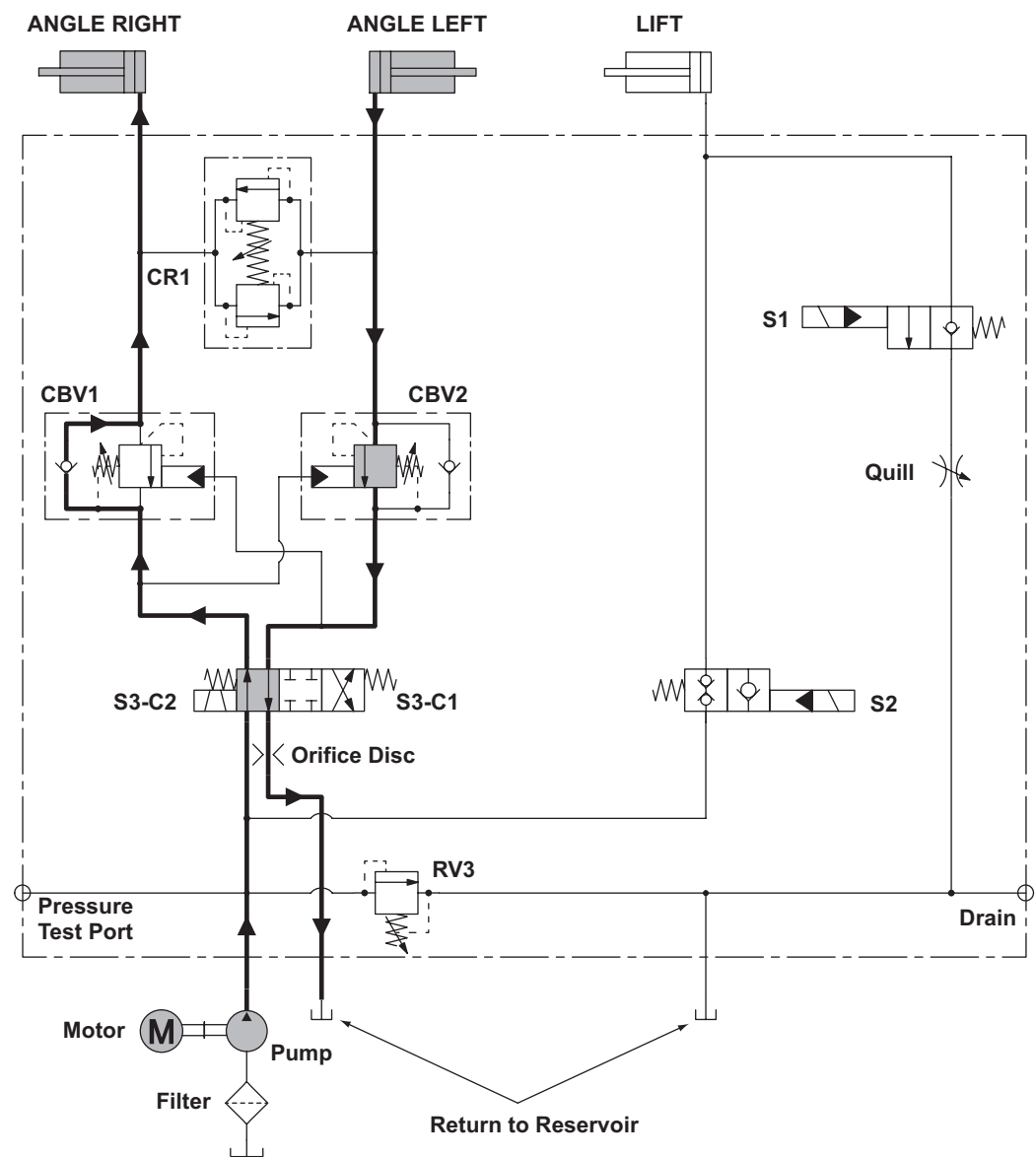
BLADE MOVEMENT		SOLENOID	RAISE	LOWER	ANGLE RIGHT	ANGLE LEFT
			↑	↓	↘	↙
MOTOR	MOTOR	M	ON		ON	ON
SV08-2004	SV1	S1		ON		
SVCV08-20	SVCV1	S2	ON			
SV08-47C	SV3	S3-C1 Top				ON
	SV3	S3-C2 Bottom			ON	



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 S3-C2 (bottom coil).
2. Hydraulic fluid from the pump flows through activated S3-C2 and into the base end of the left cylinder, causing it to extend.
3. The retracting right ram pushes the hydraulic fluid out of its base end, through activated S3-C2 and back to the reservoir.

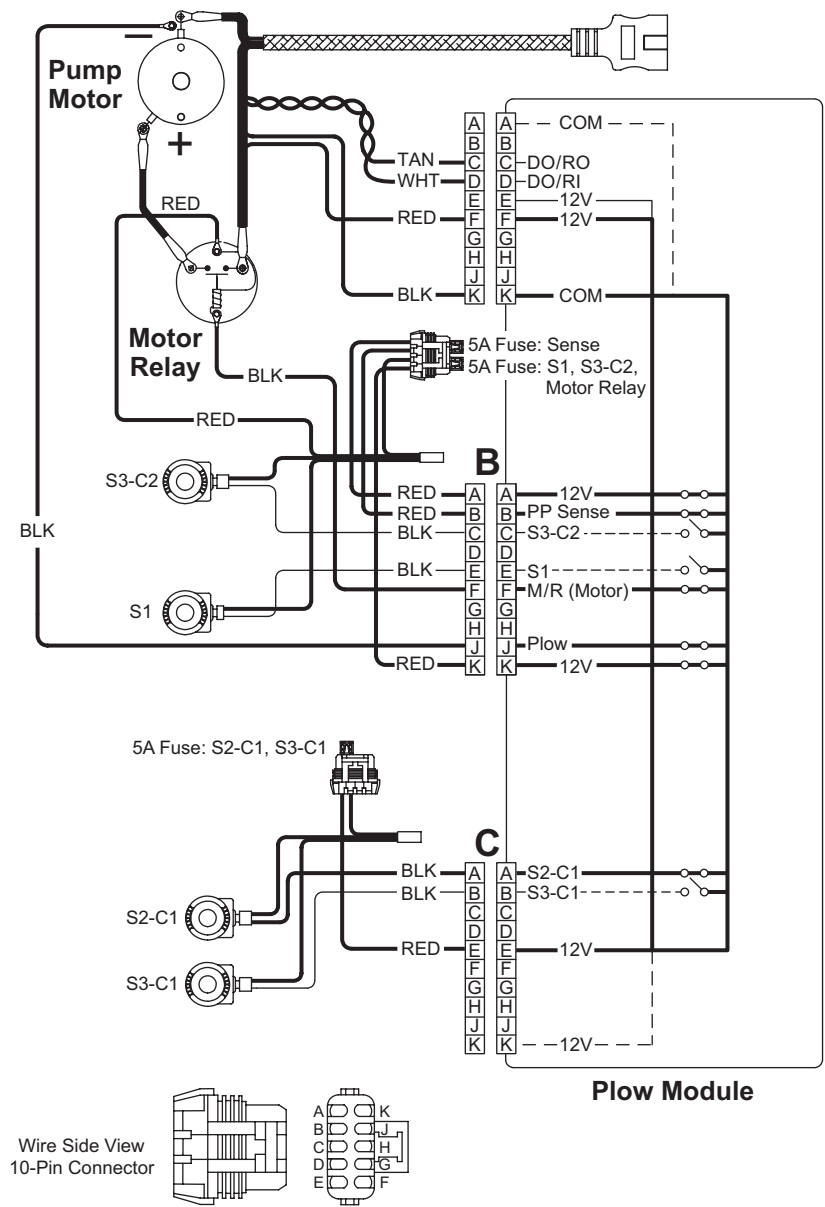
NOTE: Battery voltage is supplied to the Plow Module, the motor relay and the 4 solenoid coils when the snowplow is connected to the vehicle.

ANGLE RIGHT — HYDRAULIC



BLADE MOVEMENT		SOLENOID	RAISE ↑	LOWER ↓	ANGLE RIGHT ↘	ANGLE LEFT ↙
MOTOR	MOTOR	M	ON		ON	ON
SV08-2004	SV1	S1		ON		
SVCV08-20	SVCV1	S2	ON			
SV08-47C	SV3	S3-C1 Top				ON
	SV3	S3-C2 Bottom			ON	

ANGLE LEFT — ELECTRICAL

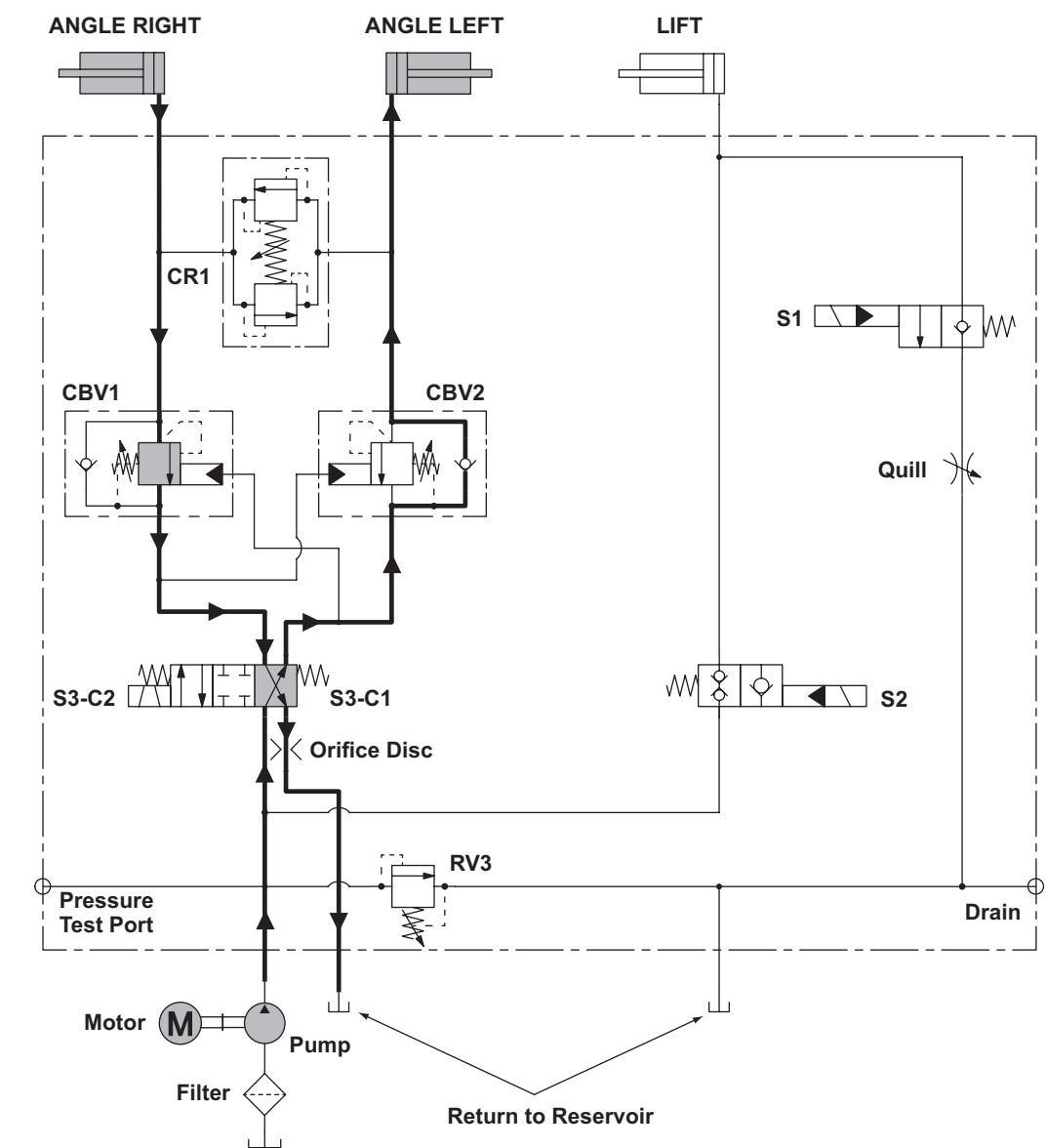


System Response

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 valve S3-C1 (top coil).
2. Hydraulic fluid from the pump flows through activated S3-C1 and into the base end of the right cylinder, causing it to extend.
3. The retracting left ram pushes the hydraulic fluid out of its base end, through activated S3-C1 and back to the reservoir.

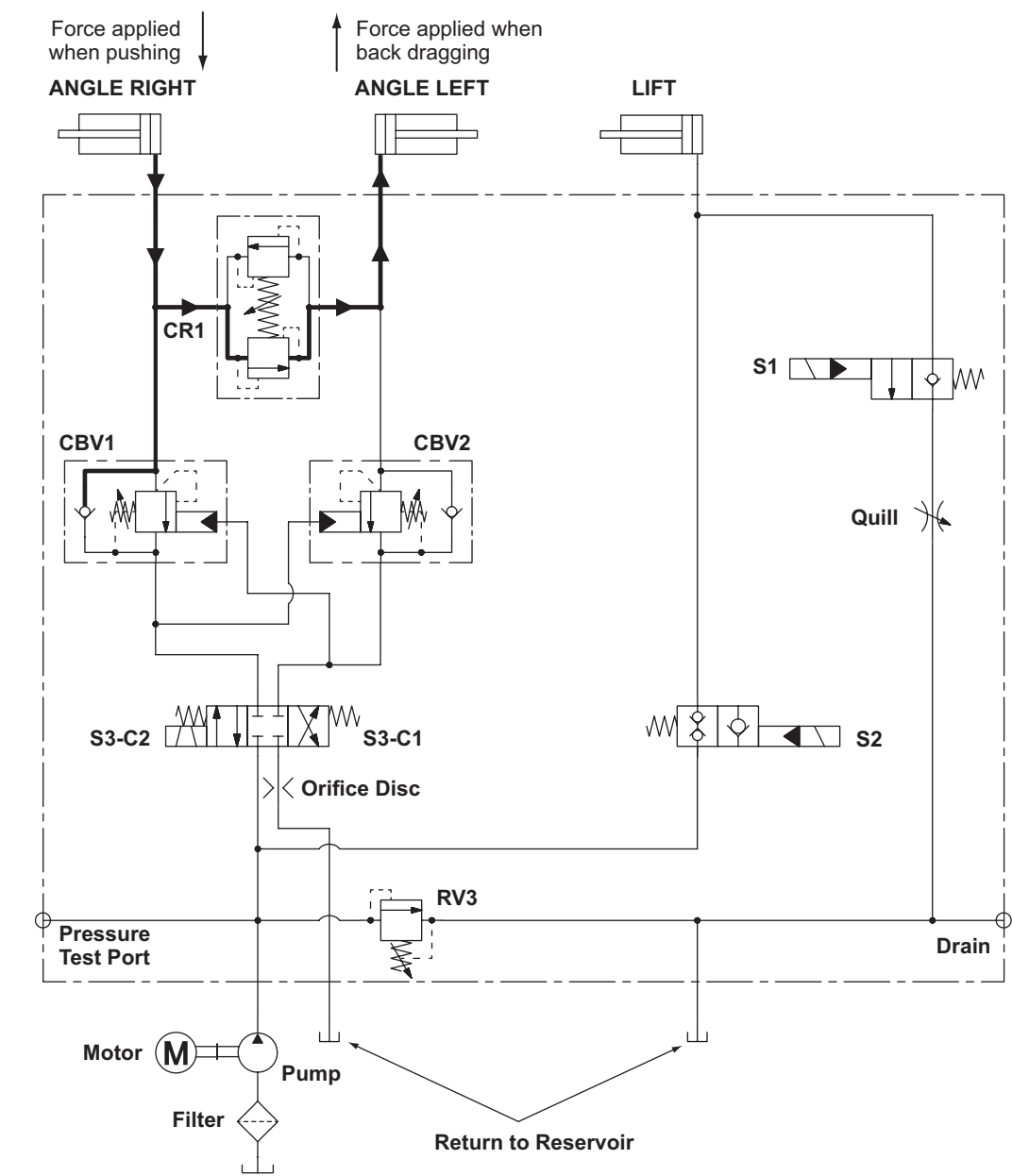
NOTE: Battery voltage is supplied to the Plow Module, the motor relay and the 4 solenoid coils when the snowplow is connected to the vehicle.

ANGLE LEFT — HYDRAULIC



BLADE MOVEMENT		SOLENOID	RAISE ↑	LOWER ↓	ANGLE RIGHT ↘	ANGLE LEFT ↙
MOTOR	MOTOR	M	ON		ON	ON
SV08-2004	SV1	S1		ON		
SVCV08-20	SVCV1	S2	ON			
SV08-47C	SV3	S3-C1 Top				ON
	SV3	S3-C2 Bottom			ON	

STRIKING AN OBJECT WHILE PLOWING (DS) — HYDRAULIC



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

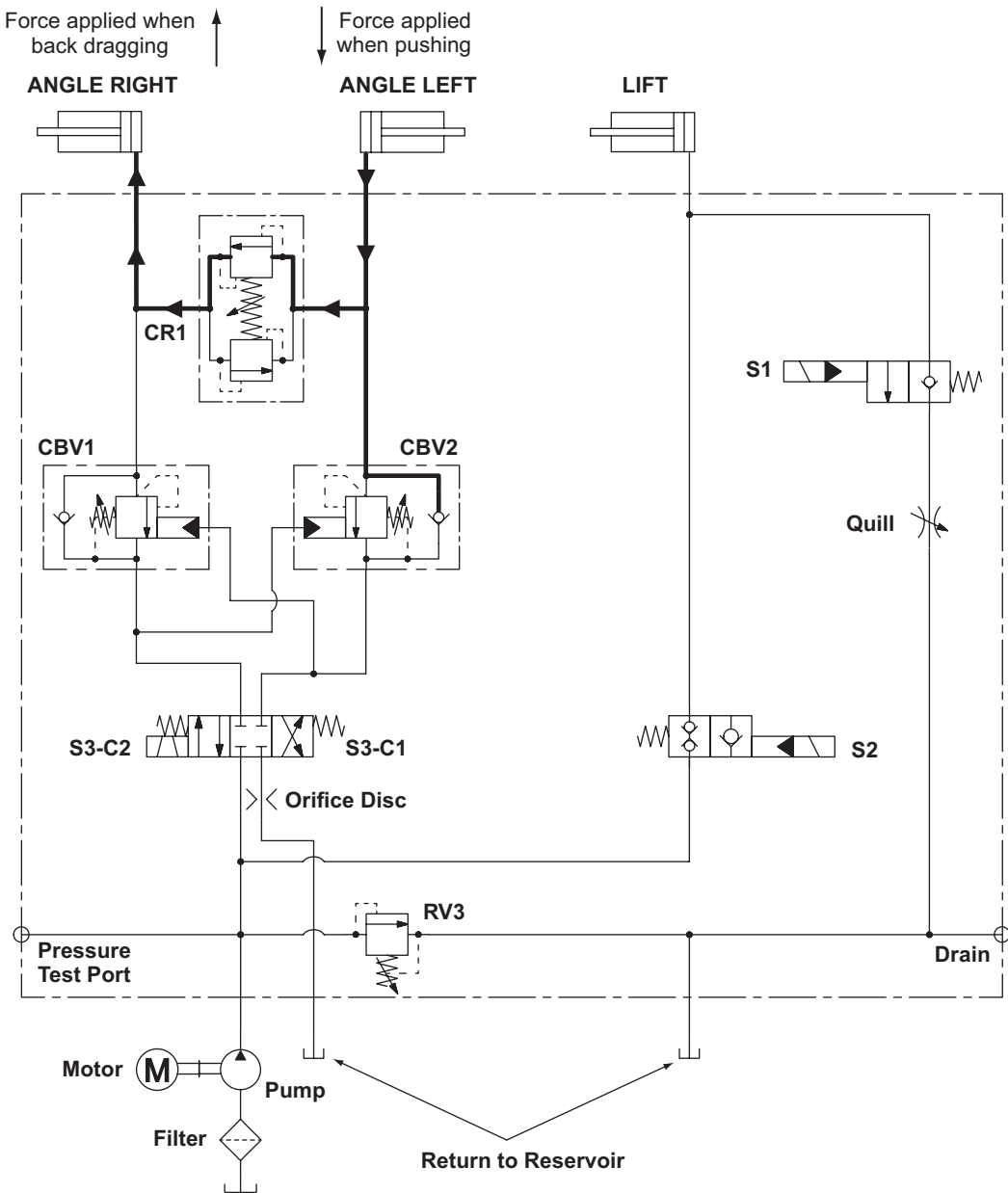
1. Hydraulic fluid is trapped in the base end of the cylinder by the counterbalance valve 1 (CBV1) and the CR1 relief valve.
2. When the snowplow contacts an object while plowing, force of the impact increases hydraulic pressure in the base end of the cylinder. When pressure exceeds the nominal setting value of the CR1 relief valve, it opens allowing hydraulic fluid to flow to the base end of the opposite cylinder.

The CR1 relief valve is not adjustable.

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BLADE MOVEMENT		SOLENOID	RAISE ↑	LOWER ↓	ANGLE RIGHT ↖	ANGLE LEFT ↗
MOTOR	MOTOR	M	ON		ON	ON
SV08-2004	SV1	S1		ON		
SVCV08-20	SVCV1	S2	ON			
SV08-47C	SV3	S3-C1 Top				ON
	SV3	S3-C2 Bottom			ON	

STRIKING AN OBJECT WHILE PLOWING (PS) — HYDRAULIC



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.

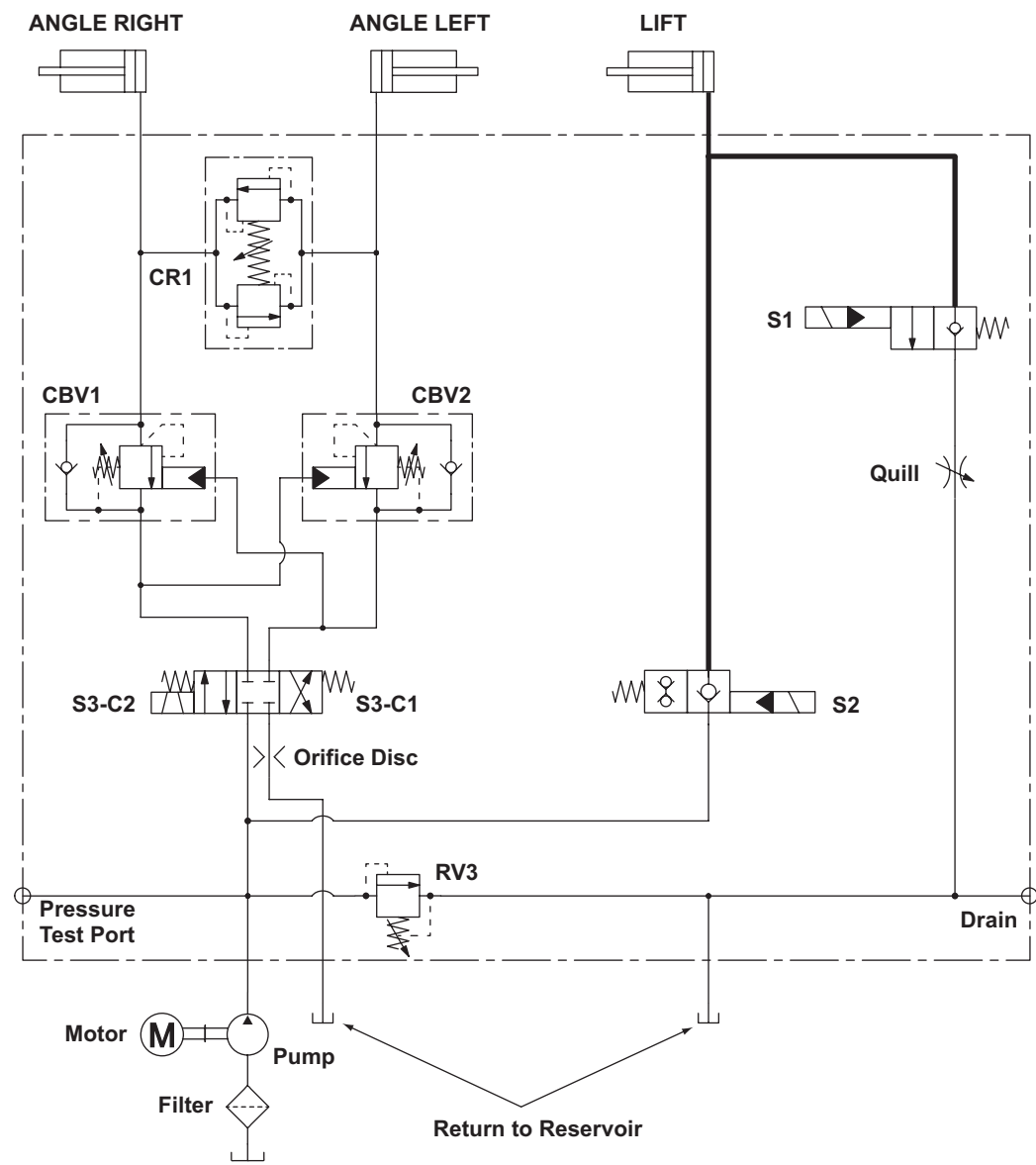
System Response

1. Hydraulic fluid is trapped in the base end of the cylinder by the counterbalance valve 2 (CBV2) and the CR1 relief valve.
2. When the snowplow contacts an object while plowing, force of the impact increases hydraulic pressure in the base end of the cylinder. When pressure exceeds the nominal setting value of the CR1 relief valve, it opens, allowing hydraulic fluid to flow to the base end of the opposite cylinder.

The CR1 relief valve is not adjustable.

BLADE MOVEMENT		SOLENOID	RAISE	LOWER	ANGLE RIGHT	ANGLE LEFT
			↑	↓		
MOTOR	MOTOR	M	ON		ON	ON
SV08-2004	SV1	S1		ON		
SVCV08-20	SVCV1	S2	ON			
SV08-47C	SV3	S3-C1 Top				ON
	SV3	S3-C2 Bottom			ON	

HOLD IN RAISE POSITION — HYDRAULIC

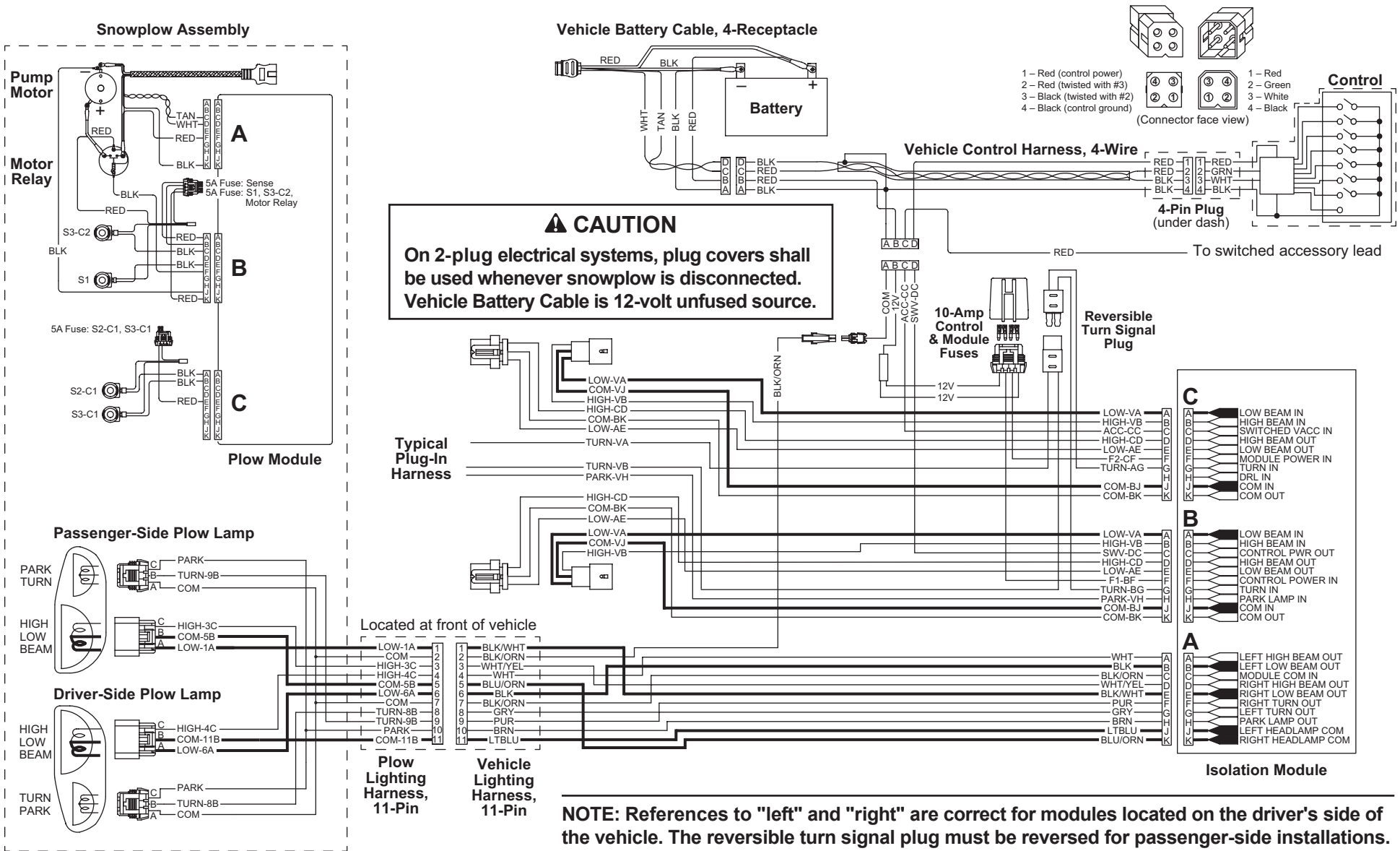


System Response

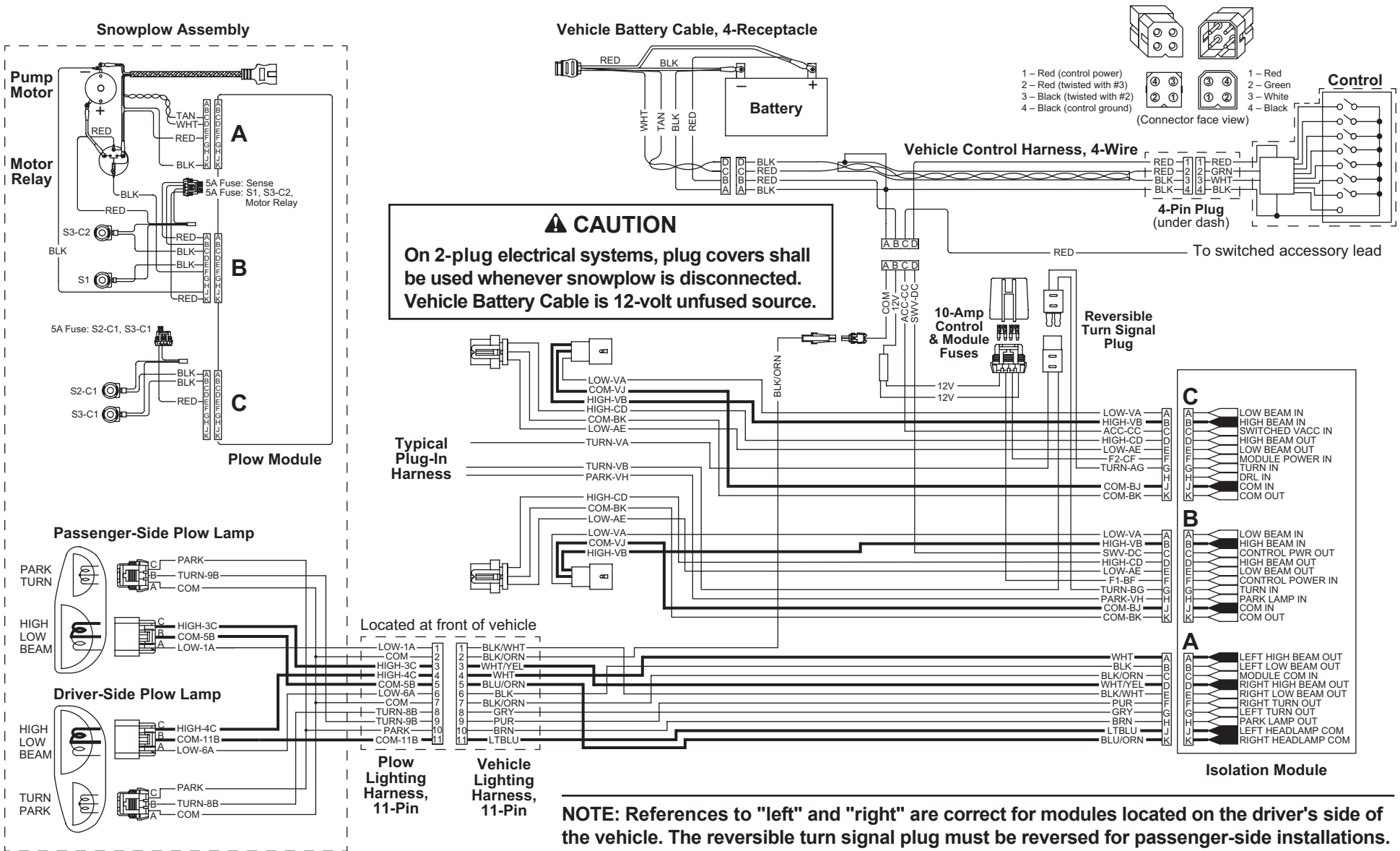
Hydraulic fluid is trapped in the base end of the lift ram by the internal check valve in solenoid cartridge valves S1 & S2.

BLADE MOVEMENT		SOLENOID	RAISE ↑	LOWER ↓	ANGLE RIGHT ↘	ANGLE LEFT ↙
MOTOR	MOTOR	M	ON		ON	ON
SV08-2004	SV1	S1		ON		
SVCV08-20	SVCV1	S2	ON			
SV08-47C	SV3	S3-C1 Top				ON
	SV3	S3-C2 Bottom			ON	

LOW-BEAM HEADLAMPS WITH SNOWPLOW CONNECTED TO VEHICLE (3-PORT MODULE)



HIGH-BEAM HEADLAMPS WITH SNOWPLOW CONNECTED TO VEHICLE (3-PORT MODULE)



Troubleshooting Guide

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TROUBLESHOOTING GUIDE

HOW TO USE THE TROUBLESHOOTING GUIDE

All malfunctions of the PRODIGY™ 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 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 PRODIGY 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.

TROUBLESHOOTING GUIDE

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 "PRODIGY™ FloStat® Hydraulic System Specifications" in the Hydraulic System 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.

TROUBLESHOOTING GUIDE

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.

TROUBLESHOOTING 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.

TROUBLESHOOTING 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.

TROUBLESHOOTING GUIDE

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.

TROUBLESHOOTING GUIDE

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 or 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.

TROUBLESHOOTING GUIDE

SOLENOID COIL ACTIVATION TEST (SCAT)

NOTE: See the Controls section for details on control time-outs and wing 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 harnesses B and C are 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.
3. When instructed to do so, perform the SCAT test by activating the control for each function and checking for magnetic pull at all four solenoid coils. A solenoid coil is magnetized if a screwdriver held nearby is attracted.

Only one coil at a time can be on the valve stem when testing for magnetism. **To test the S3-C2 coil**, remove the S3-C1 coil from the valve stem. **To test the S3-C1 coil**, remove the S3-C2 coil and replace the S3-C1 coil on the valve stem.

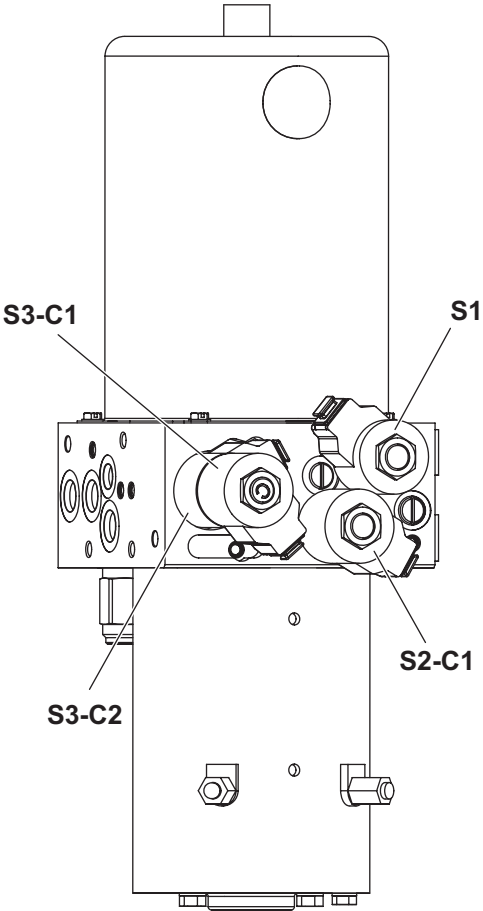
4. Compare the SCAT test results with the testing charts on the following pages.

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

If one or more coils is not magnetizing when it should be, you have an electrical problem. Connect a test light in series with the two connectors removed from the coil. Select any function on the control except LOWER. If the test light does not illuminate, determine whether 12V is present on the red wire. If 12V is present, check for switched ground. If switched ground is present, go to the Individual Solenoid Coil Test. If switched ground is not present, go to the Control/Cable/Plow Module Test.

If the motor relay and all coils are working properly, you have a hydraulic problem.

Torque Specifications	
All Solenoid Valves	19–21 ft-lb
All Solenoid Coil Nuts	48–60 in-lb
Motor Relay Terminals, Small	10–15 in-lb
Large	25–35 in-lb
Motor Terminals	50–60 in-lb



TROUBLESHOOTING GUIDE

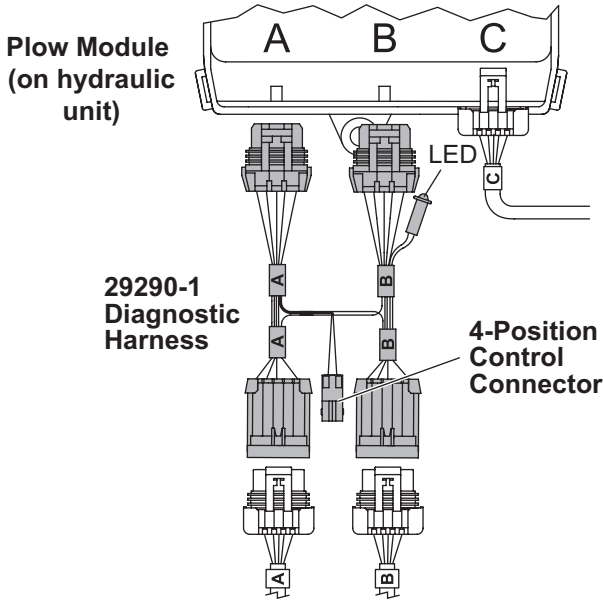
SOLENOID COIL ACTIVATION TEST (SCAT)

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.

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. 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 to the 4-position control connector either in the cab of the vehicle or on the diagnostic harness.
7. Reconnect the snowplow and vehicle battery cables. Do not connect the short cable assembly at this time.

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.

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

Solenoid Coil Activation Test (SCAT)	
Control Function	Solenoid Coil(s) Activated
Raise	S2, Motor Relay
Lower	S1
Angle Right	S3-C2, Motor Relay
Angle Left	S3-C1, Motor Relay

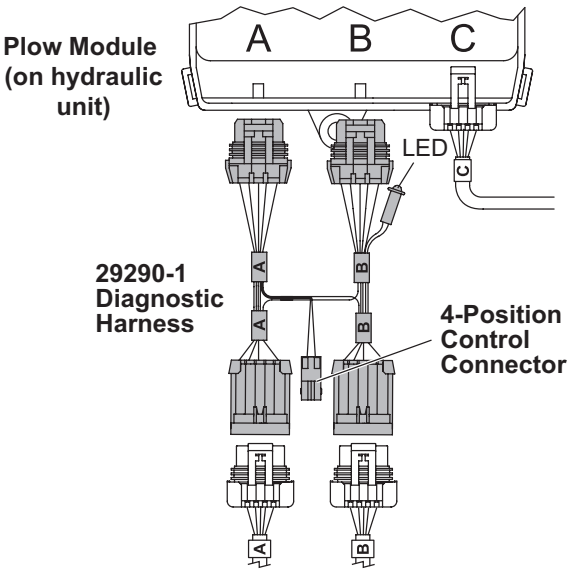
NOTE: The green LED on the diagnostic harness will illuminate when the motor relay function is activated. This light only tests the Plow Module's motor relay output. Refer to a Mechanic's Guide for instructions on properly testing a motor relay.

9. After completing the SCAT test, turn the snowplow control and the vehicle ignition OFF, then disconnect the snowplow and vehicle battery cables.
10. Perform any required repairs and retest 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.

TROUBLESHOOTING GUIDE

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 chart for solenoid numbers and functions.
- 9. After completing the SCAT test, turn the snowplow control OFF and disconnect the power source.
- 10. Perform any required repairs and retest 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.

Solenoid Coil Activation Test (SCAT)	
Control Function	Solenoid Coil(s) Activated
Raise	S2, Motor Relay
Lower	S1
Angle Right	S3-C2, Motor Relay
Angle Left	S3-C1, 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.

TROUBLESHOOTING GUIDE

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.

TROUBLESHOOTING GUIDE

CONTROL/CABLE/PLOW MODULE TEST

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 single-pin connector on vehicle lighting harness is properly connected.
	Harnesses connected to Isolation Module incorrectly	Using the electrical schematic in this guide, verify that 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.	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 damaged control.
		If the problem is not corrected with properly working control, replace the Plow Module.
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 Isolation Module and harnesses are properly connected.
	Blown fuse or damaged Plow Module	Replace all blown fuses on truck and snowplow.
		If 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 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 PC board and/or coiled cord in damaged control.
		If the problem is not corrected with properly working control, replace the Plow Module.

To Safely Handle the Printed Circuit Board

CAUTION

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.

TROUBLESHOOTING GUIDE

MOTOR AND MOTOR RELAY TEST

⚠ WARNING

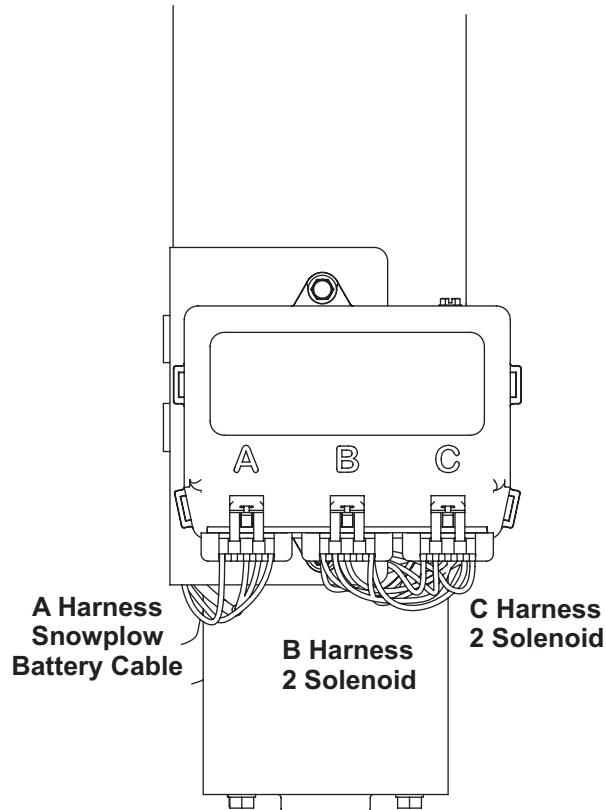
Keep 8' clear of the blade when it is being raised, lowered or angled. Do not stand between vehicle and blade or directly in front of the blade. If the blade hits or drops on you, you could be seriously injured.

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

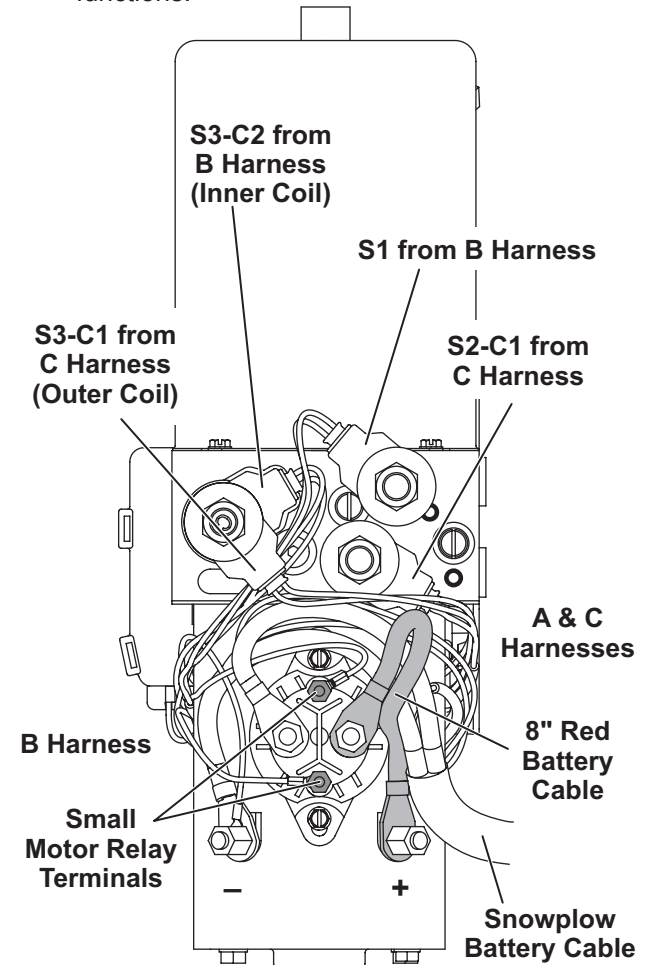
1. Check the F2 fuse on harness B. Replace if fuse is blown, then retest snowplow function.
2. Remove the 8" red battery cable from the large terminal of the motor relay and isolate it. Isolating the battery cable will eliminate the potential of accidental blade movement during testing.
3. Check for 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.

TROUBLESHOOTING GUIDE

PUMP PRESSURE TEST

NOTE: The reservoir will contain residual pressure. Remove, then reinstall, the breather to release pressure before proceeding.

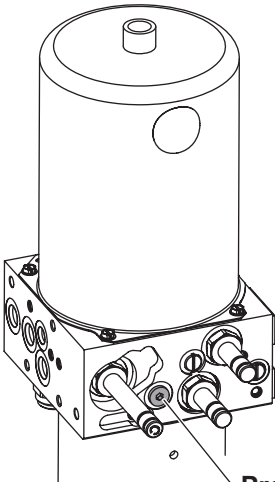
1. Verify proper fluid level before running the test.
2. Attach a 3000 psi hydraulic pressure gauge to pressure test port, as shown in the illustration.
3. Activate the ANGLE function, either left or right, until the blade is fully angled.

NOTE: The control will time out after 5.5 seconds. Repeat the command if the blade is not yet fully angled.

4. Repeat the ANGLE function and read the pressure shown on the gauge.
5. Refer to the table to determine the necessary corrective action.

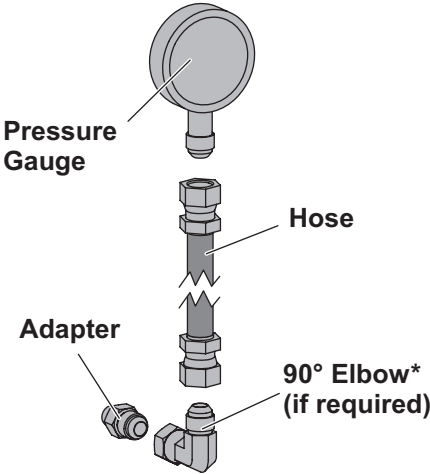
NOTE: See the following page for Relief Valve Inspection and Adjustment instructions.

BLADE MOVEMENT		ANGLE RIGHT	ANGLE LEFT
MOTOR	M	ON	ON



Pressure Test Port

CONDITION	POSSIBLE CAUSE	CORRECTIVE ACTION
Pump pressure is below 2250 ± 50 psi.	Pump Relief Valve	The pump relief valve may be out of adjustment. Turn the relief valve clockwise 1/4 turn and retest the pressure. Repeat until correct pressure (2250 ± 50 psi) is obtained. If correct pressure is not obtained after readjustment, remove and inspect the relief valve and its components. Check the O-ring, stem and ball for wear or damage. Reseat the ball or replace the relief valve as needed. Reinstall/replace and readjust the valve, then retest pump pressure.
	O-Ring (between pump and valve block)	Remove the pump and inspect the O-ring between the pump and the valve block for wear or damage. Reinstall/replace the O-ring and pump, then retest pump pressure.
	Pump	Remove the pump and inspect it for wear or broken gears. Replace the pump if needed, adjust the pump relief valve, then retest pressure.
Motor draws more than 265 amps at pump relief.	Motor	Replace the motor.



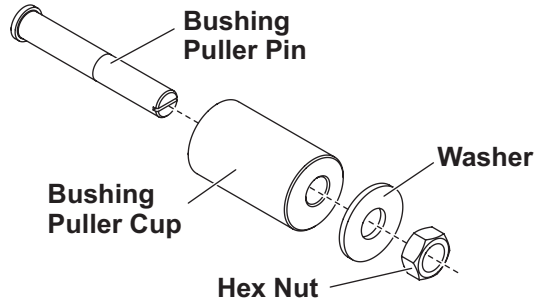
* Not included in 56679 Pressure Test Kit: 90° Elbow –6 FJIC 37° Swivel/–6 MJIC 37° Flare (Parker PN 6 C6X).

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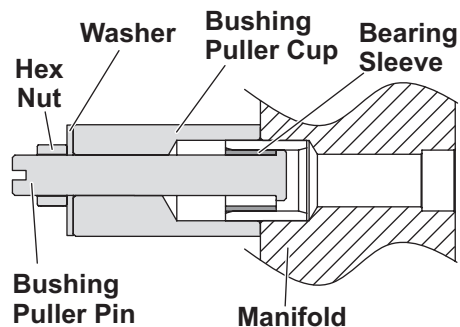
REPLACING DAMAGED BEARING SLEEVES

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.



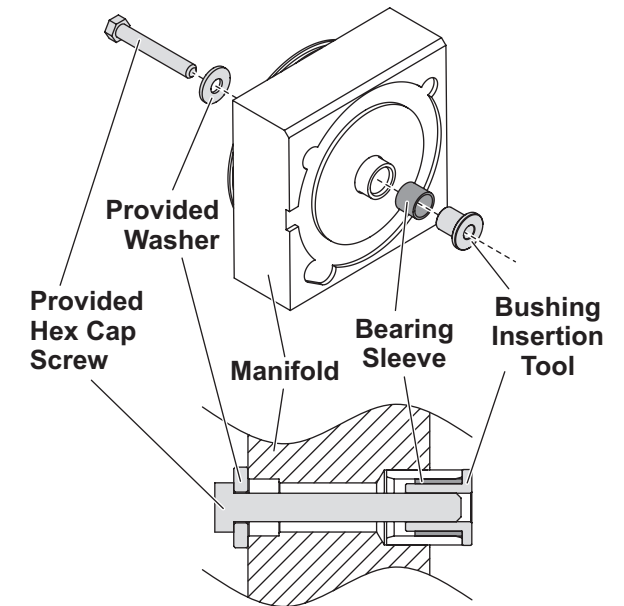
3. Insert the head of the puller pin into the bearing sleeve.



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.

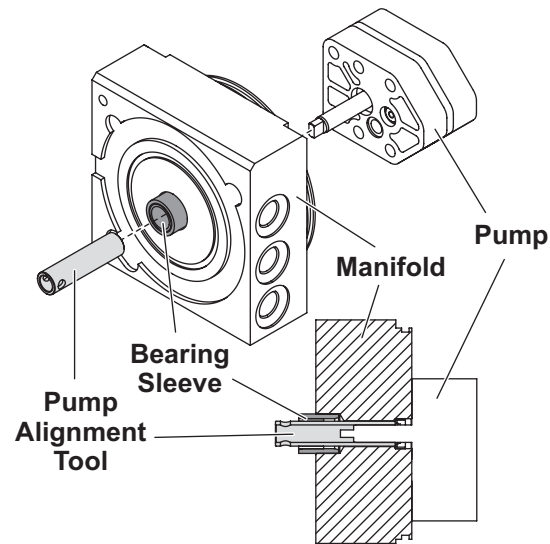
TROUBLESHOOTING GUIDE

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.





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

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