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MECHANIC'S GUIDE



SNOWPLOWS Featuring the **FloStat® MVP PLUS™ Hydraulic System & Isolation Module Light System**

⚠ CAUTION

Read this manual before servicing the snowplow.

TABLE OF CONTENTS

Introduction	4	Controls	27
Preface	4	General Information	27
Recommended Tools	4	MVP PLUS CabCommand Hand-Held Control	28
Available Service Items	4	MVP PLUS Joystick Control	30
Safety Information	5	Theory of Operation	32
System Overview	8	Electrical & Hydraulic Schematics	33
Blade, T-Frame & Lift Assemblies	8	Legend	33
Snowplow Components	8	Electrical Schematic	34
Securing Pivot Bar to T-Frame	8	Hydraulic Schematic	35
Pivot Plates	9	Raise	36
Initial Stand Shoe Setup	10	Lower	38
Stand Shoe Adjustment	10	Angle Right	40
Cutting Edge Wear and Leveling Adjustment Procedure	11	Angle Left	42
Blade Spring Replacement Tool (PN 20043)	12	Retract (Vee)	44
Lift Arm and Lift Ram Installation	13	Scoop	46
Headlamp Beam Aiming	14	Right Extend	48
Vehicle Lighting Check	15	Right Retract	50
Hydraulic	16	Left Extend	52
MVP PLUS™ FloStat® Hydraulic System Specifications	16	Left Retract	54
Hydraulic Fitting and Hose Installation	17	Hold in Raised Position	56
Hydraulic Unit Components	18	Striking An Object While Plowing Forward	57
Hydraulic Component Installation	19	Striking An Object While Back Dragging	58
Valve Location	20	Low Beam Headlamps with Snowplow Connected to Vehicle	59
Cartridge Valves	21	High Beam Headlamps with Snowplow Connected to Vehicle	60
Check Valves	22	Troubleshooting Guide Table of Contents	61
Valve Lock Rings	22		
Relief Valves	23		
Electrical	24		
Wiring	24		
Electrical Assembly	25		
Cover and Final Assembly	26		

INTRODUCTION

PREFACE

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-Nosed Pliers
- Flat Screwdriver
- 12V Test Light
- Torque Wrench
- Allen Wrench Set
- Combination Wrench Set
- 1/4" Drive Ratchet Set w/6" ext.
- 3/8" Drive Ratchet Set
- Deep Socket: 7/8"
- 11/16" Tappet Wrench
- Angle Head Wrenches: 15° and 60°
- Digital Volt/Ohmmeter
- Ammeter
- Pressure Test Kit
- Flashlight
- Pick Set
- Hammer
- Pencil Magnet
- TORX® Drivers: T20 and T30
- Automotive Blade-Type Fuses: 7.5- and 15-Amp
- Mini Fuses: 4-Amp
- 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.)
- Isolation Module Tester: PN 26470-2
- Pressure Test Kit: PN 56679
(Requires 90° elbow and adapter fittings, not included. See Pump Pressure Test .)
- Spring Removal Tool: PN 20043
- Test Harness: PN 28957
- 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.)

TORX® is a registered (®) trademark of Textron, Inc.

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.

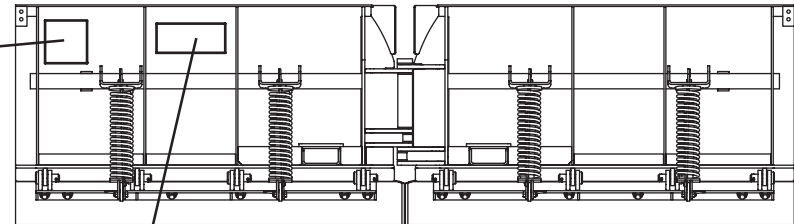
Warning and Caution Label

⚠ WARNING

LOWER BLADE WHEN VEHICLE IS PARKED.
DO NOT EXCEED GVWR OR GAWR INCLUDING BLADE AND BALLAST.
REMOVE BLADE ASSEMBLY BEFORE PLACING VEHICLE ON HOIST.

⚠ CAUTION

READ OWNER'S MANUAL BEFORE OPERATING OR SERVICING SNOWPLOW.
TRANSPORT SPEED SHOULD NOT EXCEED 45 MPH. FURTHER REDUCE SPEED UNDER ADVERSE TRAVEL CONDITIONS.
PLOWING SPEED SHOULD NOT EXCEED 10 MPH.
SEE YOUR SALES OUTLET/WEB SITE FOR SPECIFIC VEHICLE APPLICATION RECOMMENDATIONS.



Instruction Label

UltraMount[®] INSTRUCTIONS

MOUNTING PLOW (ON) Read Owner's Manual for complete instructions.

STEP 1
After seating plow horns in receiver brackets, pull Handle up; Shoe will lift off the ground.

STEP 2
Pull and hold Lock Pin out; then rotate Handle UP and release Lock Pin. It must lock into UPPER hole. Stand Hook must grip Receiver Pin.

STEP 3
Plug in electrical connections. Repeat steps 1 and 2 on other side of plow.

REMOVING PLOW (OFF) Read Owner's Manual for complete instructions.

STEP 1
After lowering blade and turning control off, disconnect electrical connections.

STEP 2
Pull and hold Lock Pin out; then rotate Handle DOWN and release Lock Pin. It must lock into LOWER hole.

STEP 3
Push down top of Shoe; Shoe will be on the ground. Repeat steps 2 and 3 on other side of plow. Back vehicle away.

Patents: US 4,999,935; 5,420,480; RE 35,700; 6,145,222; 6,209,231; 6,253,470; 6,526,677; CAN 2,060,425; patents pending.

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

⚠ WARNING

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

⚠ WARNING

Keep hands and feet clear of the blade and T-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 the driver-side vehicle door cornerpost.

⚠ WARNING

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

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.

SAFETY INFORMATION

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.

TORQUE CHART

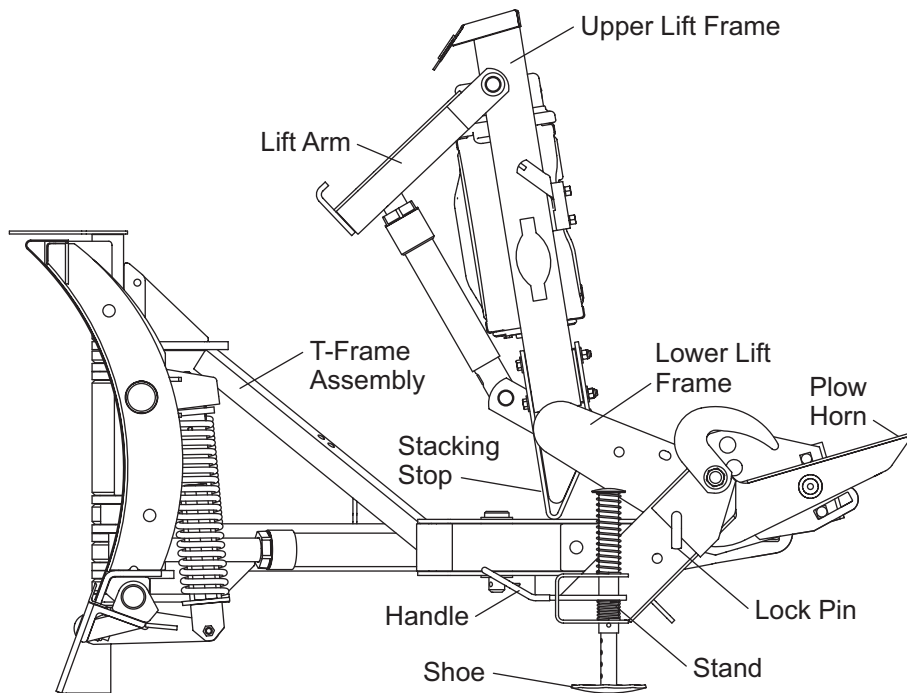
CAUTION

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 (Ft.-Lb.)			
Size	 SAE Grade 2	 SAE Grade 5	 SAE Grade 8
1/4-20	6	9	13
5/16-18	11	18	28
3/8-16	19	31	46
3/8-24	24	46	68
7/16-14	30	50	75
1/2-13	45	75	115
9/16-12	66	110	165
5/8-11	93	150	225
3/4-10	150	250	370
7/8-9	150	378	591
1-8	220	583	893
Metric Grade 8.8 (Ft.-Lb.)			
Size	Torque	Size	Torque
M 6	7	M 12	60
M 8	17	M 14	95
M 10	35	M 16	155
These torque values apply to fasteners except those noted in the instruction.			

SYSTEM OVERVIEW – BLADE, T-FRAME & LIFT ASSEMBLIES

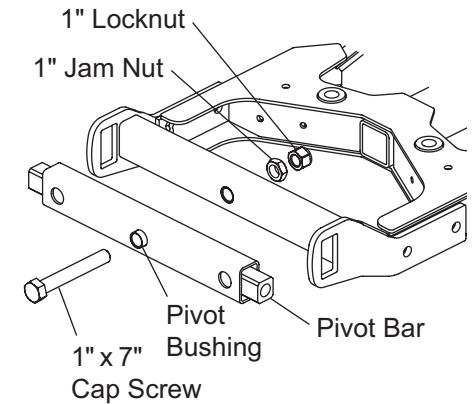
SNOWPLOW COMPONENTS



SECURING PIVOT BAR TO T-FRAME

1. Install a 1" jam nut and tighten to 25 ft-lb, then loosen 1/16 turn.
2. Hold 1" cap screw and jam nut to prevent rotation, and install 1" locknut. Tighten locknut securely against jam nut.

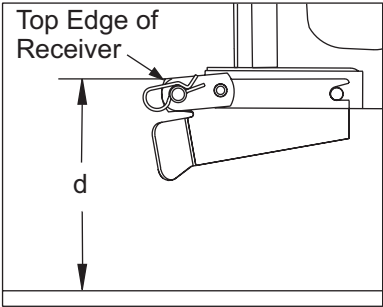
NOTE: When properly adjusted, pivot bar should pivot freely without any looseness.



SYSTEM OVERVIEW – BLADE, T-FRAME & LIFT ASSEMBLIES

PIVOT PLATES

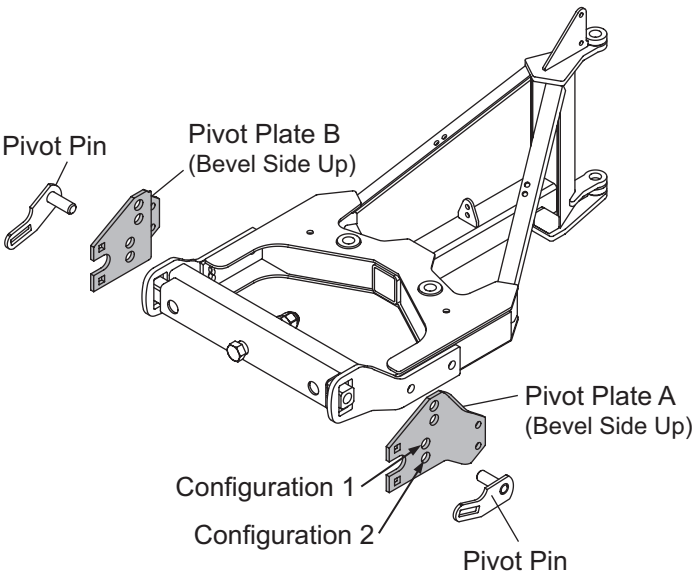
1. Measure the distance "d" from the ground to the top edge of the receiver bracket. Measure both sides and determine average value "d".



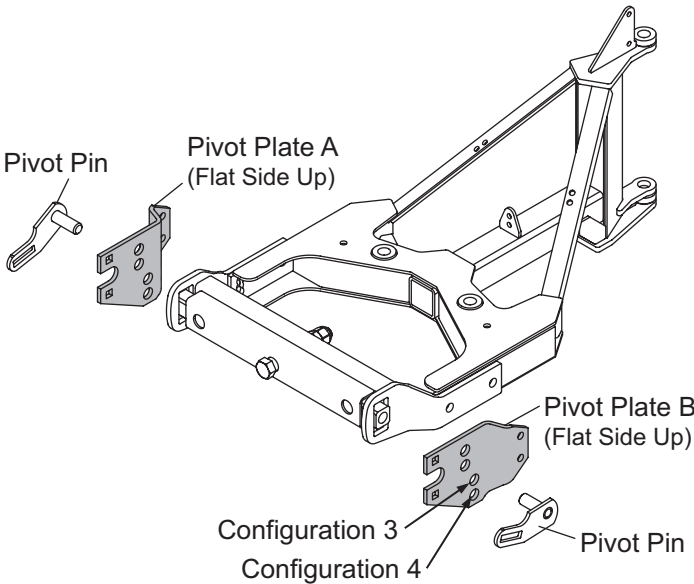
2. Use dimension "d" from Step 1, and the following chart to determine the proper pivot plate mounting position and pivot hole selection.

Pivot Plate Configuration Chart		
Dimension "d"	Configuration	Stacking Stop
13.0" – 14.5"	1	No
14.5" – 16.0"	2	No
16.0" – 17.5"	3	No
17.5" – 19.0"	4	Yes

Pivot Plate Mounting and Hole Positions for Configurations 1 & 2



Pivot Plate Mounting and Hole Positions for Configurations 3 & 4

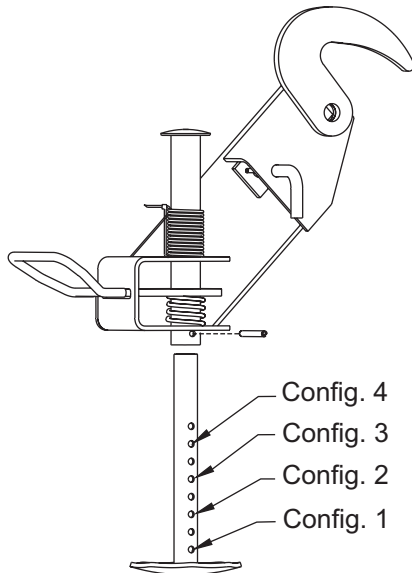


Excerpts taken from MVP PLUS™ Snowplow Installation Instructions (Lit. No. 44229, Rev. 05).

SYSTEM OVERVIEW – BLADE, T-FRAME & LIFT ASSEMBLIES

INITIAL STAND SHOE SETUP

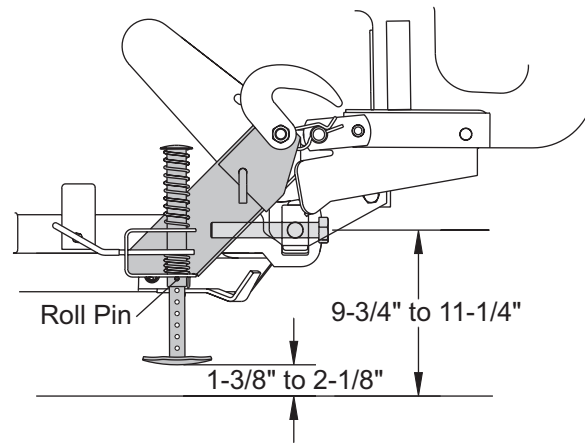
The illustration below shows the recommended starting positions for configuring your stand shoes.



STAND SHOE ADJUSTMENT

1. Attach snowplow to the vehicle mount. With snowplow lowered to the ground and on level pavement, measure the dimension from the ground to the center of the pivot bar cap screw. This dimension must be 9-3/4" to 11-1/4".
2. With the snowplow attached and on the ground, place the stand arm in the lower position with the lock pin engaged and with the stand shoe fully retracted in the "up" position. Measure the distance from the ground to the bottom of the stand shoe. This

distance should be 1-3/8" to 2-1/8". The stand can be adjusted to achieve this dimension by removing the roll pin and selecting the proper hole in the stand stem. When the stand height is correct, cut and remove the spring tie.



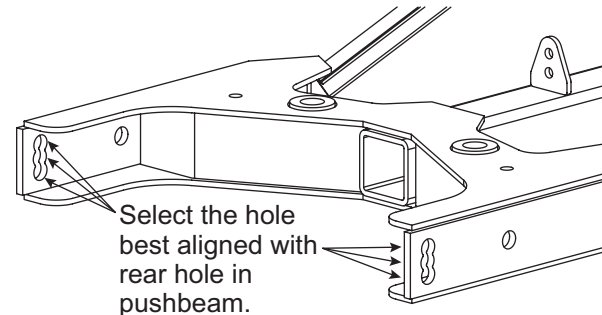
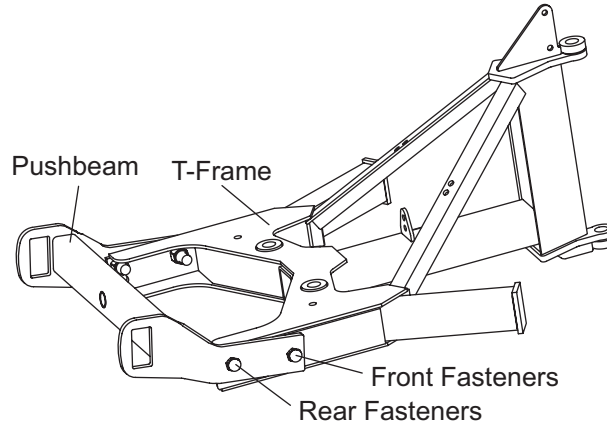
SYSTEM OVERVIEW – BLADE, T-FRAME & LIFT ASSEMBLIES

CUTTING EDGE WEAR AND LEVELING ADJUSTMENT PROCEDURE

After the snowplow has been installed on the vehicle in the correct configuration, a fine adjustment can be made to bring the cutting edges of the snowplow in full contact with the ground across the entire cutting edge. This adjustment feature should be used as the cutting edges begin to wear in order to maintain an even wear pattern across both cutting edges and provide good scraping action.

1. Snowplow must be installed on a properly ballasted vehicle, in the correct configuration.
2. Vehicle and snowplow must be on a level surface.
3. If the optional shoe kit has been installed on the blade, remove the shoes during this adjustment procedure.
4. Place blade wings in scoop position on the ground with no tension on lift chains.
5. Remove the rear pushbeam to T-frame fasteners. Loosen the front fasteners, and allow the blade to find a level position.
6. Select the hole in the rear of the T-frame that is best aligned with the rear hole in the pushbeam, and reinstall the rear fasteners. Tighten all four fasteners to 250 ft-lb.
7. Raise and lower the blade several times. The cutting edge should be contacting the level surface across the full length of the cutting edge.
8. Verify that the cutting edges remain in full contact with the ground while the wings are shifted from the scoop position to a fully retracted (vee) position.
9. Reinstall blade shoes if removed in Step 3.

Complete this procedure as often as required to provide even cutting edge wear. Replace the cutting edge(s) when worn to within 1" of the carriage bolts.



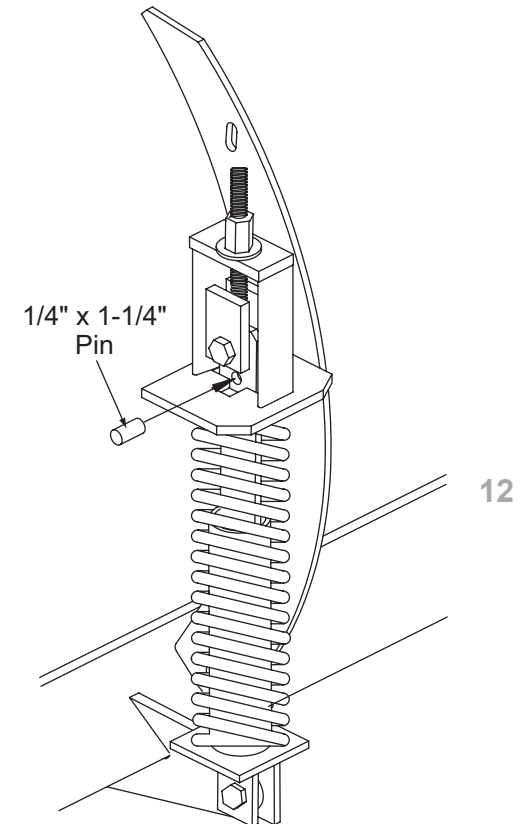
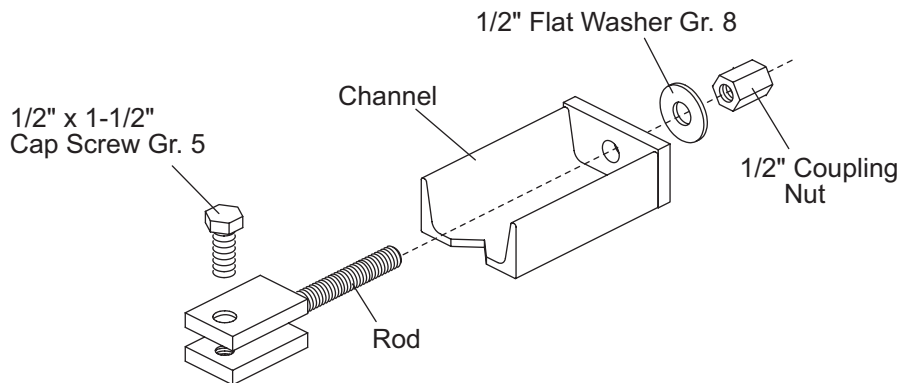
SYSTEM OVERVIEW – BLADE, T-FRAME & LIFT ASSEMBLIES

BLADE SPRING REPLACEMENT TOOL (PN 20043)

⚠ CAUTION

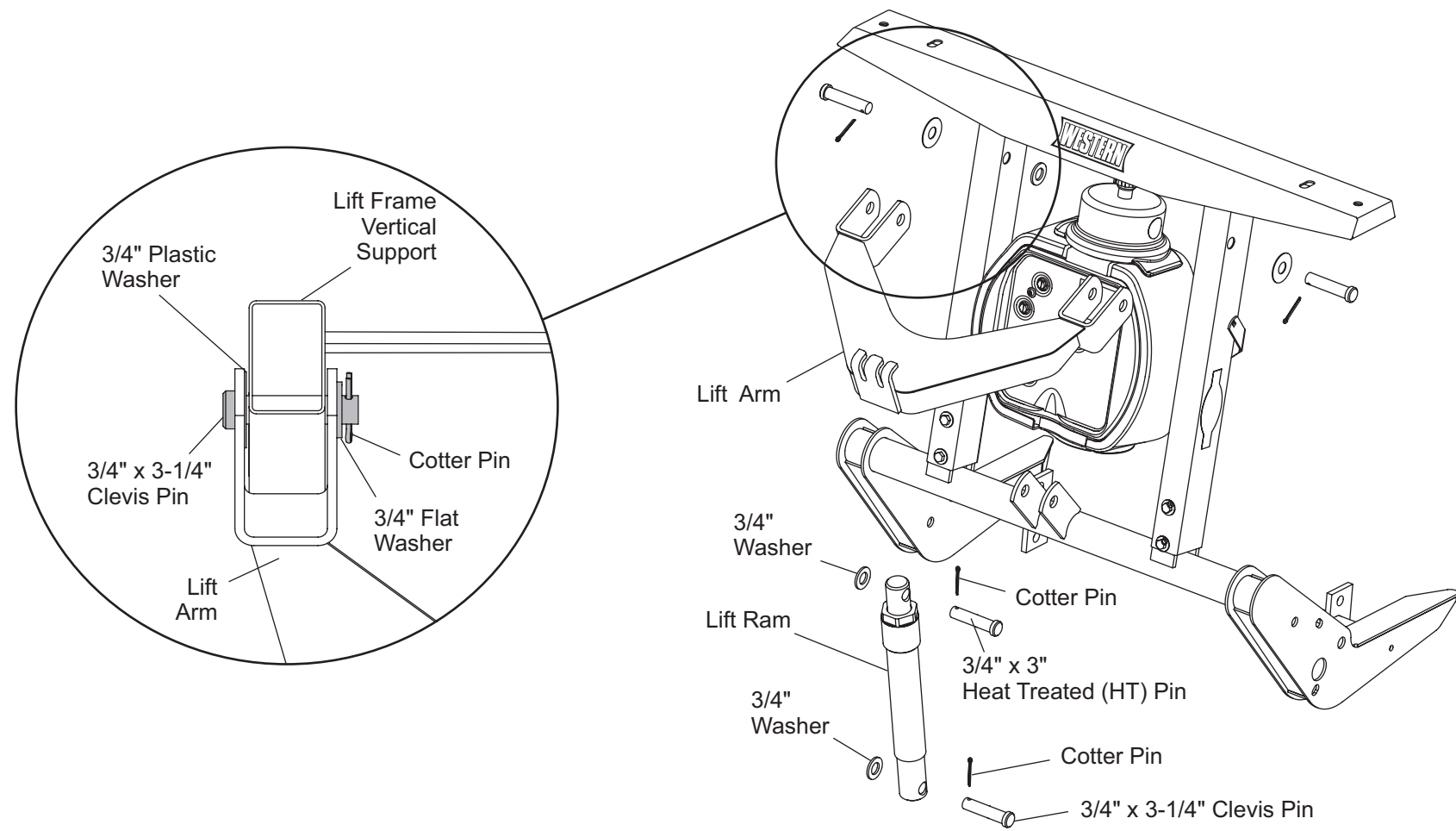
Servicing the trip springs without special tools and knowledge could result in personal injury.

1. Insert the threaded rod in through the hole in the channel weldment. Be sure the threaded hole in the tab on the rod is nearest to the channel.
2. Place the assembly on to the top anchor above the spring as illustrated. Be sure to place the spring bar in between the tabs on the rod. Insert the 1/2" x 1-1/2" Gr. 5 cap screw through the outside tab, through the hole in the spring bar, and tighten into the threaded hole.
3. Drop the 1/2" flat washer Gr. 8 over the threaded rod and fasten the nut to the threaded rod. Tighten the nut until the spring bar is raised enough to insert the pin through the pin hole. Center the pin within the hole.
4. Loosen the nut to lower the spring bar. Remove the spring tool assembly by removing the 1/2" cap screw.
5. Remove the spring from the blade by removing the bolt from the bottom of the spring bar.
6. Insert the new spring with the spring bar up through the top anchor on the blade. Fasten the bottom of the spring bar to the anchor on the trip edge with the previously removed fasteners. Tighten.
7. Repeat Steps 1 and 2 above.
8. Repeat Step 3 above, except remove the pin from the spring bar.
9. Repeat Step 4 above.



SYSTEM OVERVIEW – BLADE, T-FRAME & LIFT ASSEMBLIES

LIFT ARM AND LIFT RAM INSTALLATION

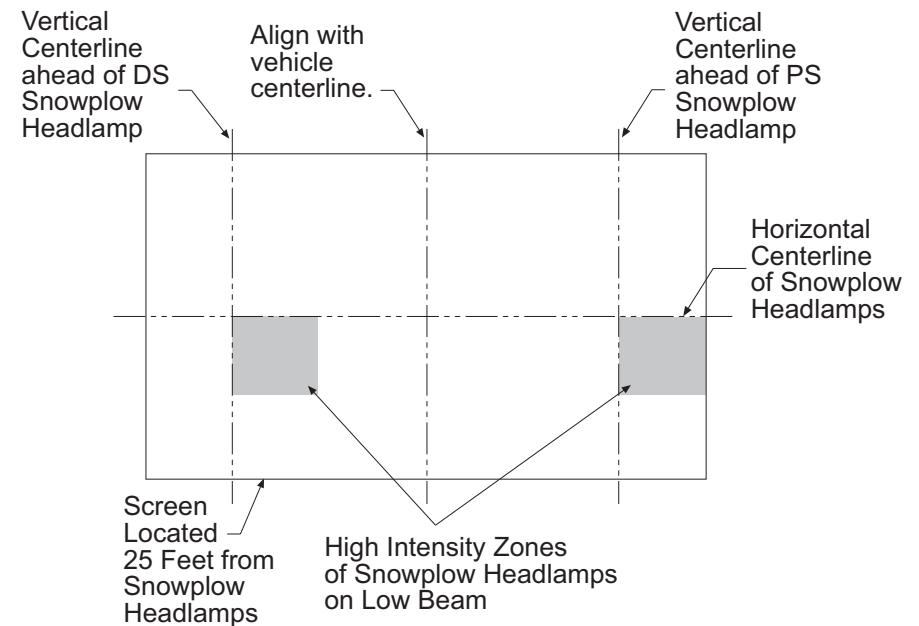


SYSTEM OVERVIEW – BLADE, T-FRAME & LIFT ASSEMBLIES

HEADLAMP BEAM AIMING

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.
 - a. Remove ice or mud from under fenders.
 - b. Set tire inflation pressures to the values specified on vehicle information label.
 - c. Check 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.
3. Prepare vehicle for headlamp aim or inspection. Before checking beam aim, the inspector will:
 - e. Check functioning of any automatic vehicle leveling systems and specific manufacturer's instructions pertaining to vehicle preparation for headlamp aiming.
 - f. Clean lenses.
 - g. Check for bulb burnout and proper beam switching.
 - h. Stabilize suspension by rocking 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 diagram.)



SYSTEM OVERVIEW – BLADE, T-FRAME & LIFT ASSEMBLIES

VEHICLE LIGHTING CHECK

1. Check the operation of vehicle lights and then 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 vehicle headlamp switch to the "ON" position. Connecting and disconnecting the headlamp harness plug should switch between vehicle and snowplow headlamps as follows:

Headlamp harness plug
DISCONNECTED

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

Headlamp harness plug
CONNECTED

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

Dimmer switch should dim whichever headlamps are operating. The high beam indicator on the dash should light when either set of headlamps is on high beam.

Daytime Running Lamps (DRLs)

With headlamp switch OFF, activate the DRLs.

Headlamp harness plug
DISCONNECTED

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

Headlamp harness plug
CONNECTED AND vehicle uses the headlamp bulbs for DRLs:

- Snowplow headlamps should be ON in DRL mode (with reduced intensity compared to high or low beam).
- Vehicle DRLs should be OFF.

Headlamp harness plug
CONNECTED AND vehicle uses lamps **other than** the headlamp bulbs for DRLs:

- Snowplow headlamps should be ON in DRL mode (with reduced intensity compared to high or low beam).
- Vehicle DRLs should be ON.
- Vehicle headlamps should be OFF.

Joystick Control or CabCommand Control

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

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

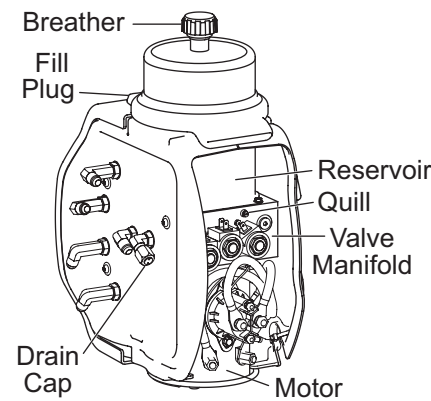
4. When the snowplow is removed from the vehicle, install plug covers on the vehicle battery cable and lighting harness. Insert the snowplow battery cable and lighting harness into the cable boot on the snowplow.

Excerpts taken from MVP PLUS™ Snowplow Installation Instructions (Lit. No. 44229, Rev. 05).

SYSTEM OVERVIEW – HYDRAULIC

MVP PLUS™ FloStat® HYDRAULIC SYSTEM SPECIFICATIONS

Western Products' FloStat hydraulic system delivers fast and uniform speed for lifting and angling. The system raises the blade in two seconds, and all angling functions are less than five seconds.



Relief Valve Settings

- Pump Relief Valve (1)
2250 psi
2-1/2 turns CCW from fully seated
- Base-End Relief Valves (4)
4600 psi
1-1/4 turns CCW from fully seated
- Rod-End Relief Valves (2) 3700 psi
1-1/4 turns CCW from fully seated

System Capacity

⚠ CAUTION

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

- Unit Reservoir = 1-3/4 Quarts
- System Total = 2-3/8–2-3/4 Quarts

Hydraulic Fluid

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

Pump Motor

12V DC with +/- connection
2200–2300 psi pump relief valve
4550–4650 psi base-end relief valves
3650–3750 psi rod-end relief valves
4.5" dia 1.5 kW motor
.000652 GAL/REV pump
Hydraulic Hose 1/4 SAE 100R1 and 3/8 SAE 100R17

Electrical System (Approximate)

- Solenoid Coil Resistance = 7 ohm at room temperature
- Solenoid Coil Amp Draw = 1.5 Amps
- Motor Relay Coil Resistance = 13.5 ohm @ 25° C
- 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 (Automotive Blade-Type)

- Park/Turn = 15 Amp
- Control = 7.5 Amp

Hydraulic Unit Harness Fuses (Mini)

- 4 Amp

Fastener Torque

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
Secondary to Primary Manifolds	1/4-20 x 3	10-13 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 Piston Locknuts		100-120 ft-lb
Angle Ram Gland Nuts		150-180 ft-lb

SYSTEM OVERVIEW – HYDRAULIC

HYDRAULIC FITTING AND HOSE INSTALLATION

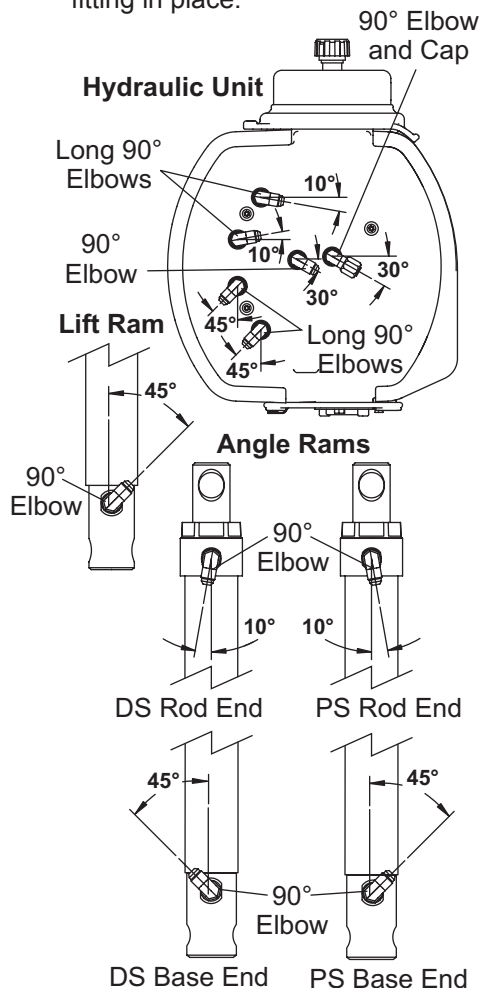
NOTE: Overtightening JIC hose fitting ends will result in a fractured fitting.

Do not use thread sealant or tape on hoses and fittings. This could damage product.

Use the following procedure and fitting orientation illustrations to install SAE O-ring fittings in valve block and rams.

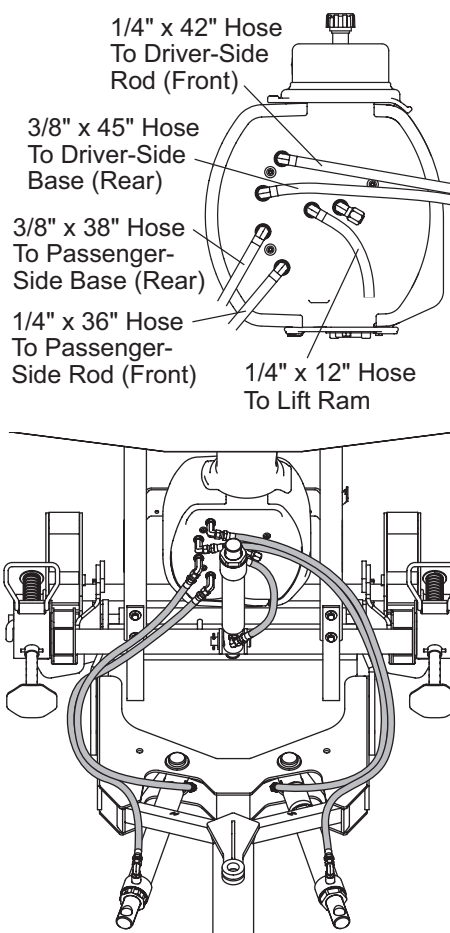
1. Remove plug from ram or manifold port. Use a rag to catch residual fluid when removing manifold plugs.
2. Turn jam nut on fitting as far back as possible.
3. Lubricate O-ring with clean hydraulic fluid.
4. Screw fitting into port by hand as far as it will go. The washer should contact port face and shoulder of jam nut threads.
5. Unscrew fitting to proper position, no more than one full turn.

6. Use one wrench to hold fitting body in position and tighten the jam nut with another wrench until the washer again contacts port face. Tighten 1/8–1/4 turn to lock fitting in place.

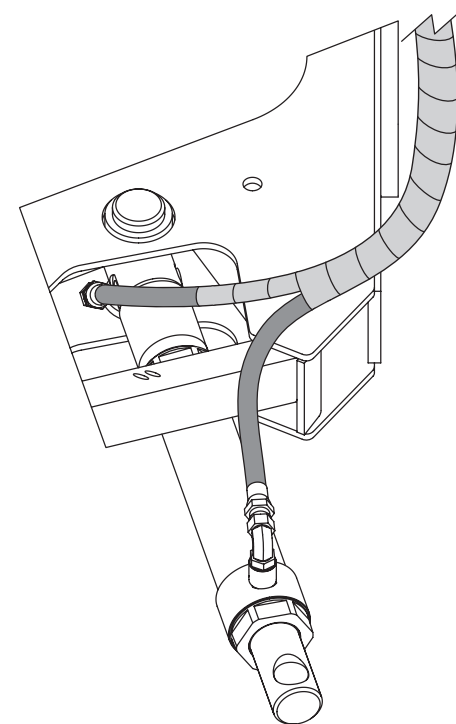


Use the following procedure and illustrations to install hydraulic hoses.

1. Attach all hoses to fittings, routing hoses as shown. Leave hoses finger tight at this time.



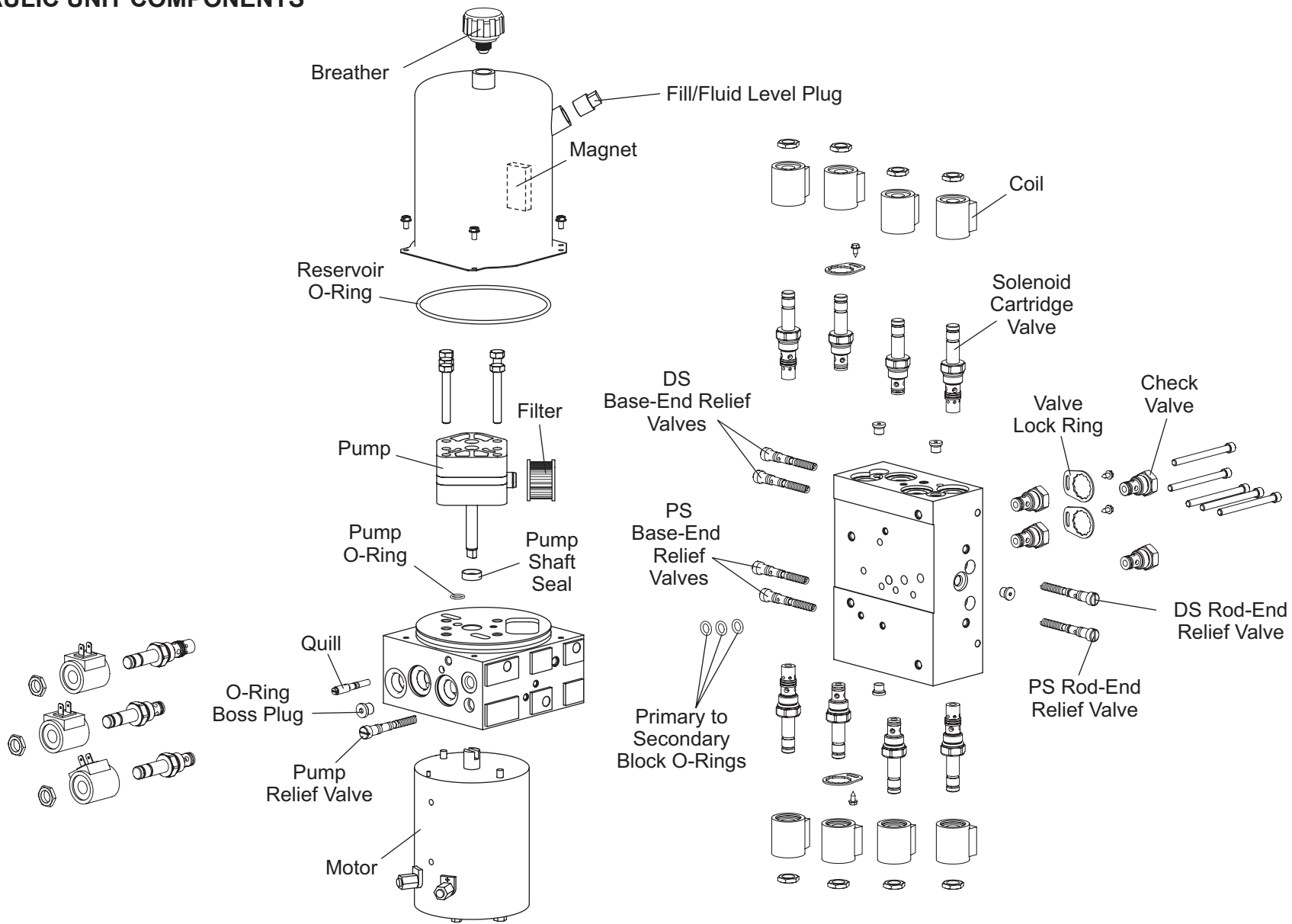
2. Wrap angle ram hoses with protective hose wrap as shown. Start wrap on base end hose so wrap covers diagonal brace. Group hoses away from brace and continue wrapping, forming a smooth outward loop to the hydraulic unit.



3. Using a wrench to hold the hose end in position, tighten all hose fittings 1/8–1/4 turn past finger tight.

SYSTEM OVERVIEW – HYDRAULIC

HYDRAULIC UNIT COMPONENTS



SYSTEM OVERVIEW – HYDRAULIC

HYDRAULIC COMPONENT INSTALLATION

Ram Seal Installation

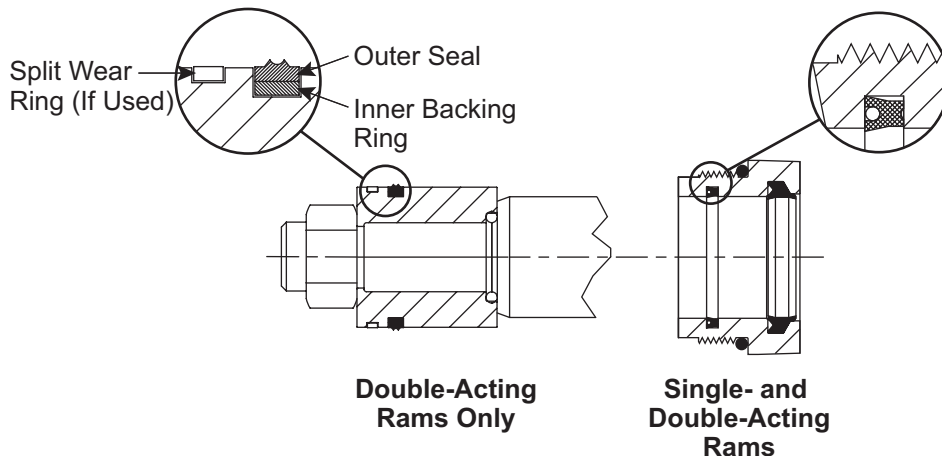
1. Lubricate the seals and O-rings with hydraulic fluid.

NOTE: Placing the part in warm fluid will facilitate installation.

2. Install the seals and O-rings in the **exact** orientation as shown.
3. **For single-acting (lift) rams:** Slide the gland nut over the split bearing end of the rod to prevent damaging the seals.

For double-acting (angle) rams: Remove the piston, and slide the gland nut over the threaded end of the rod to prevent damaging the seals.

4. **For double-acting (angle) rams only:** Install the piston in the orientation shown. Tighten piston locknut to 100–120 ft-lb.
5. Carefully reassemble the ram.
6. 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.
7. 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.

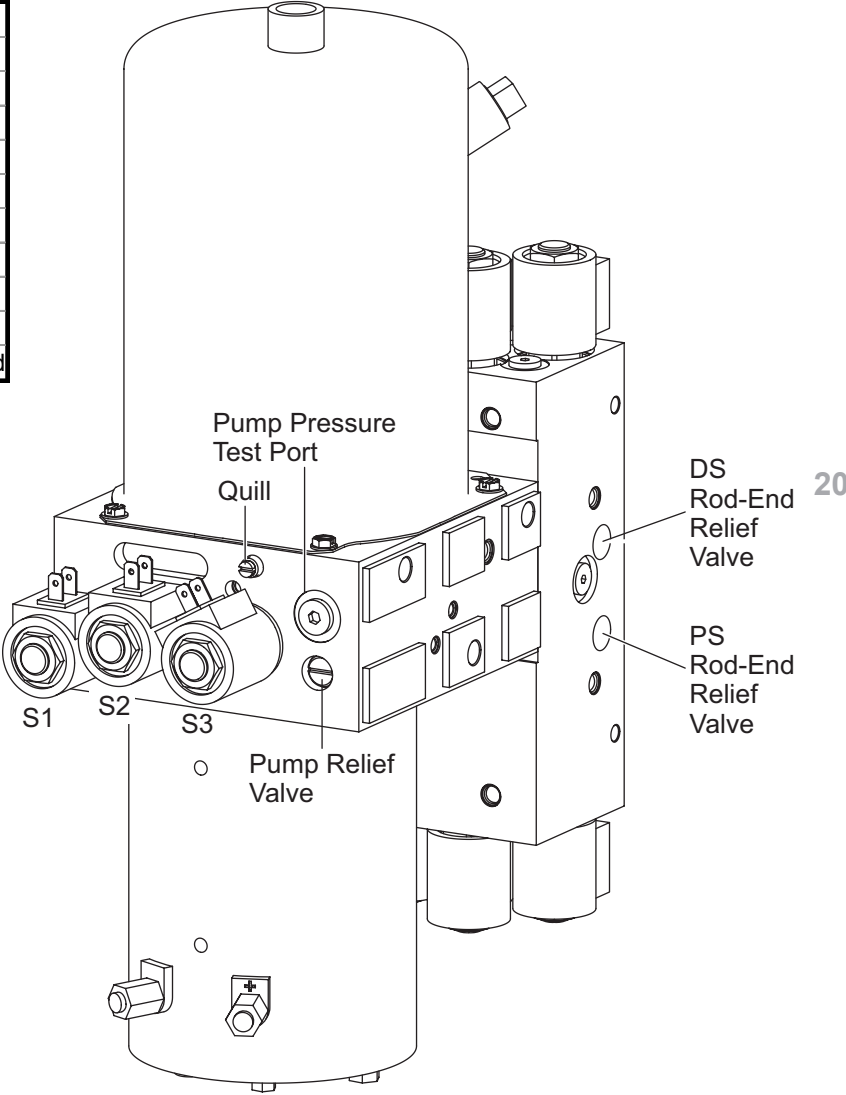
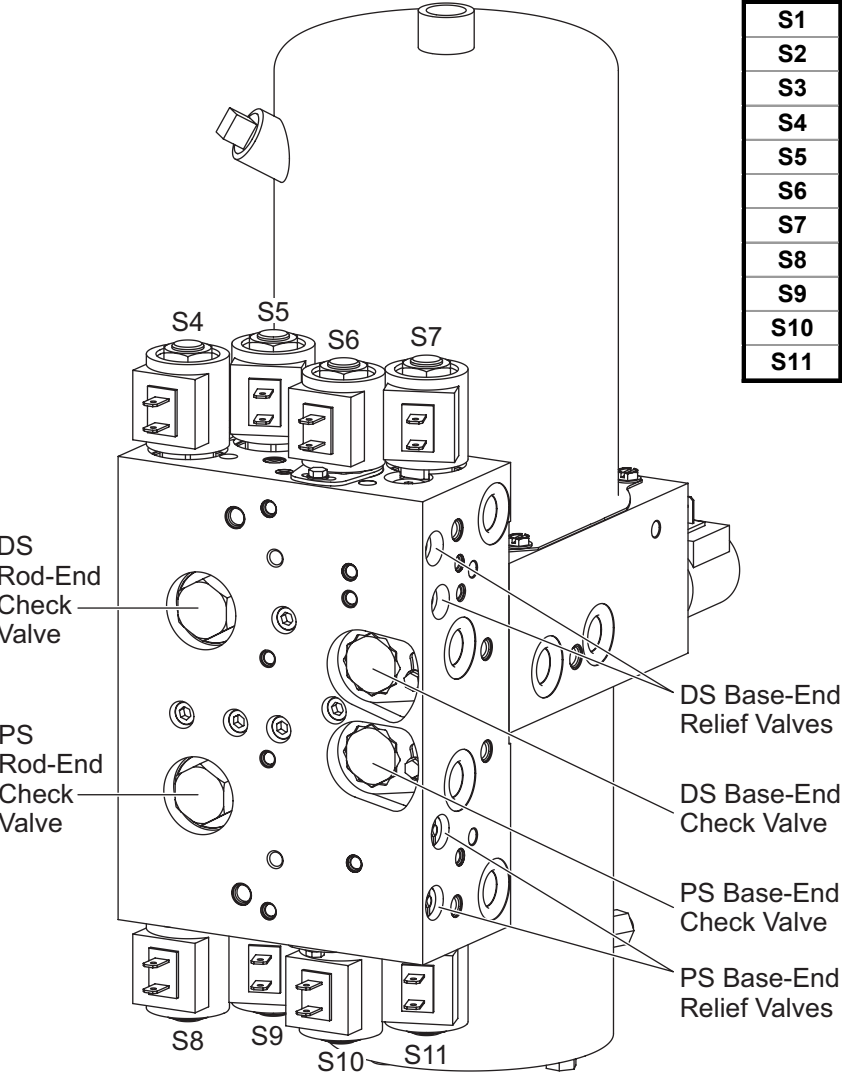
1. Install the Diagnostic Harness (PN 29290-1) following the instructions included with the kit.
2. Cycle through the control functions twice to remove the pressure in the hydraulic unit.
3. Slowly remove the breather from the top of the hydraulic unit.
4. Either (a) completely drain reservoir and skip to Step 9 or (b) proceed for instructions on removing hydraulic components without completely draining 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 29290-1 Diagnostic Harness according to the instructions included with the kit.

SYSTEM OVERVIEW – HYDRAULIC

VALVE LOCATION

Valve	Type	Wire Colors
S1	SV08-2004	White & Red
S2	SVCV08-20	Green & Red
S3	SV08-2004	Blue & Red
S4	SVCV08-20	Tan & Red
S5	SV08-2004	Black & Red
S6	SF08-2015	Yellow & Red
S7	SVCV08-20	Brown & Red
S8	SVCV08-20	Grey & Red
S9	SV08-2004	White & Red
S10	SF08-2015	Green & Red
S11	SVCV08-20	Orange & Red



SYSTEM OVERVIEW – HYDRAULIC

CARTRIDGE VALVES

The MVP PLUS™ snowplow FloStat® hydraulic system performs 10 blade movement functions.

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

Nine of the ten hydraulic functions require energizing the electric motor and opening solenoid cartridge valves. The **LOWER** function does not energize the motor but requires opening of one valve.

NOTE: Cartridges S6 and S10 have the letter "F" stamped on the end of the stem. These cartridges have a higher pressure rating than the "SV" cartridges. Cartridges and their lock rings must be installed in the correct locations for proper system performance.

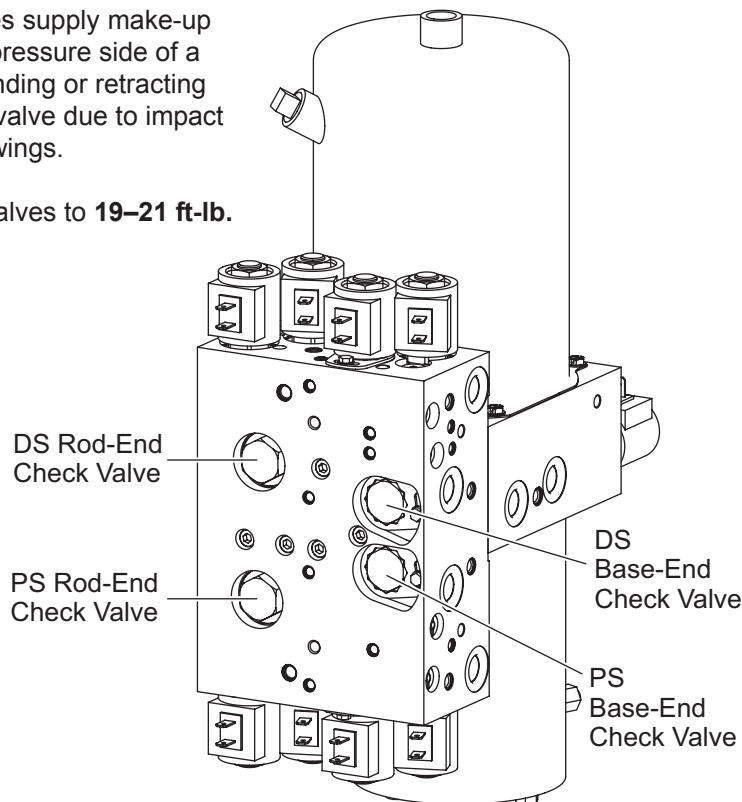
BLADE MOVEMENT		RAISE ↑	LOWER ↓	ANGLE RIGHT 	ANGLE LEFT 	VEE 	SCOOP 	RIGHT EXTEND 	RIGHT RETRACT 	LEFT EXTEND 	LEFT RETRACT 
MOTOR	M	ON		ON	ON	ON	ON	ON	ON	ON	ON
SV08-2004	S1					ON			ON		ON
SVCV08-20	S2	ON									
SV08-2004	S3		ON								
SVCV08-20	S4				ON	ON	ON			ON	ON
SV08-2004	S5			ON							
SF08-2015	S6				ON	ON					ON
SVCV08-20	S7						ON			ON	
SVCV08-20	S8			ON		ON	ON	ON	ON		
SV08-2004	S9				ON						
SF08-2015	S10			ON		ON			ON		
SVCV08-20	S11						ON	ON			

SYSTEM OVERVIEW – HYDRAULIC

CHECK VALVES

The check valves supply make-up fluid to the low-pressure side of a ram that is extending or retracting through a relief valve due to impact on one or both wings.

Tighten check valves to **19–21 ft-lb.**

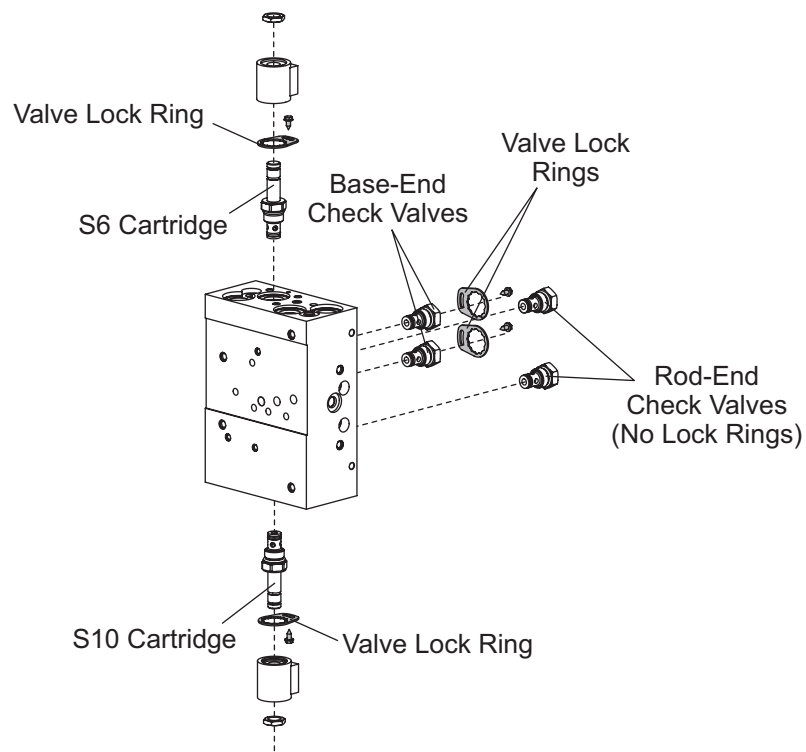


VALVE LOCK RINGS

Install valve lock rings over the base-end check valves only (not rod-end check valves). Also install valve lock rings over cartridge valves S6 and S10 only (not any other cartridges).

After tightening check valve or cartridge, place valve lock ring over hex and tighten screw to **45–55 in-lb.**

NOTE: Cartridges S6 and S10 have the letter "F" stamped on the end of the stem. These cartridges have a higher rating than the "SV" cartridges. Cartridges and their lock rings must be installed in the correct locations for proper system performance.



SYSTEM OVERVIEW – HYDRAULIC

RELIEF VALVES

When all cartridge valves are closed, hydraulic fluid is trapped in the ram by the solenoid cartridge valves, check valves, base-end relief valves and rod-end relief valves.

When the snowplow contacts an object while plowing, force of the impact increases hydraulic pressure in the base end of the ram. When pressure exceeds 4600 psi, the ram's base-end relief valves open, allowing hydraulic fluid back to the reservoir. The rod-end check valve allows fluid to fill the rod end of the ram.

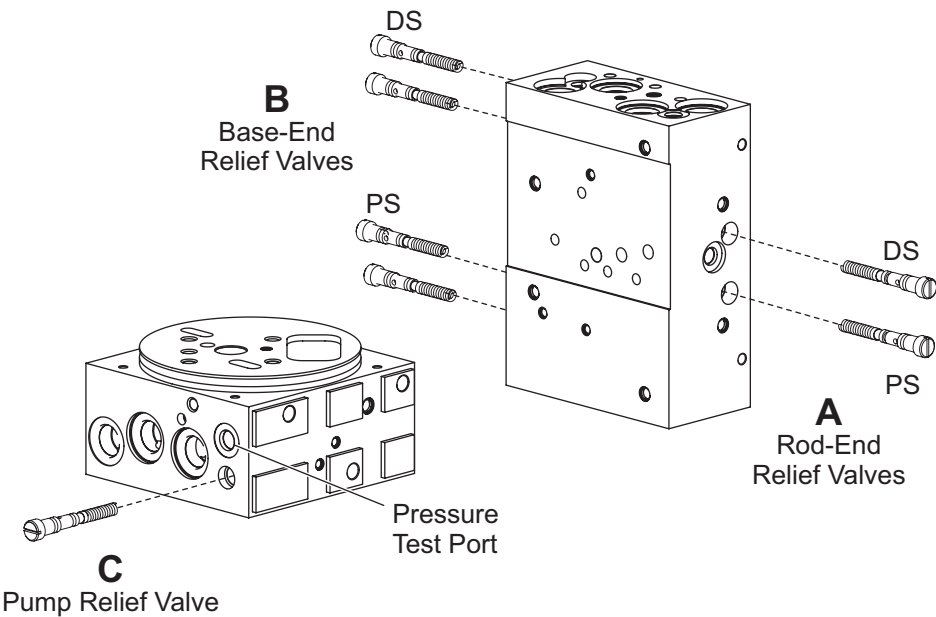
When the snowplow contacts an object while back dragging, force of the impact increases hydraulic pressure in the rod end of the ram. When pressure exceeds 3700 psi, the ram's rod-end relief valve opens, allowing hydraulic fluid into the reservoir passage. The base-end check valve allows fluid to fill the base end of the ram. Because of differential area on either side of the ram's piston, fluid flows from the reservoir to the base end.

NOTE: Relief valves B and components are not interchangeable with A and C. See Relief Valve Inspection and Adjustment Section for service.

NOTE: See "Striking an Object While Plowing" Schematics for Details.

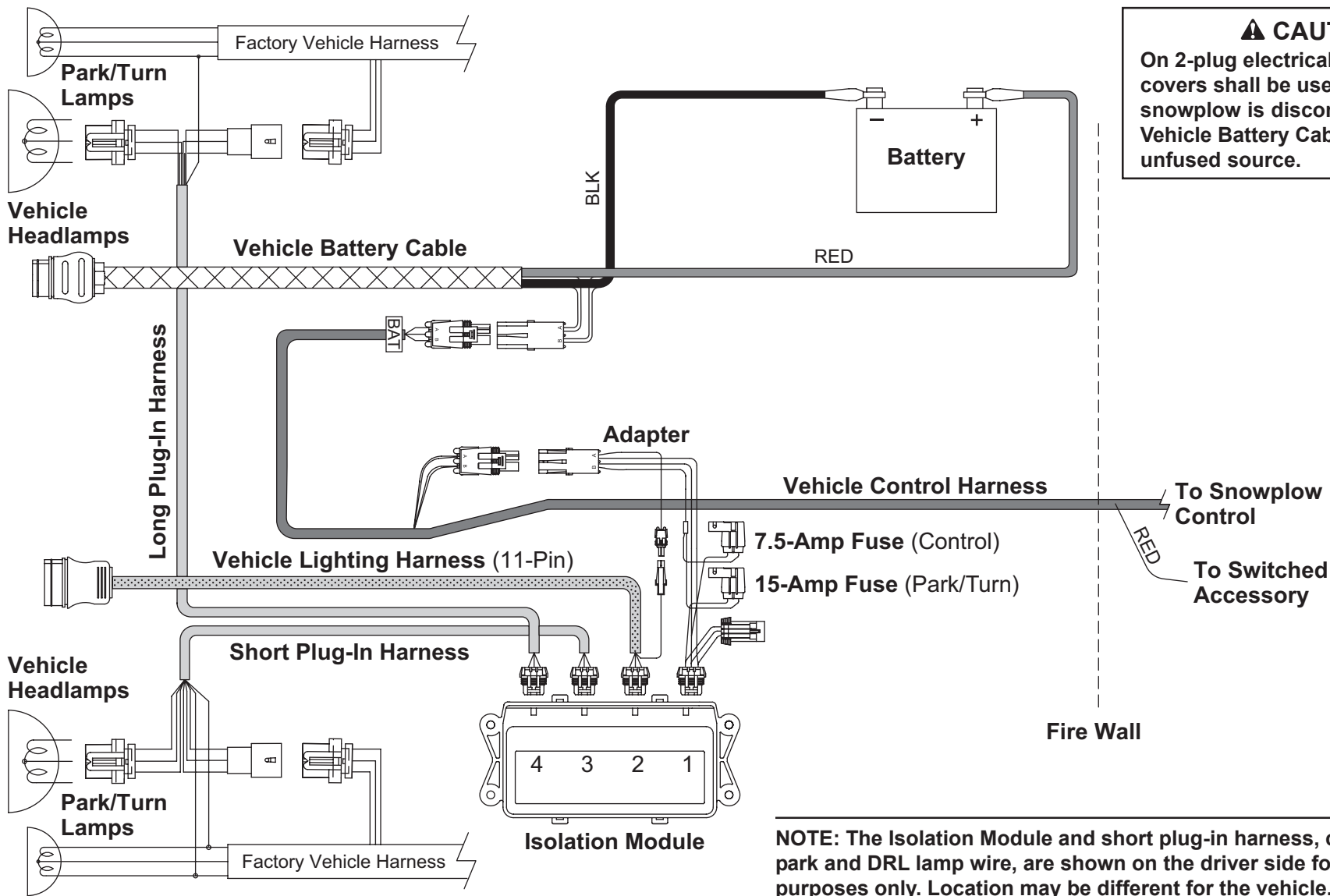
Relief Valve	Approx. Pressure (psi)	# of Turns Out (ccw) from Fully Seated
A (Qty 2)	3700	1-1/4
B (Qty 4)	4600	1-1/4
C (Qty 1)	2250*	2-1/2

* See the Pump Pressure Test Section for details.



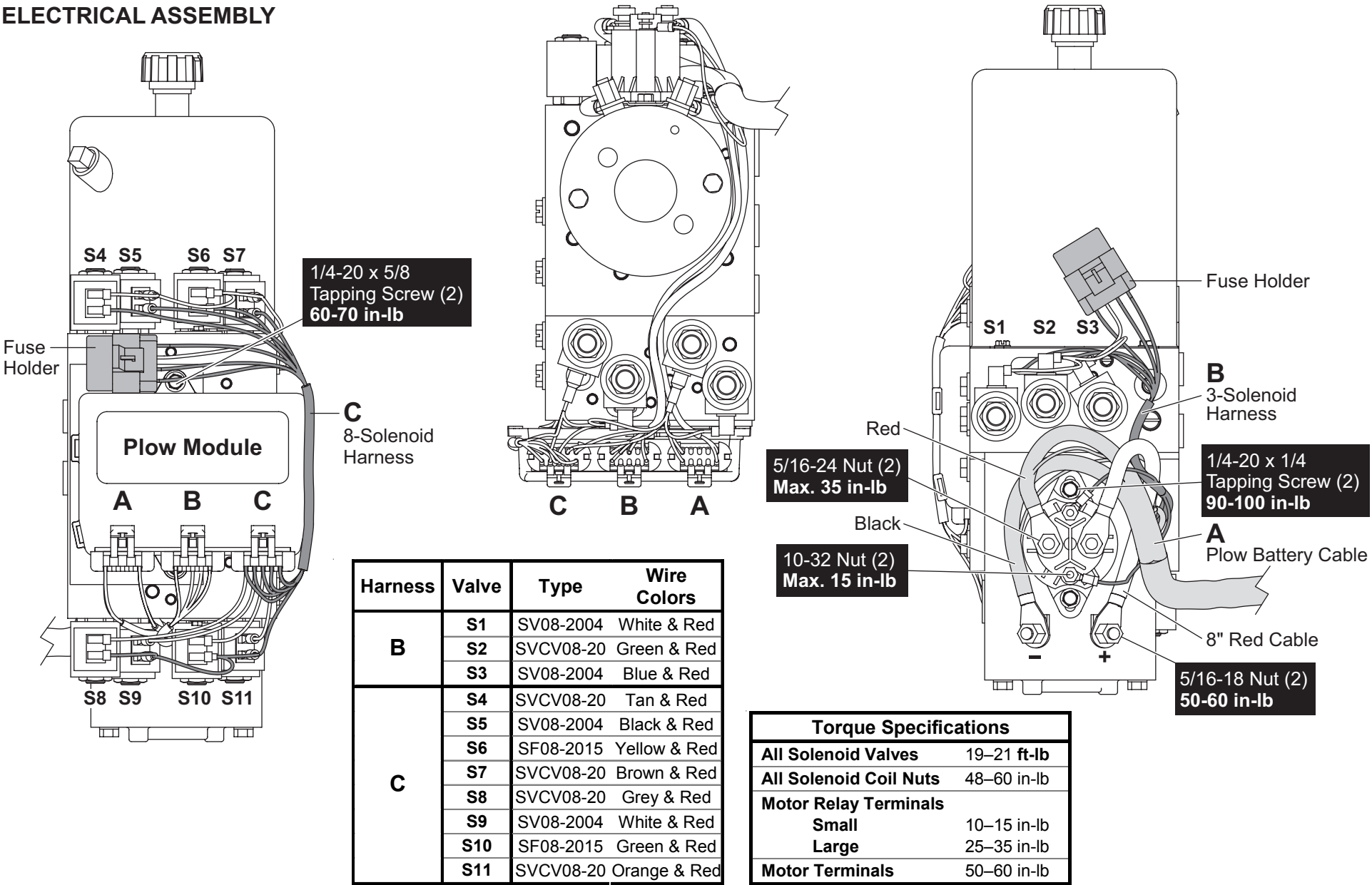
SYSTEM OVERVIEW – ELECTRICAL

WIRING



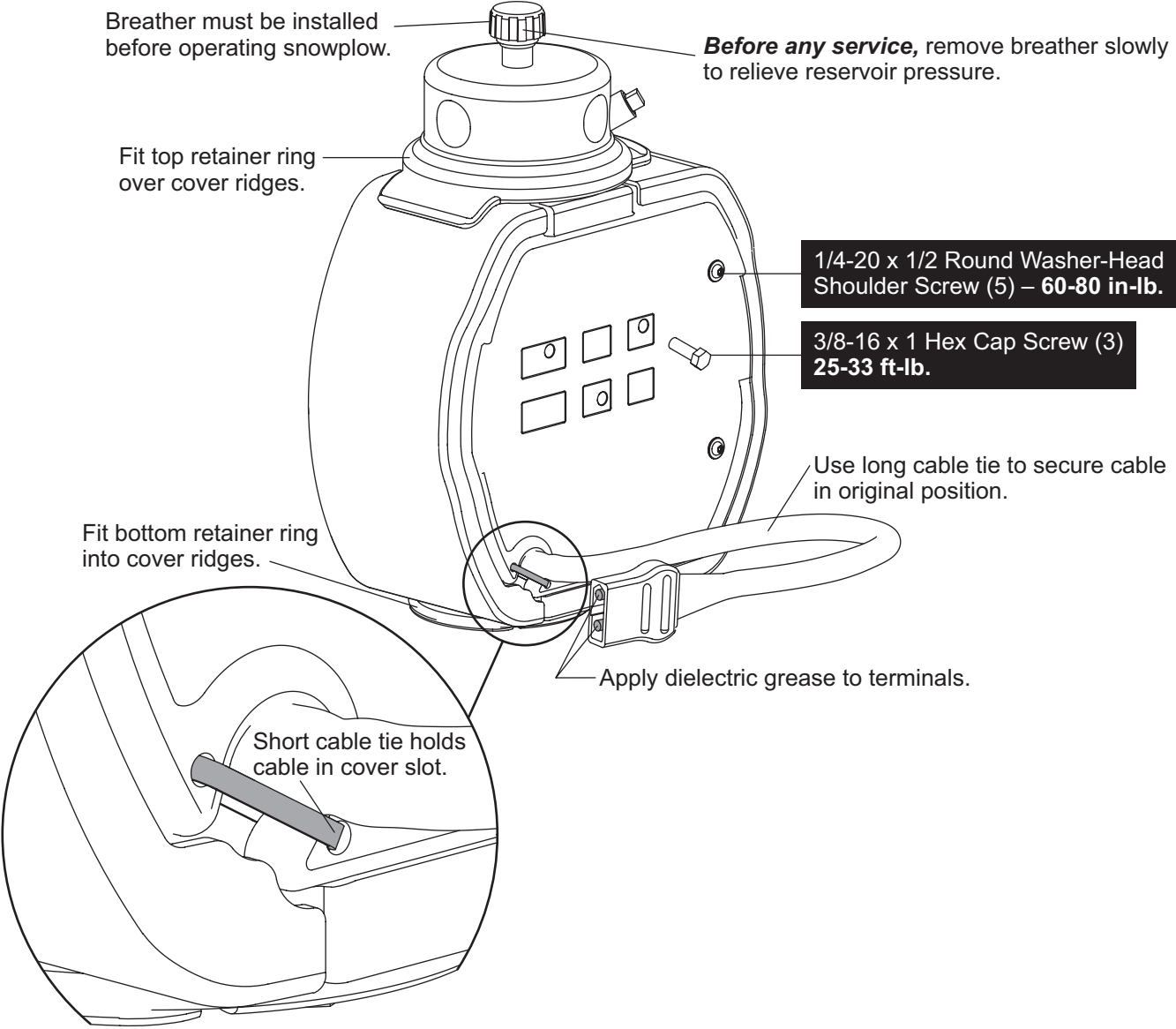
SYSTEM OVERVIEW – ELECTRICAL

ELECTRICAL ASSEMBLY



SYSTEM OVERVIEW – ELECTRICAL

COVER AND FINAL ASSEMBLY



SYSTEM OVERVIEW – CONTROLS

GENERAL INFORMATION

⚠ WARNING

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

The MVP PLUS™ snowplow is operated by with one of two special controls—the CabCommand 9-button hand-held control or a joystick-style control. The controls allow you to go from a vee, to a scoop, to a standard straight-blade snowplow, all at the touch of a button or single-lever movement.

Each control has its own ON/OFF switch with an indicator light to show

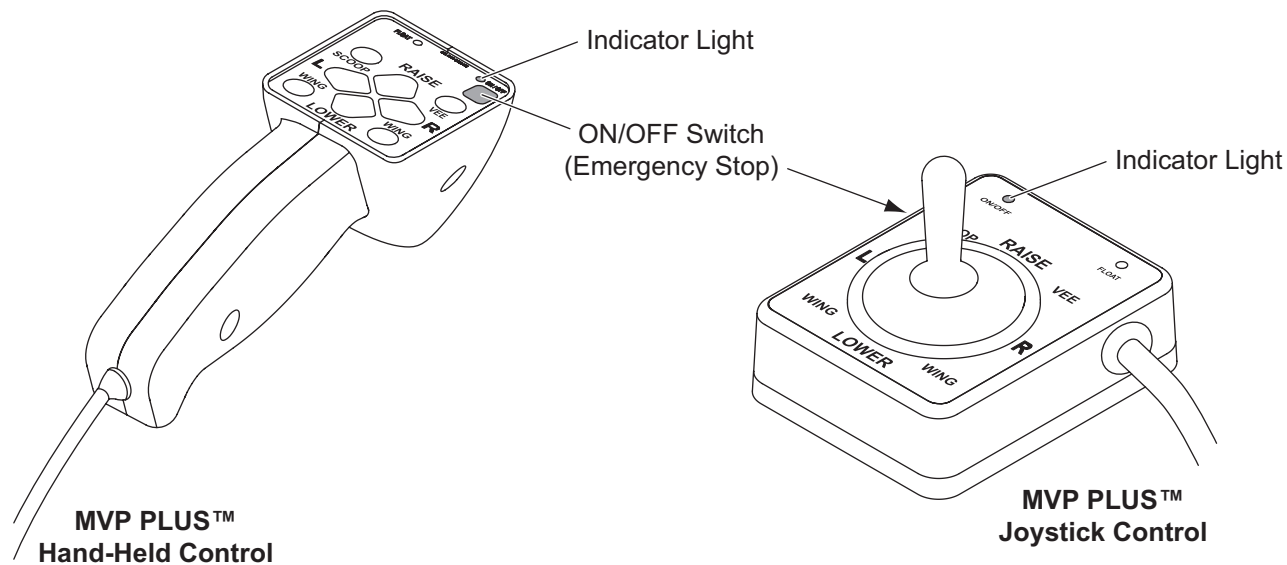
when the control is powered up. Your vehicle ignition (key) switch controls a fused circuit that powers your cab control directly from the battery.

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

The control ON/OFF 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 the Control/Cable/Plow Module Test.



SYSTEM OVERVIEW – CONTROLS

MVP PLUS™ CabCommand HAND-HELD CONTROL

⚠ WARNING

To prevent accidental movement of the blade, always push button to switch the control OFF whenever the snowplow is not in use. The control 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 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 button 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.

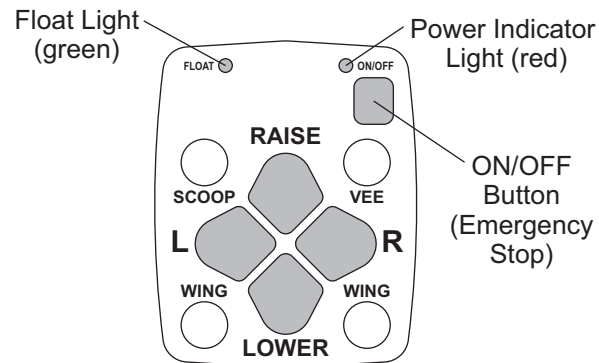
NOTE: If control function times out before desired blade movement is complete, release button and press again.

Automatic Shutdown

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 when the button is released. This results in smoother operation, reduces the shock to the hydraulic system and increases hose and valve life.

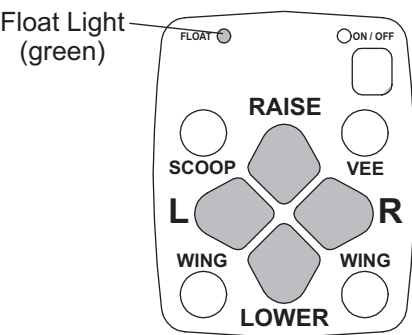


SYSTEM OVERVIEW – CONTROLS

Control Functions

Raise, Lower, Float, Angle

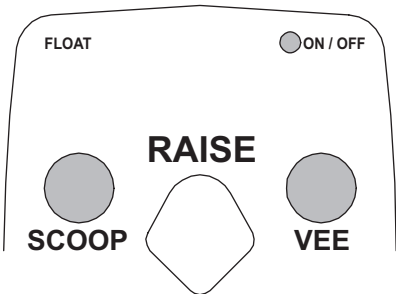
The four diamond-shaped buttons in the center of the control face, when pressed, will result in the movements described in the table:



Function	Description of Operation
RAISE	Press this button to raise the snowplow and cancel the FLOAT mode. Function times out after 4.0 seconds.
LOWER	Press this button to lower the snowplow. Release the button to stop blade at desired height.
FLOAT	Press the LOWER button and hold 3/4 second to activate this mode. The FLOAT indicator 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 raises. Function does not time out, but control will shut down after 20 minutes of nonuse. Press RAISE button momentarily to cancel FLOAT. Angling left or right will interrupt (stop) the FLOAT function while the blade angles. FLOAT will resume when angling is complete.
L (Angle Left)	With wings in a straight line, press the L button to move both wings to the angle left position to cast snow to the driver's left side. The left wing retracts while the right wing extends. Function times out after 3.0 seconds.
R (Angle Right)	With wings in a straight line, press the R button to move both wings to the angle right position to cast snow to the driver's right side. The right wing retracts while the left wing extends. Function times out after 3.0 seconds.

Scoop/Retract (Vee) Blade Position

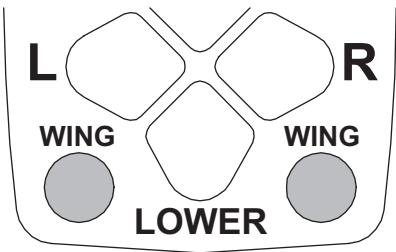
The two round buttons located to the left and right of the RAISE button move both wings at the same time into the blade positions described in the following table:



Function	Description of Operation
SCOOP	Press this button to extend both wings forward into the scoop position. Function times out after 5.0 seconds.
RETRACT (VEE)	Press this button to draw both wings into the fully retracted (vee) position. Function times out after 3.0 seconds.

Wing Positions

The two round buttons located to the left and right of the LOWER button move either wing independently of the other as described in the following table:



Function	Description of Operation
L WING	Press the round WING button on the left side of the control to move the left wing. The first time the button is pressed after the control is turned ON or another function is used, the wing will extend. Repeated use of the same button, without using another function, results in movement in the opposite direction from the previous movement. Function times out after 3.0 seconds.
R WING	Press the round WING button on the right side of the control to move the right wing. The first time the button is pressed after the control is turned ON or another function is used, the wing will extend. Repeated use of the same button, without using another function, results in movement in the opposite direction from the previous movement. Function times out after 3.0 seconds.

Excerpts taken from UltraMount® Owner's Manual (Lit. No. 44230, Rev. 06).

SYSTEM OVERVIEW – CONTROLS

MVP PLUS™ JOYSTICK 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 control indicator light will turn off.

1. Turn the vehicle ignition switch to the "ON" or the "ACCESSORY" position.
2. Move the slide switch on the side of the control to the "ON" position. The power indicator light glows red, indicating 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 control function times out before desired blade movement is complete, release the lever to the center position, then move back into the desired function.

Automatic Shutdown

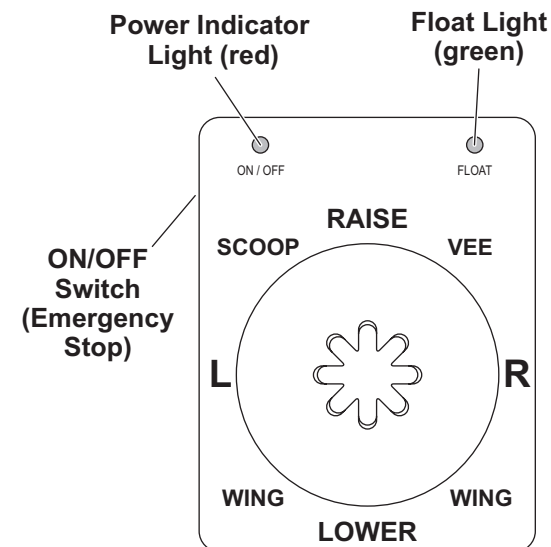
The control will automatically turn OFF after being idle for 20 minutes. To reactivate the control after a shut down, move the ON/OFF switch to OFF, then back to ON.

Smooth Stop

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

Control Lever Movement

From the center position, the control lever can be moved in one of eight (8) 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.

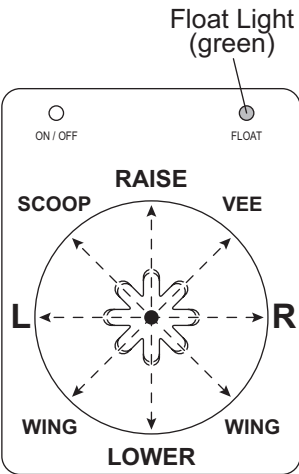


SYSTEM OVERVIEW – CONTROLS

Control Functions

Raise, Lower, Float, Angle

Movement of the control lever in straight lines up and down or from side to side on the control body will result in the blade movements as described in the following table:



Function	Description of Operation
RAISE	Move the control lever toward the top of the control body to raise the snowplow 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 snowplow. Release the lever to stop blade at desired height.
FLOAT	Move the control lever to the LOWER position and hold 3/4 second to activate this mode. The FLOAT indicator 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 raises. Function does not time out; however, control will shut down after 20 minutes of nonuse. Move lever to the RAISE position momentarily to cancel FLOAT . Angling left or right will interrupt (stop) the FLOAT function while the blade angles. FLOAT will resume when angling is complete.
L (Angle Left)	With wings in a straight line, move the control lever straight to the left to move both wings to the angle left position to cast snow to the driver's left side. The left wing retracts while the right wing extends. Function times out after 3.0 seconds.
R (Angle Right)	With wings in a straight line, move the control lever straight to the right to move both wings to the angle right position to cast snow to the driver's right side. The right wing retracts while the left wing extends. Function times out after 3.0 seconds.

Scoop/Retract (Vee) Blade Position

Moving the control lever from the center position toward the word **SCOOP** or **RETRACT (VEE)** on the face of the control body will cause

both wings to move at the same time into the blade positions described in the following table:

Function	Description of Operation
SCOOP	Move the control lever toward the word SCOOP on the control face to extend both wings forward into the scoop position. Function times out after 5.0 seconds.
RETRACT (VEE)	Move the control lever toward the word RETRACT (VEE) on the control face to draw both wings into the fully retracted (vee) position. Function times out after 3.0 seconds.

Wing Positions

Move the control lever from the center position toward the word, **WING**, on either side of the face of the control body. The use of either of

these slots will allow movement of either wing independently of the other as described in the following table:

Function	Description of Operation
L WING	Move the control lever toward the left side of LOWER on the control face to move the left wing. The first time the lever is moved into the slot after the control is turned ON or another function is used, the wing will extend. Repeated use of lever in the same slot, without using another function, results in movement in the opposite direction from the previous movement. Function times out after 3.0 seconds.
R WING	Move the control lever toward the right side of LOWER on the control face to move the right wing. The first time the lever is moved into the slot after the control is turned ON or another function is used, the wing will extend. Repeated use of lever in the same slot, without using another function, results in movement in the opposite direction from the previous movement. Function times out after 3.0 seconds.

Excerpts taken from UltraMount® Owner's Manual (Lit. No. 44230, Rev. 06).

THEORY OF OPERATION

SNOWPLOW HEADLAMPS

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 3 (left-side lighting) and position 4 (right-side lighting). Park, turn and DRL signals also enter through positions 3 and 4. The output of the vehicle dimmer switch is directed to the Isolation Module via the long and short plug-in harnesses.

All snowplow lighting exits the Isolation Module through position 2.

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 of the two following conditions are met: 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.

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

SNOWPLOW DAYTIME RUNNING LIGHTS

Because Daytime Running Lamps (DRLs) are controlled differently on some vehicles, two Isolation Modules have been developed.

The standard Isolation Module transfers the DRL output from the vehicle headlamps to the snowplow headlamps when the vehicle ignition switch is turned ON and the snowplow is attached.

The second Isolation Module, designed for vehicles with dedicated DRL bulbs, senses the vehicle in the DRL mode and a series of relays energize, placing the snowplow low beams in series. This Isolation Module does not turn OFF the vehicle's dedicated DRLs.

SNOWPLOW HYDRAULICS

The MVP PLUS™ snowplow hydraulic system performs ten blade movements.

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

Nine of the ten hydraulic movements require energizing the electric motor and appropriate solenoid cartridge valves. The tenth 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 snowplow control via the Isolation 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.

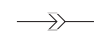
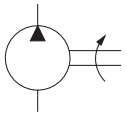
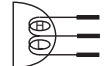
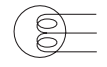
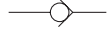
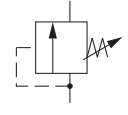
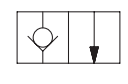
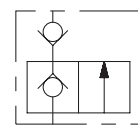
BLADE MOVEMENT	RAISE	LOWER	ANGLE RIGHT	ANGLE LEFT	VEE	SCOOP	RIGHT EXTEND	RIGHT RETRACT	LEFT EXTEND	LEFT RETRACT
										

ELECTRICAL & HYDRAULIC SCHEMATICS

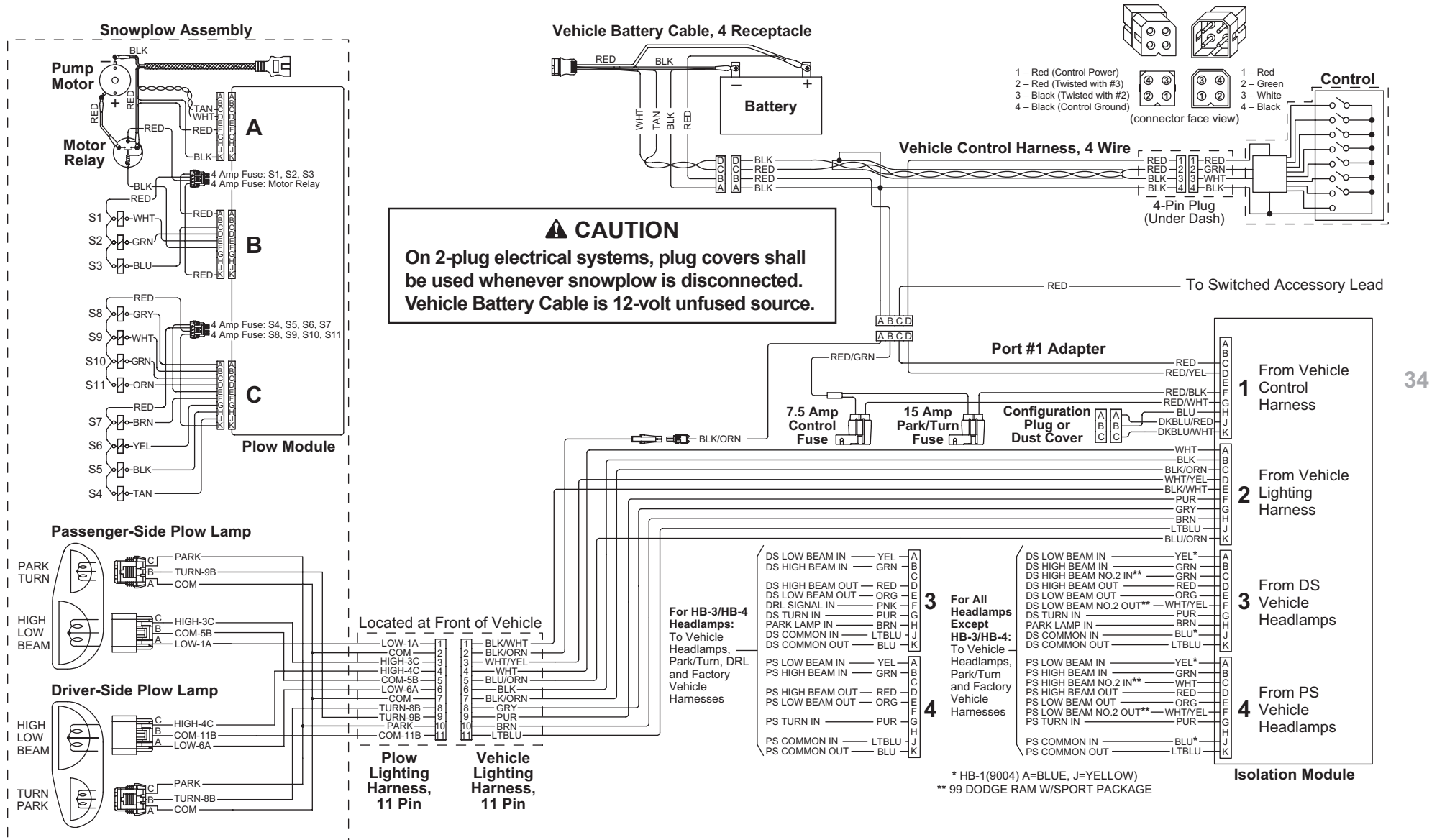
The following section contains hydraulic and electrical schematics to help explain how the hydraulic unit performs the different functions. A schematic is an abstract drawing showing the *purpose* of each of the components in the system. Each component is represented by a graphical symbol. The hydraulic 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 the snowplow and vehicle lights.

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

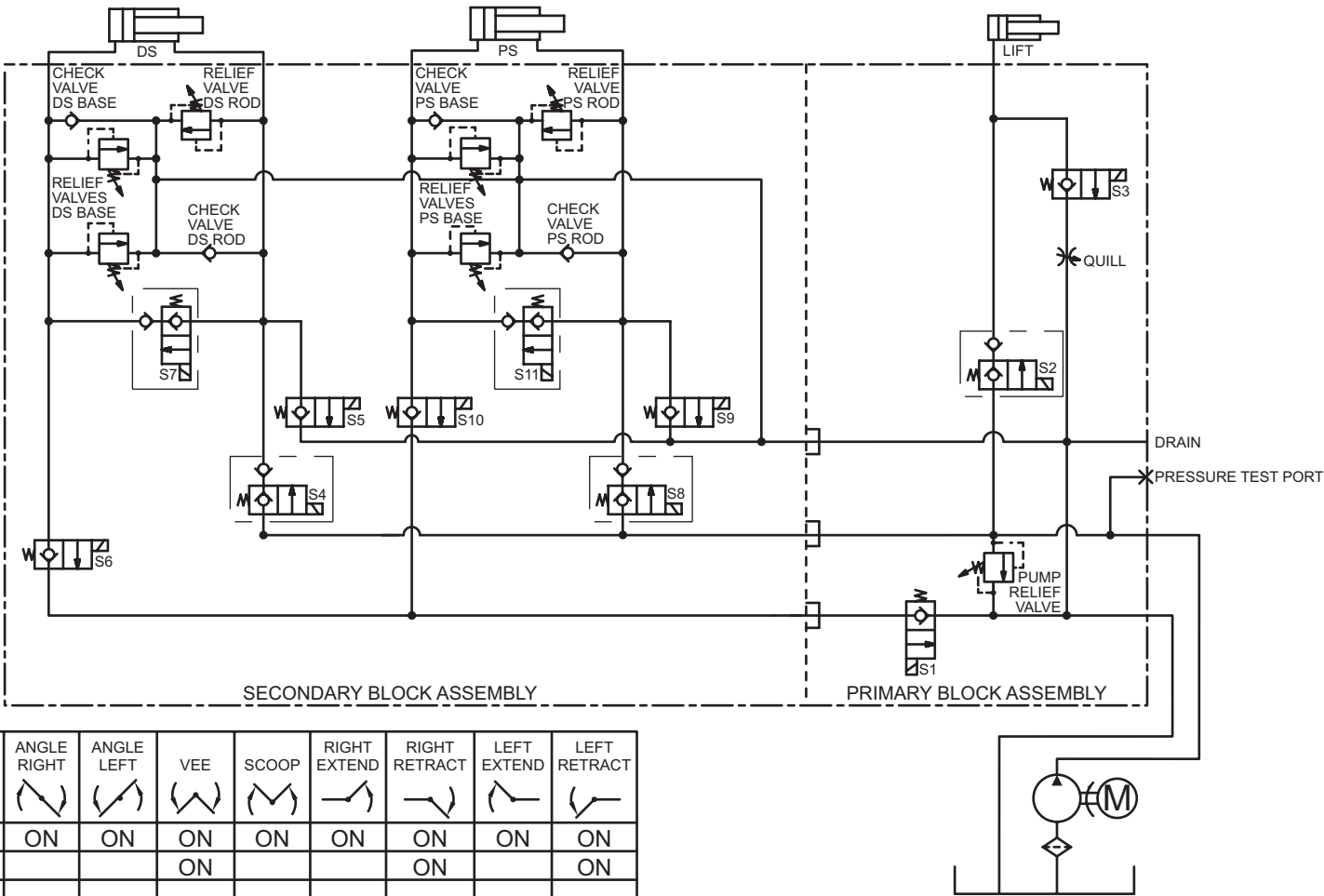
ELECTRICAL LEGEND		HYDRAULIC LEGEND	
	CROSSING WIRE		LINE, WORKING (MAIN)
	WIRE SPLICE		LINES JOINING
	IN LINE CONNECTOR		LINES CROSSING
	FUSE		FLOW, DIRECTION OF HYDRAULIC FLUID
	SOLENOID COIL		LINE, TO RESERVOIR BELOW FLUID LEVEL
	CIRCUIT GROUND		HYDRAULIC PUMP FIXED DISPLACEMENT
	MOTOR RELAY		RAM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

ELECTRICAL SCHEMATIC



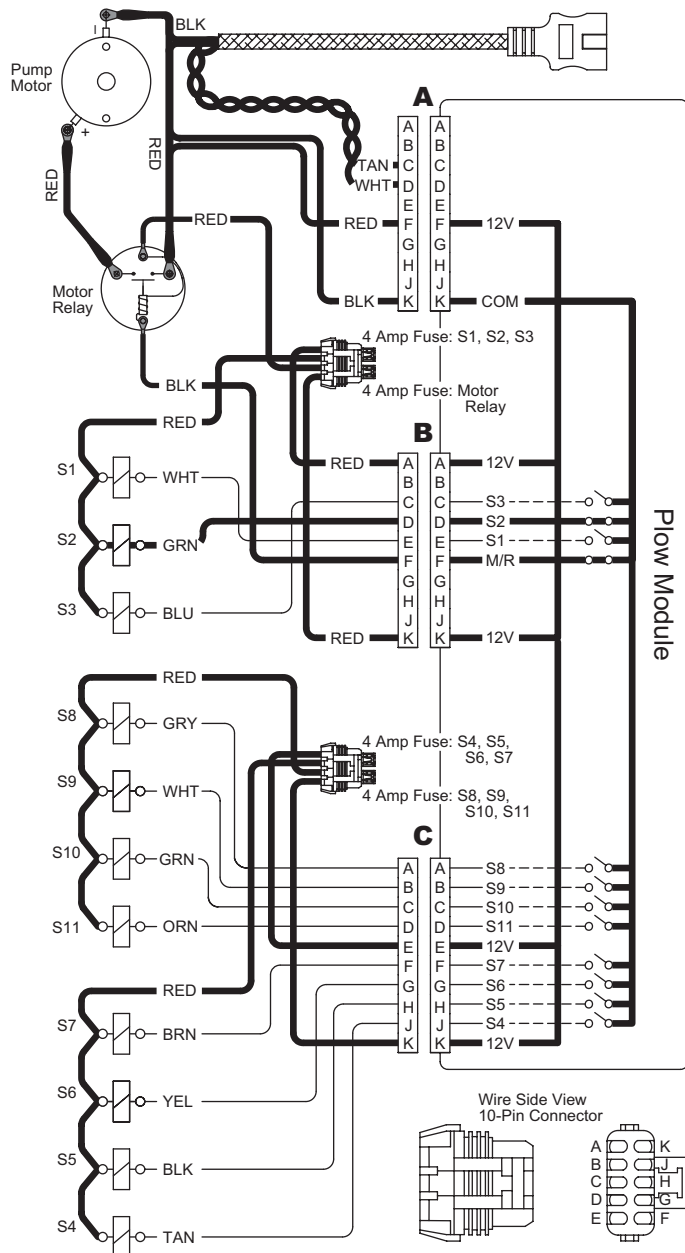
HYDRAULIC SCHEMATIC

Relief Valve Settings	
Pump	2250 psi
Ram, Rod-End	3700 psi
Ram, Base-End	4600 psi



BLADE MOVEMENT		RAISE ↑	LOWER ↓	ANGLE RIGHT 	ANGLE LEFT 	VEE 	SCOOP 	RIGHT EXTEND 	RIGHT RETRACT 	LEFT EXTEND 	LEFT RETRACT
MOTOR	M	ON		ON	ON	ON	ON	ON	ON	ON	ON
SV08-2004	S1					ON			ON		ON
SVCV08-20	S2	ON									
SV08-2004	S3		ON								
SVCV08-20	S4				ON	ON	ON			ON	ON
SV08-2004	S5			ON		ON					
SF08-2015	S6				ON	ON					ON
SVCV08-20	S7						ON			ON	
SVCV08-20	S8			ON		ON	ON	ON			
SV08-2004	S9				ON				ON		
SF08-2015	S10			ON		ON			ON		
SVCV08-20	S11						ON	ON			

RAISE – ELECTRICAL



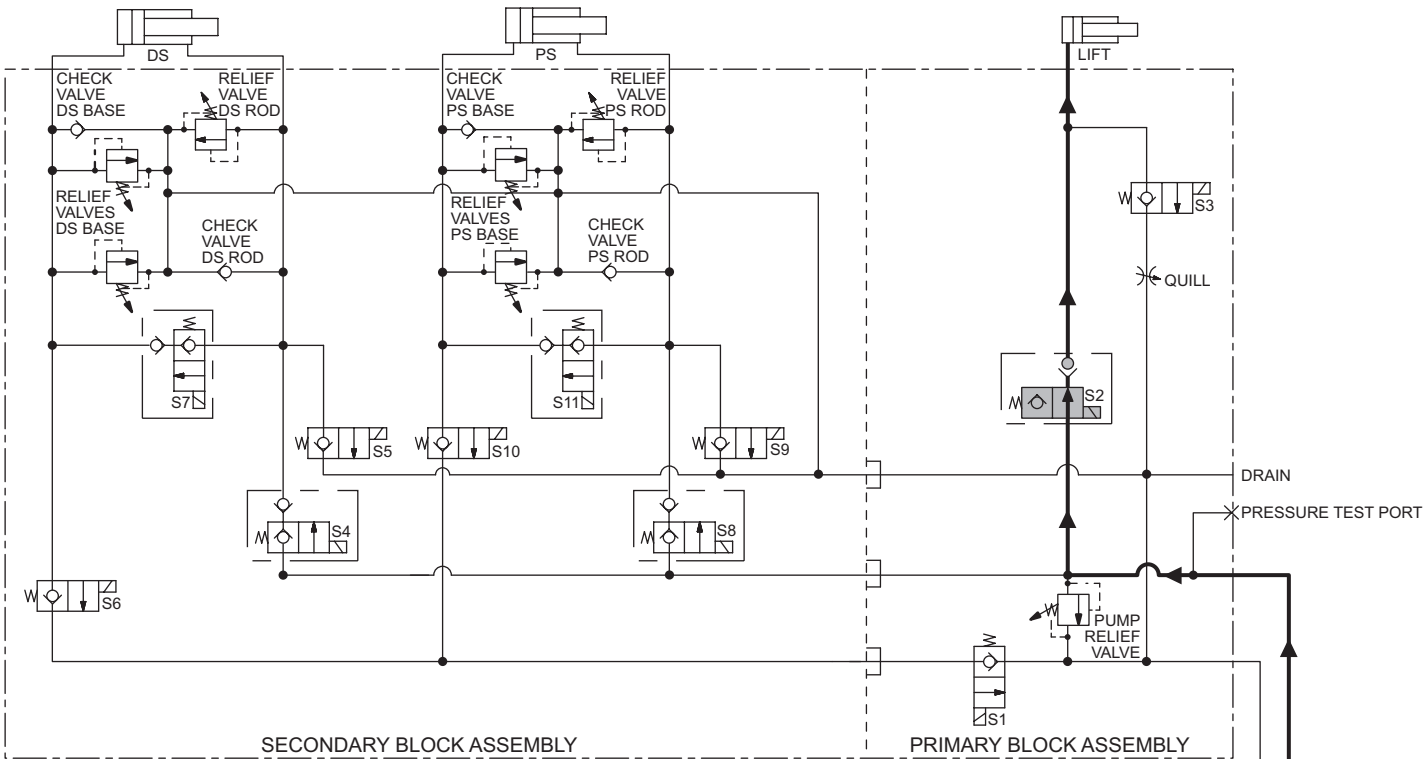
System Response

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 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 11 solenoid coils when the snowplow is connected to the vehicle.

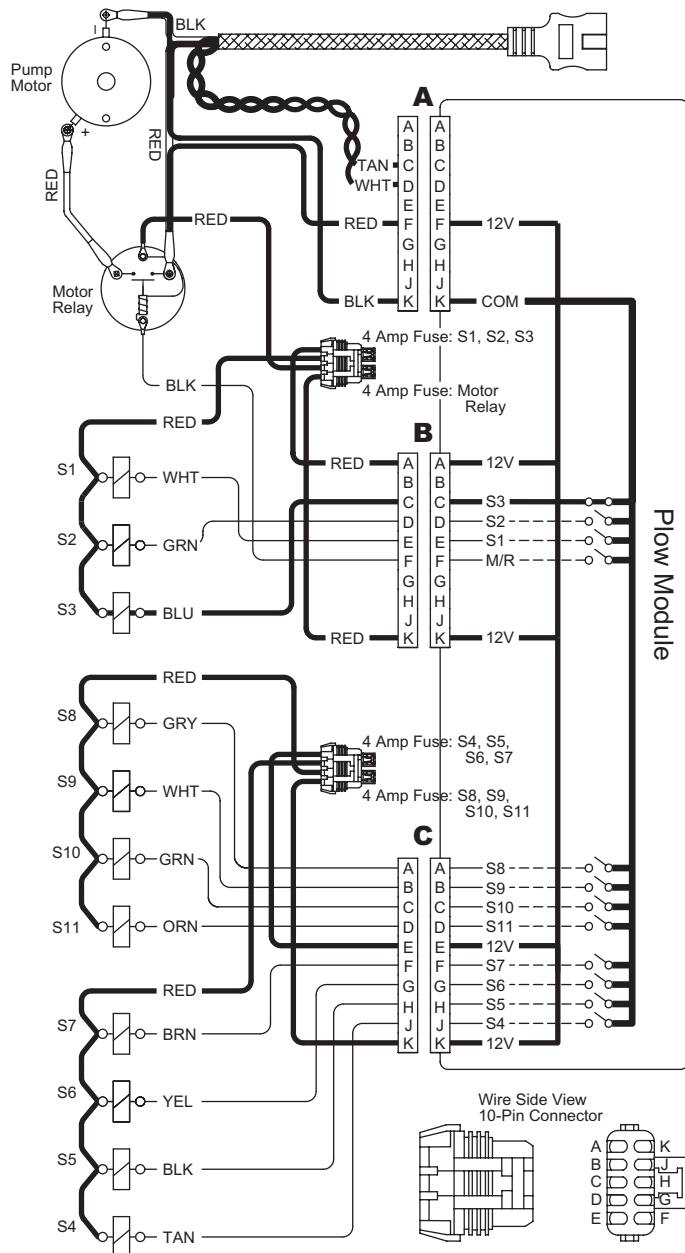
RAISE – HYDRAULIC

Relief Valve Settings	
Pump	2250 psi
Ram, Rod-End	3700 psi
Ram, Base-End	4600 psi



BLADE MOVEMENT		RAISE ↑	LOWER ↓	ANGLE RIGHT 	ANGLE LEFT 	VEE 	SCOOP 	RIGHT EXTEND 	RIGHT RETRACT 	LEFT EXTEND 	LEFT RETRACT
MOTOR	M	ON		ON	ON	ON	ON	ON	ON	ON	ON
SV08-2004	S1					ON			ON		ON
SVCV08-20	S2	ON									
SV08-2004	S3		ON								
SVCV08-20	S4				ON	ON	ON			ON	ON
SV08-2004	S5			ON		ON					
SF08-2015	S6				ON	ON					ON
SVCV08-20	S7						ON			ON	
SVCV08-20	S8			ON		ON	ON	ON			
SV08-2004	S9				ON				ON		
SF08-2015	S10			ON		ON					
SVCV08-20	S11						ON	ON			

LOWER – ELECTRICAL



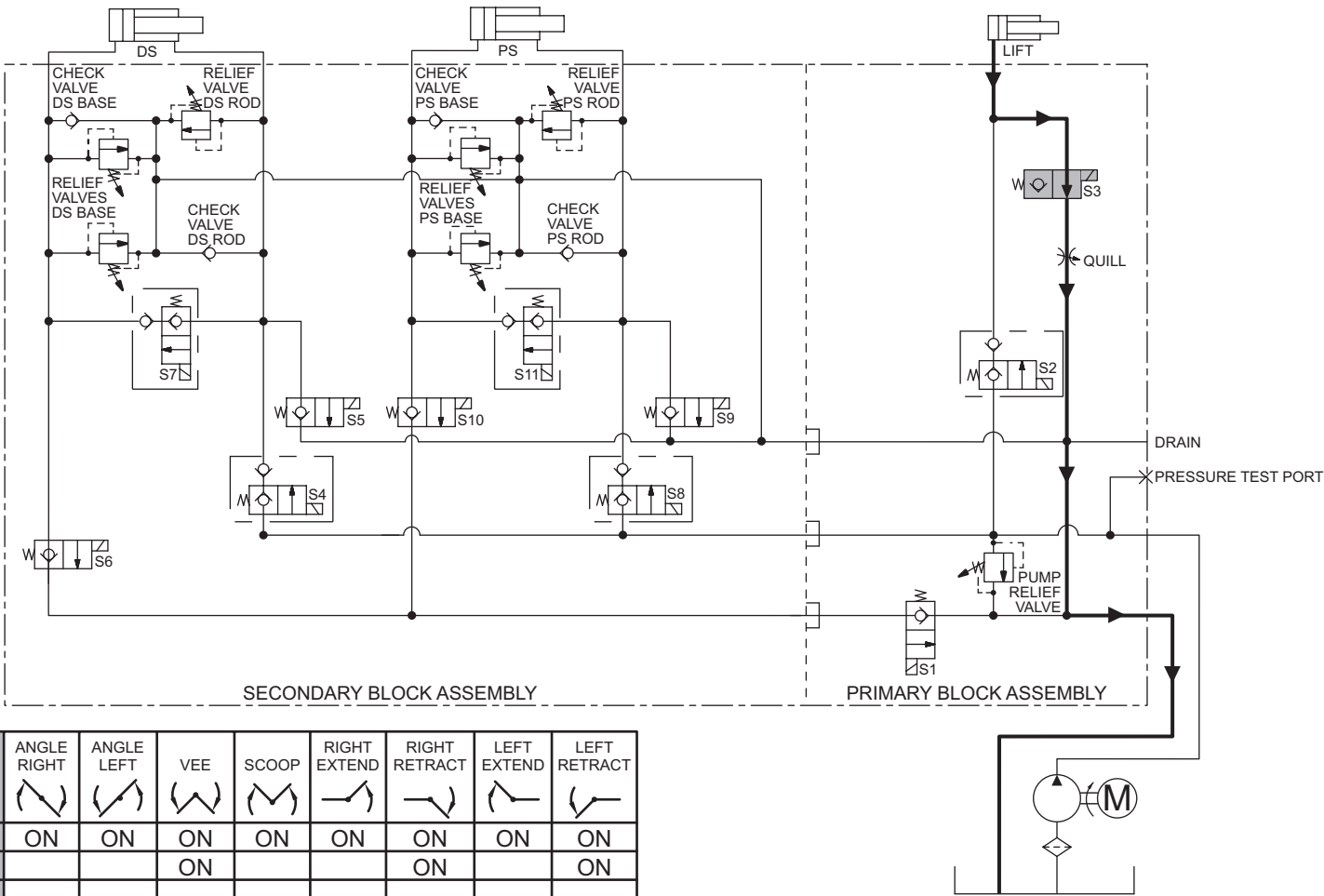
System Response

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 S3.
2. With the weight of the snowplow on the rod end of the lift ram and S3 cartridge valve shifted, the lift ram retracts. Hydraulic fluid is pushed out of the base end, through S3 and back to the reservoir.

NOTE: Battery voltage is supplied to the Plow Module, the motor relay and the 11 solenoid coils when the snowplow is connected to the vehicle.

LOWER – HYDRAULIC

Relief Valve Settings	
Pump	2250 psi
Ram, Rod-End	3700 psi
Ram, Base-End	4600 psi



BLADE MOVEMENT		RAISE ↑	LOWER ↓	ANGLE RIGHT 	ANGLE LEFT 	VEE 	SCOOP 	RIGHT EXTEND 	RIGHT RETRACT 	LEFT EXTEND 	LEFT RETRACT
MOTOR	M	ON		ON	ON	ON	ON	ON	ON	ON	ON
SV08-2004	S1					ON			ON		ON
SVCV08-20	S2	ON									
SV08-2004	S3		ON								
SVCV08-20	S4				ON	ON	ON			ON	ON
SV08-2004	S5			ON		ON					ON
SF08-2015	S6				ON	ON					
SVCV08-20	S7						ON			ON	
SVCV08-20	S8			ON		ON	ON	ON			
SV08-2004	S9				ON			ON			
SF08-2015	S10			ON		ON			ON		
SVCV08-20	S11						ON	ON			

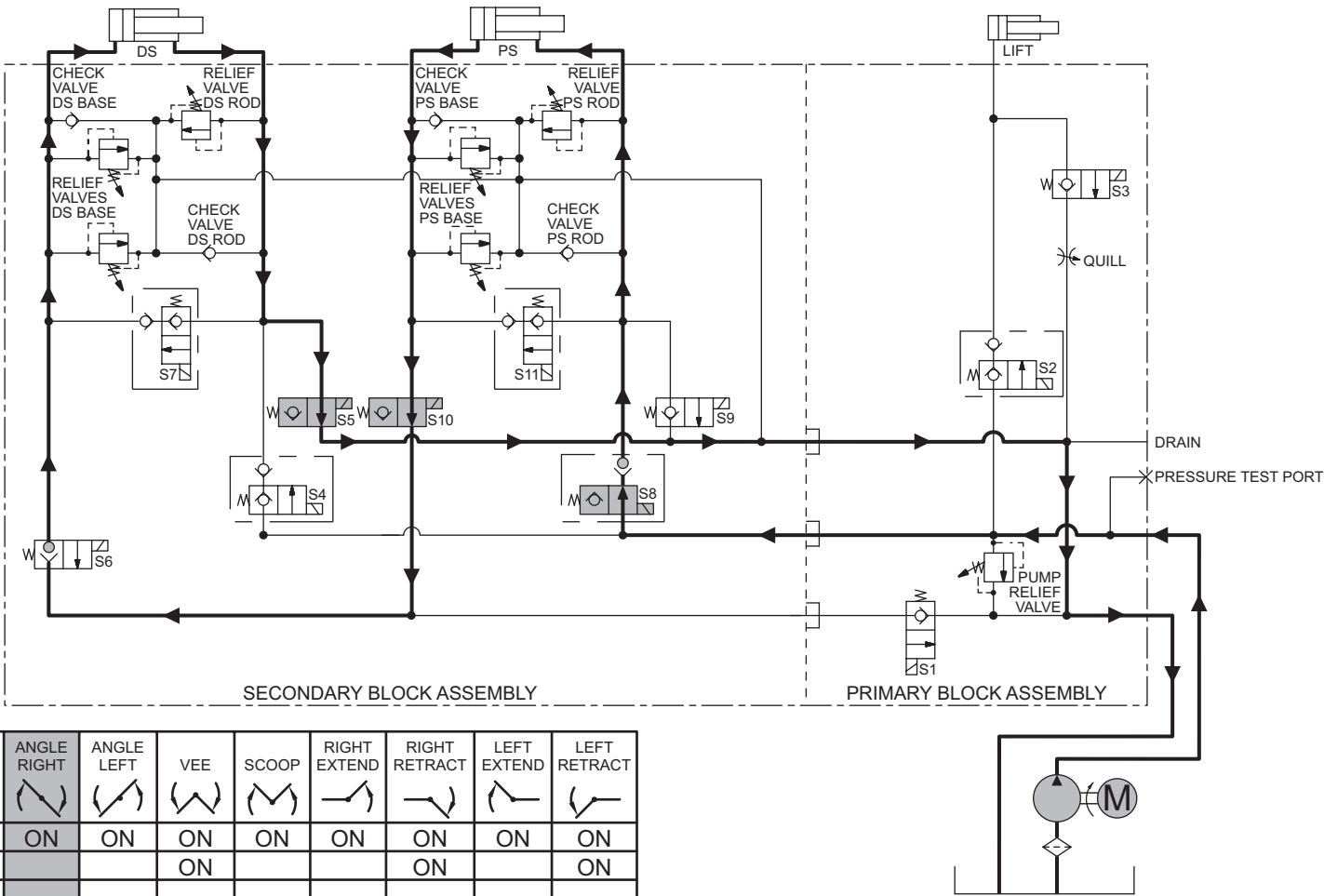
1. By activating the angle right (R on the control face) function on the cab control, the control sends a signal to the Plow Module to complete the **ground path** for the electrical circuit, activating the motor relay and solenoid cartridge valves S5, S8 & S10.
2. Hydraulic fluid from the pump flows through activated S8 and into the rod end of the right ram, causing it to retract.
3. The retracting PS ram pushes the hydraulic fluid out of its base end, through activated valve S10 and inactivated S6, then into the base end of the DS ram causing it to extend.
4. The extending DS ram pushes the hydraulic fluid out of its rod end, through activated S5 and back to the reservoir.

NOTE: Battery voltage is supplied

NOTE: Battery voltage is supplied to the Plow Module, the motor relay and the 11 solenoid coils when the snowplow is connected to the vehicle.

ANGLE RIGHT – HYDRAULIC

Relief Valve Settings	
Pump	2250 psi
Ram, Rod-End	3700 psi
Ram, Base-End	4600 psi



BLADE MOVEMENT		RAISE ↑	LOWER ↓	ANGLE RIGHT 	ANGLE LEFT 	VEE 	SCOOP 	RIGHT EXTEND 	RIGHT RETRACT 	LEFT EXTEND 	LEFT RETRACT 
MOTOR	M	ON		ON	ON	ON	ON	ON	ON	ON	ON
SV08-2004	S1					ON			ON		ON
SVCV08-20	S2	ON									
SV08-2004	S3		ON								
SVCV08-20	S4				ON	ON	ON			ON	ON
SV08-2004	S5			ON		ON					
SF08-2015	S6				ON	ON					ON
SVCV08-20	S7						ON			ON	
SVCV08-20	S8			ON		ON	ON	ON	ON		
SV08-2004	S9				ON				ON		
SF08-2015	S10			ON		ON			ON		
SVCV08-20	S11						ON	ON			

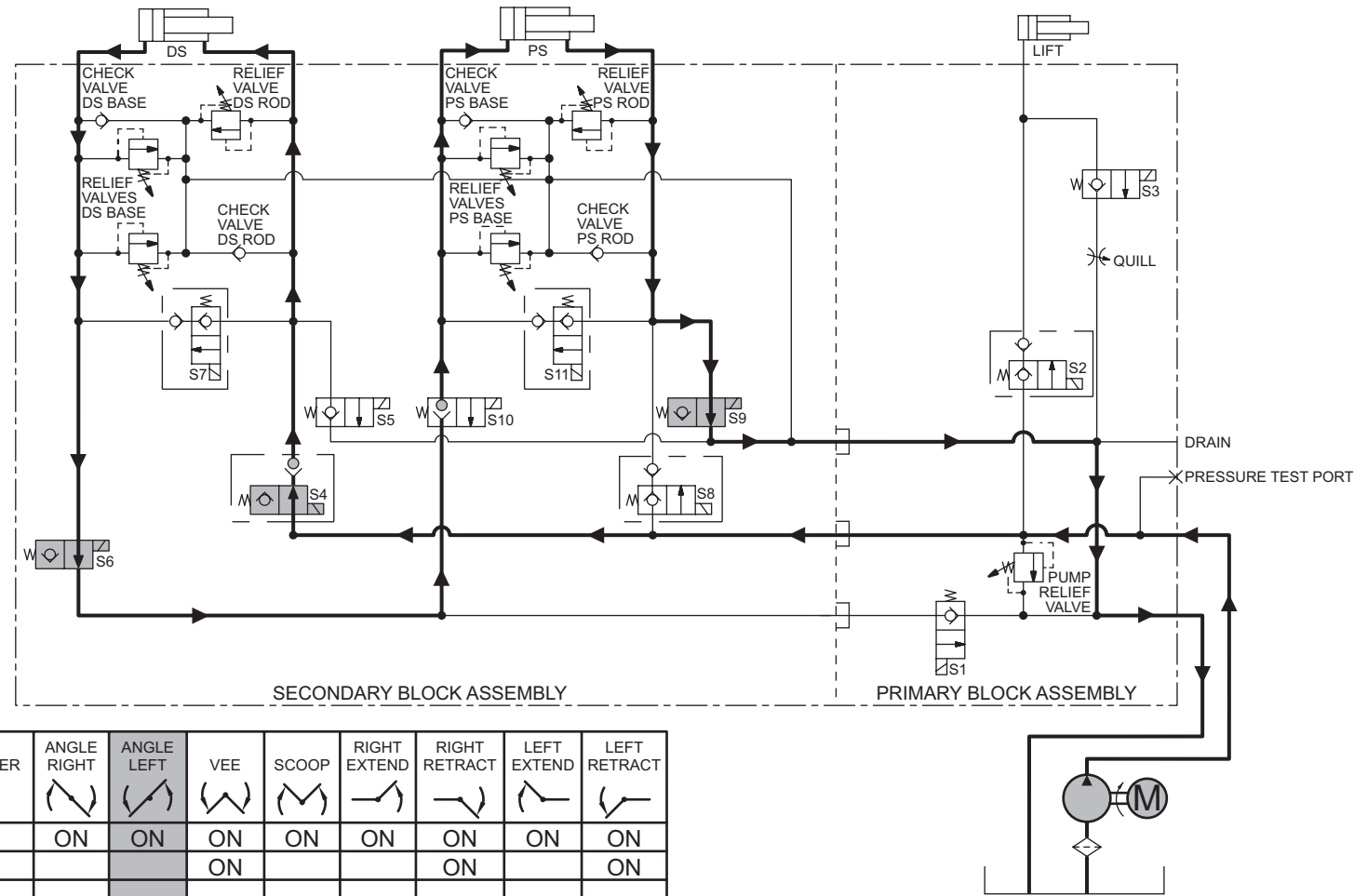
1. By activating the angle left (L on the control face) function on the cab control, the control sends a signal to the Plow Module to complete the **ground path** for the electrical circuit, activating the motor relay and solenoid cartridge valves S4, S6 & S9, activating these valves.
2. Hydraulic fluid from the pump flows through activated S4 and into the rod end of the left ram, causing it to retract.
3. The retracting DS ram pushes the hydraulic fluid out of its base end, through activated S6 and inactivated S10, then into the base end of the PS ram, causing it to extend.
4. The extending PS ram pushes the hydraulic fluid out of its rod end, through activated S9 and back to the reservoir.

NOTE: Battery voltage is supplied to the Plow Module, the motor

NOTE: Battery voltage is supplied to the Plow Module, the motor relay and the 11 solenoid coils when the snowplow is connected to the vehicle.

ANGLE LEFT – HYDRAULIC

Relief Valve Settings	
Pump	2250 psi
Ram, Rod-End	3700 psi
Ram, Base-End	4600 psi



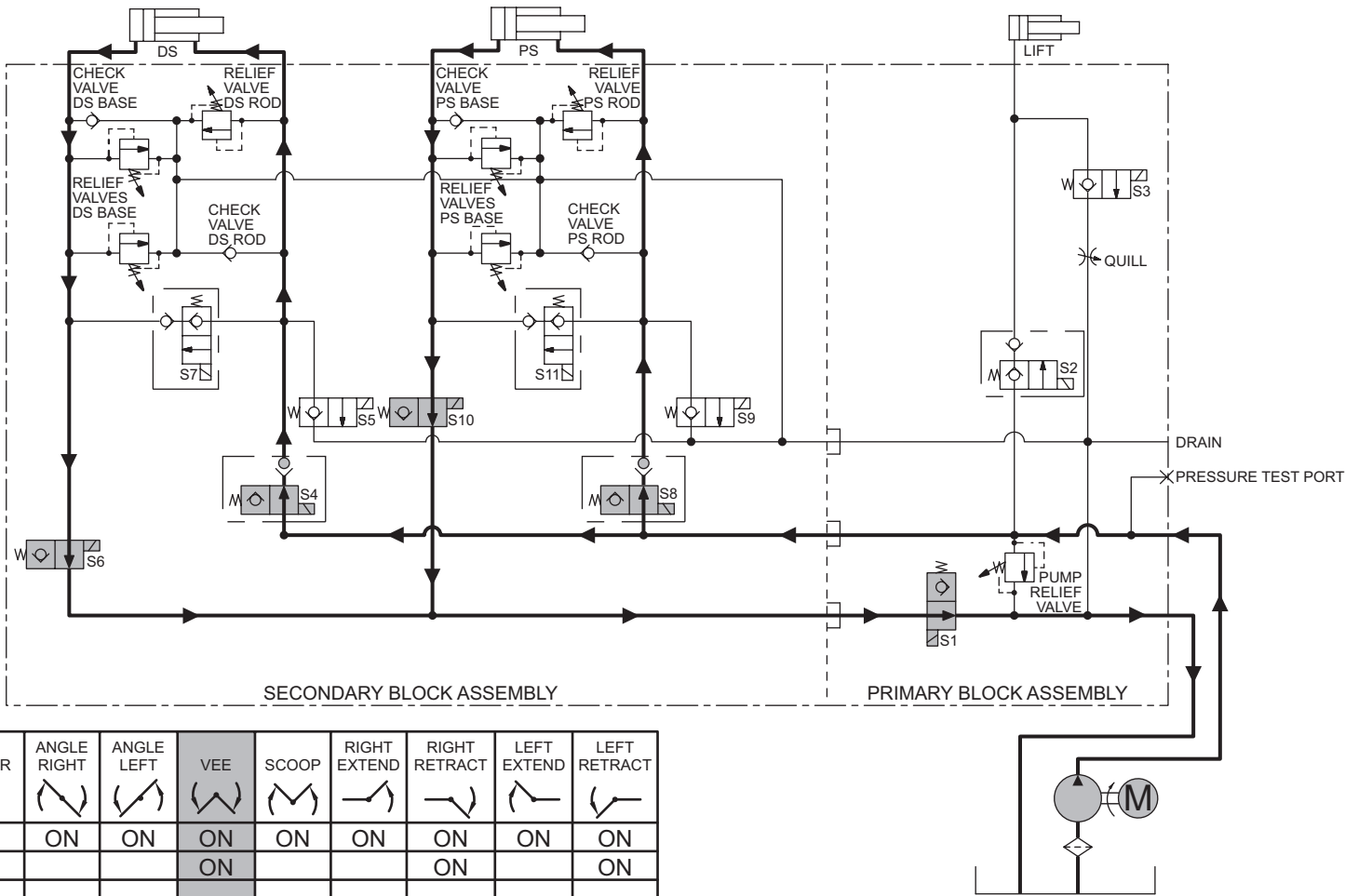
BLADE MOVEMENT		RAISE ↑	LOWER ↓	ANGLE RIGHT 	ANGLE LEFT 	VEE 	SCOOP 	RIGHT EXTEND 	RIGHT RETRACT 	LEFT EXTEND 	LEFT RETRACT
MOTOR	M	ON		ON	ON	ON	ON	ON	ON	ON	ON
SV08-2004	S1					ON			ON		ON
SVCV08-20	S2	ON									
SV08-2004	S3		ON								
SVCV08-20	S4				ON	ON	ON			ON	ON
SV08-2004	S5			ON							
SF08-2015	S6				ON	ON					ON
SVCV08-20	S7						ON			ON	
SVCV08-20	S8			ON		ON	ON	ON			
SV08-2004	S9				ON						
SF08-2015	S10			ON		ON			ON		
SVCV08-20	S11						ON	ON			

1. By activating the RETRACT (VEE) 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 S1, S4, S6, S8 and S10, activating these valves.
2. Hydraulic fluid from the pump flows through activated S4 & S8, then into the rod end of the DS and PS angle rams, causing the rams to retract.
3. The retracting DS ram pushes the hydraulic fluid out of its base end, through activated S6 & S1 and back to the reservoir.
4. The retracting PS ram pushes the hydraulic fluid out of its base end, through activated S10 & S1 and back to the reservoir.

NOTE: Battery voltage is supplied to the Plow Module, the motor relay and the 11 solenoid coils when the snowplow is connected to the vehicle.

RETRACT (VEE) – HYDRAULIC

Relief Valve Settings	
Pump	2250 psi
Ram, Rod-End	3700 psi
Ram, Base-End	4600 psi



BLADE MOVEMENT		RAISE ↑	LOWER ↓	ANGLE RIGHT 	ANGLE LEFT 	VEE 	SCOOP 	RIGHT EXTEND 	RIGHT RETRACT 	LEFT EXTEND 	LEFT RETRACT 
MOTOR	M	ON		ON	ON	ON	ON	ON	ON	ON	ON
SV08-2004	S1					ON			ON		ON
SVCV08-20	S2	ON									
SV08-2004	S3		ON								
SVCV08-20	S4				ON	ON	ON			ON	ON
SV08-2004	S5			ON		ON					
SF08-2015	S6				ON	ON					ON
SVCV08-20	S7						ON			ON	
SVCV08-20	S8			ON		ON	ON	ON	ON		
SV08-2004	S9				ON						
SF08-2015	S10			ON		ON			ON		
SVCV08-20	S11						ON	ON			

1. By activating the SCOOP 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 S4, S7, S8 & S11, activating these valves.
4. Hydraulic fluid exiting the rod end of the angle rams flows through S7 to the base end of the DS ram, and through activated S11 to the base end of the PS ram. This fluid mixes with the fluid from the pump.

NOTE: This is called a regenerative

2. Hydraulic fluid from the pump flows through activated S4 & S7 then into the base end of the driver-side angle ram, forcing the rod to extend.
3. Hydraulic fluid from the pump also flows through activated S8 & S11 then into the base end of the extending PS ram.

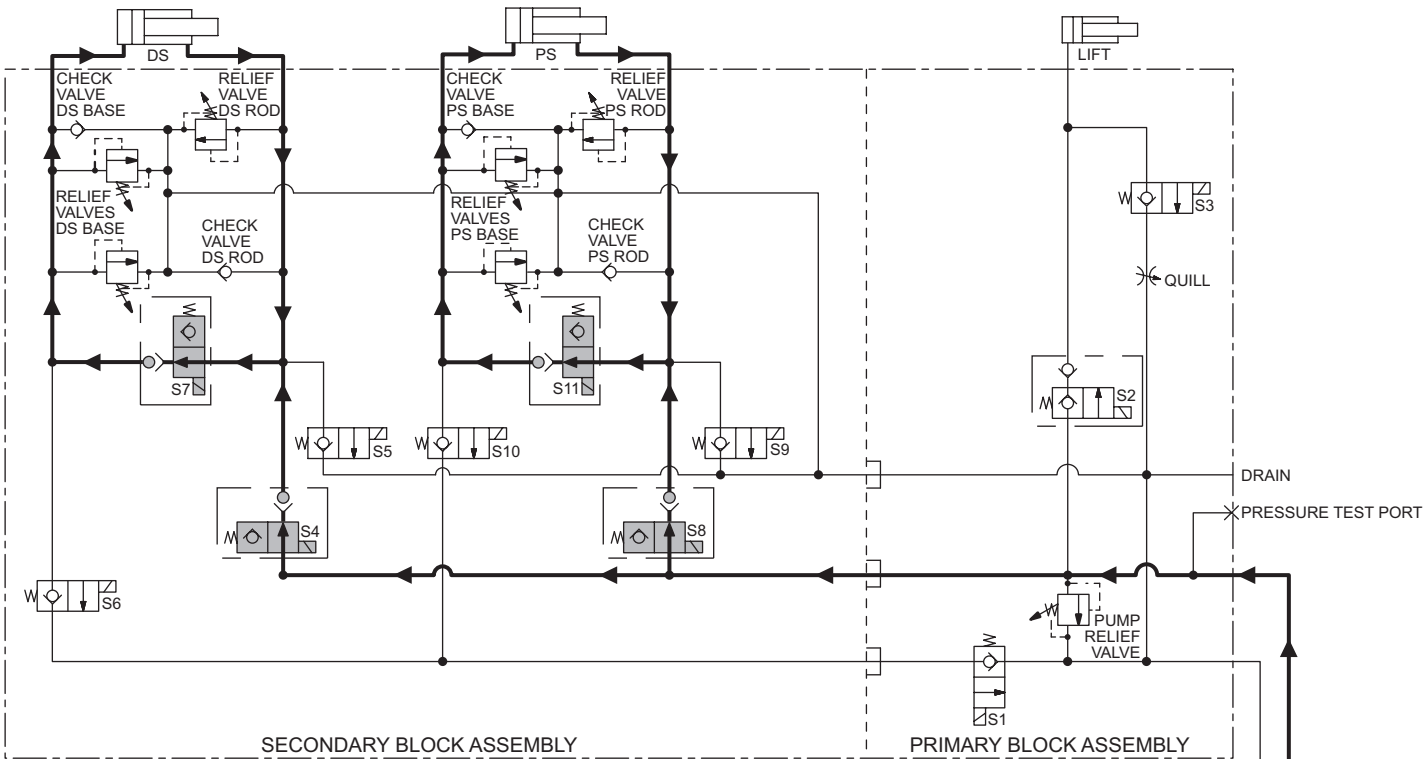
NOTE: This is called a regenerative hydraulic circuit. Even though both sides of the ram piston will experience the same hydraulic pressure, the ram will extend due to unequal force. The difference in area between the base end and rod end of the ram piston creates a greater force on the base end which extends the ram.

Force = Pressure X Surface Area.

NOTE: Battery voltage is supplied to the Plow Module, the motor relay and the 11 solenoid coils when the snowplow is connected to the vehicle.

SCOOP – HYDRAULIC

Relief Valve Settings	
Pump	2250 psi
Ram, Rod-End	3700 psi
Ram, Base-End	4600 psi



BLADE MOVEMENT		RAISE ↑	LOWER ↓	ANGLE RIGHT 	ANGLE LEFT 	VEE 	SCOOP 	RIGHT EXTEND 	RIGHT RETRACT 	LEFT EXTEND 	LEFT RETRACT 
MOTOR	M	ON		ON	ON	ON	ON	ON	ON	ON	ON
SV08-2004	S1					ON		ON		ON	
SVCV08-20	S2	ON									
SV08-2004	S3		ON								
SVCV08-20	S4				ON	ON	ON			ON	ON
SV08-2004	S5			ON		ON					
SF08-2015	S6				ON	ON					ON
SVCV08-20	S7						ON			ON	
SVCV08-20	S8			ON		ON	ON	ON	ON		
SV08-2004	S9				ON						
SF08-2015	S10			ON		ON		ON			
SVCV08-20	S11						ON	ON			

1. By activating the WING function on the right side of the cab control, the control sends a signal to the Plow Module to complete the **ground path** for the electrical circuit, activating
3. The extending PS ram pushes the hydraulic fluid out of its rod end. This fluid mixes with the hydraulic fluid from the pump and passes through activated S11 into the base end of the extending PS ram.

3. The extending PS ram pushes the hydraulic fluid out of its rod end. This fluid mixes with the hydraulic fluid from the pump and passes through activated S11 into the base end of the extending PS ram.

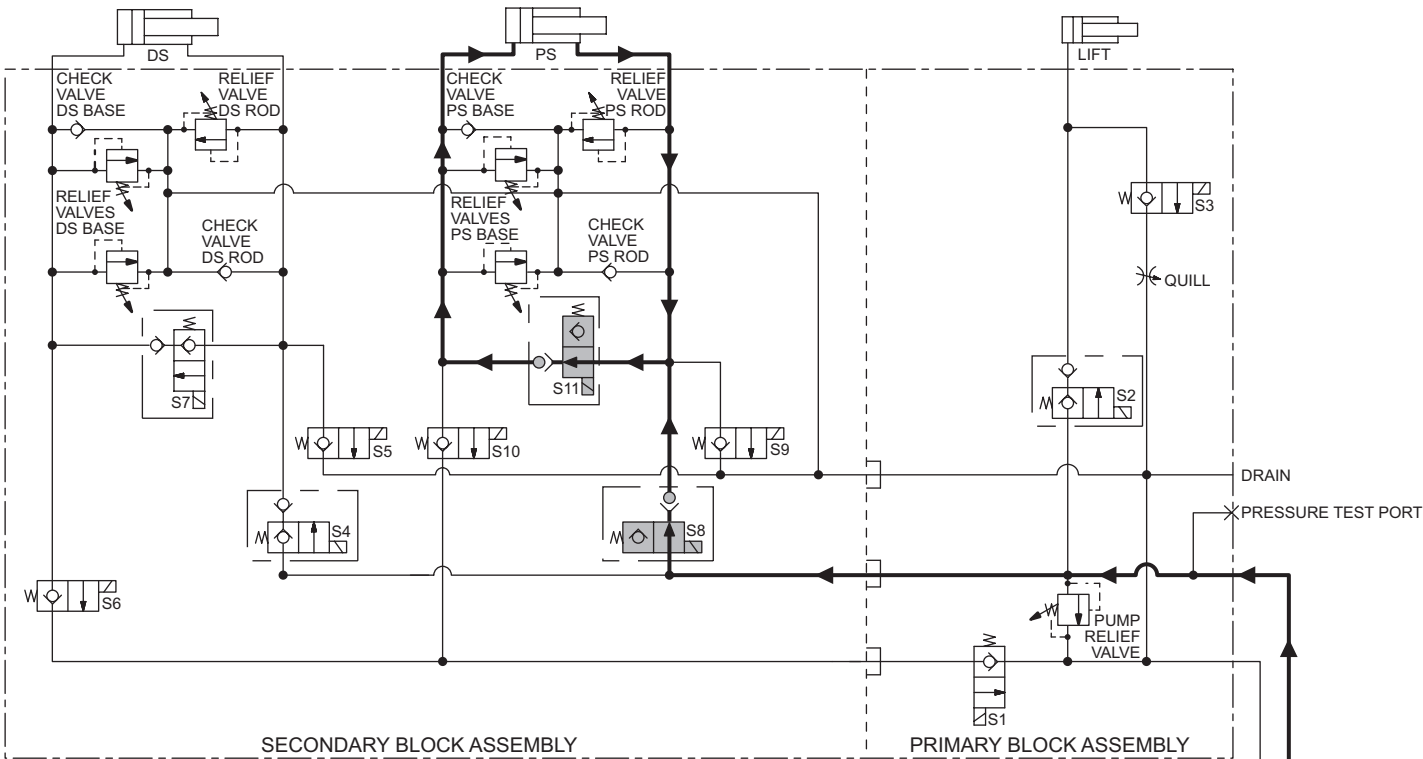
NOTE: Battery voltage is supplied to the Plow Module, the motor relay and the 11 solenoid coils when the snowplow is connected to the vehicle.

2. Hydraulic fluid from the pump flows through activated S8 & S11 into the base end of the PS ram, causing it to extend.

NOTE: Battery voltage is supplied to the Plow Module, the motor relay and the 11 solenoid coils when the snowplow is connected to the vehicle.

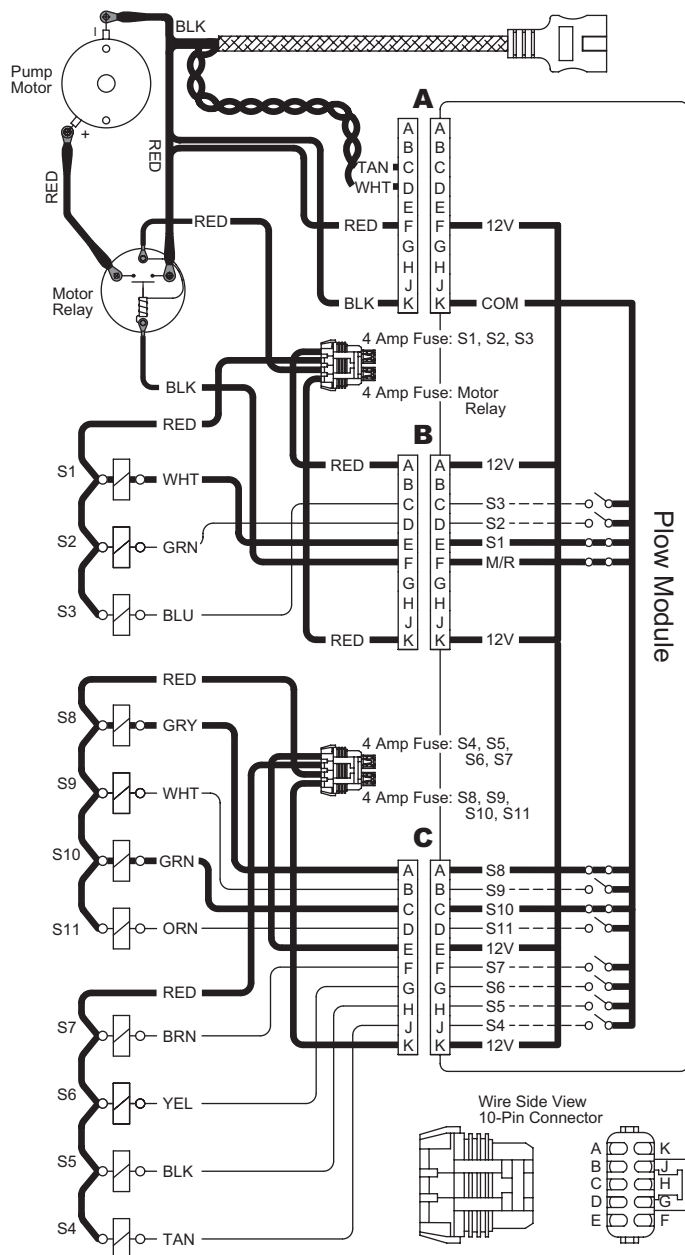
RIGHT EXTEND – HYDRAULIC

Relief Valve Settings	
Pump	2250 psi
Ram, Rod-End	3700 psi
Ram, Base-End	4600 psi



BLADE MOVEMENT		RAISE ↑	LOWER ↓	ANGLE RIGHT 	ANGLE LEFT 	VEE 	SCOOP 	RIGHT EXTEND 	RIGHT RETRACT 	LEFT EXTEND 	LEFT RETRACT
MOTOR	M	ON		ON	ON	ON	ON	ON	ON	ON	ON
SV08-2004	S1					ON			ON		ON
SVCV08-20	S2	ON									
SV08-2004	S3		ON								
SVCV08-20	S4				ON	ON	ON			ON	ON
SV08-2004	S5			ON							
SF08-2015	S6				ON	ON					ON
SVCV08-20	S7						ON			ON	
SVCV08-20	S8			ON		ON	ON	ON	ON		
SV08-2004	S9				ON						
SF08-2015	S10			ON		ON			ON		
SVCV08-20	S11						ON	ON			

RIGHT RETRACT – ELECTRICAL



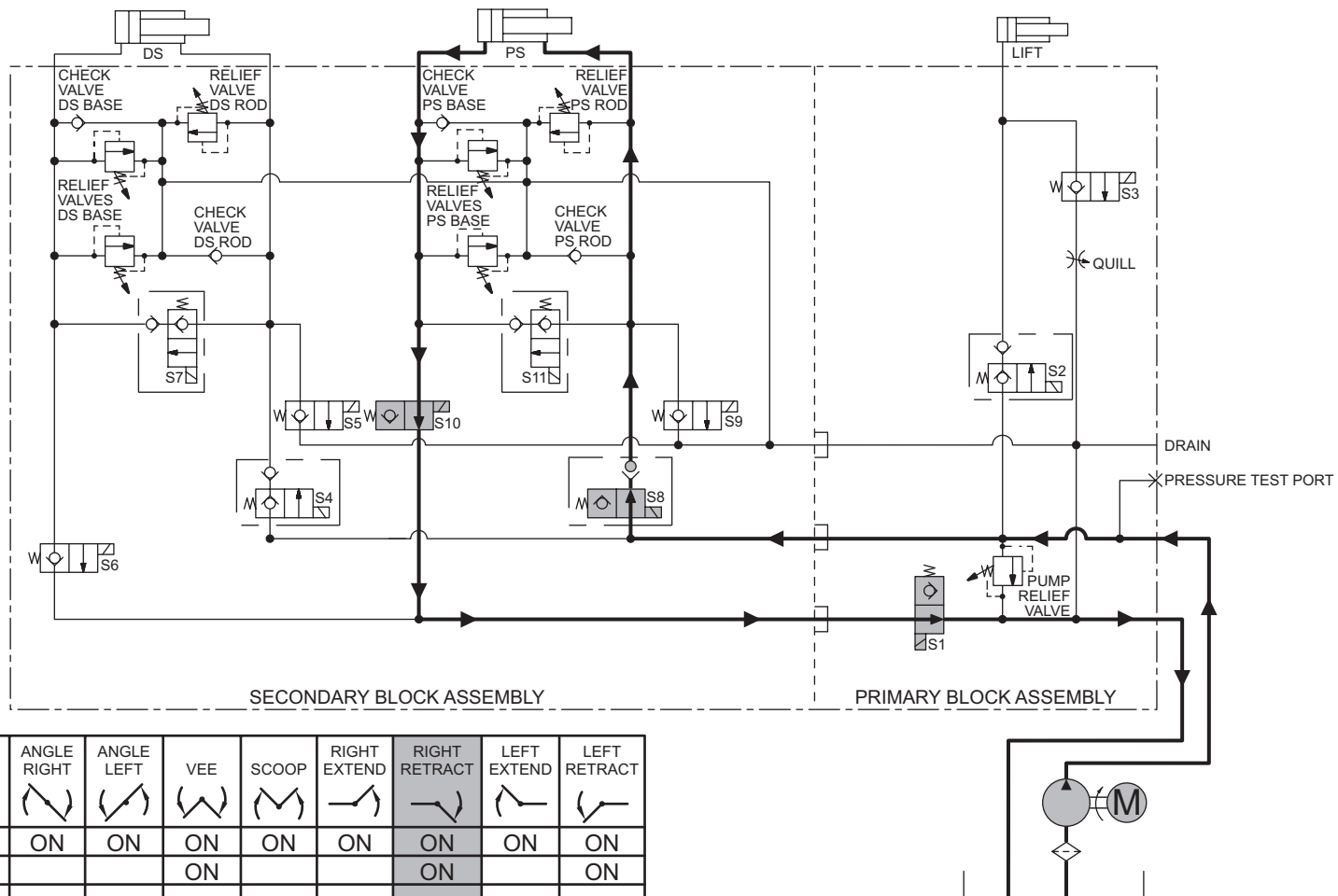
System Response

1. By activating the WING function on the right side of 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 S1, S8 & S10. The wing mode toggles between extend and retract.
2. Hydraulic fluid from the pump flows through activated S8 into the rod end of the PS ram, causing it to retract.
3. The retracting PS ram pushes the hydraulic fluid out of its base end, through activated S10 & S1 and back to the reservoir.

NOTE: See the System Overview – Controls Section for operation information.

NOTE: Battery voltage is supplied to the Plow Module, the motor relay and the 11 solenoid coils when the snowplow is connected to the vehicle.

Relief Valve Settings	
Pump	2250 psi
Ram, Rod-End	3700 psi
Ram, Base-End	4600 psi



BLADE MOVEMENT		RAISE ↑	LOWER ↓	ANGLE RIGHT 	ANGLE LEFT 	VEE 	SCOOP 	RIGHT EXTEND 	RIGHT RETRACT 	LEFT EXTEND 	LEFT RETRACT 
MOTOR	M	ON		ON	ON	ON	ON	ON	ON	ON	ON
SV08-2004	S1					ON			ON		ON
SVCV08-20	S2	ON									
SV08-2004	S3		ON								
SVCV08-20	S4				ON	ON	ON			ON	ON
SV08-2004	S5			ON							
SF08-2015	S6				ON	ON					ON
SVCV08-20	S7						ON			ON	
SVCV08-20	S8			ON		ON	ON	ON	ON		
SV08-2004	S9				ON						
SF08-2015	S10			ON		ON			ON		
SVCV08-20	S11						ON	ON			

1. By activating the WING function on the left side of 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 S4 & S7. The wing mode toggles between extend and retract.
3. The extending DS ram pushes the hydraulic fluid out of its rod end. This fluid mixes with the hydraulic fluid from the pump and passes through activated S7 into the base end of the extending DS ram.

NOTE: This is called a **regenerative hydraulic circuit**. Even though

2. Hydraulic fluid from the pump flows through activated S4 & S7 into the base end of the DS ram, causing it to extend.

3. The extending DS ram pushes the hydraulic fluid out of its rod end. This fluid mixes with the hydraulic fluid from the pump and passes through activated S7 into the base end of the extending DS ram.

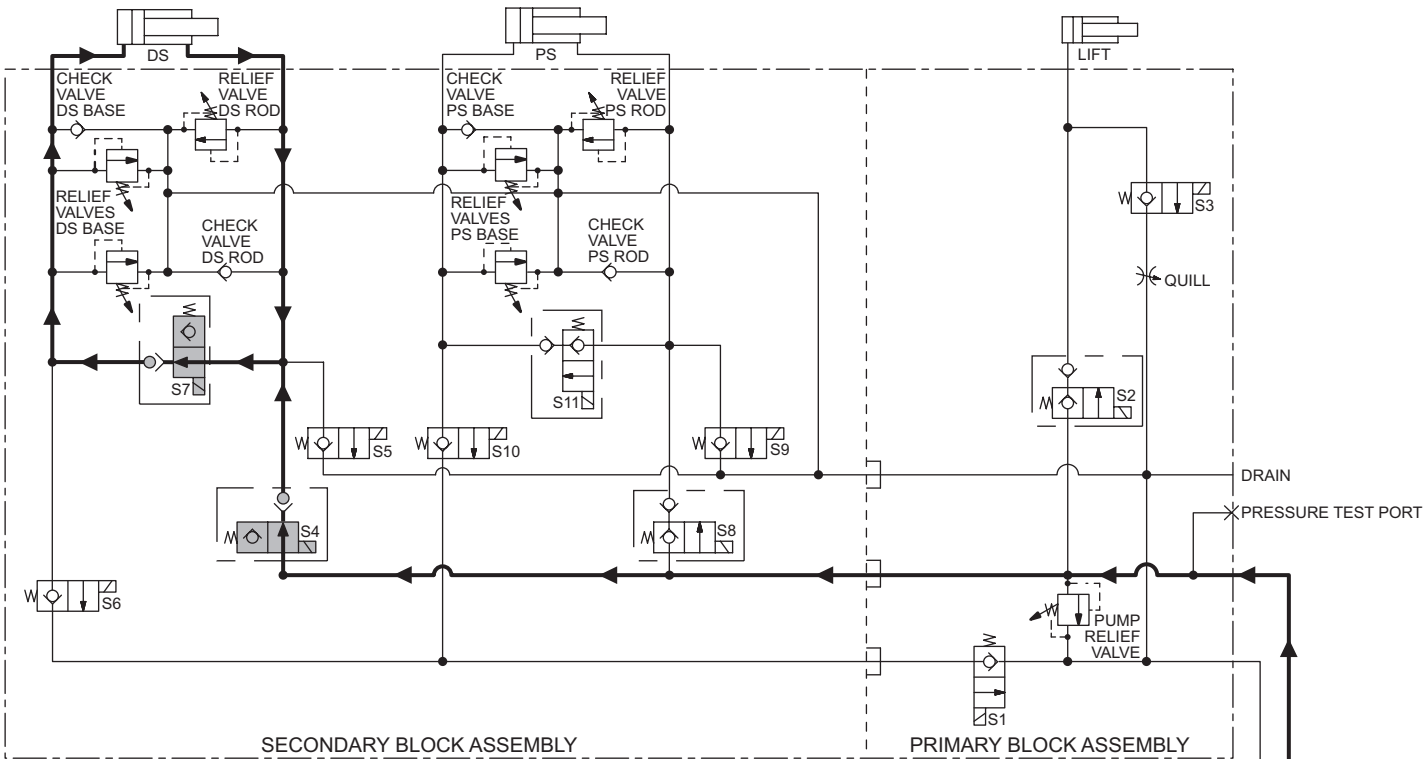
NOTE: This is called a regenerative hydraulic circuit. Even though both sides of the ram piston will experience the same hydraulic pressure, the ram will extend due to unequal force. The difference in area between the base end and rod end of the ram piston creates a greater force on the base end which extends the ram.

Force = Pressure X Surface Area.

NOTE: Battery voltage is supplied to the Plow Module, the motor relay and the 11 solenoid coils when the snowplow is connected to the vehicle.

LEFT EXTEND – HYDRAULIC

Relief Valve Settings	
Pump	2250 psi
Ram, Rod-End	3700 psi
Ram, Base-End	4600 psi



BLADE MOVEMENT		RAISE ↑	LOWER ↓	ANGLE RIGHT 	ANGLE LEFT 	VEE 	SCOOP 	RIGHT EXTEND 	RIGHT RETRACT 	LEFT EXTEND 	LEFT RETRACT 
MOTOR	M	ON		ON	ON	ON	ON	ON	ON	ON	ON
SV08-2004	S1					ON			ON		ON
SVCV08-20	S2	ON									
SV08-2004	S3		ON								
SVCV08-20	S4				ON	ON	ON			ON	ON
SV08-2004	S5			ON		ON					
SF08-2015	S6				ON	ON					ON
SVCV08-20	S7						ON			ON	
SVCV08-20	S8			ON		ON	ON	ON	ON		
SV08-2004	S9				ON				ON		
SF08-2015	S10			ON		ON			ON		
SVCV08-20	S11						ON	ON			

1. By activating the WING function on the left side of 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 S1, S4 & S6. The wing mode toggles between extend and retract.
2. Hydraulic fluid from the pump flows through activated S4 into the rod end of the DS ram, causing it to retract.
3. The retracting DS ram pushes the hydraulic fluid out of its base end, through activated S6 & S1 and back to the reservoir.

_____ to the Vehicle.

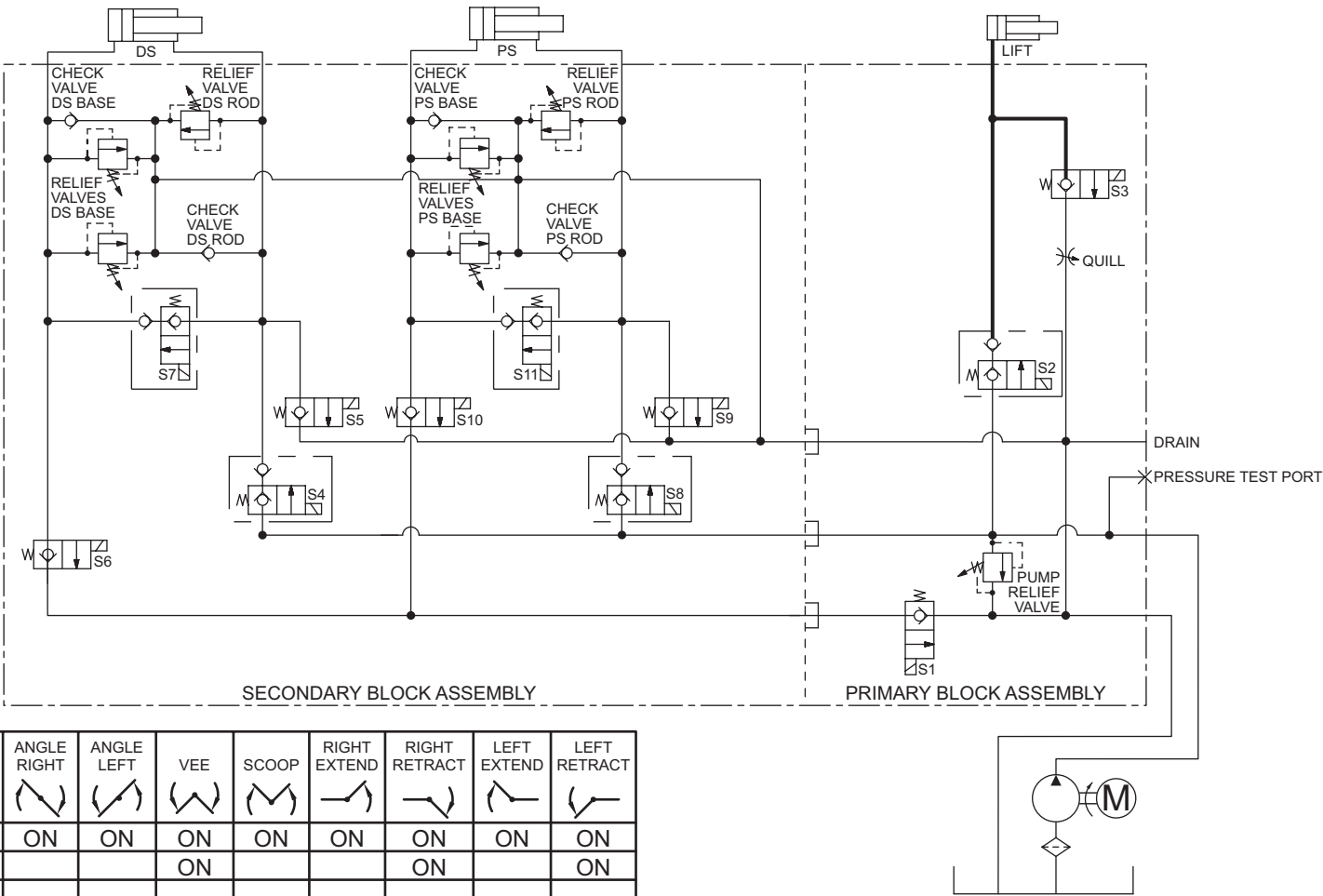


HOLD IN RAISE POSITION – HYDRAULIC

System Response

- 1. Hydraulic fluid is trapped in the base end of the lift ram by the internal check valve in solenoid cartridge valves S2 & S3.

Relief Valve Settings	
Pump	2250 psi
Ram, Rod-End	3700 psi
Ram, Base-End	4600 psi



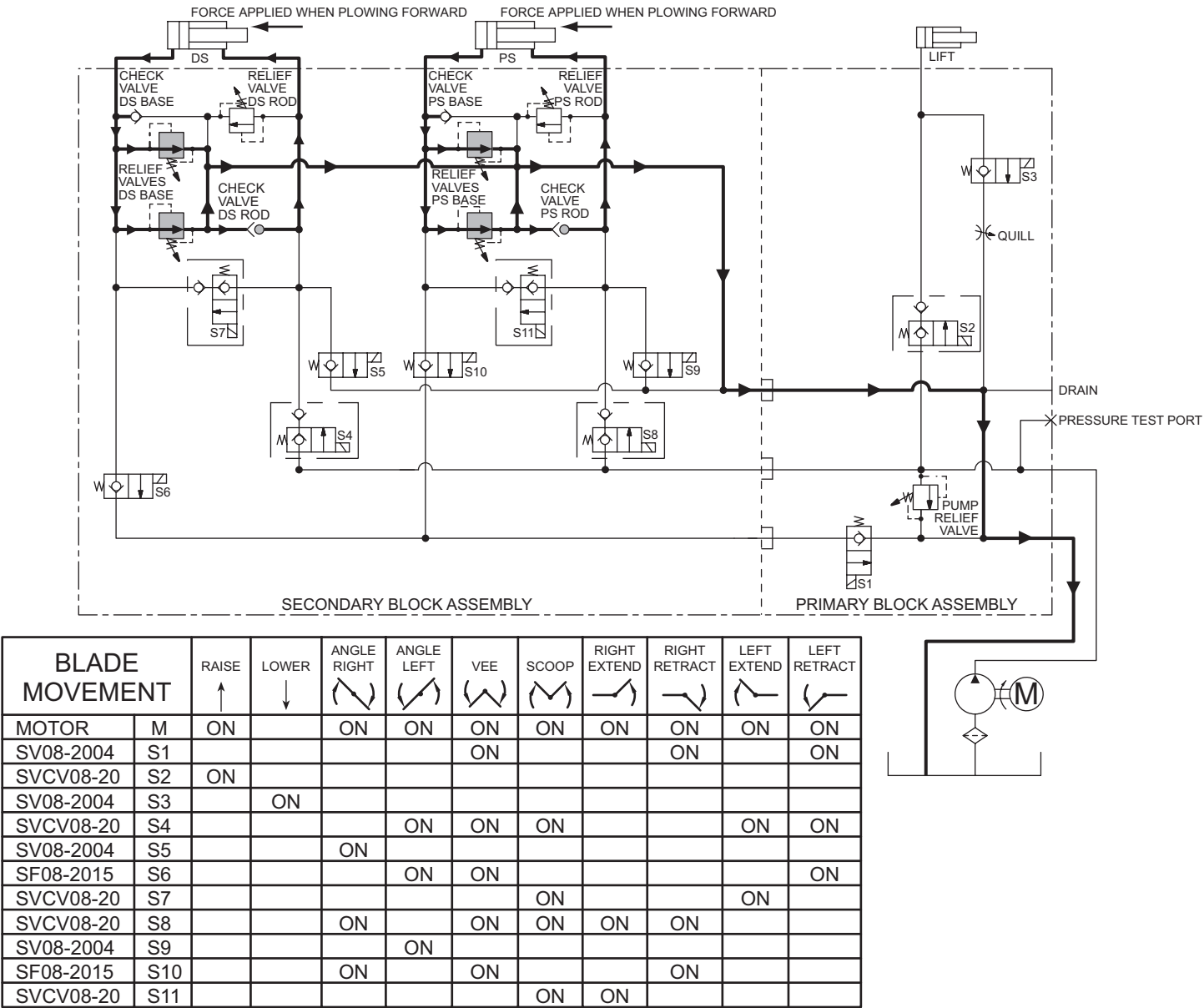
BLADE MOVEMENT		RAISE	LOWER	ANGLE RIGHT	ANGLE LEFT	VEE	SCOOP	RIGHT EXTEND	RIGHT RETRACT	LEFT EXTEND	LEFT RETRACT
MOTOR	M	ON		ON	ON	ON	ON	ON	ON	ON	ON
SV08-2004	S1					ON			ON		ON
SVCV08-20	S2	ON									
SV08-2004	S3		ON								
SVCV08-20	S4				ON	ON	ON			ON	ON
SV08-2004	S5			ON							
SF08-2015	S6				ON	ON					ON
SVCV08-20	S7						ON			ON	
SVCV08-20	S8			ON		ON	ON	ON	ON		
SV08-2004	S9				ON						
SF08-2015	S10			ON		ON			ON		
SVCV08-20	S11						ON	ON			

STRIKING AN OBJECT WHILE PLOWING FORWARD – HYDRAULIC

System Response

- 1. Hydraulic fluid is trapped in the base end of the passenger-side (PS) ram by the inactivated S10 & S11 solenoid cartridge valves and the PS base-end check valve and relief valves.
- 2. Hydraulic fluid is trapped in the base end of the driver-side (DS) ram by the inactivated S6 & S7 solenoid cartridge valves and the DS base-end check valve and relief valves.
- 3. When the snowplow contacts an object while plowing, force of the impact increases hydraulic pressure in the base end of the ram. When pressure exceeds 4600 psi, the ram's base-end relief valves open allowing hydraulic fluid back to the reservoir. The rod-end check valve opens to allow fluid to fill the rod end of the ram.
- 4. This allows the ram to collapse and the wing to move rearward.

Relief Valve Settings	
Pump	2250 psi
Ram, Rod-End	3700 psi
Ram, Base-End	4600 psi

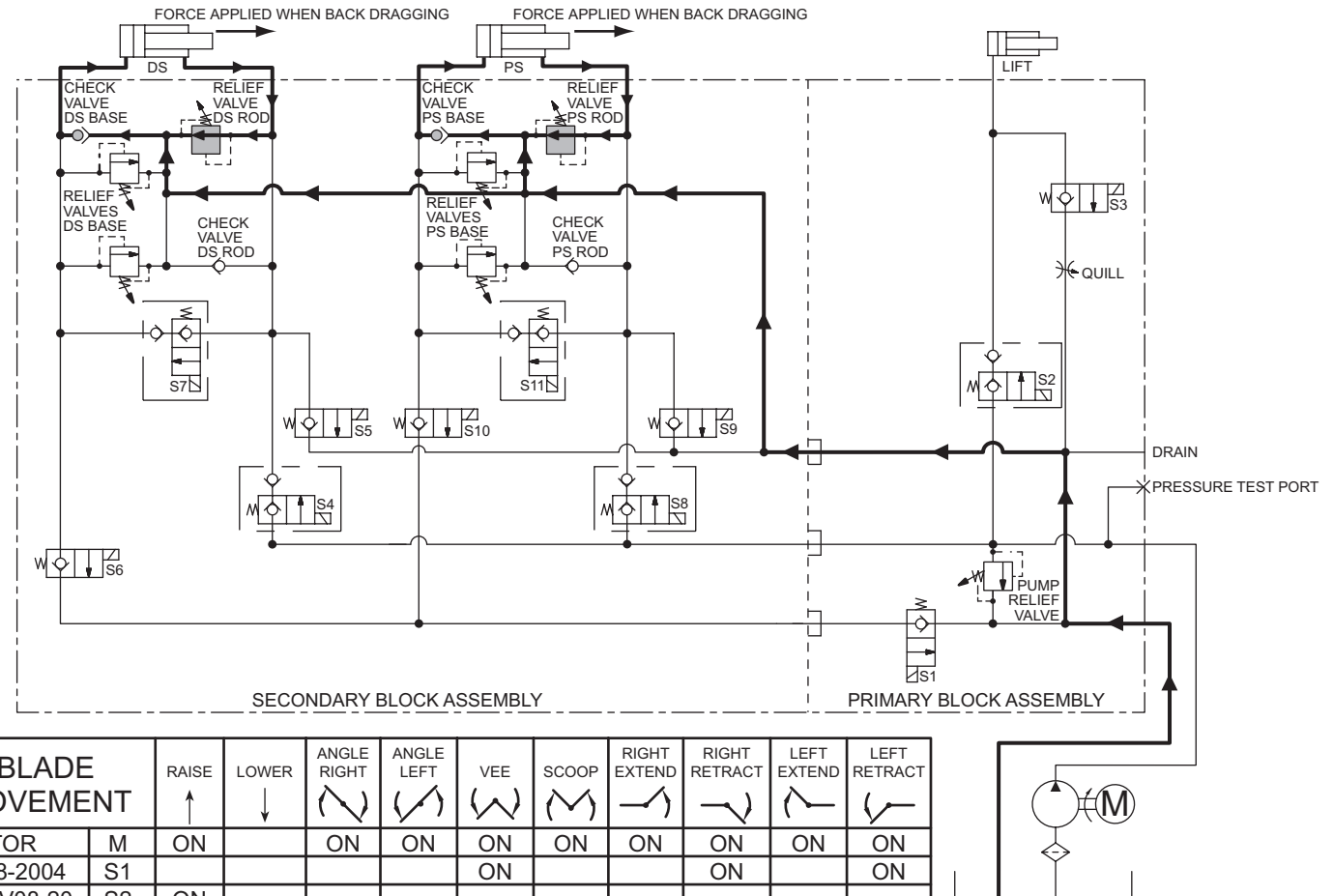


STRIKING AN OBJECT WHILE BACK DRAGGING – HYDRAULIC

System Response

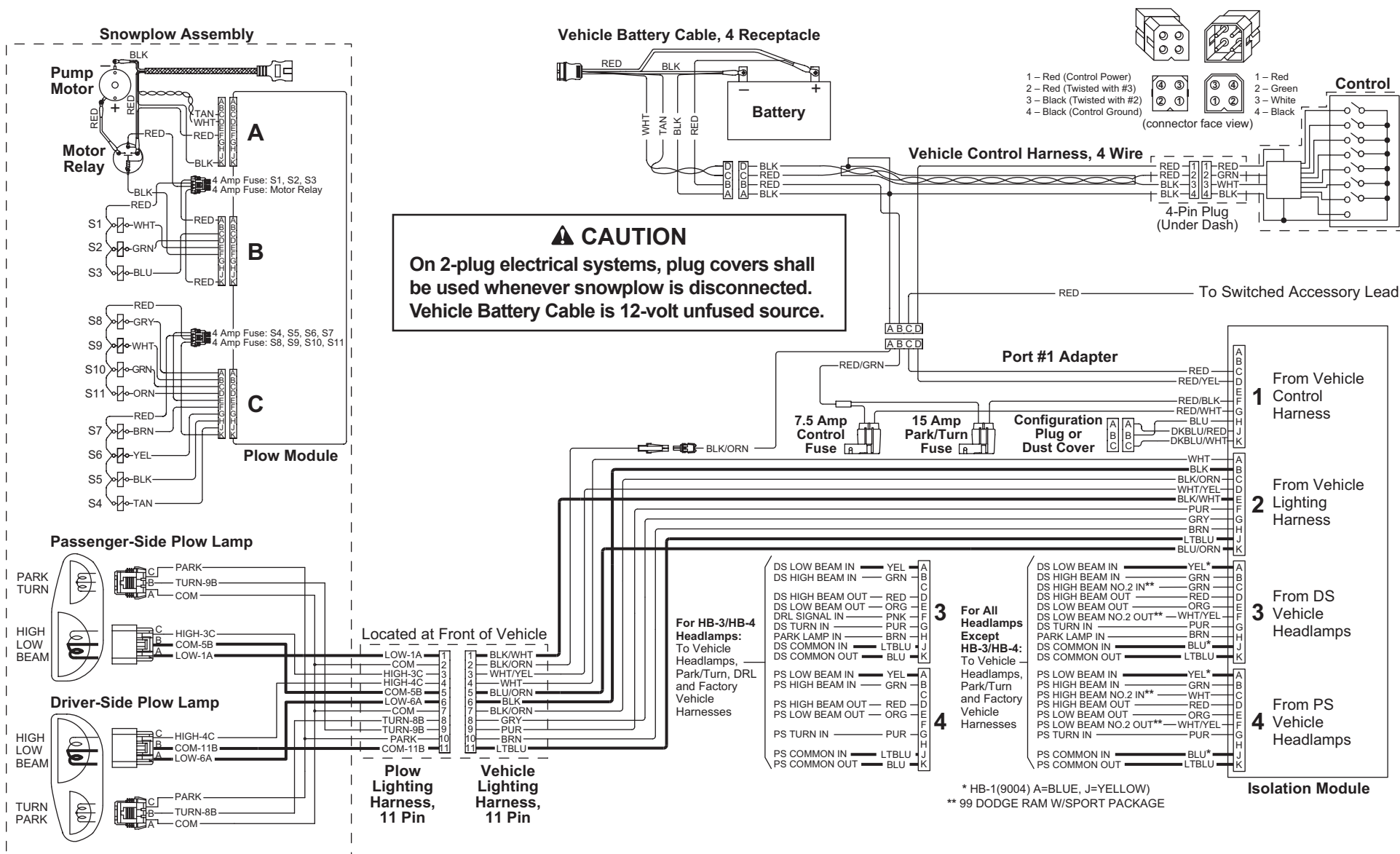
1. Hydraulic fluid is trapped in the rod end of the PS ram by the inactivated solenoid cartridge valves S8, S9 & S11 and PS rod-end relief valve and check valve.
2. Hydraulic fluid is trapped in the rod end of the DS ram by the inactivated solenoid cartridge valves S4, S5 & S7 and DS rod-end relief valve and check valve.
3. When the snowplow contacts an object while back dragging, force of the impact increases hydraulic pressure in the rod end of the ram. When pressure exceeds 3700 psi, the ram's rod-end relief valve opens, allowing hydraulic fluid into the reservoir passage. The base-end check valve allows fluid to fill the base end of the ram. Because of differential area on either side of the ram's piston, fluid flows from the reservoir to the base end.

Relief Valve Settings	
Pump	2250 psi
Ram, Rod-End	3700 psi
Ram, Base-End	4600 psi

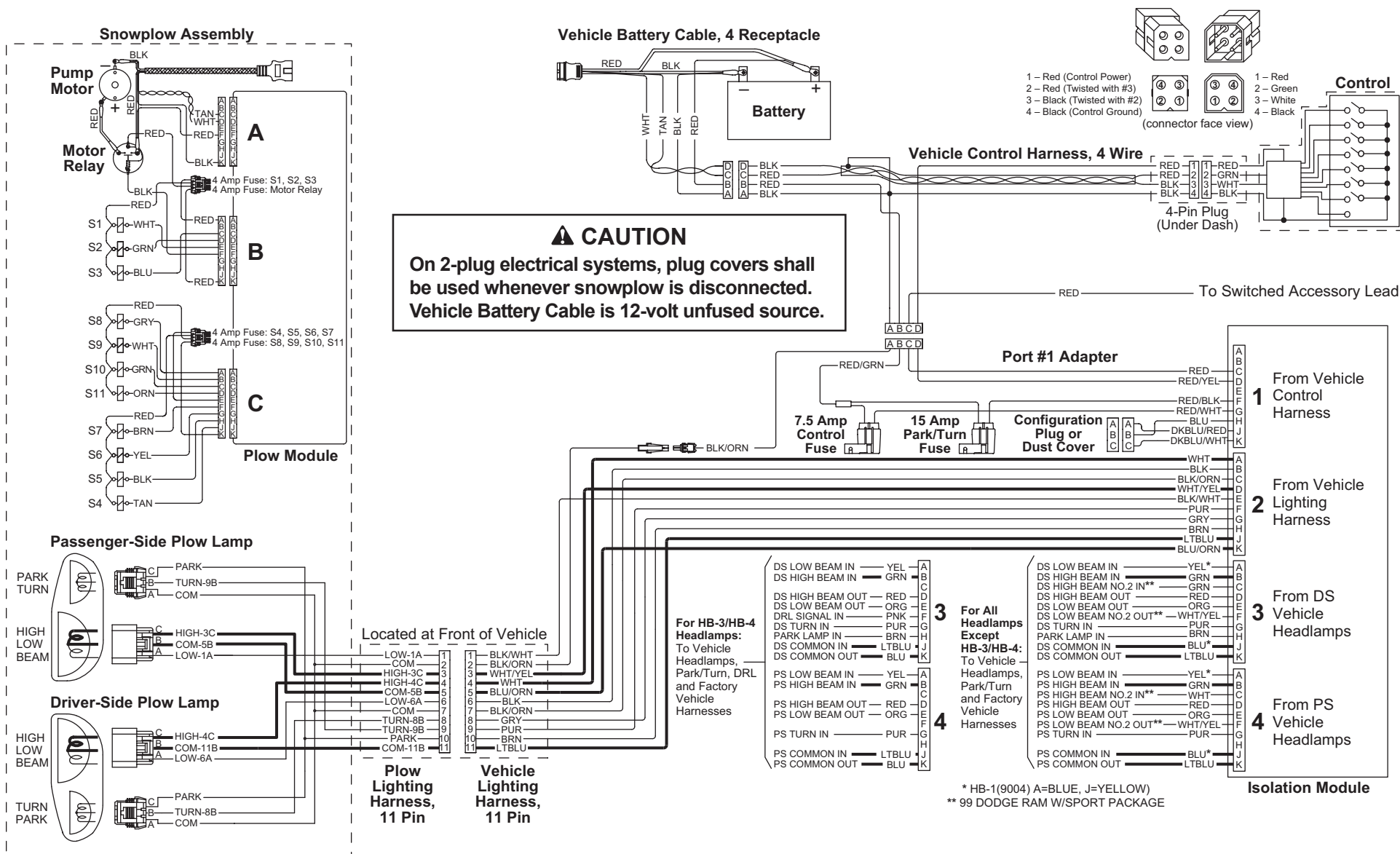


BLADE MOVEMENT		RAISE ↑	LOWER ↓	ANGLE RIGHT 	ANGLE LEFT 	VEE 	SCOOP 	RIGHT EXTEND 	RIGHT RETRACT 	LEFT EXTEND 	LEFT RETRACT 
MOTOR	M	ON		ON	ON	ON	ON	ON	ON	ON	ON
SV08-2004	S1					ON			ON		ON
SVCV08-20	S2	ON									
SV08-2004	S3		ON								
SVCV08-20	S4				ON	ON	ON			ON	ON
SV08-2004	S5			ON							
SF08-2015	S6				ON	ON					ON
SVCV08-20	S7						ON			ON	
SVCV08-20	S8			ON		ON	ON	ON	ON		
SV08-2004	S9				ON						
SF08-2015	S10			ON		ON			ON		
SVCV08-20	S11						ON	ON			

LOW BEAM HEADLAMPS WITH SNOWPLOW CONNECTED TO VEHICLE (ISOLATION MODULE)



HIGH BEAM HEADLAMPS WITH SNOWPLOW CONNECTED TO VEHICLE (ISOLATION MODULE)



TROUBLESHOOTING GUIDE – TABLE OF CONTENTS

Introduction	62	Harness Tests	76
How to Use the Troubleshooting Guide	62	Test Harness	76
Electrical Testing	62	Vehicle Control Harness (#1)	76
Before You Begin	63	Vehicle Lighting (#2) and Plug-In Harnesses (#3 & #4)	77
Headlamp Troubleshooting	64	w/White Isolation Module	77
Vehicle Headlamps	64	w/Green Isolation Module	78
Snowplow Headlamps	65	Control/Cable/Plow Module Test	79
Snowplow Park/Turn Lamps	66	Motor and Motor Relay Test	80
Snowplow DRL Lamps	67	Pump Pressure Test	81
Hydraulic System Testing	68	Relief Valve Inspection and Adjustment	82
Solenoid Coil Activation Test (SCAT)	73		
Individual Solenoid Coil Test	75		

TROUBLESHOOTING GUIDE

INTRODUCTION

All malfunctions of the MVP PLUS™ snowplow can be categorized as structural, electrical or hydraulic. Structural issues are generally related to the blade wings, T-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 before attempting troubleshooting.

HOW TO USE THE TROUBLESHOOTING GUIDE

Because of the relative complexity of the MVP PLUS snowplow electrical and hydraulic systems, some conditions must be eliminated in order to develop valid tests.

If the listed conditions are not met, the procedure can result in inaccurate results and wasted time.

In many cases, satisfying the listed conditions alone solves the problem.

1. Go to the Before You Begin section (next page), and satisfy the listed conditions. These conditions **must** be met before proceeding to any of the tables and tests that follow.
2. If a lighting problem exists, proceed to the proper Headlamp Troubleshooting tables for a list of basic test questions and solutions to common problems.

3. If still having problems or the problem is not related to the headlamps, go to the Hydraulic System Testing Section.
4. Follow along sequentially through the tables and tests, referring to the Hydraulic & Electrical Schematics and System Overview sections as needed. Eventually the problem is identified at the component level.

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.

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 performing any tests, you *must* verify the following conditions:

- 1. **Verify** that the customer has accurately and completely described the problem. Check all lighting and snowplow functions.
- 2. Check the **obvious**:
 - a. Snowplow is attached to vehicle and all harnesses are connected.
 - b. Ignition is turned ON or engine is running if operating control from within the cab.
 - c. The control is connected in the cab and turned ON. Verify that the control power LED is in a steady state and is not flashing.
 - d. Fuses are good.
 - e. 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. Hydraulic reservoir is filled to proper level with recommended fluid when snowplow is in the fully retracted (vee) position and lift ram is fully retracted. See Product Specifications.
- h. There are no fluid leaks from hoses, fittings, rams or the hydraulic unit.
- i. 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 instructions.
7	Harnesses in correct location at Isolation Module and installed per installation instructions	Install using Isolation Module instructions.
8	Harnesses configured correctly for HB-1/HB-5 and/or kits using adapters	Install using Isolation Module instructions or Electrical Schematics Guide.
9	Configuration plug correct (if required)	Refer to Isolation Module instructions or Electrical Schematics Guide.
10	Correct harnesses and/or Isolation Module in kit	Refer to Electrical Schematics Guide.
11	Harness wired per drawing	Refer to Electrical Schematics Guide.
12	Verify power and ground in proper pin locations at Isolation Module	See wiring diagram in this guide and go to Harness Tests .
13	Verify power and ground in proper pin locations to vehicle headlamp	See wiring diagram in this guide and go to Harness Tests .
14	Test Isolation Module with Isolation Module tester	Test using instructions supplied with tester.

TROUBLESHOOTING GUIDE

SNOWPLOW 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	Harnesses connected at vehicle and snowplow (all)	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 instructions.
11	Harnesses in correct location at Isolation Module and installed per installation instructions	Install using Isolation Module instructions.
12	Harnesses configured correctly for HB-1/HB-5 and/or kits using adapters	Install using Isolation Module instructions or Electrical Schematics Guide.
13	Configuration plug correct (if required)	Refer to Isolation Module instructions or Electrical Schematics Guide.
14	Correct harnesses and/or Isolation Module in kit	Refer to Electrical Schematics Guide.
15	Harness wired per drawing	Refer to Electrical Schematics Guide.
16	Verify power and ground in proper pin locations at Isolation Module	See wiring diagram in this guide and go to Harness Tests .
17	Verify power and ground in proper pin locations to vehicle headlamp	See wiring diagram in this guide and go to Harness Tests .
18	Test Isolation Module with Isolation Module tester	Test using instructions supplied with tester.

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	Harnesses connected at vehicle and snowplow (all)	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 headlamps to operate.
5	Control powers up with key ON	Go to Control/Cable/Plow Module Test .
6	15-amp park/turn fuse good in #1 harness	Replace with proper fuse.
7	Black/orange "ground" wire connected to motor ground stud **	Refer to Isolation Module instructions or Electrical Schematics Guide.
8	Spliced into OEM park/turn circuit correctly	Refer to Isolation Module instructions.
9	Harnesses in correct location at Isolation Module and installed per installation instructions	Install using Isolation Module instructions.
10	Harness wired per drawing	Refer to Electrical Schematics Guide.
11	Verify power and ground in proper pin locations at Isolation Module	See wiring diagram in this guide and go to Harness Tests .
12	Verify power and ground in proper pin locations to vehicle headlamp	See wiring diagram in this guide and go to Harness Tests .
13	Bulb burned out	Replace with proper bulb.

* Some applications may use the turn circuit for DRLs.

** Not applicable to NIGHTHAWK™ headlamps.

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	Harnesses connected at vehicle and snowplow (all)	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 wiring diagram in this guide and go to Harness Tests .
9	Correct Isolation Module kit installed for application	Verify per Quick Match at www.westernplows.com .
10	Isolation Module and harnesses correctly installed per instructions	Refer to Isolation Module instructions.
11	Harness wired per drawing	Refer to Electrical Schematics Guide.
12	Bulb burned out	Replace with proper bulb.

* Snowplow DRLs operate as a series circuit and will illuminate bulb at 1/2 intensity. In some applications, the OEM DRLs will stay illuminated with snowplow attached.

TROUBLESHOOTING GUIDE

HYDRAULIC SYSTEM TESTING

This test consists of trying all ten snowplow functions and comparing the snowplow reaction to the action requested in the following table. The table can help pinpoint malfunctioning solenoid valves, solenoid coils or motor relays and blown fuses if **only one** component is malfunctioning. If the snowplow reaction for a given function is not listed in the table, there may be relief or check valves that are stuck open or contaminated; there may be missing or damaged O-rings or backing rings on solenoid, relief or

check valves; there may be an unanticipated malfunctioning component; or there may be two or more malfunctioning components. In the last two cases (multiple or unanticipated malfunctioning components), 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 rams must be completely disassembled, inspected and cleaned.

1. Verify hydraulic hose installation is correct. Refer to the Hose Routing diagram.
2. Test all of the snowplow functions.
3. Perform Solenoid Coil Activation Test (SCAT) first.
4. Inspect and clean or replace the suspect component. Refer to the System Overview – Hydraulic Section.

5. Refer to the end of this guide for inspection and adjustment of relief valves.

IMPORTANT: When testing the snowplow functions, be sure the control is *not* in "float."

ACTION REQUESTED	SNOWPLOW REACTION	SUSPECT COMPONENT
Raise	Raises, then blade drops / Blade will not stay up	• S3 Cartridge Valve
	None	• F1 Fuse on Harness B • F2 Fuse on Harness B • S2 Coil • Motor Relay
	Raises very slowly, then drops slowly	• F1 Fuse on Harness C • S8 Coil
Lower	None	• F1 Fuse on Harness B • S3 Coil

TROUBLESHOOTING GUIDE

HYDRAULIC SYSTEM TESTING

ACTION REQUESTED	SNOWPLOW REACTION	SUSPECT COMPONENT
Angle Left	Raise	• F1 Fuse on Harness C • S8 Coil
	Scoop / DS ram extends instead of retracting	• S7 Cartridge Valve
	Left retract / PS ram does not extend	• S1 Cartridge Valve
	Angles left, but also raises	• S2 Cartridge Valve
	None	• F2 Fuse on Harness B • Motor Relay
	Angles left very slowly (runs on relief)	• S10 Cartridge Valve
	Motor runs, but blade does not move (freewheeling)	• S5 Cartridge Valve
	Motor runs, but blade does not move (runs on relief)	• F2 Fuse on Harness C • S4 Coil • S9 Coil
Angle Right	Scoop / PS ram extends instead of retracts	• S11 Cartridge Valve
	Right retract / DS ram does not extend	• S1 Cartridge Valve
	Angles right, but also raises	• S2 Cartridge Valve
	None	• F2 Fuse on Harness B • Motor Relay
	Angles right very slowly (runs on relief)	• S6 Cartridge Valve
	Motor runs, but blade does not move (freewheeling)	• S9 Cartridge Valve • S4 Cartridge Valve
	Motor runs, but blade does not move (runs on relief)	• F1 Fuse on Harness C • F2 Fuse on Harness C • S5 Coil • S8 Coil • S10 Coil

TROUBLESHOOTING GUIDE

HYDRAULIC SYSTEM TESTING

ACTION REQUESTED	SNOWPLOW REACTION	SUSPECT COMPONENT
Scoop	Right retract	• F2 Fuse on Harness C
	Lower	• F1 Fuse on Harness C • S8 Coil
	Left extend / PS ram does not extend	• S11 Coil
	Right extend / DS ram does not extend (w/ or w/o Raise)	• F2 Fuse on Harness C • S4 Coil • S7 Coil
	None	• F2 Fuse on Harness B • Motor Relay
	Motor runs, but blade does not move (freewheeling)	• S5 Cartridge Valve • S9 Cartridge Valve
Retract (Vee)	Lower	• F1 Fuse on Harness C • S8 Coil
	Left retract / DS ram does not retract	• S10 Coil
	Right retract / PS ram does not retract	• S4 Coil • S6 Coil
	None	• F1 Fuse on Harness B • F2 Fuse on Harness B • S1 Coil • Motor Relay
	Motor runs, but blade does not move (freewheeling)	• S5 Cartridge Valve • S7 Cartridge Valve • S8 Cartridge Valve • S11 Cartridge Valve

TROUBLESHOOTING GUIDE

HYDRAULIC SYSTEM TESTING

ACTION REQUESTED	SNOWPLOW REACTION	SUSPECT COMPONENT
Left Extend	Raise	• F1 Fuse on Harness C • S8 Coil
	Left wing extends, then wing drifts back	• S1 Cartridge Valve • S6 Cartridge Valve
	Left wing extends, then blade raises	• S2 Cartridge Valve
	None	• F2 Fuse on Harness B • Motor Relay
	Motor runs, but blade does not move (freewheeling)	• S5 Cartridge Valve
	Motor runs, but blade does not move (runs on relief)	• F2 Fuse on Harness C • S4 Coil • S7 Coil
Left Retract	Raise	• F1 Fuse on Harness C • S8 Coil
	None	• F2 Fuse on Harness B • Motor Relay
	Motor runs, but blade does not move (freewheeling)	• S5 Cartridge Valve • S7 Cartridge Valve
	Motor runs, but blade does not move (runs on relief)	• F1 Fuse on Harness B • F2 Fuse on Harness C • S1 Coil • S4 Coil • S6 Coil

TROUBLESHOOTING GUIDE

HYDRAULIC SYSTEM TESTING

ACTION REQUESTED	SNOWPLOW REACTION	SUSPECT COMPONENT
Right Extend	Right wing extends, then wing drifts back	• S1 Cartridge Valve • S10 Cartridge Valve
	Right wing extends, then blade raises	• S2 Cartridge Valve
	None	• F2 Fuse on Harness B • Motor Relay
	Motor runs, but blade does not move (freewheeling)	• S9 Cartridge Valve
	Motor runs, but blade does not move (runs on relief)	• F1 Fuse on Harness C
		• S8 Coil • S11 Coil
Right Retract	None	• F2 Fuse on Harness B • Motor Relay
		• S9 Cartridge Valve • S11 Cartridge Valve
	Motor runs, but blade does not move (runs on relief)	• F1 Fuse on Harness B
		• F1 Fuse on Harness C
		• S1 Coil
		• S8 Coil • S10 Coil

TROUBLESHOOTING GUIDE

SOLENOID COIL ACTIVATION TEST (SCAT)

NOTE: See the System Overview – 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 eleven solenoid coils. A solenoid coil is magnetized if a screwdriver held nearby is attracted.

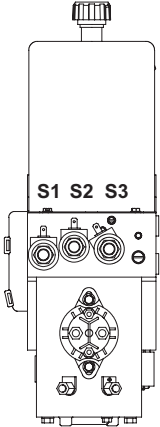
4. Compare the SCAT test results with the testing charts on the following pages.

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

If a coil(s) is not magnetizing when it 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 any function on the control except lower. 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.

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

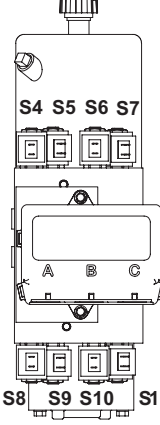
Harness B Solenoid Coil Connections



SOLENOID VALVE	S1	S2	S3
VALVE TYPE	SV08-2004	SVCV08-20	SV08-2004
WIRE COLORS	WHITE RED	GREEN RED	BLUE RED
MODULE CONNECTION	← PORT B →		
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		

44310

Harness C Solenoid Coil Connections



SOLENOID VALVE	S4	S5	S6	S7
VALVE TYPE	SVCV08-20	SV08-2004	SF08-2015	SVCV08-20
WIRE COLORS	TAN RED	BLACK RED	YELLOW RED	BROWN RED
SOLENOID VALVE	S8	S9	S10	S11
VALVE TYPE	SVCV08-20	SV08-2004	SF08-2015	SVCV08-20
WIRE COLORS	GRAY RED	WHITE RED	GREEN RED	ORANGE RED
MODULE CONNECTION	← PORT C →			
TORQUE SPECIFICATIONS				
ALL SOLENOID VALVES:	19-21 FT-LB			
ALL SOLENOID COIL NUTS:	48-60 IN-LB			

44319

TROUBLESHOOTING GUIDE

SOLENOID COIL ACTIVATION TEST (SCAT)

NOTE: This V-plow diagnostic harness kit can be used with or without the snowplow connected to a vehicle. Follow the appropriate instructions for each testing situation.

⚠ WARNING

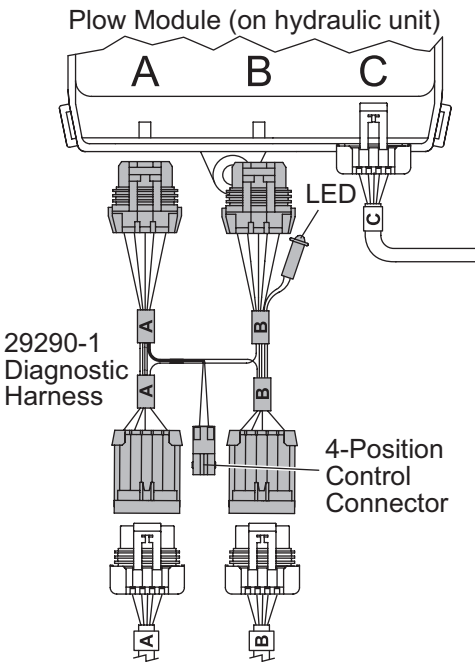
Lower blade when vehicle is parked. Temperature changes could change hydraulic pressure, causing the blade to drop unexpectedly or damaging hydraulic components. Failure to do this could result in serious personal injury.

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. 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 either in the cab of the vehicle or on the diagnostic harness.

7. 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.

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

Solenoid Coil Activation Test (SCAT) Chart	
Control Function	Component(s) Activated
Raise	S2, Motor Relay
Lower	S3
Angle Right	S5, S8, S10, Motor Relay
Angle Left	S4, S6, S9, Motor Relay
Scoop	S4, S7, S8, S11, Motor Relay
Retract (Vee)	S1, S4, S6, S8, S10, Motor Relay
Wing (Right – Out)	S8, S11, Motor Relay
Wing (Right – In)	S1, S8, S10, Motor Relay
Wing (Left – Out)	S4, S7, Motor Relay
Wing (Left – In)	S1, S4, S6, 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.

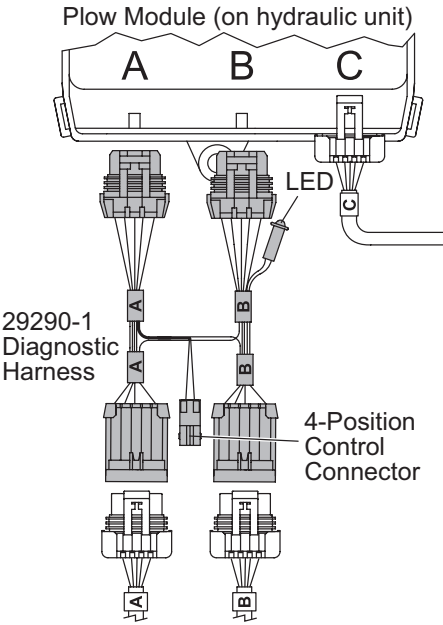
9. After completing the SCAT test, turn the snowplow control and the vehicle ignition OFF, then disconnect the snowplow and vehicle battery cables.
10. Perform any required repairs and retest as needed. Always disconnect the snowplow and vehicle battery cables before removing the diagnostic harness.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

TROUBLESHOOTING GUIDE

SOLENOID COIL ACTIVATION TEST (SCAT)

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 below for solenoid numbers and functions.

Solenoid Coil Activation Test (SCAT) Chart	
Control Function	Component(s) Activated
Raise	S2, Motor Relay
Lower	S3
Angle Right	S5, S8, S10, Motor Relay
Angle Left	S4, S6, S9, Motor Relay
Scoop	S4, S7, S8, S11, Motor Relay
Retract (Vee)	S1, S4, S6, S8, S10, Motor Relay
Wing (Right – Out)	S8, S11, Motor Relay
Wing (Right – In)	S1, S8, S10, Motor Relay
Wing (Left – Out)	S4, S7, Motor Relay
Wing (Left – In)	S1, S4, S6, 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 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.

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.

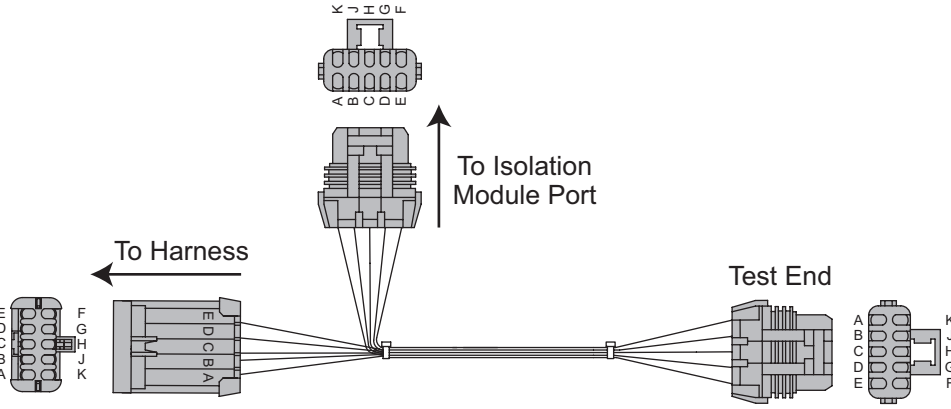
NOTE: A good coil will draw approximately 1.5 Amp.

TROUBLESHOOTING GUIDE

HARNESS TESTS

Test Harness (PN 28957)

Connecting this harness between any of the four Isolation Module harnesses and the module will allow you to test each circuit "live" by checking for voltage or ground at specified locations as described in this guide.



Vehicle Control Harness (#1)

10-Pin Connector	Ignition on & snowplow connected	Ignition on & snowplow disconnected
A	Unused	Unused
B	Unused	Unused
C	12V from ignition	12V from ignition
D	12V to control/coils	No power
E	Unused	Unused
F	12V from 15-Amp fuse holder	12V from 15-Amp fuse holder
G	12V from 7.5-Amp fuse holder	12V from 7.5-Amp fuse holder
H	Common to Isolation Module	Common to Isolation Module
J	Ground from Isolation Module	Ground from Isolation Module
K	12V from Isolation Module	12V from Isolation Module

TROUBLESHOOTING GUIDE

HARNESS TESTS

Vehicle Lighting (#2) and Plug-In Harnesses (#3 & #4) w/White Isolation Module

Common (–) System

Function	Test Location									
	Harness #3		Harness #4		Harness #3		Harness #4		Harness #2	
	input to module		input to module		output to vehicle		output to vehicle		output to plow	
	12V	neg	12V	neg	12V	neg	12V	neg	12V	neg
Left Low Beam	A	J	–	–	E	K	–	–	B	J
Left High Beam	B	J	–	–	D	K	–	–	A	J
Left High Beam #2	N/A		N/A		N/A		N/A		N/A	
Right Low Beam	–	–	A	J	–	–	E	K	E	K
Right High Beam	–	–	B	J	–	–	D	K	D	K
Right High Beam #2	N/A		N/A		N/A		N/A		N/A	
Left Turn Signal Lamp	G	–	–	–	–	–	–	–	G	*
Right Turn Signal Lamp	–	–	G	–	–	–	–	–	F	*
Park Lamp	H	–	–	–	–	–	–	–	H	*

Common (+) System

Function	Test Location									
	Harness #3		Harness #4		Harness #3		Harness #4		Harness #2	
	input to module		input to module		output to vehicle		output to vehicle		output to plow	
	12V	neg	12V	neg	12V	neg	12V	neg	12V	neg
Left Low Beam	J	A	–	–	K	E	–	–	J	B
Left High Beam	J	B	–	–	K	D	–	–	J	A
Left High Beam #2	J	C	–	–	K	F	–	–	–	–
Right Low Beam	–	–	J	A	–	–	K	E	K	E
Right High Beam	–	–	J	B	–	–	K	D	K	D
Right High Beam #2	–	–	J	C	–	–	K	F	–	–
Left Turn Signal Lamp	G	–	–	–	–	–	–	–	G	*
Right Turn Signal Lamp	–	–	G	–	–	–	–	–	F	*
Park Lamp	H	–	–	–	–	–	–	–	H	*

TROUBLESHOOTING GUIDE

HARNESS TESTS

Vehicle Lighting (#2) and Plug-In Harnesses (#3 & #4) w/Green Isolation Module

Common (–) System

Function	Test Location									
	Harness #3		Harness #4		Harness #3		Harness #4		Harness #2	
	input to module		input to module		output to vehicle		output to vehicle		output to plow	
	12V	neg	12V	neg	12V	neg	12V	neg	12V	neg
Left Low Beam	A	J	–	–	E	K	–	–	B	J
Left High Beam	B	J	–	–	D	K	–	–	A	J
Right Low Beam	–	–	A	J	–	–	E	K	E	K
Right High Beam	–	–	B	J	–	–	D	K	D	K
DRL Lamp	F								K	J
Left Turn Signal Lamp	G	–	–	–	–	–	–	–	G	*
Right Turn Signal Lamp	–	–	G	–	–	–	–	–	F	*
Park Lamp	H	–	–	–	–	–	–	–	H	*

Common (+) System

Function	Test Location									
	Harness #3		Harness #4		Harness #3		Harness #4		Harness #2	
	input to module		input to module		output to vehicle		output to vehicle		output to plow	
	12V	neg	12V	neg	12V	neg	12V	neg	12V	neg
Left Low Beam	J	A	–	–	K	E	–	–	J	B
Left High Beam	J	B	–	–	K	D	–	–	J	A
Right Low Beam	–	–	J	A	–	–	K	E	K	E
Right High Beam	–	–	J	B	–	–	K	D	K	D
DRL Lamp	F	–	–	–	–	–	–	–	K	J
Left Turn Signal Lamp	G	–	–	–	–	–	–	–	G	*
Right Turn Signal Lamp	–	–	G	–	–	–	–	–	F	*
Park Lamp	H	–	–	–	–	–	–	–	H	*

* Ground is completed through the vehicle circuit on NIGHTHAWK™ headlamps. On old-style headlamps, ground is completed by the black/orange wire at the motor NEGATIVE (–) post.

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. Look for incomplete connections or damaged wires. Complete connections or repair/replace damaged wires and harnesses as needed.
	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 problem is not corrected with properly working control, replace 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 problem is corrected, replace PC board and/or coiled cord in damaged control.
		• If problem is not corrected with properly working control, replace Plow Module.

To Safely Handle PC Board:

CAUTION

Circuit board may be damaged by static electricity. Always touch ground before handling PC board.

Before disassembling 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 to work at a properly grounded work station with a

grounded wrist strap attached to the technician. In place of 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. Your 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 the 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/or turns ON, but the motor does not run.

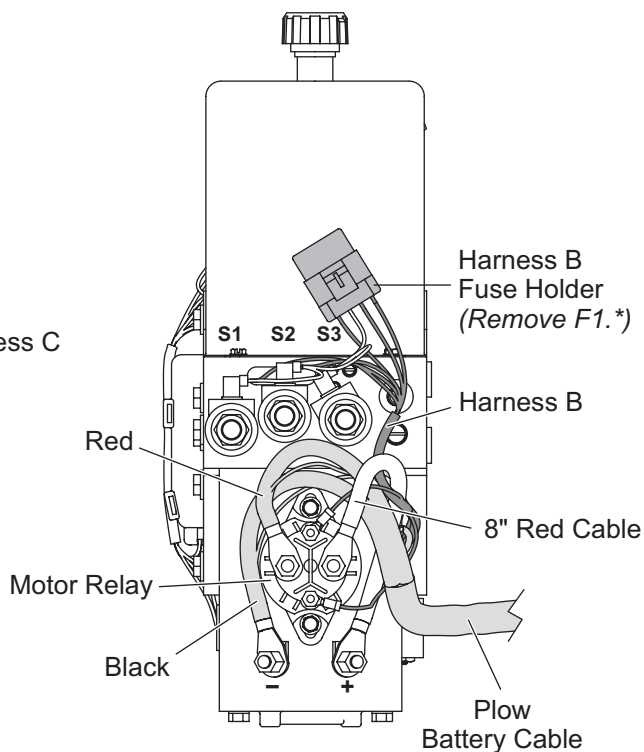
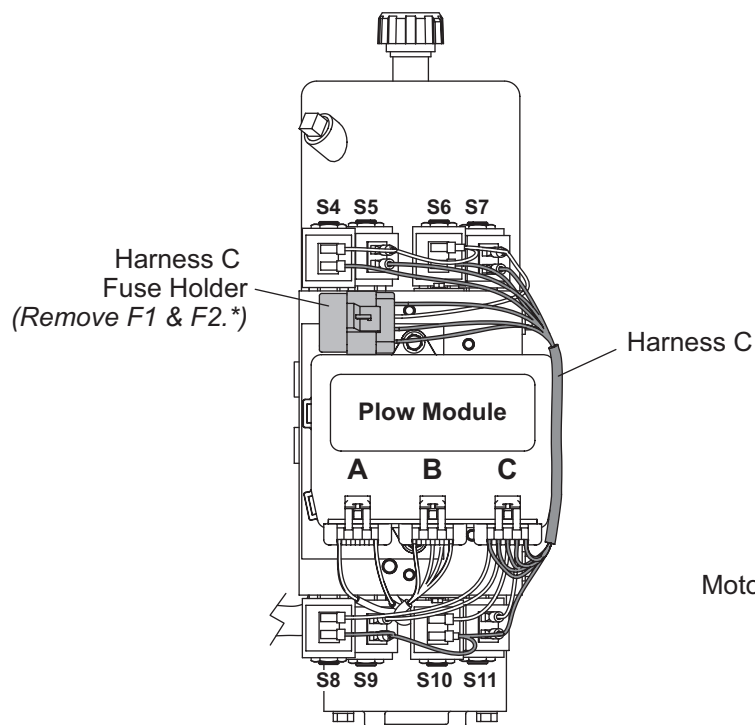
1. Check the motor relay fuse on harnesses B. Replace if fuse is blown, then retest snowplow.
2. Remove the coil fuse F1 in harness B and the coil fuses F1 and F2 in harness C of the Plow Module. Remove the 8" red

battery cable from the large terminal of the motor relay and isolate it. Removing the fuses and 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 contain 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 fuses and 8" red battery cable, then retest snowplow.



* See wire stamping for fuse identification.

TROUBLESHOOTING GUIDE

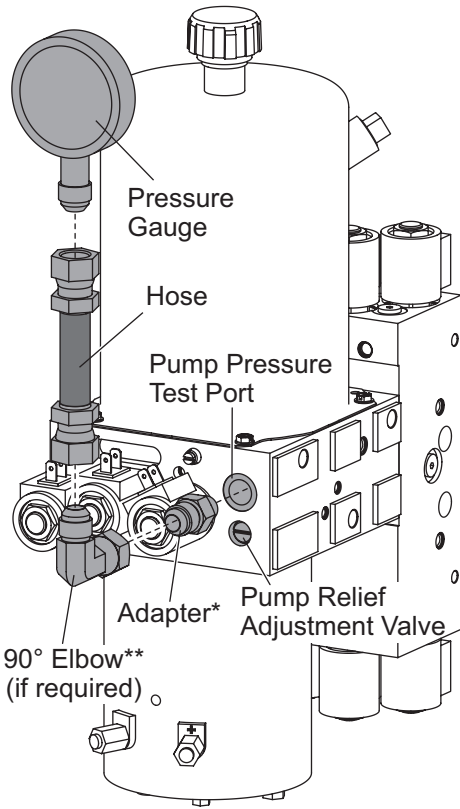
PUMP PRESSURE TEST

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

- 1. Verify proper fluid level before beginning test.
- 2. Attach a 3000 psi hydraulic pressure gauge to pressure test port as shown in the illustration.
- 3. Activate the right retract function until blade is fully retracted.

NOTE: Control will time out after 3 seconds. Repeat command if blade is not fully retracted.

- 4. Repeat the right retract function, and read the pressure shown on the gauge.
- 5. Refer to the following table.



BLADE MOVEMENT		RIGHT RETRACT
MOTOR	M	ON

CONDITION	POSSIBLE CAUSE	CORRECTIVE ACTION
Pump pressure is below 2250 ± 50 psi.	Pump Relief Valve	- Pump relief valve may be out of adjustment. Turn relief valve clockwise 1/4 turn and retest 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 O-ring, stem and ball for wear or damage. Reseat ball or replace relief valve as needed. Reinstall/replace and readjust valve, then retest pump pressure.
		Remove the pump and inspect the O-ring between the pump and the valve block for wear or damage. Reinstall/replace O-ring and pump, then retest pump pressure.
	Pump	Remove the pump and inspect it for wear or broken gears. Replace pump if needed, adjust pump relief valve, then retest pressure.
Motor draws more than 265 Amps at pump relief.	Motor	Replace the motor.

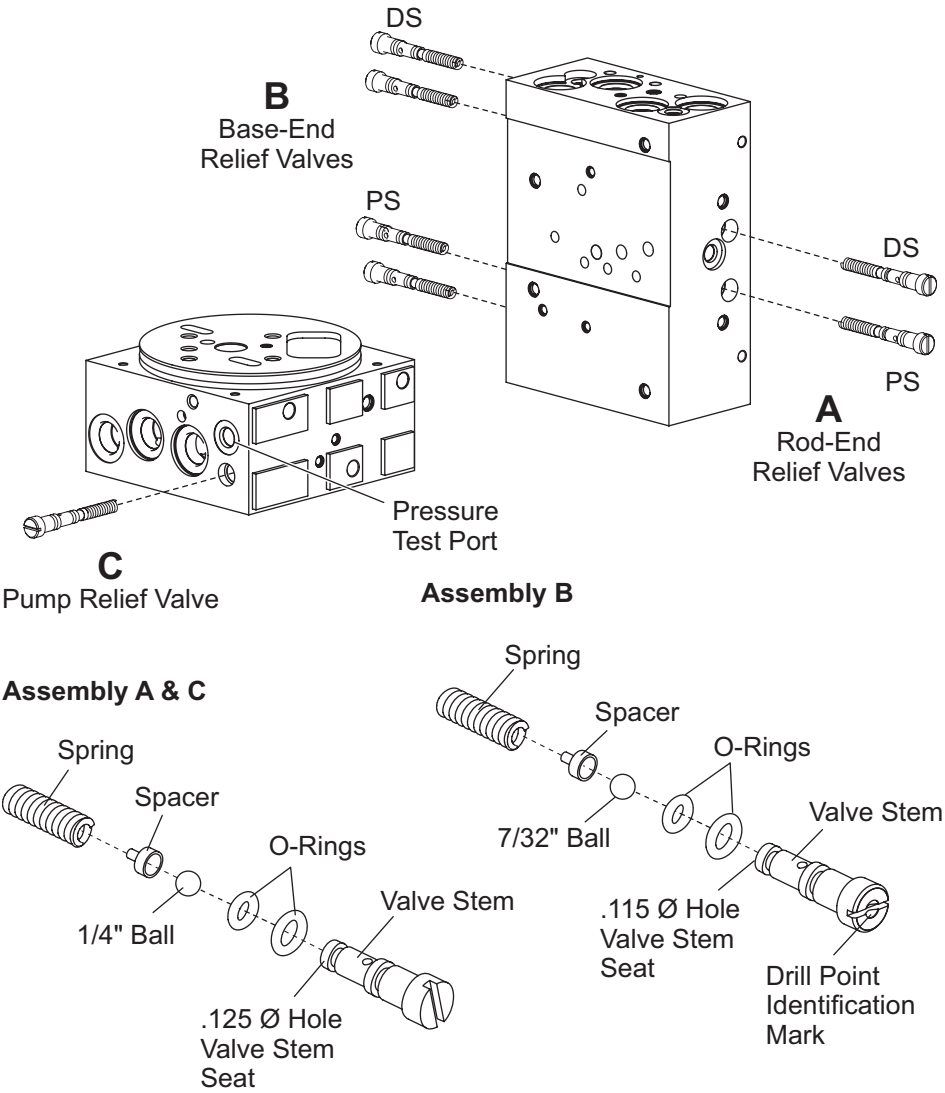
NOTE: See the following page for Relief Valve Inspection and Adjustment instructions.

* Straight Adapter (-6 JIC 37° Male Flare to -4 SAE O-Ring Boss Port) not included in 56679 Pressure Test Kit. (Parker PN 6-4 F50X)
** 90° Elbow (-6 JIC 37° Female Swivel to -6 JIC 37° Male Flare) not included in 56679 Pressure Test Kit. (Parker PN 6 C6X)

TROUBLESHOOTING GUIDE

RELIEF VALVE INSPECTION AND ADJUSTMENT

Relief valves B and components are not interchangeable with A and C. The stem is marked with a drill point in the screwdriver slot for identification.



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 stem squarely. You can bend stem if you do not strike it squarely.

3. If parts are OK, place ball on hard wood block, hold stem seat on ball and lightly strike top of stem with a hammer. This will seat the ball and valve stem.
4. Apply a light coat of anti-seize or grease to stem threads. Lubricate O-rings with hydraulic fluid. Reassemble components into valve block.

Adjustment

CAUTION
Never operate the unit while adjusting the relief valve. Doing so will damage the relief valve O-rings.

1. Screw stem in until spring is fully compressed.
2. Back out (counterclockwise) the number of turns in the following chart.

Relief Valve	Approx. Pressure (psi)	# of Turns Out (ccw) from Fully Seated
A (Qty 2)	3700	1-1/4
B (Qty 4)	4600	1-1/4
C (Qty 1)	2250*	2-1/2

* See the Pump Pressure Test Section for details.



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P.O. BOX 245038
MILWAUKEE, WI 53224-9538
www.westernplows.com

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