



June 1, 2021
Lit. No. 30118, Rev. 01

MECHANIC'S GUIDE

for the

RDV™ V-Plow

⚠ CAUTION

Read this manual before servicing the snowplow.

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INTRODUCTION

This guide has been prepared to assist the trained mechanic in the service of SnowEx® RDV™ V-plows. It also provides safety information and recommendations. We urge all mechanics to read the safety statements and instructions in this guide carefully before attempting to service the snowplow equipment covered by this guide.

Service of your SnowEx snowplow equipment is best performed by your local SnowEx products dealer. They know your snowplow best and are interested in your complete satisfaction.

RECOMMENDED TOOLS

- Long/slender needle-nose pliers
- Flat screwdriver
- 12V test light
- Torque wrench
- Hex key set, including 3/8"
- Combination standard wrench set
- 1/4" drive ratchet set with 6" extension
- 3/8" drive ratchet set
- Deep socket: 7/8"
- Digital volt/ohmmeter
- Ammeter
- Pressure test kit
- Flashlight
- Pick set
- Hammer
- Pencil magnet
- 5A mini fuses
- Vacuum pump with 3/8" NPT barbed fitting
- 3/8" NPT plug

AVAILABLE SERVICE ITEMS

- Motor Bearing Sleeve Repair Kit: PN 52251
- Pressure Test Kit: PN 56686
(Requires adapter fitting, not included.)
- Spring Replacement Tool: PN 20043-1
- Diagnostic Harness Kit: PN 29290-2
- Pump Shaft Seal Repair Kit: PN 52252

SAFETY

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 local SnowEx® dealer.


Warning/Caution Label


⚠ WARNING


 Blade could drop unexpectedly, crushing or trapping limbs. Lower blade when vehicle is parked.


 Overloading could negatively affect vehicle handling. To avoid serious injury or death, do not exceed GVWR or GAWR including blade and ballast.

⚠ CAUTION

 Read Owner's Manual before operating or servicing snowplow.

 Transport speed should not exceed 45 mph (72 km/h). Further reduce speed under adverse travel conditions.

 Plowing speed should not exceed 10 mph (16 km/h).

 See your sales outlet/website for specific vehicle application recommendations.

www.ww.

Warning Label



Instruction Label

ATTACH

1. Slowly drive vehicle forward to engage rear receiver pins into headgear slots. Apply vehicle parking brake.
2. Hold down lock lever and move hitch pin handle out of the handle lock notch, allowing spring to move the hitch pin handle forward.
3. Plug in electrical harness.
4. Turn plow control in vehicle ON and activate FLOAT.
5. Stand in front of blade. Push top of headgear toward vehicle to allow hitch pins to fully engage hitch pin holes.
6. Verify the lock pin is engaged in the forward hole in the lock pin bracket.
7. Remove hairpin, adjustment pin, & stand.

DETACH

1. With blade straight, lower snowplow to the ground. Activate FLOAT, then turn plow control in vehicle OFF. Apply vehicle parking brake.
2. Unplug electrical harness.
3. Insert stand through slot in the passenger side headgear horn. Adjust stand as far down as possible. Install adjustment pin, and secure with a hairpin.
4. Hold down lock lever to disengage the lock pin and move the hitch pin handle rearward to fully disengage hitch pins from receivers.
5. Move hitch pin handle into handle lock notch.

⚠ WARNING

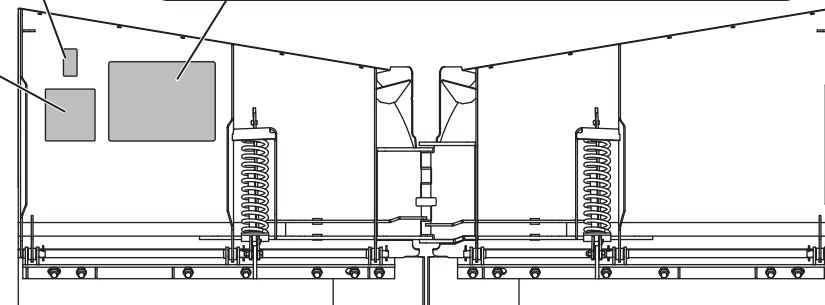
Keep fingers away from snowplow and UTV attachment points.

ATTACH – Steps 2, 6, & 7

DETACH – Step 3

DETACH – Steps 4 & 5

Labels include diagrams of the snowplow attachment and detachment process, showing components like the lock lever, hitch pin handle, headgear, and stand.



SAFETY

SAFETY PRECAUTIONS

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

⚠ WARNING

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

⚠ WARNING

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

⚠ WARNING

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

⚠ WARNING

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

⚠ WARNING

Remove blade assembly before placing vehicle on hoist.

⚠ CAUTION

Refer to the current online selection system 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 electrical and hydraulic systems contain several automotive-style 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. See the Troubleshooting section of this guide for fuse replacement information.

PERSONAL SAFETY

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

SAFETY

FIRE AND EXPLOSION

⚠ WARNING

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

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

CELL PHONES

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

VENTILATION

⚠ WARNING

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

BATTERY SAFETY

⚠ CAUTION

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

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

NOISE

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









VIBRATION

Operating snowplow vibration does not exceed 2.5 m/s² to the hand-arm or 0.5 m/s² to the whole body.

TORQUE CHART

⚠ CAUTION

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

Recommended Fastener Torque Chart					
Inch Fasteners Grade 5 and Grade 8					
Size	Torque (ft-lb)		Size	Torque (ft-lb)	
	 Grade 5	 Grade 8		 Grade 5	 Grade 8
1/4-20	8.4	11.9	9/16-12	109	154
1/4-28	9.7	13.7	9/16-18	121	171
5/16-18	17.4	24.6	5/8-11	150	212
5/16-24	19.2	27.3	5/8-18	170	240
3/8-16	30.8	43.6	3/4-10	269	376
3/8-24	35.0	49.4	3/4-16	297	420
7/16-14	49.4	69.8	7/8-9	429	606
7/16-20	55.2	77.9	7/8-14	474	669
1/2-13	75.3	106.4	1-8	644	909
1/2-20	85.0	120.0	1-12	704	995
Metric Fasteners Class 8.8 and 10.9					
Size	Torque (ft-lb)		Size	Torque (ft-lb)	
	 Class 8.8	 Class 10.9		 Class 8.8	 Class 10.9
M6 x 1.00	7.7	11.1	M20 x 2.50	325	450
M8 x 1.25	19.5	26.9	M22 x 2.50	428	613
M10 x 1.50	38.5	53.3	M24 x 3.00	562	778
M12 x 1.75	67	93	M27 x 3.00	796	1139
M14 x 2.00	107	148	M30 x 3.50	1117	1545
M16 x 2.00	167	231	M33 x 3.50	1468	2101
M18 x 2.50	222	318	M36 x 4.00	1952	2701
These torque values apply to fasteners except those noted in the instructions.					

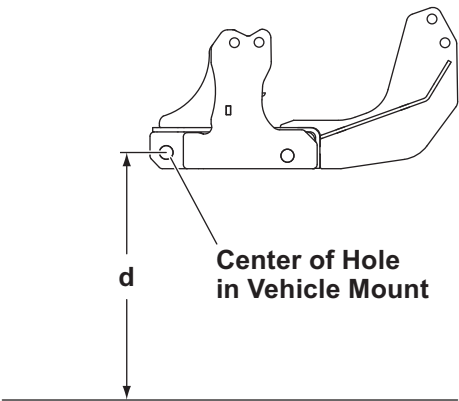
BLADE, T-FRAME & HEADGEAR

T-FRAME HOLE POSITION

IMPORTANT! Before assembling the headgear to the T-frame, the T-frame hole position must be determined using the following procedure. (If the truck is not available, use the middle position. Adjustments can be made later.)

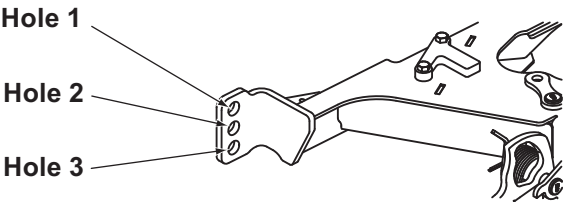
Before measuring the vehicle mount height, the vehicle mount must be installed, ballast must be installed, if required, and the vehicle must be parked on a level surface.

1. Measure the distance "d" from the ground to the center of the hole in the vehicle mount. Measure the distance on both sides of the vehicle and determine average value for "d."



2. Use distance "d" from Step 1 and the following chart to determine the proper T-frame hole.

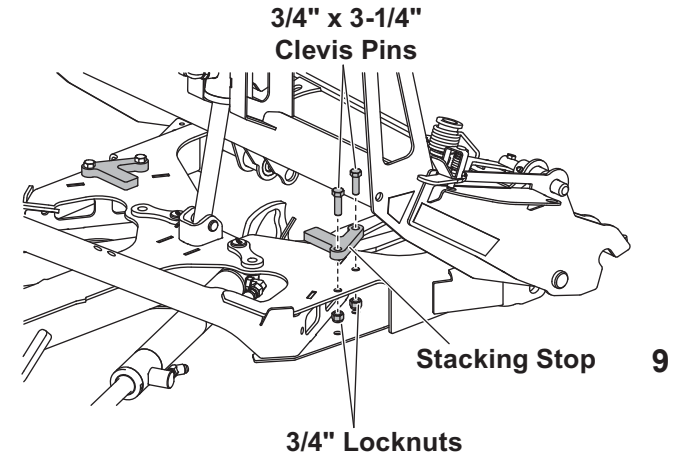
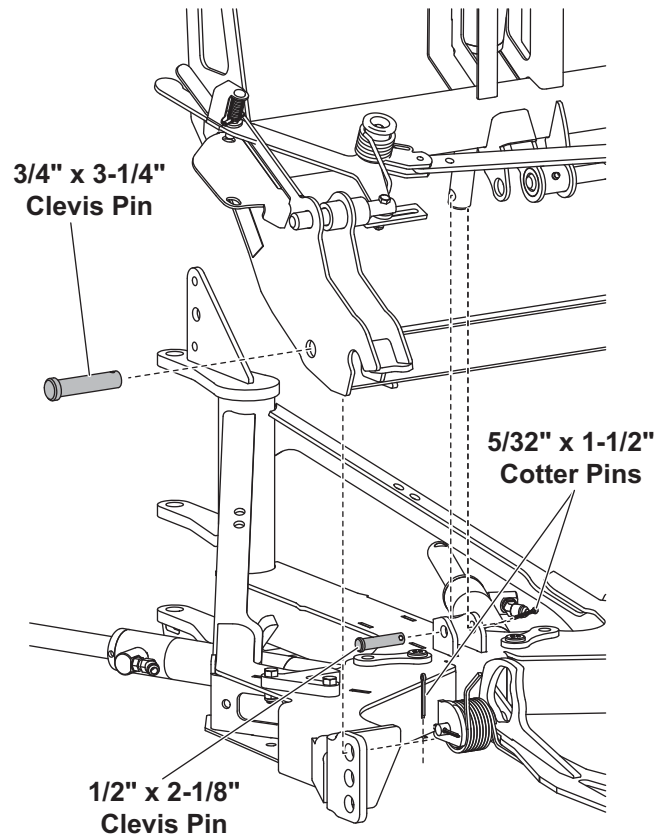
T-Frame Hole Chart	
Distance "d"	Hole
14.25" – 15.5"	1
13.0" – 14.25"	2
11.75" – 13.0"	3



BLADE, T-FRAME & HEADGEAR

T-FRAME TO BLADE ASSEMBLY

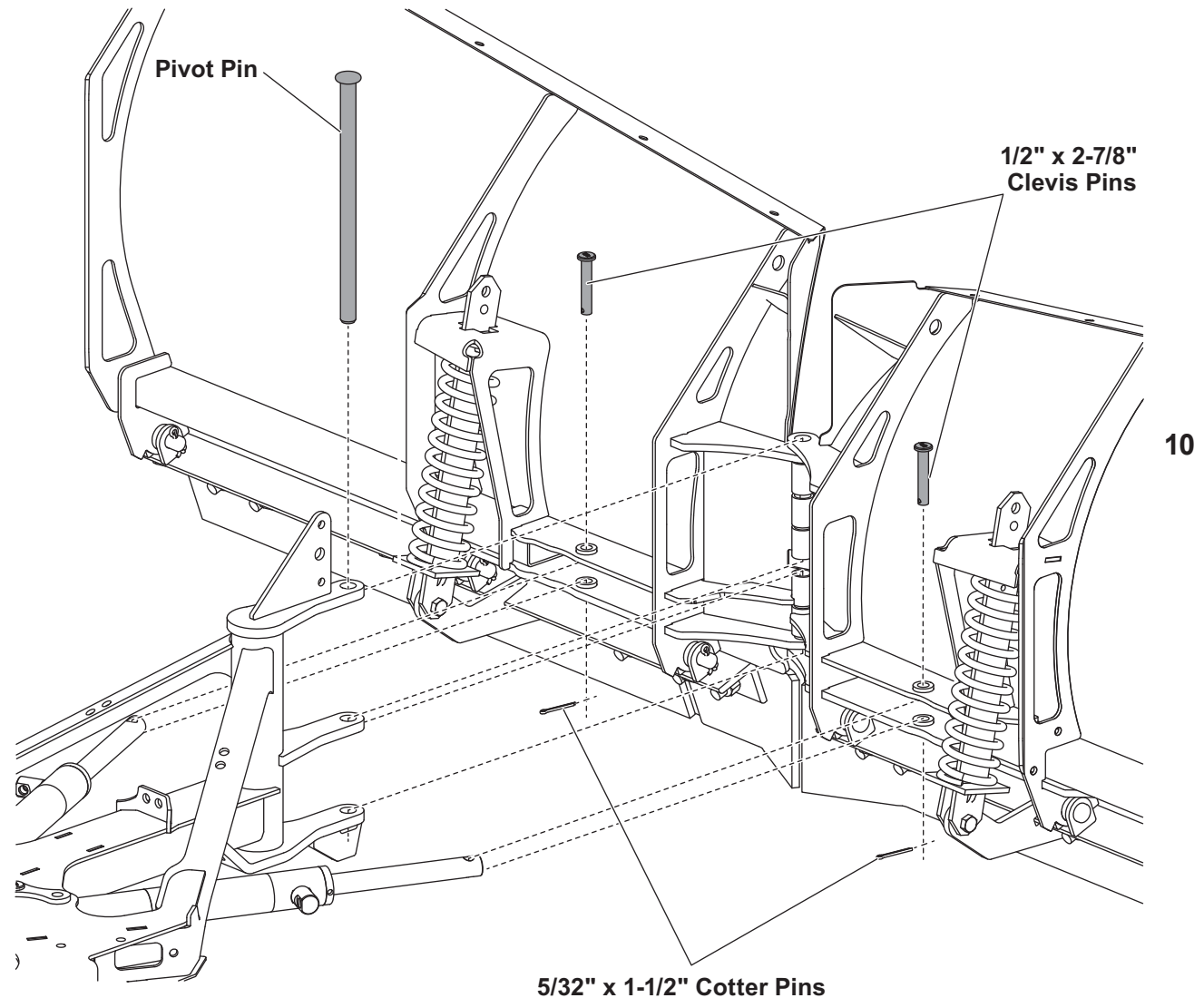
1. Position the T-frame between the headgear strut and inner ear, aligned with the appropriate T-frame hole.
2. On each side, insert $\frac{3}{4}$ " x $3\frac{1}{4}$ " clevis pins (from the shipping bracket) from the outside of the headgear through the correct T-frame holes. Secure the clevis pins with $\frac{5}{32}$ " x $1\frac{1}{2}$ " cotter pins found in the parts bag.
3. Fold the headgear forward and pin the lift cylinder to the T-frame using a $\frac{1}{2}$ " x $2\frac{1}{8}$ " clevis pin and $\frac{5}{32}$ " x $1\frac{1}{2}$ " cotter pin from the parts bag.
4. If the T-frame was installed into the top hole, install the stacking stops using $\frac{3}{8}$ " x $1\frac{1}{4}$ " cap screws and $\frac{3}{8}$ " locknuts.



BLADE, T-FRAME & HEADGEAR

T-FRAME TO BLADE ASSEMBLY

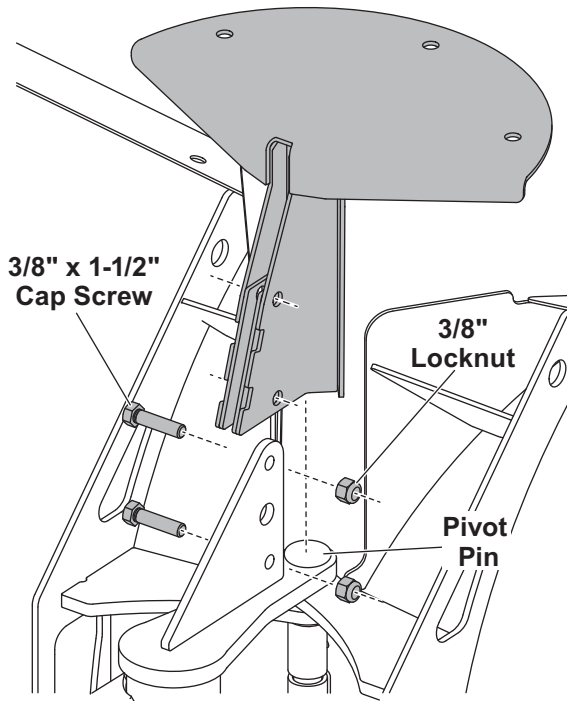
1. Remove the blade wings from the crate. Remove the four shipping straps, then replace the cutting edge hardware.
2. Align the hinges of each wing. Position the T-frame assembly between the blade wings so the holes in the T-frame are aligned with the holes in wing hinges.
3. Insert the pivot pin from top to bottom through all hinges as shown.
4. Move the snowplow into a normal operating position.
5. Remove the protective packaging from the angle rams.
6. Align the holes in the rod end of the angle ram with the corresponding holes on the back of the blade.
7. Install a 1/2" x 2-7/8" clevis pin (from the shipping bracket) from the top down to attach each rod. Secure the clevis pins with 5/32" x 1-1/2" cotter pins from the parts bag.



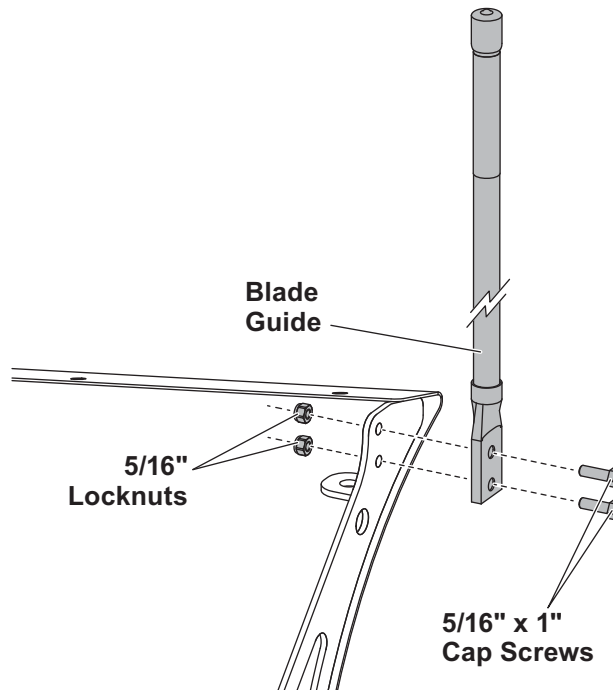
BLADE, T-FRAME & HEADGEAR

CENTER DEFLECTOR AND BLADE GUIDES

8. Install the center snow deflector using two 3/8" x 1-1/2" cap screws and 3/8" locknuts.



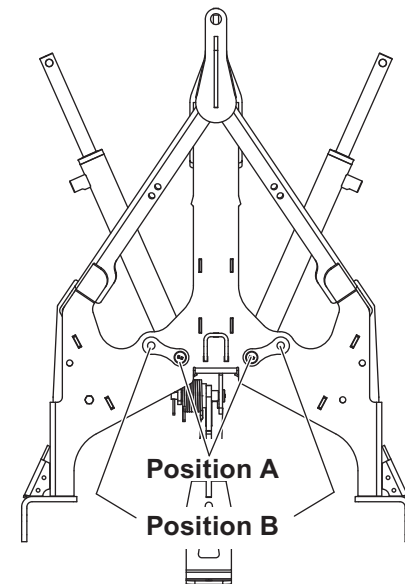
9. Install the blade guides with 5/16" x 1" cap screws and 5/16" locknuts, as shown.



ANGLE RAM ADJUSTMENT – RDV™ BLADE

The RDV V-plow has adjustable angle rams with two possible mounting positions at the base end of each ram, nearest the vehicle. This feature provides a means for making an adjustment in available ground clearance for when the snowplow is fully raised and in full angled or retracted (vee) positions. The angle rams are installed from the factory in the inner holes (position A). If additional ground clearance is desired, reposition the rams to position B, being sure to use the same corresponding hole for attaching each ram.

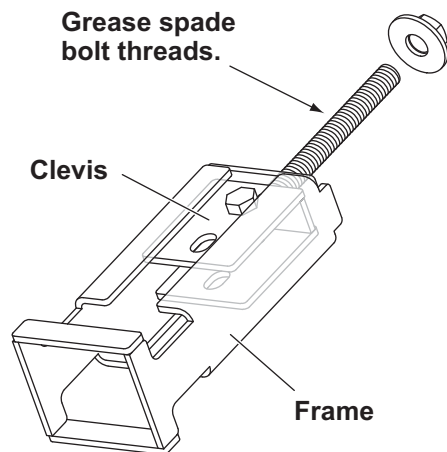
NOTE: Failure to make the adjustment or failure to use the same corresponding holes for attaching the rams could result in poor performance or damage.



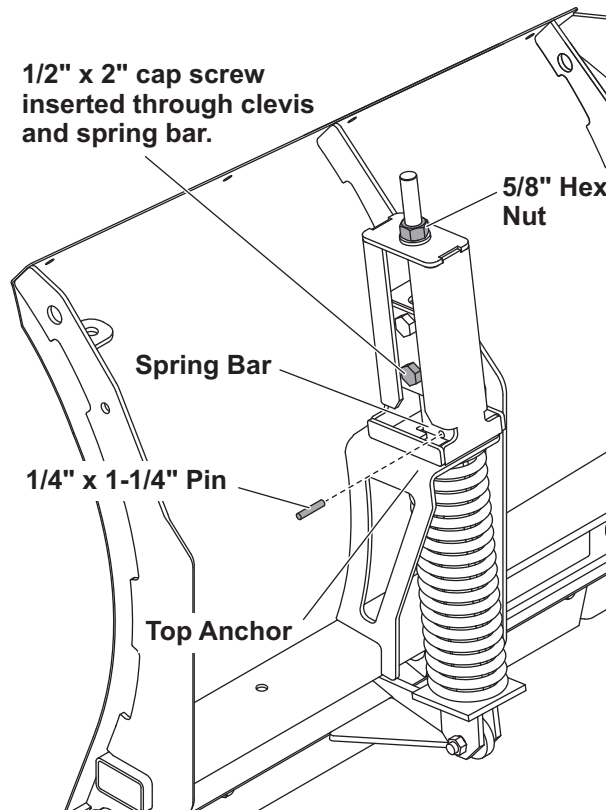
BLADE, T-FRAME & HEADGEAR

USING THE BLADE SPRING REPLACEMENT TOOL

1. Park the vehicle on a smooth, level, hard surface, such as concrete. Lower the blade to the ground and turn the control OFF. Disconnect the snowplow from the vehicle or turn the vehicle ignition to the "OFF" position and remove the key.
2. The spring replacement tool (PN 20043-1) ships fully assembled. Before using the tool, apply a light coating of multipurpose grease to the threaded end of the spade bolt.



3. Place the tool on the top anchor above the spring, making sure that the upper end of the spring bar is between the clevis tabs of the spring replacement tool. Insert a 1/2" x 2" cap screw through the lower hole in one clevis tab, through the top hole in the spring bar, then the hole in the other clevis tab. Install a 1/2" nut and hand tighten.



4. Use hand tools to tighten the 5/8" hex nut until the spring bar is raised enough to access the pin hole. Insert the 1/4" x 1-1/4" pin through the pin hole, centering the pin from side to side.
5. Loosen the 5/8" hex nut to lower the spring bar. Remove the spring tool assembly by removing the 1/2" cap screw inserted through the spring bar in Step 3.
6. Detach the spring from the blade by removing the shoulder bolt and locknut at the bottom of the spring bar. Retain the fasteners.
7. Insert the replacement spring with spring bar up through the top anchor on the blade. Install the bottom of the spring bar to the anchor on the trip edge using the retained shoulder bolt and locknut. Tighten to 50 ft-lb.
8. Repeat Step 3.
9. Use hand tools to tighten the 5/8" hex nut until the spring bar is raised enough to access the 1/4" x 1-1/4" pin inserted in Step 4. Remove the pin.
10. Repeat Step 5.

HYDRAULIC SYSTEM

HYDRAULIC SYSTEM SPECIFICATIONS

The hydraulic system delivers fast and uniform speed for blade movement, raising the blade in two seconds and performing all angling functions in less than five seconds.

Relief Valve Settings

- Pump Relief Valve (1): 2250 ± 100 psi
2 turns CCW from fully seated
- Base-End Relief Valves (2): 3400 ± 100 psi
1-3/8 turns CCW from fully seated
- Rod-End Relief Valves (2): 2200 ± 100 psi
2 turns CCW from fully seated
- Scrape Lock Relief Valve (1): 210 psi
2-1/4 turns CCW from fully seated

Pump Motor

12V DC with +/- Connection
3.0" dia. 0.8 kW Motor
2200–2300 psi Pump Relief Valve
3400 psi Plowing Relief Valves
2200 psi Back Dragging Relief Valves
0.000477 gal/rev Pump
Hydraulic Hose 1/4 SAE 100R1

System Capacity

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

Hydraulic Fluid

⚠ CAUTION

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

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

Fastener Torque Specifications

Pump Cap Screws	5/16-18 x 2-1/4	150–160 in-lb
Motor Terminals (+ and –)	5/16-18 Nut	50–60 in-lb
Motor to Manifold Cap Screws	M5 x .8 Bolt	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
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 3-1/2	7–9 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 3/8	60–70 in-lb
Plow Module Mount Screws	1/4-20 x 3/8	60–70 in-lb
Angle Ram –4 Elbow Fitting Nut		11–12 in-lb
Angle Ram Piston Locknuts		90–100 ft-lb
Lift Ram Piston Nut		90–100 ft-lb
Angle Ram Gland Nuts		120–150 ft-lb
Lift Ram Gland		30–40 ft-lb

Electrical System (Approximate Values)

- Solenoid Coil Resistance = 7 ohm @ room temp.
- Solenoid Coil Amperage Draw = 1.5A
- Motor Relay Coil Resistance = 5.4 ohm
- Motor Relay Amperage Draw = 3A
- Maximum Motor Amperage Draw = 190A over relief at 2250 psi
- Switch Accessory Lead Draw = 0.75A

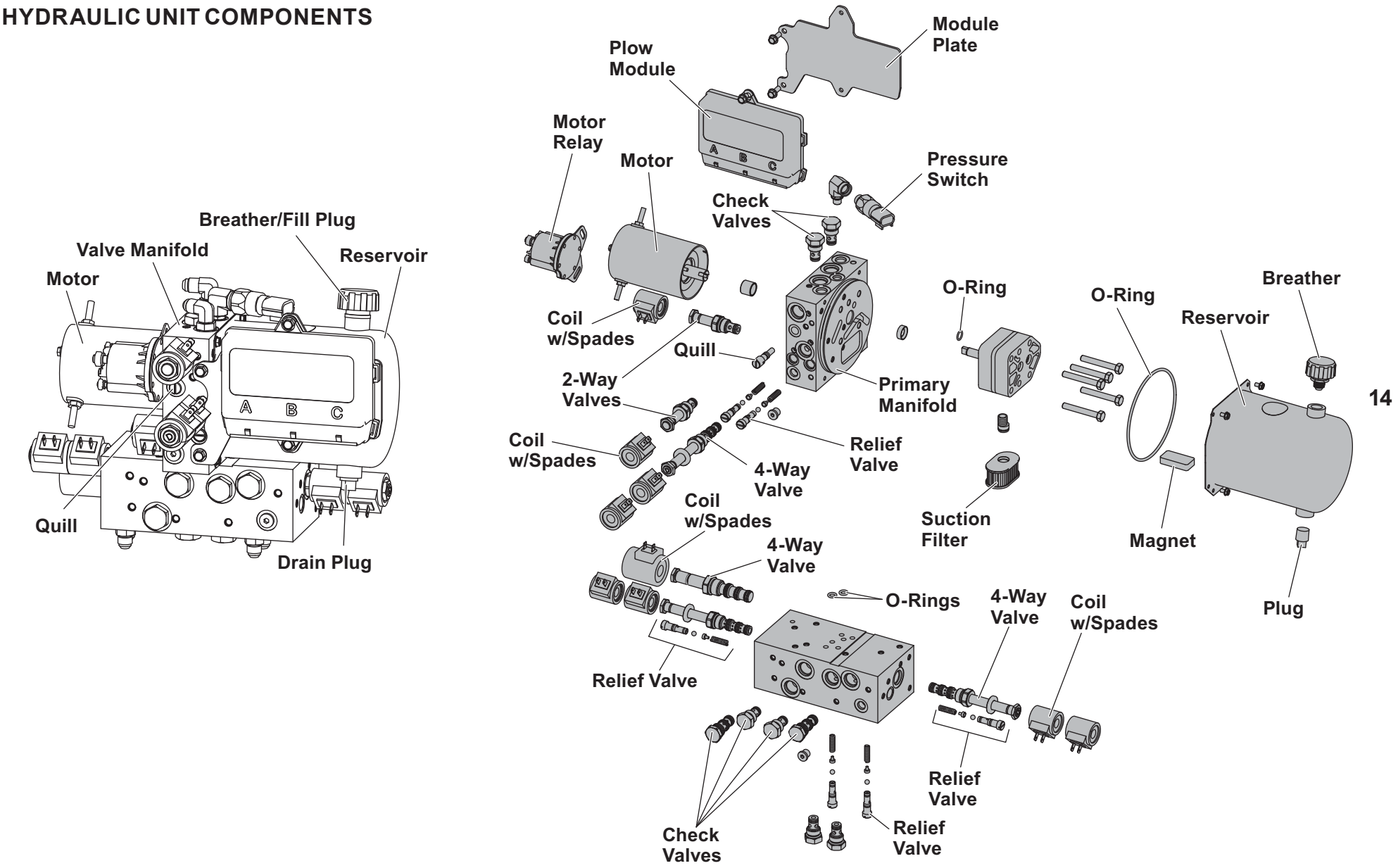
Fuses

- Hydraulic Unit Harness Fuses: 5A mini

AeroShell® is a registered (®) trademark of Shell Oil Company.

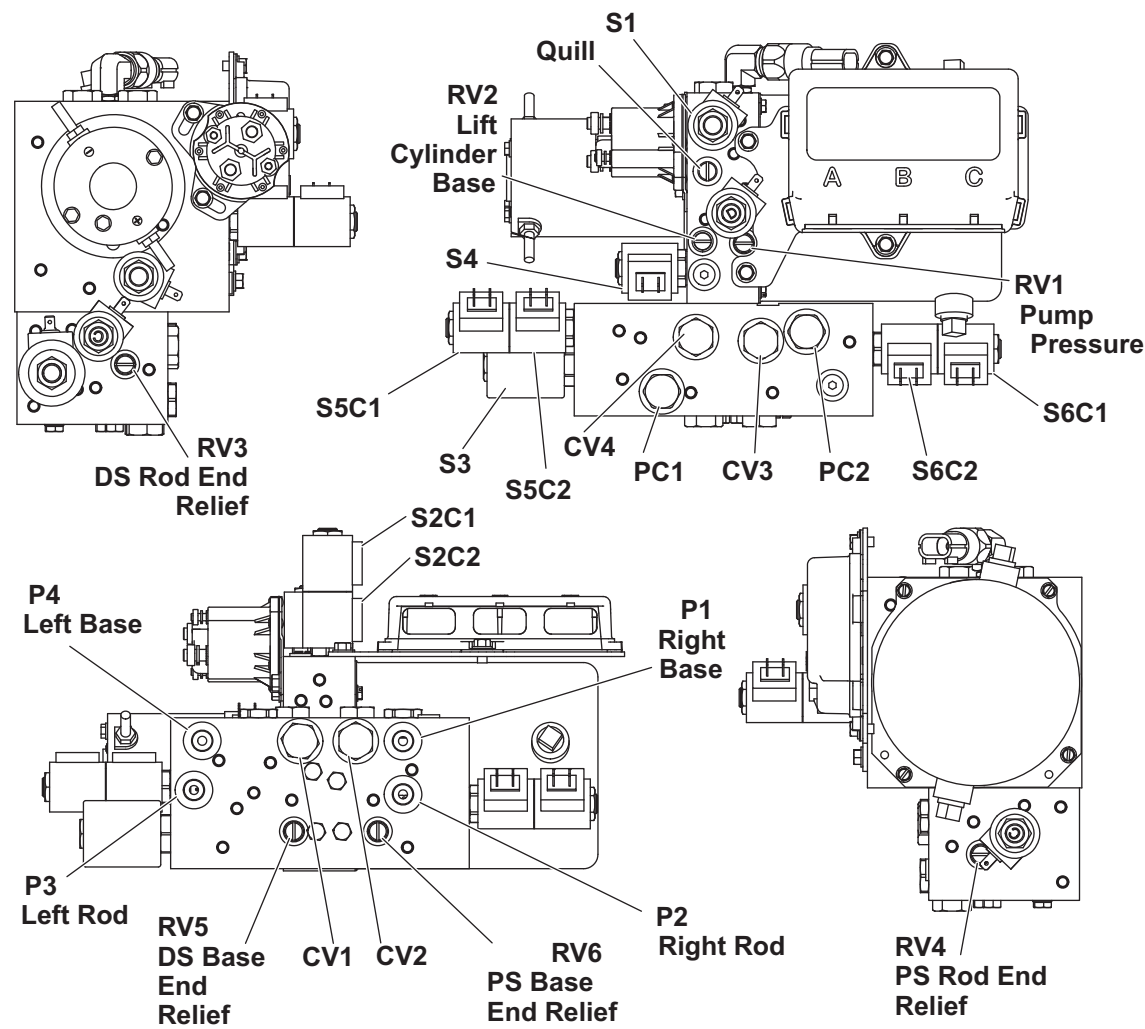
HYDRAULIC SYSTEM

HYDRAULIC UNIT COMPONENTS

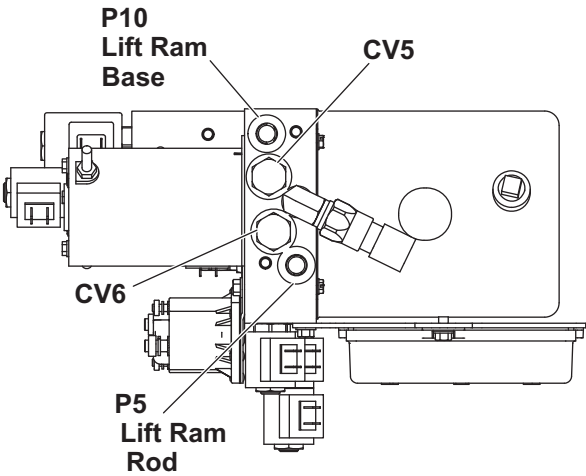


HYDRAULIC SYSTEM

VALVE LOCATION



Solenoid Cartridge Valves		
Coil	Valve Type	Wire Color
S1	SV08-2211	Pink
S2C1	SV08-47D	Dark Green
S2C2		Purple
S3	SV10-43	Yellow
S4	SV08-2211	Blue
S5C1	SV08-47C	Black
S5C2		Orange
S6C1	SV08-47C	Brown
S6C2		White



HYDRAULIC SYSTEM









CARTRIDGE VALVES

The RDV™ V-plow hydraulic system performs ten 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 the opening of one cartridge valve.

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

Solenoid		Blade Movement												
		RAISE ↑	LOWER ↓	ANGLE RIGHT 	ANGLE LEFT 	VEE 	SCOOP 	RIGHT EXTEND 	RIGHT RETRACT 	LEFT EXTEND 	LEFT RETRACT 	ATTACH	DETACH	Scrape Maxx™ FEATURE (OPT)
Motor	M	ON		ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON
SV08-2211	S1		ON									ON		ON
SV08-47D	S2C1	ON											ON	
	S2C2											ON		
SV10-43	S3			ON	ON									
SV08-2211	S4	ON	ON										ON	
SV08-47C	S5C1				ON	ON					ON			
	S5C2			ON			ON			ON				
SV08-47C	S6C1						ON	ON						
	S6C2					ON			ON					

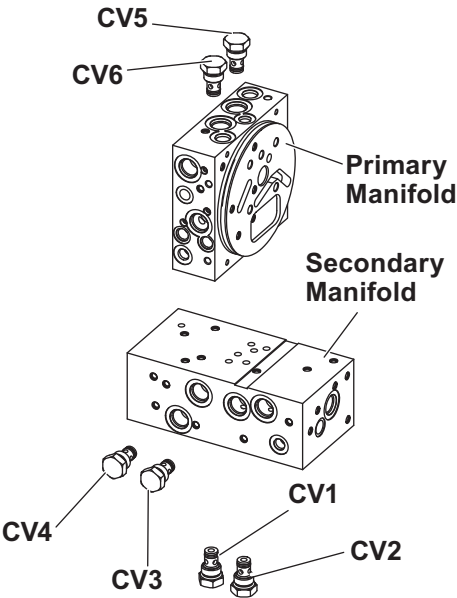
HYDRAULIC SYSTEM

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.

A pilot-operated check valve (PC) allows fluid to flow in only one direction unless it receives pilot pressure through another circuit to shift it to an open position.

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



Check Valves	
CV1	CV08-2004
CV2	
CV3	
CV4	
CV5	CV08-2059

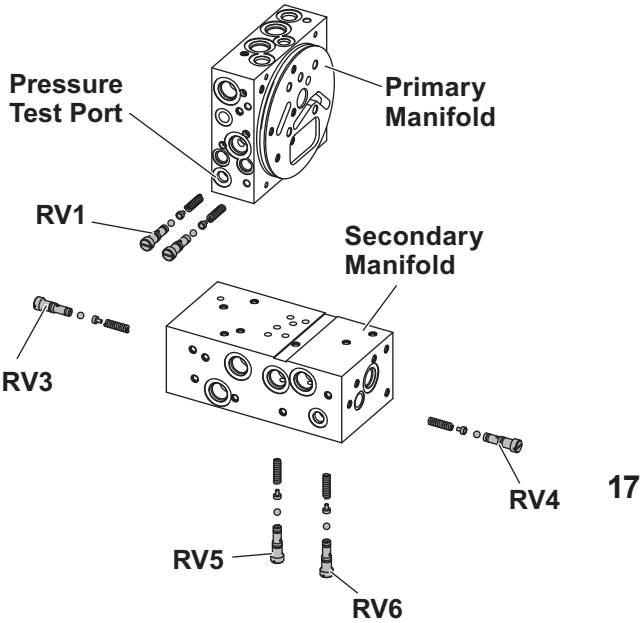
RELIEF VALVES

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 3400 psi, the ram's base-end relief valves open, allowing hydraulic fluid back to the reservoir. Due to the small volume on the rod side of the piston, fluid is not replaced. This causes a slight temporary vacuum in that circuit.

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 2200 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: See "Striking an Object While Plowing Forward" and "Striking an Object While Back Dragging" schematics for details.



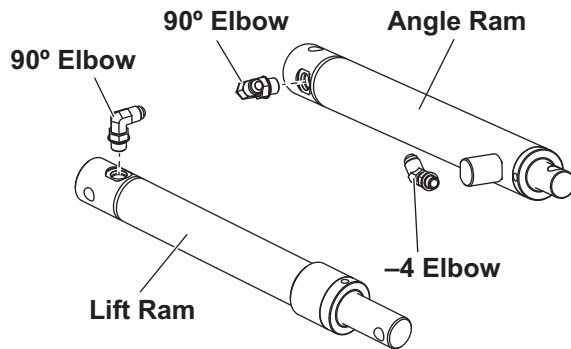
Relief Valve Settings		
RV1	Pump	2250 ± 100 psi
RV3	DS Ram Rod End	2200 ± 100 psi
RV4	PS Ram Rod End	
RV5	DS Ram Base End	3400 ± 100 psi
RV6	PS Ram Base End	

HYDRAULIC SYSTEM

HYDRAULIC FITTING AND HOSE INSTALLATION

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

DO NOT use thread sealant/tape on hydraulic hoses or fittings. These materials could damage the product. Always use two wrenches to ensure proper tightening of fittings and hoses.



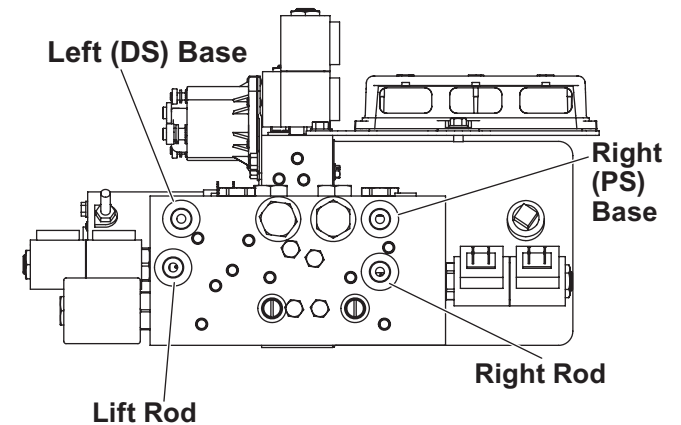
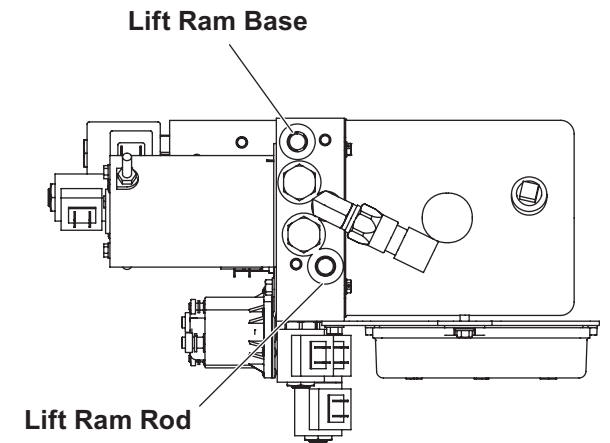
To install SAE O-ring fittings in the valve block and rams:

1. Turn the jam nut on the fitting as far back as possible.
2. Lubricate the O-ring with clean hydraulic fluid.
3. Screw the fitting into the port by hand until the washer contacts the port face and the shoulder of the jam nut threads.

4. Unscrew the fitting to its proper position; no more than one full turn.
5. Using two wrenches, hold the fitting body in position and tighten the jam nut until the washer again contacts port face, then tighten an additional 1/8 to 1/4 turn to lock the fitting in place. Final torque on the jam nut should be approximately 20 ft-lb.

To install hydraulic hoses:

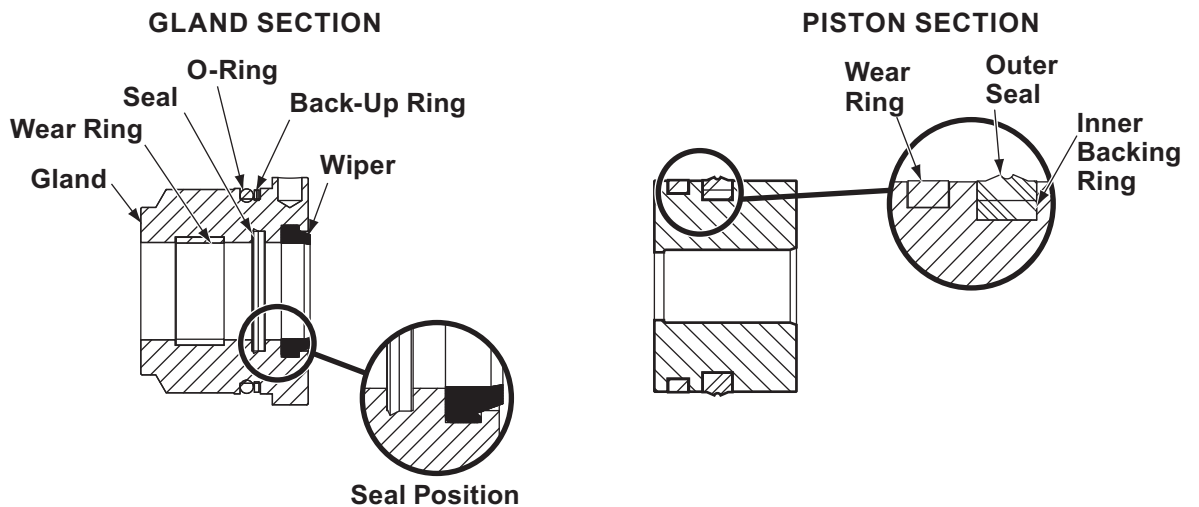
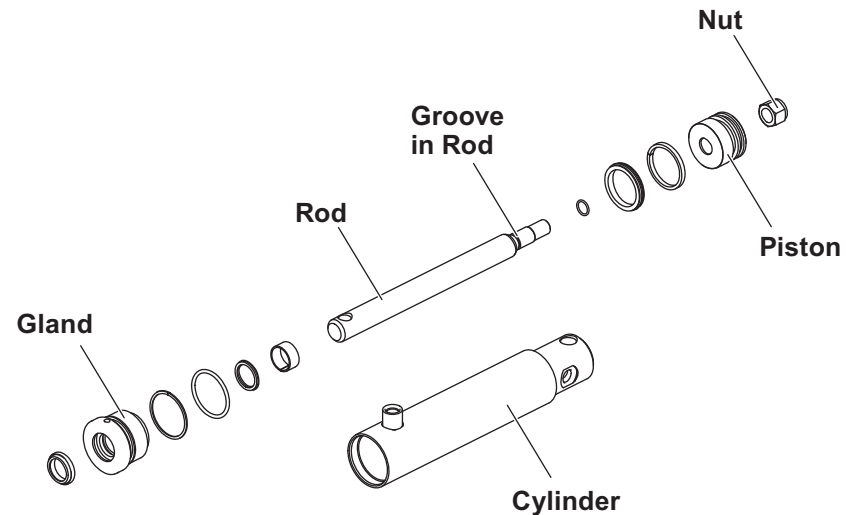
1. Screw the flare nut onto the fitting flare and hand tighten it.
2. Align the hose so that there are no twists or sharp bends and so that it will not be pinched or pulled by moving parts.
3. Using a pair of adjustable pliers, hold the hose in position, and use a wrench to tighten the flare nut 1/8 to 1/4 turn beyond hand tight. Final torque on the flare nut should be approximately 20 ft-lb.
4. Reinstall any protective hose wraps in their original positions.



HYDRAULIC SYSTEM

RAM SEAL INSTALLATION

1. Lubricate the O-rings with hydraulic fluid before assembly.
2. Assemble the gland components as shown, then lubricate them with hydraulic fluid.
3. Remove the piston from the rod and assemble the piston components as shown.
4. Assemble the gland to threaded end of the rod. Do not slide the gland over the cross hole in the rod.
5. Reassemble piston to rod and tighten the nut:
 - 90–100 ft-lb for angle ram
 - 90–100 ft-lb for lift ram.
6. Assemble the O-ring into the groove on the rod. Use tape or other protection on the threads.
7. Apply a bead of medium-strength threadlocker all around the threads of the gland.
8. Lubricate the piston seals and the inside of the cylinder.
9. Press the rod assembly into the cylinder and tighten the gland nut:
 - 120–150 ft-lb for the angle ram
 - 30–40 ft-lb for the lift ram.



HYDRAULIC SYSTEM

CARTRIDGE & CHECK VALVE REMOVAL

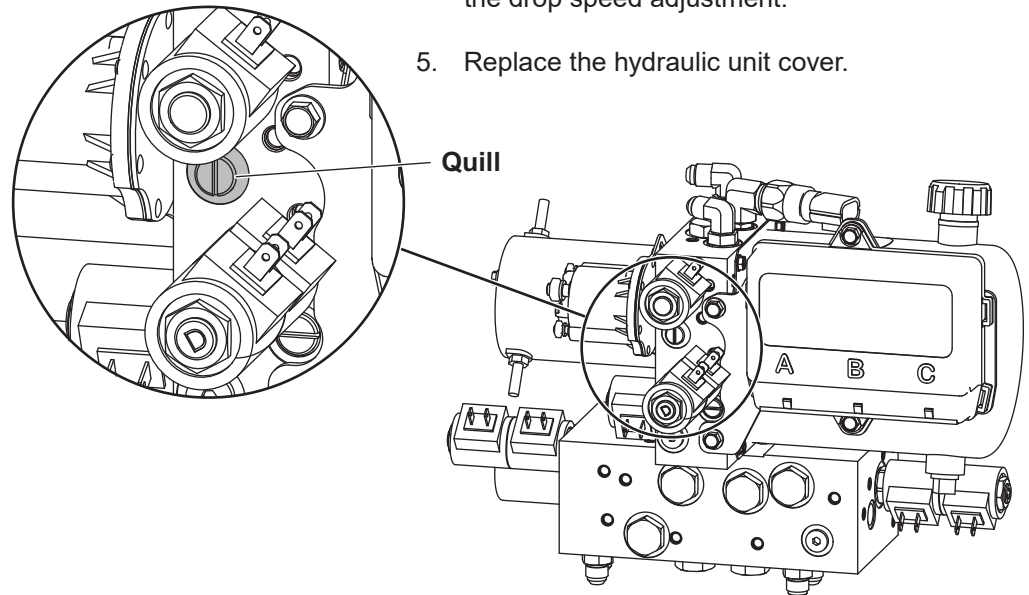
It is possible to remove cartridges and check valves from a hydraulic unit without draining the hydraulic fluid from the reservoir.

1. Install the Diagnostic Harness (PN 29290-2) 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. **To remove cartridges or check valves without draining the reservoir**, proceed with Steps 5–8 and 10.

To drain the reservoir before replacing components, remove the drain plug and completely drain the reservoir. Reinstall the drain plug. Replace the desired components and skip to Step 9.

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 to 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. **If the reservoir was completely drained** at Step 4 above, refill the reservoir with hydraulic fluid to 1-1/2" to 2" from the top.
10. Reinstall the breather and remove the 29290-2 Diagnostic Harness according to the instructions included with the harness kit.



BLADE DROP SPEED ADJUSTMENT

⚠ WARNING

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

1. Lower the blade to the ground before making any adjustment.
2. Remove the hydraulic unit cover.
3. The quill in the valve manifold adjusts the blade drop speed. Turn the quill IN (clockwise) to decrease drop speed. Turn the quill OUT (counterclockwise) to increase drop speed.
4. Stand 8 feet clear of the blade when checking the drop speed adjustment.
5. Replace the hydraulic unit cover.

HYDRAULIC SYSTEM – Scrape Maxx™ DOWN-FORCE KIT

⚠ WARNING

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

⚠ CAUTION

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

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.

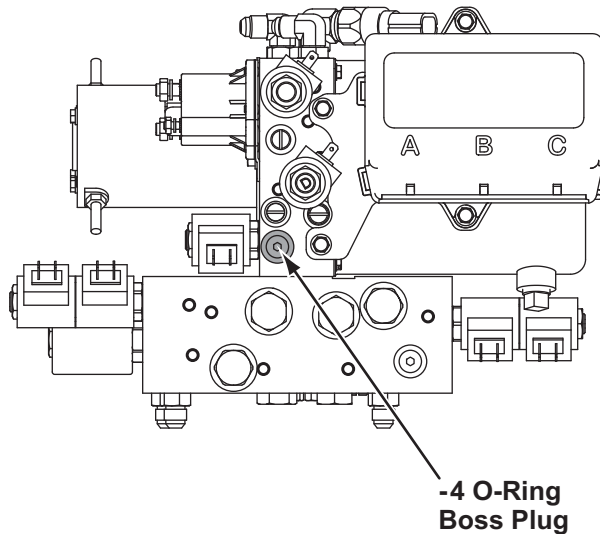
Loosen hydraulic components slowly to relieve any residual pressure.

INSTALLING THE Scrape Maxx KIT

1. Park the vehicle on a smooth, level, hard surface, such as concrete. Move the blade to center position and lower it to the ground.
2. Activate the FLOAT mode by holding the LOWER button (hand-held control) or holding the lever in LOWER position (joystick control) for 3/4 second. Turn the cab control OFF.
3. Remove the hydraulic unit cover. Remove the reservoir breather.

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

4. Locate the -4 O-ring boss plug on the front of the hydraulic unit.
5. Remove the O-ring boss plug. (Retain for reinstallation if the Scrape Maxx™ accessory is later uninstalled.)



6. Install the pressure switch in place of the O-ring boss plug. Gripping the hex portion only, tighten the pressure switch to 10–13 ft-lb.
7. Reinstall the reservoir breather.
8. Locate the black connector with two gray wires on the harness connected to port B of the plow module. Remove the jumper plug from the

connector. (Retain the plug for reinstallation if the Scrape Maxx™ accessory is later uninstalled.)

9. **If the harness connector is triangular**, plug the connector directly onto the pressure switch installed in Step 6.

If the harness connector is oval shaped, install the supplied switch adapter between the harness connector and the pressure switch.

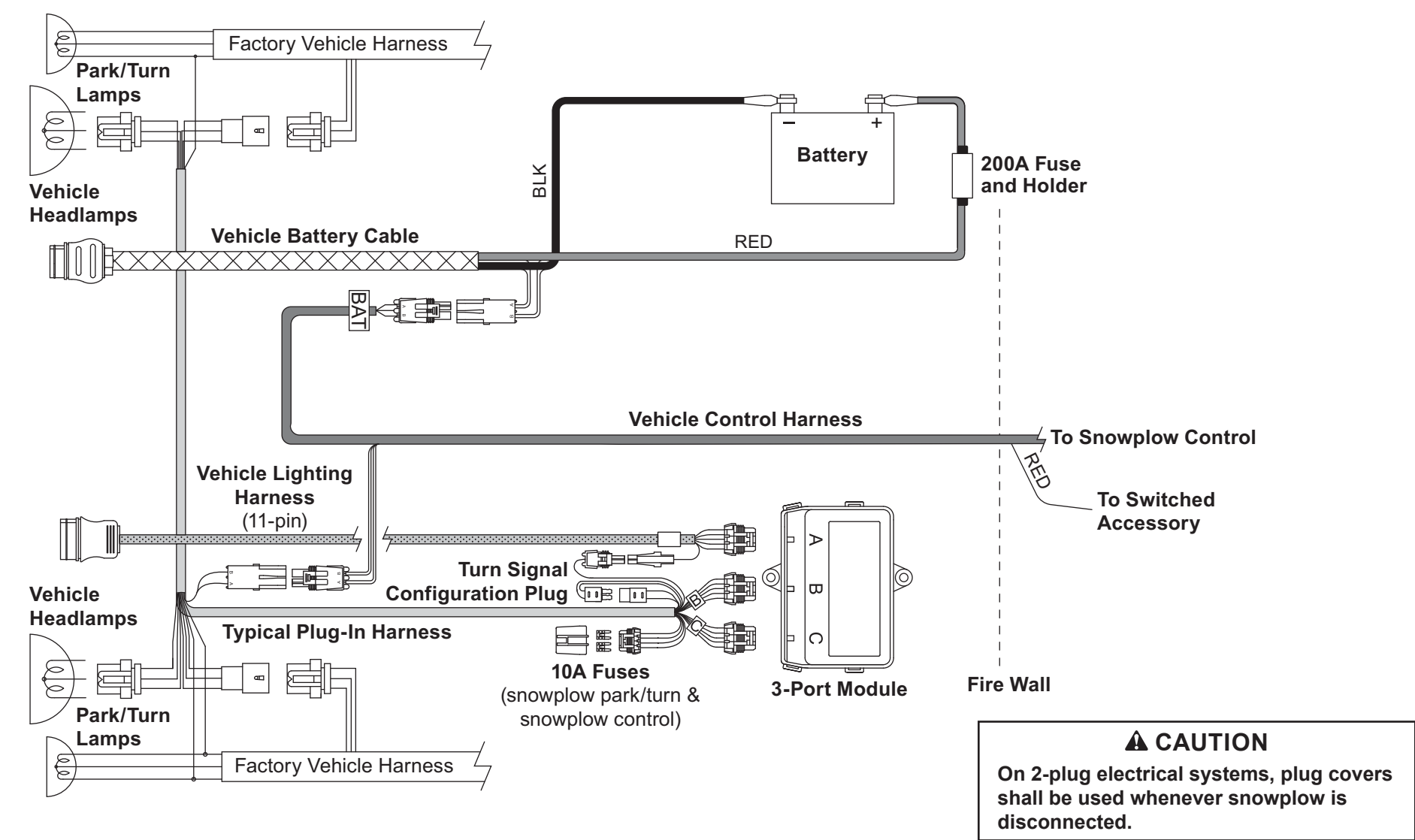
10. Turn the cab control ON. Raise and lower the blade several times to purge the lift ram.
11. Activate the Scrape Maxx™ down force mode. The hydraulic unit will run momentarily to pressurize the lift ram and then turn OFF.
12. Inspect all hydraulic connections for leaks. If you suspect a hose leak, DO NOT use your hand to locate it. Use a piece of cardboard or wood. Replace the hydraulic unit cover.
13. Apply the Scrape Maxx label to the headgear below the SECURITY GUARD™ label on the driver's side.

UNINSTALLING THE Scrape Maxx KIT

If the Scrape Maxx pressure switch is removed from the snowplow, reinstall the retained -4 O-ring boss plug and jumper plug removed in Steps 5 and 8 above.

VEHICLE-SIDE ELECTRICAL COMPONENTS

HARNESS DIAGRAM

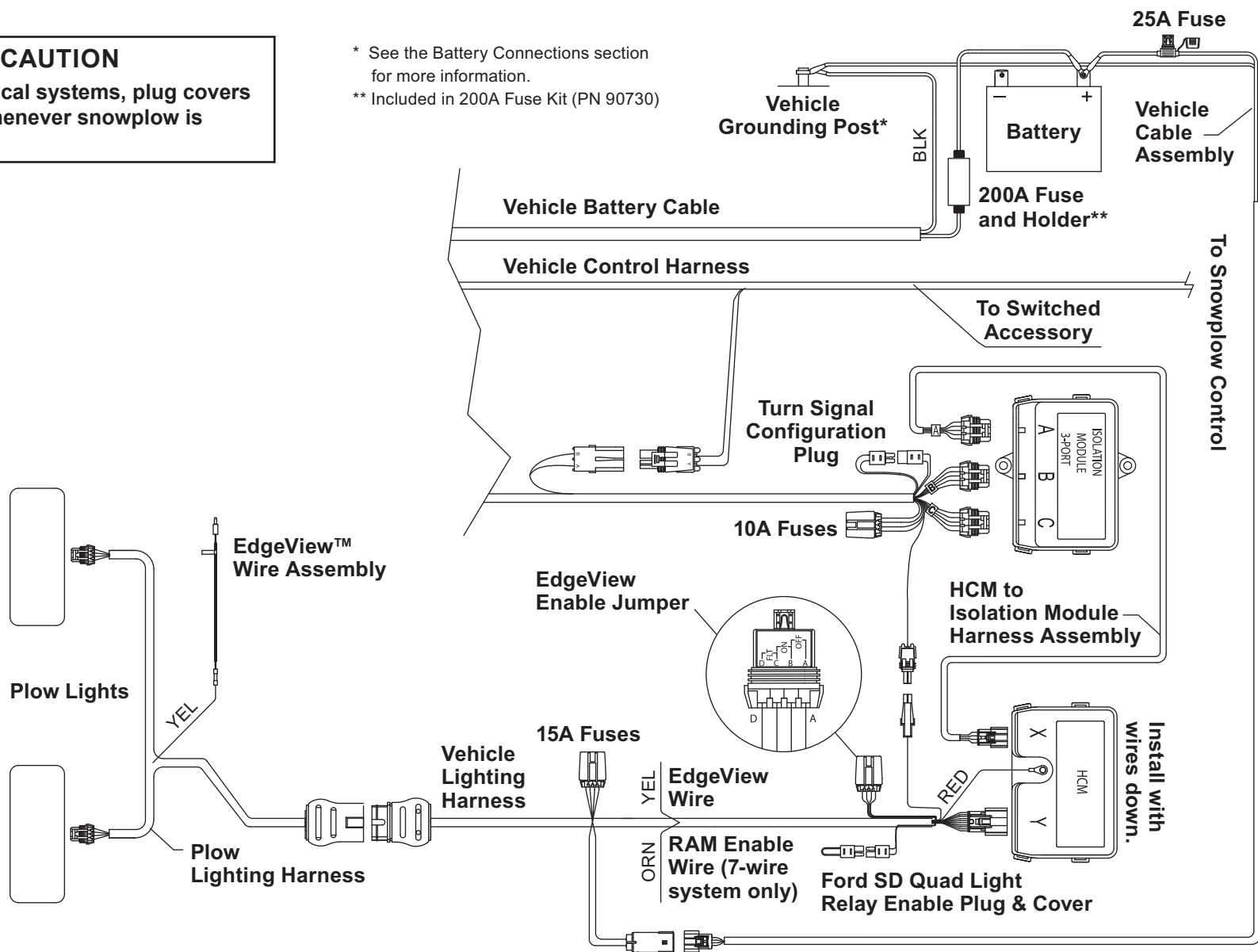


VEHICLE-SIDE ELECTRICAL COMPONENTS

HARNESS DIAGRAM – LED HEADLAMPS

⚠ CAUTION
On 2-plug electrical systems, plug covers shall be used whenever snowplow is disconnected.

* See the Battery Connections section for more information.
** Included in 200A Fuse Kit (PN 90730)



OVERVIEW

⚠ WARNING

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

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

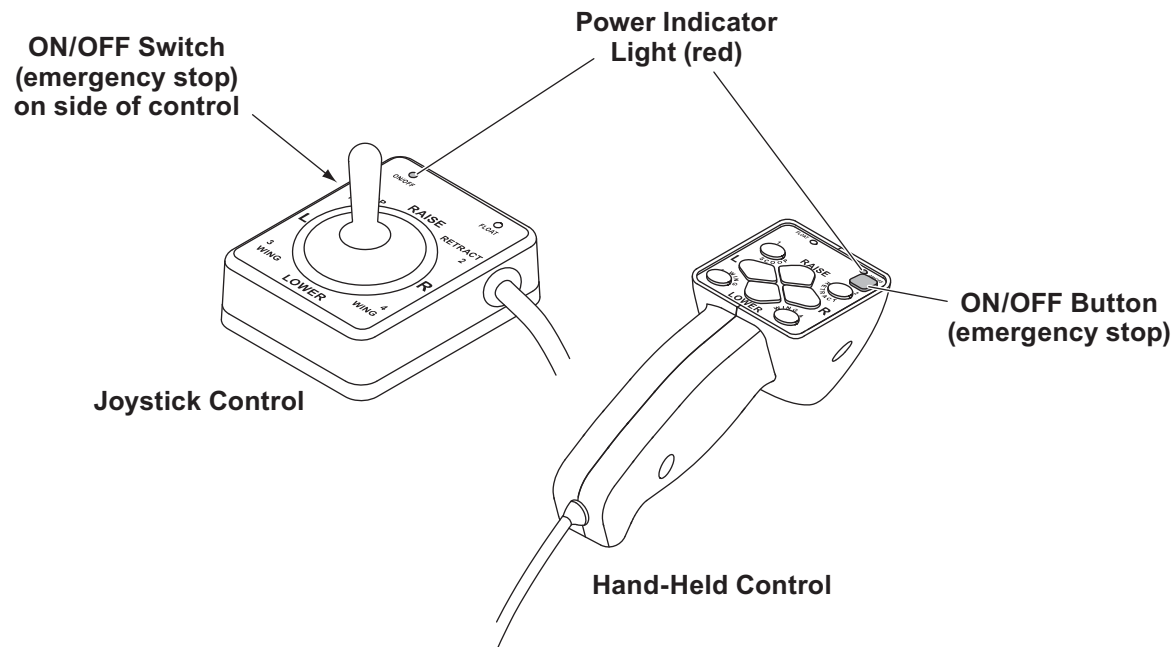
Each control is equipped with an ON/OFF button or switch and an indicator light to show when the control is powered ON or OFF. The controls are powered by the vehicle's battery, so the vehicle ignition (key) switch must be ON to use the controls.

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

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

All controls are protected by a replaceable fuse located in the control harness assembly. See "Fuse Replacement" in the Maintenance section of the Owner's Manual.

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



CONTROLS

OPERATING THE POWER GRIP™ HAND-HELD CONTROL

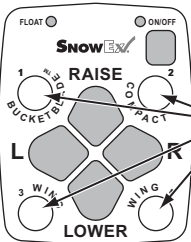
⚠ WARNING

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

- 1. Turn the vehicle ignition switch to the "ON" or "ACCESSORY" position.
- 2. Press the ON/OFF button on the control. The power indicator light glows red, indicating that the control is ON. The power indicator light glows red whenever the control and vehicle ignition switch are both ON, and the electrical connections to the snowplow are completed.

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

The round buttons numbered 1, 2, 3, and 4 operate the SECURITY GUARD™ system. See the SECURITY GUARD System section of this guide for instructions.



Buttons 1, 2, 3, and 4 control SECURITY GUARD system functions.

Function Time-Outs

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

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

Automatic Shutdown

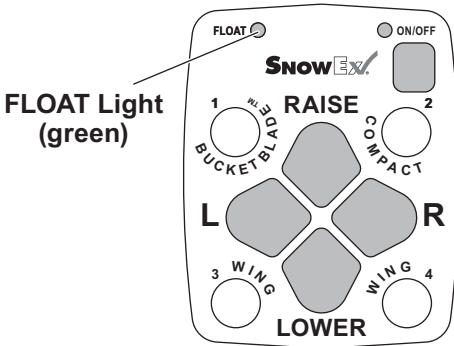
The control will automatically turn OFF after being idle for 20 minutes. To reactivate the control after a shutdown, press the ON/OFF button.

Smooth Stop

The control automatically allows the blade to coast to a stop when a control button is released. This results in smoother operation, reduces the shock to the hydraulic system, and increases hose and valve life. For instructions on enabling/disabling this feature, see "Smooth Stop" in this section.

Control Functions

Raise, Lower, Float, Angle



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

Function	Description of Operation
RAISE	Press this button to raise the blade and cancel the FLOAT mode.
LOWER	Press this button to lower the blade. Release the button to stop the blade at the desired height.
FLOAT*	Press the LOWER button and hold 3/4 second to activate this mode. The FLOAT light in the upper left corner of the control face will illuminate. The blade will lower to the ground surface and follow the contour of the surface as it dips or raises. Function does not time out; however, control will shut down after 20 minutes of nonuse. Press the RAISE button momentarily to cancel FLOAT. Angling left or right will not interrupt (pause) the FLOAT function.

Based on Operating Instructions for 84400 & 84455 POWER GRIP Hand-Held Control (Lit. No. 52220, Rev. 00).

Table continues on next page.

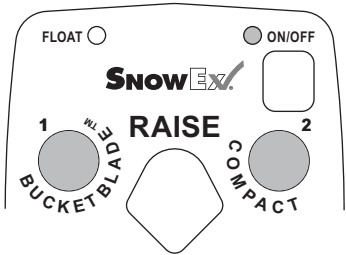
POWER GRIP™ Hand-Held Control Functions, continued

L (Angle Left)	With wings in a straight line, press the L button to move both wings to the angle left position. The left wing retracts while the right wing extends.
R (Angle Right)	With wings in a straight line, press the R button to move both wings to the angle right position. The right wing retracts while the left wing extends.

* FLOAT mode activates immediately when the One-Touch FLOAT feature is enabled. See "One-Touch FLOAT" in the FLEET FLEX Electrical System section for more information.

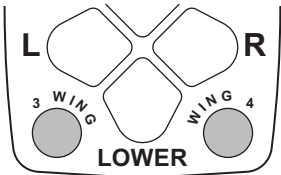
Scoop/Retract Blade Positions

The two round buttons located to the left and right of the RAISE button move both wings at the same time, into the following blade positions.



Function	Description of Operation
BUCKET BLADE™	Press this button to extend both wings forward into the BUCKET BLADE position.
COMPACT	Press this button to draw both wings into the fully retracted/COMPACT position.

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 below.

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

Function	Description of Operation
L WING	Press this 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.
R WING	Press this 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.

POWER GRIP™ Hand-Held Control Function Time-Outs (seconds)									
Model	RAISE	L (Angle Left)	R (Angle Right)	BUCKET BLADE	COMPACT	L WING (OUT)	L WING (IN)	R WING (OUT)	R WING (IN)
RDV™ Snowplow	4.0	3.0	3.0	5.0	3.0	3.0	3.0	3.0	3.0

FLOAT = 0.75 seconds (does not timeout). Control will shut down after 20 minutes of nonuse.

CONTROLS

OPERATING THE JOYSTICK CONTROL

⚠ WARNING

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

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

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

Function Time-Outs

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

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

Automatic Shutdown

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

Smooth Stop

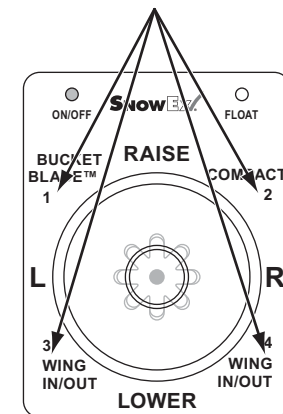
The control automatically allows the blade to coast to a stop when the lever returns to center position. This results in smoother operation, reduces the shock to the hydraulic system, and increases hose and valve life. For instructions on enabling/disabling this feature, see the FLEET FLEX Electrical System section of this guide.

Control Lever Movement

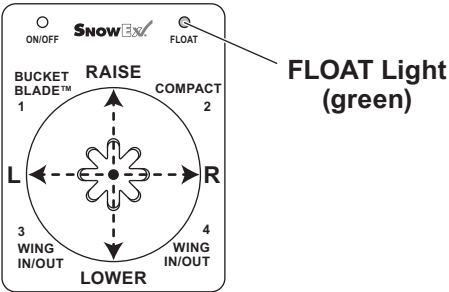
From the center position, the control lever can be moved in one of eight directions to control various movements of the snowplow blade. To change from one movement of the blade to another, the control lever must be moved back to the center position before selecting the desired function. Whenever the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

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

Positions numbered 1, 2, 3, and 4 control SECURITY GUARD system functions.



Control Functions



Raise, Lower, Float, Angle

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

Function	Description of Operation
RAISE	Move the control lever toward the top of the control body to raise the blade and cancel the FLOAT mode.
LOWER	Move the control lever toward the bottom of the control body to lower the blade. Release the lever to stop the blade at desired height.
FLOAT†	<p>Move the control lever to the LOWER position and hold 3/4 second to activate this mode. The FLOAT light in the upper right corner of the control face will illuminate. The blade will lower to the ground surface and follow the contour of the surface as it dips or rises. Function does not time out; however, the control will shut down after 20 minutes of nonuse.</p> <p>Move the lever to the RAISE position momentarily to cancel FLOAT. Angling left or right will not interrupt (pause) the FLOAT function.</p>

Function	Description of Operation
L (Angle Left)	Move the control lever straight to the left to angle the blade left.
R (Angle Right)	Move the control lever straight to the right to angle the blade right.

* FLOAT mode activates immediately when the One-Touch FLOAT feature is enabled. See "One-Touch FLOAT" in the FLEET FLEX Electrical System section for more information.

BUCKET BLADE™/COMPACT Blade Positions

Moving the control lever from the center position toward "BUCKET BLADE" or "COMPACT" on the face of the control body will cause both wings to move at the same time, as described in the table below.

Function	Description of Operation
BUCKET BLADE	Move the control lever toward the words BUCKET BLADE on the control face to extend both wings forward into the scoop position.
COMPACT	Move the control lever toward the word COMPACT on the control face to draw both wings into the fully retracted/vee position.

Wing Positions

Moving the control lever from the center position toward "L WING IN/OUT" or "R WING IN/OUT" on the face of the control body will cause one wing to move independently of the other, as described in the following table.

Function	Description of Operation
L WING IN/OUT	Move the control lever toward the <i>left</i> 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 the lever in the same slot, without using another function, results in movement in the opposite direction from the previous movement.
R WING IN/OUT	Move the control lever toward the <i>right</i> 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 the lever in the same slot, without using another function, results in movement in the opposite direction from the previous movement.

SnowEx® Joystick Control Function Time-Outs (seconds)									
Model	RAISE	L (Angle Left)	R (Angle Right)	BUCKET BLADE™	COMPACT	L WING (OUT)	L WING (IN)	R WING (OUT)	R WING (IN)
RDV Snowplow	4.0	3.0	3.0	5.0	3.0	3.0	3.0	3.0	3.0

FLOAT = 0.75 seconds (does not timeout). Control will shut down after 20 minutes of nonuse.

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

SMOOTH STOP AND ONE-TOUCH FLOAT FEATURES

Smooth Stop

Smooth stop, or soft stop, allows the blade to coast to a stop when the button/lever is released. The result is smoother operation, reduction in shock to the hydraulic system, and longer hose and valve life.

While there are advantages to having this feature, there are also advantages to temporarily disabling it. For example, disabling smooth stop allows for more precise movements of the blade while operating close to buildings and other obstacles.

All controls come standard with this feature **ENABLED**.

One-Touch FLOAT

One-touch FLOAT immediately activates the FLOAT mode and releases the blade to the ground, without having to hold the button or lever in LOWER. This can improve transition time when backing up to plow forward again, eliminating the time spent holding the control and waiting for the blade to fully drop.

All controls come standard with this feature **DISABLED**.

Enable/Disable Procedure

To enable/disable the smooth stop and one-touch FLOAT features, perform the following steps.

Performing the sequence multiple times will toggle the feature between enabled and disabled.

1. Turn the vehicle ignition switch to the "ON" or "ACCESSORY" position. (It is not necessary to start the vehicle.)
2. Verify that the control power indicator is OFF. If the power indicator light is red, the control is ON. Turn the control OFF.

3. **Smooth Stop:** Move and hold the control lever to the "R" position or press and hold the R button while turning the control ON.

One-Touch FLOAT: Move and hold the control lever to the "LOWER" position or press and hold the LOWER button while turning the control ON.

The power indicator light will turn ON and the FLOAT light will flash, indicating the status of the feature.

Light Flash Indicators	
Light	Description
POWER – Red	Solid ON = Control is ON
FLOAT – Green	1 Flash = Feature is <i>disabled</i> 2 Flashes = Feature is <i>enabled</i>

SECURITY GUARD™ SNOWPLOW ANTI-THEFT SYSTEM

Activation & Establishing a 4-Digit Security Code

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

1. Turn the vehicle ignition switch to the "ON" or "ACCESSORY" position. (It is not necessary to start the vehicle.)
2. Verify that the control power indicator is OFF. If the power indicator light is red, the control is ON. Turn the control OFF.
3. To activate the SECURITY GUARD mode, move the control lever to the #1 position or press the #1 button four consecutive times, and then move the lever to the #4 position or press the #4 button four consecutive times (sequence: 1, 1, 1, 1, 4, 4, 4, 4). The green FLOAT light will flash quickly and the red power indicator light will turn ON, indicating that the system is ready to accept your 4-digit security code.

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

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

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

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

Manual Unlock

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

1. Turn the vehicle ignition to the "ON" or "ACCESSORY" position.
2. Turn the control ON.
3. The power indicator light will flash rapidly, indicating that the snowplow is locked.
4. Enter the 4-digit security code.
5. After the correct security code is entered, the power indicator light will change from flashing rapidly to a solid light to indicate that the snowplow has been successfully unlocked.

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

SECURITY GUARD™ SNOWPLOW ANTI-THEFT SYSTEM, continued

Clearing an Established 4-Digit Security Code

1. Turn the vehicle ignition switch to the "ON" or "ACCESSORY" position.
2. If the snowplow is locked (the control power indicator light will be flashing rapidly), unlock the snowplow by following the Manual Unlock procedure described above.
3. Turn the control OFF. Verify that the power indicator light is OFF.
4. With the control OFF, move the control lever to the #2 position or press the #2 button four consecutive times, then move the lever to the #3 position or press the #3 button four consecutive times. This sequence (2, 2, 2, 2, 3, 3, 3, 3) will clear the 4-digit security code from the SECURITY GUARD system. The FLOAT light will flash to indicate that the 4-digit security code was cleared.

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

Light Flash Indicators

POWER – Red	Function
OFF	Control is OFF
Solid ON	Control is ON and active
Slow Flash (1 per second)	No communication
Fast Flash (2 per second)	Snowplow is locked. Enter 4-digit security code to unlock

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

Additional Notes

- The SECURITY GUARD system requires any control other than one with the assigned 4-digit security code to enter the security code before the snowplow can be activated. Once the security code is established, the SECURITY GUARD system recognizes that a control with the same security code is attached, and **does not** require a manual unlock to activate the snowplow. The system will recognize the control as "safe" and will automatically unlock.
- The SECURITY GUARD system is only fully functional with joystick control PN 84460, and hand-held control PN 84455.
- In the event that a snowplow is locked and cannot be manually unlocked or reset, contact your Authorized Dealer.
- REMINDER: Record your security code for future reference.

SECURITY GUARD™ SNOWPLOW ANTI-THEFT SYSTEM, continued

Distributor Master Control

The Distributor Master Control (PN 78800) can clear an established code in a snowplow module without using the original control that was used to establish the code. This procedure should also be used to reset the module if the security code is unknown.

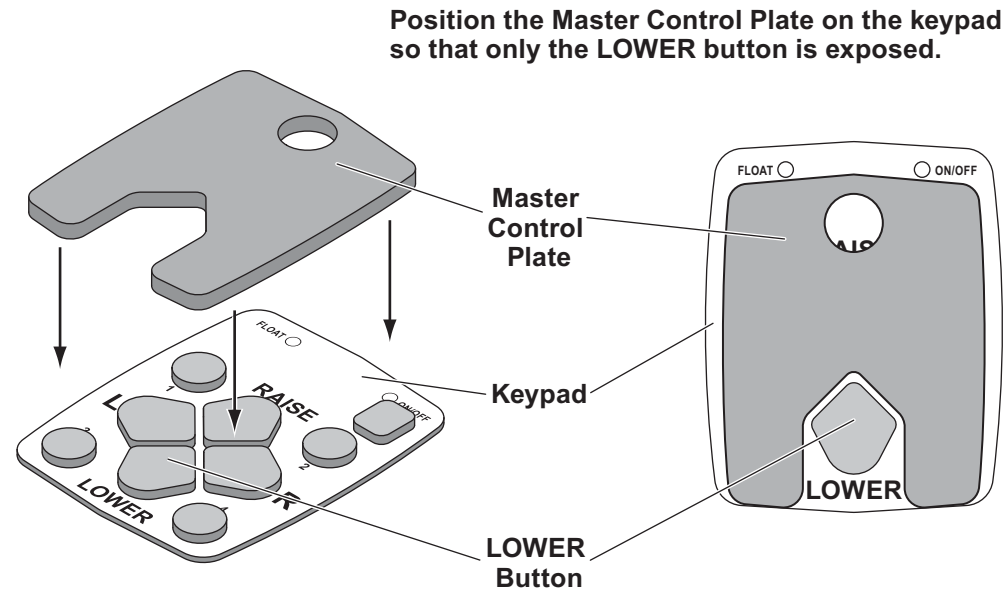
IMPORTANT: The following steps must be performed using the Distributor Master Control. Only the Distributor Master Control is programmed to clear an established security code when the original control used to establish the code is not available.

⚠ WARNING

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

1. Turn the vehicle ignition to the "OFF" position.
2. With the control power OFF, using the tool that was included in the Distributor Master Control box, place the tool over the keypad, and push down on the plate.
3. Pushing the tool down will engage all functions except LOWER. While pushing down on the plate, turn the vehicle ignition ON.
4. When the ignition is turned to the "ON" position, the system will reset and the security code associated with the snowplow will be cleared.

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












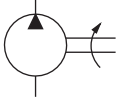

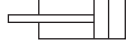













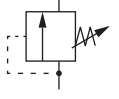




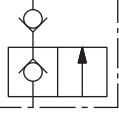




ELECTRICAL & HYDRAULIC SCHEMATICS

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 symbol. The hydraulic and electrical legends describe each of the symbols used in the schematics for this guide.

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

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

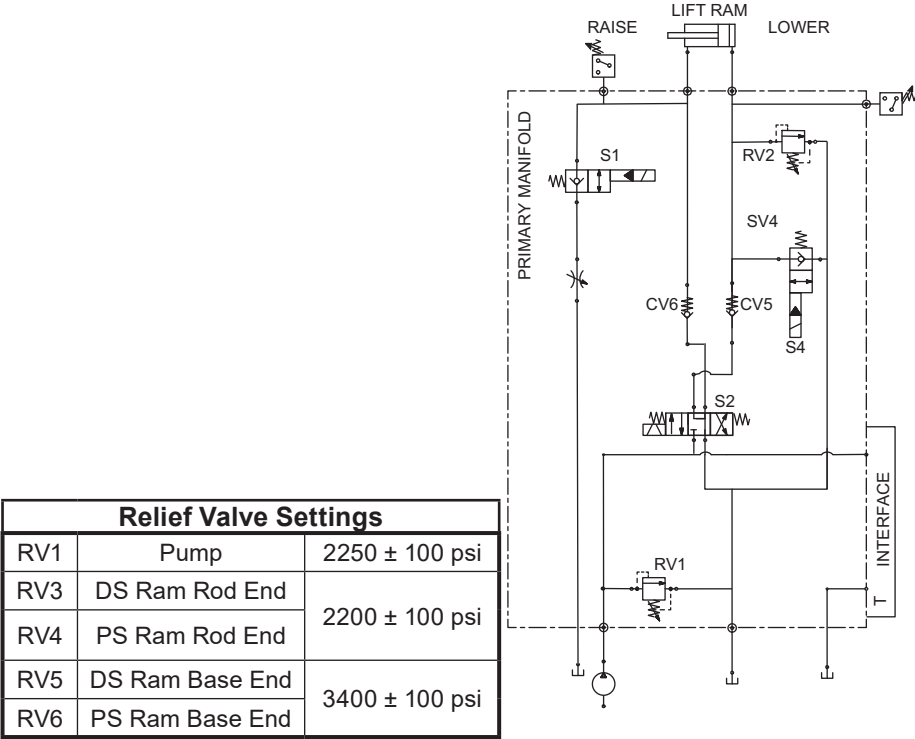
ELECTRICAL LEGEND		HYDRAULIC LEGEND	
	CROSSING WIRE		LINE, WORKING (MAIN)
	WIRE SPLICE		LINES JOINING
	IN-LINE CONNECTOR		LINES CROSSING
	FUSE		FLOW, DIRECTION OF HYDRAULIC FLUID
	SOLENOID COIL		LINE, TO RESERVOIR BELOW FLUID LEVEL
	CIRCUIT GROUND		HYDRAULIC PUMP FIXED DISPLACEMENT
	MOTOR RELAY		RAM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

Electrical Schematic – RDV™ V-Plow

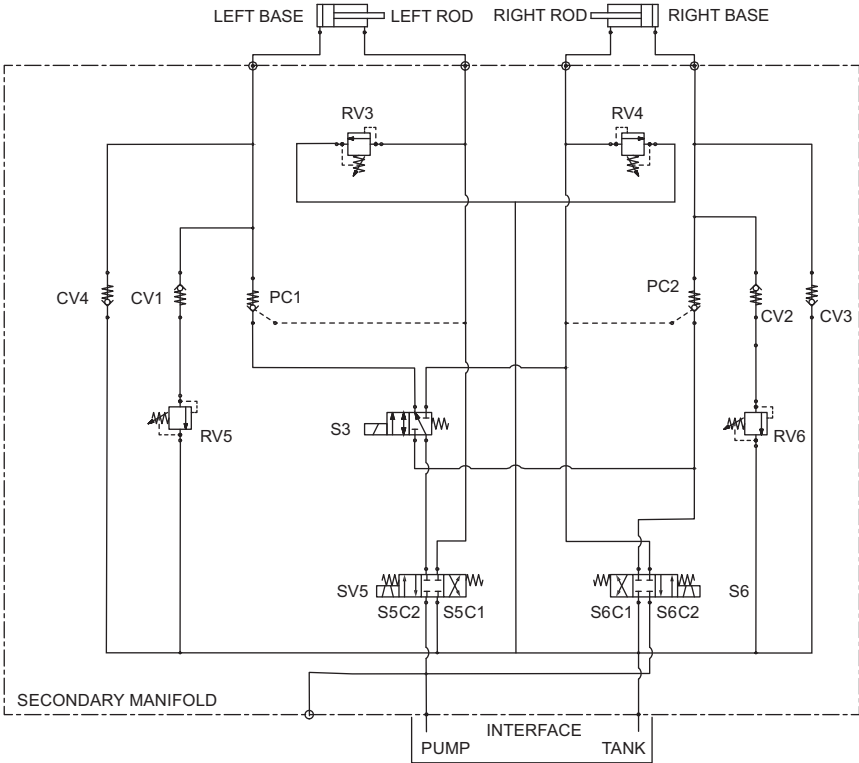


ELECTRICAL & HYDRAULIC SCHEMATICS

Hydraulic Schematic – RDV™ V-Plow

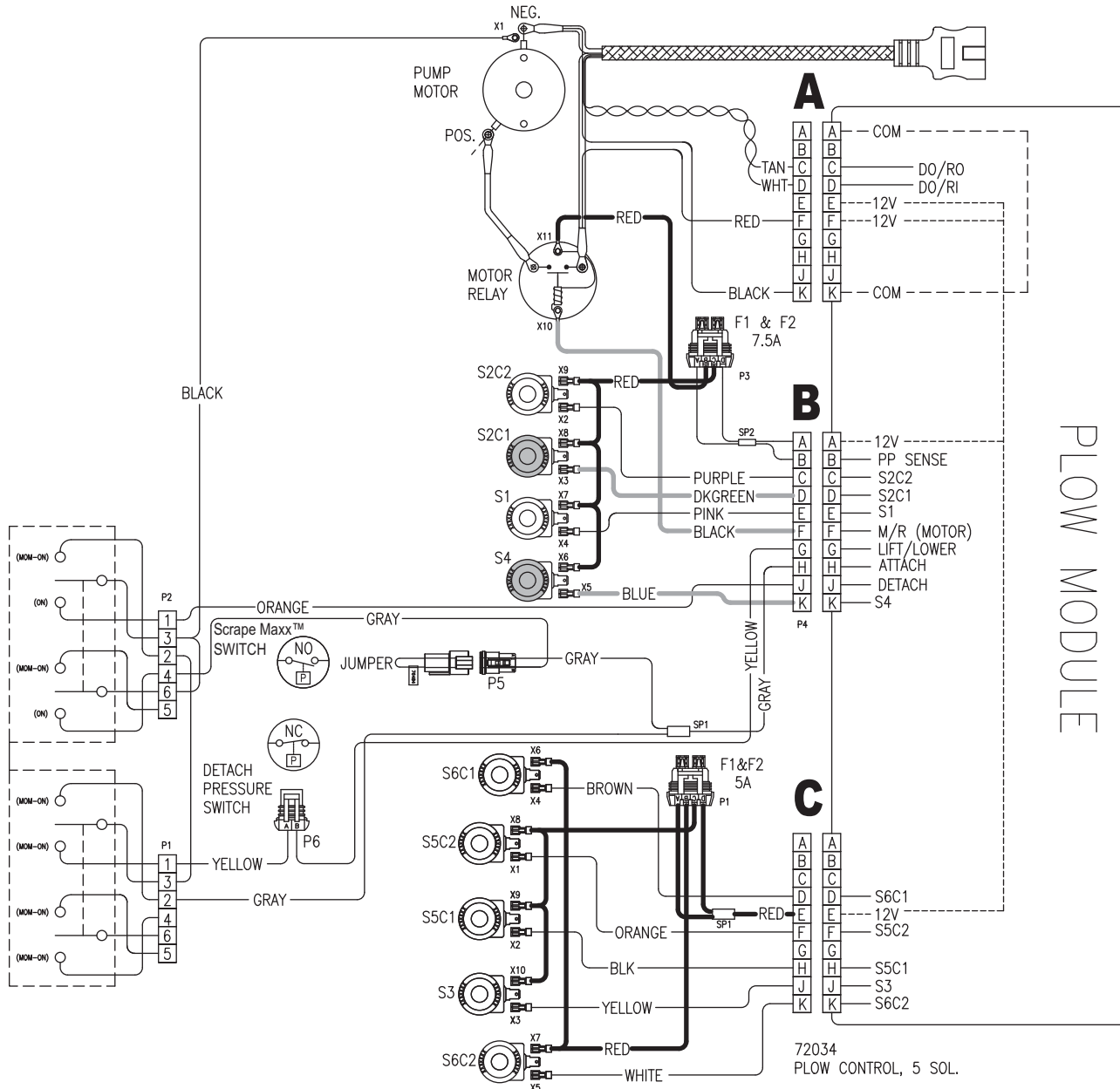


Relief Valve Settings		
RV1	Pump	2250 ± 100 psi
RV3	DS Ram Rod End	2200 ± 100 psi
RV4	PS Ram Rod End	
RV5	DS Ram Base End	3400 ± 100 psi
RV6	PS Ram Base End	



Solenoid		Blade Movement												Scrape Maxx™ FEATURE (OPT)
		RAISE ↑	LOWER ↓	ANGLE RIGHT ↘	ANGLE LEFT ↙	VEE ∧	SCOOP ⌢	RIGHT EXTEND →	RIGHT RETRACT ←	LEFT EXTEND →	LEFT RETRACT ←	ATTACH	DETACH	
Motor	M	ON		ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON
SV08-2211	S1	ON	ON									ON	ON	ON
SV08-47D	S2C1	ON										ON	ON	
	S2C2											ON		
SV10-43	S3			ON	ON									
SV08-2211	S4	ON	ON										ON	
SV08-47C	S5C1				ON	ON					ON			
	S5C2			ON			ON			ON				
SV08-47C	S6C1						ON	ON						
	S6C2					ON			ON					

RAISE – ELECTRICAL

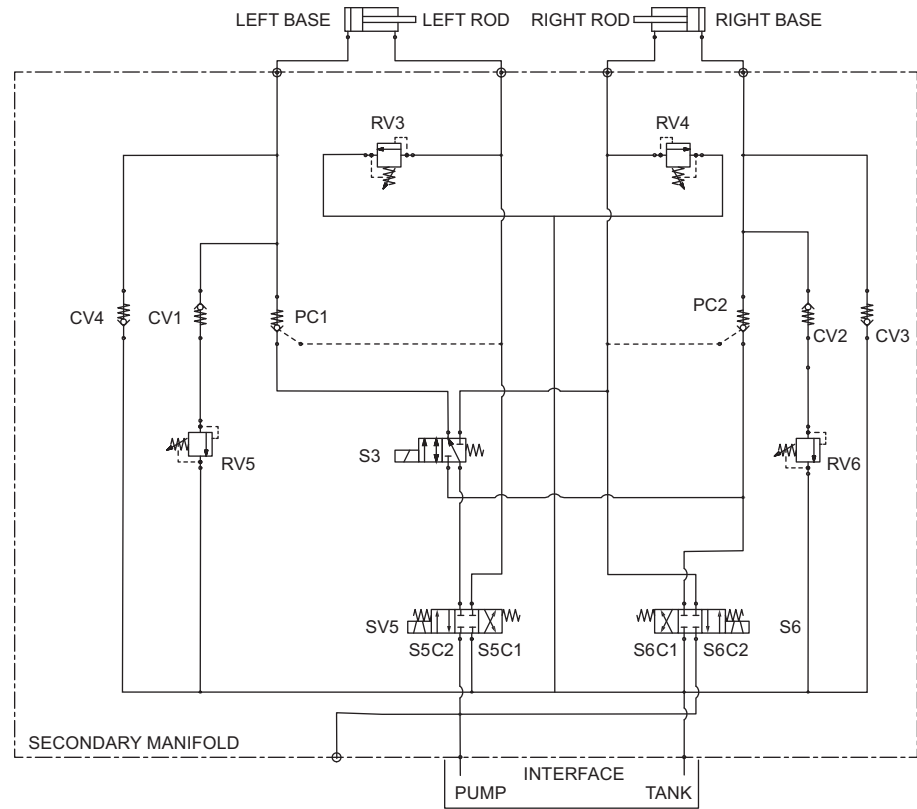
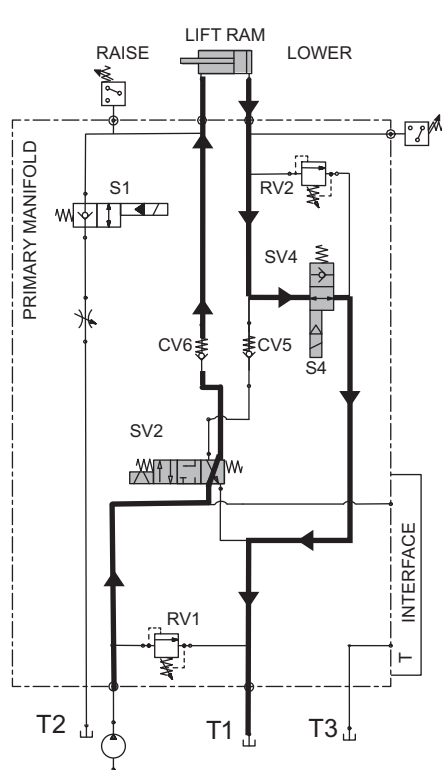


System Response

1. Verify that the **POWER** switch is in the plow position.
2. By activating the RAISE function on the cab control, the control sends a signal to plow module to complete the ground path for the electrical circuit, activating the motor relay and solenoid cartridge valves S2C1 and S4.
3. Hydraulic fluid from the pump flows through the activated S2C1, through CV6 and into the rod end of the lift cylinder, causing the ram to retract. At the same time fluid is forced out of the base of the ram, through the activated S4, and returned to the reservoir.

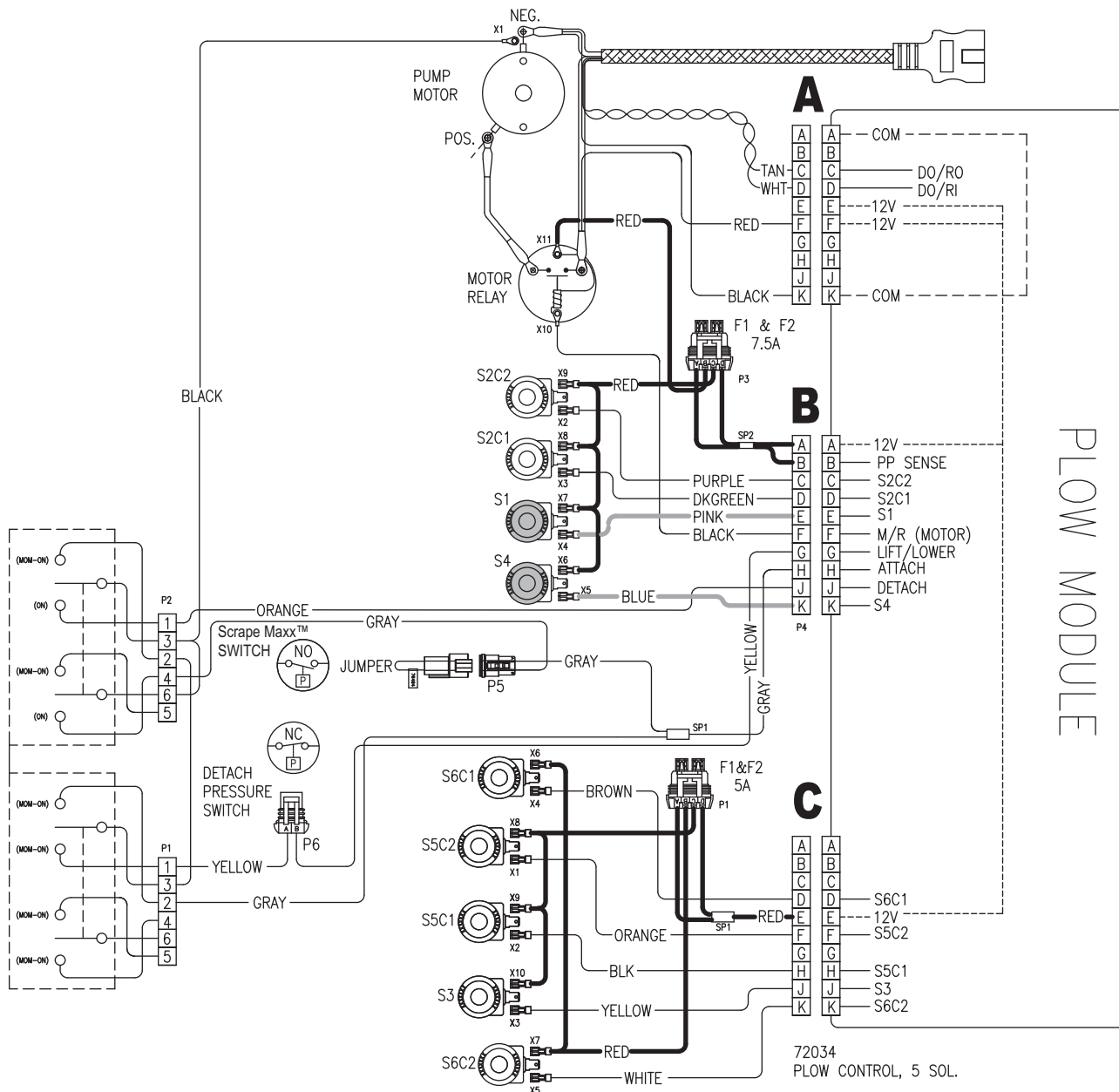
NOTE: Battery voltage is supplied to the plow module, motor relay and the 9 solenoid coils when the snowplow is connected to the vehicle.

RAISE – HYDRAULIC



Solenoid		Blade Movement												
		RAISE ↑	LOWER ↓	ANGLE RIGHT ↘	ANGLE LEFT ↙	VEE ∩	SCOOP ∪	RIGHT EXTEND →	RIGHT RETRACT ←	LEFT EXTEND ↗	LEFT RETRACT ↖	ATTACH	DETACH	Scrape Maxx™ FEATURE (OPT)
Motor	M	ON		ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON
SV08-2211	S1		ON									ON		ON
SV08-47D	S2C1	ON											ON	
	S2C2											ON		
SV10-43	S3			ON	ON									
SV08-2211	S4	ON	ON										ON	
SV08-47C	S5C1				ON	ON					ON			
	S5C2			ON			ON			ON				
SV08-47C	S6C1						ON	ON						
	S6C2					ON			ON					

LOWER/FLOAT – ELECTRICAL



System Response

⚠ WARNING

If Scrape Maxx™ feature is **ENABLED** and vehicle key is ON, the hydraulic unit can turn on temporarily without notice, if the control has been placed in the **LOWER** mode without any further control input.

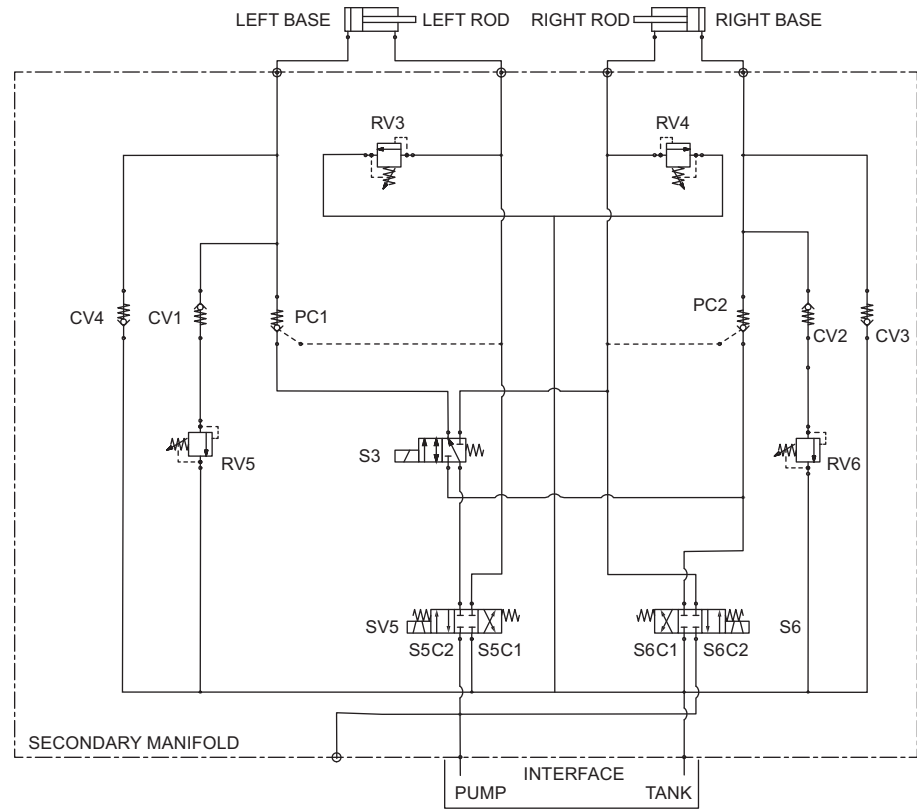
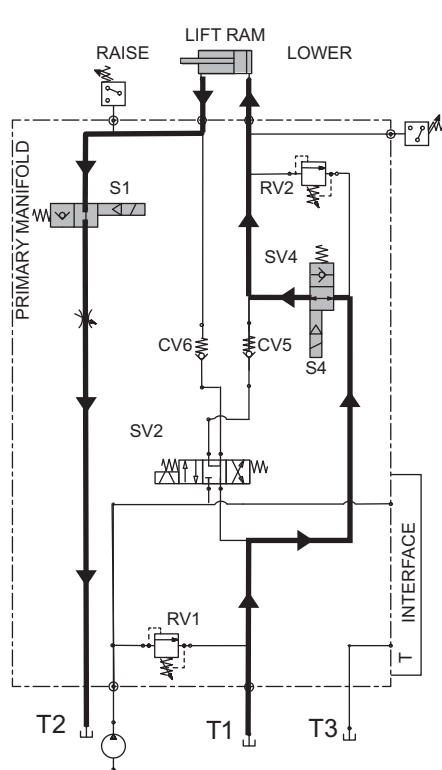
NOTE: For units with the accessory Scrape Maxx down force kit, see that section below.

1. Verify that the POWER switch is in the plow position.
2. 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 valves S1 and S4.
3. With the weight of the snowplow on the rod end of the lift ram and the S1 cartridge valve shifted, the lift ram extends. Hydraulic fluid is pushed out of the rod end through the activated S1 through the quill, and then returned to the reservoir. At the same time fluid is drawn from the reservoir through the activated S4 into the base of the ram, S4 will close after the lower button is released.

NOTE: When the FLOAT mode is active, the S1 cartridge stays open until the RAISE function is activated.

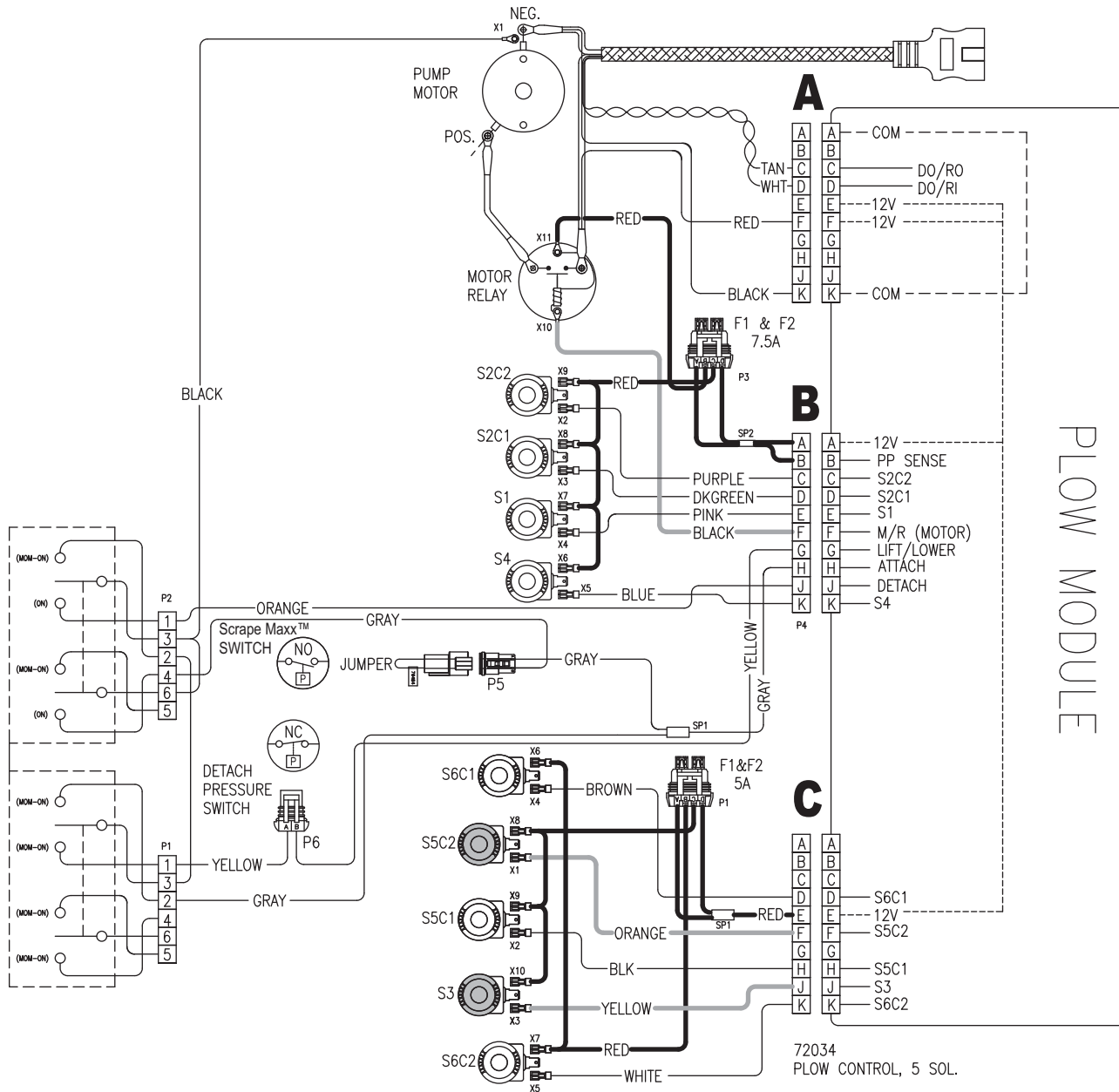
NOTE: Battery voltage is supplied to the plow module, motor relay and the 9 solenoid coils when the snowplow is connected to the vehicle.

LOWER/FLOAT – HYDRAULIC



Solenoid		Blade Movement												
		RAISE ↑	LOWER ↓	ANGLE RIGHT ↘	ANGLE LEFT ↙	VEE ∩	SCOOP ∪	RIGHT EXTEND →	RIGHT RETRACT ←	LEFT EXTEND ↗	LEFT RETRACT ↖	ATTACH	DETACH	Scrape Maxx™ FEATURE (OPT)
Motor	M	ON		ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON
SV08-2211	S1		ON									ON		ON
SV08-47D	S2C1	ON										ON		
	S2C2												ON	
SV10-43	S3			ON	ON									
SV08-2211	S4	ON	ON										ON	
SV08-47C	S5C1				ON	ON					ON			
	S5C2			ON			ON			ON				
SV08-47C	S6C1						ON	ON						
	S6C2					ON			ON					

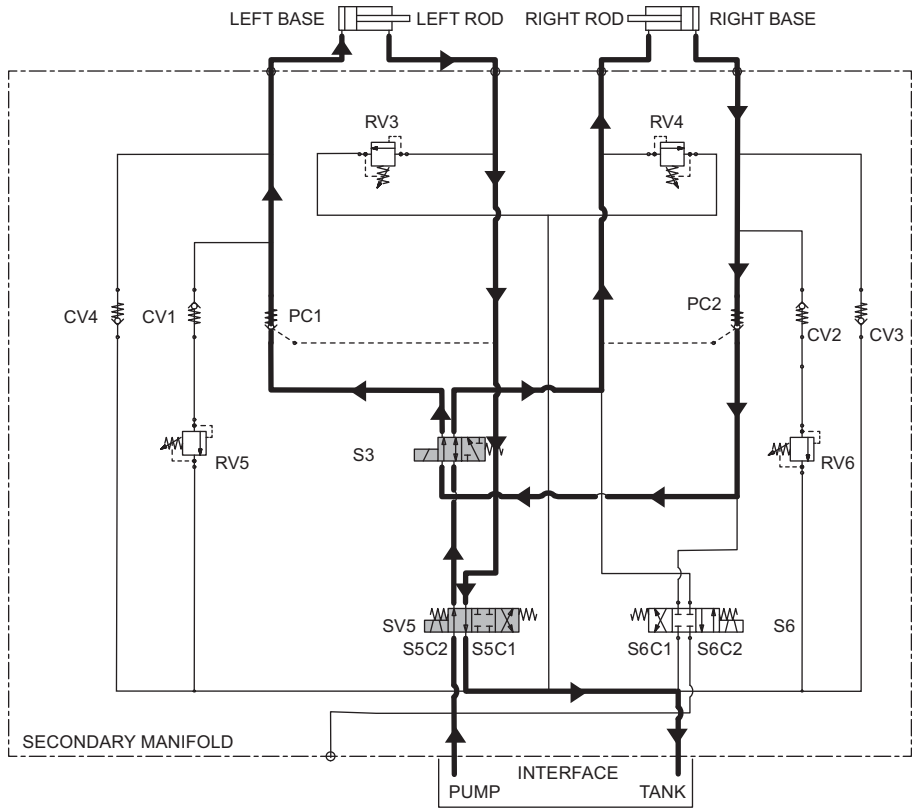
ANGLE RIGHT – ELECTRICAL











System Response

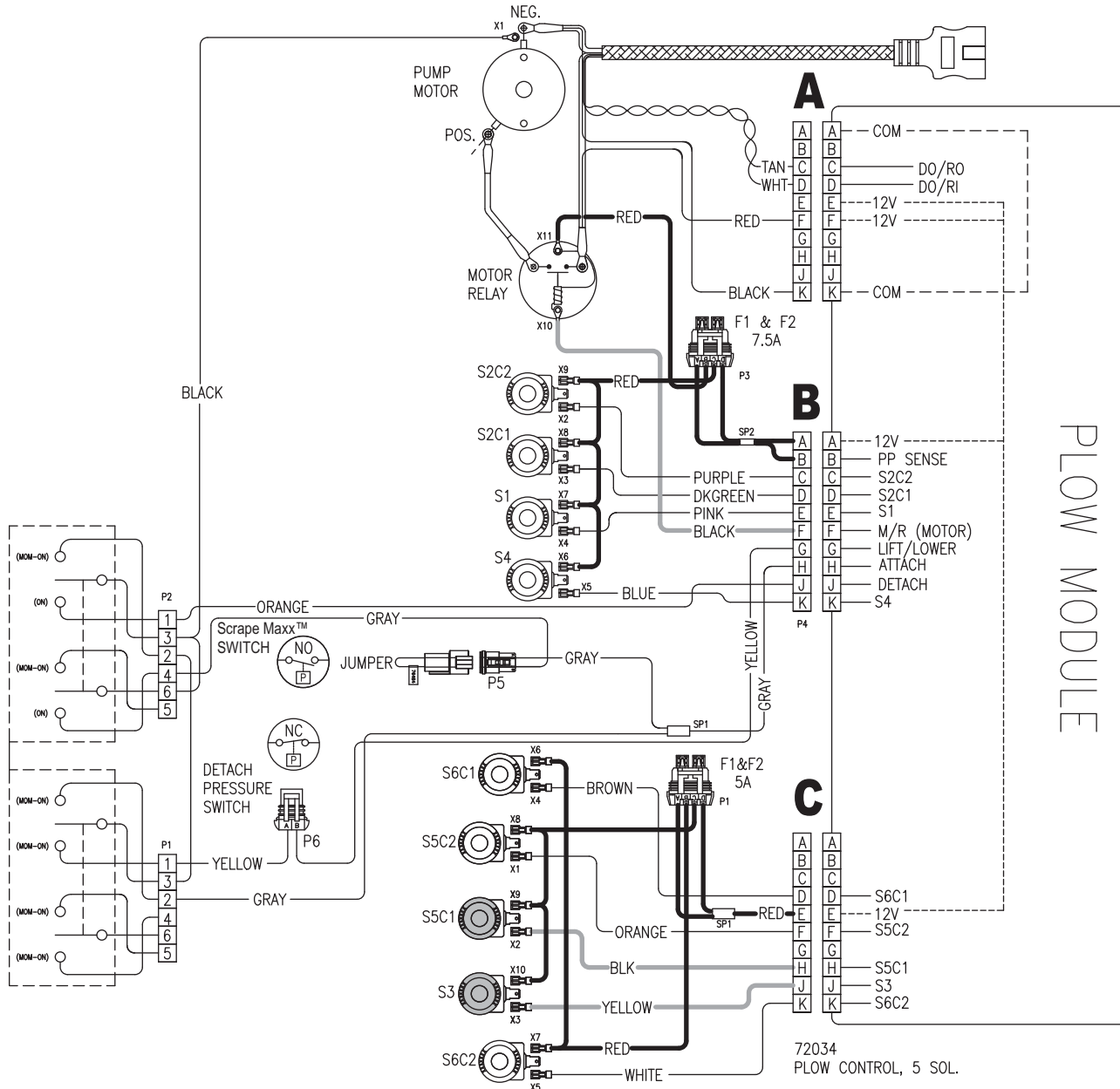
1. Verify that the **POWER** switch is in the plow position.
2. By activating the Angle Right function on the cab control, the control sends a signal to the plow module to complete the ground path for the electrical circuit, activating the motor relay and solenoid cartridge valves S5C2 and S3.
3. Hydraulic fluid from the pump flows through the activated S5C2 and S3 cartridge valves and into the rod end of the right (passenger-side) ram, causing the ram to retract.
4. The retracting right ram pushes hydraulic fluid out of the base end of the ram, through the activated PC2 pilot-operated check valve, back through the activated S3 and through the PC1 valve. The fluid then enters the base end of the left (driver-side) ram, causing the ram to extend.
5. The extending left ram pushes hydraulic fluid out of the rod end of the ram and back through the activated S5C2 to the reservoir.

NOTE: Battery voltage is supplied to the plow module, motor relay and the 9 solenoid coils when the snowplow is connected to the vehicle.



Solenoid		Blade Movement												
		RAISE ↑	LOWER ↓	ANGLE RIGHT 	ANGLE LEFT 	VEE 	SCOOP 	RIGHT EXTEND 	RIGHT RETRACT 	LEFT EXTEND 	LEFT RETRACT 	ATTACH	DETACH	Scrape Maxx™ FEATURE (OPT)
Motor	M	ON		ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON
SV08-2211	S1		ON									ON		ON
SV08-47D	S2C1	ON											ON	
	S2C2											ON		
SV10-43	S3			ON	ON									
SV08-2211	S4	ON	ON										ON	
SV08-47C	S5C1				ON	ON					ON			
	S5C2			ON			ON			ON				
SV08-47C	S6C1						ON	ON						
	S6C2					ON			ON					

ANGLE LEFT – ELECTRICAL

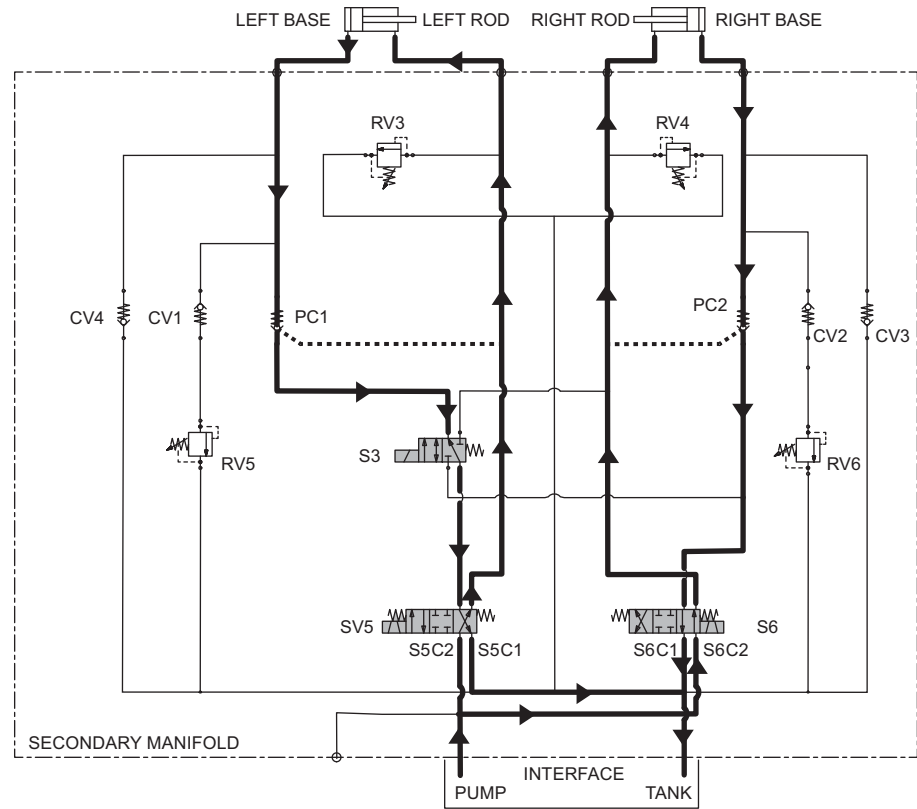
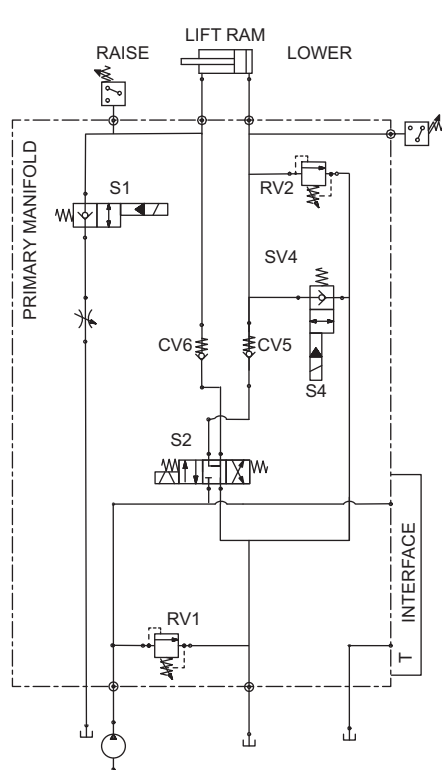


System Response

1. Verify that the **POWER** switch is in the plow position.
2. By activating the Angle Right 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 S5C1 and S3.
3. Hydraulic fluid from the pump flows through the activated S5C1 and S3 cartridge valves and into the rod end of the left (driver-side) ram, causing the ram to retract.
4. The retracting left ram pushes hydraulic fluid out of the base end of the ram, through the activated PC1 pilot-operated check valve, back through the activated S3 and through the PC2 valve. The fluid then enters the base end of the right (passenger-side) ram, causing the ram to extend.
5. The extending left ram pushes hydraulic fluid out of the rod end of the ram and back through the activated S5C1 to the reservoir.

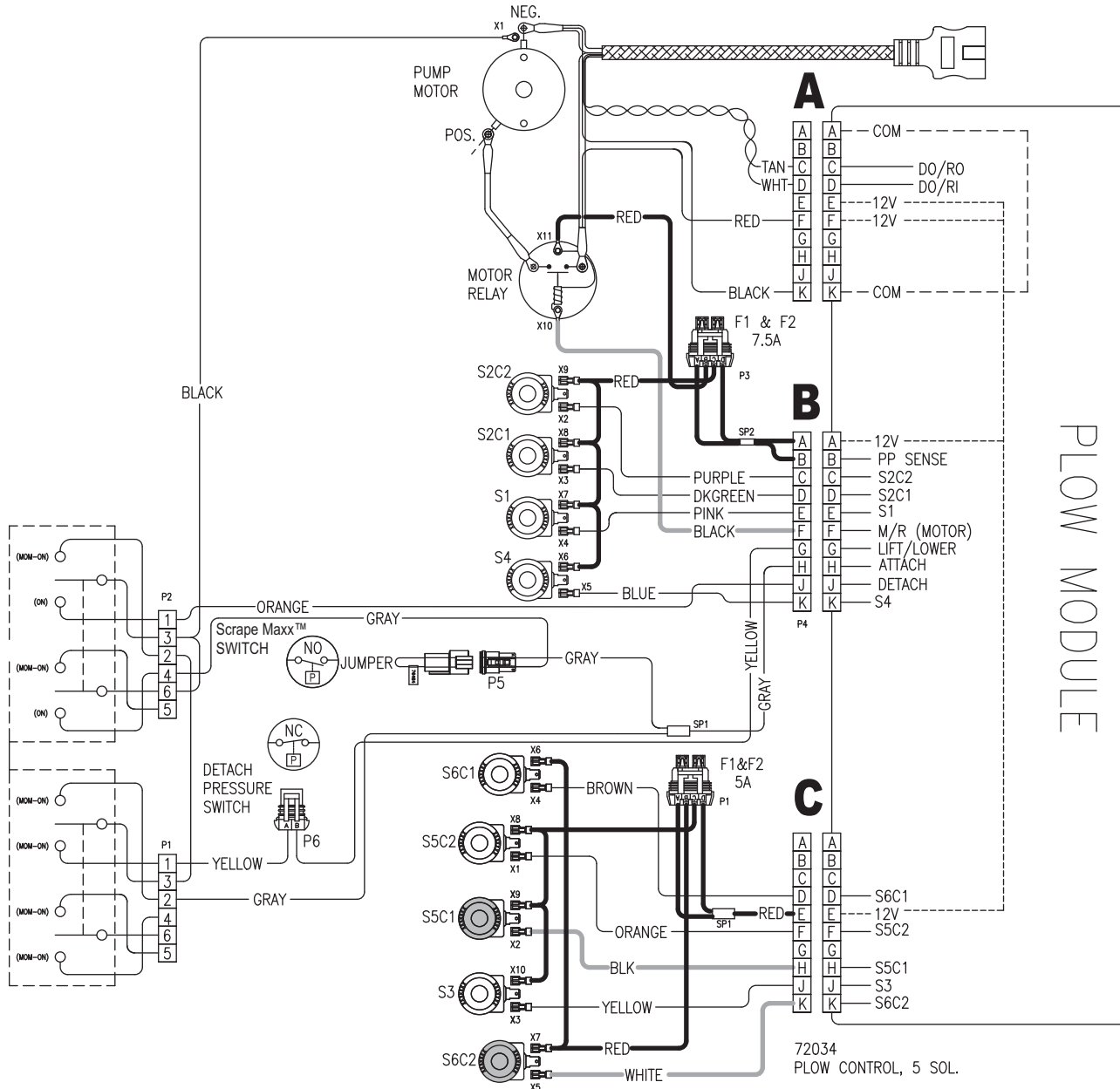
NOTE: Battery voltage is supplied to the plow module, motor relay and the 9 solenoid coils when the snowplow is connected to the vehicle.

ANGLE LEFT – HYDRAULIC



Solenoid		Blade Movement												
		RAISE ↑	LOWER ↓	ANGLE RIGHT ↘	ANGLE LEFT ↙	VEE ∧	SCOOP ∩	RIGHT EXTEND ↗	RIGHT RETRACT ↖	LEFT EXTEND ↗	LEFT RETRACT ↖	ATTACH	DETACH	Scrape Maxx™ FEATURE (OPT)
Motor	M	ON		ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON
SV08-2211	S1		ON									ON		ON
SV08-47D	S2C1	ON											ON	
	S2C2											ON		
SV10-43	S3			ON	ON									
SV08-2211	S4	ON	ON										ON	
SV08-47C	S5C1				ON	ON					ON			
	S5C2			ON			ON			ON				
SV08-47C	S6C1						ON	ON						
	S6C2					ON			ON					

COMPACT (VEE) – ELECTRICAL

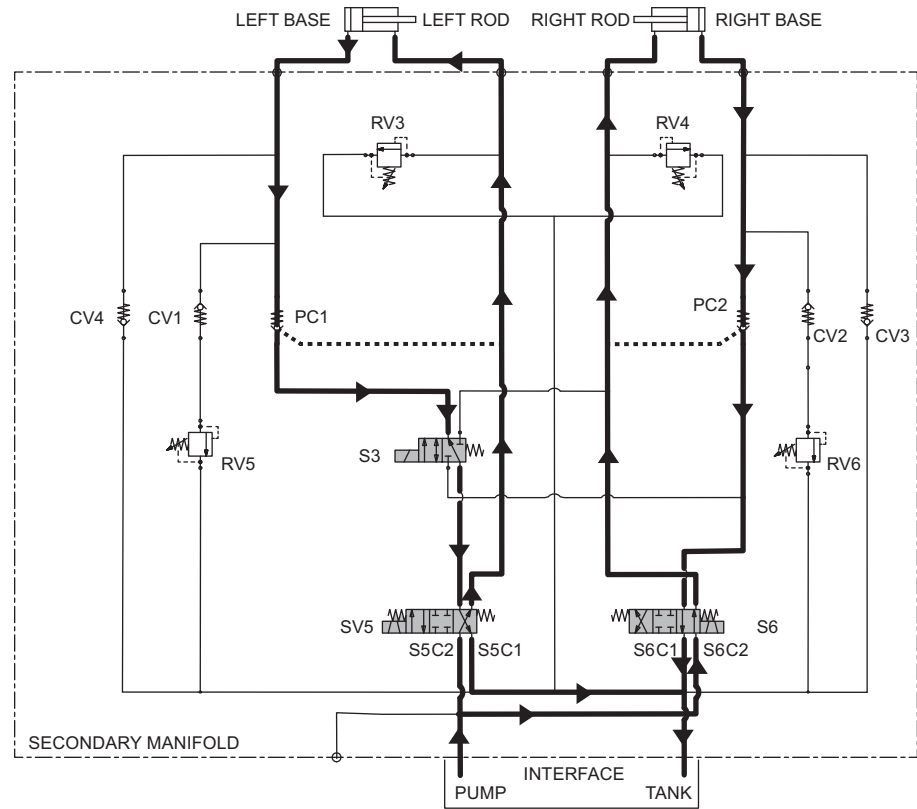
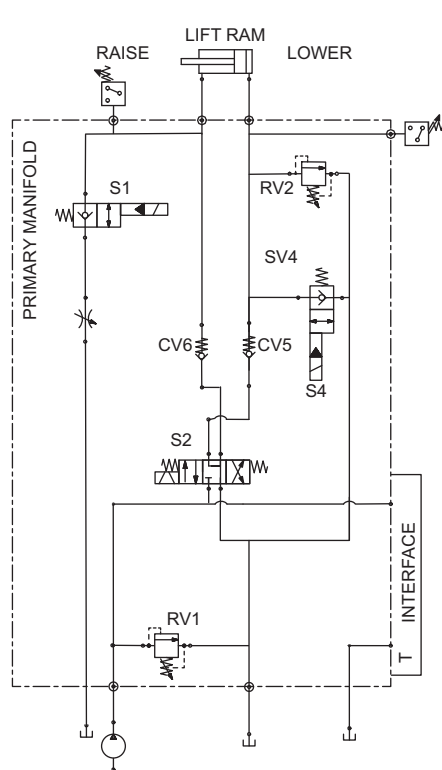


System Response

1. Verify that the **POWER** switch is in the plow position.
2. By activating the COMPACT (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 S5C1 and S6C2.
3. Hydraulic fluid from the pump flows through the activated S5C1 and S6C2 cartridge valves and into the rod end of both the left (driver-side) and the right (passenger-side) rams, causing the rams to retract.
4. Pressure within the hydraulic circuit causes the PC1 and PC2 pilot operated check valves to open.
5. The retracting driver-side ram pushes hydraulic fluid out the base end of the ram, through the activated PC1, through the inactive S3, and back through the activated S5C1 to the reservoir.
6. The retracting passenger-side ram pushes hydraulic fluid out the base end of the ram, through the activated PC2, and back through the activated S6C2 to the reservoir.

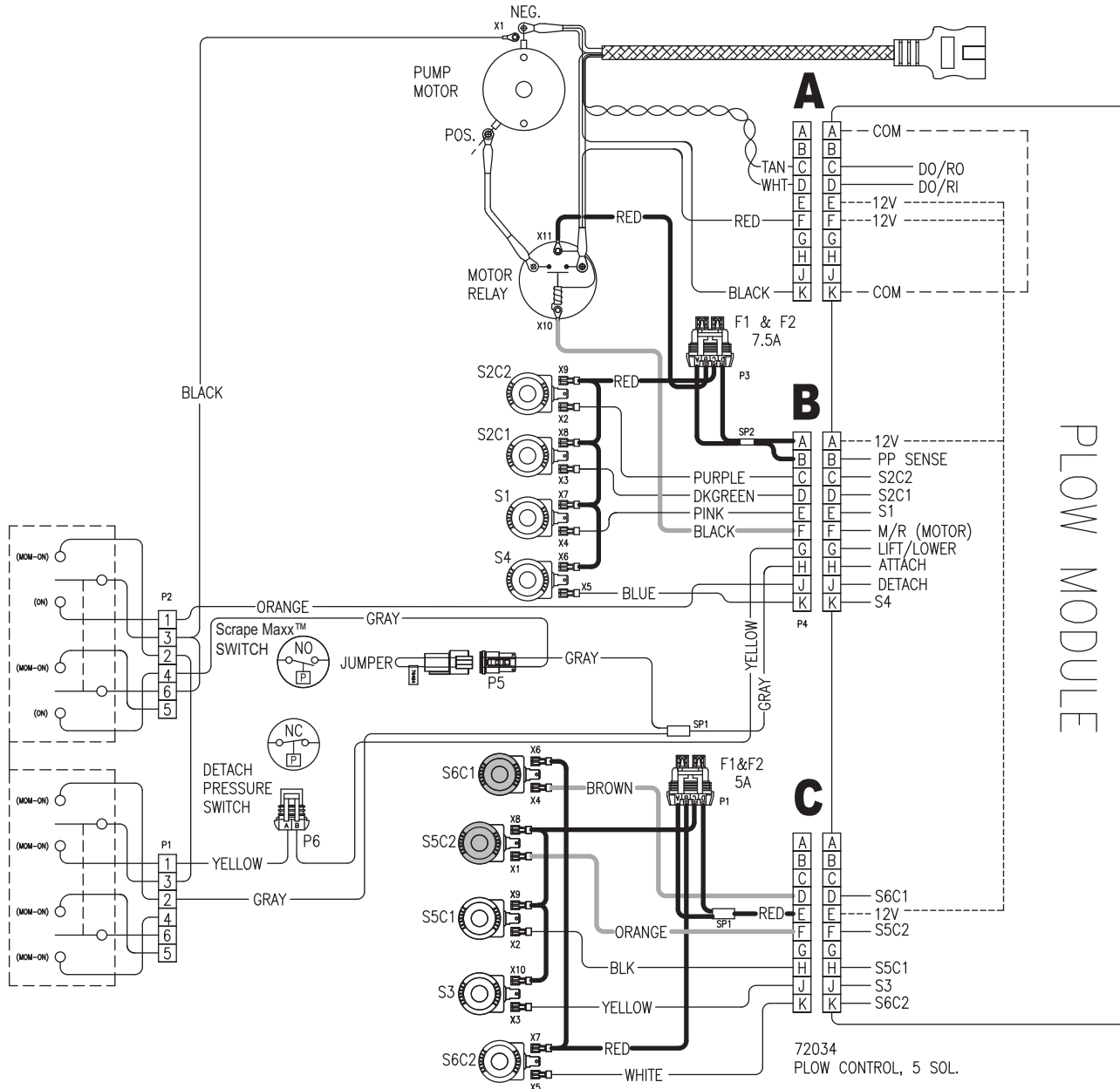
NOTE: Battery voltage is supplied to the plow module, motor relay and the 9 solenoid coils when the snowplow is connected to the vehicle.

COMPACT (VEE) – HYDRAULIC



Solenoid		Blade Movement												
		RAISE ↑	LOWER ↓	ANGLE RIGHT ↘	ANGLE LEFT ↙	VEE ↖	SCOOP ↗	RIGHT EXTEND ↗	RIGHT RETRACT ↖	LEFT EXTEND ↗	LEFT RETRACT ↖	ATTACH	DETACH	Scrape Maxx™ FEATURE (OPT)
Motor	M	ON		ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON
SV08-2211	S1		ON									ON		ON
SV08-47D	S2C1	ON											ON	
	S2C2											ON		
SV10-43	S3			ON	ON									
SV08-2211	S4	ON	ON										ON	
SV08-47C	S5C1				ON	ON					ON			
	S5C2			ON			ON			ON				
SV08-47C	S6C1						ON	ON						
	S6C2					ON			ON					

BUCKET BLADE™ (SCOOP) – ELECTRICAL

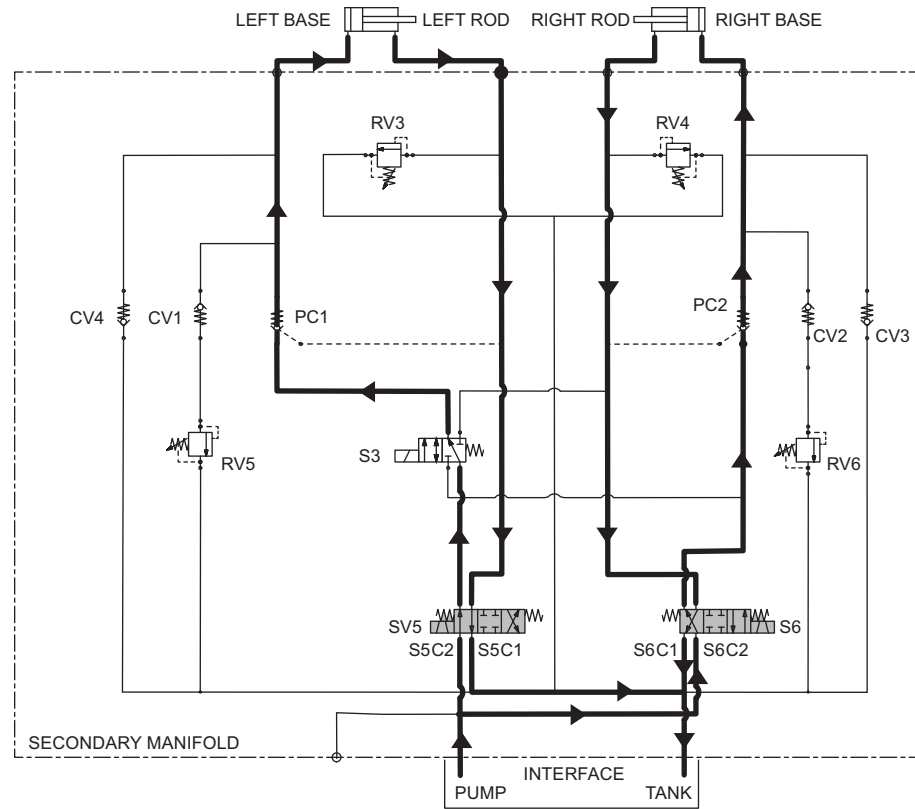
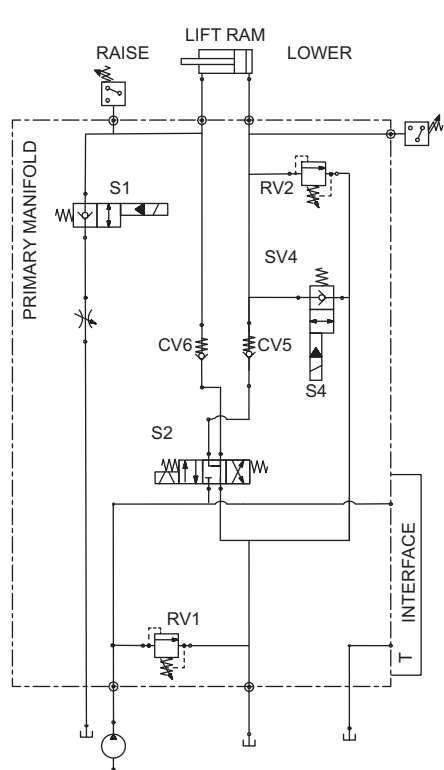


System Response

1. Verify that the **POWER** switch is in the low position.
2. By activating the BUCKET BLADE (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 S5C2 and S6C1.
3. Hydraulic fluid from the pump flows through the activated S5C2, through the S3 (driver-side) ram and S6C1 cartridge valve (passenger-side) then through pilot operated check valves PC1 and PC2 into the base end of both angle rams, causing the rams to extend.
4. The extending driver-side ram pushes hydraulic fluid out of the rod end and back through the activated S5C2 to the reservoir.
5. The extending passenger-side ram pushes hydraulic fluid out of the rod end and back through the activated S6C1 to the reservoir.

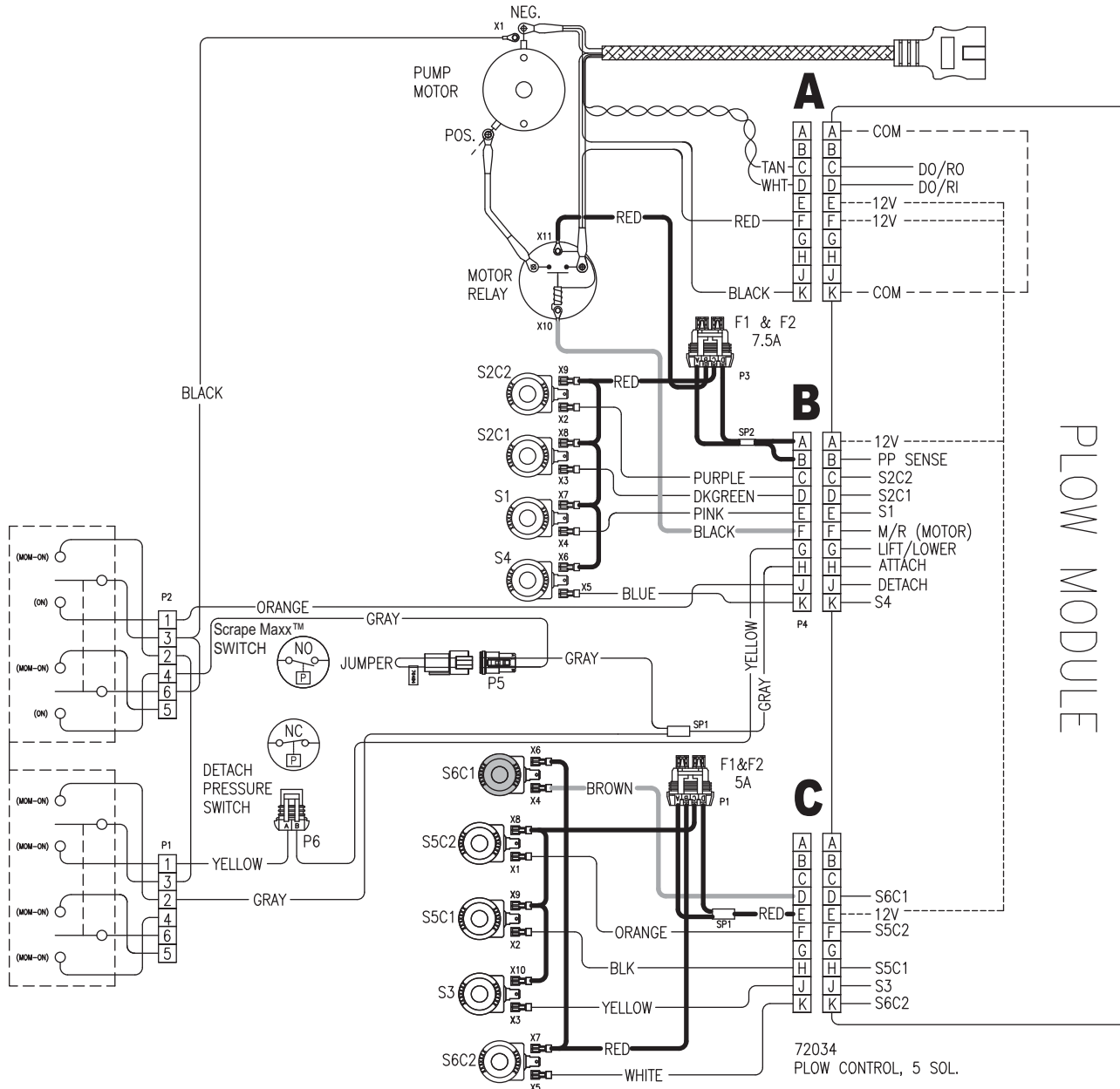
NOTE: Battery voltage is supplied to the plow module, motor relay and the 9 solenoid coils when the snowplow is connected to the vehicle.

BUCKET BLADE™ (SCOOP) – HYDRAULIC



Solenoid		Blade Movement												
		RAISE ↑	LOWER ↓	ANGLE RIGHT ↘	ANGLE LEFT ↙	VEE ∧	SCOOP ↻	RIGHT EXTEND ↗	RIGHT RETRACT ↖	LEFT EXTEND ↗	LEFT RETRACT ↖	ATTACH	DETACH	Scrape Maxx™ FEATURE (OPT)
Motor	M	ON		ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON
SV08-2211	S1		ON									ON		ON
SV08-47D	S2C1	ON											ON	
	S2C2											ON		
SV10-43	S3			ON	ON									
SV08-2211	S4	ON	ON										ON	
SV08-47C	S5C1				ON	ON					ON			
	S5C2			ON			ON			ON				
SV08-47C	S6C1						ON	ON						
	S6C2					ON			ON					

RIGHT (PS) WING EXTEND – ELECTRICAL

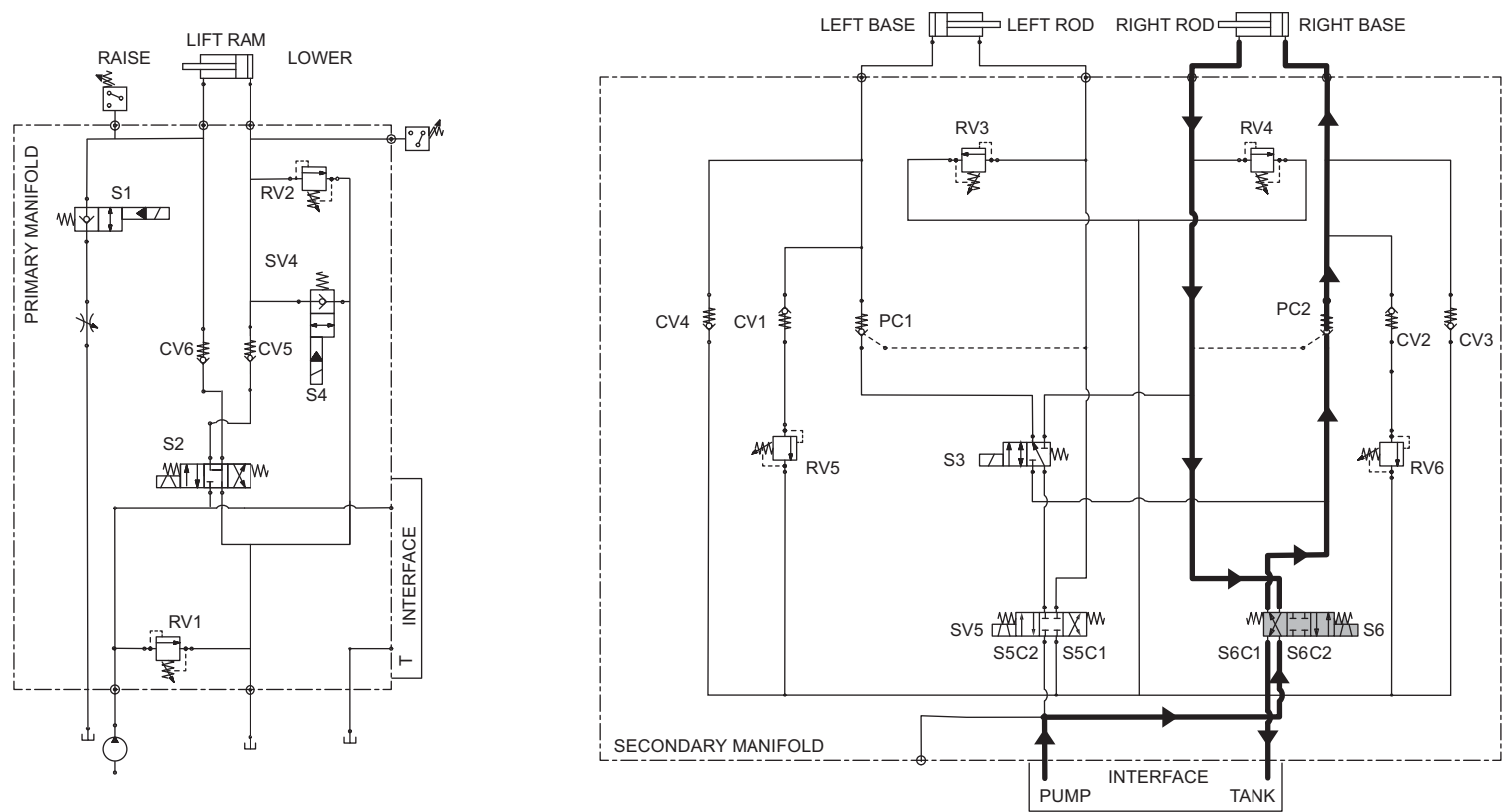


System Response

1. Verify that the **POWER** switch is in the plow position.
2. By activating the Right Wing Extend 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 S6C1.
3. Hydraulic fluid from the pump flows through the activated S6C1 through the pilot operated check valve PC2 into the base end of the passenger side ram, causing it to extend.
4. The extending ram pushes hydraulic fluid out of the rod end and back through the activated S6C1 to the reservoir.

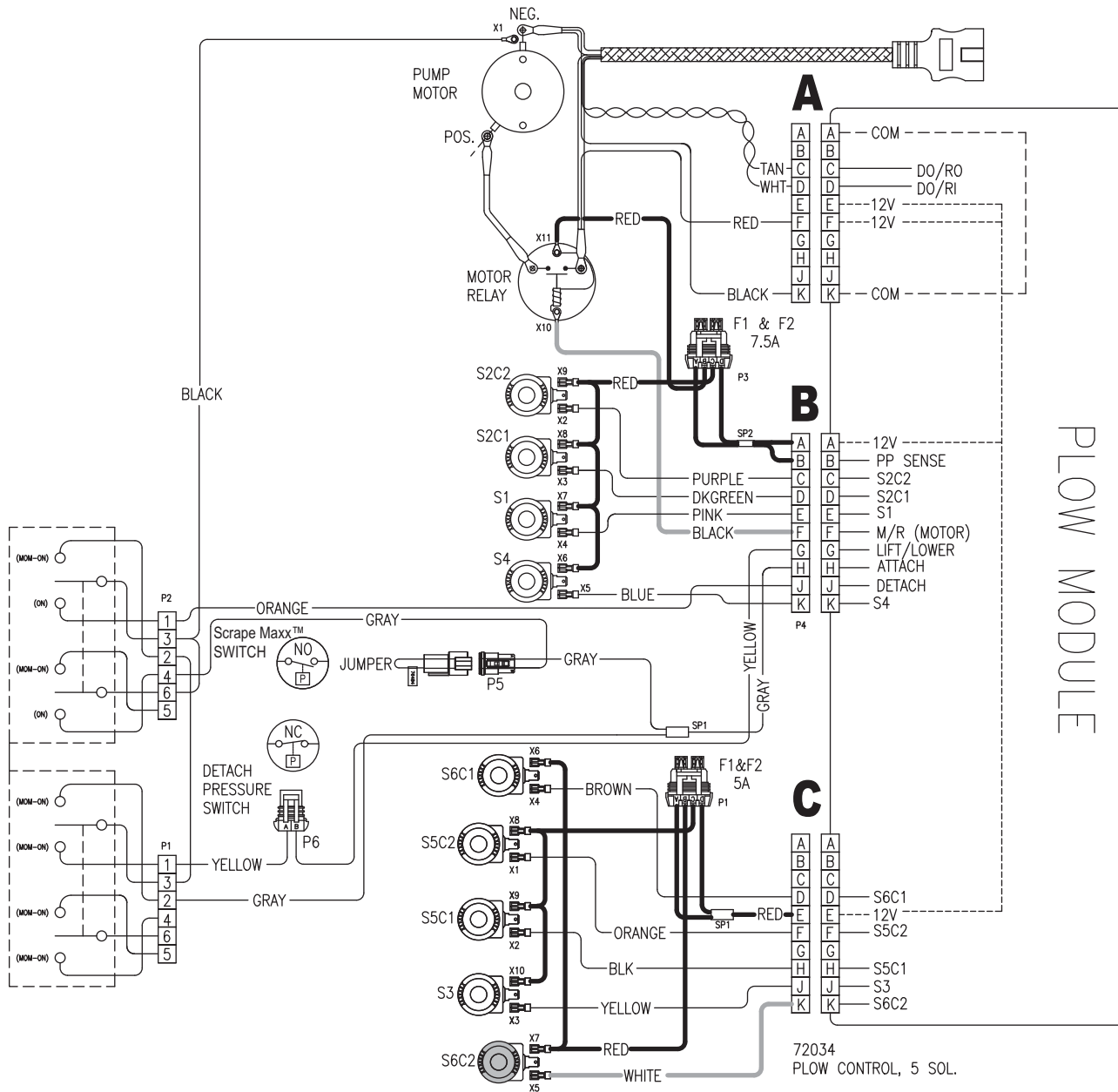
NOTE: Battery voltage is supplied to the plow module, motor relay and the 9 solenoid coils when the snowplow is connected to the vehicle.

RIGHT (PS) WING EXTEND – HYDRAULIC



Solenoid		Blade Movement												
		RAISE ↑	LOWER ↓	ANGLE RIGHT ↘	ANGLE LEFT ↙	VEE ∧	SCOOP ⌒	RIGHT EXTEND →	RIGHT RETRACT ←	LEFT EXTEND ↶	LEFT RETRACT ↷	ATTACH	DETACH	Scrape Maxx™ FEATURE (OPT)
Motor	M	ON		ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON
SV08-2211	S1		ON									ON		ON
SV08-47D	S2C1	ON											ON	
	S2C2											ON		
SV10-43	S3			ON	ON									
SV08-2211	S4	ON	ON										ON	
SV08-47C	S5C1				ON	ON					ON			
	S5C2			ON			ON			ON				
SV08-47C	S6C1						ON							
	S6C2					ON		ON						

RIGHT (PS) WING RETRACT – ELECTRICAL

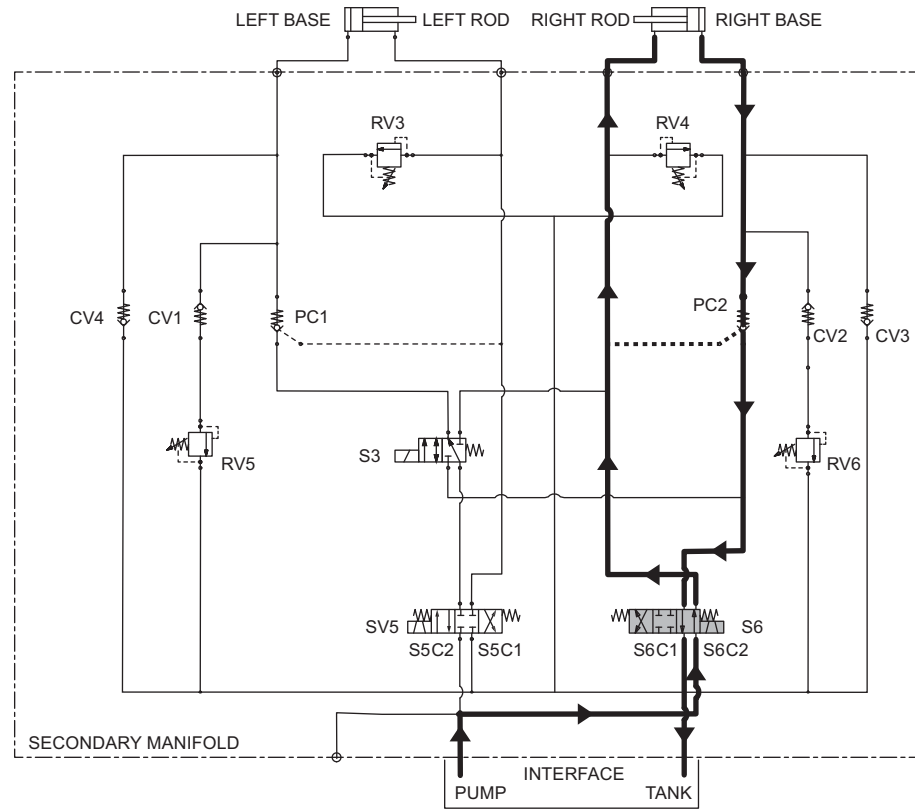
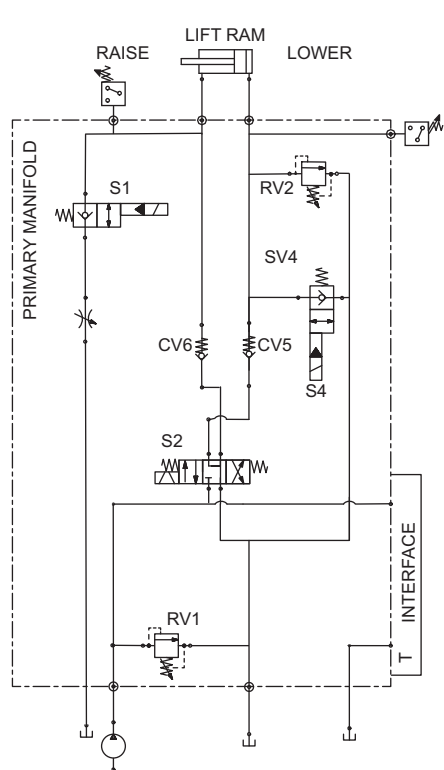


System Response

1. Verify that the **POWER** switch is in the plow position.
2. By activating the Right Wing Retract 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 S6C2.
3. Pressure within the hydraulic circuit causes the PC2 pilot operated check valve to open.
4. Hydraulic fluid from the pump flows through the activated S6C2 into the rod end of the passenger-side ram, causing it to retract hydraulic fluid flows through the open pilot operated check valve PC2 and back through the activated S6C2 to the reservoir.

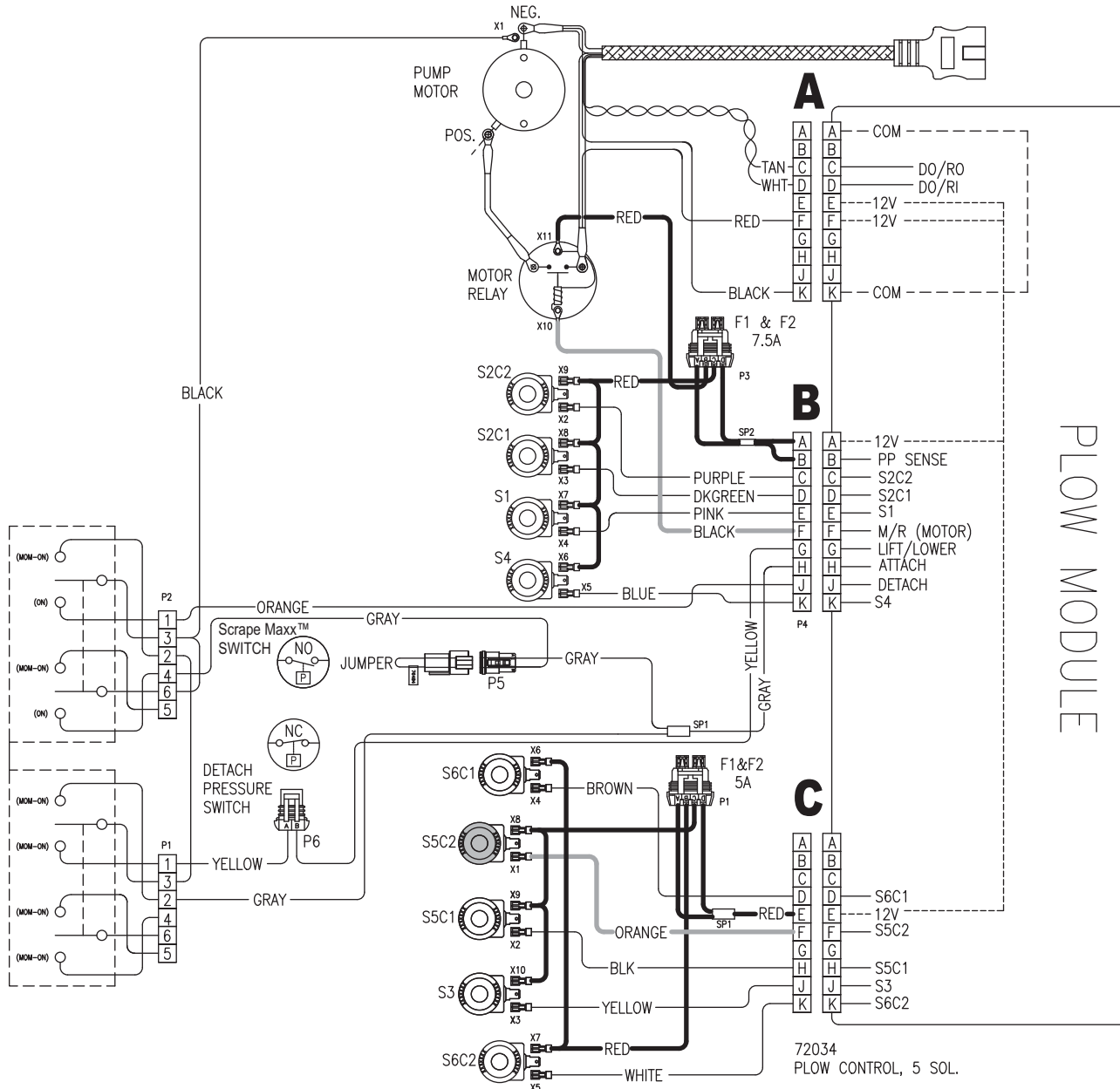
NOTE: Battery voltage is supplied to the plow module, motor relay and the 9 solenoid coils when the snowplow is connected to the vehicle.

RIGHT (PS) WING RETRACT – HYDRAULIC



Solenoid		Blade Movement												
		RAISE ↑	LOWER ↓	ANGLE RIGHT ↘	ANGLE LEFT ↙	VEE ∧	SCOOP ⌢	RIGHT EXTEND →	RIGHT RETRACT ←	LEFT EXTEND →	LEFT RETRACT ←	ATTACH	DETACH	Scrape Maxx™ FEATURE (OPT)
Motor	M	ON		ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON
SV08-2211	S1		ON									ON		ON
SV08-47D	S2C1	ON										ON		
	S2C2												ON	
SV10-43	S3			ON	ON									
SV08-2211	S4	ON	ON										ON	
SV08-47C	S5C1				ON	ON					ON			
	S5C2			ON			ON			ON				
SV08-47C	S6C1						ON	ON						
	S6C2					ON			ON					

LEFT (DS) WING EXTEND – ELECTRICAL

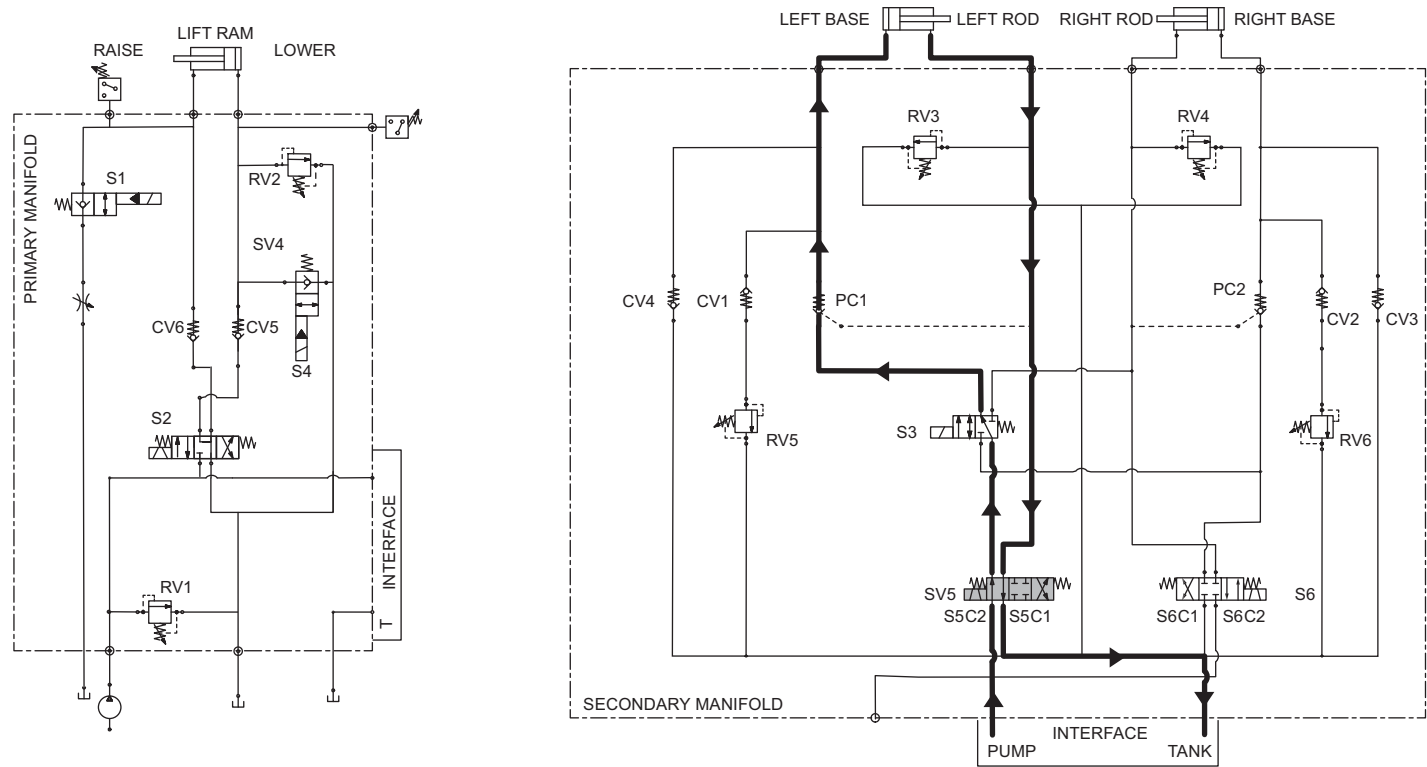












System Response

1. Verify that the **POWER** switch is in the plow position.
2. By activating the Left Wing Extend 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 S5C2.
3. Hydraulic fluid from the pump flows through the activated S5C2 through S3 and the pilot operated check valve PC1 into the base end of the passenger-side ram, causing it to extend.
4. The extending ram pushes hydraulic fluid out of the rod end and back through the activated S5C2 to the reservoir.

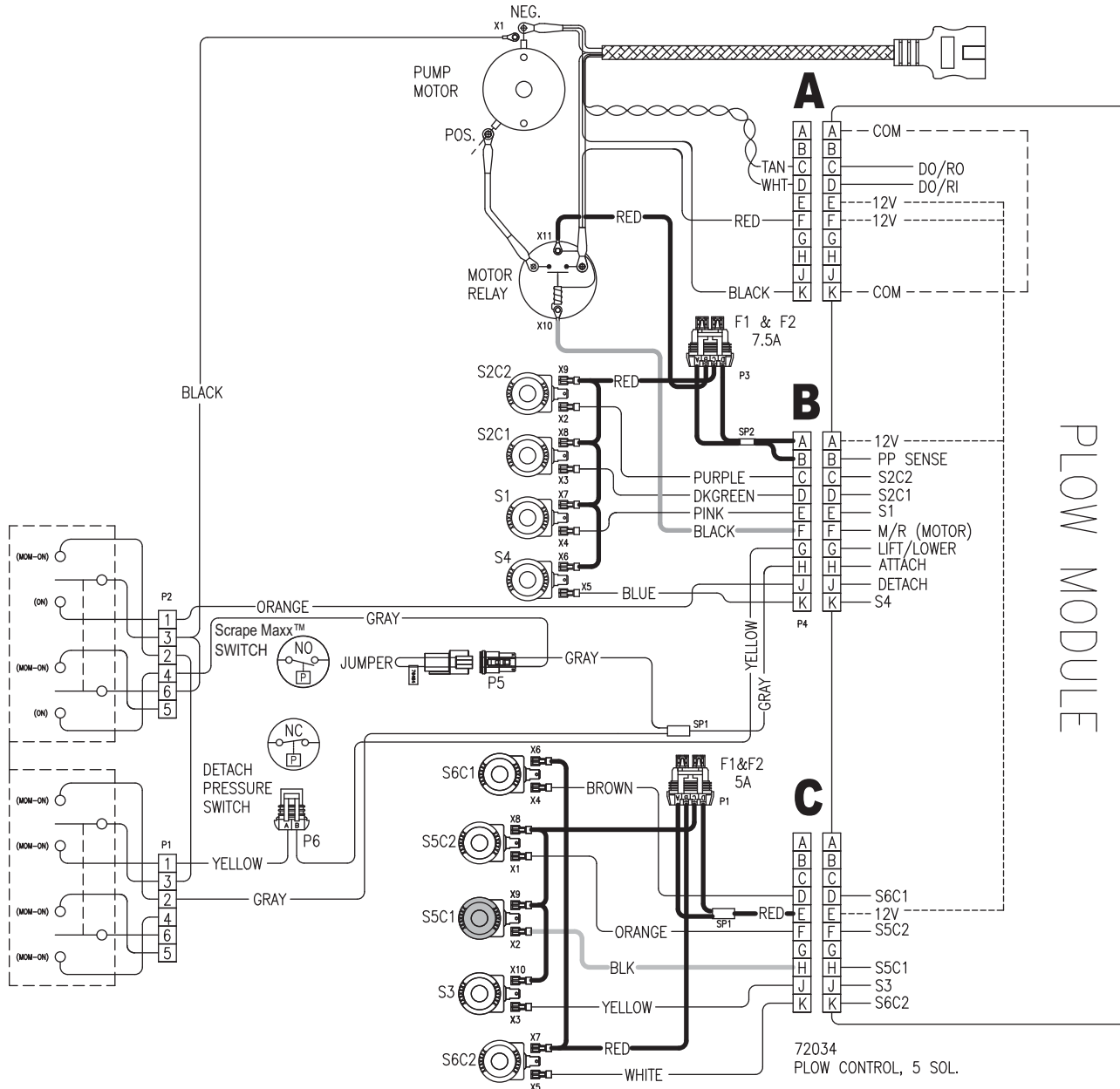
NOTE: Battery voltage is supplied to the plow module, motor relay and the 9 solenoid coils when the snowplow is connected to the vehicle.

LEFT (DS) WING EXTEND – HYDRAULIC



Solenoid		Blade Movement												
												ATTACH	DETACH	Scrape Maxx™ FEATURE (OPT)
Motor	M	ON		ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON
SV08-2211	S1		ON									ON		ON
SV08-47D	S2C1	ON											ON	
	S2C2											ON		
SV10-43	S3			ON	ON									
SV08-2211	S4	ON	ON										ON	
SV08-47C	S5C1				ON	ON					ON			
	S5C2			ON			ON			ON				
SV08-47C	S6C1						ON	ON						
	S6C2					ON			ON					

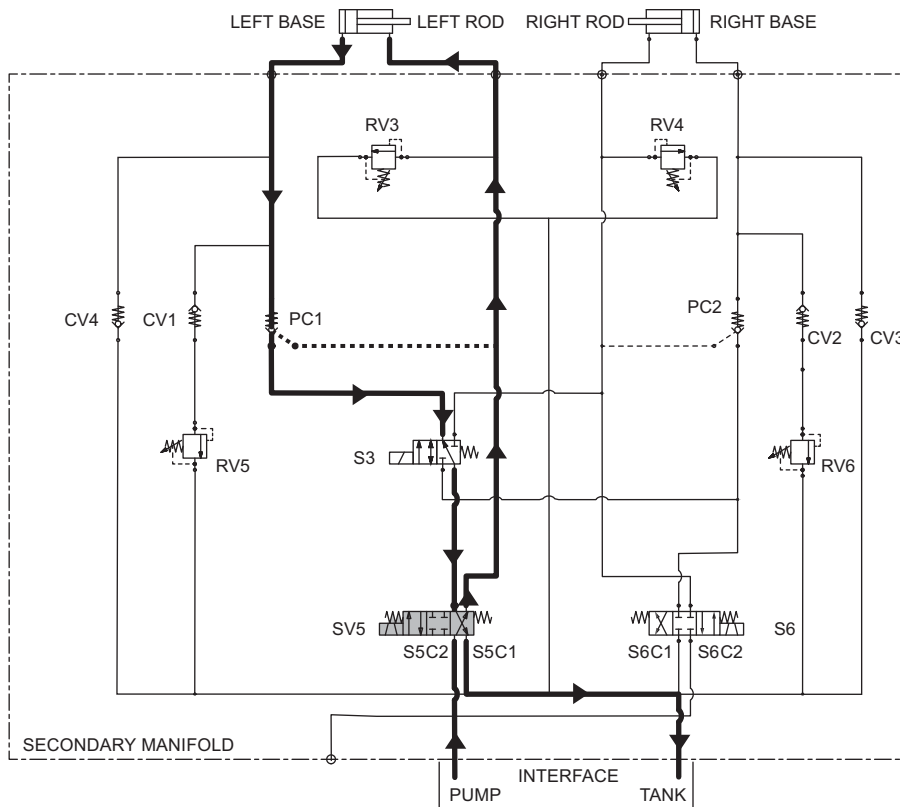
LEFT (DS) WING RETRACT – ELECTRICAL



System Response

1. Verify that the **POWER** switch is in the plow position.
2. By activating the Left Wing Retract 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 S5C1.
3. Pressure within the hydraulic circuit causes the PC1 pilot operated check valve to open.
4. Hydraulic fluid from the pump flows through the activated S5C1 into the rod end of the driver-side ram, causing it to retract, hydraulic fluid flows through the open pilot operated check valve PC1 and back through the activated S5C1 to the reservoir.

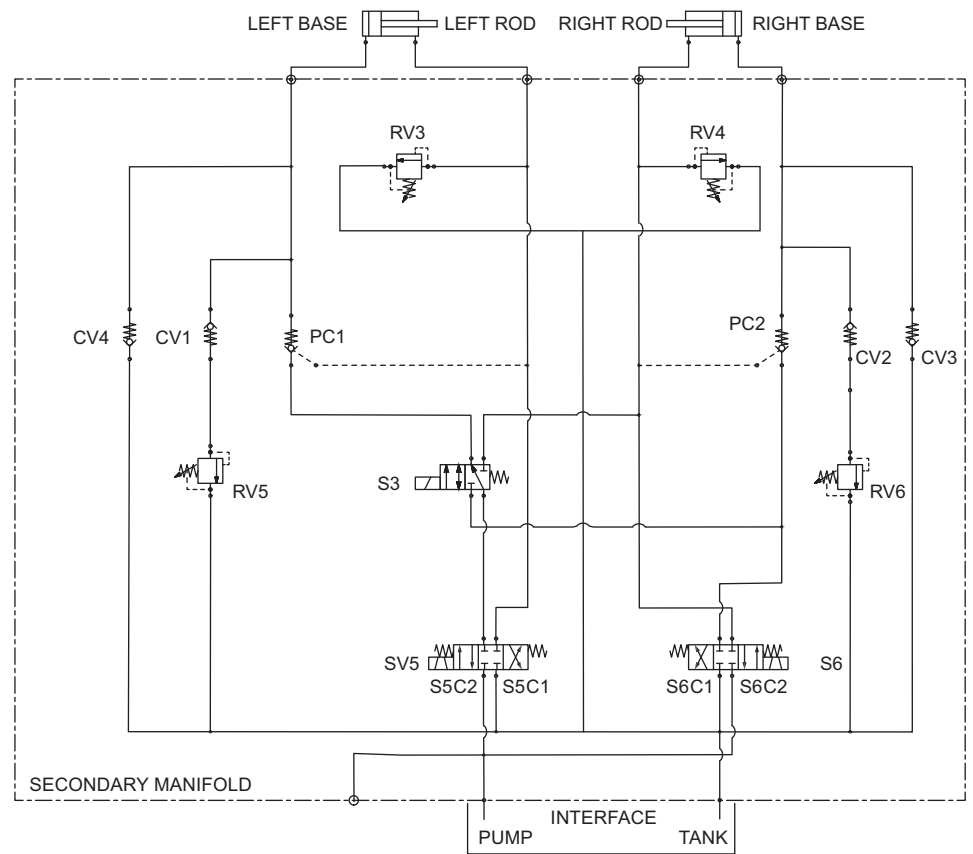
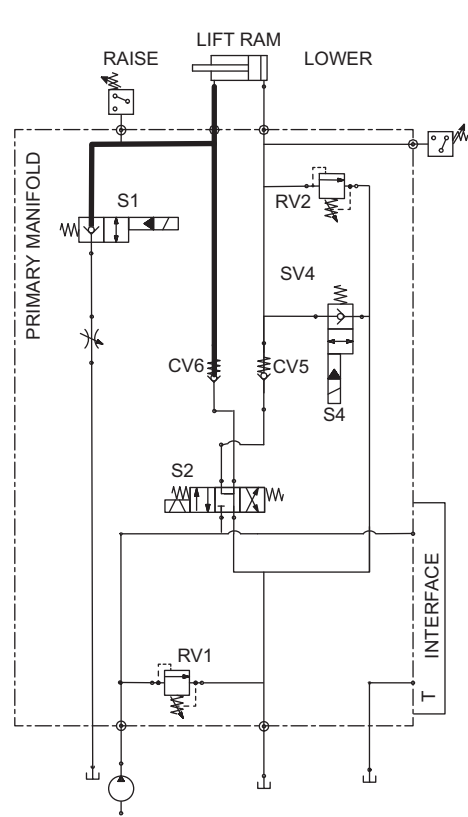
NOTE: Battery voltage is supplied to the plow module, motor relay and the 9 solenoid coils when the snowplow is connected to the vehicle.



HOLD IN RAISE POSITION

System Response

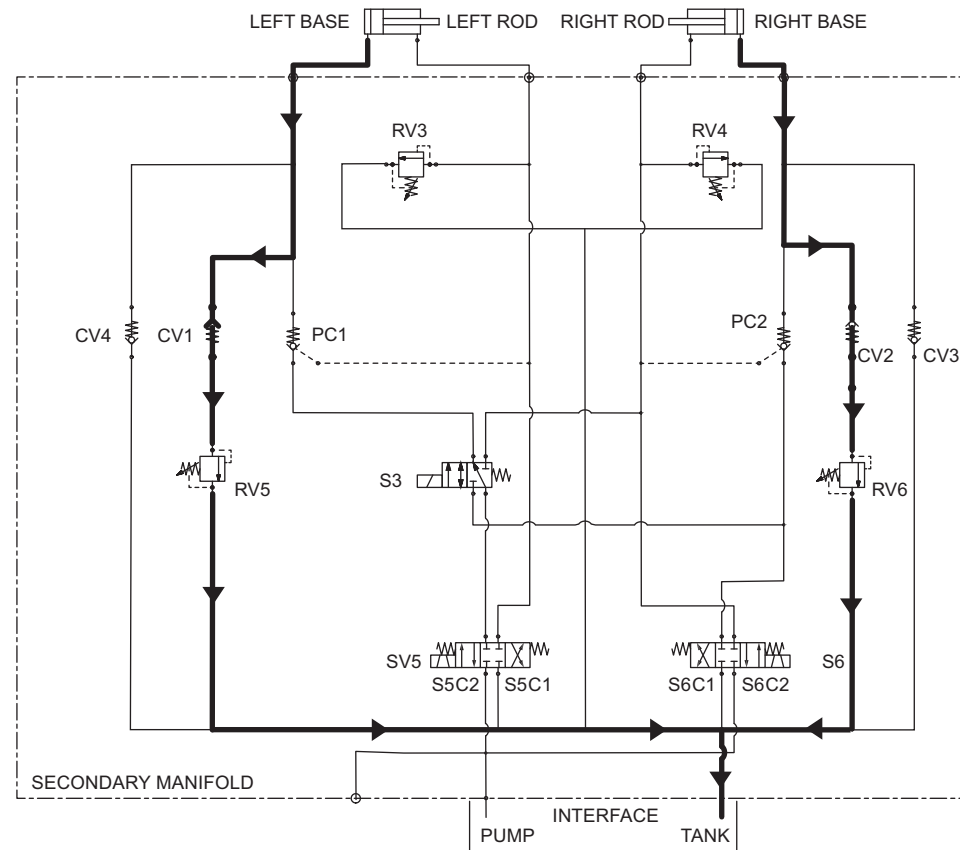
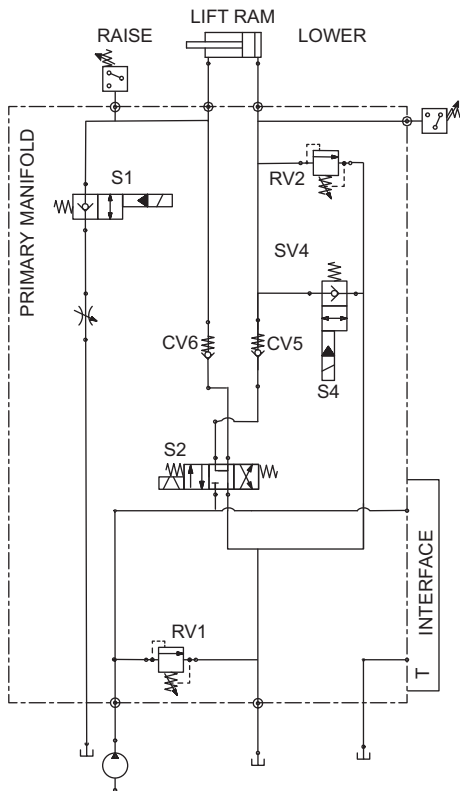
Hydraulic fluid is trapped in the rod end of the lift ram by the solenoid cartridge valve S1 and check valve CV6.



STRIKING AN OBJECT WHILE PLOWING FORWARD – HYDRAULIC

System Response

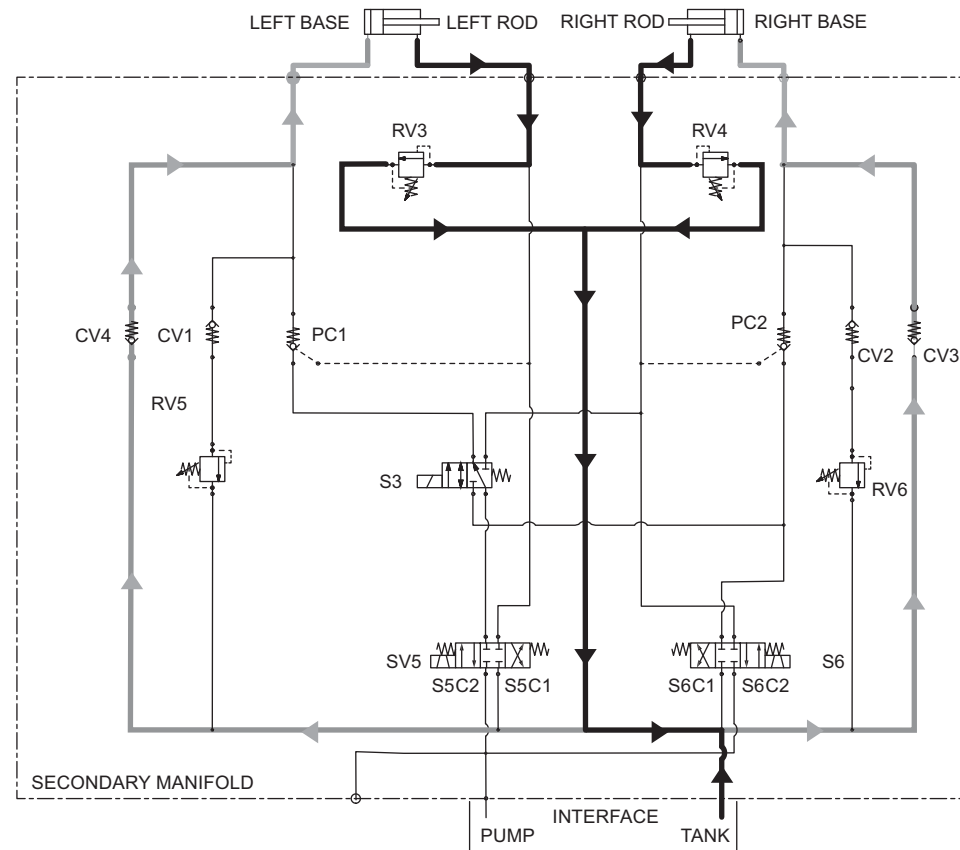
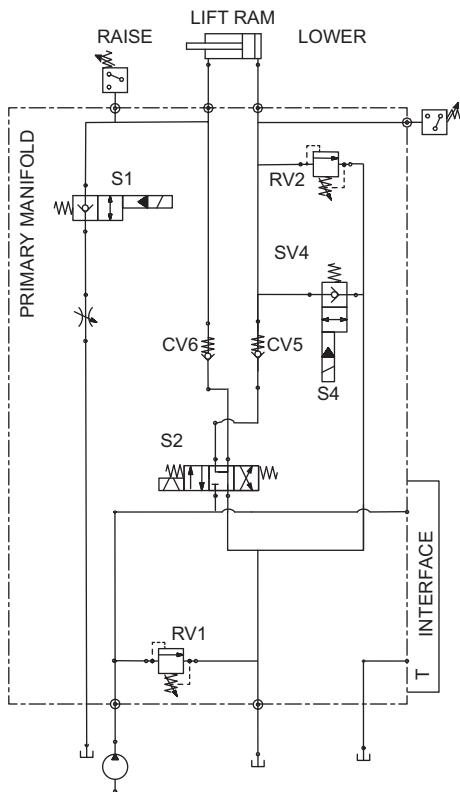
1. Hydraulic fluid is trapped in the base end of the driver-side ram by the CV4 check valve, RV5 relief valve, and PC1 pilot-operated check valve.
2. Hydraulic fluid is trapped in the base end of the passenger-side ram by the CV3 check valve, RV6 relief valve, and PC2 pilot-operated check valve.
3. When the snowplow contacts an object while plowing, the force of the impact increases hydraulic pressure in the base end of the ram. When the pressure exceeds 3400 psi, the ram's base-end relief valve opens (RV5 on the driver's side, RV6 on the passenger's side), allowing fluid to flow back to the reservoir.
4. Due to the small volume on the rod side of the piston, fluid is not replaced. This causes a slight temporary vacuum in that circuit.



STRIKING AN OBJECT WHILE BACK DRAGGING – HYDRAULIC

System Response

1. Hydraulic fluid is trapped in the rod end of the driver-side ram by the inactivated S4 solenoid cartridge valve and the RV3 rod-end relief valve.
2. Hydraulic fluid is trapped in the rod end of the passenger-side ram by the inactivated S3 solenoid cartridge valve and RV4 rod-end relief 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 the pressure exceeds 2200 psi, the ram's rod-end relief valve opens (RV3 on the driver's side, RV4 on the passenger's side), allowing fluid to flow into the ram's base end.
4. Because of differential volume on either side of the ram's piston, fluid is drawn from the reservoir through CV4 (on the driver's side) or CV3 (on the passenger's side) to the base end of the ram.



DETACH – HYDRAULIC

System Response

NOTE: Read instructions for complete detachment.

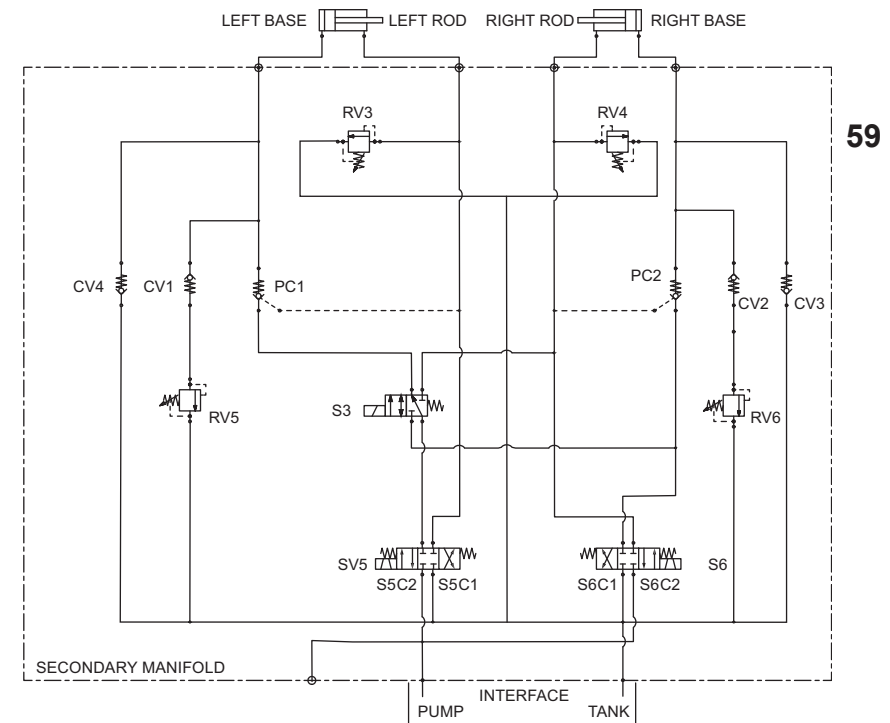
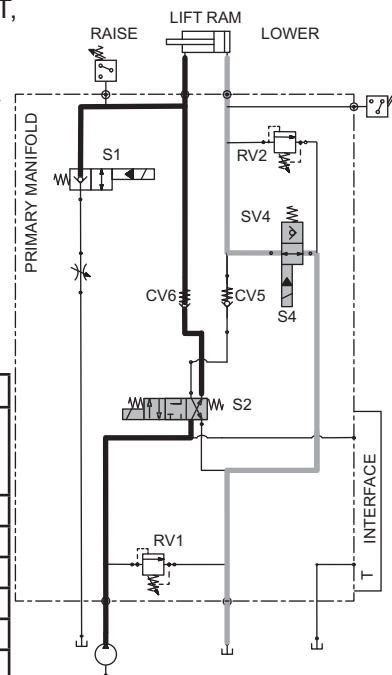
1. Control must be connected and turned OFF.
2. With electrical harness connected. Move the POWER switch (top switch) to center or OFF position (ON, OFF, MOM-ON).
3. Push and hold the POWER switch to the RIGHT, this sends ground to the ATTACH/DETACH switch (MOM-ON, OFF, MOM-ON). By holding this switch to the LEFT, ground is sent down the YELLOW wire to the plow module port B. The module then completes the ground path to the motor relay and solenoid cartridge valves S2C1 and S4.

4. Hydraulic fluid from the pump flows through the activated S2C1 cartridge valve, through CV6 into the rod end of the lift ram, causing the ram to retract.
5. The retracting ram pushes hydraulic fluid out of the base end of the cylinder through the activated S4 cartridge valve and back into the reservoir.

6. Retracting the cylinder moves the headgear forward, dropping the stand. Once the stand contacts the ground and hydraulic pressure reaches 550 psi at the rod end of the lift cylinder, pressure switch (PSW1) will open the electrical circuit, turning the hydraulic unit OFF.

NOTE: Battery voltage is supplied to the plow module, motor relay, and the 9 solenoid coils when the snowplow is connected to the vehicle.

BLADE MOVEMENT				
Solenoid		ATTACH	DETACH	Scrape Maxx™ FEATURE (OPT)
Motor	M	ON	ON	ON
SV08-2211	S1	ON	ON	ON
SV08-47D	S2C1	ON	ON	
	S2C2	ON		
SV10-43	S3			
SV08-2211	S4		ON	
SV08-47C	S5C1			
	S5C2			
SV08-47C	S6C1			
	S6C2			



ATTACH – HYDRAULIC

System Response

NOTE: Read instructions for complete attachment.

- Control must be connected and turned OFF.
- Move the POWER switch (top switch) to center or OFF position, plug in electrical harness. (ON, OFF, MOM-ON).
- Push and hold POWER switch to the RIGHT, this in turn sends ground down to the ATTACH/DETACH switch (MOM-ON, OFF, MOM-ON) by holding this switch to the RIGHT ground is sent through the GREY wire to the plow module port B. The module then completes the ground path to the motor relay and solenoid cartridge valves S2C2 and S1.

- Hydraulic fluid from the pump flows through the activated S2C2 cartridge valve, through CV5 into the base end of the lift ram.
- The extending ram pushes hydraulic fluid out of the rod end of the cylinder through the activated S1 cartridge valve, through the quill and back into the reservoir.

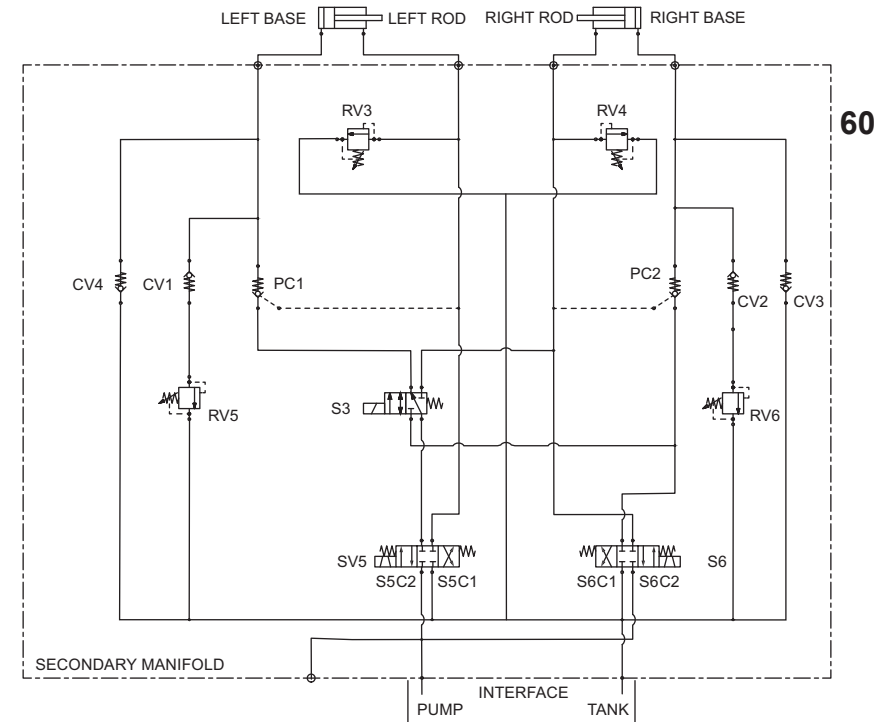
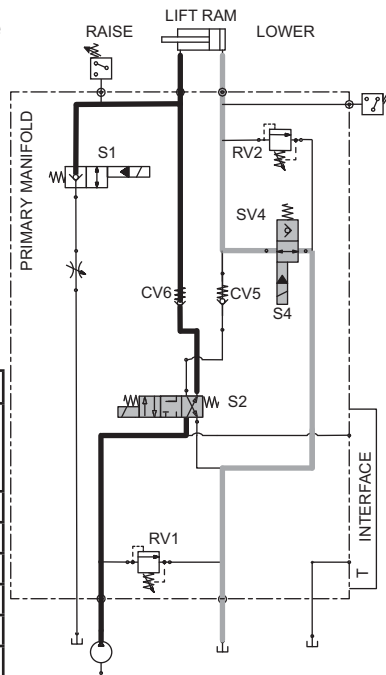
- This action rotates the headgear up into mounting position.

NOTE: if pressure exceeds 425 psi, RV2 will open and dump back to tank.

- Complete attaching the snowplow per instructions.

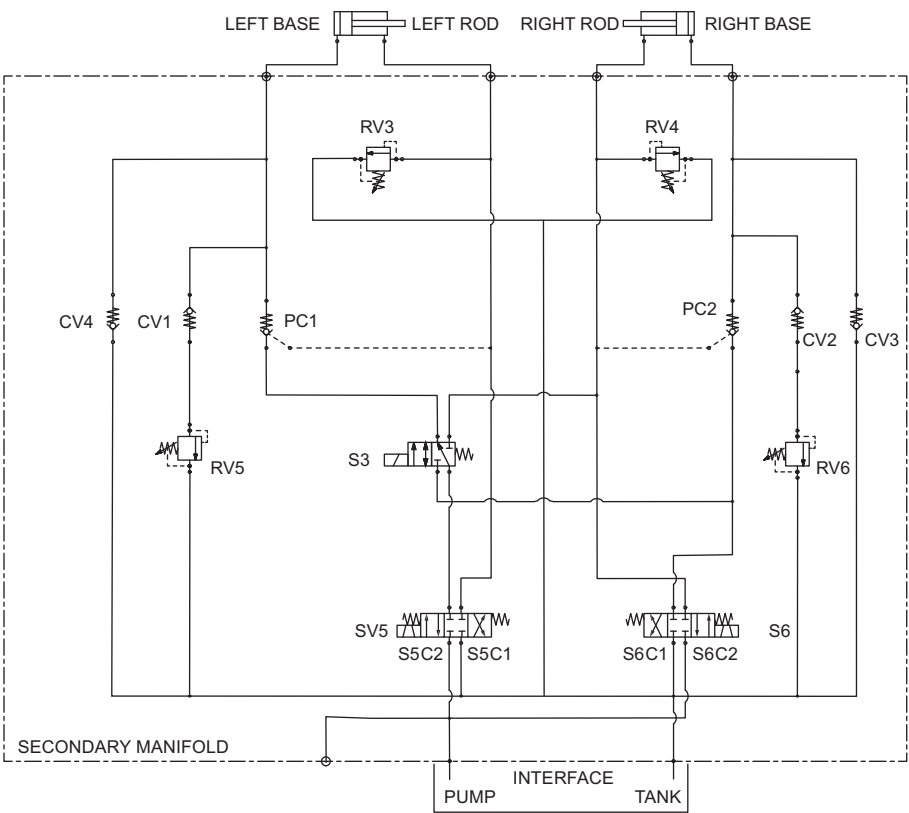
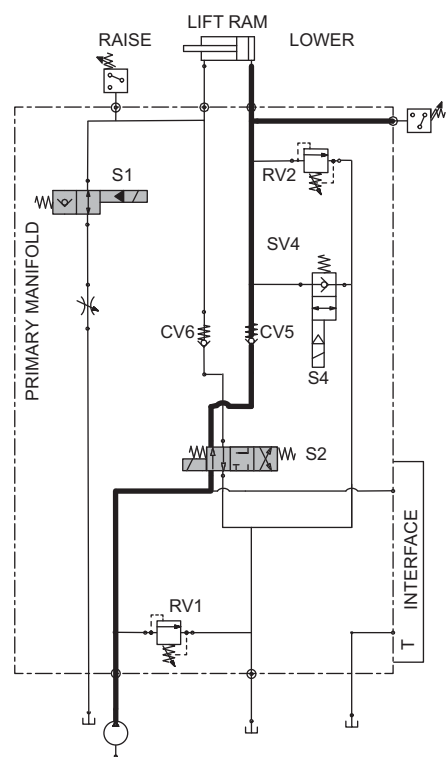
NOTE: Battery voltage is supplied to the plow module, motor relay, and the 9 solenoid coils when the snowplow is connected to the vehicle.

Solenoid		BLADE MOVEMENT		
		ATTACH	DETACH	Scrape Maxx™ FEATURE (OPT)
Motor	M	ON	ON	ON
SV08-2211	S1	ON		ON
SV08-47D	S2C1		ON	
	S2C2	ON		
SV10-43	S3			
SV08-2211	S4		ON	
SV08-47C	S5C1			
	S5C2			
SV08-47C	S6C1			
	S6C2			



Scrape Maxx™ DOWN FORCE KIT – HYDRAULIC

NOTE: Verify if Scrape Maxx™ feature has been installed and if **ENABLED** on the hydraulic system.



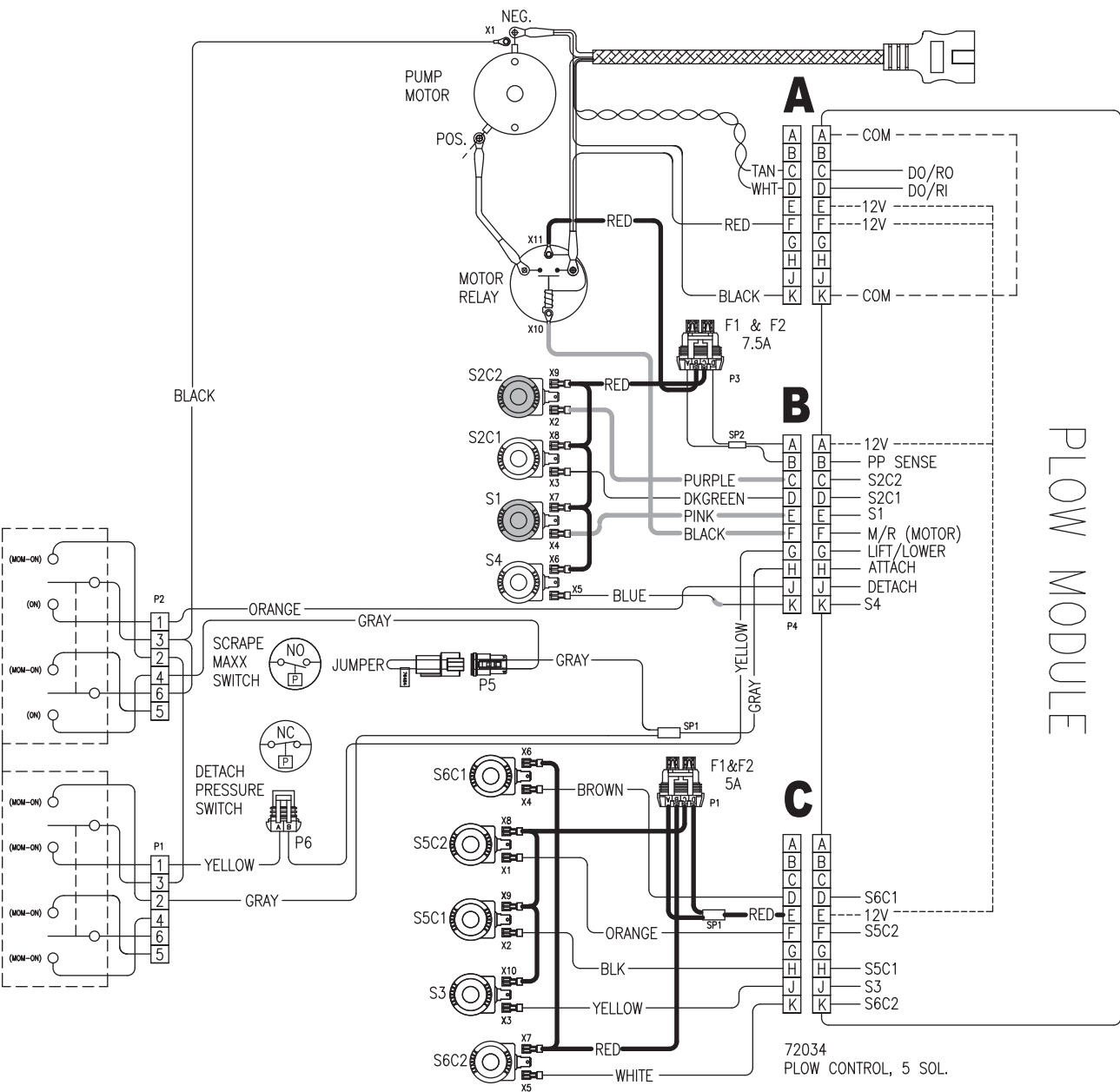
61

BLADE MOVEMENT				
Solenoid		ATTACH	DETACH	Scrape Maxx™ FEATURE (OPT)
Motor	M	ON	ON	ON
SV08-2211	S1	ON		ON
SV08-47D	S2C1		ON	
	S2C2	ON		
SV10-43	S3			
SV08-2211	S4		ON	
SV08-47C	S5C1			
	S5C2			
SV08-47C	S6C1			
	S6C2			

⚠ WARNING

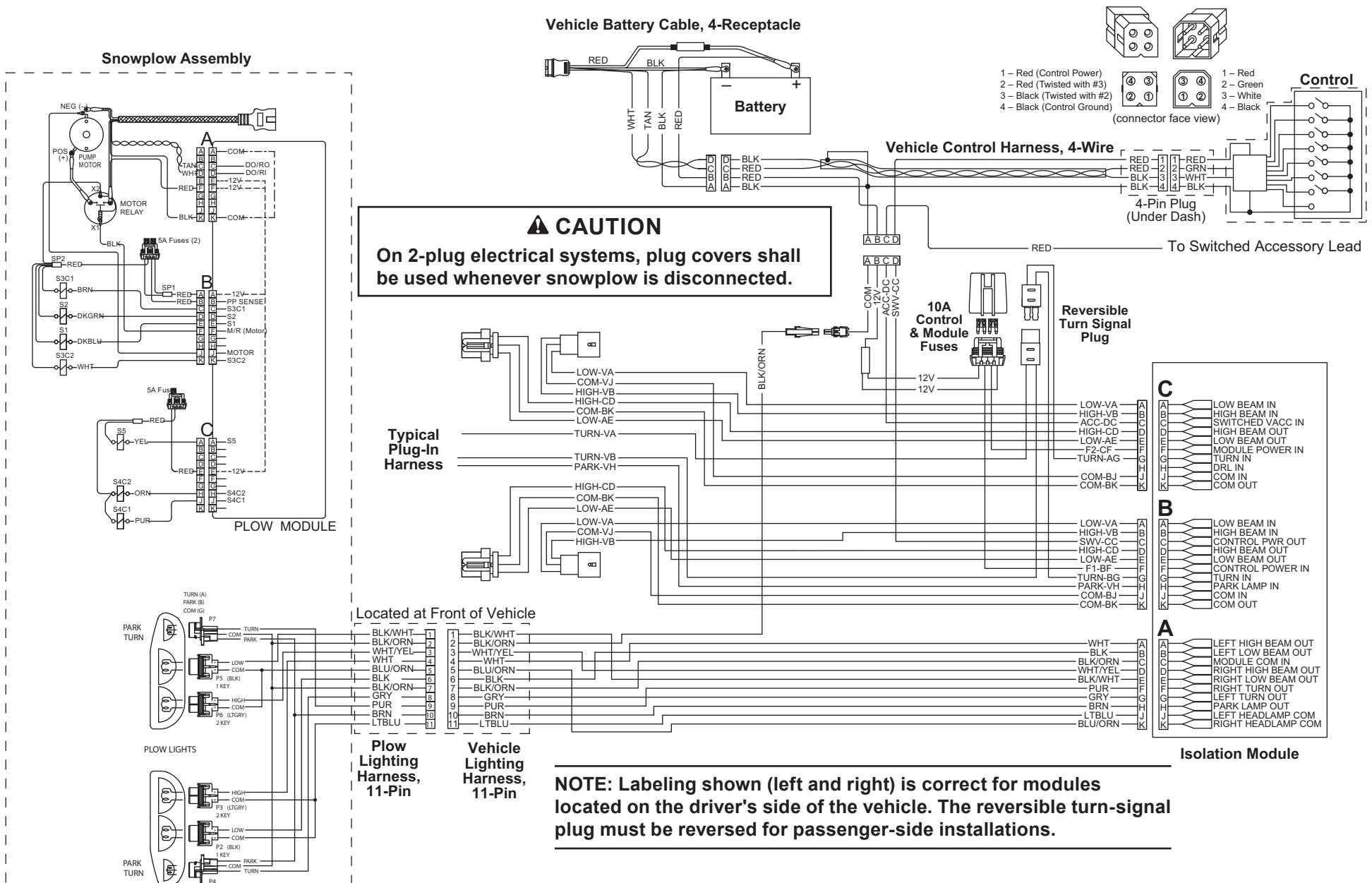
If Scrape Maxx feature is **ENABLED**, the vehicle key is on, and the control has been placed in the **LOWER/FLOAT** mode, without any further control input the hydraulic unit will cycle **ON** and **OFF** without notice, to maintain 200 psi of down pressure.

Scrape Maxx™ DOWN FORCE KIT – ELECTRICAL





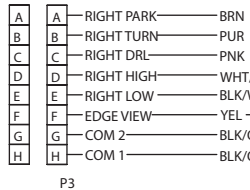
HEADLAMPS: ELECTRICAL SCHEMATIC – 3-PORT MODULE



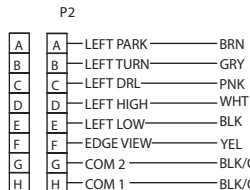
HEADLAMPS: TYPICAL LED SCHEMATIC (continued on following page)

LED PLOW LIGHTS

NEW PLOW LIGHTING HARNESS: PN 72547 (72548)



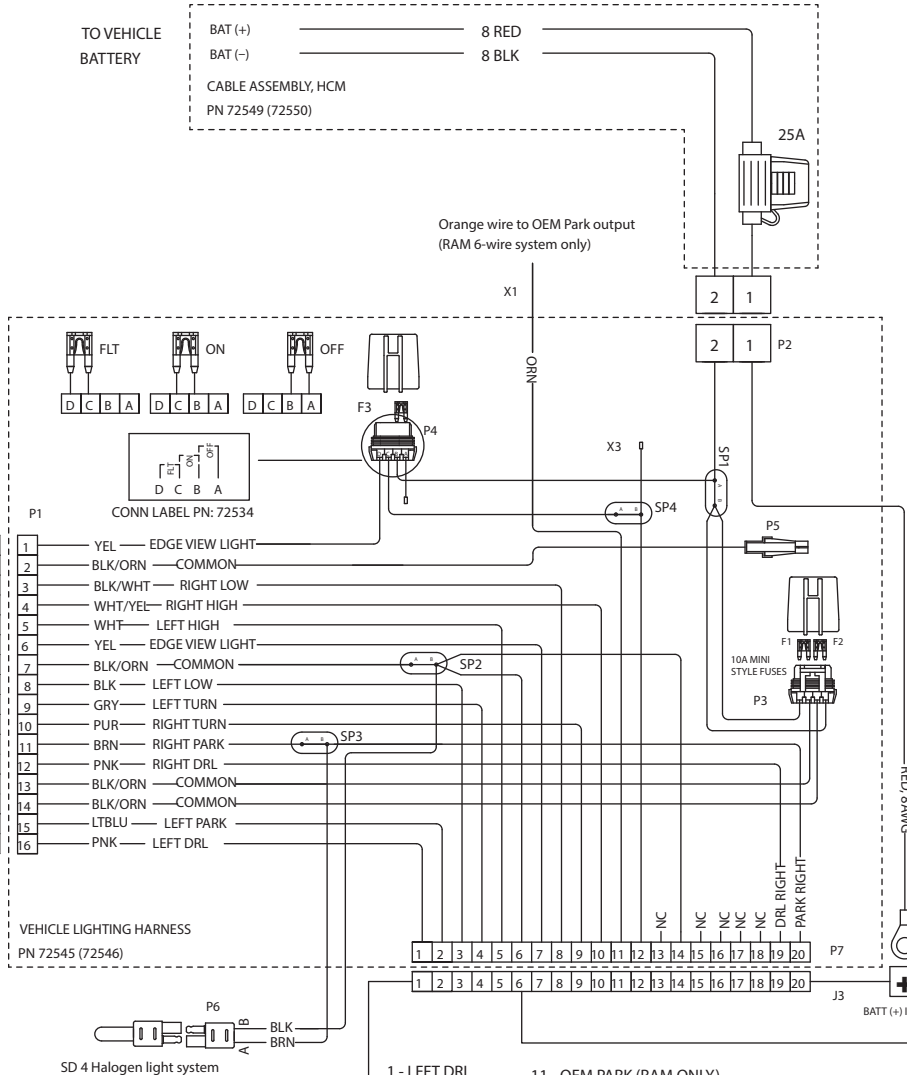
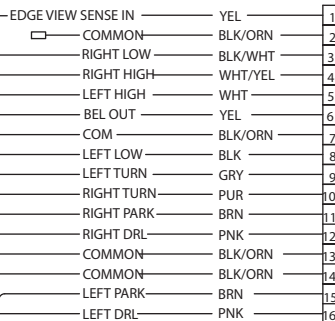
LED PLOW LIGHT KIT PN: 39900
SERVICE KIT (PS) PN: 39902
SERVICE KIT (DS) PN: 39901



CONNECTION: FROM WIRE ON THE FLOAT SOLENOID COIL, HYDRAULIC UNIT, TO YELLOW WIRE BREAKOUT AT THE Y OF THE PLOW LIGHTING HARNESS. PN: 72551 (72552)



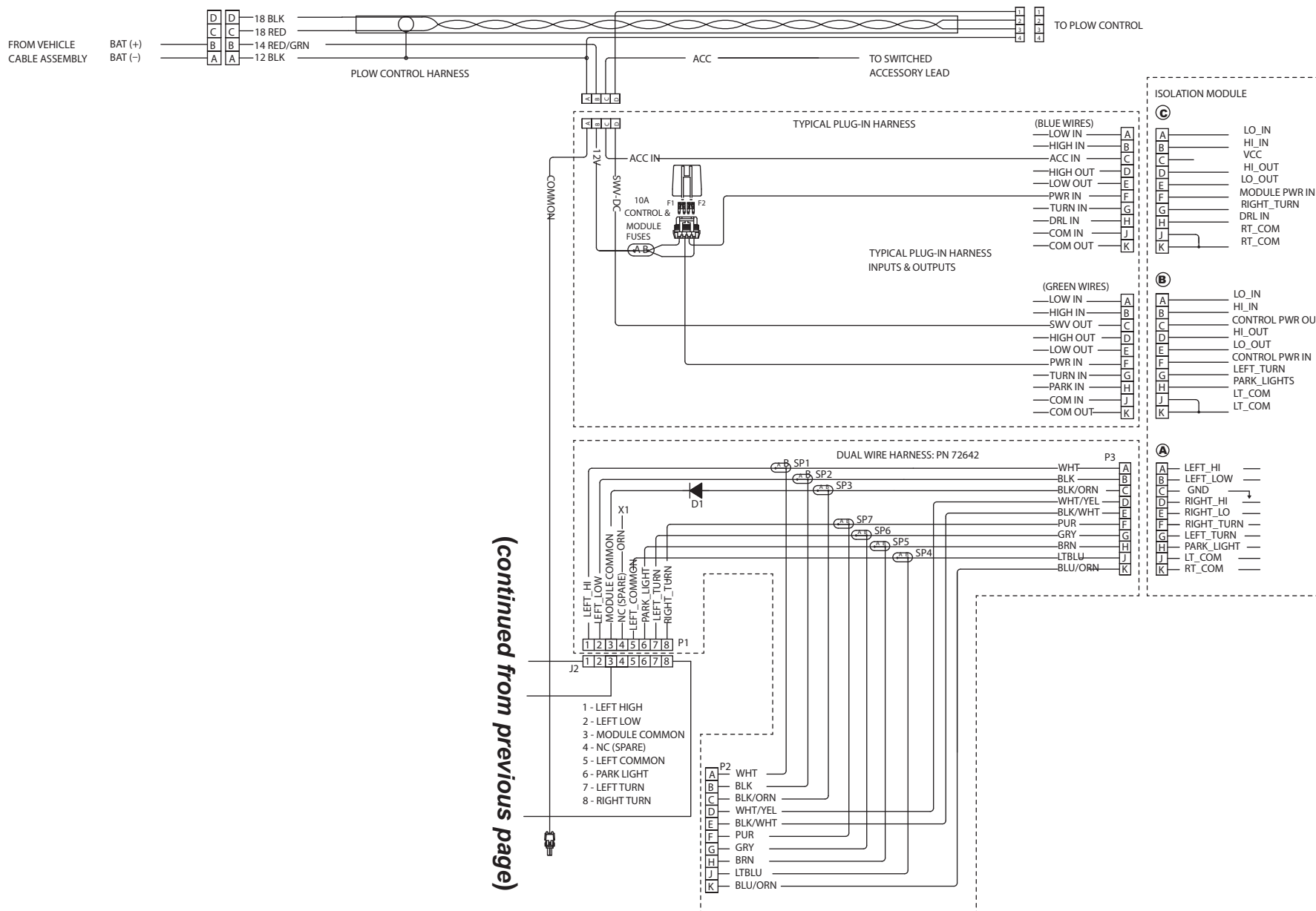
X1 - EdgeView™ light input from hydraulic unit to HCM.



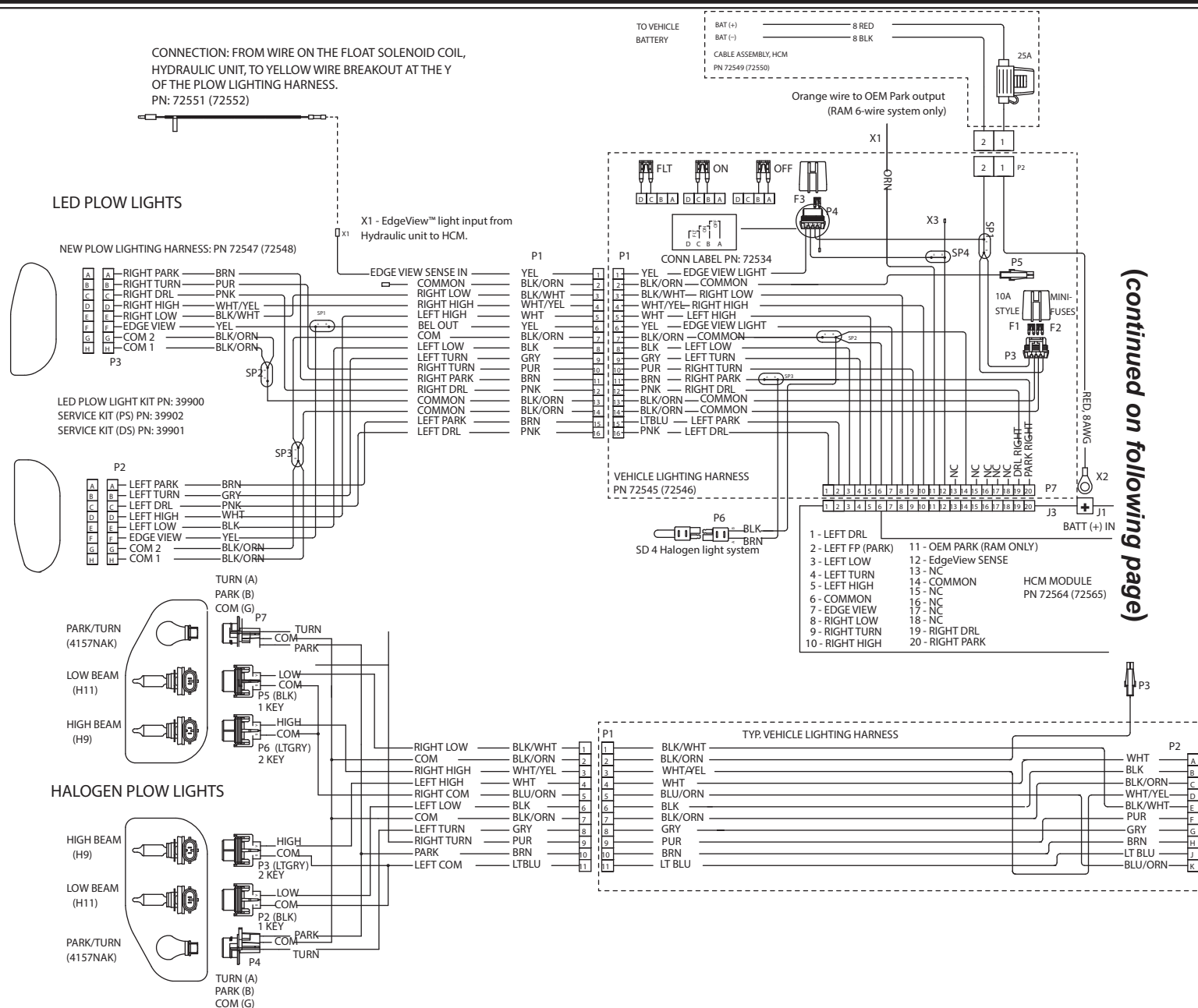
- | | |
|--------------------|--------------------------|
| 1 - LEFT DRL | 11 - OEM PARK (RAM ONLY) |
| 2 - LEFT FP (PARK) | 12 - EV SENSE |
| 3 - LEFT LOW | 13 - NC |
| 4 - LEFT TURN | 14 - COMMON |
| 5 - LEFT HIGH | 15 - NC |
| 6 - COMMON | 16 - NC |
| 7 - EDGE VIEW | 17 - NC |
| 8 - RIGHT LOW | 18 - NC |
| 9 - RIGHT TURN | 19 - RIGHT DRL |
| 10 - RIGHT HIGH | 20 - RIGHT PARK |

HCM MODULE
PN 72564 (72565)

HEADLAMPS: TYPICAL LED SCHEMATIC (continued from previous page)

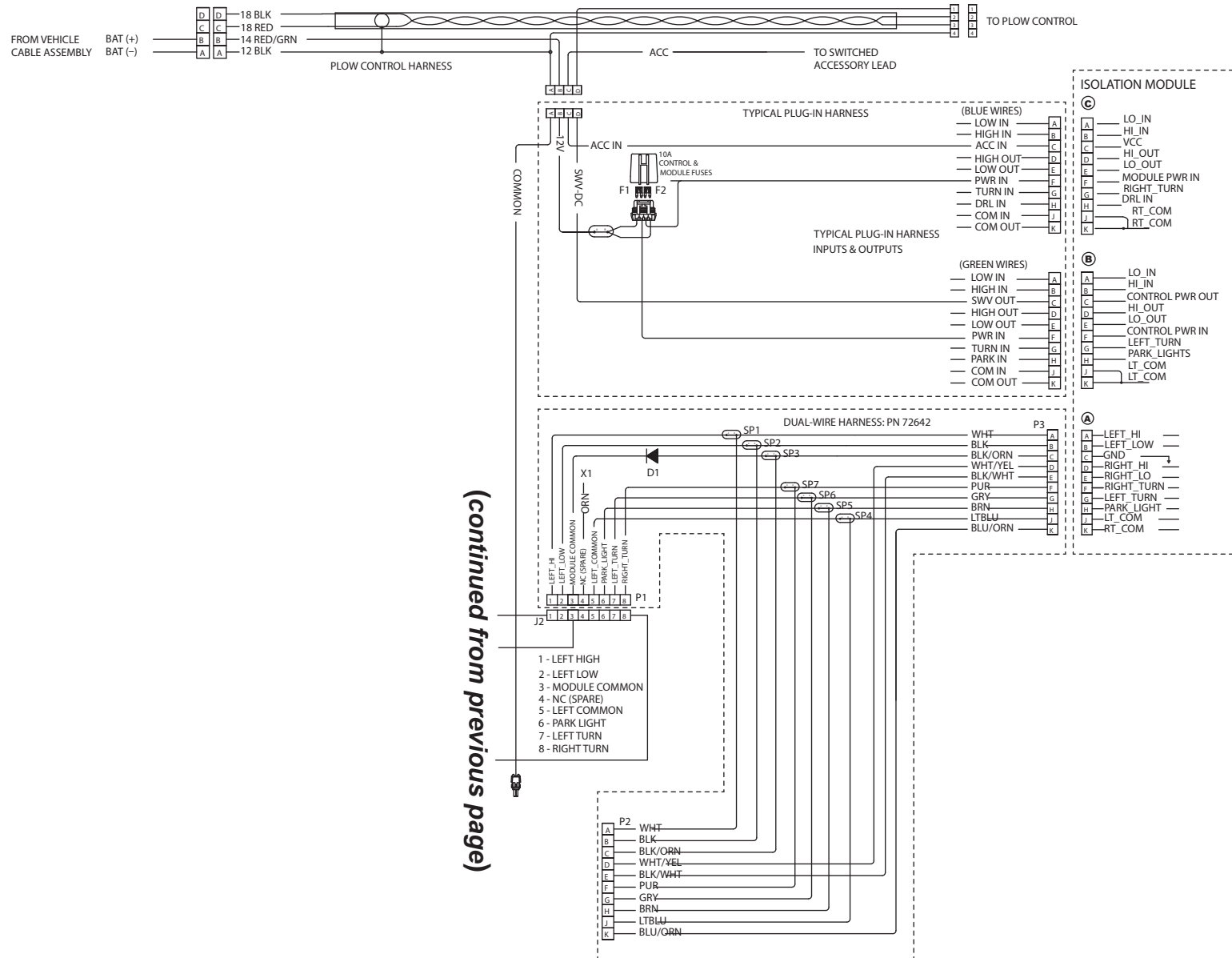


HEADLAMPS: TYPICAL DUAL-WIRE HALOGEN/LED SCHEMATIC (continued on following page)

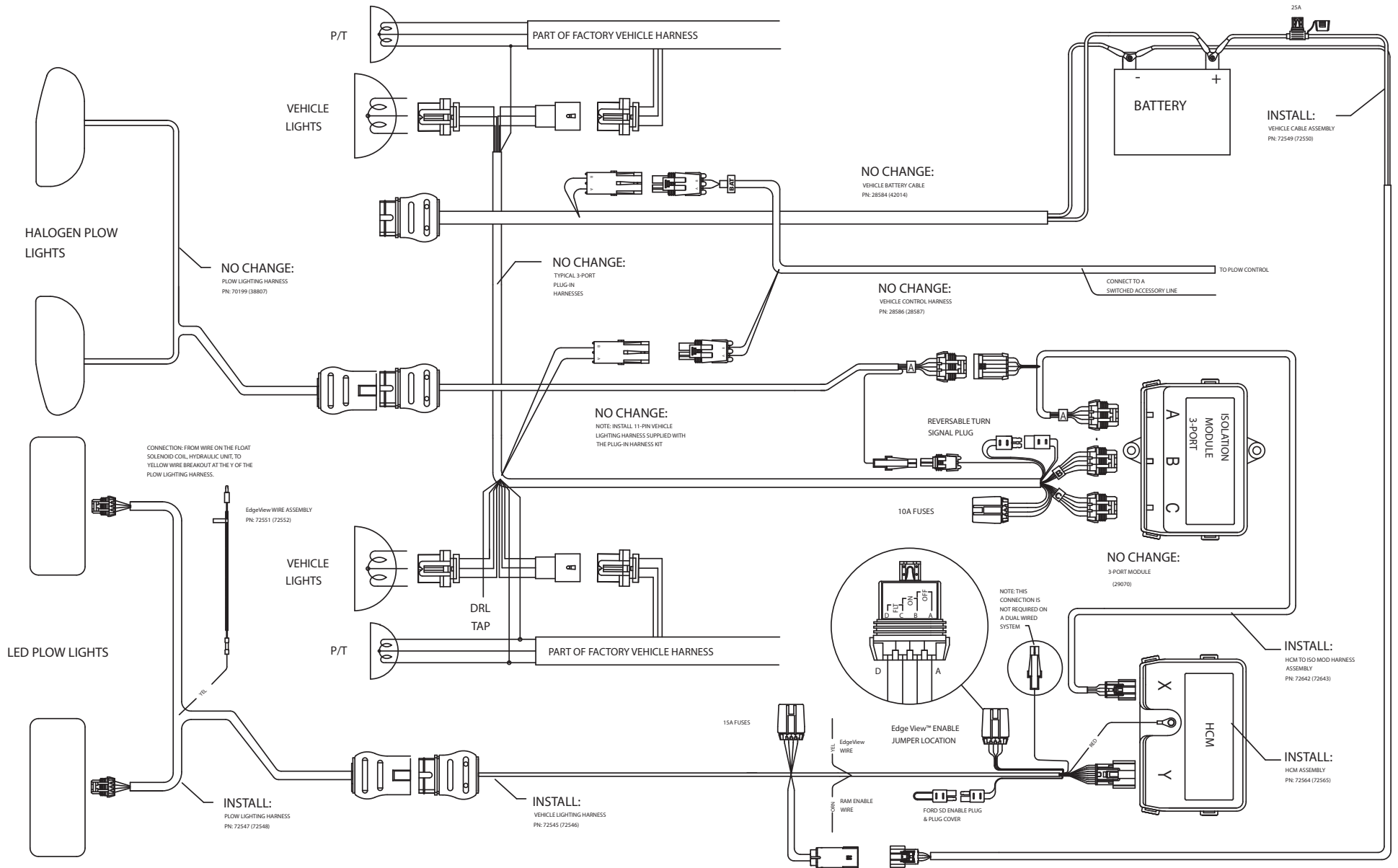


(continued on following page)

HEADLAMPS: TYPICAL DUAL-WIRE HALOGEN/LED SCHEMATIC *(continued from previous page)*



HEADLAMPS: DUAL-WIRE HALOGEN/LED INSTALLATION



TROUBLESHOOTING

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TROUBLESHOOTING

HOW TO USE THE TROUBLESHOOTING GUIDE

All malfunctions of the SnowEx® RDV™ V-plow can be categorized as structural, electrical, or hydraulic. Structural issues are generally related to the blade, T-frame, lift frame, and mount components, and are usually identified by visual inspection. Electrical and hydraulic issues, however, can be more difficult to trace.

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

Go to the "Before You Begin" instructions on the next page and satisfy the listed conditions before starting any testing. In many cases, satisfying the listed conditions alone solves the problem.

Follow along sequentially through the tables and tests, referring to the relevant sections of this guide as needed.

ELECTRICAL TESTING

⚠ CAUTION

Do not probe wires. Doing so will damage the wire insulation, causing the wire to fail prematurely.

A simple 12-volt (12V) test light with a ground lead can be used for circuit testing in most cases. The exception is the paired multiplex wiring, which carries a low-level signal from the control to the plow module. In this case, an ohmmeter may be used to check continuity.

When directed to check for 12V, ground the test light 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.

FUSE REPLACEMENT

The vehicle control harness contains one 2A automotive-style mini fuse and the hydraulic unit contains three 5A automotive-style mini fuses. (See schematics on pages 21, 22, and 32.)

The control fuse is "hot" when the vehicle ignition switch is ON.

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.

TROUBLESHOOTING

BEFORE YOU BEGIN

Before proceeding, or carrying out any tests, you *must* verify the following conditions:

1. **Verify** that the customer has accurately and completely described the problem. **Observe** all snowplow functions.
2. **Check the obvious**, to confirm that:
 - a. The snowplow is attached to the vehicle and all harnesses are connected.
 - b. The ignition is turned ON, or engine is running if operating the control from within the cab.
 - c. The control is connected in the cab and turned ON. The control power LED is in a steady state and is not flashing.

- d. The fuses are good.
- e. The vehicle battery and charging system are in good condition, and battery connections are clean and tight.
- f. Harness connector pins and terminals are free of corrosion, ensuring good connections, and coated with dielectric grease.

CAUTION

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

CAUTION

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

- g. The hydraulic reservoir is filled to the proper level with recommended fluid when the blade is sitting on the ground in the retracted (vee) position, with the vehicle setting level. **Fluid level should be 1-1/2" to 2" below the top of the fill hole.**
- h. There are no fluid leaks from hoses, fittings, rams, or the hydraulic unit.
- i. All hoses are routed correctly.
- j. Coil wire connections are secure and correct.
- k. Correct cartridges are installed in the proper locations.

TROUBLESHOOTING

SOLENOID COIL ACTIVATION TEST (SCAT)

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

The main purpose of the SCAT 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 29290-2) according to the instructions on the following pages.
3. When instructed to do so, perform the SCAT by activating the control for each function and checking for magnetic pull at all the solenoid coils. A solenoid coil is magnetized if a screwdriver held nearby is attracted.

NOTE: When checking for magnetism on the activated coil, check the inactive coils for stray magnetism.

Only one coil at a time can be tested for magnetism. *To test double-stacked coils:*

- a. Remove the thin nut that holds the stacked coils on the valve stem. Verify that the steel spacer washer is in place between the coils.

- b. Separate the coils by approximately 1/2" and hold them in that position. Activate the function that uses one of the coils. If the coil is magnetized, the steel washer will be drawn to that coil. Activate the function for the second coil. If that coil is magnetized, the steel washer will be drawn to that side.

- c. After testing, retighten the coil nut to 48–60 in-lb.

NOTE: If a control function times out before the desired coil activation is complete, release the button and press it again (hand-held control), or release the lever to the center position, then move it back into the desired function (joystick control).

4. Compare the SCAT results with the testing table on the following page.

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

If one or more coils are not magnetized when they should be, you have an electrical problem. Using a test light, check the ground wires (not red) attached to the improperly

acting coil(s) for switched ground while activating the function that should energize the coil(s).

If switched ground is present, go to the Individual Solenoid Coil Test.

If switched ground is not present, go to the Control/Cable/Plow Module Test.

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

Solenoid Cartridge Valves		
Coil	Valve Type	Wire Color
S1	SV08-2211	Pink
S2C1	SV08-47D	Dark Green
S2C2		Purple
S3	SV10-43	Yellow
S4	SV08-2211	Blue
S5C1	SV08-47C	Black
S5C2		Orange
S6C1	SV08-47C	Brown
S6C2		White

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

TROUBLESHOOTING

Diagnostic Harness Installation

The diagnostic harness kit can be used with or without the snowplow connected to a vehicle. Follow the appropriate instructions for each testing situation.

1. **Off-Truck Testing:** Begin with Step 2.

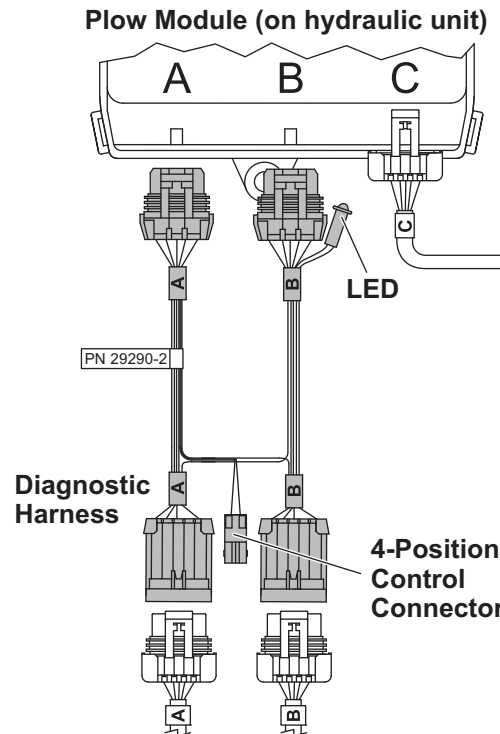
⚠ WARNING

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

On-Truck Testing: Lower the blade to the ground. Put the vehicle in PARK or in gear and remove the ignition key to prevent others from starting the vehicle during testing. Disconnect the snowplow and vehicle battery cables.

2. Remove the hydraulic unit covers.
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. **Off-Truck Testing:** Connect the snowplow control into the 4-position control connector on the diagnostic harness.

On-Truck Testing: Connect the snowplow control into the 4-position control connector either in the cab of the vehicle or on the diagnostic harness.

7. **Off-Truck Testing:** 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.

On-Truck Testing: Reconnect the snowplow and vehicle battery cables.

NOTE: If you connected 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 connected the control to the diagnostic harness, the key should be left out of the ignition.

TROUBLESHOOTING

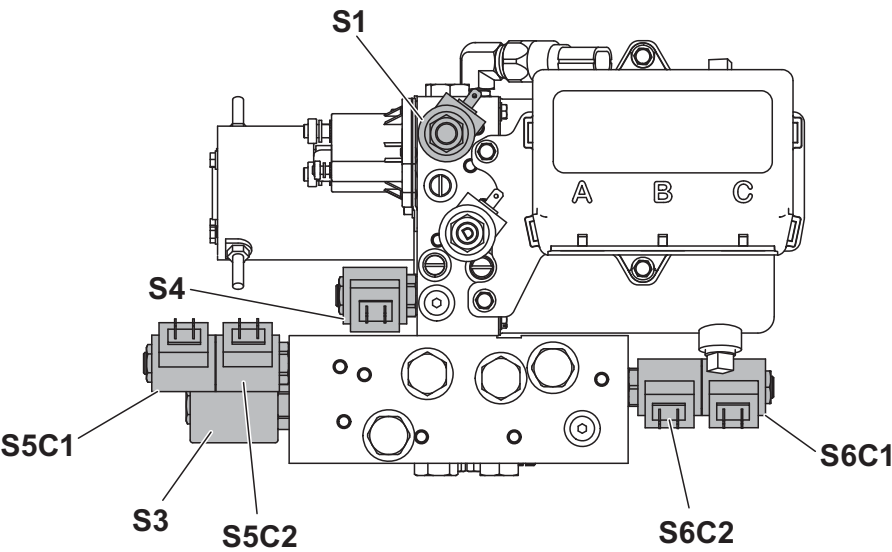
SOLENOID COIL ACTIVATION TEST (SCAT), continued

8. Turn the snowplow control ON and perform a Solenoid Coil Activation Test (SCAT) for each control function. Refer to the table for solenoid numbers and functions.

Control Function	Solenoid Coil(s) Activated
Raise	S2C1, S4, motor relay
Lower/Float	S1, S4
Angle Right	S3, S5C2, motor relay
Angle Left	S3, S5C1, motor relay
R Wing Extend	S6C1, motor relay
R Wing Retract	S6C2, motor relay
L Wing Extend	S5C2, motor relay
L Wing Retract	S5C1, motor relay
Scoop	S5C2, S6C1, motor relay
Vee	S5C1, S6C2, 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.

NOTE: If a control function times out before the desired coil activation is complete, release the button and press it again (hand-held control), or release the lever to the center position, then move it back into the desired function (joystick control).



9. After completing the SCAT, turn the snowplow control OFF.

Off-Truck Testing: Disconnect the 12V power source.

On-Truck Testing: Turn the vehicle ignition OFF. Disconnect the snowplow and vehicle battery cables.

10. Perform any required repairs and retest as needed.
11. When testing is completed, disconnect the power source or the snowplow and vehicle battery cables as described in Step 9 before unplugging the diagnostic harness. Plug the snowplow connectors back into ports A and B of the plow module.
12. Replace the hydraulic unit covers.

After On-Truck Testing: Reconnect the snowplow and vehicle battery cables.

TROUBLESHOOTING

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 ohm 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 approximately 7 ohm across terminals *and* "open" between terminal and washer, then the coil is good.

NOTE: A good coil will draw approximately 1.5A.

TROUBLESHOOTING

CONTROL/CABLE/PLOW MODULE TEST

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

To Safely Handle the Printed Circuit Board

⚠ CAUTION

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

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

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

Handle the PC board by the edges only.

Do not touch the carbon (black) areas of the keypad. Skin oils will deteriorate the contact area.

TROUBLESHOOTING

MOTOR AND MOTOR RELAY TEST

⚠ WARNING

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

Perform this test if the control lights up and turns ON but the motor does not run.

1. Check both fuses on harness B. Replace any blown fuses, then retest snowplow function.
2. Disconnect the vehicle battery cable from the snowplow battery cable. Disconnect the 8" red battery cable from the large terminal of the motor relay and isolate it to eliminate potential for accidental blade movement during testing.
3. Reconnect the vehicle battery cable to the snowplow battery cable. Check for 12V at the small terminal of the motor relay with the red wire attached to it.

If 12V is not present, check the red wire and harness B. Replace/repair either the wire or the harness as needed.

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.

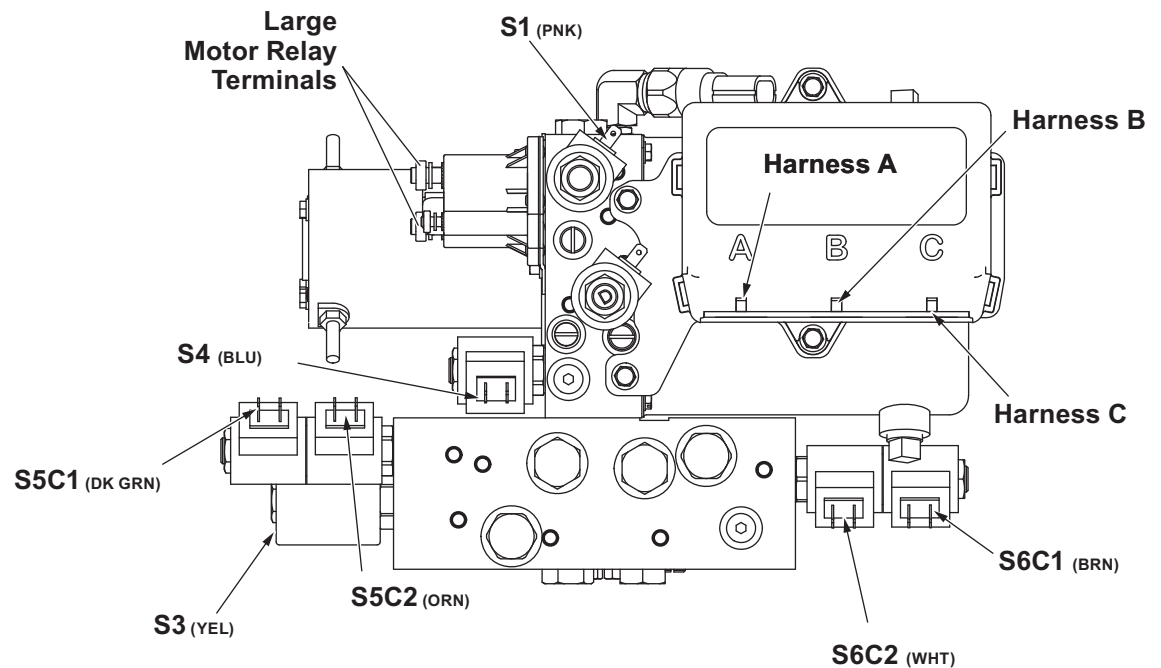
4. Check for switched 12V at the empty large motor relay terminal while activating any control function except LOWER. The empty terminal is the terminal that would normally connect the 8" red battery cable.

If switched 12V is not present, disconnect the vehicle battery cable from the snowplow battery cable and replace the motor relay.

If switched 12V is present at the empty large motor relay terminal, disconnect the snowplow battery cable from the vehicle battery cable and replace the motor.

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

HARNESS CONNECTIONS



TROUBLESHOOTING

PUMP PRESSURE TEST

⚠ WARNING

The tester shall keep bystanders 8' clear of the blade during these tests. Do not stand between vehicle and blade or within 8 feet of a moving blade. A moving or falling blade could cause personal injury.

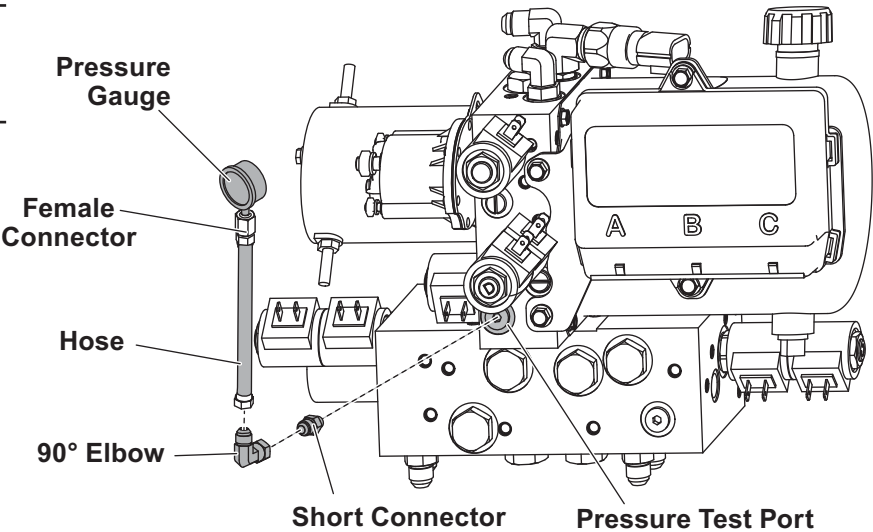
NOTE: Reservoir will contain residual pressure. Slowly remove, then reinstall, the breather to release pressure before proceeding.

- 1. Lower the blade to the ground. Verify proper fluid level before running the test.
- 2. Attach a 3000 psi hydraulic pressure gauge to the pressure test port in the location shown.
- 3. Activate the RIGHT WING EXTEND function until the wing is fully extended.

NOTE: Control will time out after 3.0 seconds. Repeat the command if blade is not yet fully extended.

- 4. Repeat the RIGHT WING EXTEND function and read the pressure shown on the gauge.
- 5. Refer to the table to determine the necessary corrective action. Do not adjust the pressure setting more than 1/4 turn at a time. **Do not adjust the relief valve while the motor is running.**

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



CONDITION	POSSIBLE CAUSE	CORRECTIVE ACTION
Pump pressure is below 2000 ± 100 psi.	Pump Relief Valve	The pump relief valve may be out of adjustment. Turn the relief valve clockwise 1/4 turn and retest the pressure. Repeat until correct pressure (2250 ± 100 psi) is obtained. If correct pressure is not obtained after readjustment, remove and inspect the relief valve and its components. Check the O-ring, stem, and ball for wear or damage. Reseat the ball or replace the relief valve as needed. Reinstall/replace and readjust the valve, then retest pump pressure.
	O-Ring (between pump and valve block)	Remove the pump and inspect the O-ring between the pump and the valve block for wear or damage. Reinstall/replace the O-ring and pump, then retest pump pressure.
	Pump	Remove the pump and inspect it for wear or broken gears. Replace the pump if needed, adjust the pump relief valve, then retest pressure.
Motor draws more than 190A at pump relief.	Motor	Replace the motor.

TROUBLESHOOTING

RELIEF VALVE INSPECTION AND ADJUSTMENT

Relief valve RV2 and components are not interchangeable with the other relief valves.

NOTE: The spring for relief valve RV2 is different from the other springs and should not be interchanged. The RV2 spring is made of a lighter wire and is gold in color.

Inspection

- 1. Remove the valve stem, ball, spacer, and spring.
- 2. Look for broken or damaged parts, contamination, or missing or damaged O-rings.

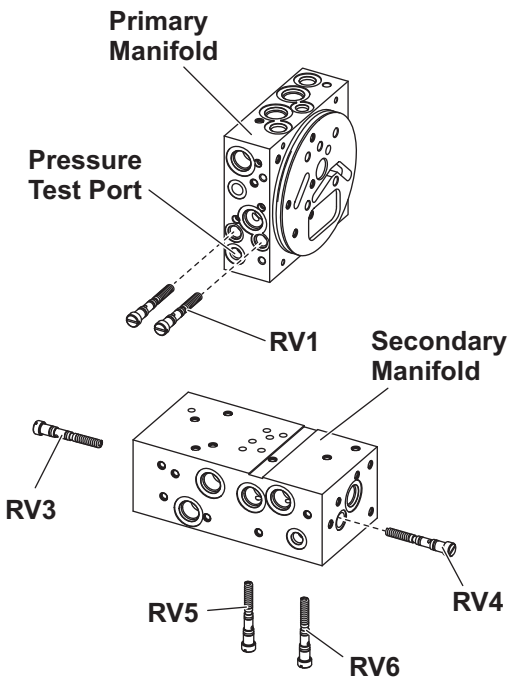
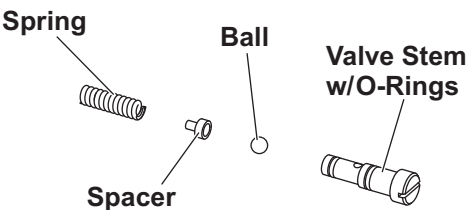
CAUTION
Be careful to strike the valve stem squarely. You can bend the stem if you do not strike it squarely.

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

Adjustment

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

- 1. Screw the valve stem inward until the spring is fully compressed.
- 2. Back out the valve stem by turning it counterclockwise (CCW) the number of turns indicated in the table.



Relief Valve		Approx. Pressure	# of Turns CCW from Fully Seated
RV1	Pump	2250 ± 100 psi	2
RV3	DS Ram Rod End	2200 ± 100 psi	
RV4	PS Ram Rod End		
RV5	DS Ram Base End	3400 ± 100 psi	1-3/8
RV6	PS Ram Base End		

TROUBLESHOOTING

SCRAPE LOCK ADJUSTMENT

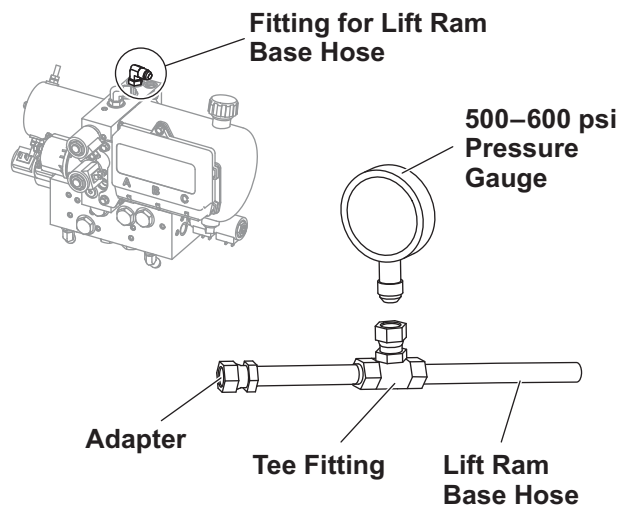
⚠ WARNING

If the Scrape Maxx™ down-force feature is **ENABLED**, the vehicle key is **ON**, and the control has been placed in the **LOWER/FLOAT** mode, without any further control input the hydraulic unit will cycle **ON & OFF** without notice, to maintain 200 psi of down pressure.

NOTE: Verify if the Scrape Maxx down-force feature has been installed and if it is **ENABLED** on the hydraulic system.

Follow the instructions below to adjust the pressure setting of the scrape lock feature. The snowplow must be attached to the vehicle.

1. Park the vehicle on a smooth, level, hard surface, such as concrete. Lower the blade to



the ground and turn the control OFF. Turn the vehicle ignition to the "OFF" position.

2. Disconnect the snowplow battery cable from the vehicle battery cable.

⚠ WARNING

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

3. Remove the hydraulic unit cover.
4. Loosen the breather/fill plug slowly to relieve any pressure in the reservoir.
5. Disconnect the lift ram base hose and install a 500–600 psi pressure gauge with a tee fitting into the lift ram base hose line.
6. Retighten the breather/fill plug.
7. Reconnect the snowplow battery cable to the vehicle battery cable. Turn the vehicle ignition and snowplow control ON.
8. Raise the blade high enough to slide a floor

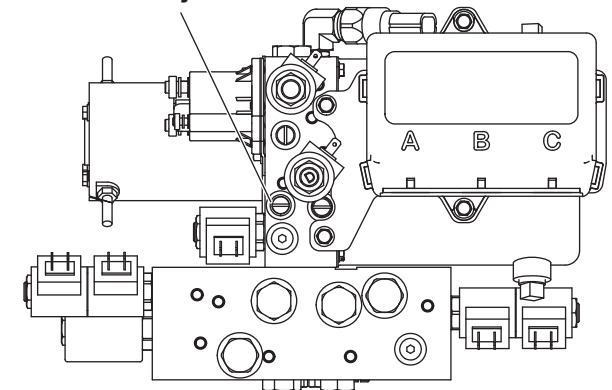
⚠ CAUTION

Never operate the unit while adjusting the scrape lock valve. Doing so will damage the scrape lock valve O-rings.

jack under the center of the blade. Lower the blade onto the jack. Turn the control OFF to ensure that the FLOAT function is off.

9. While raising the blade with the jack, observe the lift cylinder. When the lift cylinder starts to retract, the pressure gauge should read 210 psi.

RV2 for Scrape Lock Adjustment



The pressure can only be measured as the blade is rising. It may be necessary to perform this process more than once to obtain an accurate reading.

TROUBLESHOOTING

10. Lower the floor jack. Turn the control ON and lower the blade onto the jack.
11. If the pressure reading obtained in Step 9 was less than 210 psi, turn the scrape lock (RV2) valve stem *clockwise* 1/4 turn.

If the pressure reading obtained in Step 9 was more than 210 psi, turn the scrape lock (RV2) valve stem *counterclockwise* 1/4 turn.

NOTE: Adjustments should be made in 1/4-turn increments.

12. Repeat Steps 9–11 until the recommended scrape lock pressure (210 psi) is achieved.

NOTE: Adjusting the scrape lock pressure in excess of the recommended pressure will increase amperage draw and will shorten the life of the plow motor.

13. Once the recommended pressure is achieved, remove the floor jack, lower the blade completely, and turn the control OFF. Turn the vehicle ignition to the "OFF" position.

14. Disconnect the snowplow battery cable from the vehicle battery cable.
15. Loosen the breather/fill plug slowly to relieve any pressure in the reservoir.
16. Remove the tee fitting and pressure gauge from the lift ram base hose. Reconnect the lift ram base hose to the manifold and tighten it securely.

CAUTION

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

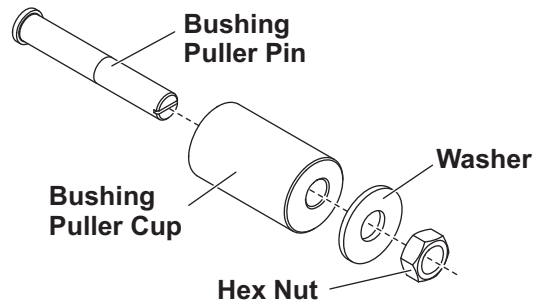
17. Check the hydraulic fluid level and add fluid if necessary.
18. Retighten the breather/fill plug and replace the hydraulic unit cover.
19. Check all blade functions.

TROUBLESHOOTING

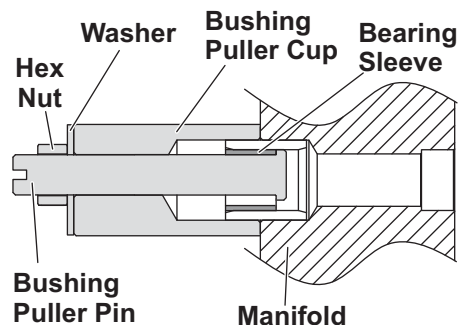
REPLACING DAMAGED BEARING SLEEVES

Remove Damaged Bearing Sleeve

1. Remove the reservoir, pump, and motor from the hydraulic manifold.
2. Insert the bushing puller pin into the bore end of the bushing puller cup, install the washer, and hand turn the hex nut onto the pin two to three full rotations.



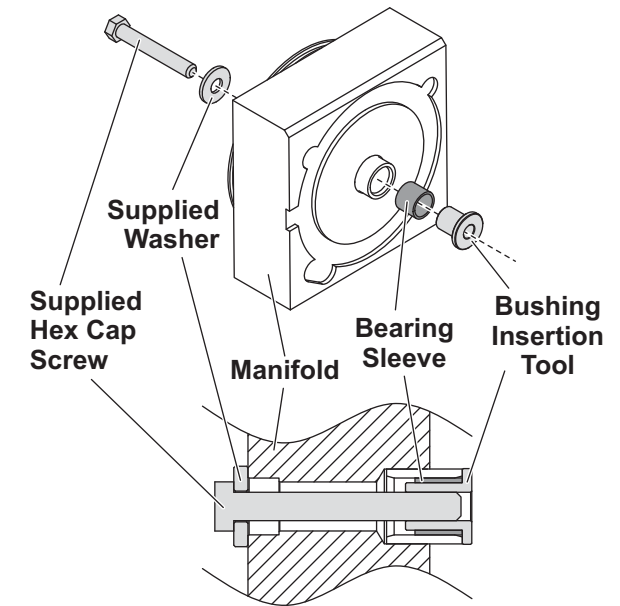
3. Insert the head of the puller pin into the bearing sleeve.



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

Insert New Bearing Sleeve

1. After the damaged bearing sleeve has been removed, install the new bearing sleeve onto the bushing insertion tool as shown, and place it into the chamfer of the aluminum bushing in the manifold.
2. Install the supplied washer onto the supplied hex cap screw, and hand turn the cap screw into the bushing insertion tool from the pump side of the manifold.
3. Turn the cap screw into the insertion tool until the insertion tool contacts the aluminum bushing.



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

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

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



TrynEx International, LLC
531 Ajax Drive
Madison Heights, MI 48071-2429
www.snowexproducts.com

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