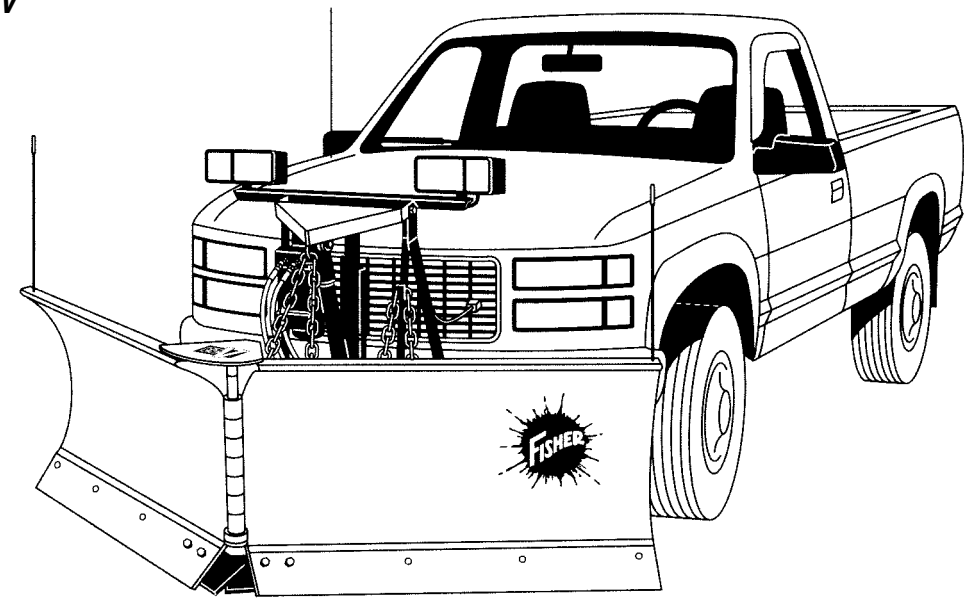
Fisher Engineering

May 1999
No. 26512

EZ-V® SNOWPLOW

MECHANIC'S GUIDE



Featuring the
Insta-Act® Hydraulic System
and the
E-Force Isolation Module System

⚠ CAUTION

Read this manual before servicing the FISHER® EZ-V® snowplow.

TABLE OF CONTENTS

PREFACE

This guide has been prepared to assist the trained mechanic in the service of FISHER® snowplows. It also provides safety information and recommendations. We urge all mechanics to read this manual carefully before attempting to service the FISHER snowplow equipment covered by this guide.

Service of your FISHER snowplow equipment is best performed by your local Fisher Engineering outlet. They know your snowplow best and are interested in your complete satisfaction.

⚠ WARNING

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

⚠ CAUTION

Indicates a situation that, if not avoided, could result in minor personal injury and/or damage to product or property.

NOTE: Identifies tips, helpful hints and maintenance information the owner/operator should know.

BEFORE YOU BEGIN

⚠ WARNING

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

⚠ WARNING

Remove blade assembly before placing vehicle on hoist. Failure to do this could result in personal injury.

⚠ WARNING

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

- Park the vehicle on a level surface, place shift lever in PARK or NEUTRAL and set parking brake.
- Leave the snowplow mounted on the vehicle and lowered for most service procedures, unless told otherwise.

PERSONAL SAFETY

- Wear only snug-fitting clothing while working on your vehicle or snowplow.
- Do not wear jewelry or a necktie, and secure long hair.
- Be especially careful near moving parts such as fan blades, pulleys and belts.
- 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 handy, rated BC for flammable liquids and electrical fires.

VENTILATION

⚠ WARNING

Vehicle exhaust contains deadly carbon monoxide (CO) gas. Breathing this gas, even in low concentrations, could cause death. Never operate a vehicle in an enclosed area without venting exhaust to the outside.

If you work on the vehicle or snowplow in a garage or other enclosed area, be sure to vent exhaust gas directly to the outside through a leakproof exhaust hose.

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.

HYDRAULIC SAFETY

⚠ WARNING

Hydraulic oil under pressure could cause skin injection injury. If you are injured by hydraulic oil, get medical treatment 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.

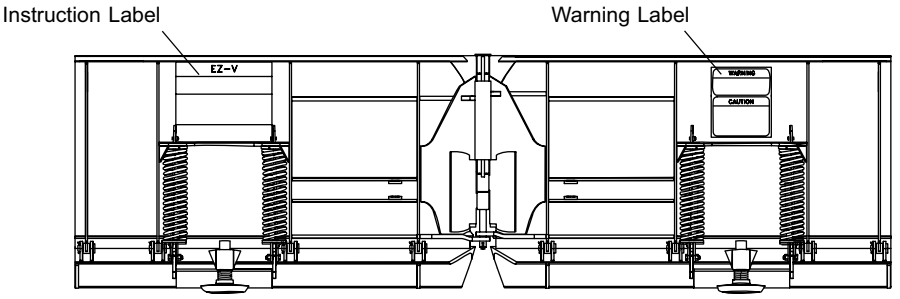
⚠ CAUTION

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.

Please become familiar with and make owners knowledgeable of the Warning and Instruction labels on the back of the blade!



Warning Label

⚠ WARNING

LOWER BLADE WHEN VEHICLE IS PARKED.

REMOVE BLADE ASSEMBLY BEFORE PLACING VEHICLE ON HOIST.

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. REDUCE SPEED UNDER ADVERSE TRAVEL CONDITIONS.

PLOWING SPEED SHOULD NOT EXCEED 10 MPH.

REMOVE SLACK FROM CARRYING CHAIN BEFORE TRAVELING.

SEE YOUR FISHER OUTLET FOR APPLICATION RECOMMENDATIONS.

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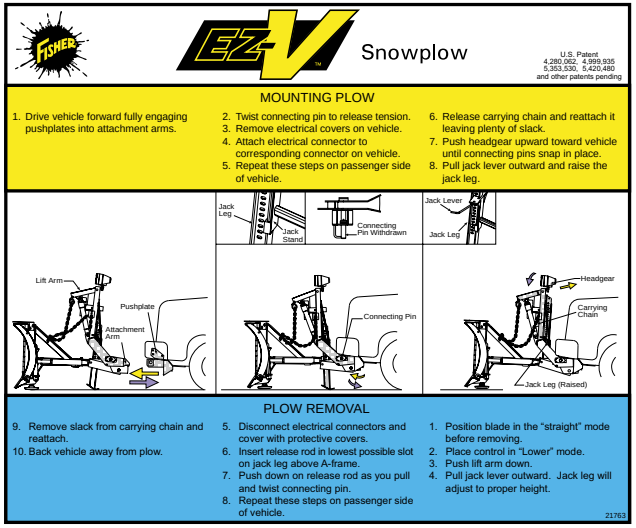
Instruction Label



V-PLOW SPECIFICATIONS

Hydraulic System

Relief valve settings

- Pump relief valve = 1750 PSI. 2-1/2 - 2-3/4 turns CCW from fully seated
- Primary relief valve = 3000 PSI. 1-1/2 - 1-3/4 turns CCW from fully seated
- Secondary relief valve = 3500 PSI. 1-1/4 - 1-1/2 turns CCW from fully seated

Fluid Capacity—Hydraulic Oil

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

Hydraulic Oil

⚠ CAUTION

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

- FISHER® High Performance Fluid to -25°F (-32°C)

Solenoid Valve Spool Travel = 0.07" for three- and four-way valves

Electrical System – approximate values:

- Solenoid Coil Resistance = 7 Ohms at room temperature
- Solenoid Coil Amp. Draw = 1.5 Amp.
- Motor Relay Coil Resistance = 16 - 17 Ohms
- Motor Relay Amp. Draw = 0.7 Amp.
- Maximum Motor Amp. Draw = 190 Amp. at 1750 psi.
- Headlamp Relay Coil Resistance = 106 Ohms
- Headlamp Relay Amp Draw = 0.1 Amp.

Vehicle Control Harness Fuse Size:

- Park/Turn – 15 Amp (ATC)
- Control – 10 Amp (ATC)

Mechanical

Fastener Torque for :

- Pump Bolts = 150–160 IN-LB
- Motor Bolts = 30–40 IN-LB
- Reservoir Bolts = 15–20 IN-LB
- Cartridge Torque = 120 IN-LB
- Check Valve Torque = 120 IN-LB
- Coil Nut Torque = 48–60 IN-LB
- Secondary Manifold Block Assembly Bolt Torque = 108 IN-LB
- Angle Cylinder

  Piston Locknut Torque = 100-120 FT-LB

  Gland Nut Torque = 150-180 FT-LB.

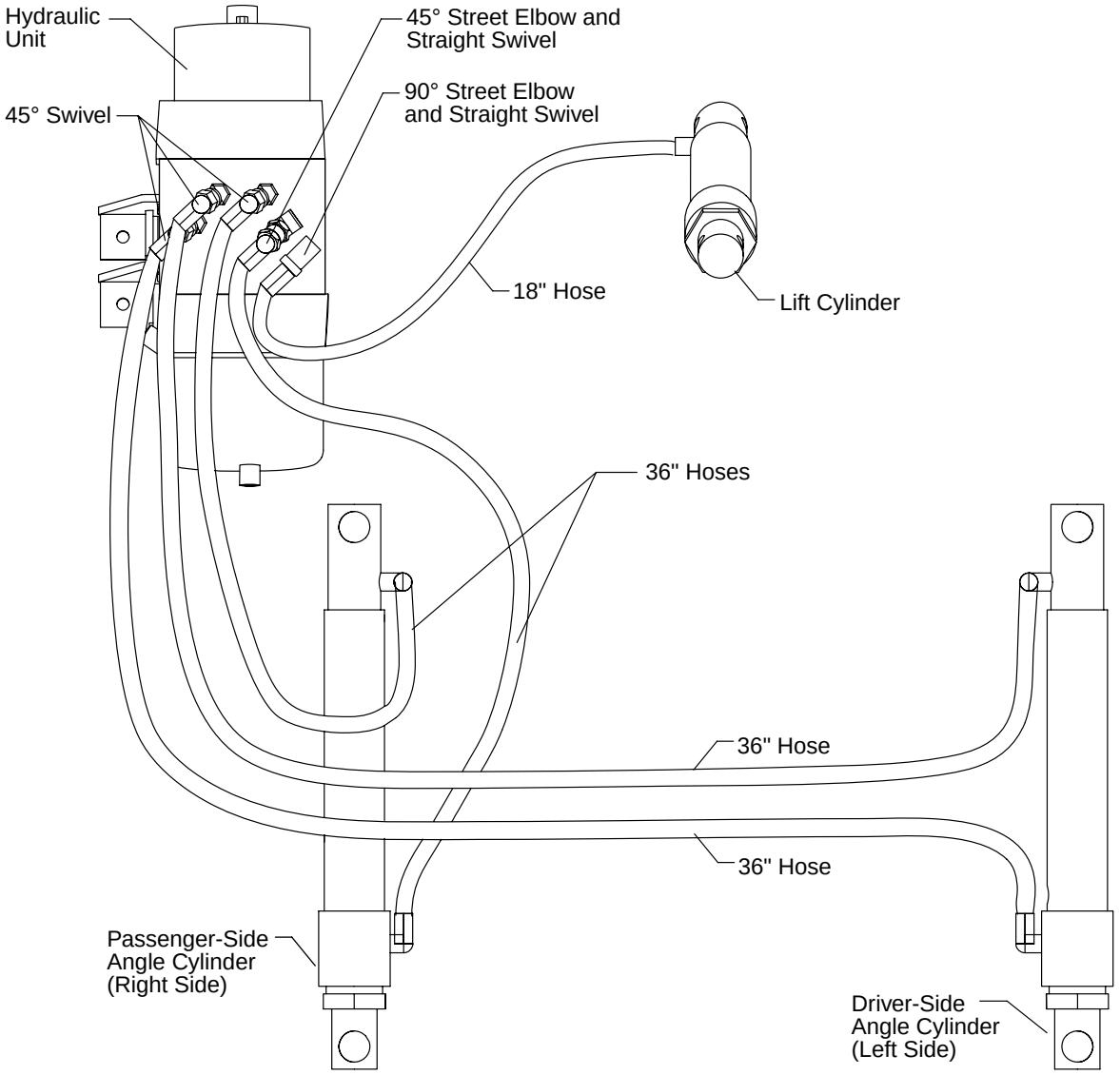
TOOLS

- Long/Slender Needle Nose Pliers
- Flat Screwdriver
- Combination Wrenches: 3/8", 7/16" (2), 1/2", 11/16", 3/4", 7/8", 1-1/16", 1-1/8"
- 1/4" Socket or Nut driver
- 12V Test Light
- Torque Wrench (IN-LB)
- Allen Wrench Set
- Deep Sockets: 11/16", 7/8", 1-1/16", 1-1/8"
- Digital Volt/Ohm Meter
- 3000 PSI Pressure Gauge
- Flashlight
- Pick Set
- Hammer
- Pencil Magnet

Available from your FISHER® outlet :

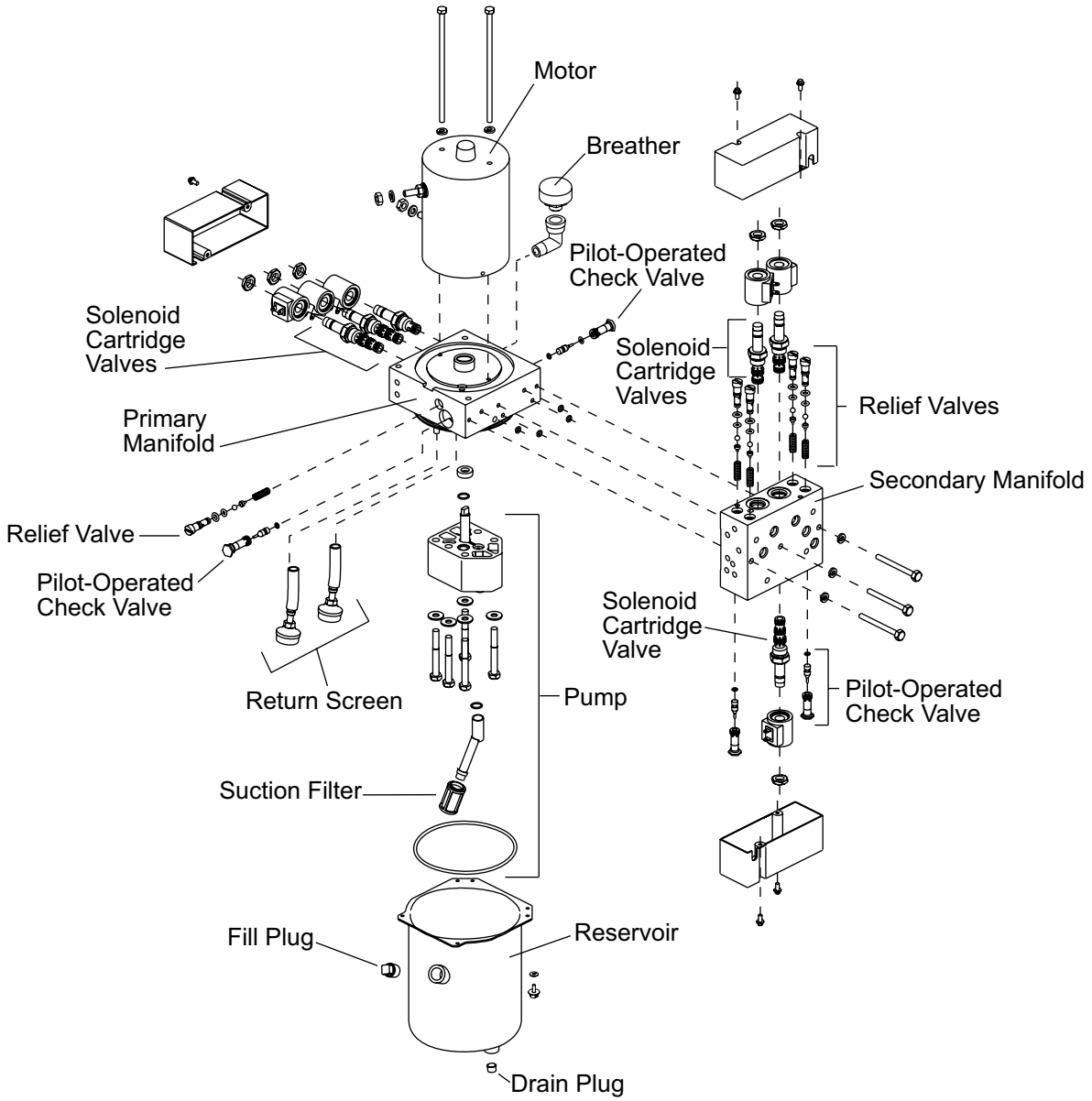
- EZ-V® Snowplow Electrical Tester
- Isolation Module Tester
- Removable Spring Tool

HYDRAULIC HOSE ROUTING

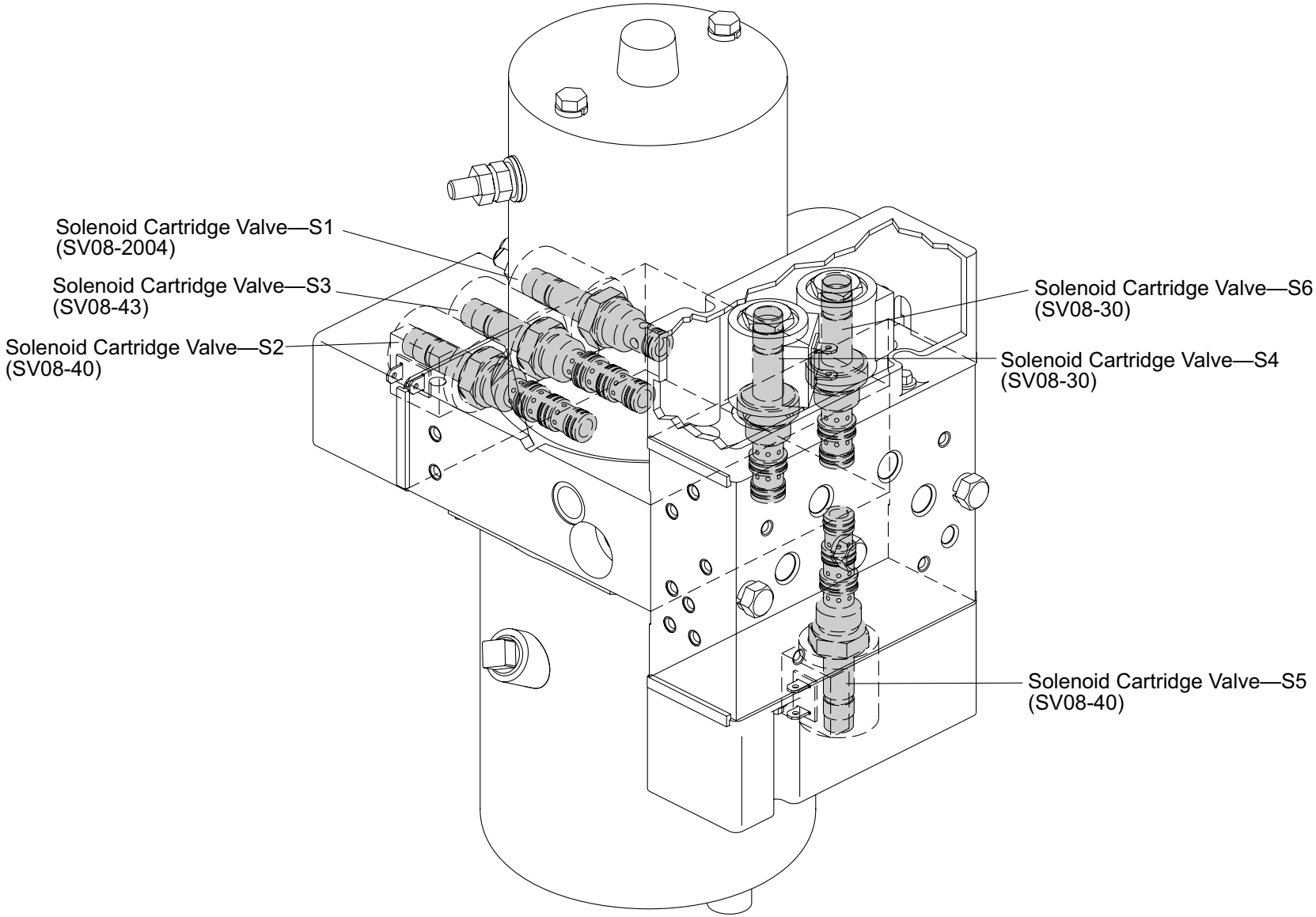


SNOWPLOW SIDE

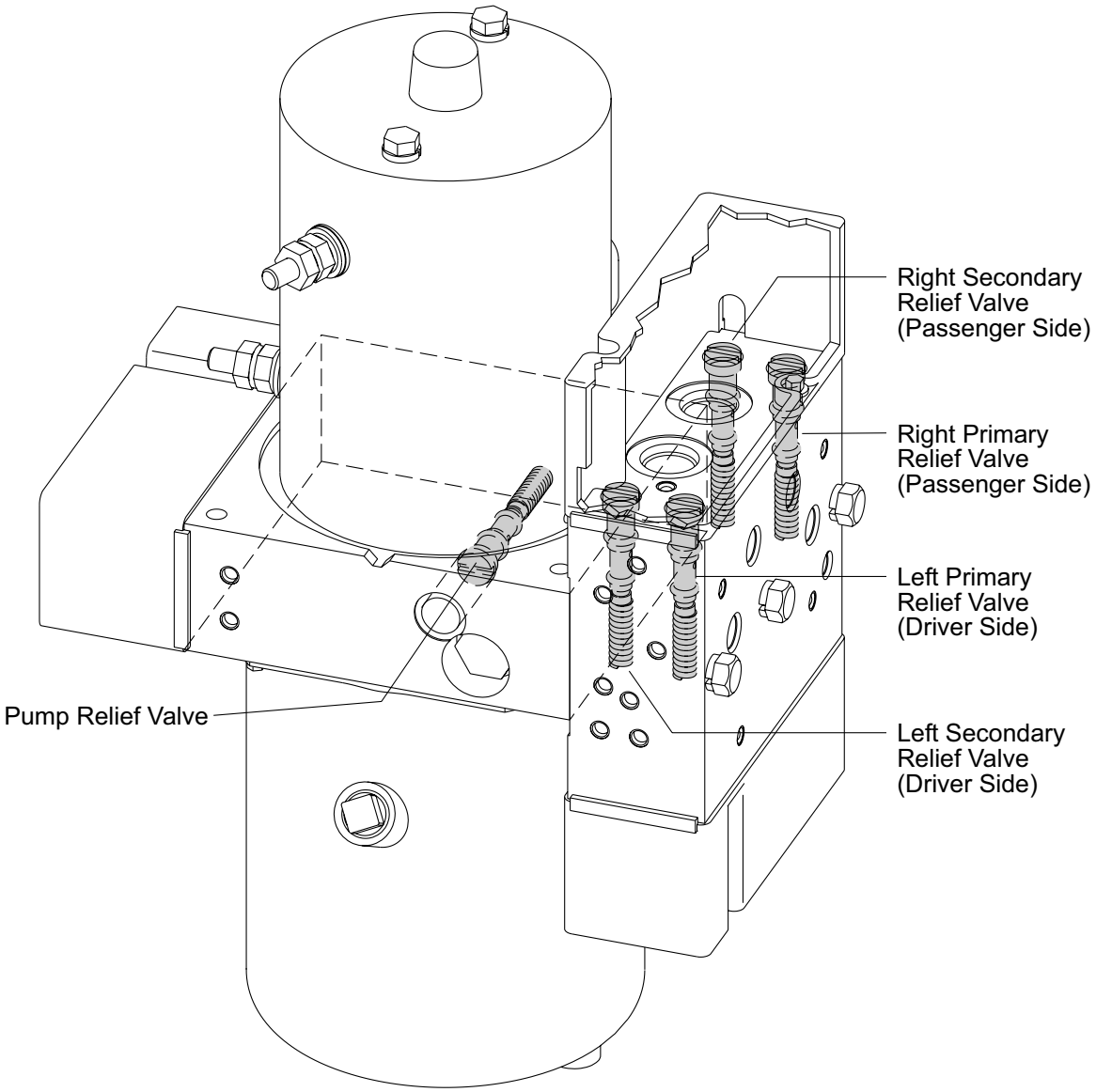
HYDRAULIC UNIT PARTS DIAGRAM



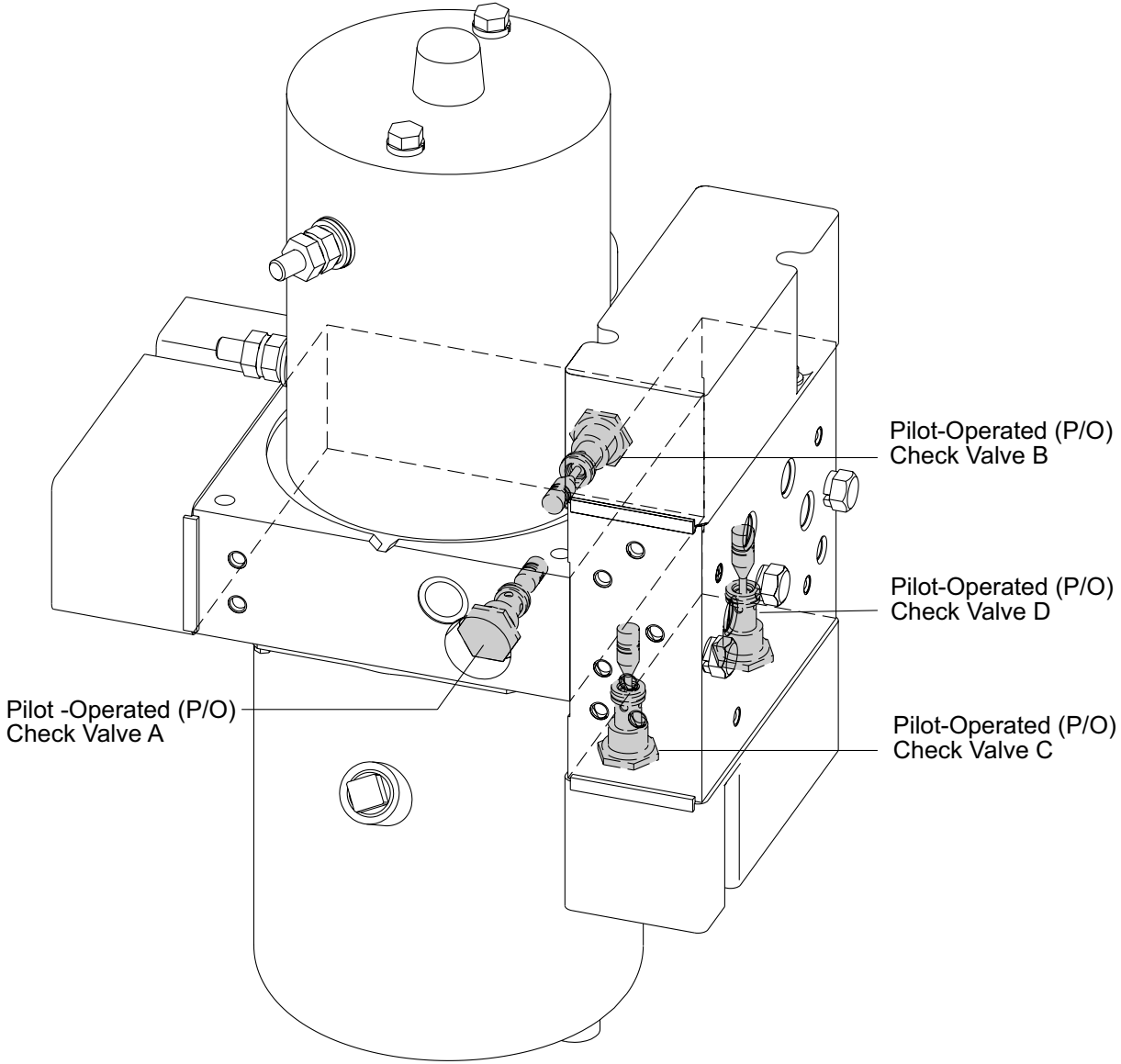
SOLENOID CARTRIDGE VALVE IDENTIFICATION AND LOCATION



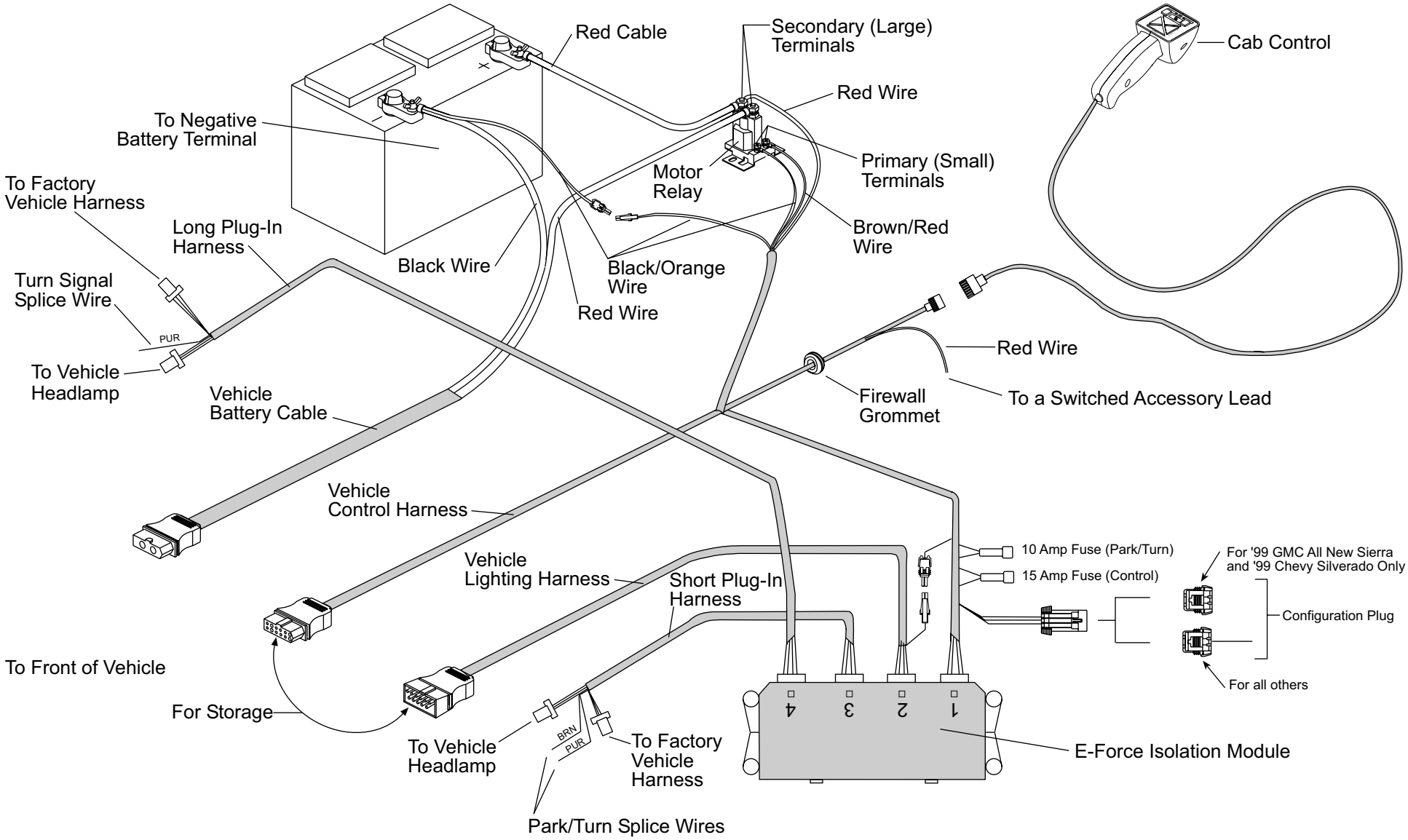
RELIEF VALVE IDENTIFICATION AND LOCATION



PILOT-OPERATED CHECK VALVE IDENTIFICATION AND LOCATION



VEHICLE HARNESS AND VEHICLE CABLE LOCATION



FISH-STIK® HAND-HELD CONTROL

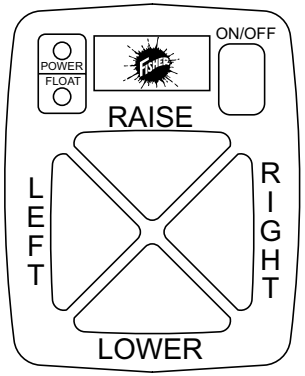
⚠ WARNING

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

⚠ CAUTION

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

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



2. Press the PWR button on the control. The control indicator light glows red indicating the control is on. The control indicator light glows red whenever the control ON/OFF switch and the vehicle ignition switch are both ON and the plow plugs are connected to the grill connectors.

FUNCTION TIME OUTS

All control functions, except for LOWER, automatically time out—stop—after a period of time. This helps prolong the battery charge. The time-out period for the RAISE function is 2.5 seconds, while all others are 4.25 seconds.

The control automatically turns off after being idle for 20 minutes.

Smooth Stop

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

STRAIGHT BLADE MODE—DEFAULT

The **control** automatically **defaults** to the straight blade mode when turned on. The MODE lamp, near the MODE key in the upper left corner of the keypad, will not be illuminated or flashing when the control is in the straight blade mode.

The functions shown at right are performed in the straight blade mode:

Button	Description of Operation
RAISE	Press this button to raise the snowplow and to cancel the float mode. NOTE: Snowplow automatically stops raising after 2.5 seconds. To resume raising the snowplow, release the button and press again.
LOWER	Press this button to lower the snowplow. NOTE: After reaching the desired height, release the button. Holding the button down for more than 3/4 second activates the float mode, indicated by green FLT lamp.
L / SCP	Press this button to angle both wings to the left.
R / VEE	Press this button to angle both wings to the right.

VEE/SCOOP MODE

Quickly press and release the MODE key to put the control into the vee/scoop mode. The MODE lamp, near the upper left corner of the keypad, lights. Quickly pressing and releasing the MODE key toggles control between straight blade mode and vee/scoop mode.

The functions shown at right are performed in the vee/scoop mode:

Button	Description of Operation
RAISE	Press this button to raise the snowplow and to cancel the float mode. NOTE: Snowplow automatically stops raising after 2.5 seconds. To resume raising the snowplow, release the button and press again.
LOWER	Press this button to lower the snowplow. NOTE: After reaching the desired height, release the button. Holding the button down for more than 3/4 second activates the float mode, indicated by green FLT lamp.
L / SCP	Press this button to extend both wings to the scoop position.
R / VEE	Press this button to retract both wings to the vee position.

WING MODE

To put the control into the wing mode, press and hold the MODE key for about two seconds until the MODE lamp near the upper left corner of the keypad flashes. The L / SCP and R / VEE keys are used to activate the four functions of the wing mode. The RAISE and LOWER keys function the same as in the other modes.

The functions shown at right are performed in the wing mode:

Button	Description of Operation
RAISE	Press this button to raise the snowplow and to cancel the float mode. NOTE: Snowplow automatically stops raising after 2.5 seconds. To resume raising the snowplow, release the button and press again.
LOWER	Press this button to lower the snowplow. NOTE: After reaching the desired height, release the button. Holding the button down for more than 3/4 second activates the float mode, indicated by green FLT lamp.
L / SCP	Pressing this button the first time retracts the left wing. Pressing this button the next time extends the left wing.
R / VEE	Pressing this button the first time retracts the right wing. Pressing this button the next time extends the right wing.

SNOWPLOW HEADLAMPS

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

The vehicle high and low beams enter and exit the Isolation Module through positions 3 (left side lighting) and position 4 (right side lighting). Park, turn, and DRL signals also enter through positions 3 and 4.

The output of the vehicle dimmer switch is directed to the Isolation Module via the long and short plug-in harnesses. When the snowplow is not attached to the vehicle, the signal passes through the normally closed relay contacts to the vehicle headlamps. During this time, the Isolation Module is inactive, placing no current draw on the vehicle's electrical system.

With the snowplow attached, the Isolation Module is still inactive until either of the two following conditions are met: the vehicle parking lights are turned on or the vehicle ignition switch is turned on.

Turning on the vehicle parking lights activates a series of relays, automatically transferring the vehicle high and low beams to the snowplow while supplying battery power directly to the snowplow parking lights. All snowplow lighting exits the Isolation Module through position 2.

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

SNOWPLOW DAYTIME RUNNING LAMPS

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

The standard Isolation Module transfers the DRL output to the snowplow lights when the vehicle ignition switch is on and the snowplow is attached.
When the Isolation Module designed for the 1999 GMC All New Sierra and 1999 Chevy Silverado senses the vehicle in the DRL mode, a series of relays energize, placing the snowplow high beams in series. This Isolation Module does not turn off the vehicle DRLs.

SNOWPLOW HYDRAULICS

The EZ-V® snowplow hydraulic system performs 10 blade movements.

All movements require the vehicle ignition (key) switch to be in the run or accessory position and the power to be activated on the snowplow cab control.
Nine of the ten hydraulic movements require energizing the electric motor, shifting solenoid cartridge spools, or activating p/o check valves. The tenth function, lower, does not energize the motor but requires shifting solenoid cartridge spools.

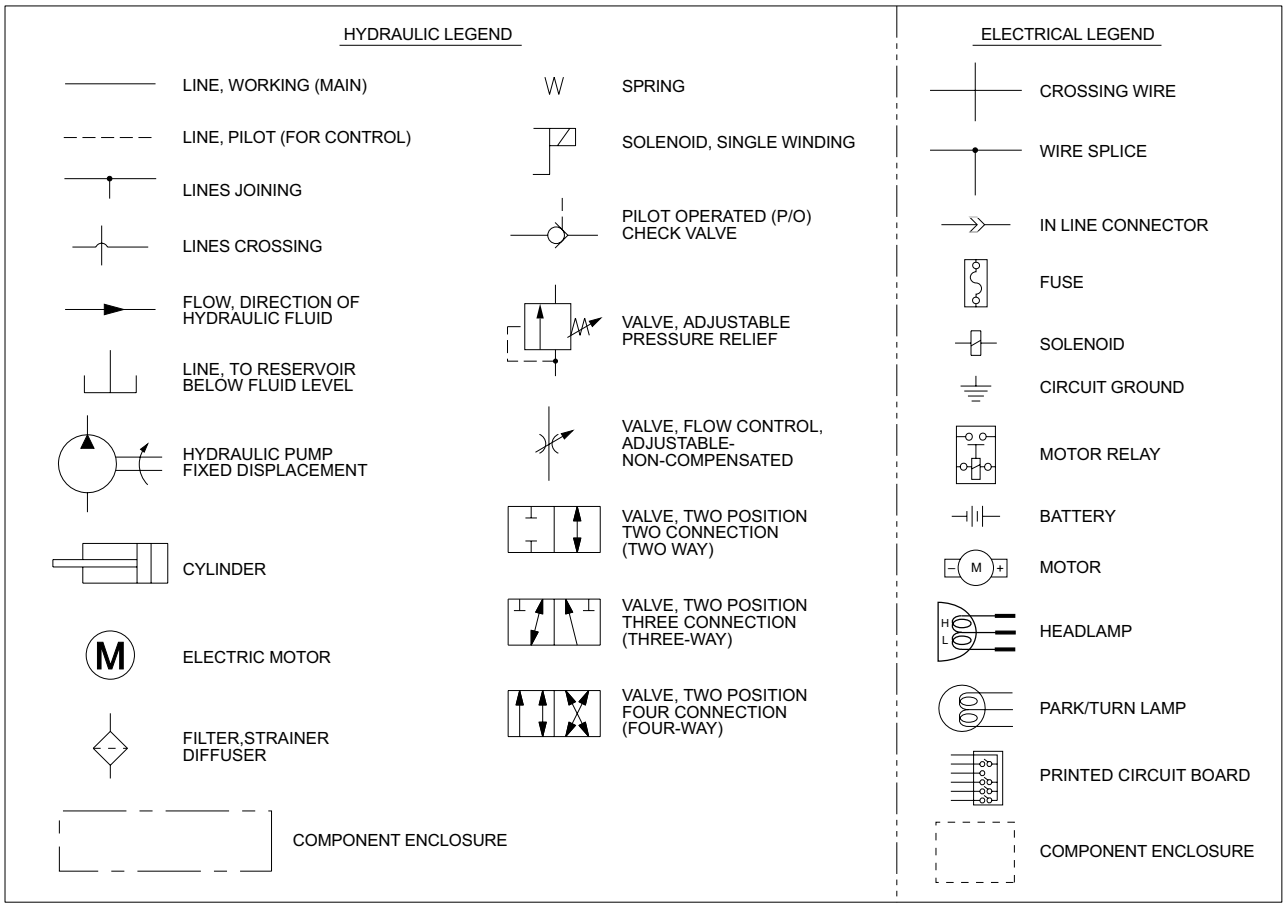
Power from the vehicle battery is supplied to the solenoid coils and the snowplow control via the Isolation Module. The solenoid cartridge valves operate in various combinations, directed by the cab control, to send hydraulic fluid to the snowplow lift and angle cylinders or back to the reservoir.

CONTROLLER MODE	ALL	ALL	STRAIGHT BLADE (DEFAULT)		V / SCOOP		WING			
CONTROLLER BUTTON	RAISE	LOWER	R/VEE	L/SCP	R/VEE	L/SCP	R/VEE	R/VEE	L/SCP	L/SCP
BLADE MOVEMENT	RAISE	LOWER	ANGLE RIGHT	ANGLE LEFT	VEE	SCOOP	RIGHT RETRACT	RIGHT EXTEND	LEFT RETRACT	LEFT EXTEND

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

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

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



NOTE:

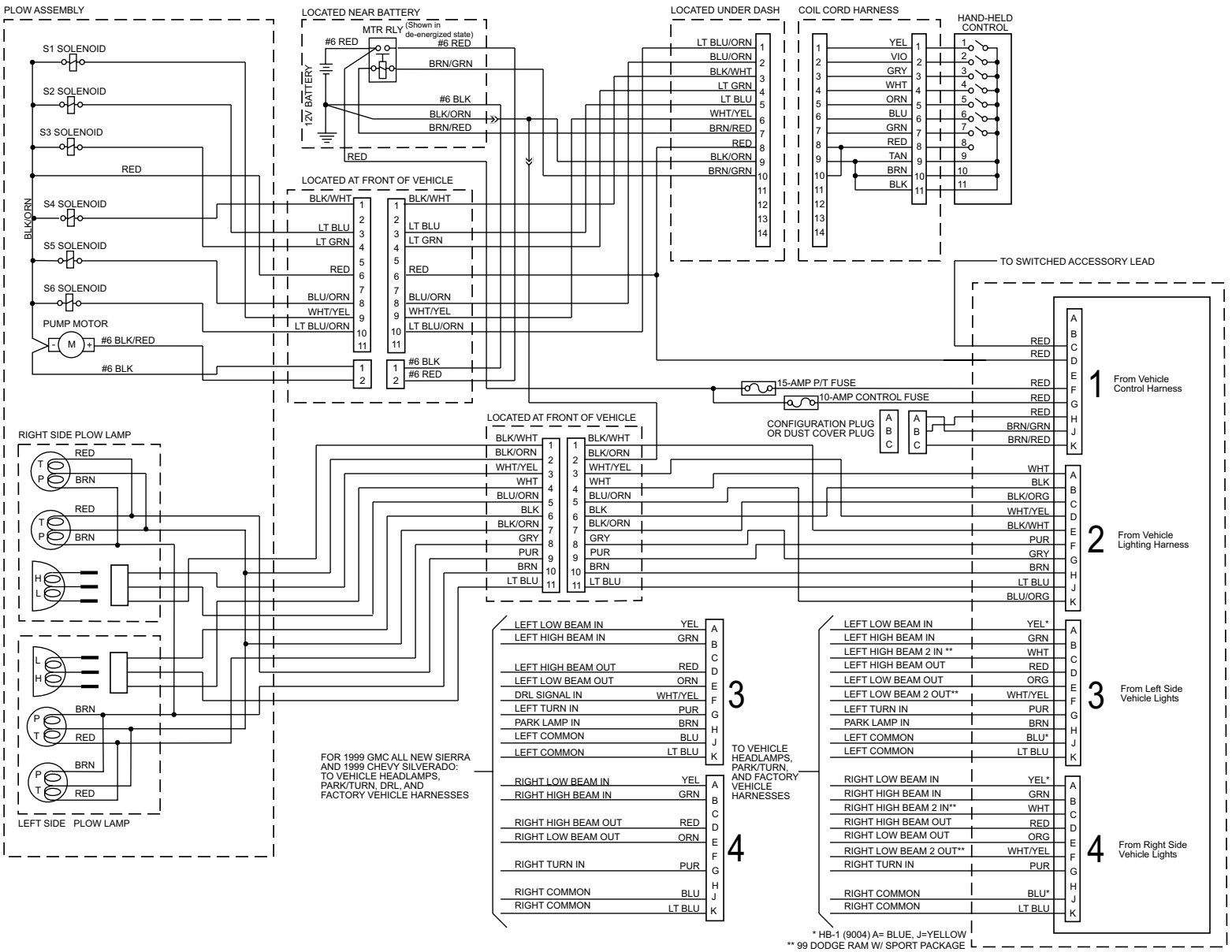
Left side = Driver side

Right side = Passenger side

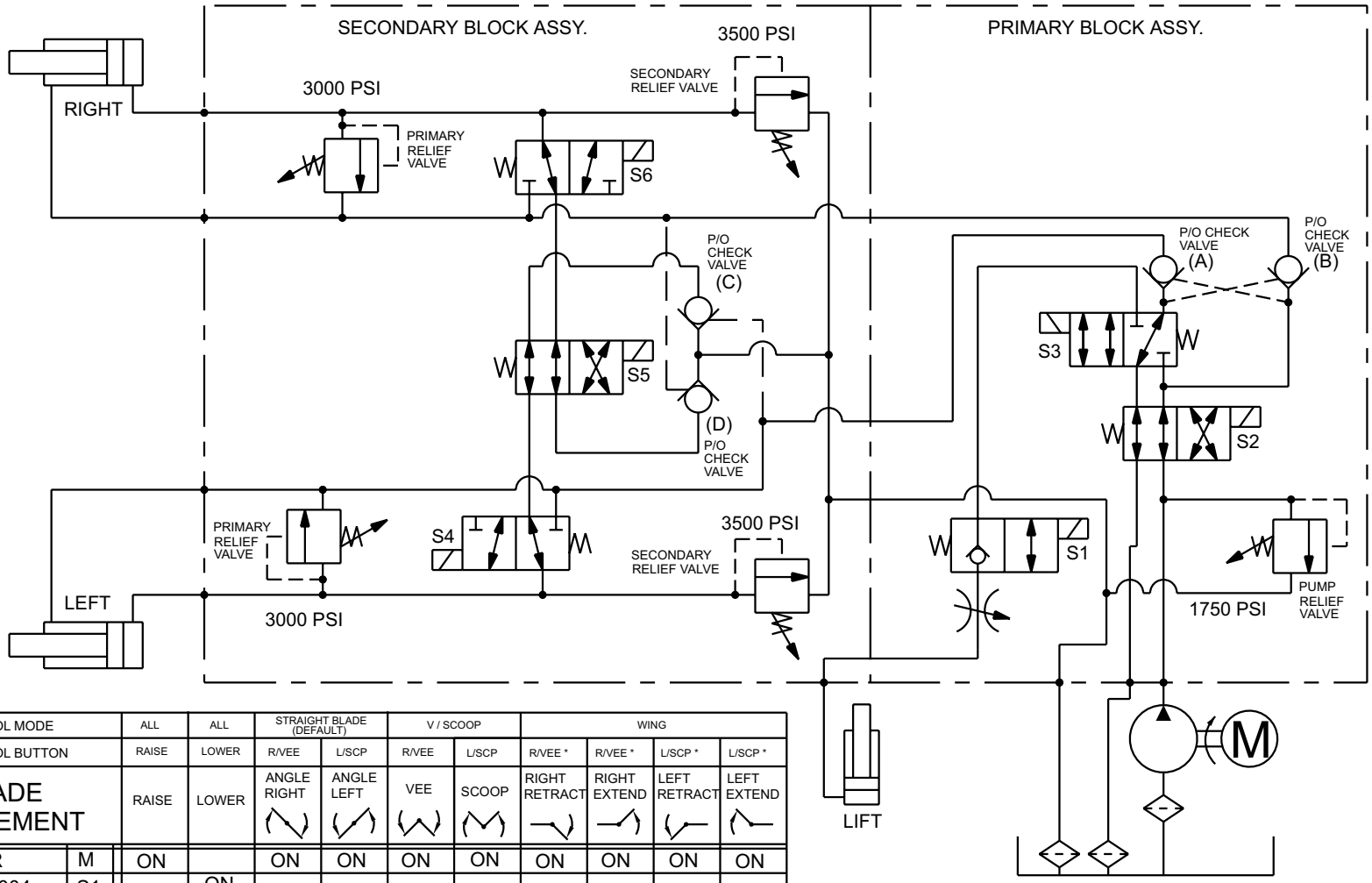
Wire Color Code							
BLK	Black	BRN	Brown	LTGRN	Light Green	TAN	Tan
BLK/ORN	Black w/ Orange	BRN/GRN	Brown w/ Green	LTBLU/ORN	Light Blue w/ Orange	VIO	Violet
BLK/RED	Black w/ Red	BRN/RED	Brown w/ Red	ORN	Orange	WHT	White
BLK/WHT	Black w/ White	GRN	Green	PNK	Pink	WHT/YEL	White w/ Yellow
BLU	Blue	GRY	Gray	PUR	Purple	YEL	Yellow
BLU/ORN	Blue w/ Orange	LTBLU	Light Blue	RED	Red		

Abbreviations	
DRL	Daytime Running Lights
MTR RLY	Motor Relay
P/T SIG	Park / Turn Signal

ELECTRICAL SCHEMATIC



HYDRAULIC SCHEMATIC



CONTROL MODE		ALL	ALL	STRAIGHT BLADE (DEFAULT)		V / SCOOP		WING			
CONTROL BUTTON		RAISE	LOWER	R/VEE	L/SCP	R/VEE	L/SCP	R/VEE *	R/VEE *	L/SCP *	L/SCP *
BLADE MOVEMENT		RAISE	LOWER	ANGLE RIGHT	ANGLE LEFT	VEE	SCOOP	RIGHT RETRACT	RIGHT EXTEND	LEFT RETRACT	LEFT EXTEND
MOTOR	M	ON		ON	ON	ON	ON	ON	ON	ON	ON
SV08-2004	S1		ON								
SV08-40	S2	ON			ON					ON	ON
SV08-43	S3	ON	ON			ON	ON				
SV08-30	S4						ON				ON
SV08-40	S5			ON	ON						
SV08-30	S6						ON		ON		

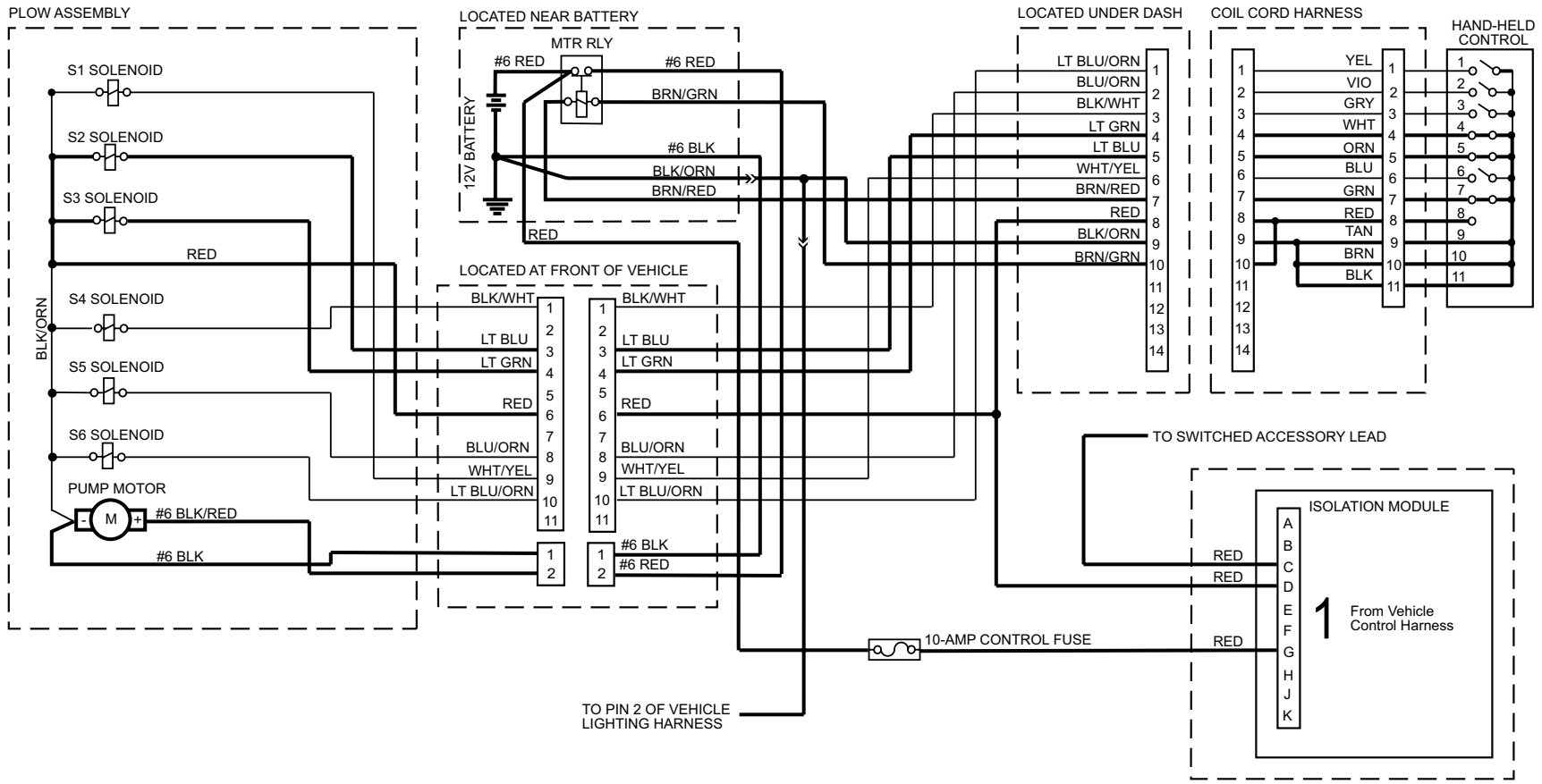
* NOTE - SEE BLADE MOVEMENT TEXT FOR BUTTON OPERATION

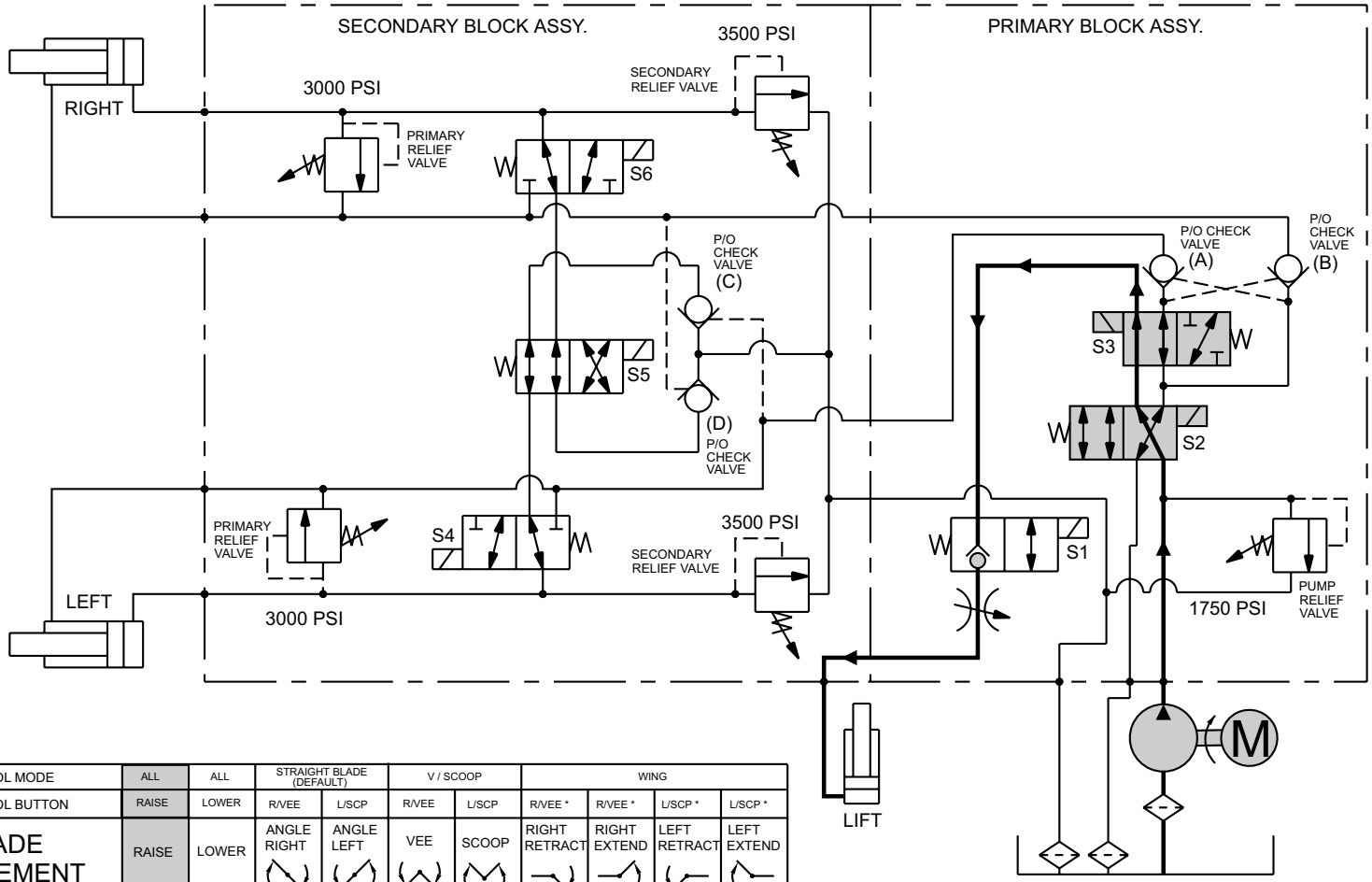
RAISE – ELECTRICAL

Blade Movement: Raise
Control Mode: All Modes
Control Button: Raise

System Response:

1) By pressing the control button, the circuit board inside the cab control completes the ground path for the electrical circuit.
2) Electrical current flows through the motor relay, activating the pump motor, and solenoid cartridge valves S2 & S3, shifting both spools.
3) Hydraulic oil from the pump flows through solenoid cartridge valves S2 & S3, through the internal check valve in solenoid cartridge valve S1 into the base end of the lift cylinder causing it to extend.





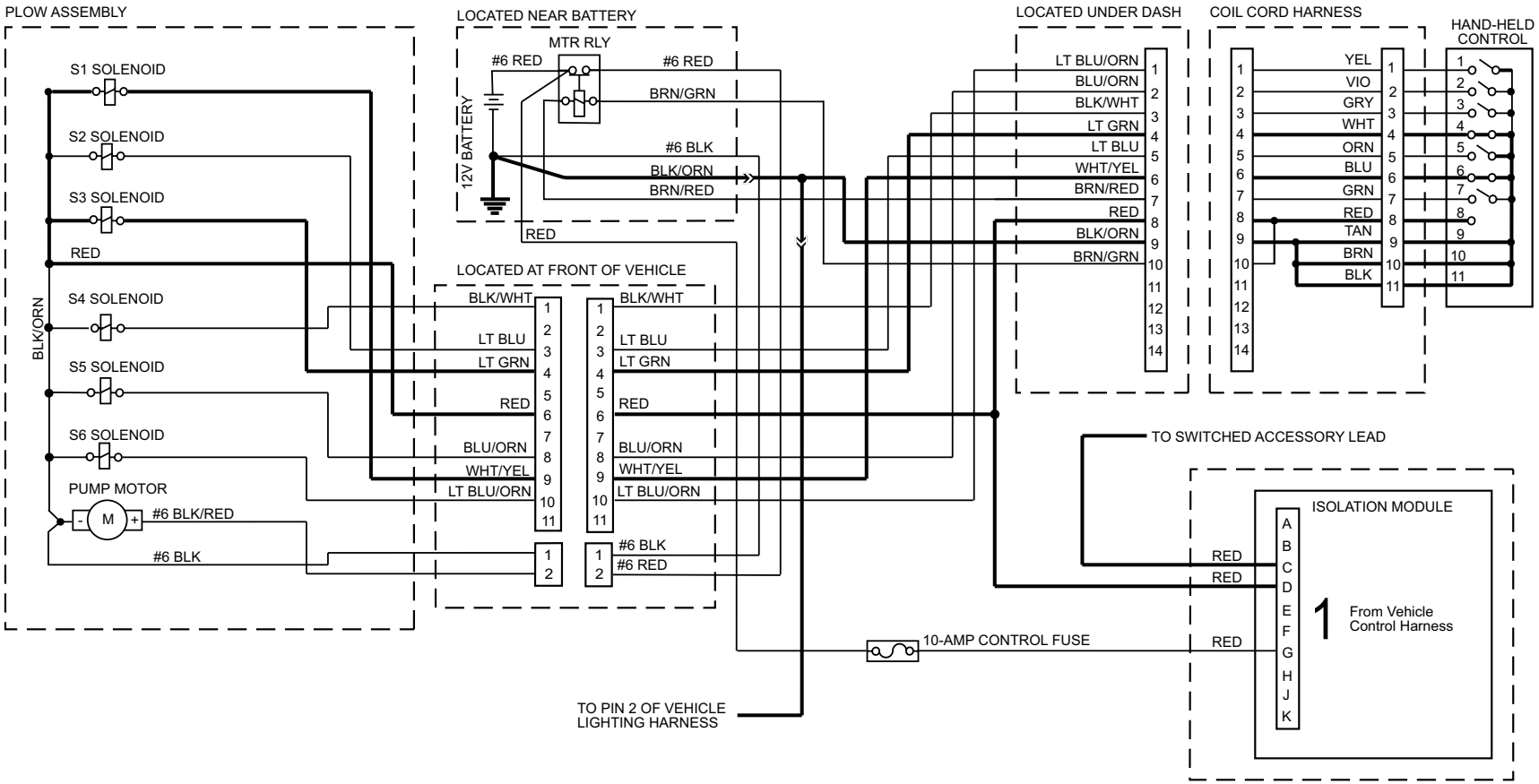
CONTROL MODE		ALL	ALL	STRAIGHT BLADE (DEFAULT)		V / SCOOP		WING			
CONTROL BUTTON		RAISE	LOWER	R/VEE	L/SCP	R/VEE	L/SCP	R/VEE *	R/VEE *	L/SCP *	L/SCP *
BLADE MOVEMENT		RAISE	LOWER	ANGLE RIGHT	ANGLE LEFT	VEE	SCOOP	RIGHT RETRACT	RIGHT EXTEND	LEFT RETRACT	LEFT EXTEND
MOTOR	M	ON		ON	ON	ON	ON	ON	ON	ON	ON
SV08-2004	S1		ON								
SV08-40	S2	ON			ON					ON	ON
SV08-43	S3	ON	ON			ON	ON				
SV08-30	S4						ON				ON
SV08-40	S5			ON	ON						
SV08-30	S6						ON		ON		

* NOTE - SEE BLADE MOVEMENT TEXT FOR BUTTON OPERATION

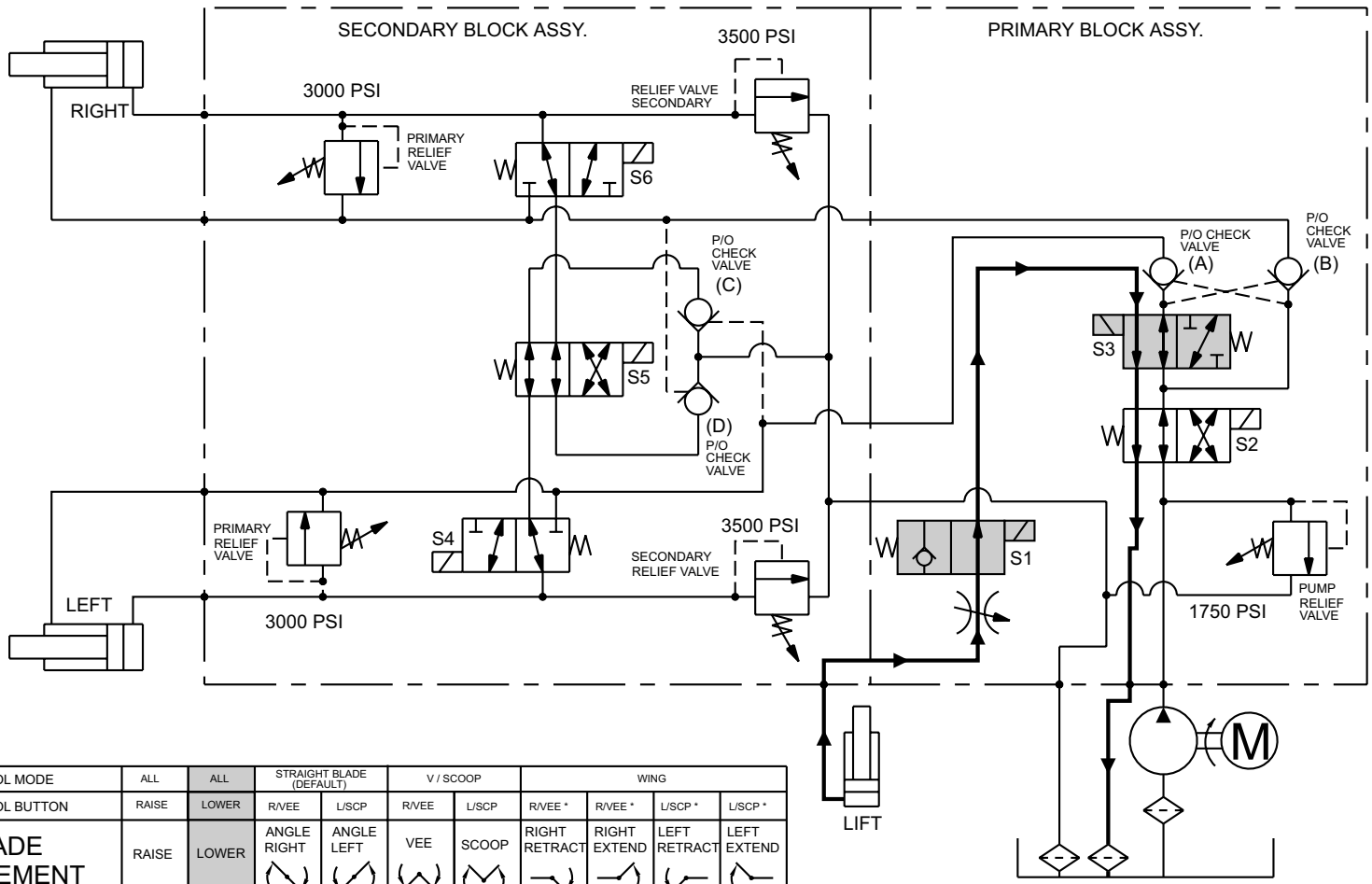
Blade Movement: Lower / Float
Control Mode: All Modes
Control Button: Lower

System Response:

1) By pressing the control button, the circuit board inside the cab control completes the ground path for the electrical circuit.
2) Electrical current flows through solenoid cartridge valves S1 & S3 shifting both spools.
3) The weight of the plow forces the lift cylinder to retract. The retracting lift cylinder pushes the hydraulic oil out of its base end, through solenoid cartridge valves S1 & S3 & S2, and back to the reservoir.



LOWER – HYDRAULIC



CONTROL MODE		ALL	ALL	STRAIGHT BLADE (DEFAULT)		V / SCOOP		WING			
CONTROL BUTTON		RAISE	LOWER	R/VEE	L/SCP	R/VEE	L/SCP	R/VEE *	R/VEE *	L/SCP *	L/SCP *
BLADE MOVEMENT		RAISE	LOWER	ANGLE RIGHT	ANGLE LEFT	VEE	SCOOP	RIGHT RETRACT	RIGHT EXTEND	LEFT RETRACT	LEFT EXTEND
MOTOR	M	ON		ON	ON	ON	ON	ON	ON	ON	ON
SV08-2004	S1		ON								
SV08-40	S2	ON			ON					ON	ON
SV08-43	S3	ON	ON			ON	ON				
SV08-30	S4						ON				ON
SV08-40	S5			ON	ON						
SV08-30	S6						ON		ON		

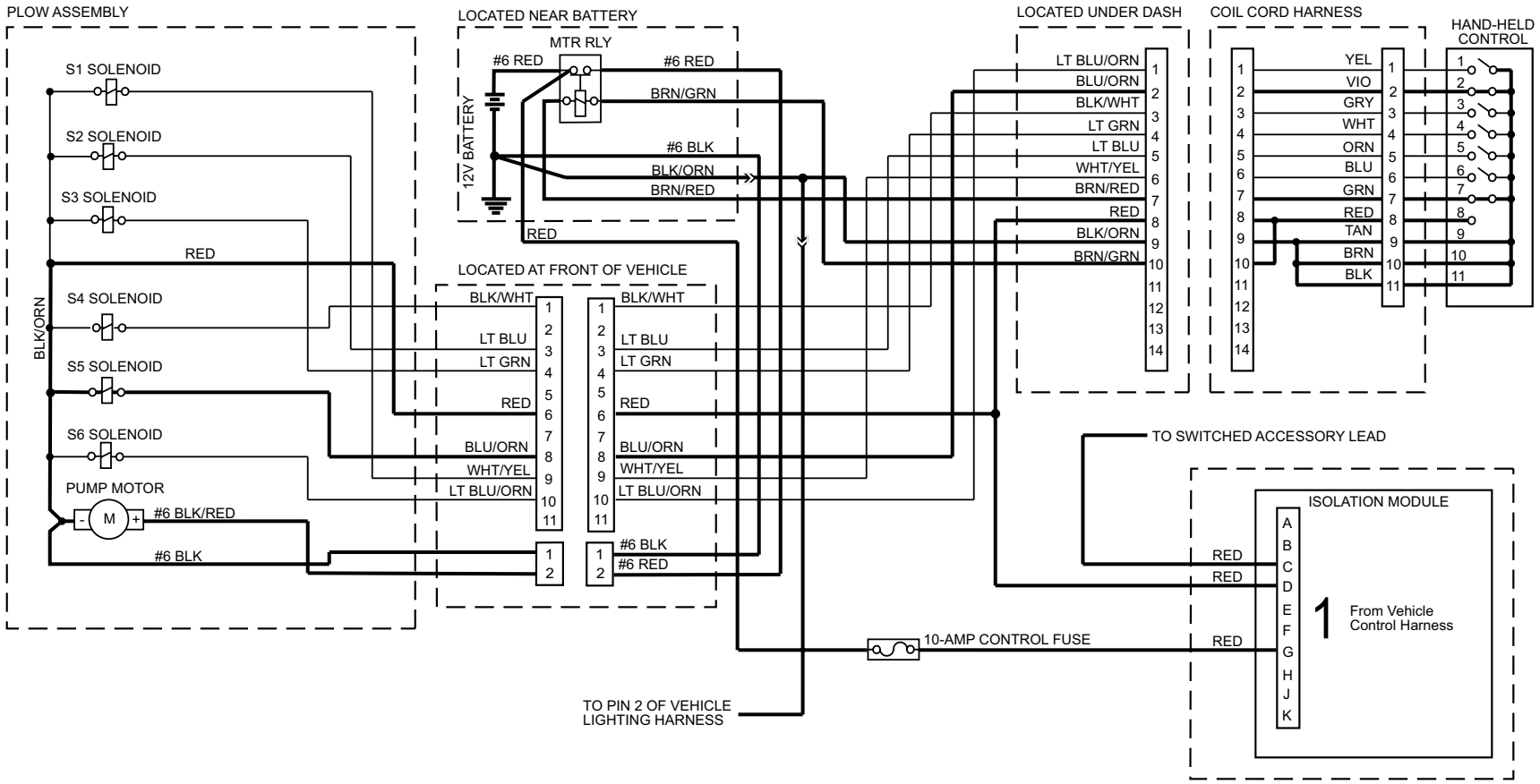
* NOTE - SEE BLADE MOVEMENT TEXT FOR BUTTON OPERATION

ANGLE RIGHT – ELECTRICAL

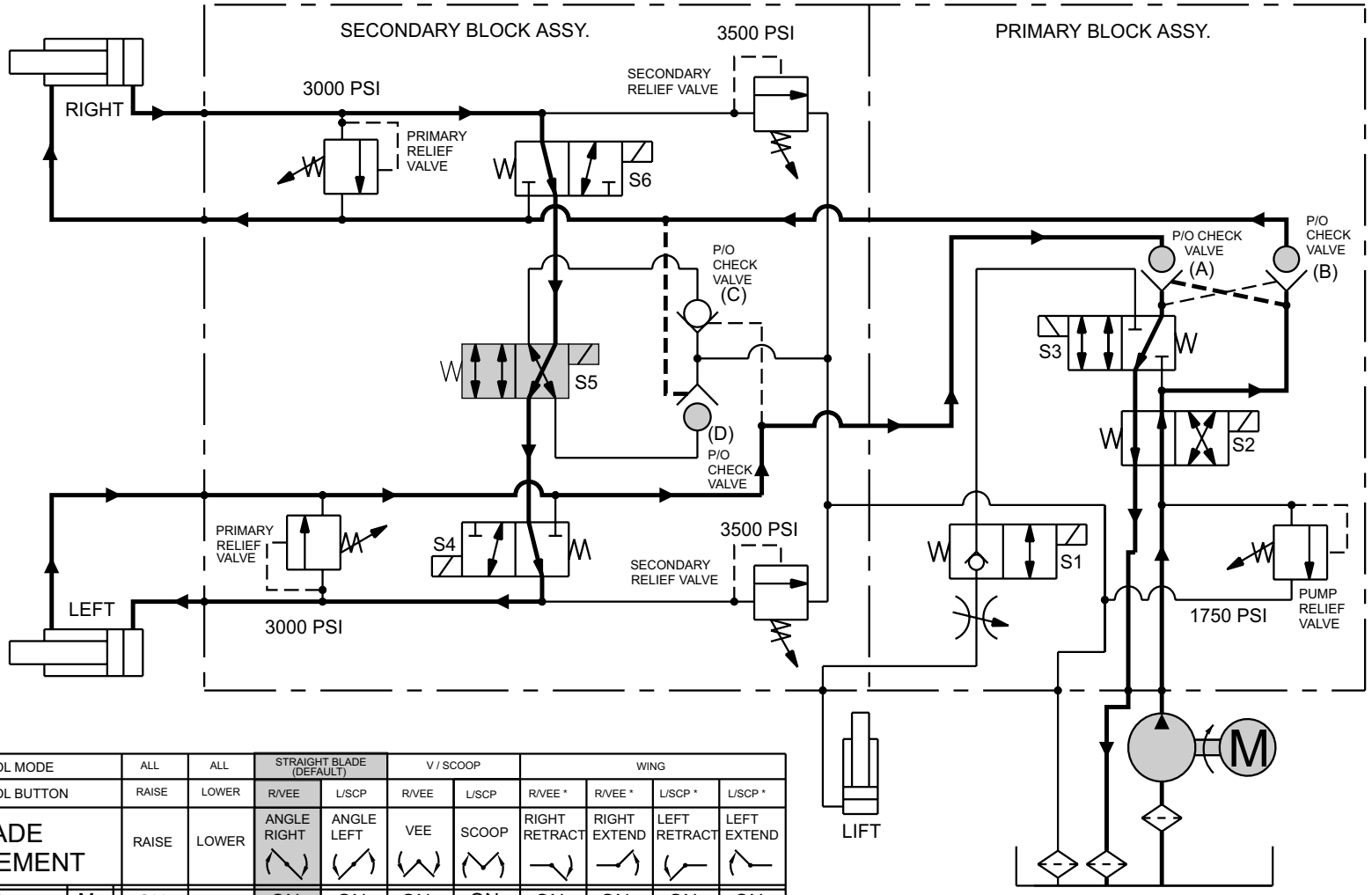
Blade Movement: Angle Right
Control Mode: Straight Blade Mode (Default)
Control Button: R/VEE

System Response:

1) By pressing the control button, the circuit board inside the cab control completes the ground path for the electrical circuit.
2) Electrical current flows through the motor relay, activating the pump motor, and solenoid cartridge valve S5, shifting its spool.
3) Hydraulic oil from the pump flows through solenoid cartridge valve S2, P/O check valve (B) and into the rod end of the right cylinder causing it to retract.
4) Pressure within the hydraulic circuit causes P/O check valves (A) & (D) to open.
5) The retracting right cylinder pushes the hydraulic oil out of its base end, through solenoid cartridge valves S6 & S5 & S4 and into the base end of the left cylinder causing it to extend.
6) The extending left cylinder pushes the hydraulic oil out of its rod end, through P/O check valve (A), solenoid cartridge valves S3 & S2 and back to the reservoir.



ANGLE RIGHT – HYDRAULIC



CONTROL MODE		ALL	ALL	STRAIGHT BLADE (DEFAULT)		V / SCOOP		WING			
CONTROL BUTTON		RAISE	LOWER	R/VEE	L/SCP	R/VEE	L/SCP	R/VEE *	R/VEE *	L/SCP *	L/SCP *
BLADE MOVEMENT		RAISE	LOWER	ANGLE RIGHT	ANGLE LEFT	VEE	SCOOP	RIGHT RETRACT	RIGHT EXTEND	LEFT RETRACT	LEFT EXTEND
MOTOR	M	ON		ON	ON	ON	ON	ON	ON	ON	ON
SV08-2004	S1		ON								
SV08-40	S2	ON			ON					ON	ON
SV08-43	S3	ON	ON			ON	ON				
SV08-30	S4						ON				ON
SV08-40	S5			ON	ON						
SV08-30	S6						ON		ON		

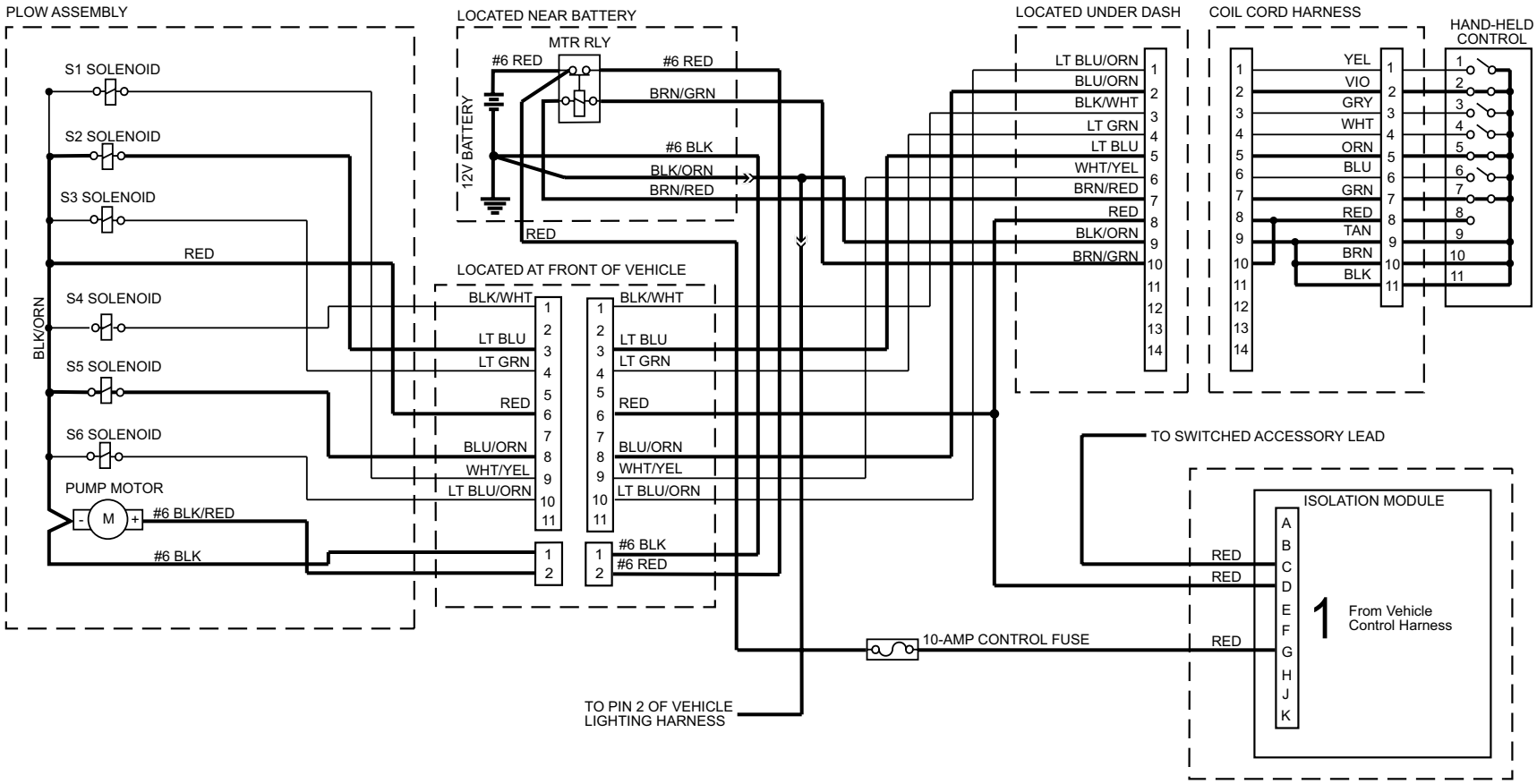
* NOTE - SEE BLADE MOVEMENT TEXT FOR BUTTON OPERATION

ANGLE LEFT – ELECTRICAL

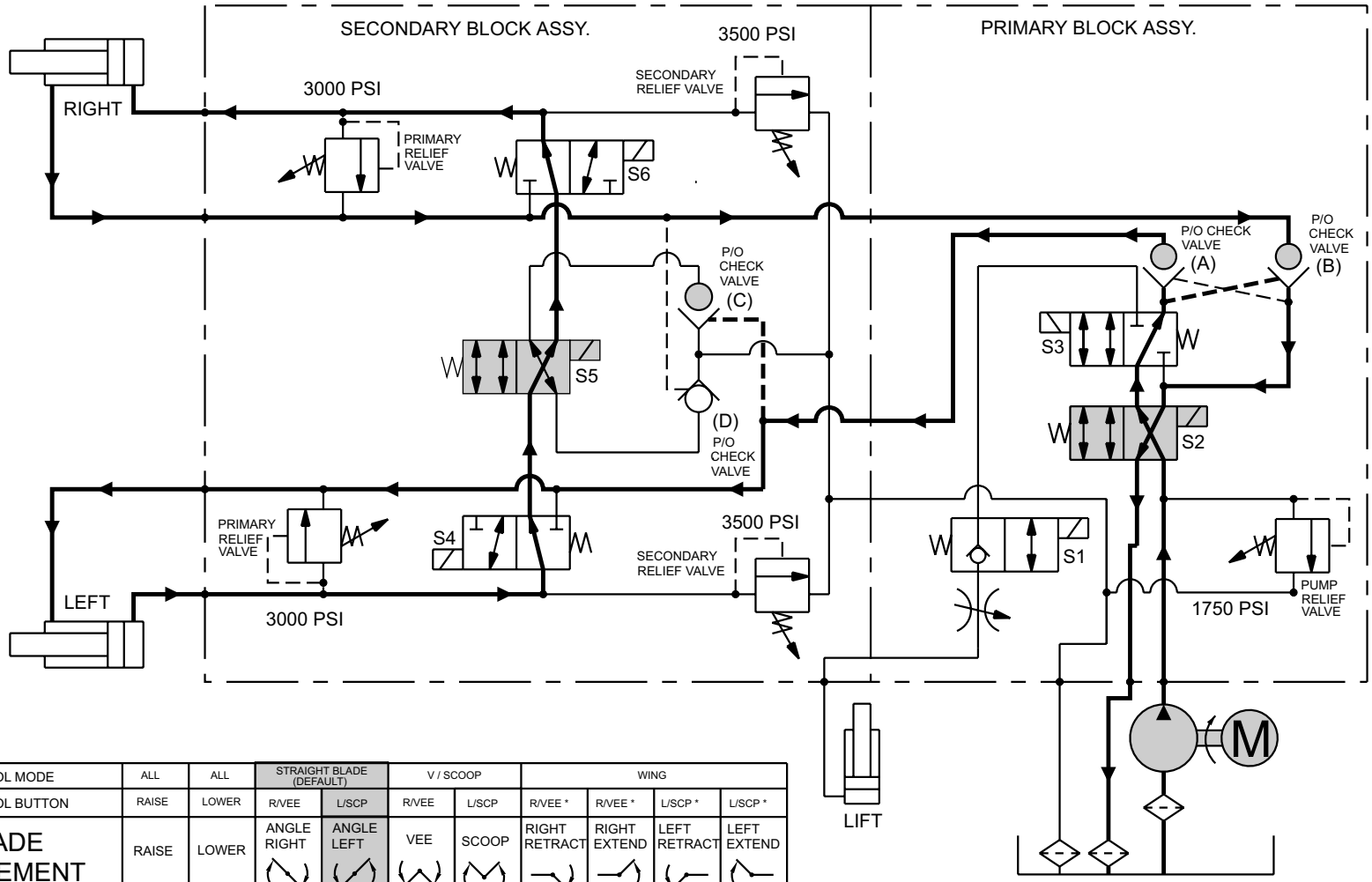
Blade Movement: Angle Left
Control Mode: Straight Blade Mode (Default)
Control Button: L/SCP

System Response:

1) By pressing the control button, the circuit board inside the cab control completes the ground path for the electrical circuit.
2) Electrical current flows through the motor relay, activating the pump motor, and solenoid cartridge valves S2 & S5, shifting both spools.
3) Hydraulic oil from the pump flows through solenoid cartridge valves S2 & S3, P/O check valve (A) and into the rod end of the left cylinder causing it to retract.
4) Pressure within the hydraulic circuit causes P/O check valves (B) & (C) to open.
5) The retracting left cylinder pushes the hydraulic oil out of its base end, through solenoid cartridge valves S4 & S5 & S6 and into the base end of the right cylinder causing it to extend.
6) The extending right cylinder pushes the hydraulic oil out of its rod end, through P/O check valve (B), solenoid cartridge valve S2 and back to the reservoir.



ANGLE LEFT – HYDRAULIC



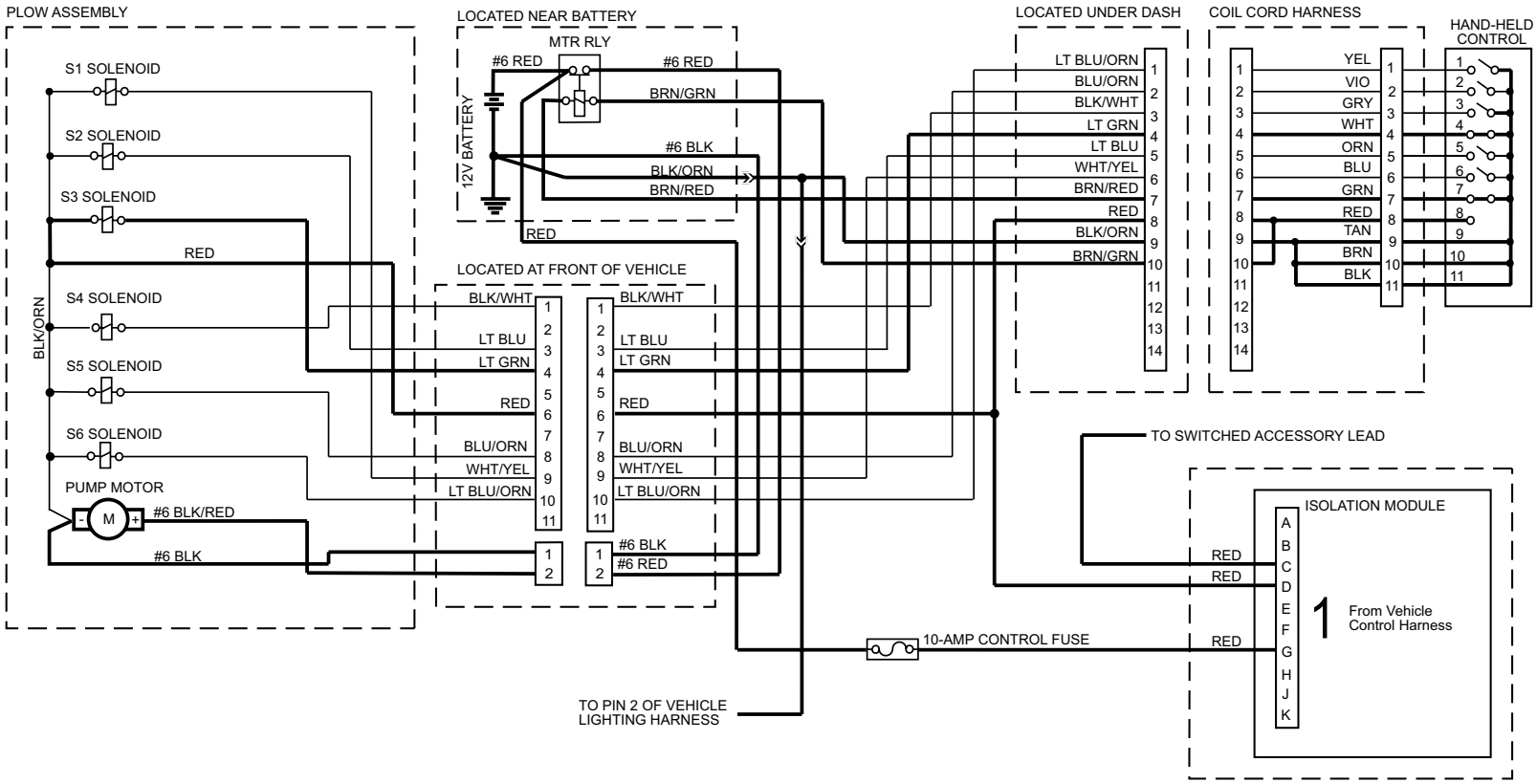
CONTROL MODE		ALL	ALL	STRAIGHT BLADE (DEFAULT)		V / SCOOP		WING			
CONTROL BUTTON		RAISE	LOWER	R/VEE	L/SCP	R/VEE	L/SCP	R/VEE *	R/VEE *	L/SCP *	L/SCP *
BLADE MOVEMENT		RAISE	LOWER	ANGLE RIGHT	ANGLE LEFT	VEE	SCOOP	RIGHT RETRACT	RIGHT EXTEND	LEFT RETRACT	LEFT EXTEND
MOTOR	M	ON		ON	ON	ON	ON	ON	ON	ON	ON
SV08-2004	S1		ON								
SV08-40	S2	ON			ON					ON	ON
SV08-43	S3	ON	ON			ON	ON				
SV08-30	S4						ON				ON
SV08-40	S5			ON	ON						
SV08-30	S6						ON		ON		

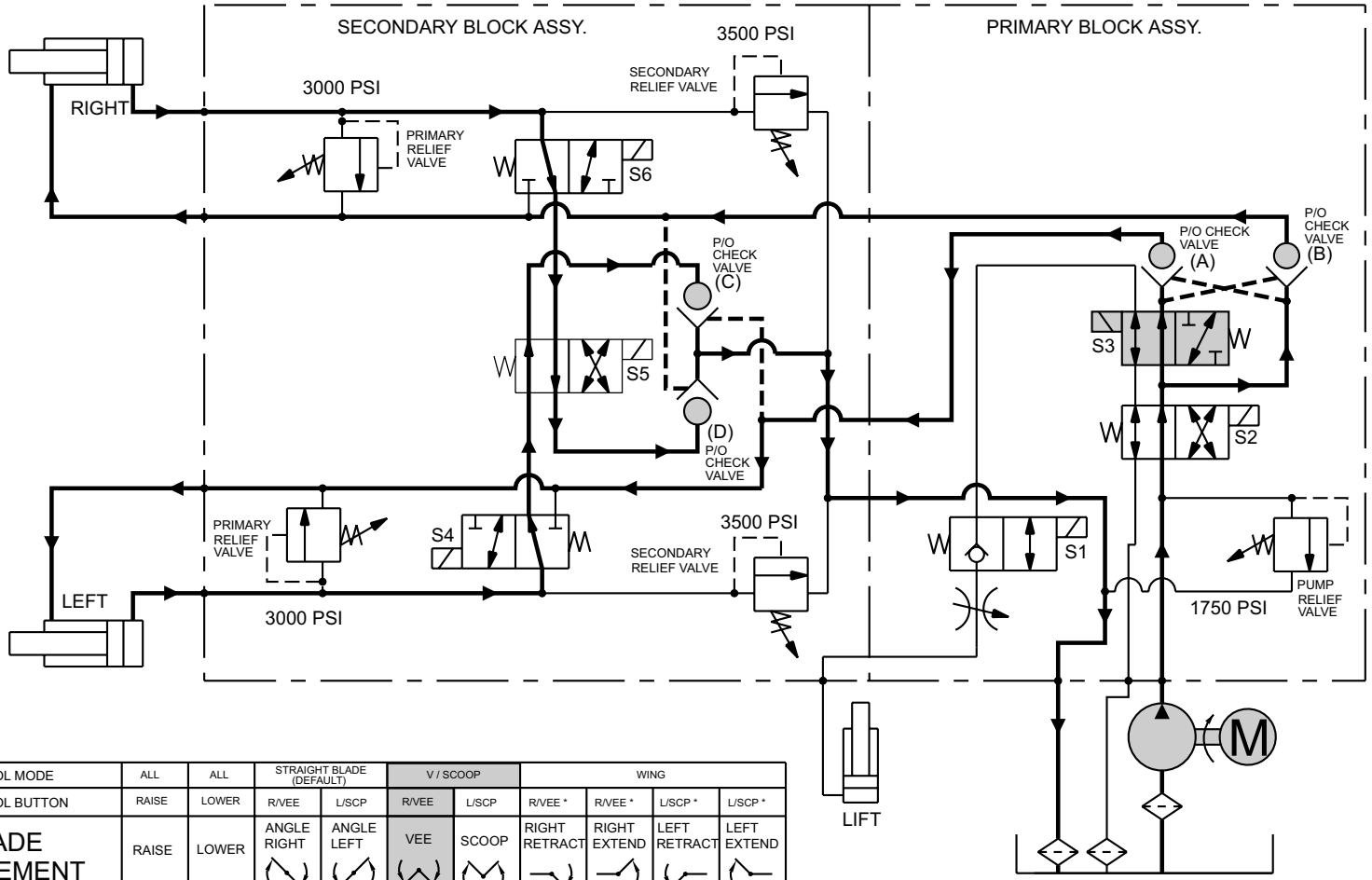
* NOTE - SEE BLADE MOVEMENT TEXT FOR BUTTON OPERATION

Blade Movement: Vee
Control Mode: V / Scoop Mode
Control Button: R/VEE

System Response:

1) By pressing the control button, the circuit board inside the cab control completes the ground path for the electrical circuit.
2) Electrical current flows through the motor relay, activating the pump motor, and solenoid cartridge valve S3, shifting its spool.
3) Hydraulic oil from the pump flows through solenoid cartridge valve S2 and into two separate hydraulic circuits.
4) Half of the oil flows through P/O check valve (B) and into the rod end of the right cylinder causing it to retract.
5) The other half of the oil flows through solenoid cartridge valve S3, P/O check valve (A) and into the rod end of the left cylinder causing it to retract.
6) Pressure within the hydraulic circuit causes P/O check valves (C) & (D) to open.
7) The retracting right cylinder pushes the hydraulic oil out of its base end, through solenoid cartridge valves S6 & S5, P/O check valve (D) and back to the reservoir.
8) The retracting left cylinder pushes the hydraulic oil out of its base end, through solenoid cartridge valves S4 & S5, through P/O check valve (C) and back to the reservoir.





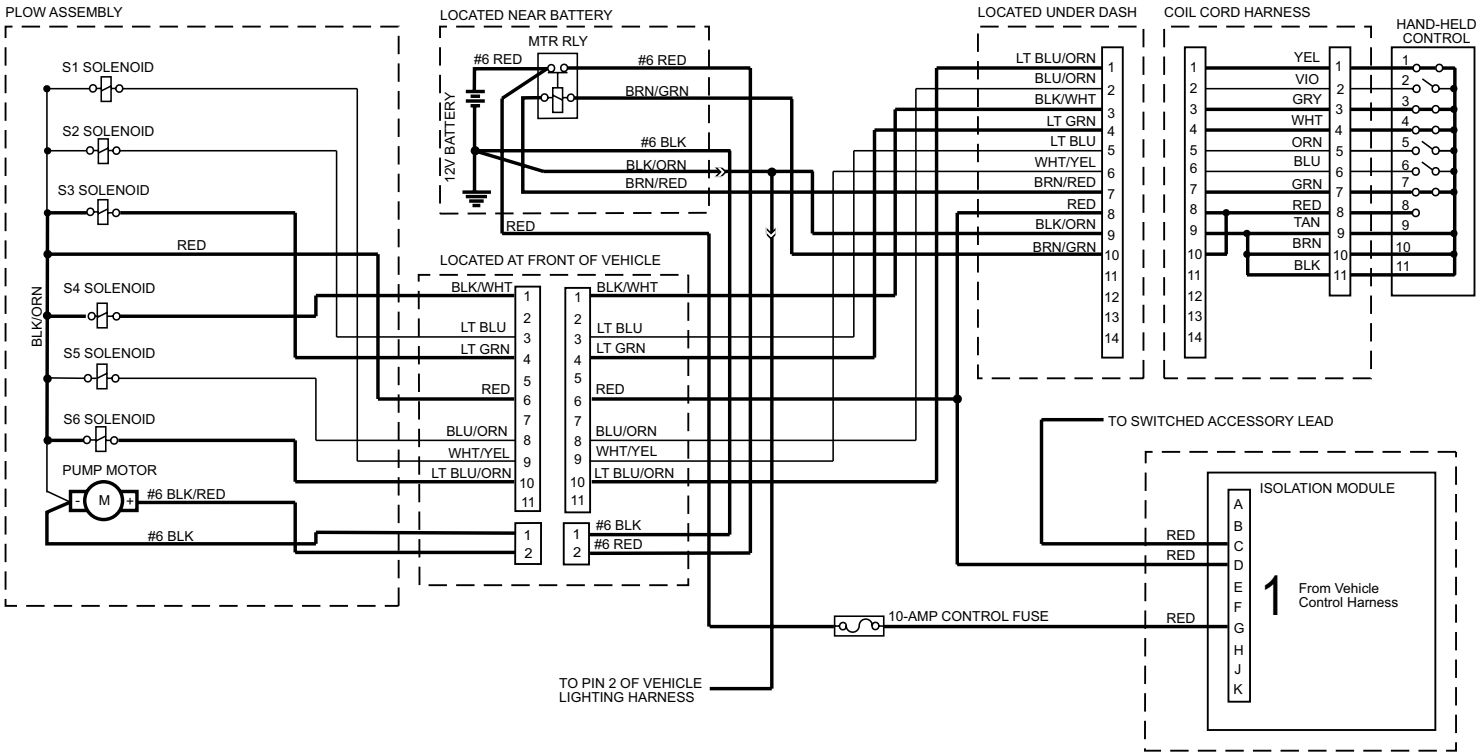
CONTROL MODE		ALL	ALL	STRAIGHT BLADE (DEFAULT)		V / SCOOP		WING			
CONTROL BUTTON		RAISE	LOWER	R/VEE	L/SCP	R/VEE	L/SCP	R/VEE *	R/VEE *	L/SCP *	L/SCP *
BLADE MOVEMENT		RAISE	LOWER	ANGLE RIGHT	ANGLE LEFT	VEE	SCOOP	RIGHT RETRACT	RIGHT EXTEND	LEFT RETRACT	LEFT EXTEND
MOTOR	M	ON		ON	ON	ON	ON	ON	ON	ON	ON
SV08-2004	S1		ON								
SV08-40	S2	ON			ON					ON	ON
SV08-43	S3	ON	ON			ON	ON				
SV08-30	S4						ON				ON
SV08-40	S5			ON	ON						
SV08-30	S6						ON		ON		

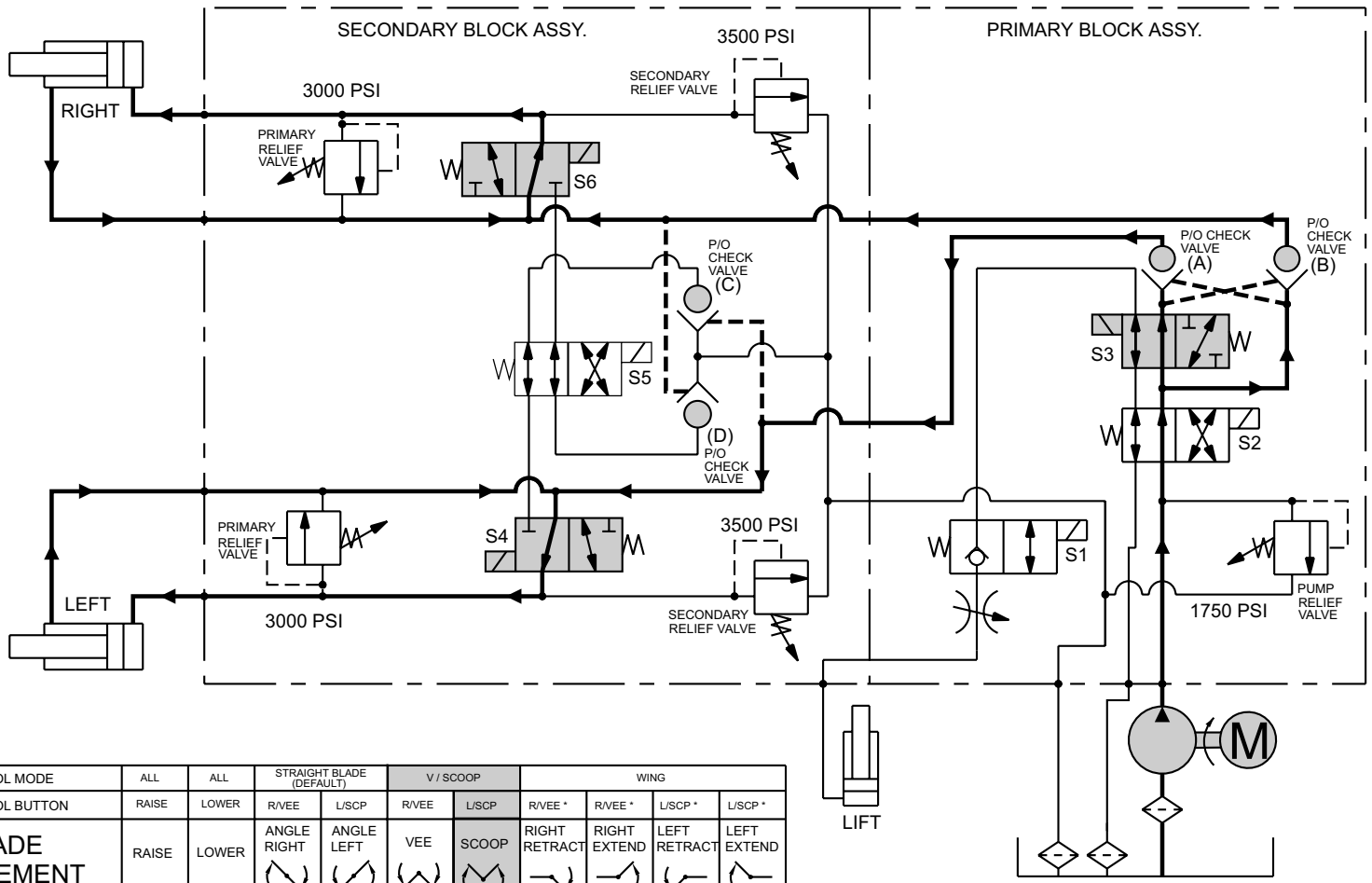
* NOTE - SEE BLADE MOVEMENT TEXT FOR BUTTON OPERATION

Blade Movement: Scoop
Control Mode: V / Scoop Mode
Control Button: L/SCP

System Response:

1) By pressing the control button, the circuit board inside the cab control completes the ground path for the electrical circuit.
2) Electrical current flows through the motor relay, activating the pump motor, and solenoid cartridge valves S3 & S4 & S6, shifting the three spools.
3) Hydraulic oil from the pump flows through solenoid cartridge valve S2 and into two separate hydraulic circuits.
4) Half of the oil flows through P/O check valve (B), solenoid cartridge valve S6 and into the base end of the right cylinder causing it to extend. The extending right cylinder pushes the hydraulic oil out of its rod end. This oil mixes with the hydraulic oil from the pump, passes through solenoid cartridge valve S6 and into the base end of the extending right cylinder. This is called a *regenerative hydraulic circuit. Even though both sides of the cylinder piston will experience the same hydraulic pressure, the cylinder will extend due to unequal force. The difference in area between the base end and rod end of the cylinder piston creates a greater force on the base end which extends the cylinder. Force = Pressure X Surface Area.*
5) The other half of the oil flows through solenoid cartridge valve S3, P/O check valve (A), solenoid cartridge valve S4 and into the base end of the left cylinder causing it to extend. The extending left cylinder pushes the hydraulic oil out of its rod end. This oil mixes with the hydraulic oil from the pump, passes through solenoid cartridge valve S4 and into the base end of the extending left cylinder. This is also a *regenerative hydraulic circuit.*
6) Pressure within the hydraulic circuit causes P/O check valves (C) & (D) to open.





CONTROL MODE		ALL	ALL	STRAIGHT BLADE (DEFAULT)		V / SCOOP		WING			
CONTROL BUTTON		RAISE	LOWER	R/VEE	L/SCP	R/VEE	L/SCP	R/VEE *	R/VEE *	L/SCP *	L/SCP *
BLADE MOVEMENT		RAISE	LOWER	ANGLE RIGHT	ANGLE LEFT	VEE	SCOOP	RIGHT RETRACT	RIGHT EXTEND	LEFT RETRACT	LEFT EXTEND
MOTOR	M	ON		ON	ON	ON	ON	ON	ON	ON	ON
SV08-2004	S1		ON								
SV08-40	S2	ON			ON					ON	ON
SV08-43	S3	ON	ON			ON	ON				
SV08-30	S4						ON				ON
SV08-40	S5			ON	ON						
SV08-30	S6						ON		ON		

* NOTE - SEE BLADE MOVEMENT TEXT FOR BUTTON OPERATION

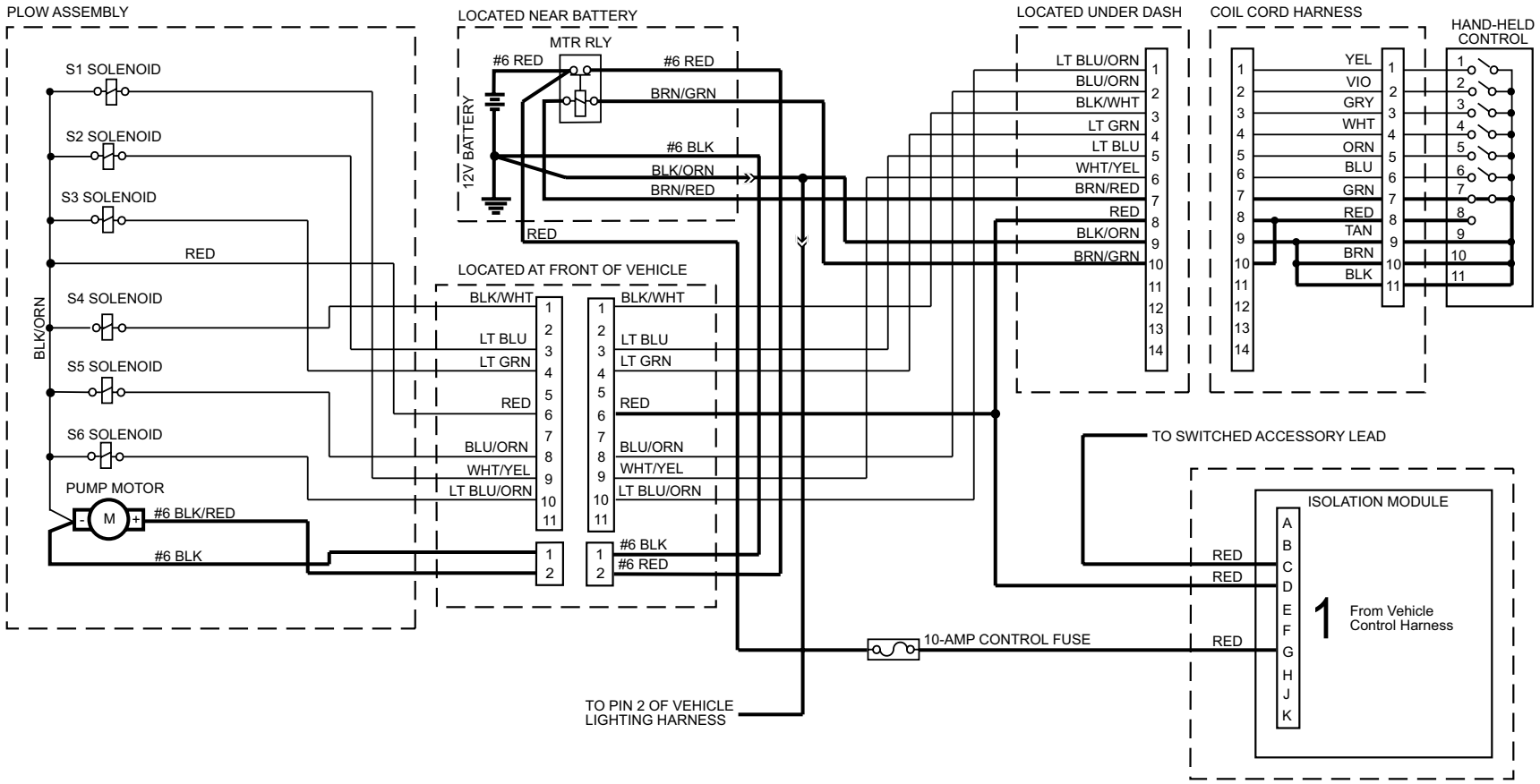
RIGHT RETRACT – ELECTRICAL

Blade Movement: Right Retract
Control Mode: Wing Mode
Control Button: R/VEE

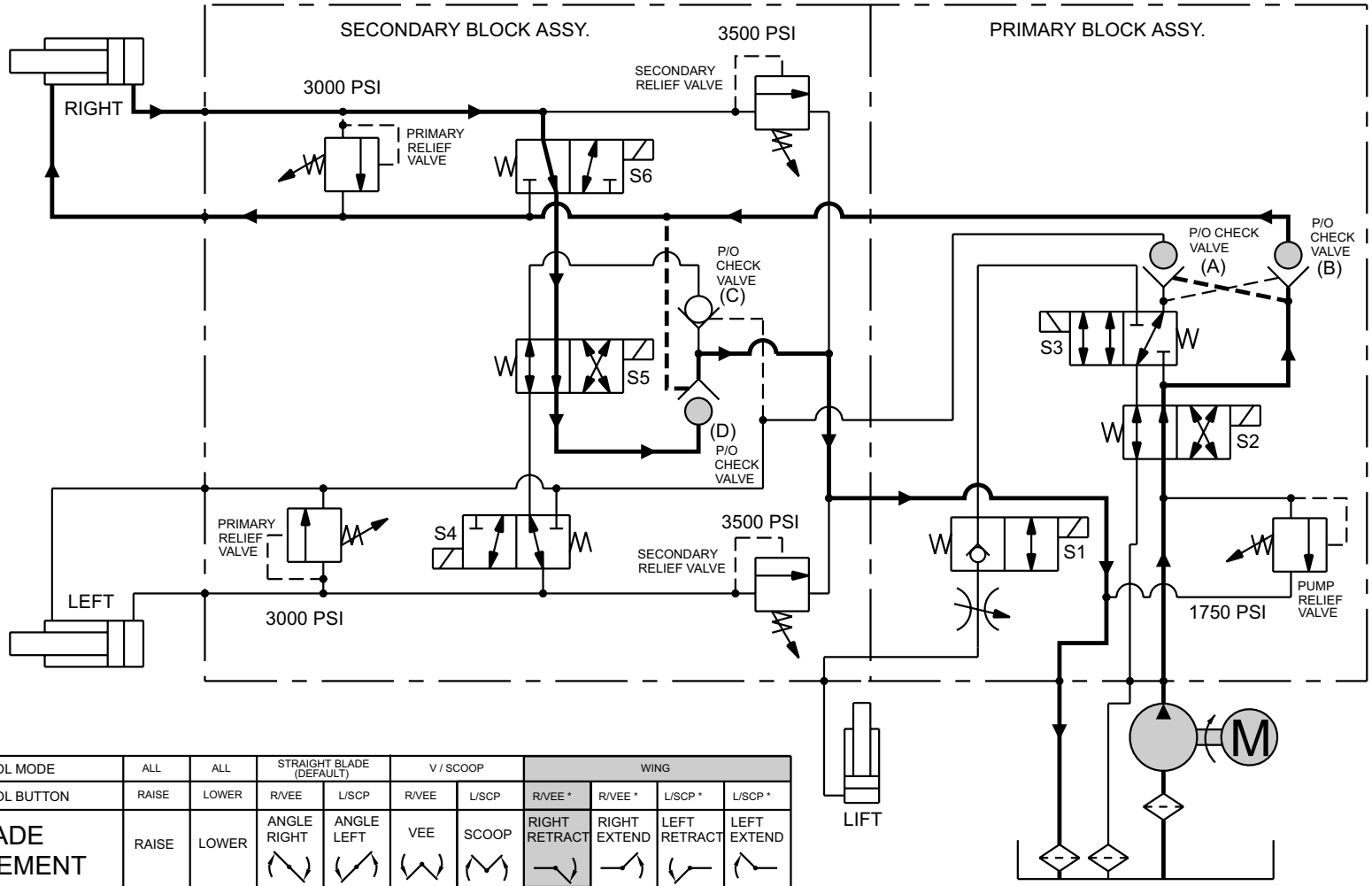
This button toggles between retract and extend in wing mode. Upon entering wing mode, the first activation of this button and every other activation thereafter retracts the wing. The second activation of this button and every other activation thereafter extends the wing.

System Response:

1) By pressing the control button, the circuit board inside the cab control completes the ground path for the electrical circuit.
2) Electrical current flows through the motor relay activating the pump motor.
3) Hydraulic oil from the pump flows through solenoid cartridge valve S2, P/O check valve (B) and into the rod end of the right cylinder causing it to retract.
4) Pressure within the hydraulic circuit causes P/O check valves (A) & (D) to open.
5) The retracting right cylinder pushes the hydraulic oil out of its base end, through solenoid cartridge valves S6 & S5, P/O check valve (D) and back to the reservoir.



RIGHT RETRACT – HYDRAULIC



CONTROL MODE		ALL	ALL	STRAIGHT BLADE (DEFAULT)		V / SCOOP		WING			
CONTROL BUTTON		RAISE	LOWER	R/VEE	L/SCP	R/VEE	L/SCP	R/VEE *	R/VEE *	L/SCP *	L/SCP *
BLADE MOVEMENT		RAISE	LOWER	ANGLE RIGHT	ANGLE LEFT	VEE	SCOOP	RIGHT RETRACT	RIGHT EXTEND	LEFT RETRACT	LEFT EXTEND
MOTOR	M	ON		ON	ON	ON	ON	ON	ON	ON	ON
SV08-2004	S1		ON								
SV08-40	S2	ON			ON					ON	ON
SV08-43	S3	ON	ON			ON	ON				
SV08-30	S4						ON				ON
SV08-40	S5			ON	ON						
SV08-30	S6						ON		ON		

* NOTE - SEE BLADE MOVEMENT TEXT FOR BUTTON OPERATION

RIGHT EXTEND – ELECTRICAL

Blade Movement: Right Extend
Control Mode: Wing Mode
Control Button: R/VEE

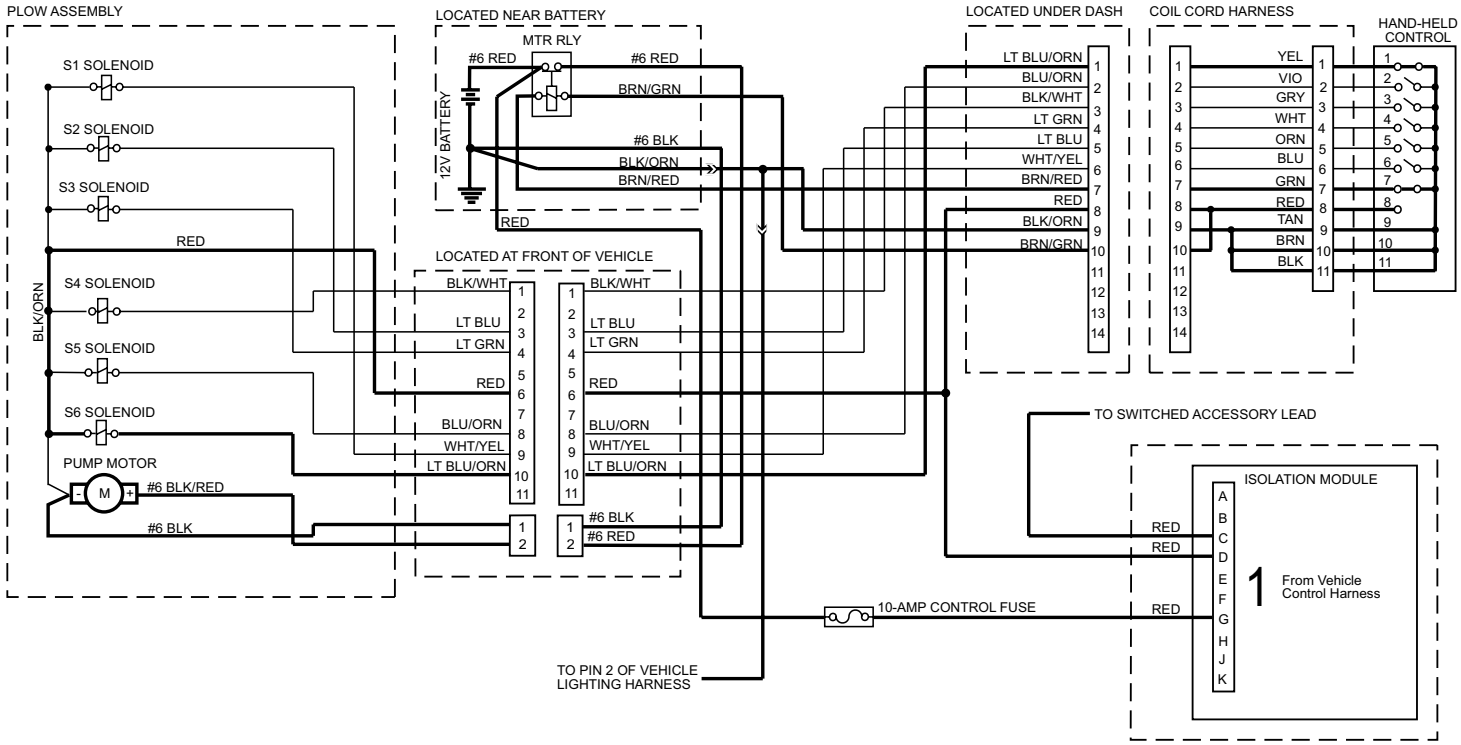
This button toggles between retract and extend in wing mode. Upon entering wing mode, the first activation of this button and every other activation thereafter retracts the wing. The second activation of this button and every other activation thereafter extends the wing.

System Response:

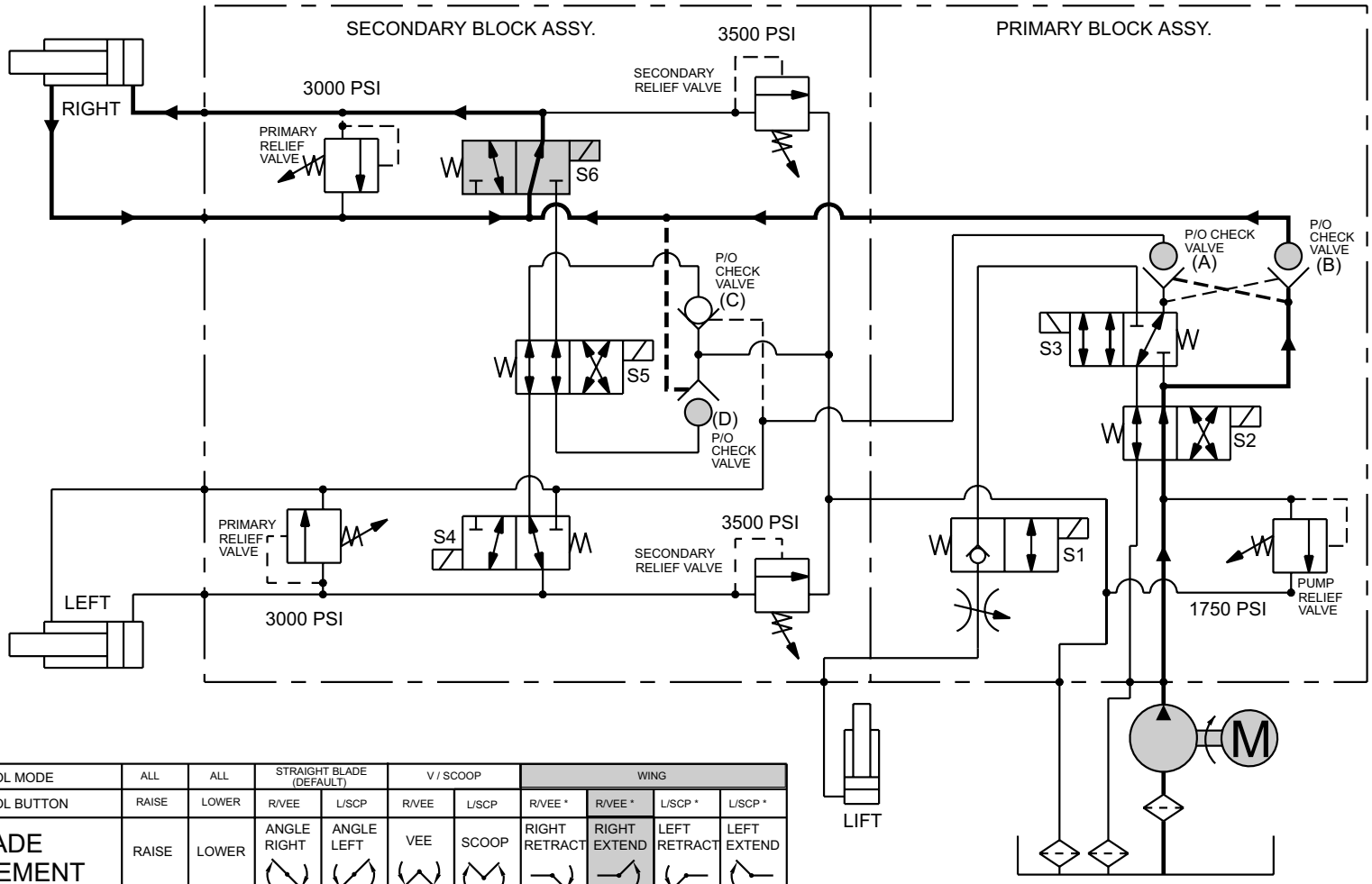
1) By pressing the control button, the circuit board inside the cab control completes the ground path for the electrical circuit.
2) Electrical current flows through the motor relay, activating the pump motor, and solenoid cartridge valve S6, shifting its spool.
3) Hydraulic oil from the pump flows through solenoid cartridge valve S2, P/O check valve (B), solenoid cartridge valve S6 and into the base end of the right cylinder causing it to extend.
4) The extending right cylinder pushes the hydraulic oil out of its rod end. This oil mixes with the hydraulic oil from the pump, passes through solenoid cartridge valve S6 and into the base end of the extending right cylinder. This is called a *regenerative hydraulic circuit.*

Even though both sides of the cylinder piston experience the same hydraulic pressure, the cylinder extends due to unequal force. The difference in area between the base end and rod end of the cylinder piston creates a greater force on the base end which extends the cylinder. Force = Pressure X Surface Area.

5) Pressure within the hydraulic circuit causes P/O check valves (A) & (D) to open.



RIGHT EXTEND – HYDRAULIC



CONTROL MODE		ALL	ALL	STRAIGHT BLADE (DEFAULT)		V / SCOOP		WING			
CONTROL BUTTON		RAISE	LOWER	R/VEE	L/SCP	R/VEE	L/SCP	R/VEE *	R/VEE *	L/SCP *	L/SCP *
BLADE MOVEMENT		RAISE	LOWER	ANGLE RIGHT	ANGLE LEFT	VEE	SCOOP	RIGHT RETRACT	RIGHT EXTEND	LEFT RETRACT	LEFT EXTEND
MOTOR	M	ON		ON	ON	ON	ON	ON	ON	ON	ON
SV08-2004	S1		ON								
SV08-40	S2	ON			ON					ON	ON
SV08-43	S3	ON	ON			ON	ON				
SV08-30	S4						ON				ON
SV08-40	S5			ON	ON						
SV08-30	S6						ON		ON		

* NOTE - SEE BLADE MOVEMENT TEXT FOR BUTTON OPERATION

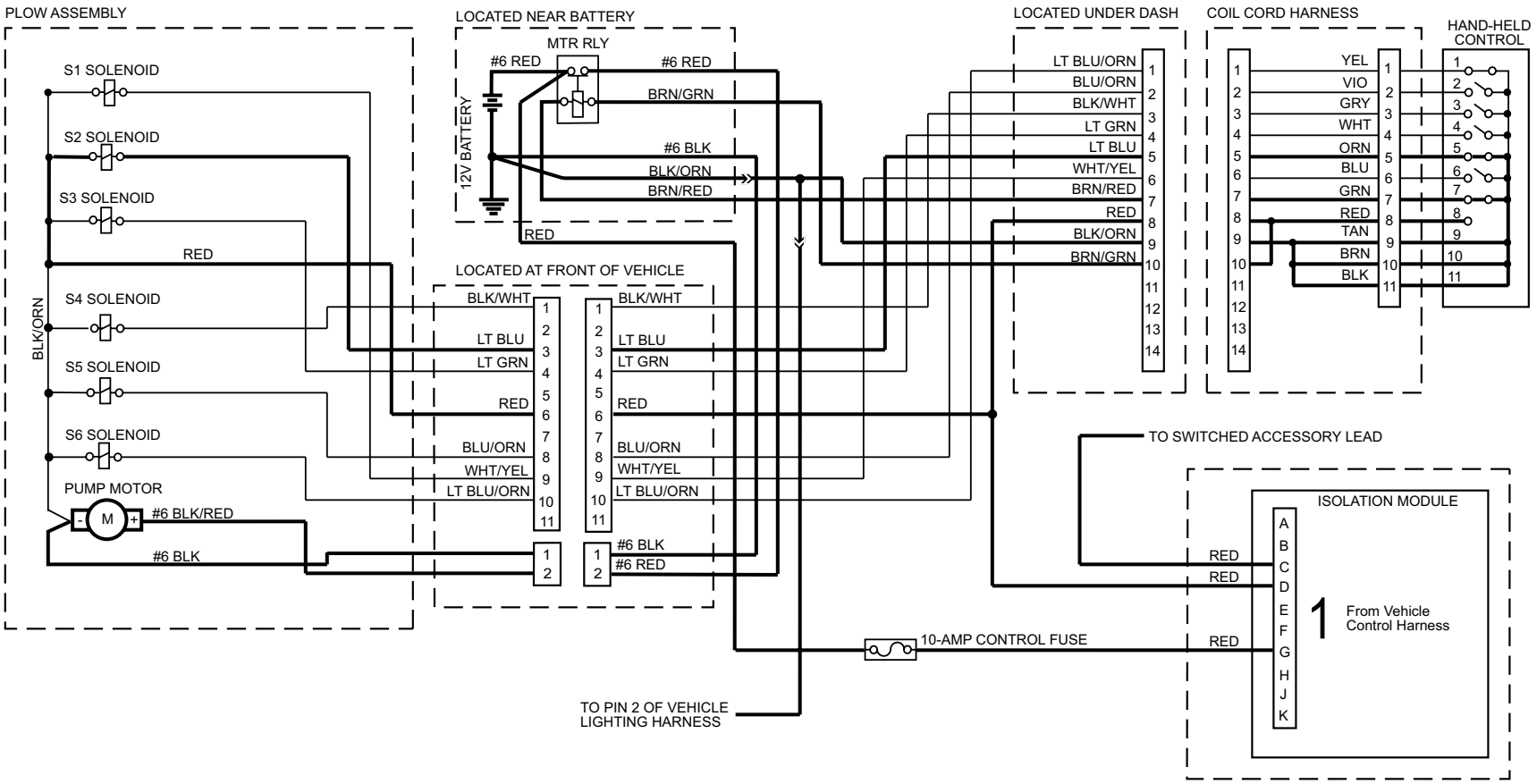
LEFT RETRACT – ELECTRICAL

Blade Movement: Left Retract
Control Mode: Wing Mode
Control Button: L/SCP

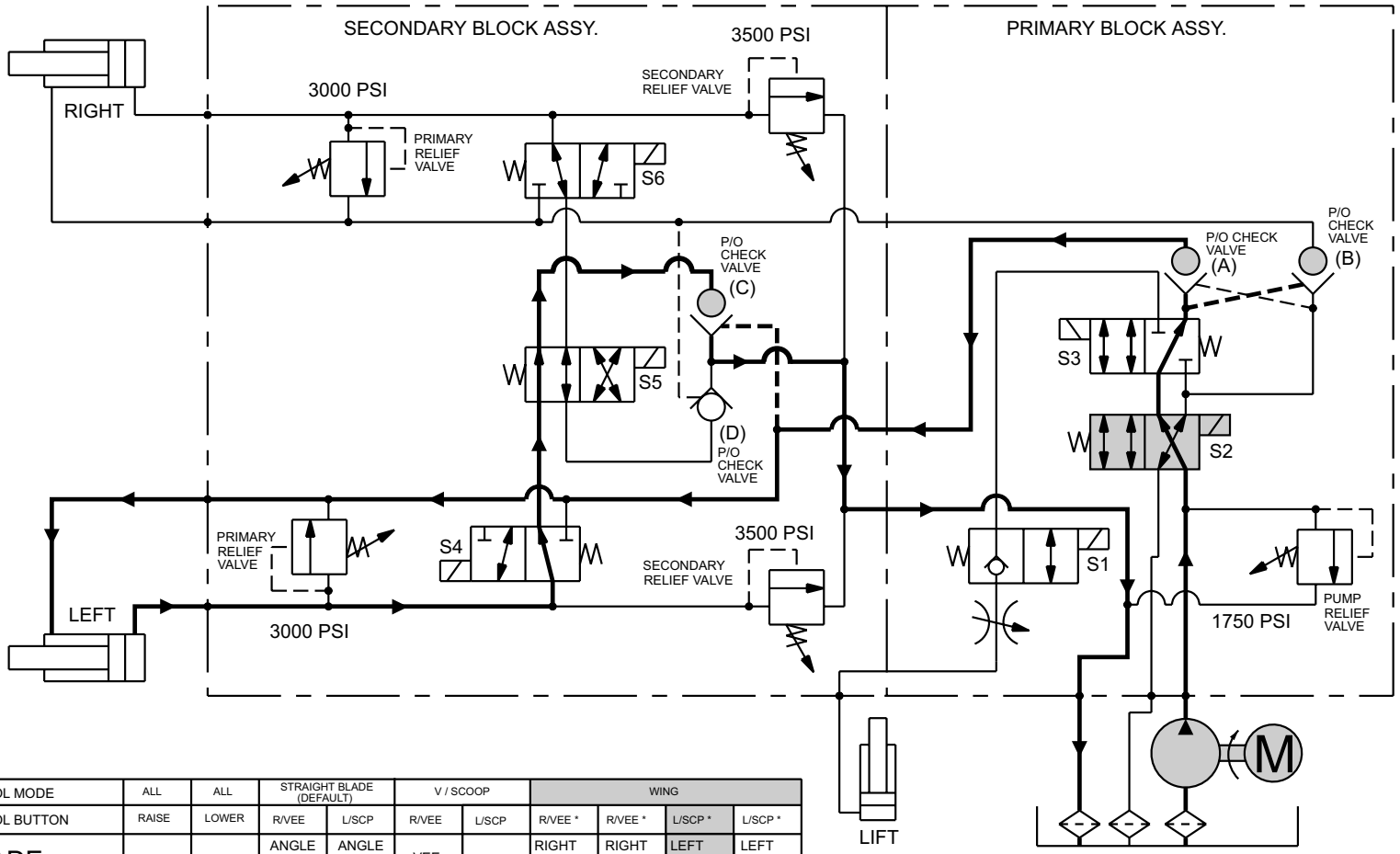
This button toggles between retract and extend in wing mode. Upon entering wing mode, the first activation of this button and every other activation thereafter retracts the wing. The second activation of this button and every other activation thereafter extends the wing.

System Response:

1) By pressing the control button, the circuit board inside the cab control completes the ground path for the electrical circuit.
2) Electrical current flows through the motor relay, activating the pump motor, and solenoid cartridge valve S2, shifting its spool.
3) Hydraulic oil from the pump flows through solenoid cartridge valves S2 & S3, P/O check valve (A), and into the rod end of the left cylinder causing it to retract.
4) Pressure within the hydraulic circuit causes P/O check valves (B) & (C) to open.
5) The retracting left cylinder pushes the hydraulic oil out of its base end, through solenoid cartridge valves S4 & S5, through P/O check valve (C) and back to the reservoir.



LEFT RETRACT – HYDRAULIC



CONTROL MODE		ALL	ALL	STRAIGHT BLADE (DEFAULT)		V / SCOOP		WING			
CONTROL BUTTON		RAISE	LOWER	R/VEE	L/SCP	R/VEE	L/SCP	R/VEE *	R/VEE *	L/SCP *	L/SCP *
BLADE MOVEMENT		RAISE	LOWER	ANGLE RIGHT	ANGLE LEFT	VEE	SCOOP	RIGHT RETRACT	RIGHT EXTEND	LEFT RETRACT	LEFT EXTEND
MOTOR	M	ON		ON	ON	ON	ON	ON	ON	ON	ON
SV08-2004	S1		ON								
SV08-40	S2	ON			ON					ON	ON
SV08-43	S3	ON	ON			ON	ON				
SV08-30	S4						ON				ON
SV08-40	S5			ON	ON						
SV08-30	S6						ON		ON		

* NOTE - SEE BLADE MOVEMENT TEXT FOR BUTTON OPERATION

LEFT EXTEND – ELECTRICAL

Blade Movement: Left Extend
Control Mode: Wing Mode
Control Button: L/SCP

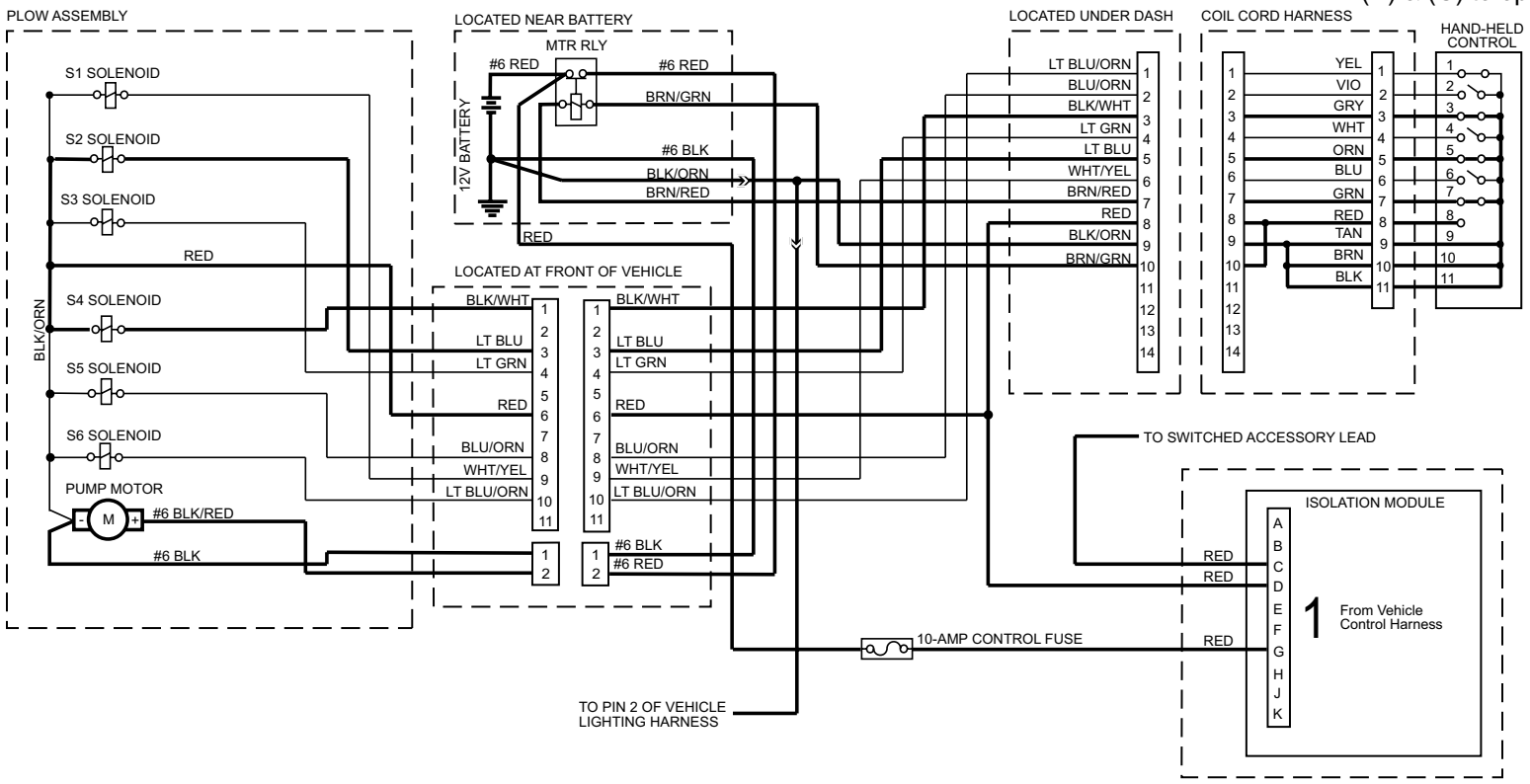
This button toggles between retract and extend in wing mode. Upon entering wing mode, the first activation of this button and every other activation thereafter retracts the wing. The second activation of this button and every other activation thereafter extends the wing.

System Response:

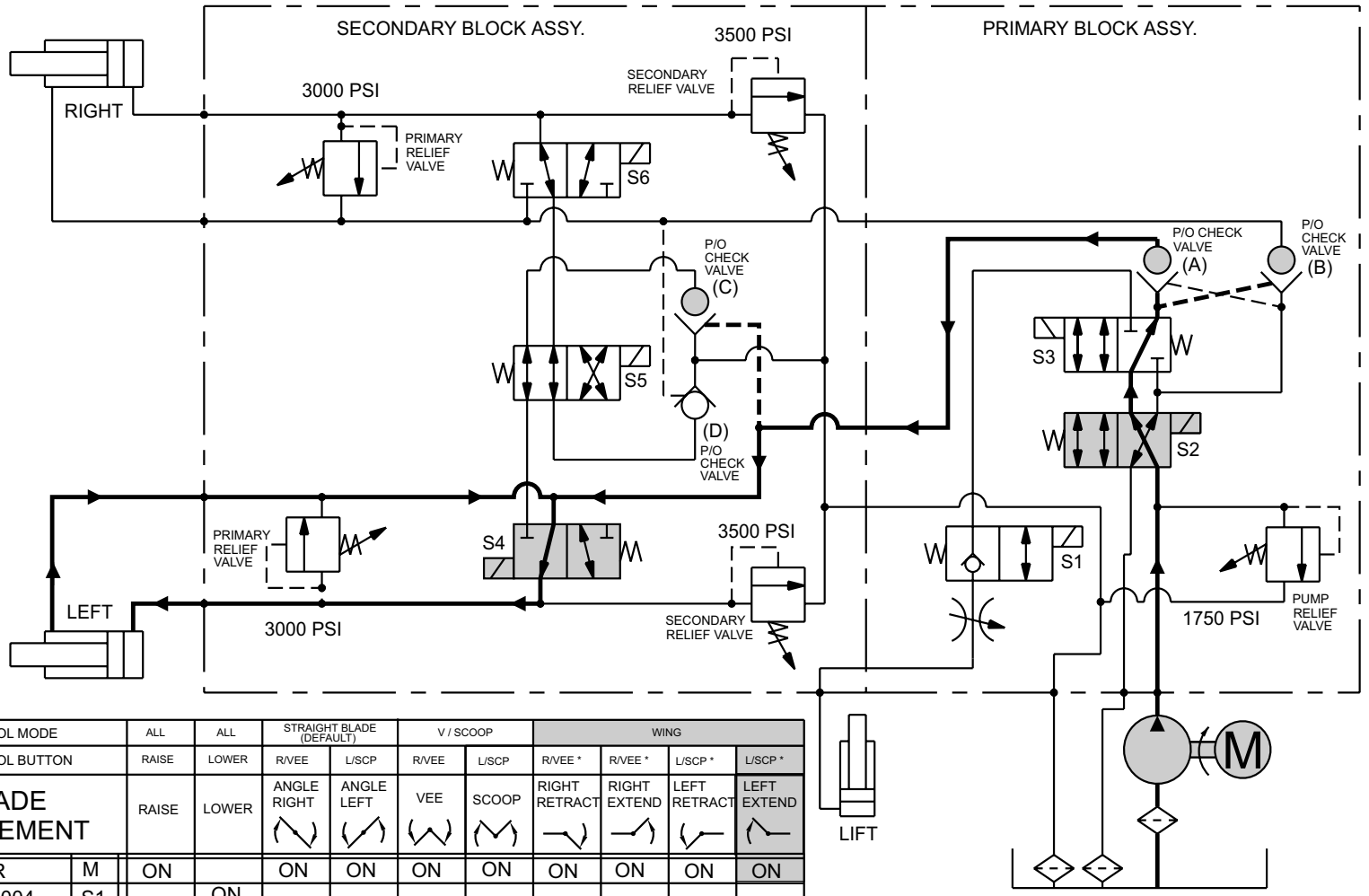
1) By pressing the control button, the circuit board inside the cab control completes the ground path for the electrical circuit.
2) Electrical current flows through the motor relay, activating the pump motor, and solenoid cartridge valves S2 & S4, shifting both spools.
3) Hydraulic oil from the pump flows through solenoid cartridge valves S2 & S3, P/O check valve (A), solenoid cartridge valve S4 and into the base end of the left cylinder causing it to extend.
4) The extending left cylinder pushes the hydraulic oil out of its rod end. This oil mixes with the hydraulic oil from the pump, passes through solenoid cartridge valve S4 and into the base end of the extending left cylinder. This is called a *regenerative hydraulic circuit.*

Even though both sides of the cylinder piston will experience the same hydraulic pressure, the cylinder will extend due to unequal force. The difference in area between the base end and rod end of the cylinder piston creates a greater force on the base end which extends the cylinder. Force = Pressure X Surface Area.

5) Pressure within the hydraulic circuit causes P/O check valves (B) & (C) to open.



LEFT EXTEND – HYDRAULIC



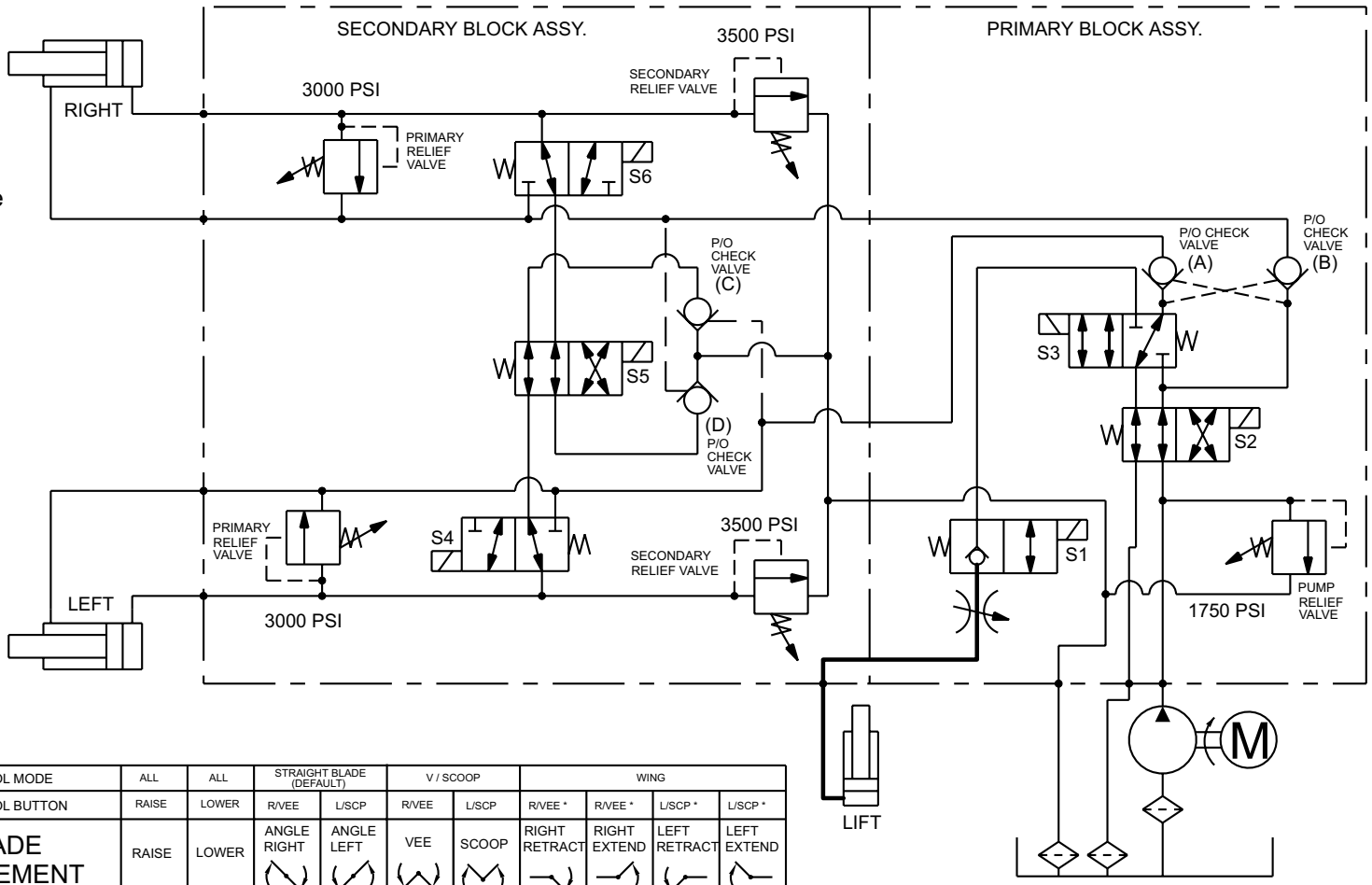
CONTROL MODE		ALL	ALL	STRAIGHT BLADE (DEFAULT)		V / SCOOP		WING			
CONTROL BUTTON		RAISE	LOWER	R/VEE	L/SCP	R/VEE	L/SCP	R/VEE *	R/VEE *	L/SCP *	L/SCP *
BLADE MOVEMENT		RAISE	LOWER	ANGLE RIGHT	ANGLE LEFT	VEE	SCOOP	RIGHT RETRACT	RIGHT EXTEND	LEFT RETRACT	LEFT EXTEND
MOTOR	M	ON		ON	ON	ON	ON	ON	ON	ON	ON
SV08-2004	S1		ON								
SV08-40	S2	ON			ON					ON	ON
SV08-43	S3	ON	ON			ON	ON				
SV08-30	S4						ON				ON
SV08-40	S5			ON	ON						
SV08-30	S6						ON		ON		

* NOTE - SEE BLADE MOVEMENT TEXT FOR BUTTON OPERATION

HOLD IN RAISE POSITION – HYDRAULIC

Blade Movement: Hold in Raised Position
Control Mode: All Modes
Control Button: None
System Response:

1) Hydraulic oil is trapped in the base end of the lift cylinder by the internal check valve in solenoid cartridge valve S1.



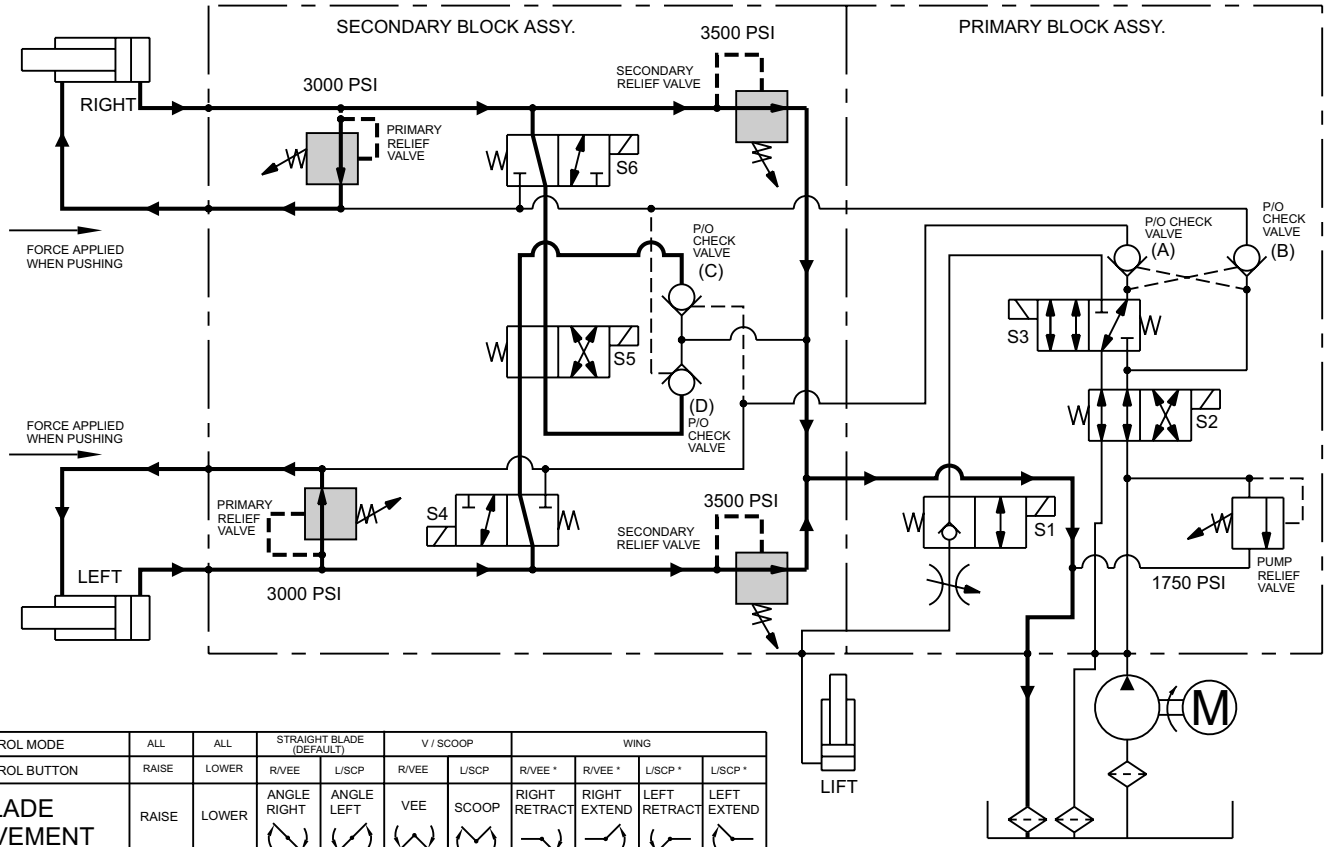
CONTROL MODE		ALL	ALL	STRAIGHT BLADE (DEFAULT)		V / SCOOP		WING			
CONTROL BUTTON		RAISE	LOWER	R/VEE	L/SCP	R/VEE	L/SCP	R/VEE *	R/VEE *	L/SCP *	L/SCP *
BLADE MOVEMENT		RAISE	LOWER	ANGLE RIGHT	ANGLE LEFT	VEE	SCOOP	RIGHT RETRACT	RIGHT EXTEND	LEFT RETRACT	LEFT EXTEND
MOTOR	M	ON		ON	ON	ON	ON	ON	ON	ON	ON
SV08-2004	S1		ON								
SV08-40	S2	ON			ON					ON	ON
SV08-43	S3	ON	ON			ON	ON				
SV08-30	S4						ON				ON
SV08-40	S5			ON	ON						
SV08-30	S6						ON		ON		

* NOTE - SEE BLADE MOVEMENT TEXT FOR BUTTON OPERATION

STRIKING AN OBJECT WHILE PLOWING FORWARD – HYDRAULIC

Blade Movement: Striking an Object While Plowing Forward
Control Mode: All Modes
Control Button: None
System Response:

1) Hydraulic oil is trapped in the base end of the right cylinder by the right primary relief valve, right secondary relief valve, and P/O check valve (D). Hydraulic oil is trapped in the base end of the left cylinder by left primary relief valve, left secondary relief valve, and P/O check valve (C).
2) When the snowplow contacts an object on the front side of either wing, the force of the impact increases the hydraulic pressure in the base end of one cylinder. When the pressure exceeds 3000 psi, the cylinder's primary relief valve opens allowing some of the hydraulic oil to move from the base end to rod end of the same cylinder.
3) Due to the unequal displacement of oil between the base and rod ends of the cylinder, hydraulic pressure continues to increase. When the pressure exceeds 3500 psi, the cylinder's secondary relief valve opens allowing the remaining hydraulic oil back to the reservoir.



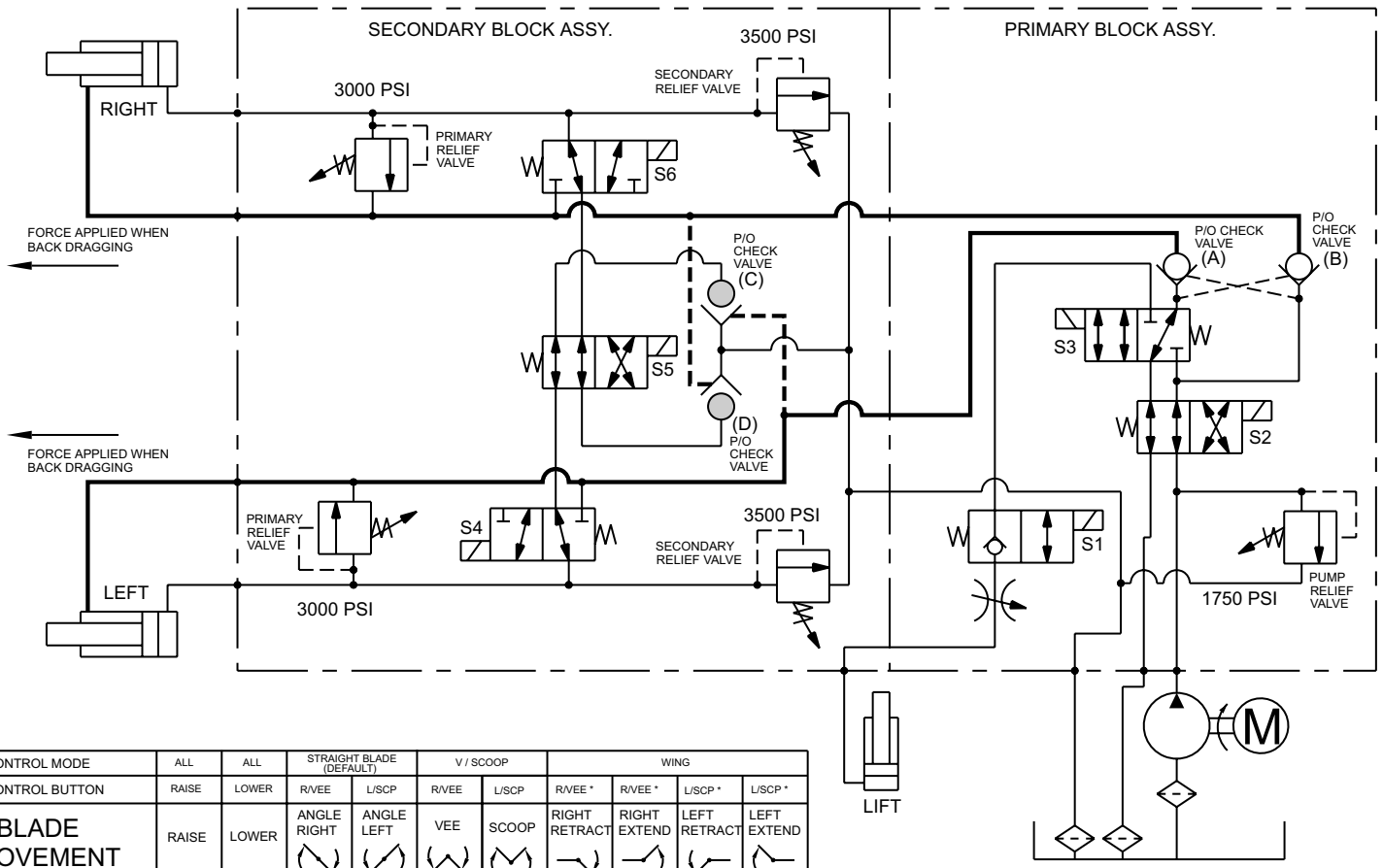
CONTROL MODE		ALL	ALL	STRAIGHT BLADE (DEFAULT)		V / SCOOP		WING			
CONTROL BUTTON		RAISE	LOWER	R/VEE	L/SCP	R/VEE	L/SCP	R/VEE *	R/VEE *	L/SCP *	L/SCP *
BLADE MOVEMENT		RAISE	LOWER	ANGLE RIGHT	ANGLE LEFT	VEE	SCOOP	RIGHT RETRACT	RIGHT EXTEND	LEFT RETRACT	LEFT EXTEND
MOTOR	M	ON		ON	ON	ON	ON	ON	ON	ON	ON
SV08-2004	S1		ON								
SV08-40	S2	ON			ON					ON	ON
SV08-43	S3	ON	ON			ON	ON				
SV08-30	S4						ON				ON
SV08-40	S5			ON	ON						
SV08-30	S6						ON		ON		

* NOTE - SEE BLADE MOVEMENT TEXT FOR BUTTON OPERATION

STRIKING AN OBJECT WHILE BACK DRAGGING – HYDRAULIC

Blade Movement: Striking an Object While Back Dragging
Control Mode: All Modes
Control Button: None
System Response:

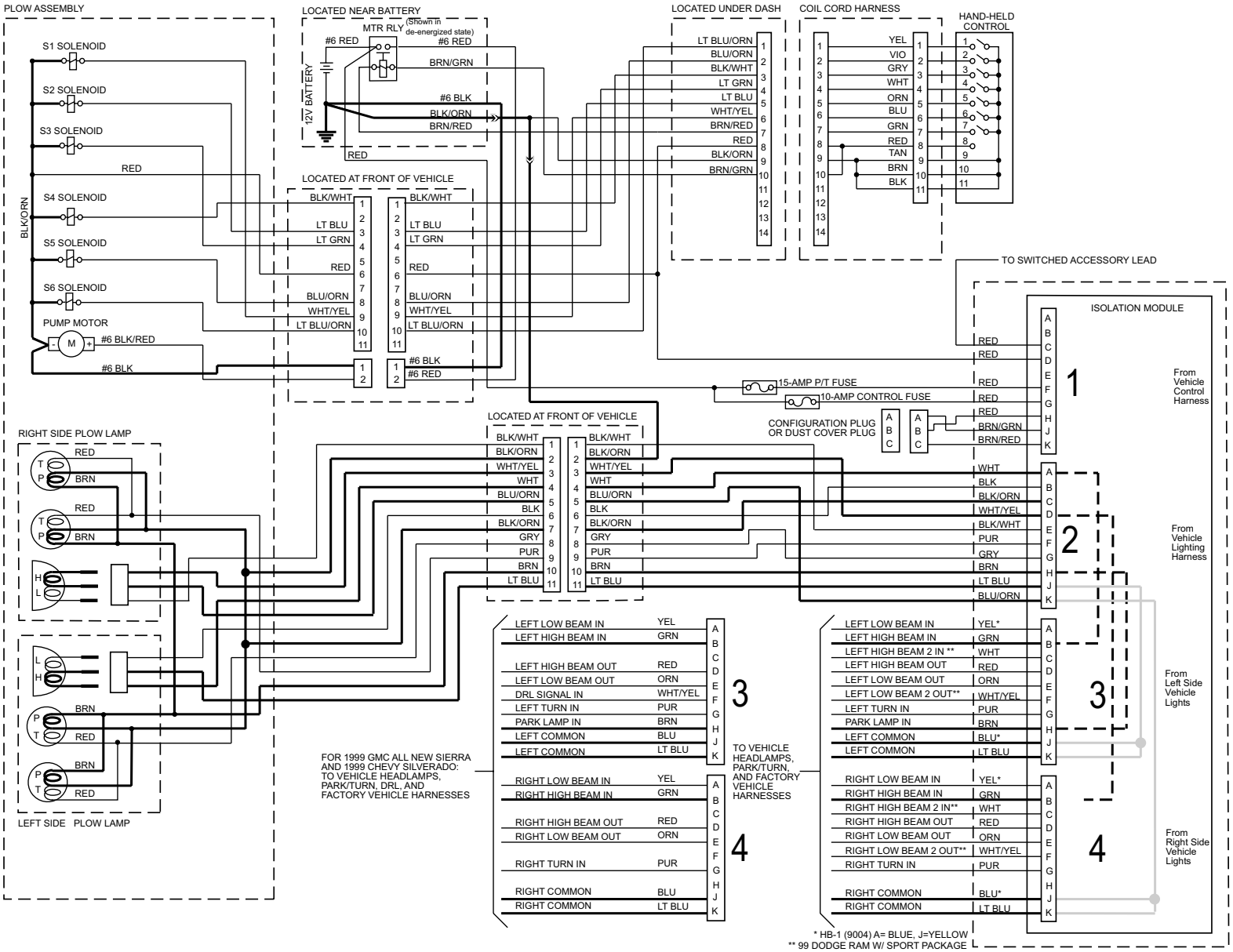
1) Hydraulic oil is trapped in the rod end of the right cylinder by P/O check valve (B). Hydraulic oil is trapped in the rod end of the left cylinder by P/O check valve (A). **The hydraulic system does not provide pressure relief while back dragging.**



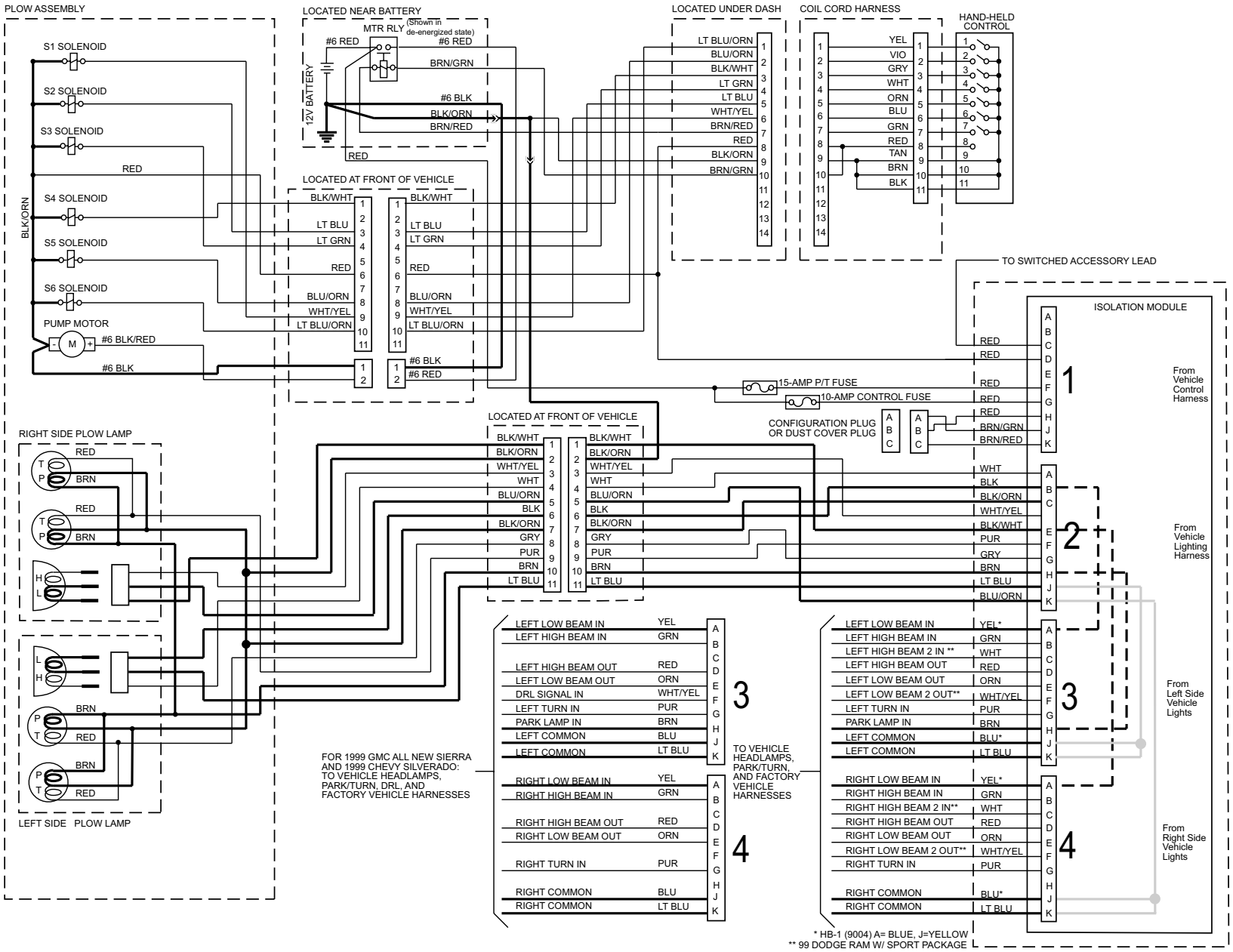
CONTROL MODE		ALL	ALL	STRAIGHT BLADE (DEFAULT)		V / SCOOP		WING			
CONTROL BUTTON		RAISE	LOWER	R/VEE	L/SCP	R/VEE	L/SCP	R/VEE *	R/VEE *	L/SCP *	L/SCP *
BLADE MOVEMENT		RAISE	LOWER	ANGLE RIGHT	ANGLE LEFT	VEE	SCOOP	RIGHT RETRACT	RIGHT EXTEND	LEFT RETRACT	LEFT EXTEND
MOTOR	M	ON		ON	ON	ON	ON	ON	ON	ON	ON
SV08-2004	S1		ON								
SV08-40	S2	ON			ON					ON	ON
SV08-43	S3	ON	ON			ON	ON				
SV08-30	S4						ON				ON
SV08-40	S5			ON	ON						
SV08-30	S6						ON		ON		

* NOTE - SEE BLADE MOVEMENT TEXT FOR BUTTON OPERATION

HIGH BEAM HEADLAMPS WITH PLOW CONNECTED TO VEHICLE



LOW BEAM HEADLAMPS WITH PLOW CONNECTED TO VEHICLE



TROUBLESHOOTING GUIDE CONTENTS

TROUBLESHOOTING GUIDE

INTRODUCTION

This guide contains a series of tables, diagrams, flowcharts, and other information. When used properly it helps the mechanic to identify and repair faulty system components. Fisher Engineering highly recommends using the EZ-V® Electrical Tester as a timesaving tool for electrical system diagnosis. When using this tester, refer to the supplied instruction manual.

All malfunctions of the EZ-V snowplow can be categorized as mechanical, electrical, or hydraulic. Mechanical issues are generally related to the blade wings, A-frame, lift frame, and mount components and are usually identified by visual inspection. However, electrical and hydraulic issues can be difficult to trace to the component level and that is the purpose of this troubleshooting guide.

Read and understand the Theory of Operation before attempting troubleshooting.

HOW TO USE THE TROUBLESHOOTING GUIDE

Because of the relative complexity of the EZ-V snowplow electrical and hydraulic systems, some conditions must be eliminated in order to develop valid tests. These conditions are listed before the tables or flowcharts and must be satisfied before proceeding.

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

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

1. Go to the General Diagnostic Table and satisfy the ten listed conditions. These conditions must be met before proceeding into the table or to any subsequent test.

2. Locate the condition in the table which best describes the problem and check possible causes and actions in the order listed.

3. Proceed to a service procedure, another condition, or a specific test as directed. All tests, except the Hydraulic System Test, use a flowchart format. To use these flowcharts, first satisfy any listed conditions at the top of the page. Then begin at the upper left square and proceed as directed.

4. Follow along sequentially through the table and tests, referring to the hydraulic and electrical schematics in the Theory of Operation section and the component Identification and Location diagrams. Eventually the problem is identified at the component level.

ELECTRICAL TESTING

Read and understand the section describing electrical circuit operation in the Theory of Operation section. A simple 12V test light with a ground lead can be used for circuit testing. When directed to check for 12 volts (12V), ground the test lamp lead and probe the terminal. When asked to check for ground, attach the test lamp lead to +12V and probe the terminal. Note that 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.

GENERAL DIAGNOSTIC TABLE

BEFORE USING THIS GENERAL DIAGNOSTIC TABLE, OR PERFORMING ANY TESTS, YOU MUST VERIFY THE FOLLOWING CONDITIONS:

1. Snowplow is attached to vehicle and all harnesses are connected.
2. Harness connector pins and terminals are free of corrosion, ensuring good connections, and coated with dielectric grease.
3. Vehicle battery and charging system are in good condition and battery connections are clean and tight.

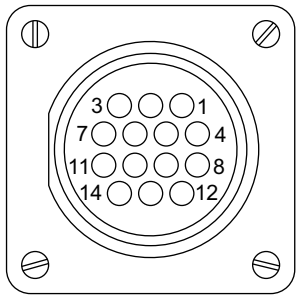
⚠ CAUTION

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

4. Hydraulic reservoir is filled to fill plug level with recommended fluid when plow is in "vee" position and lift cylinder is fully retracted. See Product Specifications.
5. No oil leaks from hoses, fittings, cylinders, or the hydraulic unit.
6. All built-up snow and ice is removed from the snowplow.
7. Vehicle control harness wires are correctly installed in the 14-pin connector, located in the cab.
8. 10-amp fuse in vehicle control harness is good.
9. Ignition is turned on or engine is running.
10. The control is connected in the cab and turned on.

NOTE: Do not use a straight blade control with the adapter cable for these tests.

14-Pin Connector



Wire Color	Pin No.
Light Blue with Orange Stripe	1
Blue with Orange Stripe	2
Black with White Stripe	3
Light Green	4
Light Blue	5
White with Yellow Stripe	6
Brown with Red Stripe	7
Red	8
Black with Orange Stripe	9
Brown with Green Stripe	10

GENERAL DIAGNOSTIC TABLE

CONDITION	POSSIBLE CAUSE	ACTION
Motor does not run for any requested function.	Poor connections in vehicle or snowplow battery cables.	Clean and re-establish connections.
	Motor worn or damaged or pump seized.	Go to Motor Test.
	Motor relay inoperative.	Go to Motor Relay Test.
	Fault in vehicle wiring harness.	Go to Vehicle Control Harness Test.
	Defective control.	Go to Control Test.
Motor runs continuously.	Motor relay sticking or always energized.	Go to Motor Relay Test.
	Fault in vehicle harness wiring.	Go to Vehicle Control Harness Test.
	Defective control.	Go to Control Test.
Snowplow won't raise — motor runs.	Lift cylinder packing nut too tight.	Adjust lift cylinder packing nut.
	Clogged pump filter (all functions are affected). *	Clean or replace filter, flush reservoir.
	Worn or damaged pump.	Go to Pump Pressure Test.
	Solenoid valve coils not energizing properly.	Go to Solenoid Coil Activation Test.
	Hydraulic system malfunction. *	Go to Hydraulic System Test.
	Defective control.	Go to Control Test.
Snowplow raises slowly or partially — motor runs.	Lift cylinder packing nut too tight.	Adjust lift cylinder packing nut.
	Clogged pump filter (all functions are affected). *	Clean or replace filter, flush reservoir.
	Worn or damaged pump.	Go to Pump Pressure Test.
	Defective control.	Go to Control Test.
In *straight blade* mode, snowplow angles slowly or partially -or- In *wing* mode, wings move slowly or partially — motor runs.	Air in angle cylinders.	Cycle wings stop to stop to remove air.
	Relief valves damaged or out of adjustment.	Go to Relief Valve Inspection and Adjustment.
	Clogged pump filter (all functions are affected). *	Clean or replace filter, flush reservoir.
	Worn or damaged pump.	Go to Pump Pressure Test.
	Solenoid valve coils not activating properly.	Go to Solenoid Coil Activation Test.
	Hydraulic system malfunction. *	Go to Hydraulic System Test.
	Angle cylinders damaged or bypassing internally.	Rebuild or replace angle cylinder.
Snowplow will not lower or lowers slowly, or won't float.	Lift cylinder packing nut too tight.	Adjust lift cylinder packing nut.
	Solenoid valve coils not activating properly.	Go to Solenoid Coil Activation Test.
	Hydraulic system malfunction. *	Go to Hydraulic System Test.

* Thread sealant/tape is not compatible with hydraulics.

GENERAL DIAGNOSTIC TABLE

CONDITION	POSSIBLE CAUSE	ACTION
Snowplow lowers by itself or won't stay in raised position	Solenoid valve coils not activating properly.	Go to Solenoid Coil Activation Test
	Hydraulic system malfunction. *	Go to Hydraulic System Test
	Defective control.	Go to Control Test.
Wings will not lock hydraulically or hold position.	Air in angle cylinders.	Cycle wings stop to stop to remove air.
	Relief valves damaged or out of adjustment.	Go to Relief Valve Inspection & Adjustment.
	P/O check valve stuck open.	Go to P/O Check Valve Inspection.
	Solenoid coils not activating properly.	Go to Solenoid Coil Activation Test.
	Hydraulic system malfunction. *	Go to Hydraulic System Test.
	Angle cylinders damaged or leaking internally.	Repair or replace angle cylinders.
Snowplow does not perform the selected function or performs a different function.	Hydraulic hose routing incorrect.	Verify correct hose installation. See Hydraulic Hose Routing diagram.
	Solenoid valve coils not energizing properly.	Go to Solenoid Coil Activation Test.
	Hydraulic system malfunction. *	Go to Hydraulic System Test.
Vehicle control harness 10 amp fuse blows.	Red wire in snowplow control harness going to solenoid valve coils is shorted to ground.	Repair wire or replace snowplow control harness.
	Red wire in vehicle control harness is shorted to ground.	Repair wire or replace harness.
	Brown/green wire in vehicle control harness going to motor relay primary is shorted to ground.	Repair wire or replace harness.
	Faulty control.	Go to Control Test.
Control F1 fuse blows.	Motor relay primary shorted internally.	Replace motor relay.
	Solenoid valve coil S1, S2 or S3 shorted internally.	Go to Individual Coil Test.
Control F2 fuse blows.	Solenoid valve coil S4, S5 or S6 shorted internally.	Go to Individual Coil Test.
Vehicle accessory fuse blows.	Circuit overloaded.	Consult vehicle owner's manual for correct application of aftermarket electrical loads.
Excessive load on vehicle electrical system while using snowplow.	Lift cylinder packing nut too tight.	Adjust lift cylinder packing nut.
	Worn or damaged motor or pump.	Go to Pump Pressure Test.
	Poor connections on battery cables.	Inspect battery cables, clean and re-attach all connections.

* Thread sealant/tape is not compatible with hydraulics.

GENERAL DIAGNOSTIC TABLE

CONDITION	POSSIBLE CAUSE	ACTION
Snowplow headlamps operate irregularly or not at all – snowplow attached. -or- Vehicle headlamps operate irregularly or not at all – snowplow removed.	Burned out bulbs or corroded sockets.	Replace bulbs, clean contacts.
	Wires improperly connected to Isolation Module.	Review and correct wire installation. See Vehicle Harness and Vehicle Cable Location diagram.
	Isolation Module improperly connected.	Go to Isolation Module Test.
Vehicle daytime running lamps (DRLs) do not work – snowplow removed.	Parking brake on, vehicle not in drive. Light sensor not deactivated.	Fully release parking brake, place vehicle in drive. Place light by sensor.
	Power in DRL circuit has been interrupted.	Turn lamp and/or ignition switch on and off to cycle the DRL circuitry.
	No output from DRL module.	Repair vehicle electrical system.
Blade will not hold position.	Hydraulic system malfunction. *	Go to Hydraulic System Test.

* Thread sealant/tape is not compatible with hydraulics.

PACKING NUT ADJUSTMENT

NOTE: This adjustment applies to the lift cylinder only. Angle cylinders use gland nuts which are torqued to specifications.

Periodically verify the lift cylinder packing nut is tight. If the packing nut is loose or leakage appears when raising the plow, tighten the packing nut 1/4 turn maximum after you feel the packing nut contact the packing.

⚠ CAUTION

Do not overtighten the packing nut. Over-tightening affects the operation and life of the packing.

Packings not used for a period of time may show signs of oil weep. This should stop after use.

NOTE: A small amount of leakage is necessary to properly lubricate the rod.

MOTOR TEST

⚠ WARNING

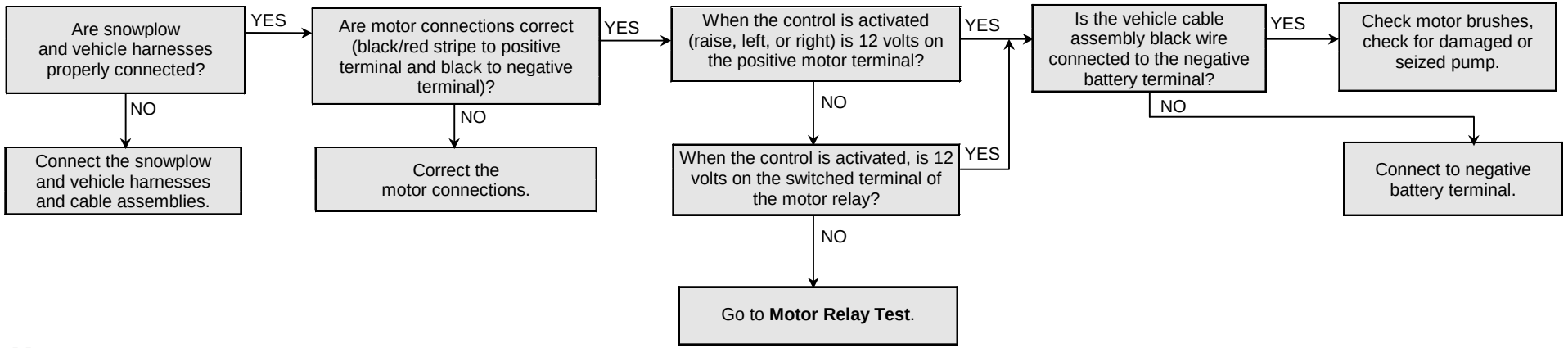
The driver shall keep bystanders clear of the blade during this test. Do not stand between the vehicle and the blade. During this test the right wing will retract. A moving or falling blade could cause personal injury.

Refer to the Motor and Motor Relay Test Diagram.

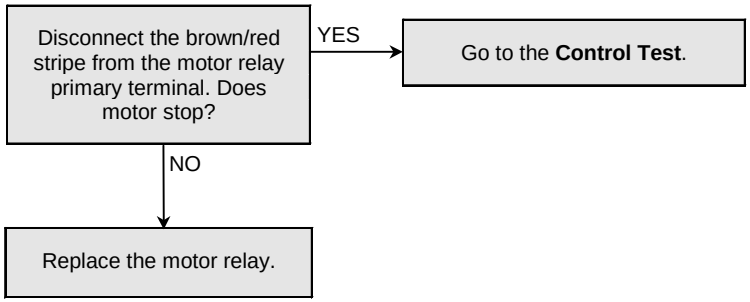
To activate the motor, the following conditions must be met:

1. All three (3) snowplow and vehicle harnesses and cable assemblies must be connected.
2. The vehicle control harness is plugged into position 1 of the Isolation Module.
3. The vehicle lighting harness is plugged into position 2 of the Isolation Module.
4. +12V from the battery must be connected to one secondary terminal of the motor relay.
5. The vehicle ignition switch must be in the ON position.
6. The control must be turned on.

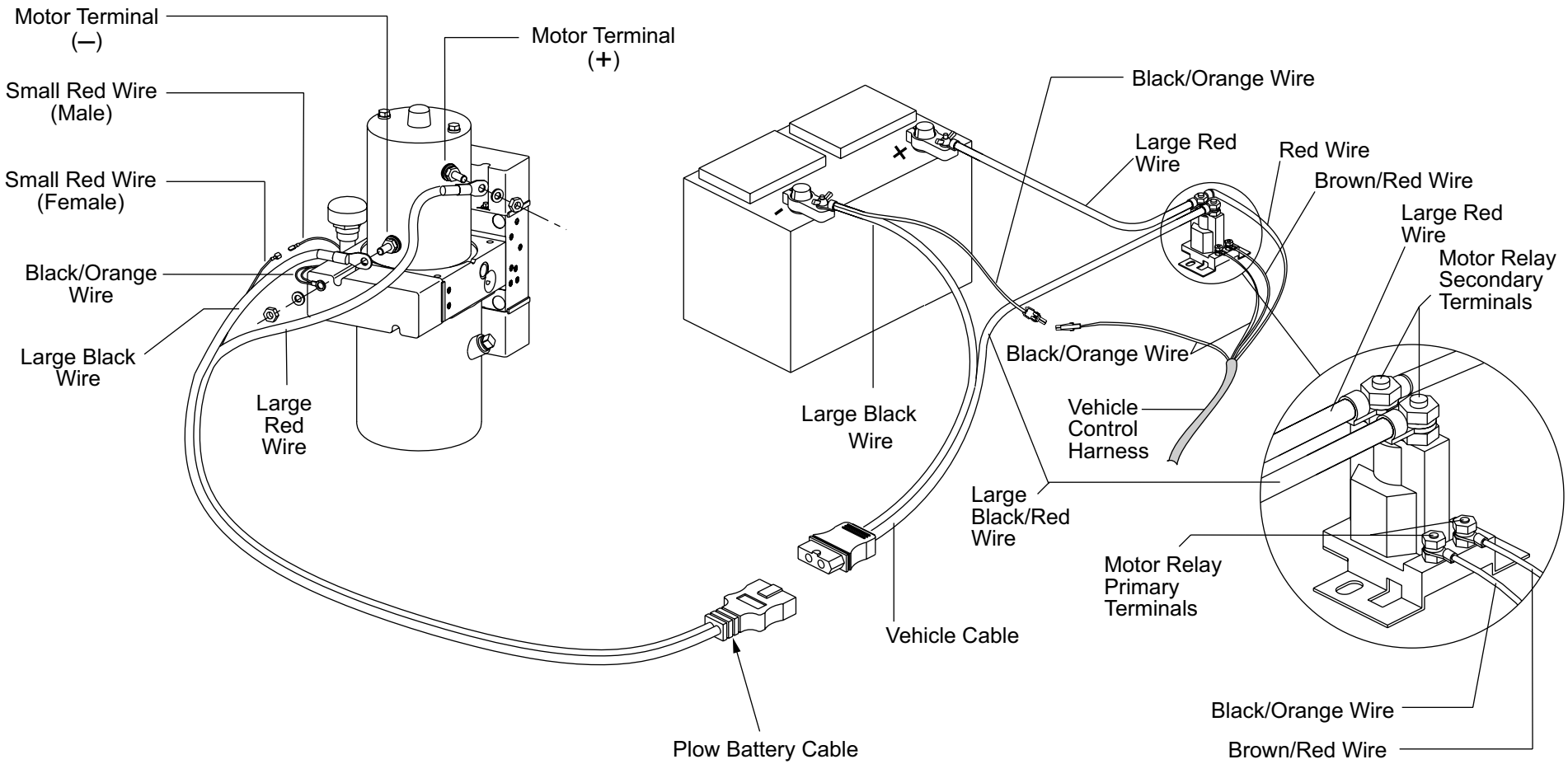
MOTOR DOES NOT RUN



MOTOR RUNS CONTINUOUSLY



MOTOR AND MOTOR RELAY TEST DIAGRAM



MOTOR RELAY TEST

⚠ WARNING

The driver shall keep bystanders clear of the blade during this test. Do not stand between the vehicle and the blade. During this test the right wing will retract. A moving or falling blade could cause personal injury.

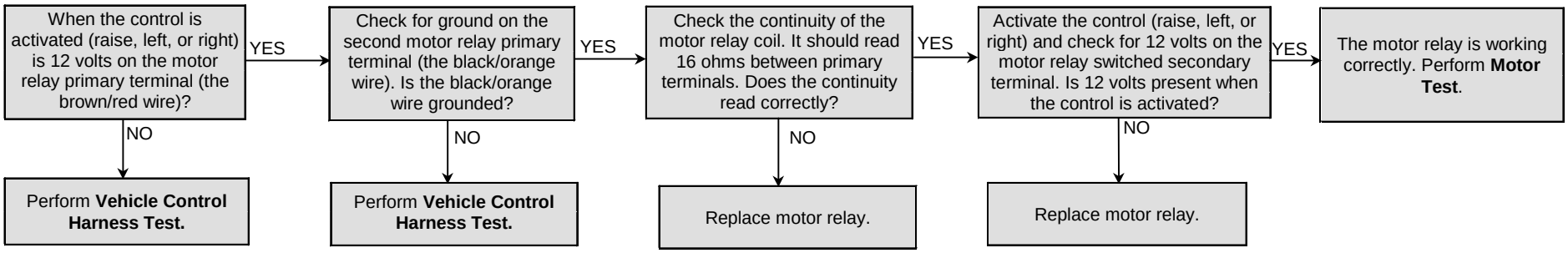
Perform motor test first to verify battery cables and motor are in good condition.

Refer to the Motor and Motor Relay Test Diagram.

To activate the motor, the following conditions must be met:

1. The snowplow and vehicle harness must be connected.
2. The vehicle control harness is plugged into position 1 of the Isolation Module.
3. The vehicle lighting harness is plugged into position 2 of the Isolation Module.
4. +12V from the battery must be connected to one secondary terminal of the motor relay.
5. The vehicle iginition switch must be in the ON position.
6. The control must be turned on.

MOTOR RELAY WILL NOT ACTIVATE



VEHICLE CONTROL HARNESS TEST

⚠ WARNING

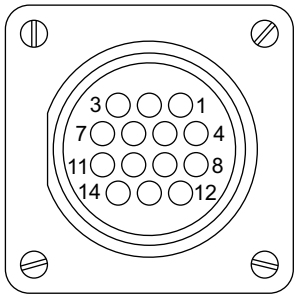
The driver shall keep bystanders clear of the blade during this test. Do not stand between the vehicle and the blade. During this test the right wing will retract. A moving or falling blade could cause personal injury.

Perform the Motor Test and Motor Relay Test first.

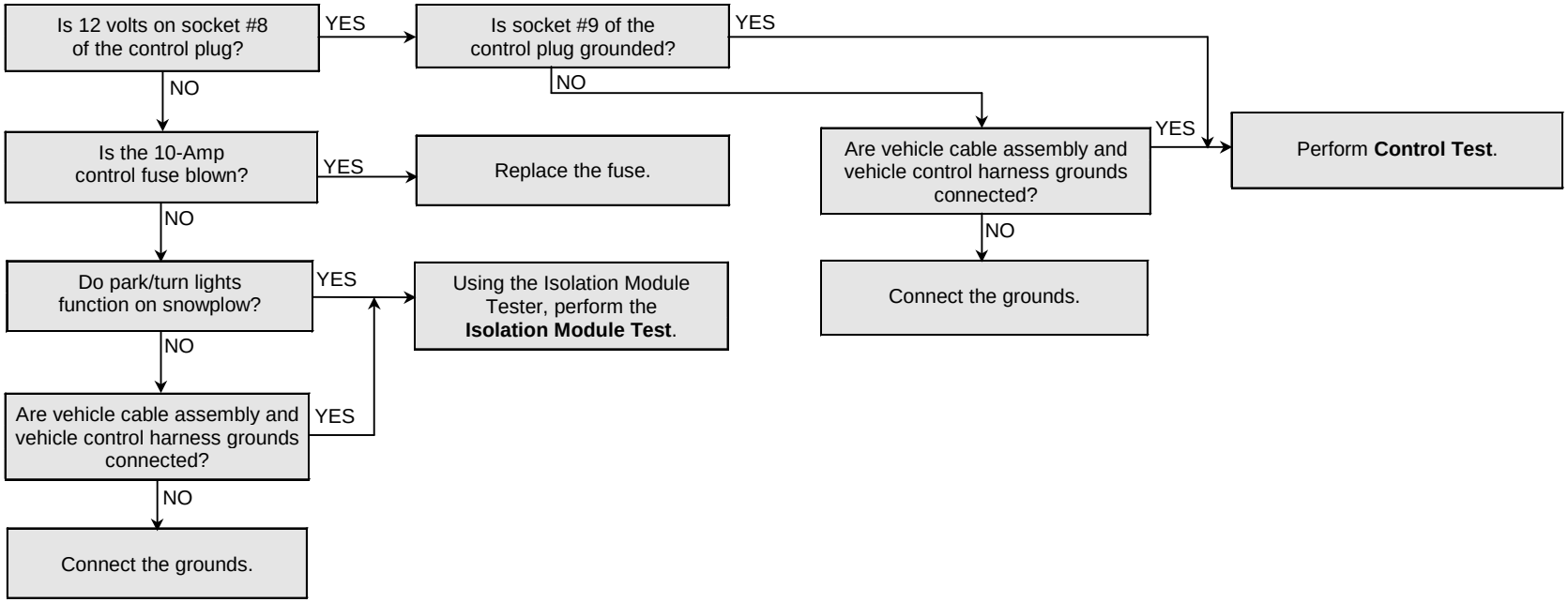
To check the Vehicle Control Harness, the following conditions must be met:

1. The snowplow and vehicle lighting harnesses must be connected.
2. The vehicle control harness is plugged into position 1 of the Isolation Module.
3. The vehicle lighting harness is plugged into position 2 of the Isolation Module.
4. **Disconnect** the control in the cab.
5. The vehicle ignition switch must be in the ON position.
6. Refer to the 14-pin Connector diagram. Test the vehicle side of the connector in the cab as follows.

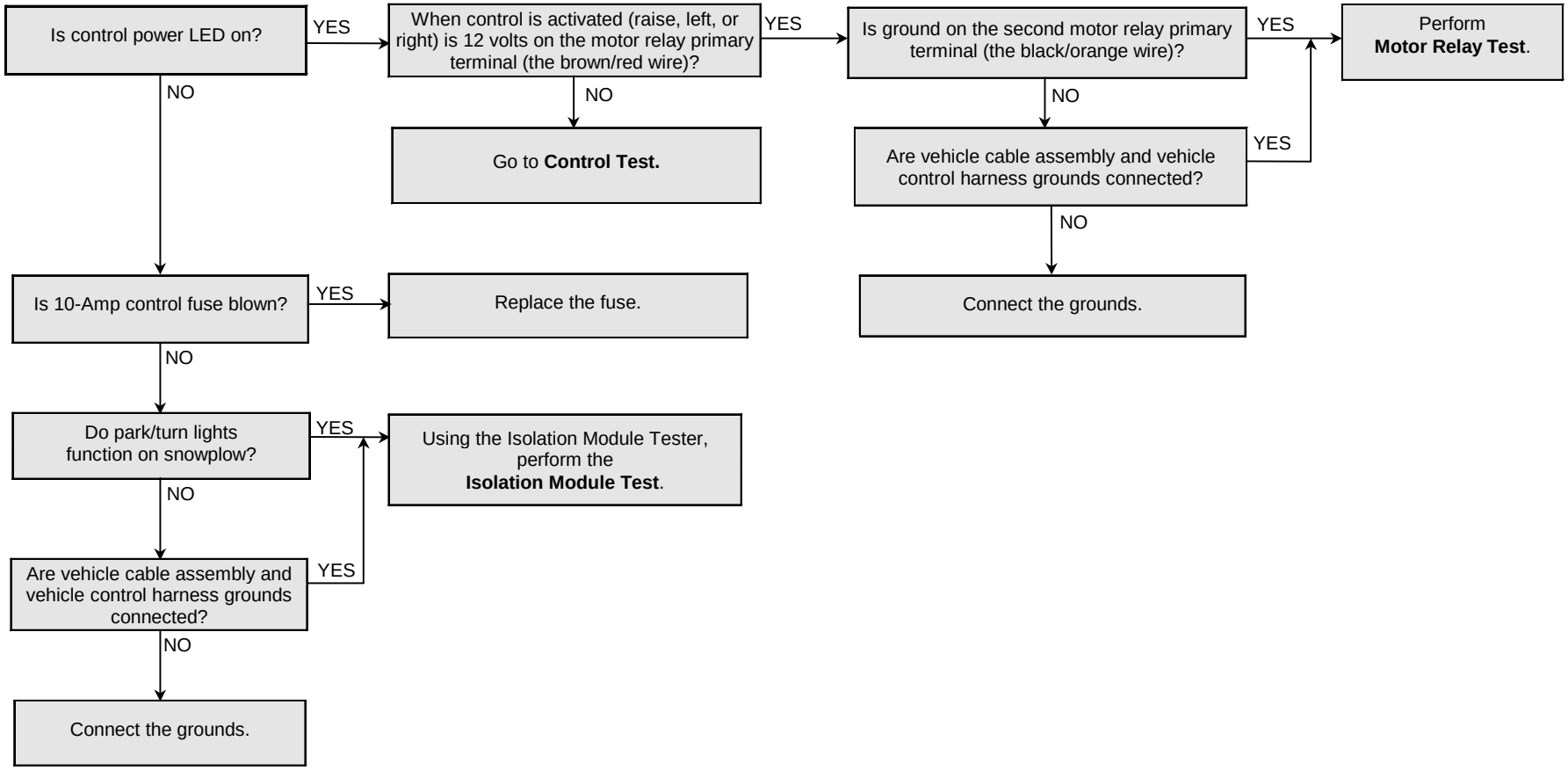
14-Pin Connector



NO POWER TO THE CONTROL



MOTOR RELAY WILL NOT ACTIVATE

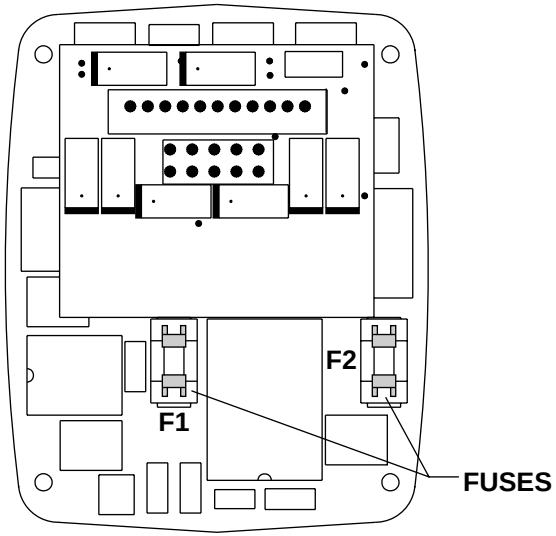


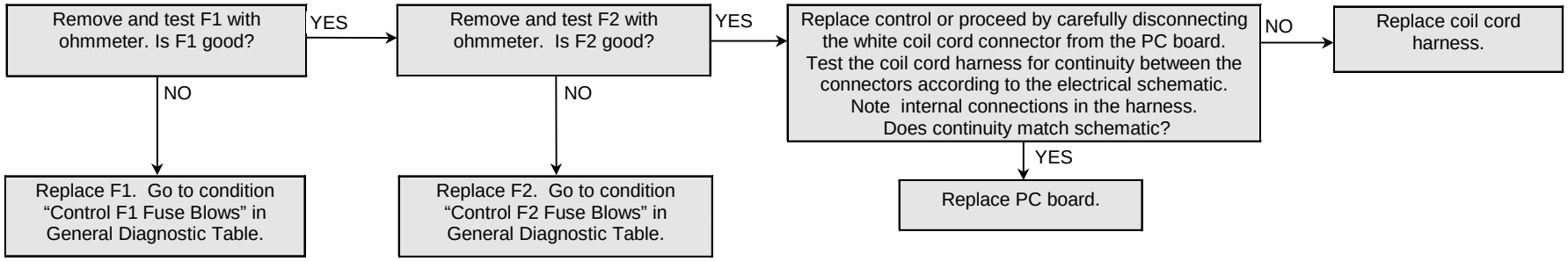
⚠ CAUTION
Printed circuit board (PCB) is subject to damage from static electricity. Follow instructions below to safely handle PCB.

To safely handle PCB:

1. Disconnect the control in the cab and remove to bench.
2. Place control on its side and remove top half of handle.
3. Touch any grounded metal object to discharge possible static buildup.
4. Remove PCB from housing by only touching the edges of the PCB.
5. PCB is now safe to handle as long as contact with it is maintained.
6. Refer to diagram for fuse location.

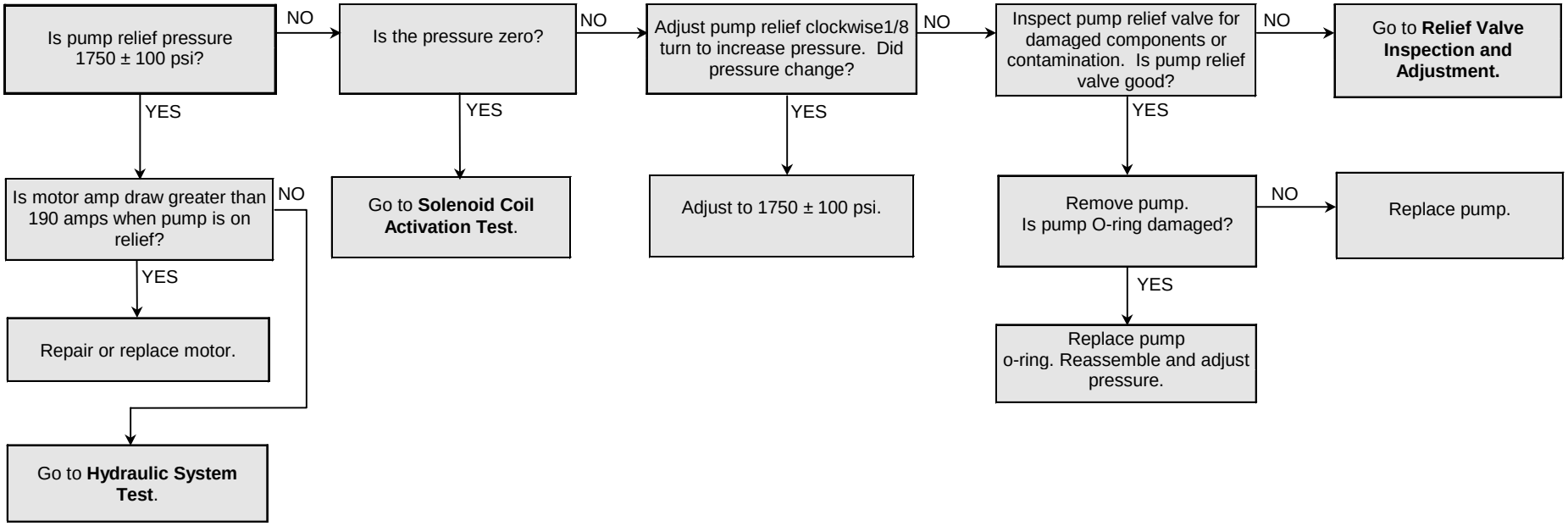
NOTE: Fuse F1 is for motor relay, S1, S2 and S3 solenoid coils. Fuse F2 is for S4, S5 and S6 solenoid coils.





PUMP PRESSURE TEST

1. Install a tee in-line with the lift cylinder hydraulic hose and attach a 3000 psi pressure gauge.
2. Raise the snowplow fully, hold the raise button and read the pump relief pressure.
3. Refer to Relief Valve Identification and Location for valve location.



SOLENOID COIL ACTIVATION TEST

1. **Disconnect the red (+) battery cable from the motor and isolate it.**

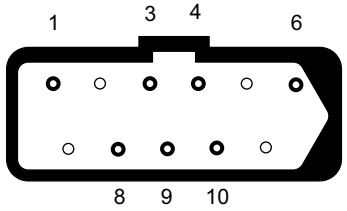
2. Remove the two lift arm pivot pins from the headgear. Place the lift arm and lift cylinder against the A-frame. This will allow access to the solenoid valve covers. Remove the solenoid cartridge covers.

3. Verify wires are properly attached to solenoid coils. Refer to table below, Electrical Schematic and Solenoid Cartridge Valve Identification and Location.

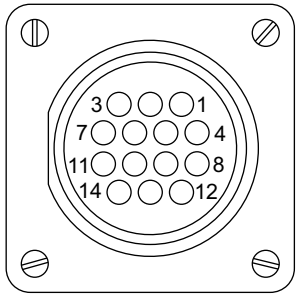
4. Activate the control for each function and check for magnetic pull at all six solenoid valve coils using common screwdriver. Only the coils designated as "ON" in the table below should activate for each function. After noting which coils are energized, proceed to the flowchart.

5. Reassemble the headgear and lift arm after the test is complete.

7-Pin Connector
Snowplow Side



14-Pin Connector

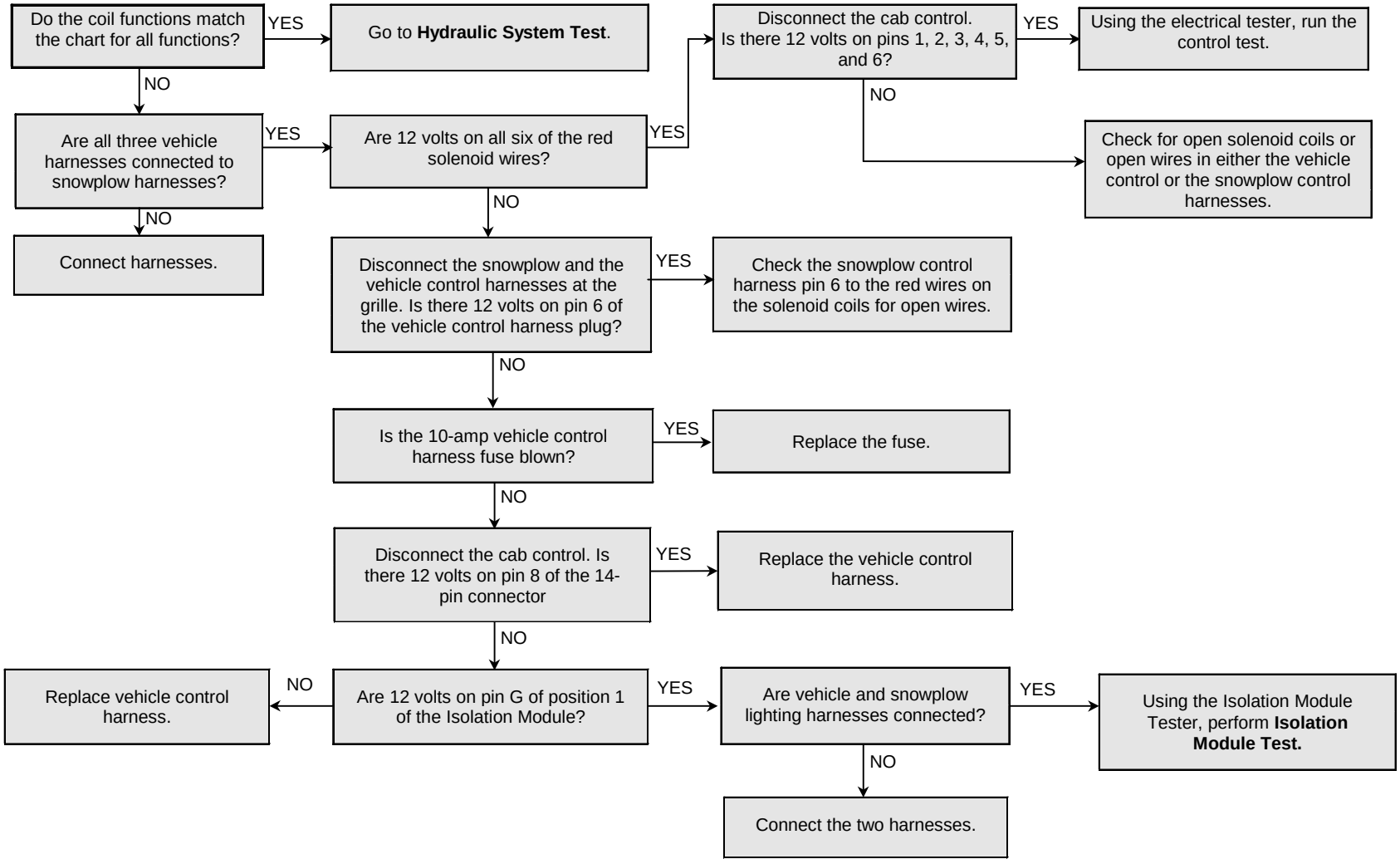


Solenoid Coil	S1	S2	S3	S4	S5	S6
7-PIN GRILL CONNECTOR PIN #	9	3	4	1	8	10
14-PIN CONNECTOR PIN #	6	5	4	3	2	1
WIRE COLOR	WHITE/ YELLOW	LIGHT BLUE	LIGHT GREEN	BLACK/ WHITE	BLUE/ ORANGE	LT BLUE/ ORANGE
RAISE		ON	ON			
LOWER	ON		ON			
ANGLE RIGHT					ON	
ANGLE LEFT		ON			ON	
VEE			ON			
SCOOP			ON	ON		ON
RIGHT RETRACT *						
RIGHT EXTEND *						ON
LEFT RETRACT *		ON				
LEFT EXTEND *		ON		ON		

***Coils activate on every other touch of the button in wing mode, beginning with retract when wing mode is first entered.**

SOLENOID COIL ACTIVATION TEST

TEST PROCEDURE



HYDRAULIC SYSTEM TEST

This test consists of trying all the snowplow functions and comparing the snowplow reaction to the action requested in the following table. The table will pinpoint defective solenoid valves or closed p/o check valves accurately if only one component is malfunctioning. If the snowplow reaction for a given function is not listed in the table, there may be relief or p/o check valves which are stuck open or contaminated, missing or damaged o-rings or backing rings on solenoid, relief or p/o check valves, or there may be two or more faulty components. In this case, use the specific function hydraulic schematic and carefully inspect each component in the flow circuit. If contamination is evident in more than one component, the hydraulic unit, hoses and cylinders must be completely disassembled, inspected and cleaned.

1. Perform Solenoid Coil Activation Test first.
2. Verify hydraulic hose installation is correct. Refer to the Hose Routing diagram.
3. Test all of the snowplow functions.
4. Inspect and clean or replace the suspected component. Refer to the Hydraulic Unit Parts Diagram.
5. Refer to the sections following the table for inspection and adjustment of solenoid, cartridge valves, p/o check valves and relief valves.

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

ACTION REQUESTED	PLOW REACTION	POSSIBLE CAUSE
Angle Right	• **Angle Left**	⇒ **S2 stuck shifted**
	• **None**	⇒ **S3 stuck shifted** ⇒ **Check valve B closed** ⇒ **Check valve A closed**
	• **Right Extend**	⇒ **S6 stuck shifted**
	• **Right Retract**	⇒ **S5 not shifted**
	• **None**	⇒ **S4 stuck shifted**
Angle Left	• **Angle Right**	⇒ **S2 not shifted**
	• **Raise**	⇒ **S3 stuck shifted**
	• **None**	⇒ **Check valve A closed** ⇒ **Check valve B closed**
	• **Left Extend**	⇒ **S4 stuck shifted**
	• **Left Retract**	⇒ **S5 not shifted**
	• **None**	⇒ **S6 stuck shifted**

ACTION REQUESTED	PLOW REACTION	POSSIBLE CAUSE
Right Retract	• **Left Retract**	⇒ **S2 stuck shifted**
	• **Vee**	⇒ **S3 stuck shifted**
	• **None**	⇒ **Check valve B closed** ⇒ **Check valve D closed**
	• **Right Extend**	⇒ **S6 stuck shifted**
	• **Angle Right**	⇒ **S5 stuck shifted**
Right Extend	• **Left Retract**	⇒ **S2 stuck shifted**
	• **Right Extend and Left Retract—wings not locked**	⇒ **S3 stuck shifted**
	• **None**	⇒ **Check valve B closed**
	• **Right Retract**	⇒ **S6 not shifted**
Left Retract	• **Right Retract**	⇒ **S2 not shifted**
	• **Raise**	⇒ **S3 stuck shifted**
	• **None**	⇒ **Check valve A closed** ⇒ **Check valve C closed**
	• **Left Extend**	⇒ **S4 stuck shifted**
	• **Angle Left**	⇒ **S5 stuck shifted**
Left Extend	• **Right Retract**	⇒ **S2 not shifted**
	• **Raise**	⇒ **S3 stuck shifted**
	• **None**	⇒ **Check valve A closed**
	• **Left Retract**	⇒ **S4 not shifted**

ACTION REQUESTED	PLOW REACTION	POSSIBLE CAUSE
Scoop	• **Raise**	⇒ **S2 stuck shifted**
	• **Right Extend—left wing floats**	⇒ **S3 not shifted**
	• **Right Extend**	⇒ **Check valve A closed**
	• **Left Extend**	⇒ **Check valve B closed**
	• **Right Extend and Left Retract—wings not locked**	⇒ **S4 not shifted**
	• **Left Extend**	⇒ **S6 not shifted**
Vee	• **Raise**	⇒ **S2 stuck shifted**
	• **Right Retract**	⇒ **S3 not shifted** ⇒ **Check valve A closed** ⇒ **Check valve C closed**
	• **Left Retract**	⇒ **Check valve B closed**
	• **Left Extend and Right Retract—wings not locked**	⇒ **S4 stuck shifted**
	• **Left Retract**	⇒ **Check valve D closed**
	• **None**	⇒ **S5 stuck shifted**
	• **Left Retract and Right Extend—wings not locked**	⇒ **S6 stuck shifted**
Raise	• **Vee**	⇒ **S2 not shifted**
	• **Left Retract**	⇒ **S3 not shifted**
	• **Raises very slowly**	⇒ **S1 stuck shifted**
Hold Raised	• **Lower**	⇒ **S1 stuck shifted or has faulty internal check valve**
Lower	• **Lowers very slowly**	⇒ **S2 stuck shifted**
	• **None**	⇒ **S3 not shifted** ⇒ **S1 not shifted**

RELIEF VALVE INSPECTION AND ADJUSTMENT

Relief Valve Inspection

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

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

3. If OK, place ball on hard wood block, hold stem seat on ball and lightly strike stem with a hammer.

> **⚠ CAUTION**
>
> **Be careful to strike stem squarely. You can bend stem if you do not strike it squarely.**

4. Reassemble components into manifold block. Apply a light coat of anti-seize or grease to stem threads.

Adjustment

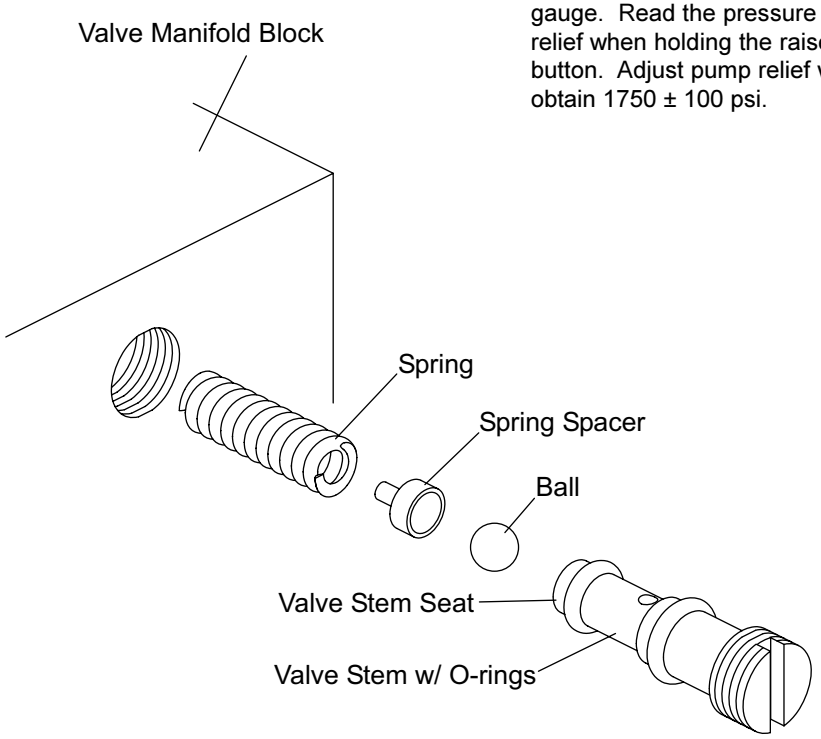
1. Adjust by tightening the relief valve stem as much as possible (until spring is fully compressed)

2. Back off valve stem (rotate counterclockwise) the number of turns indicated in the chart.

Relief Valve	No. of Turns Backed Off (CCW) From Fully Seated	Approximate Relief Valve Pressure (PSI)
Pump Relief	2-1/2 - 2-3/4*	1750
Right or Left Cylinder Primary Relief	1-1/2 - 1-3/4**	3000
Right or Left Cylinder Secondary Relief	1-1/4 - 1-1/2	3500

* Install a tee in line with the lift cylinder hydraulic hose and attach a 3000 psi gauge. Read the pressure at pump relief when holding the raise function button. Adjust pump relief valve to obtain 1750 ± 100 psi.

** Be certain the cylinder primary relief valve stem is backed out 1/4 turn farther than the secondary relief valve stem.

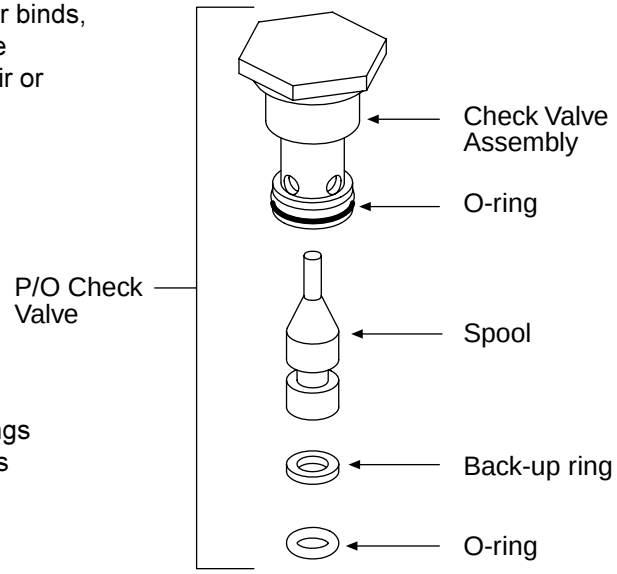


PILOT-OPERATED CHECK VALVE INSPECTION

1. Remove check valve assembly from manifold block. Using long/slender needle nosed pliers, remove the spool from the bore.

2. Using a plastic, aluminum or soft brass probe, push on the ball in the end of the check valve. It should move freely, then return to the closed position. If the ball sticks open or closed or binds, replace the check valve assembly. Clean, repair or replace as necessary. **Be sure replacement service p/o check valve assemblies have the letter "V" stamped on the hex.** Inspect the spool for signs of wear or any damage indicating it is not shifting. Look for worn or damaged O-rings and repair or replace as necessary.

3. Re-oil all O-rings and reinstall the spool by holding the stem with the miniature needle nosed pliers and carefully inserting it fully into the bore. Install the check valve assembly and torque to 120 in-lb.



INDIVIDUAL SOLENOID COIL TEST

1. Remove both wires from coil terminals.

2. Attach an ohmmeter across the coil terminals.

3. A reading of approximately 7 ohms indicates the coil is OK.

NOTE: A good coil will draw approximately 1.5 amps.

SOLENOID CARTRIDGE VALVE INSPECTION

NOTE: S3, the SV08-43 cartridge valve is identical to the S2 and S5 SV08-40 cartridge valves in physical appearance. These two valves function differently internally and cannot be interchanged. The only way to tell them apart is by looking for the stamping "SV08-43" or "SV08-40" on the side of the hex.

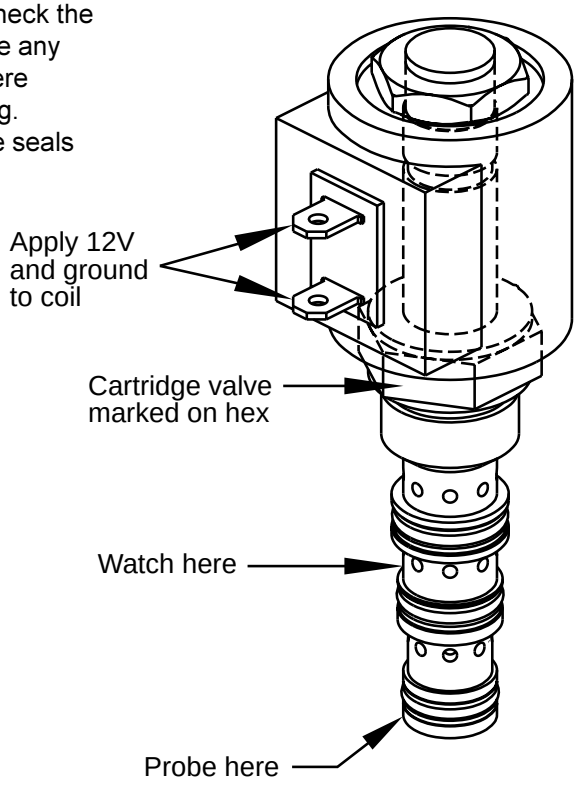
1. Remove coils from the solenoid cartridge valves and remove the valves from manifold. Look for visible contamination or damaged seals. Check for stuck spools with a plastic, aluminum, or soft brass probe by pushing on the spring loaded internal spool from the end of the valve. The spool should move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

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

2. Bench test the cartridge valve by installing a coil on the stem and applying 12V and ground to coil. Watch through the side ports for internal spool travel.

   If the cartridge valve spool is stuck or its travel is restricted, replace the cartridge. If the cartridge valve appears to be in good condition, clean it with parts cleaning solvent and dry with compressed air, being careful not to damage the seals. Check the spool travel again in case any internal contaminants were dislodged during cleaning. Re-oil the cartridge valve seals and o-rings and reinstall the cartridge valve, torquing to 10 ft-lb. Install the coils and torque retaining nuts to 4-5 ft-lb.

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



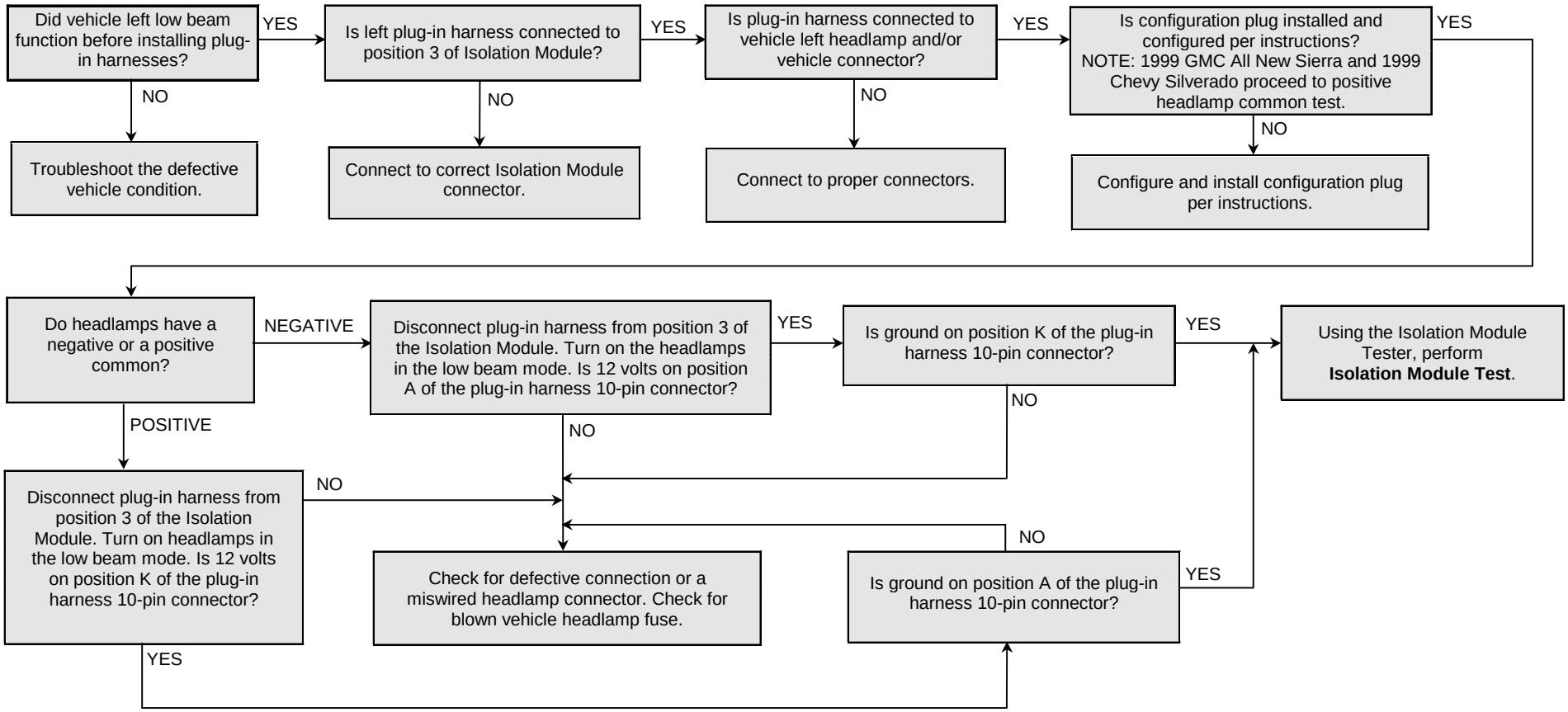
VEHICLE HEADLAMP TEST

Refer to Electrical Schematic.

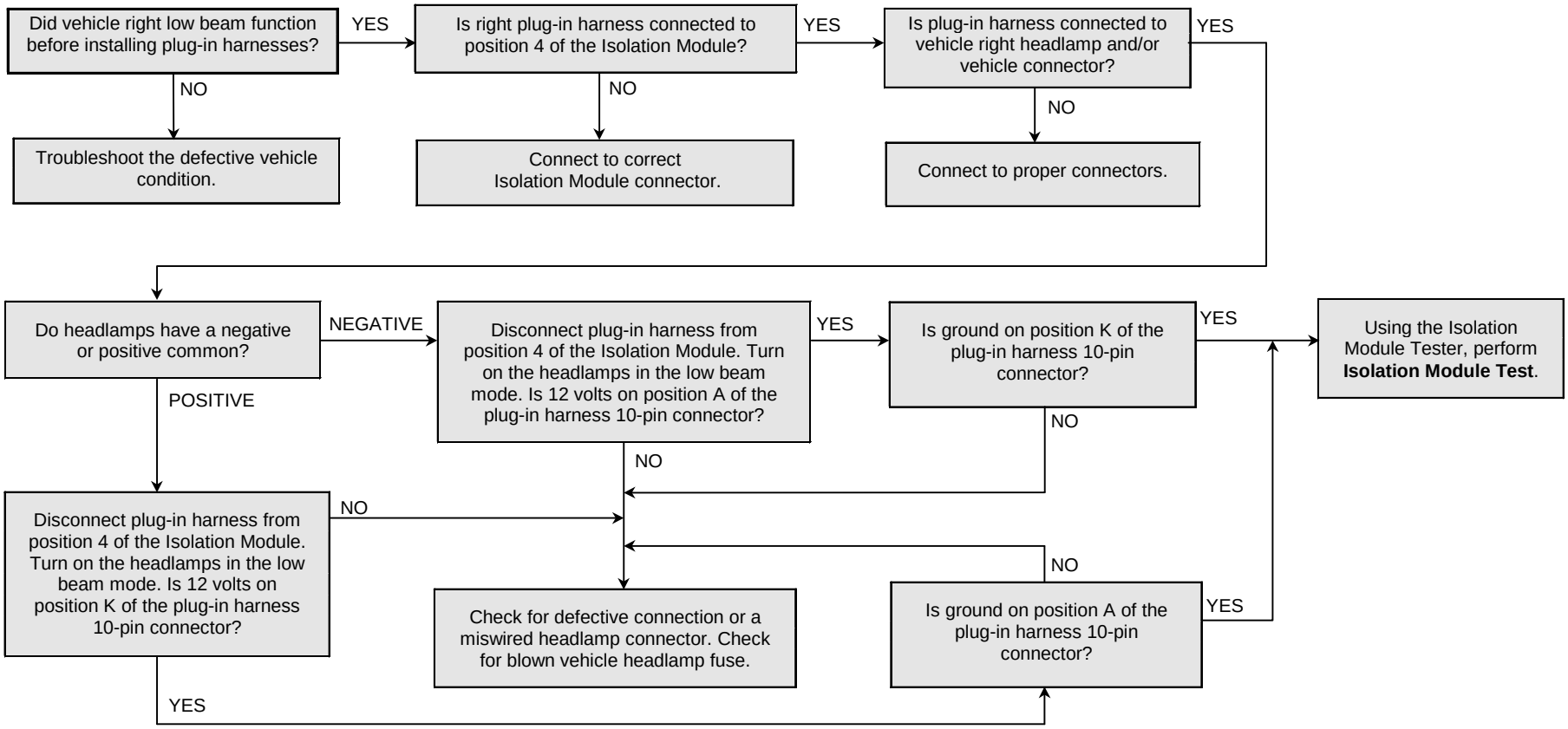
To check the vehicle headlamps the following conditions must be met:

1. Both plug-in harnesses (the long and the short) must be properly installed.
2. FISHER® park, turn, and DRL wires (if applicable) must be connected.
3. The vehicle control harness is plugged into position 1 of the Isolation Module.
4. The vehicle lighting harness is plugged into position 2 of the Isolation Module.
5. The vehicle ignition switch must be in the ON position.

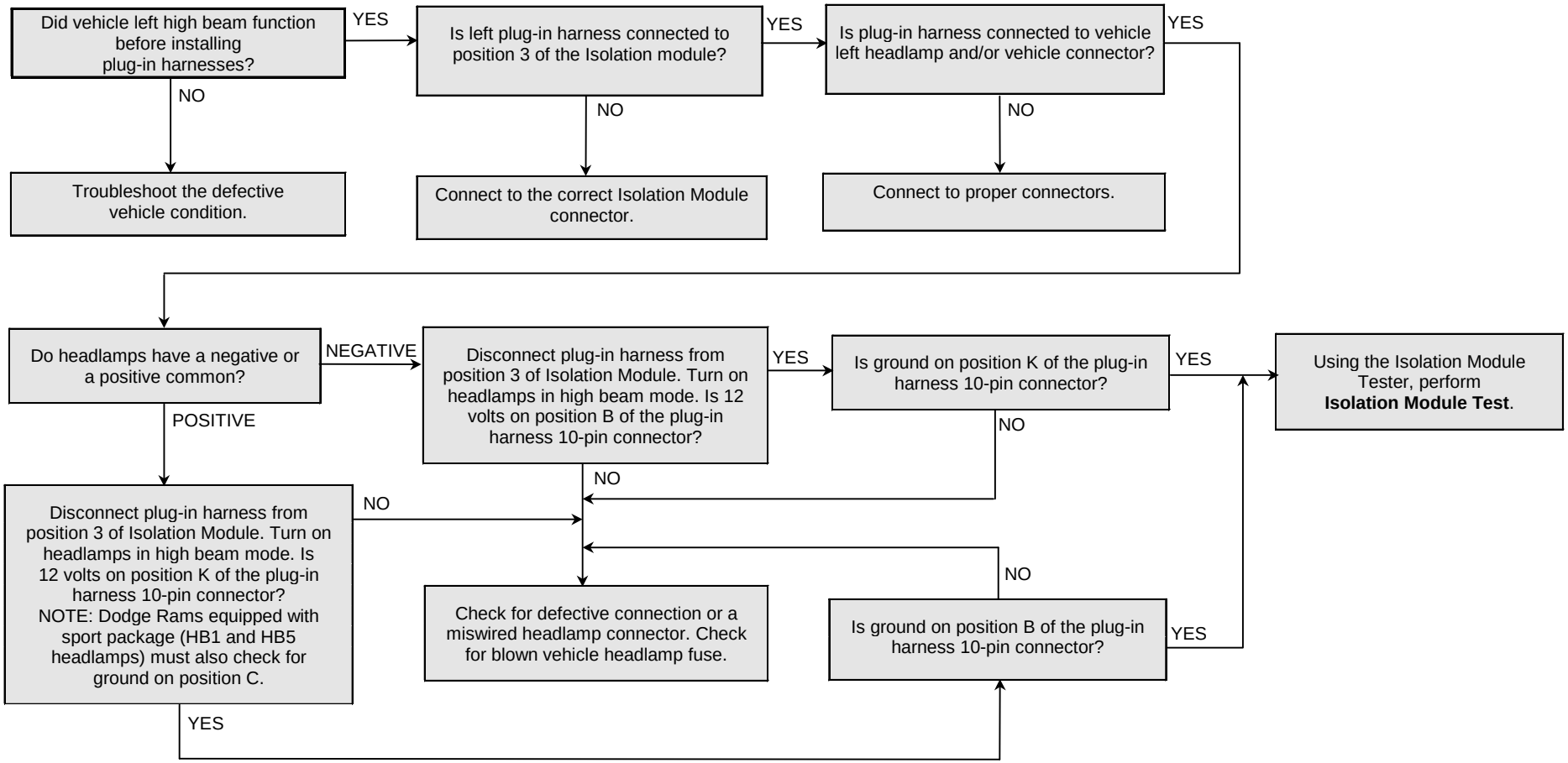
NO LEFT LOW BEAM



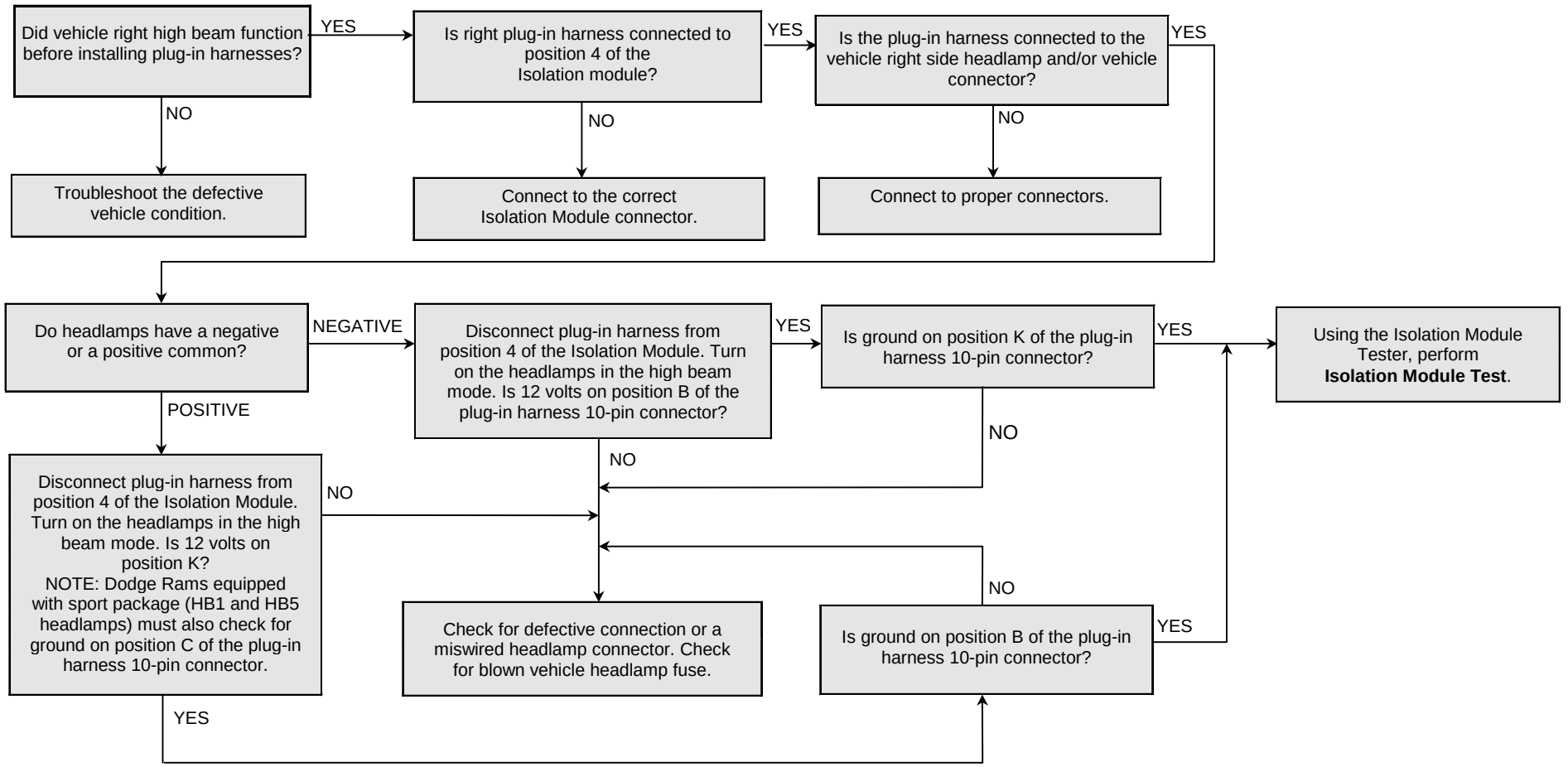
NO RIGHT LOW BEAM



NO LEFT HIGH BEAM



NO RIGHT HIGH BEAM

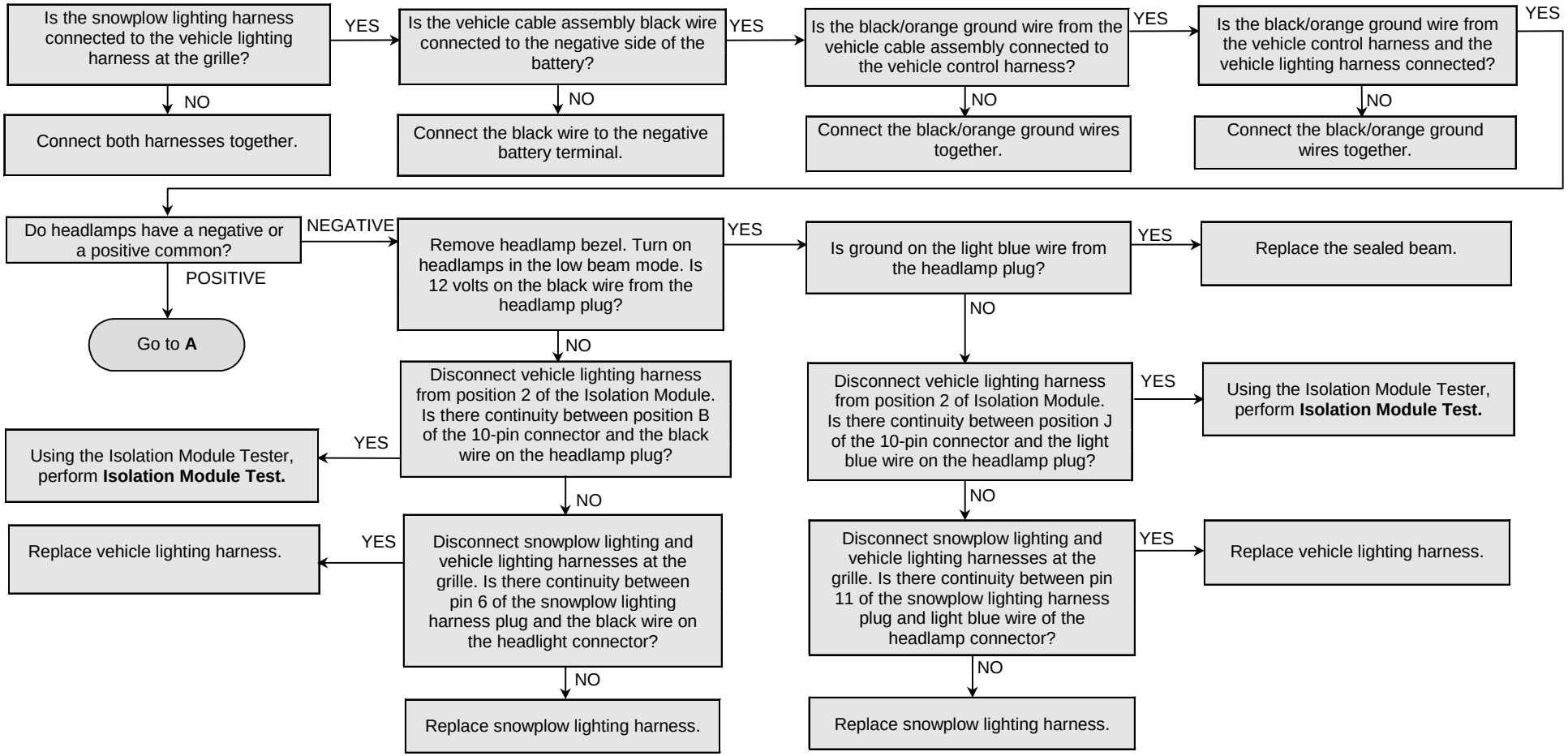


SNOWPLOW HEADLAMP TEST

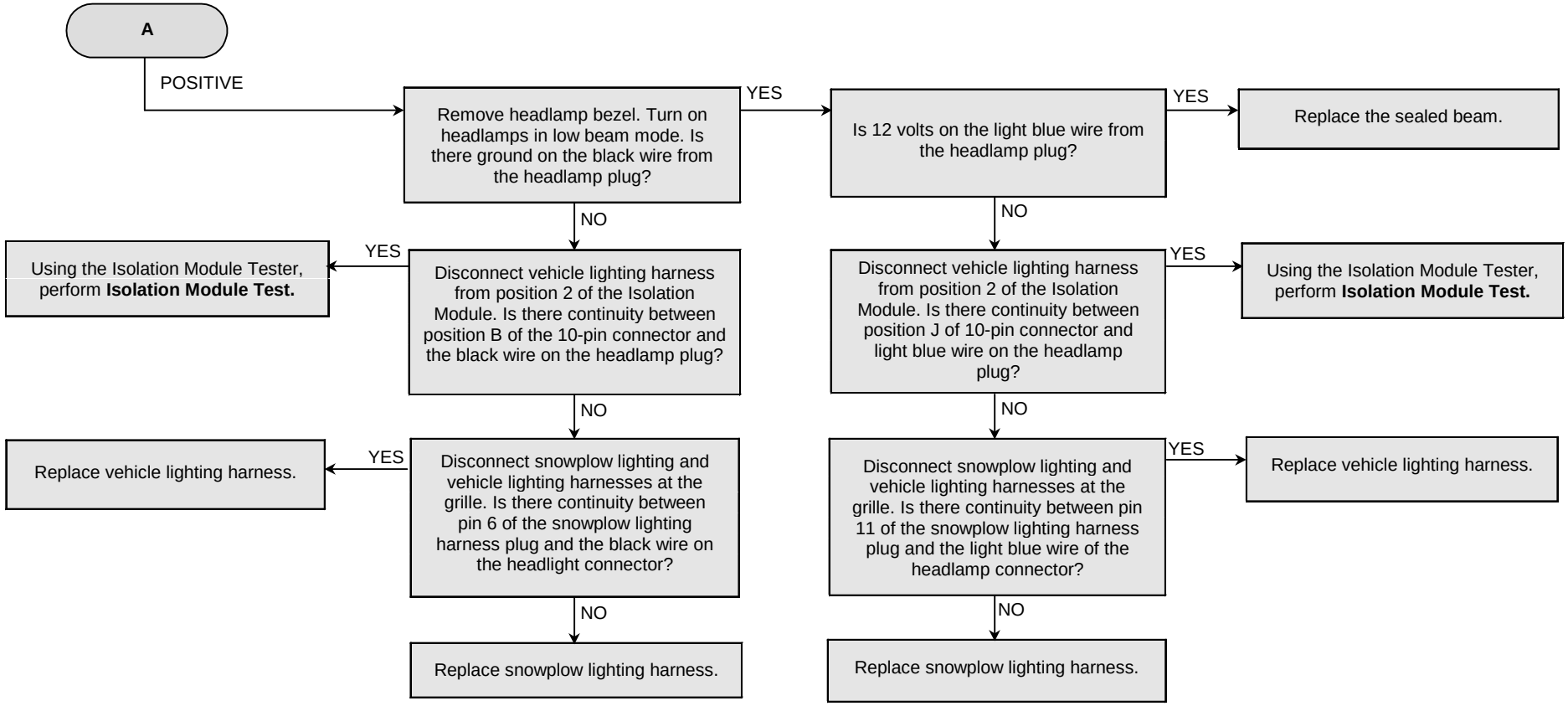
To check the snowplow headlamps the following conditions must be met:

1. All vehicle lights must be functioning correctly with the Isolation Module installed. If the vehicle lights are not functioning correctly, run the Vehicle Headlamp Test before proceeding.
2. FISHER® park, turn, and DRL wires (if applicable) must be connected.
3. The snowplow lighting harness must be connected to the vehicle lighting harness.
4. The vehicle ignition switch must be in the ON position.

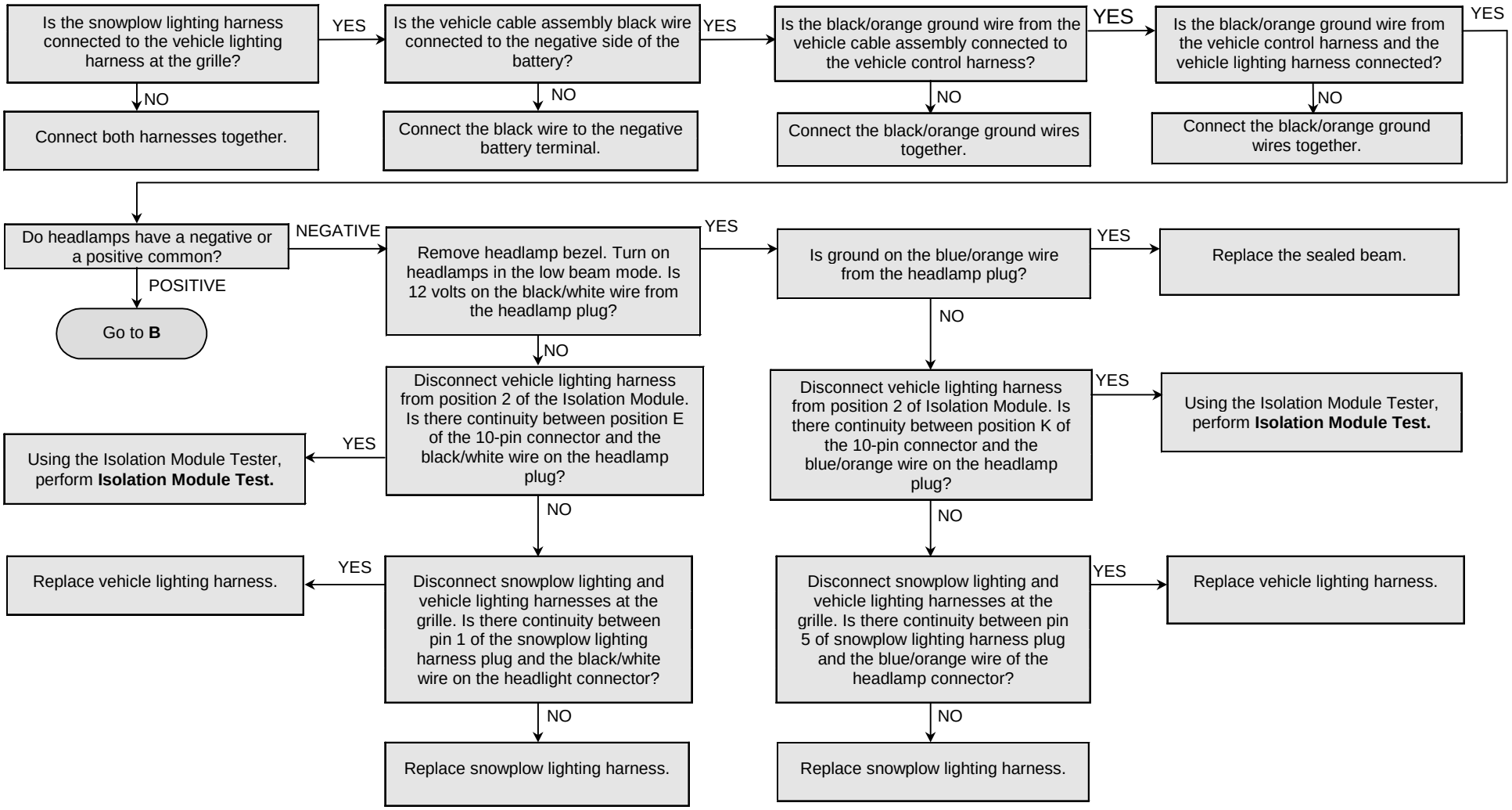
NO LEFT LOW BEAM



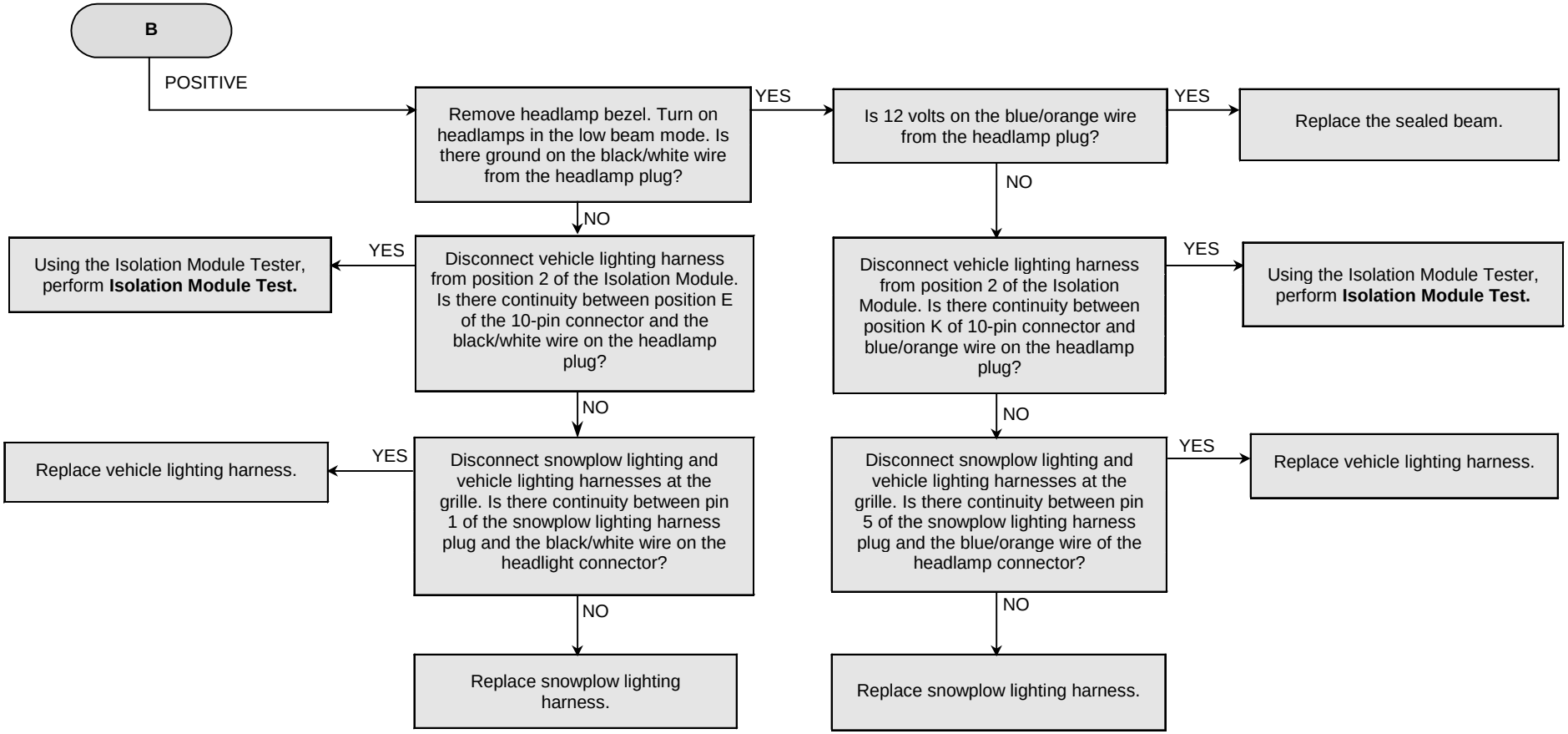
NO LEFT LOW BEAM, CONTINUED



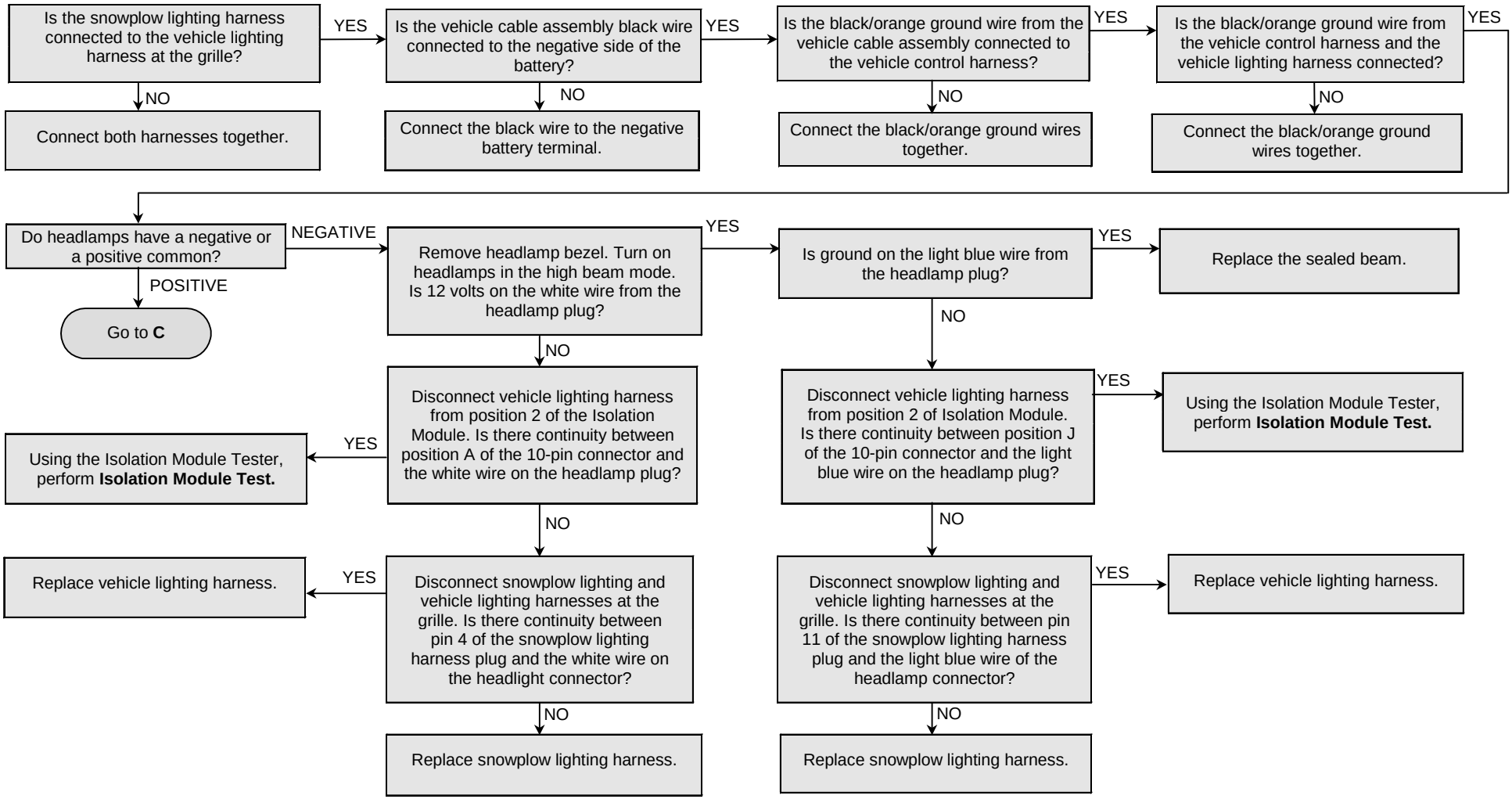
NO RIGHT LOW BEAM



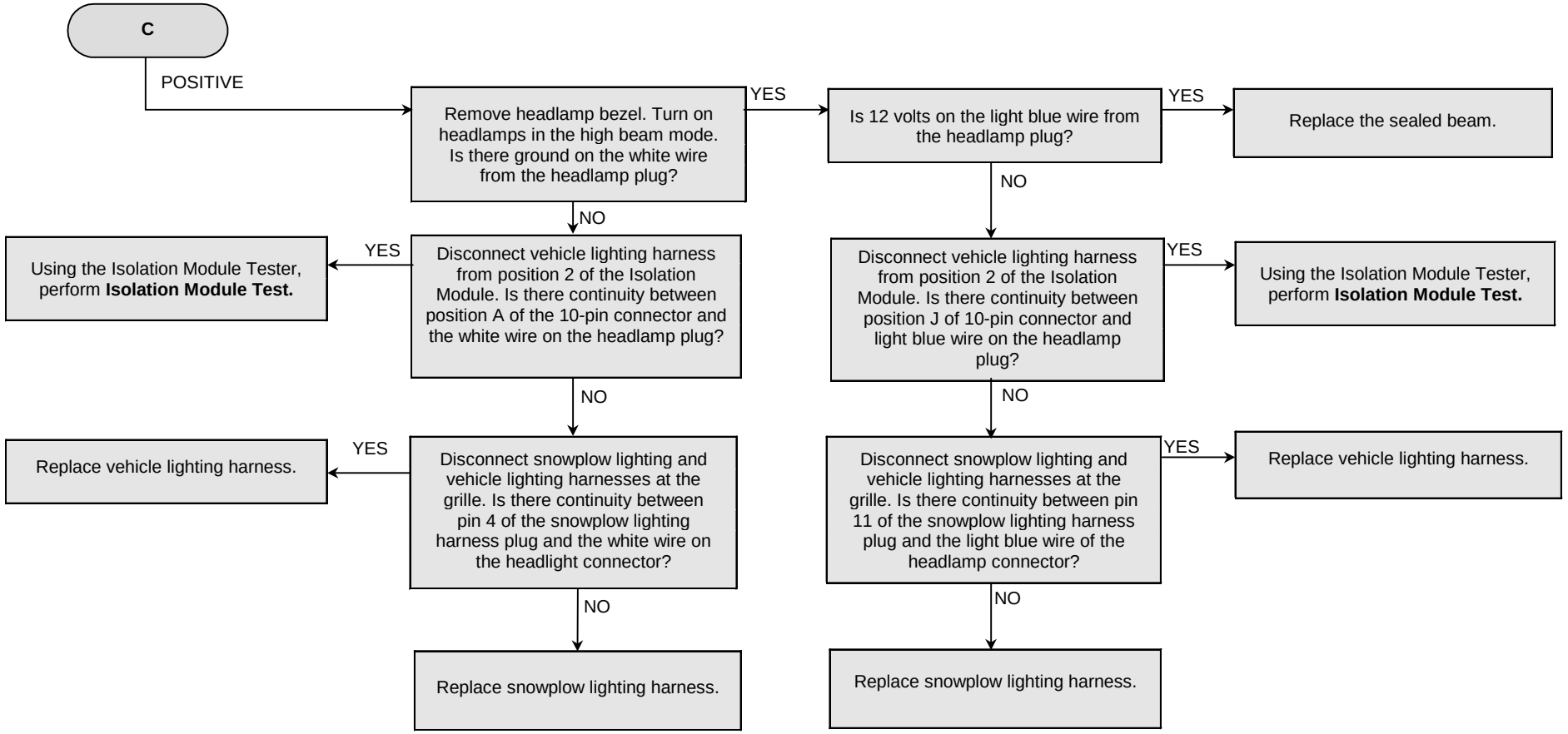
NO RIGHT LOW BEAM, CONTINUED



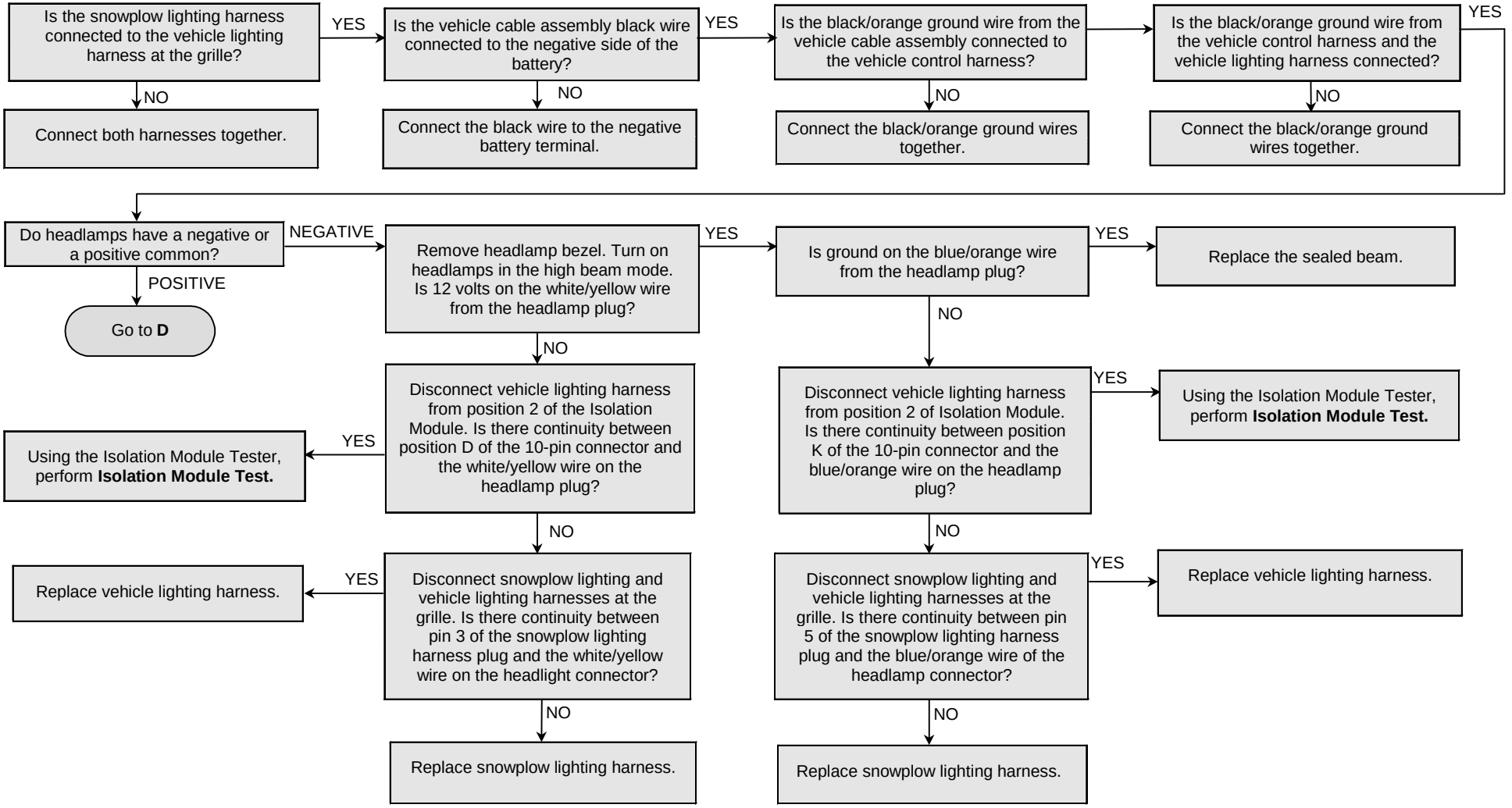
NO LEFT HIGH BEAM



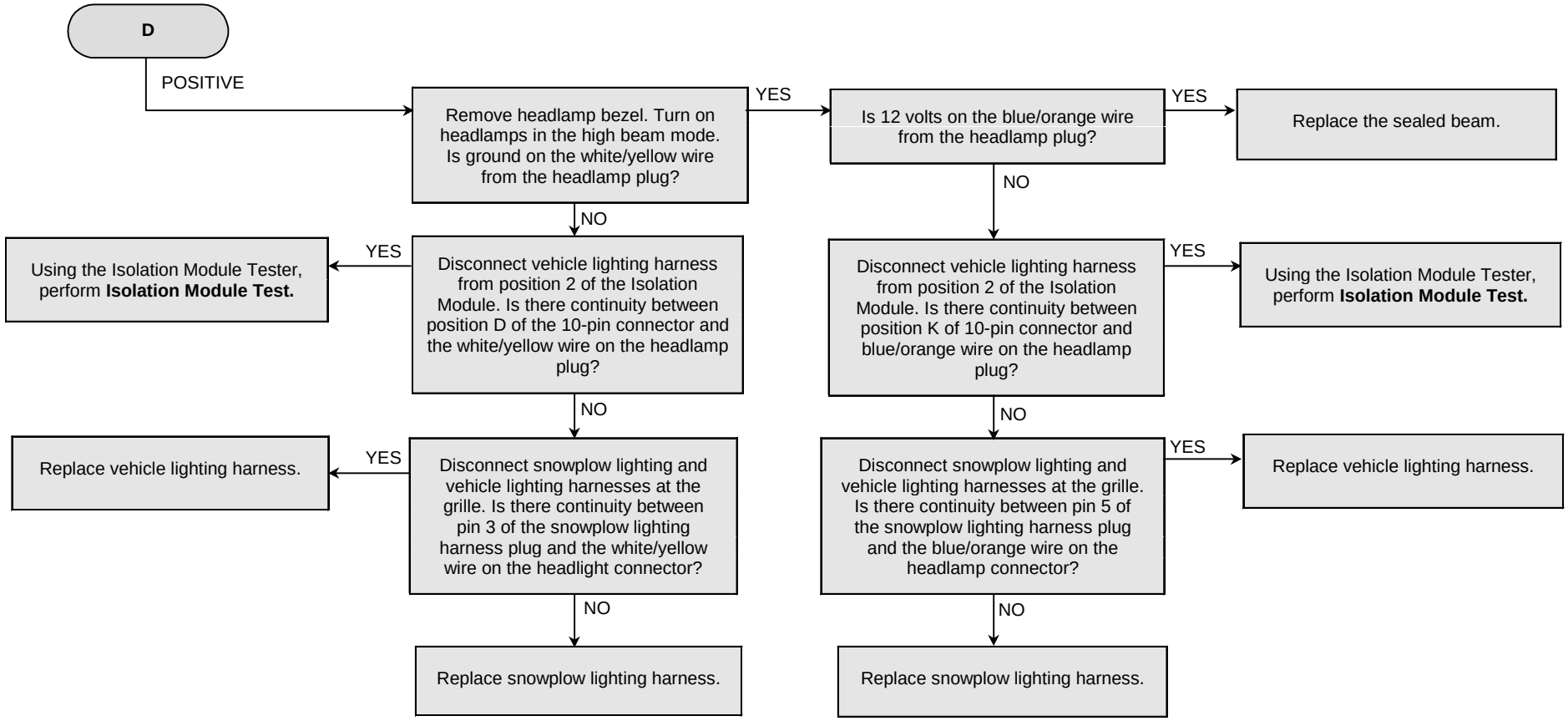
NO LEFT HIGH BEAM, CONTINUED



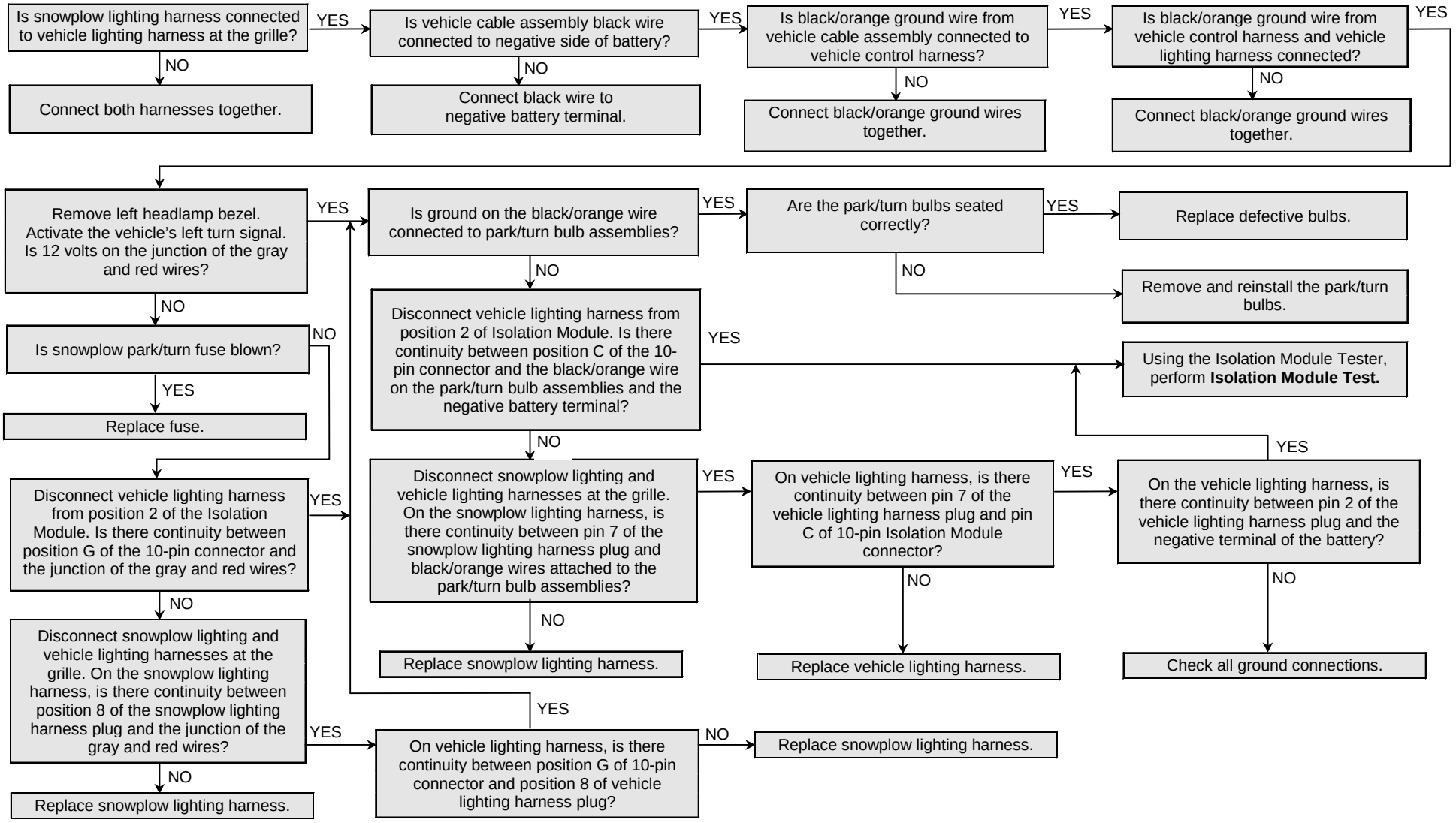
NO RIGHT HIGH BEAM



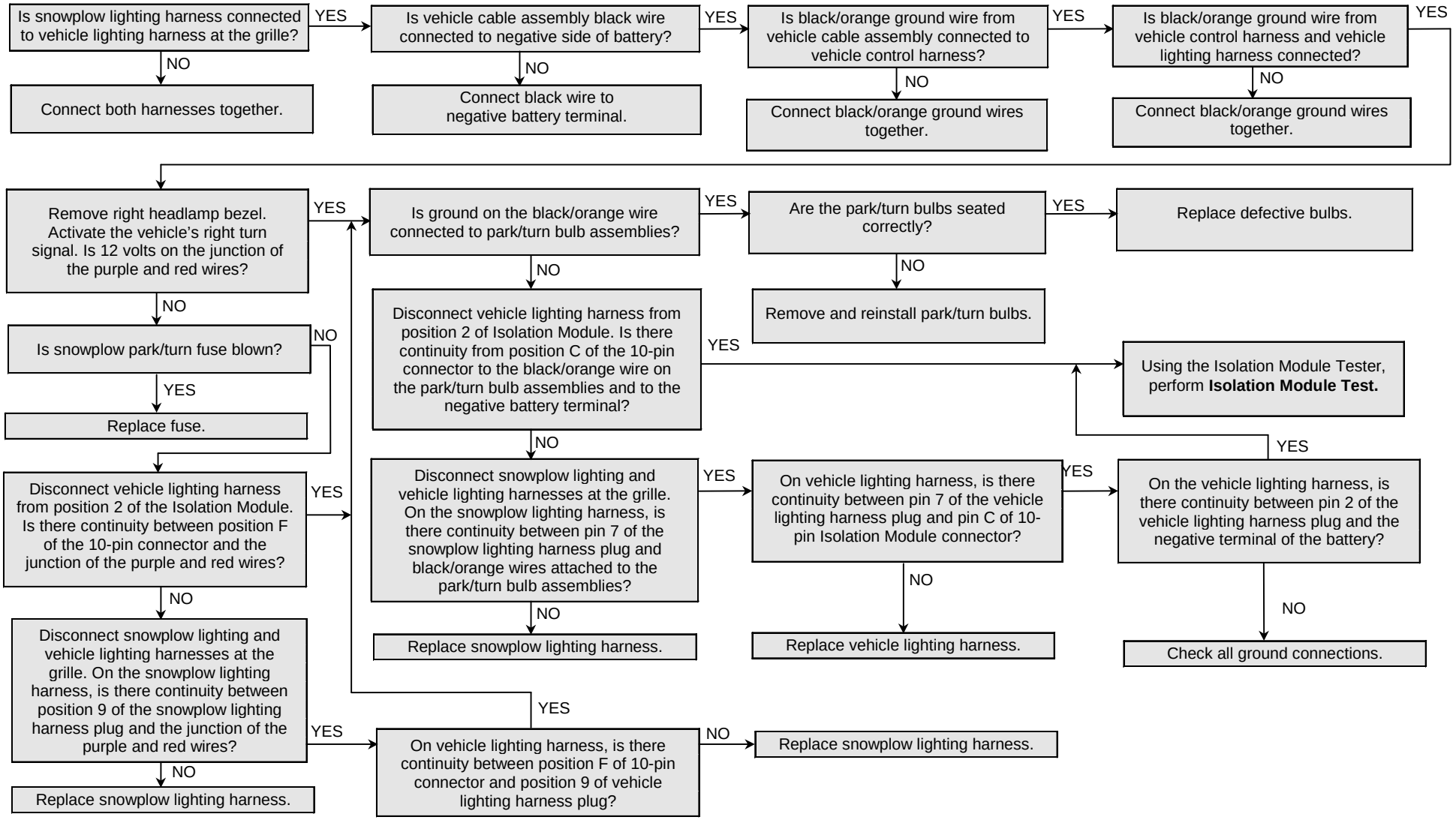
NO RIGHT HIGH BEAM, CONTINUED



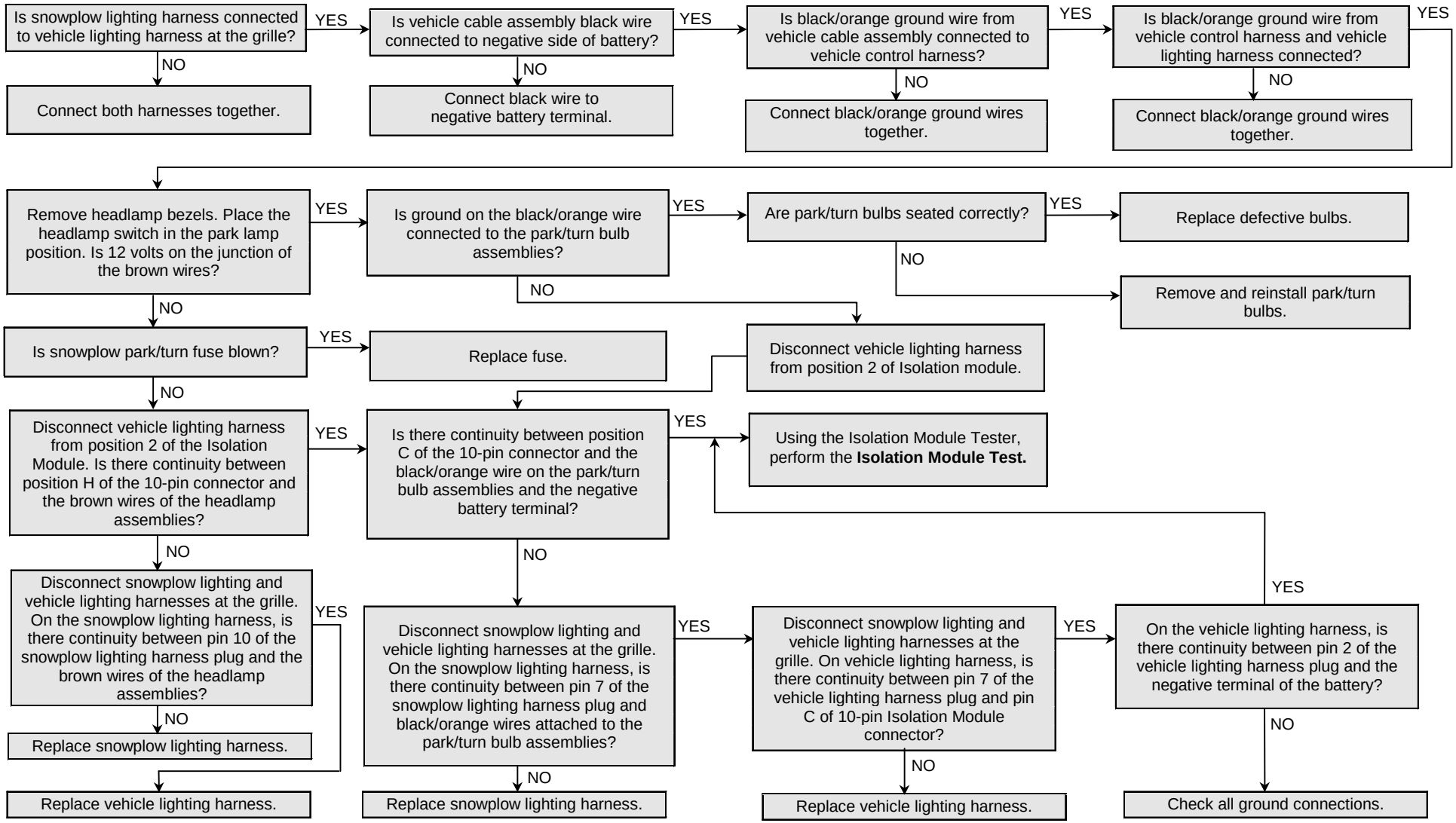
NO LEFT SNOWPLOW TURN SIGNAL LAMP



NO RIGHT SNOWPLOW TURN SIGNAL LAMP



NO SNOWPLOW PARKING LIGHTS

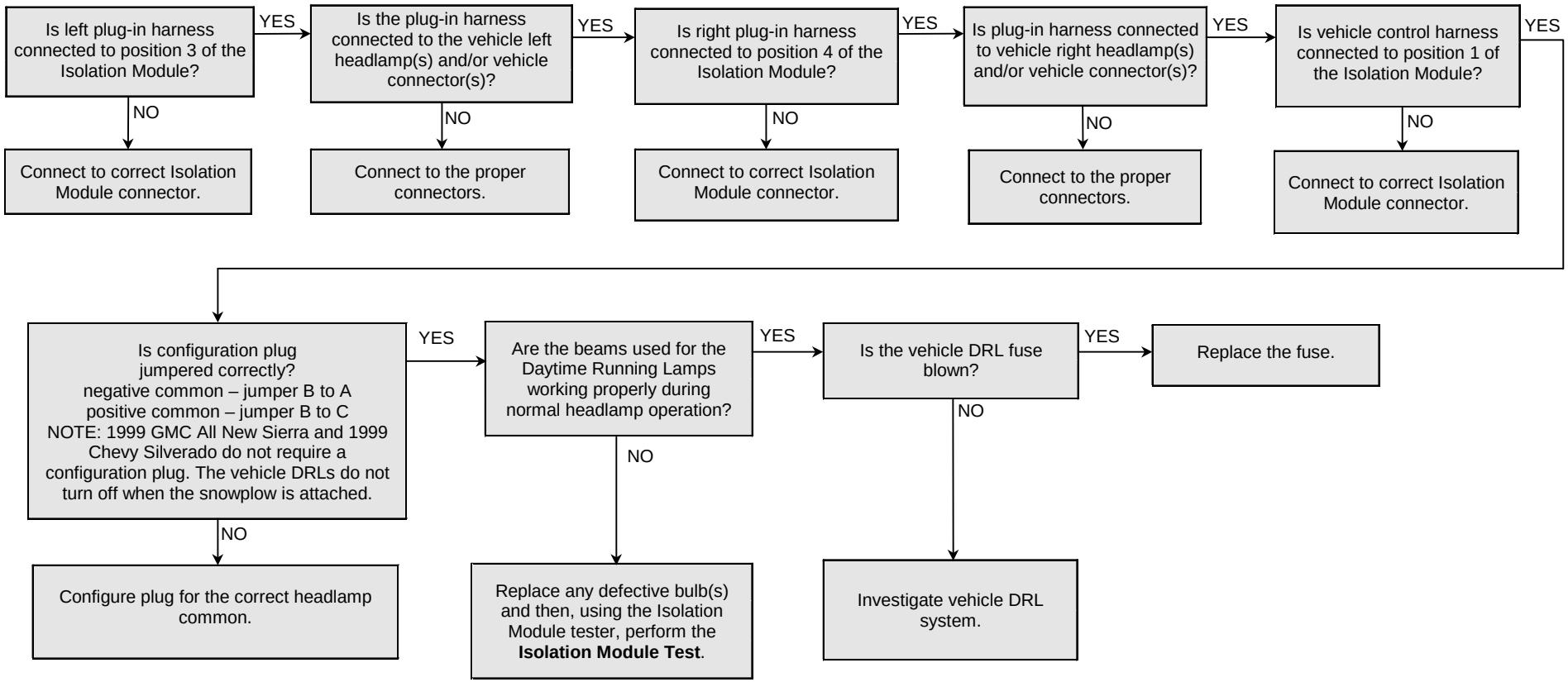


VEHICLE DAYTIME RUNNING LAMPS (DRL) TEST

To check the vehicle DRL system, the following condiitons must be met:

1. Fully understand the operation of the vehicle DRL system before attempting to troubleshoot DRL problems on the snowplow.
2. All vehicle lighting systems must be functioning correctly before the Isolation Module is installed.
3. The Isolation Module and the associated harnesses have been installed using the installation instructions provided.
4. FISHER® DRL wires (if applicable) must be connected.
5. The vehicle ignition switch must be in the ON position.

NO VEHICLE DRLs

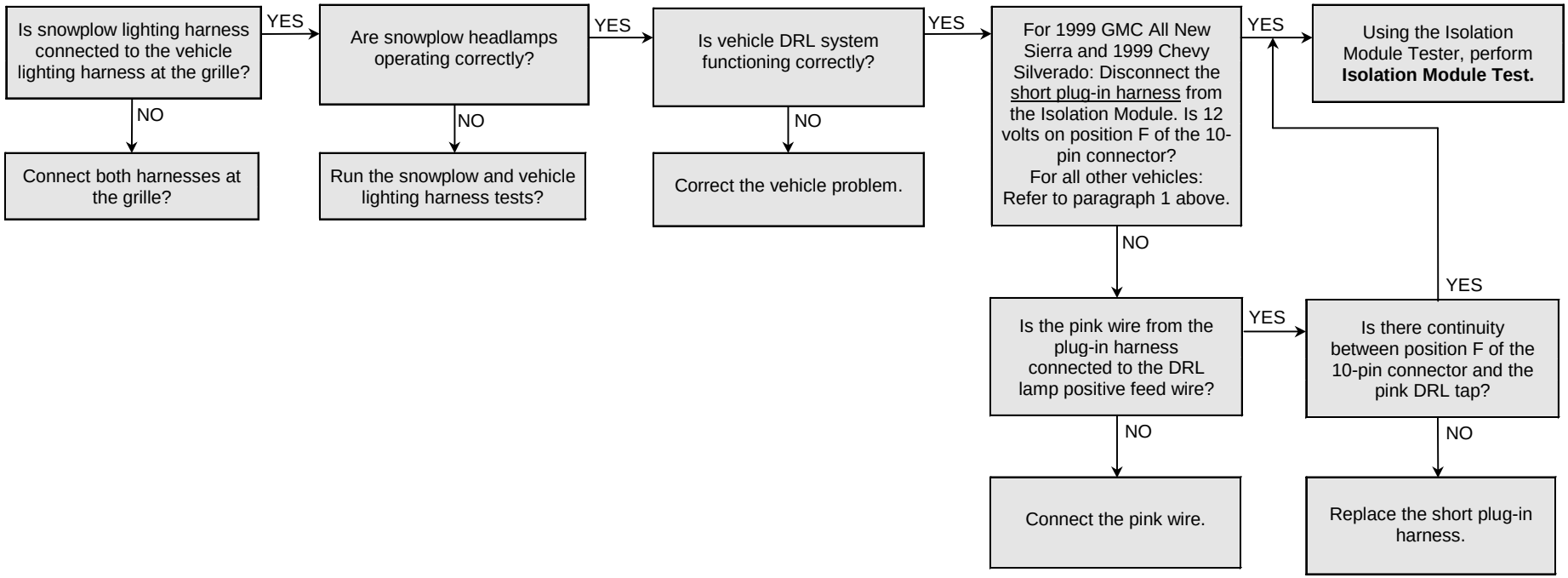


SNOWPLOW DAYTIME RUNNING LAMPS (DRL) TEST

To check the snowplow DRL system, the following conditions must be met:

1. Fully understand the operation of the vehicle DRL system before attempting to troubleshoot DRL problems on the snowplow.
2. All vehicle lighting systems must be functioning correctly before the Isolation Module is installed.
3. FISHER® DRL wires (if applicable) must be connected.
4. The vehicle ignition switch must be in the ON position.

NO SNOWPLOW DRLs

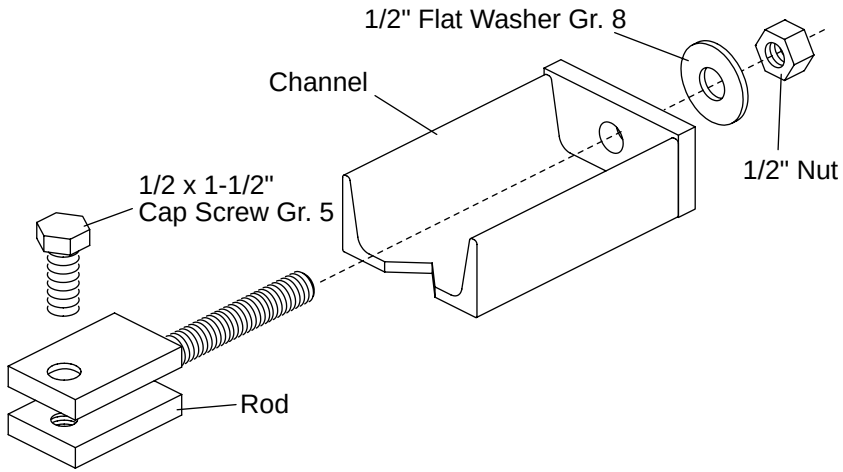


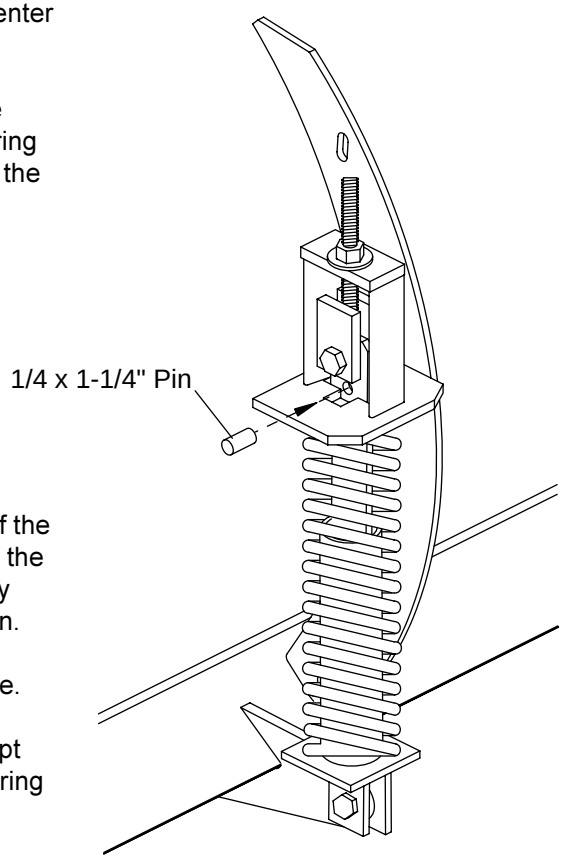
TO REPLACE A SPRING ON THE BLADE, FOLLOW THE INSTRUCTIONS BELOW.

⚠ CAUTION

Servicing the trip springs without special tools and knowledge could result in personal injury. See your authorized Fisher Engineering outlet for service.

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

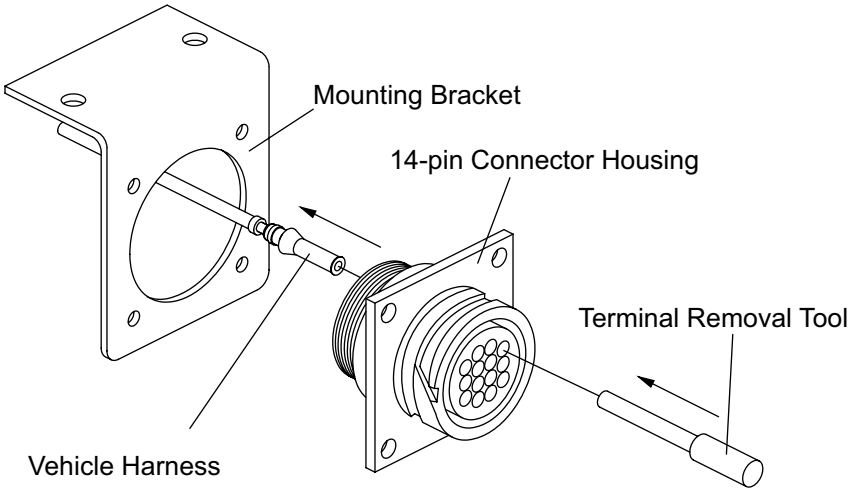




TERMINAL REMOVAL TOOL AND TERMINAL REPLACEMENT

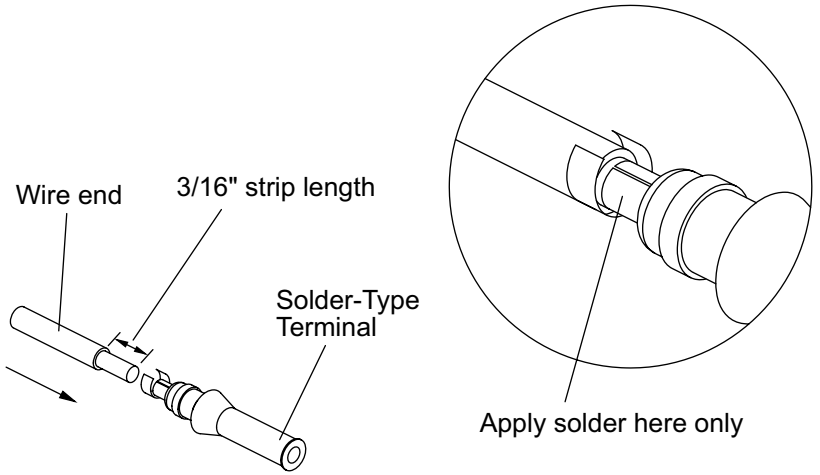
TO USE THE TERMINAL REMOVAL TOOL FOLLOW THE INSTRUCTIONS BELOW:

1. Gently insert the open end of the tool into the desired socket compartment in the 14-pin connector housing as illustrated.
2. Push it in until it bottoms out in the housing.
3. Gently pull the wire that corresponds with the socket compartment out of the housing.
4. Continue until the desired number of wires have been removed from the housing.
5. To reinsert the terminal simply gently push the terminal into its proper compartment until it locks into place.



TO REPLACE A TERMINAL FOLLOW THE INSTRUCTIONS BELOW:

1. Remove the damaged or faulty terminal from the end of the wire.
2. Strip 3/16” of insulation off the end of the wire as illustrated.
3. Push the Solder-Type Terminal over the bared wire.
4. Using proper soldering techniques, solder the terminal to the wire. Apply solder only to the barrel of the terminal as illustrated.



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Printed in USA

May 1999
No. 26512