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M3593-WING

Operating Information



General Information about Power Unit M3593-WING

Warranty Identification

For purposes of warranty consideration, recording the serial number of the power unit is necessary. This serial number is displayed on the reservoir of the power unit.

Maintenance

Under normal operating conditions, the M3593-WING should not require servicing during the plowing season, provided post season maintenance has been carried out.

It is recommended that after every season the hydraulic fluid to be changed. (For the first 3 years after purchase a preventive maintenance schedule must be performed in order to extend your warranty- please see your dealer for details). The replacement fluid is **UNIVIS J13 (HVI 13)** hydraulic fluid. Automatic transmission fluid is not recommended for this system and may lead to aeration of the oil in very cold weather conditions. Use of any fluid other than J13 will void warranty. The oil level in the reservoir is to be within ½" from the top surface (when lift cylinder is collapsed).

When draining the hydraulic fluid, the hoses at the cylinders should be disconnected and drained. With the hose disconnected, the cylinders should be collapsed to displace the oil out of the cylinder.

Periodically, and during post season maintenance, make sure the electrical connections are tight and free of corrosion. The terminals must be covered with grease for additional protection from corrosion.

Electrical System and Electric Motor

Frequently problems develop due to an undersized electrical charging and storage system. Generally, the heavier the usage, the heavier the system should be. For heavy usage and in the case where a number of other devices are run off the battery simultaneously, heavier ratings are strongly recommended. The 8111 electric motor is consisting primarily of an armature/commutator, two field coils, four brushes in a brush holder set, and a tubular steel body with cast end cap. The power unit with this motor is equipped with the pump that offers optimum performance.

Hydraulic Pump

The hydraulic pump converts mechanical energy transmitted by the prime mover (in this case a 12 volt DC electric motor) into hydraulic energy. The hydraulic energy is due to flow (kinetic energy) and pressure (potential energy). The rate of energy output is expressed in horsepower. At the inlet, as the gears unmesh, the volume in the cavity increases thereby causing fluid to enter. This fluid is then carried between the gears and the housing to the other side of the gears into the outlet cavity. At this point the gear teeth mesh. The outlet cavity volume decreases, causing fluid to flow into the system. Note that without a load, the pressure at the outlet port is nil. The pressure at the outlet of the pump is due to external loads placed on the system. These loads can be transmitted through cylinders and linear actuators as well as hydraulic motors and rotary actuators. In practice, system components by virtue of orifice and line sizes, offer some resistance to the flow of fluid. This translates into pressure at the outlet of the pump.

Valve Information

Pressure Relief Valve

The pressure relief valve consists of a ball, a retaining spring and a seat. The ball is exposed to the pressure in the outlet line from the pump. This pressure acting on the exposed area of the ball causes a force on the retaining spring. When the pressure is such that the force on the ball exceeds the force in the spring (due to a pre-set amount of pre-compression) the ball lifts off the seat and the fluid from the outlet of the pump is allowed to flow back to the reservoir. The “standard relief valve setting” for the M3593-WING is 2250 psi.

Directional Valves

The M3593-WING circuit contains 7 directional valves identified as ‘A’, ‘C’, ‘D’, ‘E’, ‘F’, ‘G’ and ‘H’ and they are 3 way, 2 position spool valves. Valve ‘B’ is a 2 way/2 position normally closed poppet valve. A basic directional valve consists of a valve cartridge and a coil. Inside the cartridge valve, an armature is attached to the valve mechanism.

The coil consists of a wire wrapped around a spool. When power is applied to the coil (the coil is energized), the magnetic field created by coil pulls the armature into the coil. The armature shifts the valve mechanism into the energized position. When power is removed from the coil, a spring inside the valve cartridge pushes the armature and valve mechanism to the de-energized position.

Valve ‘B’ is a 2 way 2 position normally closed poppet valve which is used for lowering the plow. In the de-energized position, valve B acts as a check valve allowing pump flow to the lift cylinder but preventing return flow from the lift cylinder to the reservoir. Energizing valve B opens the valve and allows flow from the lift cylinder to the reservoir thereby lowering the plow. Note: the lift cylinder is connected to C3.

Directional Valves ‘A’, ‘C’, ‘D’, ‘E’, ‘F’, ‘G’ and ‘H’ are 3 way/ 2 position spool valves. Directional Valve ‘C’ operates the lift cylinder on C3 port. Directional Valves ‘A’ and ‘D’ operate the left and right angling cylinders. Directional valves ‘E’, ‘F’, ‘G’ and ‘H’ operate wing cylinders. In the de-energized position, the valves block flow from pump to the cylinder but allow return flow from the cylinder to the reservoir. In the energized position, flow from the pump to the cylinder is permitted, but flow from the cylinder to the reservoir is not.

Note: When angling the plow, one cylinder is extending and the other is retracting therefore one cylinder is receiving oil from the pump and the other is returning oil to the reservoir. Valves ‘A’ and ‘D’ must work together same as valves ‘E’ and ‘F’, and ‘G’ and ‘H’.

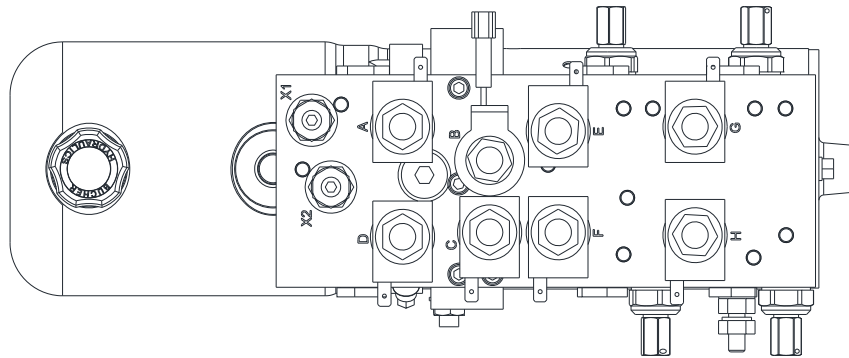
Pressure Compensated Flow Control

When B valve is energized oil from a lift cylinder is going through the orifice to the tank. There is also pressure compensated flow control 1 gpm that restricts flow from the wing cylinders. A pressure compensated flow control valve automatically compensates for pressure changes and maintains its setting even as work load changes.

X- over relief valve

The X-over relief valves are provided to protect the valves and manifold from the pressure spikes created when the plow strikes an object. The X - over relief valves is similar in construction to a regular direct acting relief valve. X - over valves when activated; bleed fluid from C1 to C2 or vice versa. Direct acting relief valves are on C4, C5, C6 and C7 direct flow to the tank.

In this manner the angling cylinders, the plow frame and the truck frame are offered some protection from the normal impact forces associated with plowing. Striking a fixed object while plowing at high speeds will damage the cylinders and perhaps the plow. The cross over relief valves are adjustable and are normally set at about 3,000 psi.



Pilot Operated (PO) Check Valve

A dual pilot operated check valve (PO Check Valve) is provided on ports C1 and C2 to hold the plow at the desired angle. Also PO check valves are installed on ports C4 & C5 same as C6 and C7. Without the PO Check valves, leakage through directional valves would allow the plow or the wings to drift.

Without pilot pressure, a pilot operated check valve (PO check valve) allows flow in only one direction. In the free flow direction, oil flowing through the valve lifts the poppet of the seat. In the opposite direction, returning oil pushes the poppet against the seat thereby blocking flow. When pressure is applied to the pilot piston, the poppet is lifted off the seat and flow in both directions is permitted. When angling, pilot pressure is provided for the check valve returning oil to the reservoir. For example; when valve 'D' is energized pump flows oil to C1. Oil is allowed to return oil through the check valve to the reservoir because the pressure on C1 is acting on the pilot piston of the C2 PO Check Valve. PO check valve operates same on the ports C4, C5, C6 and C7.


Control Switch

The M3593-WING uses a handheld controller. Handheld controller – all control functions automatically time out (shut off) after 6-8 seconds except float position. This helps to reduce wear on the motor and to prevent battery drain. After being idle for approximately 20 minutes the controller will automatically turn off and the indicator light located at the center of the keypad will blink from red to green. To restart the control, turn the control OFF (ON/OFF switch) and then back ON .

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M3593-WING Installation Instructions

(for electrical installation instructions check one-piece harness 53617-M or multiplexing installation 53618-M)
(it requires light kit 800084 or 800086)

 Warning

- Top of battery needs to be protected. If positive side of battery is accidentally grounded person could be burnt or wiring system can be damaged, or battery gasses could explode causing injuries.
- Disconnect cable from negative battery terminal before starting installation.
- Always wear eye protection and protective clothing when working around hydraulic systems.
- Remove jewelry and objects that might conduct electricity while working on power units.
- Fluid under pressure can pierce the skin and enter the bloodstream causing death or serious injury.
- Hydraulic hoses and electrical cables (harnesses) must be tied and routed safely to avoid any damage and pinching (away from hot places, sharp objects etc.).
- When drilling mounting holes or using self-tapping screws in the engine compartment, be sure to check the mounting location for any wires, hoses other obstructions that could be damaged during installation.

Note: Do not use Teflon tape on hydraulic fittings as it can easily jam valves and plug the filters in the system. **Use of fluid other than J13 will void warranty. Apply dielectric grease to all connections to prevent corrosion.**

[Read also One-piece harness installation / Multiplexing installation instructions before proceed with the installation below.](#)

*For electrical installation read:
one piece harness installation 53617-M or multiplexing installation 53618-M.*

Hydraulic Installation:

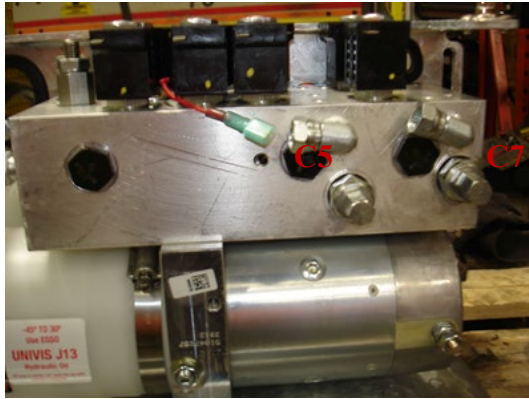
1. Install hoses and fittings as per diagrams and pictures below.
2. Remove vent cap and fill reservoir with UNIVIS J13 (HVI 13) hydraulic oil. Do not use automatic transmission fluid in this system as it may lead to aeration of the oil in very cold weather conditions. Use of fluid other than J13 will void warranty.
3. Manually angle one section of the blade to one side (Curb side (CS)) before activating the power unit. Tighten hose – the fitting on the Curb Side cylinder. Note: Wings must be in the straight (open) position.

The hose connection on the Driver Side cylinder must be loose (to let air out). Press the controller and angle the blade all the way to the Driver Side. Tighten hose – the fitting on the Driver Side cylinder. Fill up the reservoir, so that oil level is ¾” from the top of the reservoir and angle the blade to the curb side.

Operate the wings In and Out a few times. Move, operate, the blade up and down and refill it up as necessary.

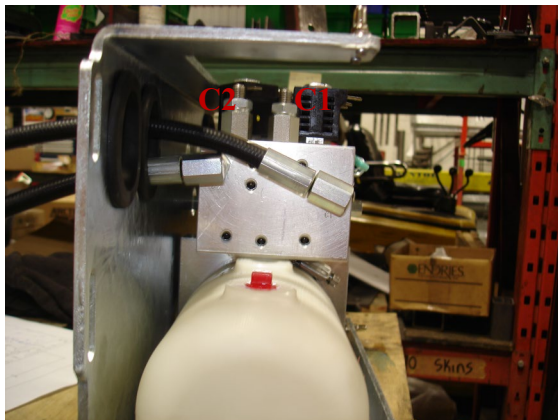
4. Install power unit cover (3).

53622-M M3593-Wing Pump kit (no harness)			
Item	Part Number	Description	Quantity
1	M3593-WING	Power Unit for Wing Plow	1
2	53529-C	Wing Blade Pump Plate Ass	1
3	52429-C	Arctic Power Unit Cover	1
4	53538-N	83" Hose	2
5	53539-N	96" Hose	1
6	53540-N	113" Hose	1
7	51002-M	18" Hose	1
8	51904-M	29" Hose Assembly (St-90)	1
9	51905-M	36" Hose Assembly (St-90)	1
10	53476-B	18" Cable Plug Assembly	1
11	53477-B	90" Ground Cable (Black)	1
12	53478-B	90" Power Cable (Red)	1
13	CS200-06.00-NRS	2" x 6" Lift Cylinder	1
14	53494-M-BB	Pump Kit Bolt Bag	1
15	53608-N	Circuit Breaker	1
16	51335-22-M	4 Gauge Battery Cable, 22	1
17	51335-56-M	4 Gauge Battery Cable, 56	1
Bolt Bag for Wing Blade 53494-M-BB			
18	Part#	Description	Quantity
19	53535-02-N	#6 O-ring boss to 90 Swivel ¼ NPT	4
21	HH-00790-002	90 Deg Swivel Elbow	4
22	52436-N	Grommet 1/4"X1.3/4x2.1/2	2
23	52435-N	Grommet 3/16x1.1/2x2.1/8	1
24	52427-N	Red Terminal Protector	1
25	53560-A	Dummy Plug (Power & Ground)	1
26	490056-01	1/2 Oz Tube Dielectric Grease	1
27	52700-01-N	Grommet 1/8x3x3.625	1
28	HH-00293-049	3/8-16x1 HHCS	2
29	HH-00971-043	5/16-18x1 Carriage	4
30	HH-00340-017	5/16-18 Nyl. Ins.	4
31	HH-00341-004	3/8 Flatwasher	2
32	52435-01-N	Grommet 1/4x1.1/2x2.1/8	5
33	HH-00455-007	#8x3/8 Screw	4
34	53541-N	6" Cable Tie	10
35	HH-00293-028	5/16-18x1 HHCS	1
36	HH-00457-007	5/16 Lockwasher	1
37	HH-00457-004	3/8 Lockwasher	2
40	53536-N	90 Deg Extended Elbow	3

Hoses installation 2014 and up:

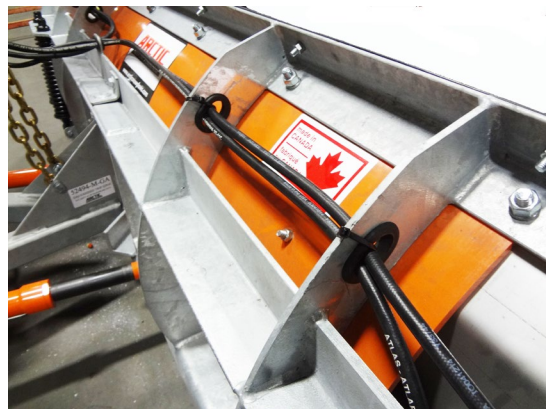
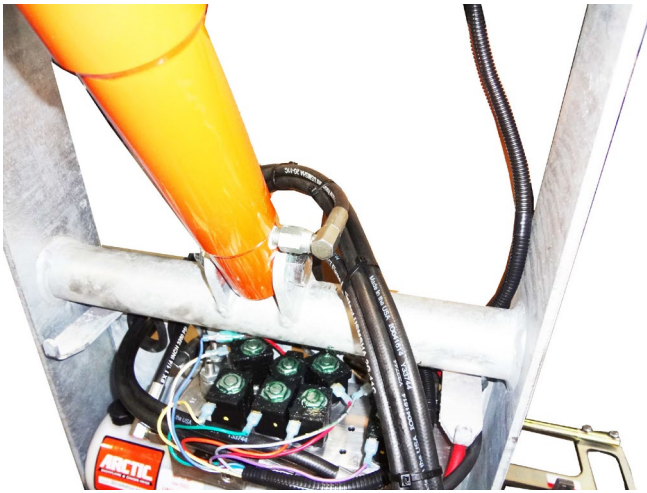
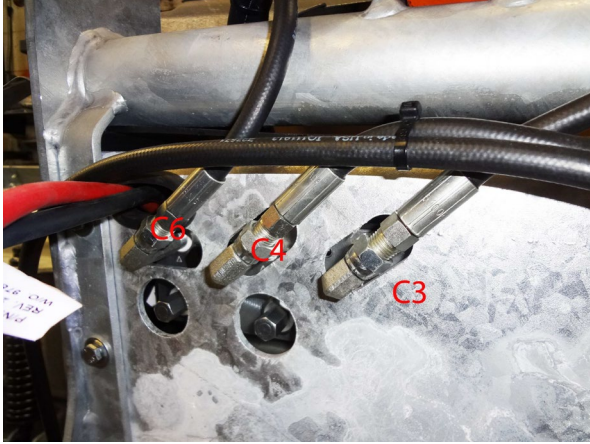
Note: 3x 90 Deg Extended Swivel Elbow
(53536-N)

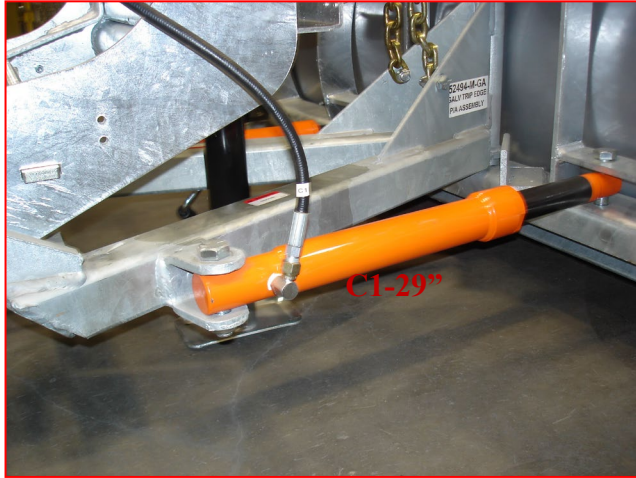
Install swivel elbow a short elbow in the front (20)



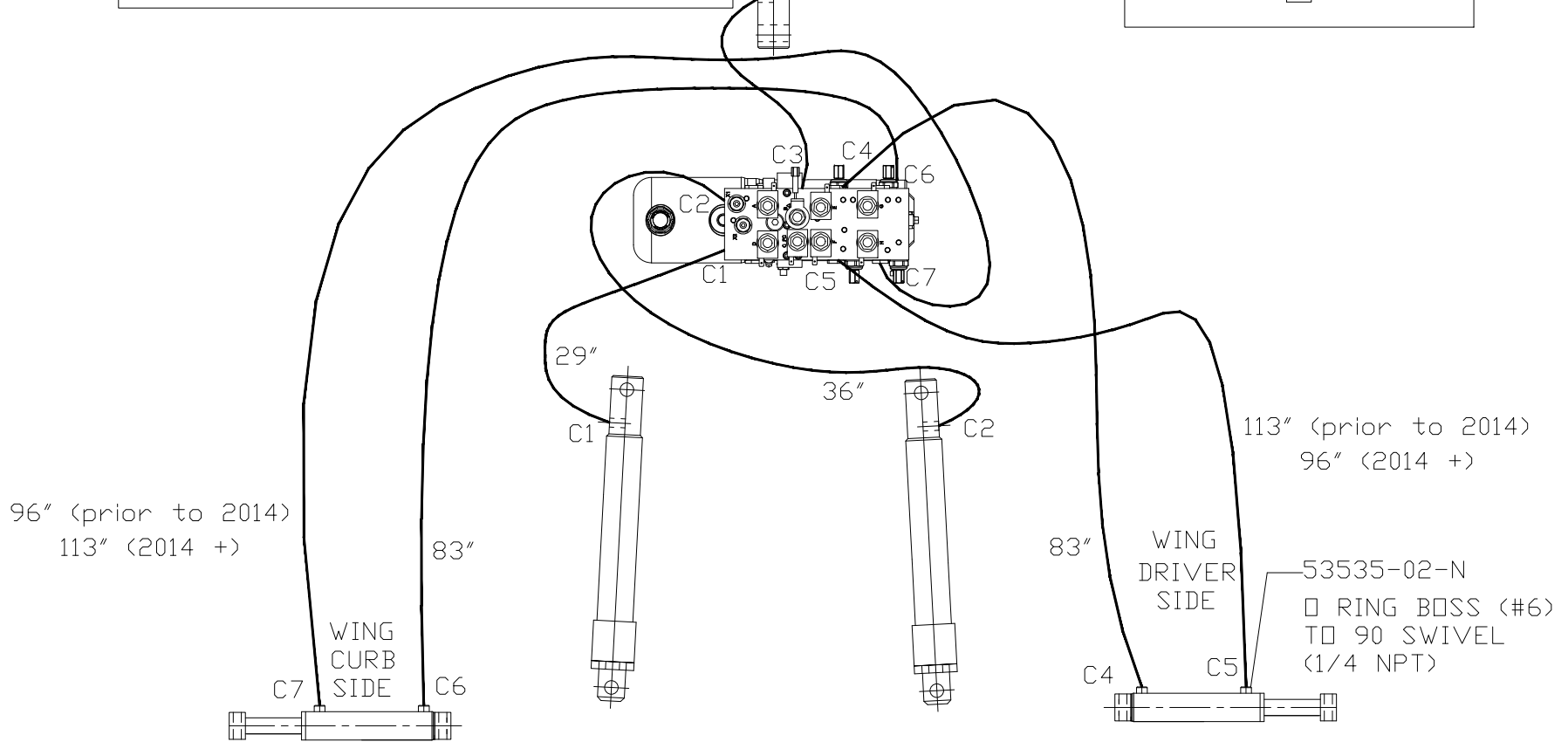
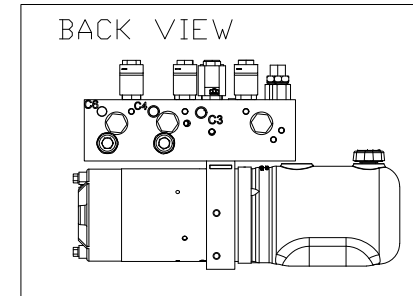
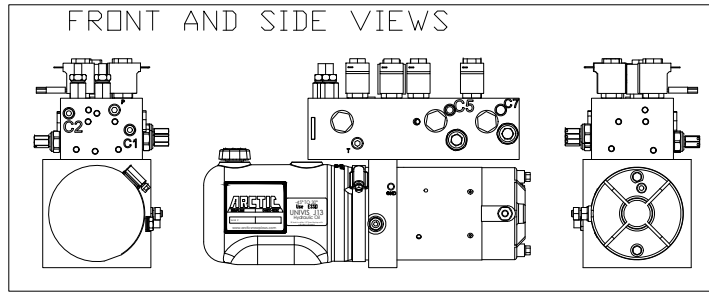
Install angle hoses C1 – 29” and C2 – 36”.

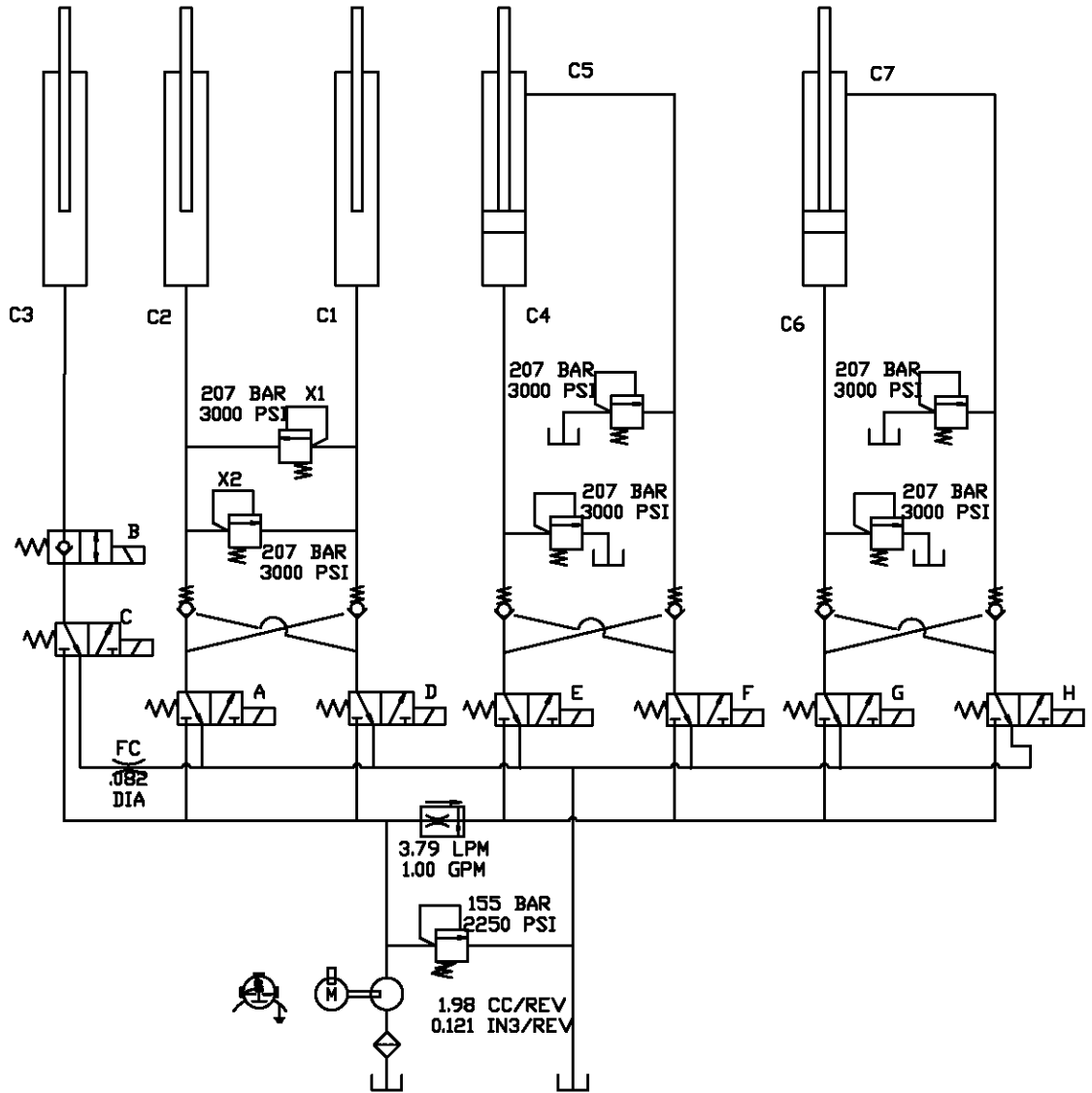
Install grommets (38) in 4 ribs and one steel ring (loop) and route all hoses through those holes.





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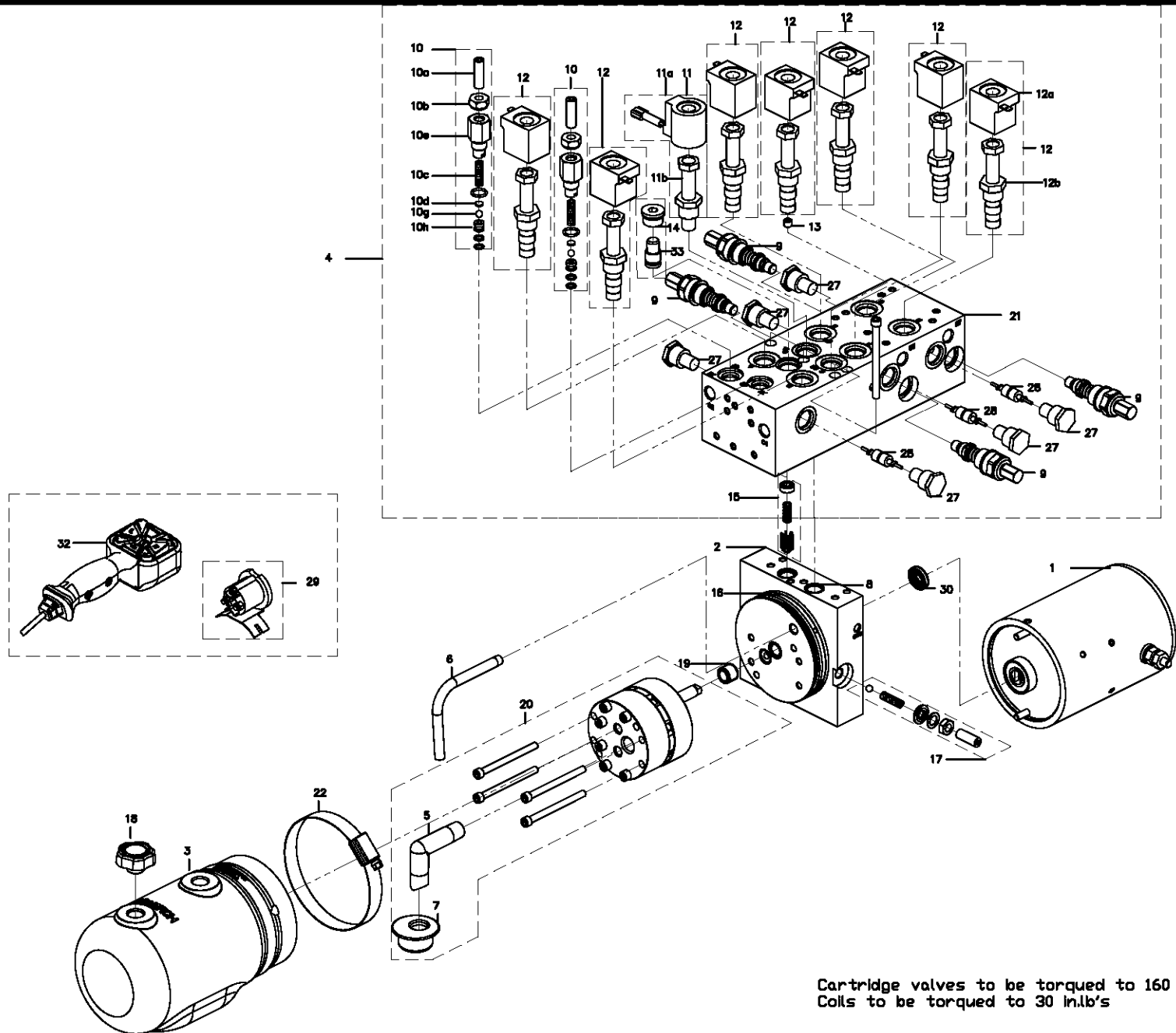


SCHEMATIC

ELEC DEVICE	FUNCTION									
	RAISE	LOWER	ANGLE RIGHT	ANGLE LEFT	WINGS OUT	WINGS IN	RIGHT OUT	RIGHT IN	LEFT OUT	LEFT IN
MOTOR	ON		ON	ON	ON	ON	ON	ON	ON	ON
A - white b/s			ON							
B-blue		ON								
C-green	ON									
D-yellow				ON						
E-red					ON				ON	
F-orange						ON				ON
G-gray					ON		ON			
H-purple						ON		ON		

M3593-WING

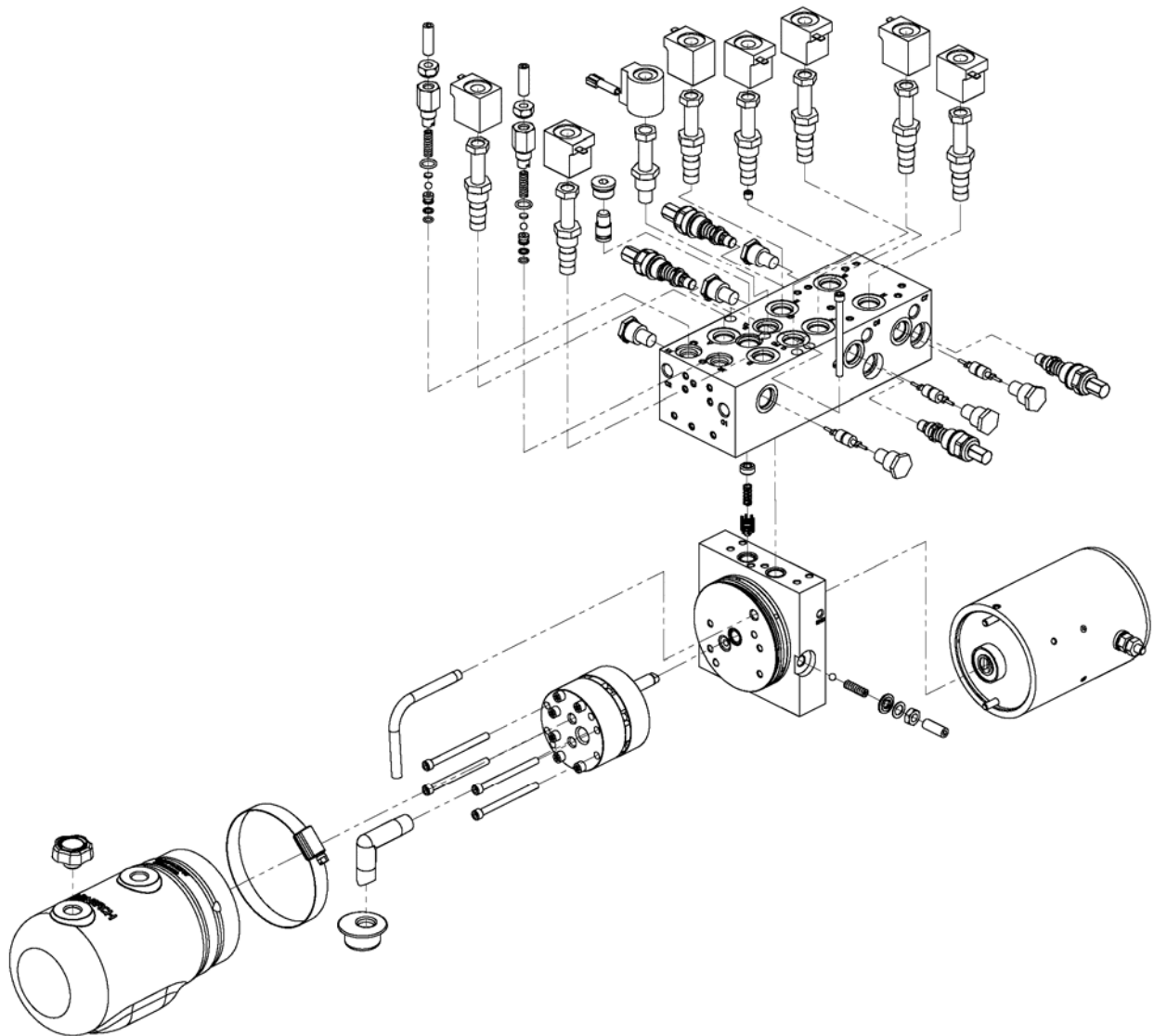
Parts List



Cartridge valves to be torqued to 160 in.lb's
 Coils to be torqued to 30 in.lb's

M3593-WING			
Item	Part number	Description	Quantity
1	FP8111-I	Motor	1
2	FP18405	Pump base assembly	1
3	FP6102	Reservoir	1
4	FP22003	Manifold assembly (incl. all valves)	1
5	FP1209	Suction tube	1
6	FP13058	Return tube	1
7	FP1134	Suction filter	1
8	FP0118	O-ring, 5/8 x 3/4 x 1/16 -016	2
9	200787400740	Relief Valve	4
10	FP13023	X over valve assembly (XA1, XA2, XD1, XD2)	2
10a	FP7899	Screw	1
10b	FP0386	Sealing nut	1
10c	FP0147	Spring	1
10d	FP1288	Plate	1
10e	FP0379	Housing	1
10g	FP0012	Ball	1
10h	FP0378	Seat	1
11	FP0490-D	Valve, #8, 2W / 2P, NC poppet (C)	1
11a	FP10861-D	Coil #8, 2W / 2P 12V	1
11b	FP10907-D	Valve cartridge, #8, NC poppet	1
12	FP7249-D	Valve, #8, 3W / 2P, spade terminal (A1, D1, A2, D2, C)	5
12a	FP18835-D	Coil, 12 VDC, #8, with spade terminal	1
12b	FP0679-D	Valve cartridge, #8 spool, 3W / 2P	1
13	FP2361	Orifice	1
14	FP3274	Plug, SAE 3/4"-16	1
15	FP7526	Check valve kit	1
16	FP2352	O-ring, 3 3/4 x 4 x 1/8, -240	1
17	FP7527	Relief valve,(flat washer FPN0575/seal washer FP3874)	1
18	FPN0571	Breather	1
19	FP7985	Needle Bearing	1
20	FP12171-250-SA	Pump assembly kit	1
21	FP22002	Manifold only	1
22	FP7900	Clamp, (clamp up to 80inlb)	1
23	FP7837	Screw, SHCS, 1/4 x 3 1/4"	4
24	53469-B	Harness, valve section	1
25	53470-B	Underhood intermediate harness	1
26	53487-B	Incab intermediate harness	1
27	FP7217	Check Valve	6
28	FP7218	Piston	3
29	FP17757	Solenoid, switch	1
30	FP2159	Pump shaft seal	1

M3593-WING			
Item	Part number	Description	Quantity
31	FP2318	Motor bearing	1
32	53495	Handheld Controller	1
33	FP1723-1.0	Flow Control	1



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HANDHELD CONTROL for WING BLADE

1. Turn the ON/OFF switch on the control to the ON position. The control keypad will glow green, indicating the control is on.

NOTE: The ON/OFF switch can be used as an emergency stop when required.

2. Press the DOWN button for 1.3 seconds to engage the FLOAT mode. The FLOAT indicator light, located in the center of the keypad (logo), will change from green to red. To cancel the FLOAT mode, momentarily press the UP button.

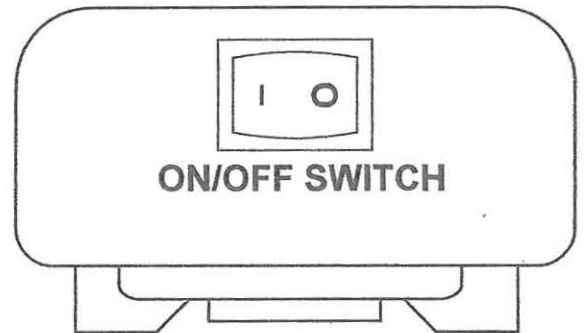
FLOAT mode will automatically cancel after 20 minutes, and the FLOAT indicator light will turn back to green. To restart FLOAT mode, repeat step 2.

Blade Operation Time Outs

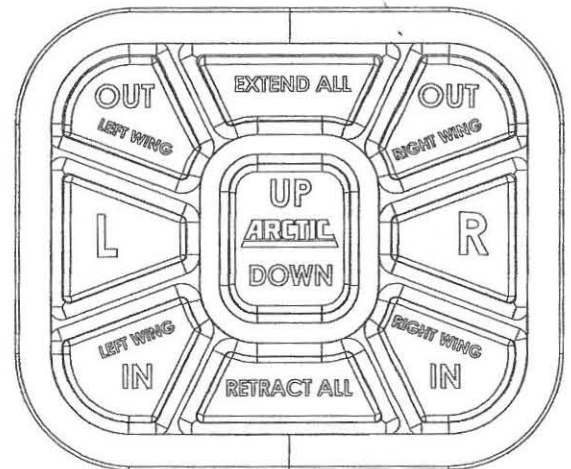
All control functions automatically time out (shut off) after a period of time. This helps reduce wear on the pump motor and prevent unnecessary battery drain. All functions will time out after 6 to 8 seconds.

Automatic Shutdown

After being idle for approx. 22 minutes, the control will automatically turn off and the indicator light located at the center of the keypad (logo) will blink from red to green. To restart the control, turn the control OFF (ON/OFF switch) and then back ON.



(LOCATED ON TOP OF HANDHELD CONTROL)




KEYPAD



WARNING

TO PREVENT
ACCIDENTAL ACTIVATION
OF PLOW, TURN PLOW
OFF WHEN NOT IN USE

M3593-WING troubleshooting

 Warning

- Servicing the snowplow (hydraulic power system, hoses, hydraulic cylinders, controllers, wiring harnesses, lights, blade frame, blade moldboard, A-frame, quadrant, lift frame and vehicle undercarriage) without special tools and knowledge could result in personal injury. See an authorized Arctic dealer for service.
- Fluid under pressure can pierce the skin and enter the bloodstream resulting in serious injury or death.
- Eye protection and protective clothing must be worn when working on any portion of the snowplow.
- Remove any jewellery (rings, bracelets, watches, necklaces) that could conduct electricity while working with electrical system.
- Lifted blade should be securely propped or immobilized while working on it or any other suspended part so it cannot fall.
- Do not operate blade when anyone is within a 10 foot radius of it.
- Use of any fluid other than J13 will void warranty

Tips:

- Pump shaft can be turned freely (smoothly) using two fingers. If it can't be turned replace pump. Proper pump rotation is clockwise looking from the motor end.
- Use a screwdriver to check magnetism of solenoid coils. Place screwdriver on the nut securing the coil and have the switch operated. Strong magnetic attraction should be felt.
- Measure pump pressure at an angle hose (at full angle) it has to be 2250 psi (assuming that cross over relief valve setting is 3000 psi, if X-over relief valve setting is less than relief valve setting pressure gage will read lowest reading). The most accurate reading of system pressure is reading pressure on lift cylinder. When testing or making adjustments on the relief valve the system must be "dead headed" (cylinder at full stroke or in a position where cylinder movement is zero).
- AMP draw of motor should be measured at maximum raise or maximum angle when motor is running at 2250 psi.
- Use volt meter or test light to test for power in a harness or continuity in a switch. A test light is simply a light bulb which has one end connected by a wire to an alligator clip and the other end connected to a metal probe. It is used to check the electrical circuit when the battery is connected to the system. The alligator clip is grounded and the light glows when the probe comes in contact with a "live" electrical component.
- Do not screw cartridge valves into cavity too fast; use a back and forth motion and have O-rings well lubricated.
- Clean all parts thoroughly before assembly and lubricate with clean oil.

-Do not use Teflon tape on hydraulic connections as it can easily jam the valves and plug the filters in the system, use pipe sealant. Never apply pipe sealant at the end of fitting, always 2- 3 threads back.

-X-over pressure could be set only for angling cylinders (pressure can't be set on crossovers for wing blade) using hand (hydraulic) pump. Example: If you want to set the pressure at x-over X1 insert hand pump hose in the C1 port together with pressure gauge. Loosen the jam nut and turn adjusting screw clockwise a turn or two and watch the gauge; if it goes up, continue to turn the screw until the required setting is reached. Retighten the jam nut. To set X-over X2 repeat the same steps as setting X1.

To adjust relief valve:

-Loosen jam nut counter-clockwise. Turn screw clockwise to increase pressure or turn screw counter-clockwise to decrease pressure. Tighten jam nut clockwise to 50in.lb. torque. Check system pressure after jam nut is tight. Readjust pressure if screw is moved during tightening of jam nut.

Specification:

-Max Amp Draw 230 AMP (AMP draw of motor should be measured at maximum raise or maximum angle when motor is running at pressure setting at 2250 psi).

Note: Do not operate motor continuously for more than 30 sec.

-Relief valve setting 2250 psi.

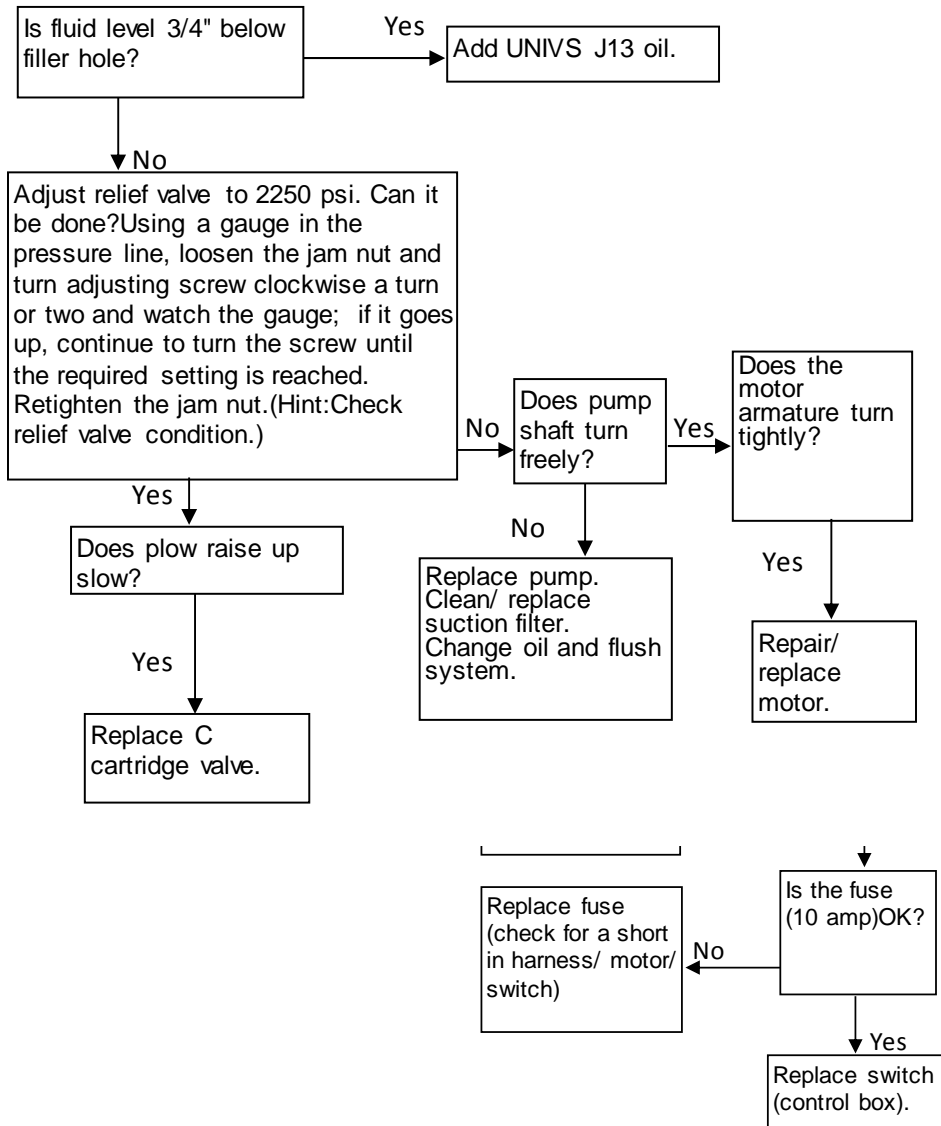
-X-over relief valve setting 3000 psi.

Note:

1) Before starting to troubleshoot try new controller to check that existing controller works properly.

For Multiplexing troubleshooting contact Arctic Equipment Manufacturing.

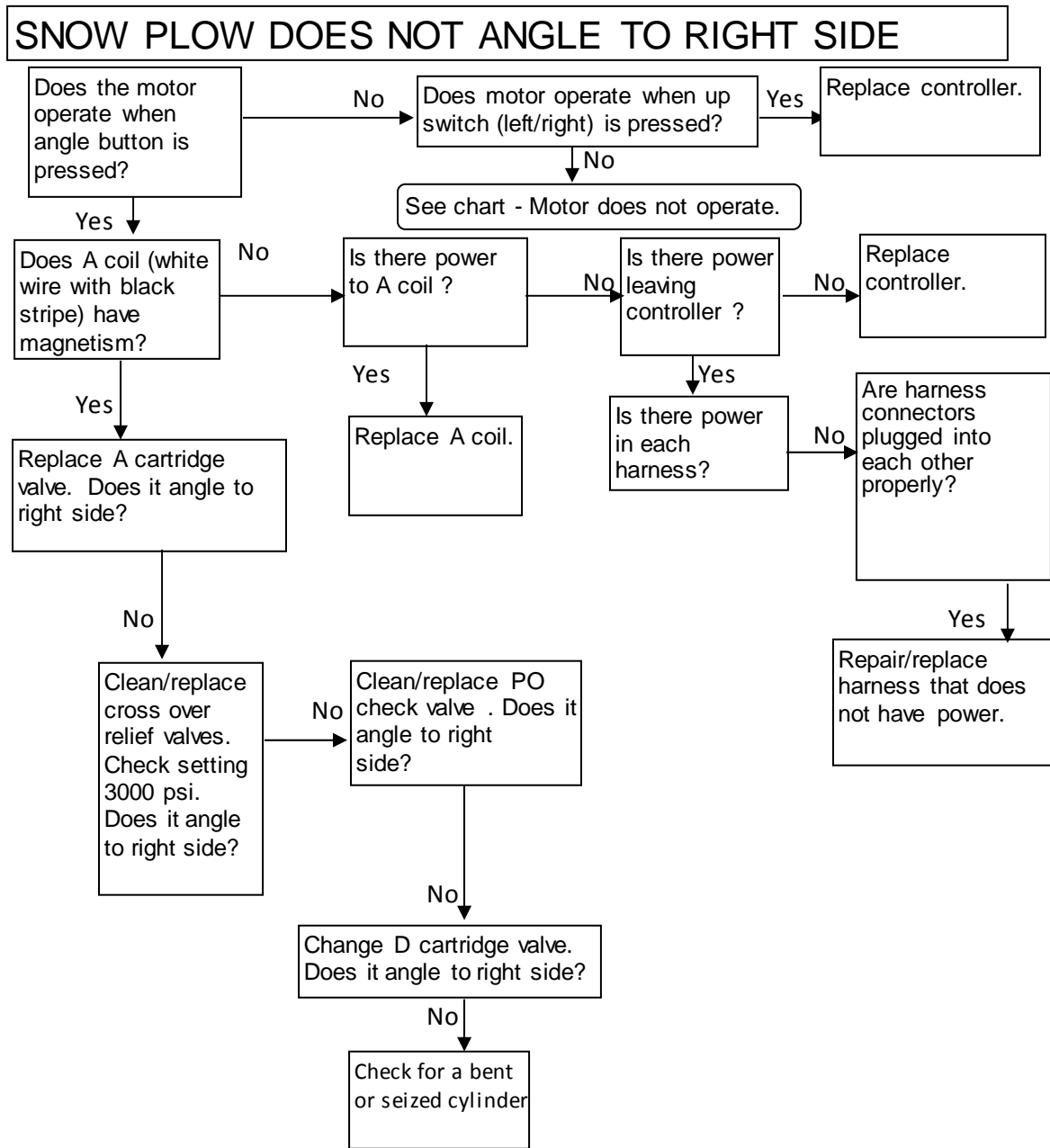
SNOW PLOW RAISES VERY SLOWLY M3593-WING



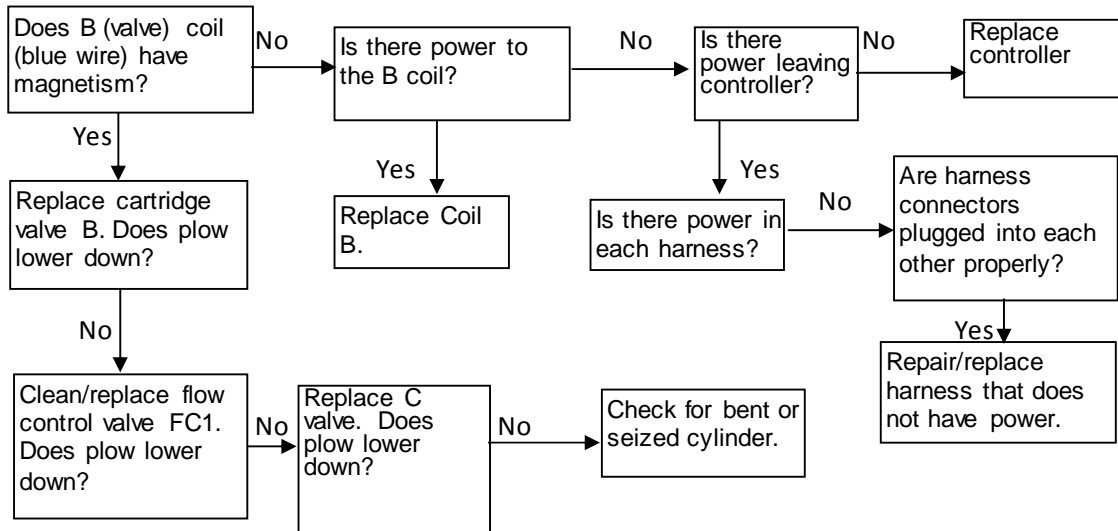
MOTOR OPERATES CONTINUOUSLY

If motor operates continuously, change

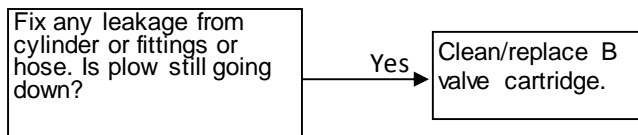




SNOW PLOW WILL NOT LOWER M3593-WING



SNOW PLOW LEAKS DOWN M3593-WING

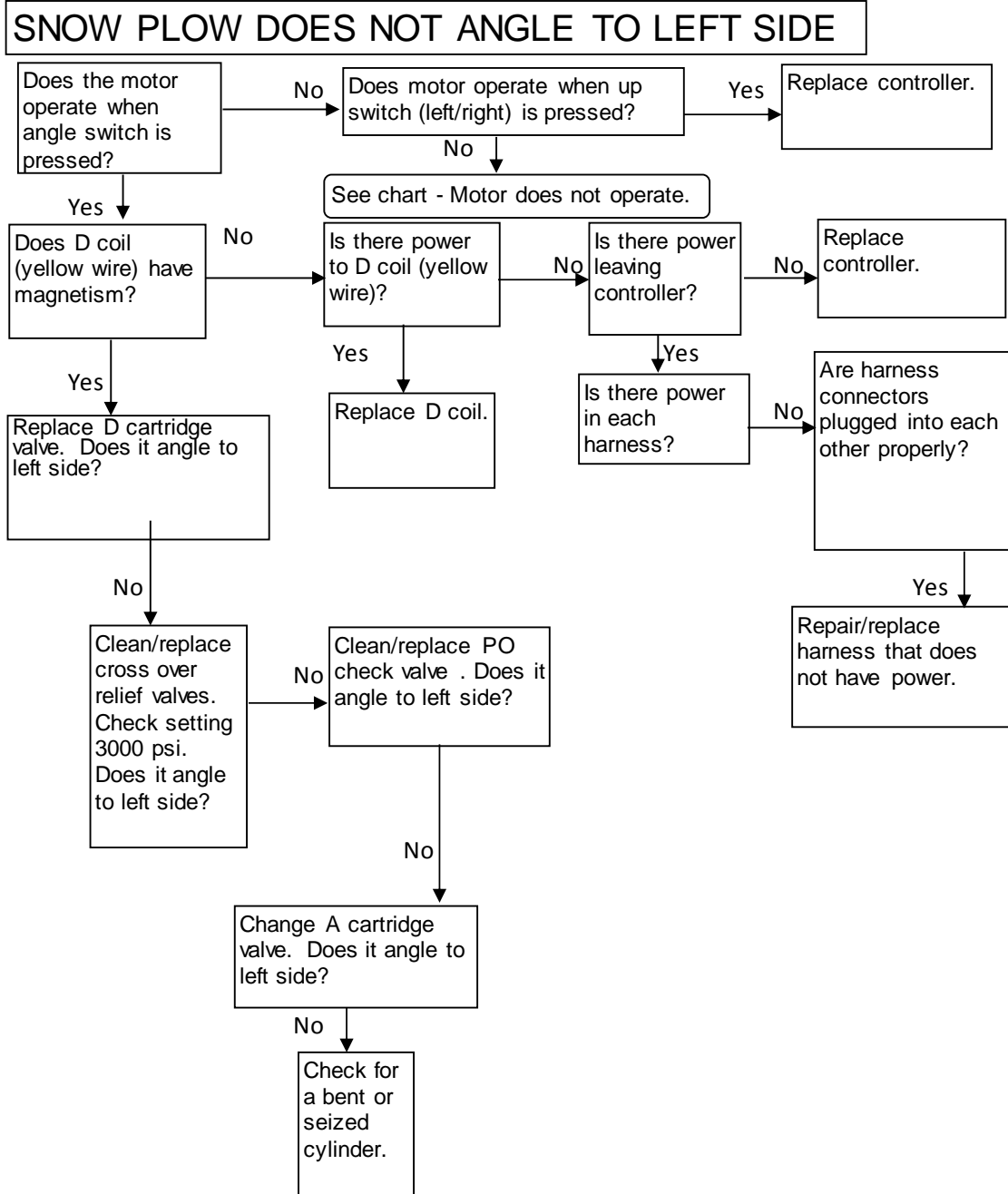


SNOW PLOW ANGLES BEFORE GOING UP WHEN UP BUTTON IS PRESSED M3593-WING

If snow plow angles left before going up change D valve and if snow plow angles to right side change A valve.

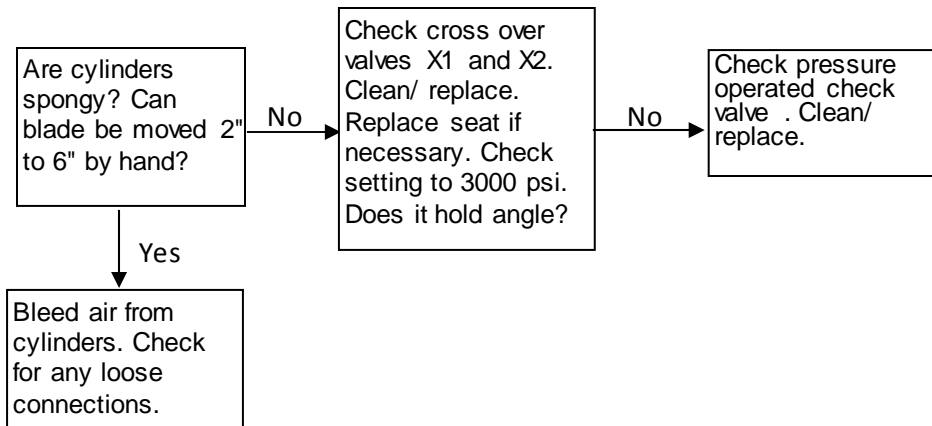
SNOW PLOW WHEN FULLY ANGLED GOES UP (WHEN ANGLE BUTTON IS PRESSED) M3593-WING

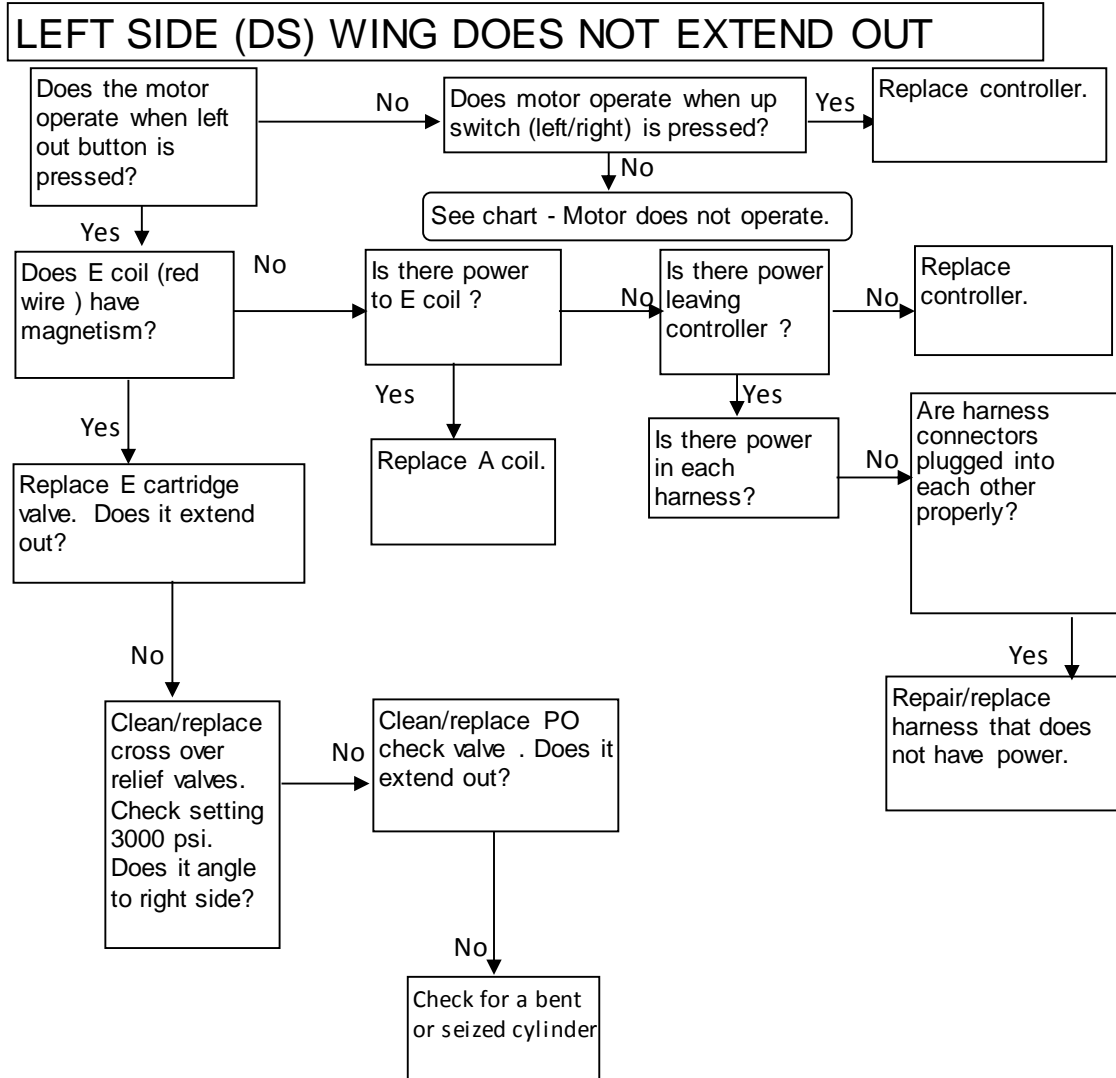
Change C Valve cartridge.

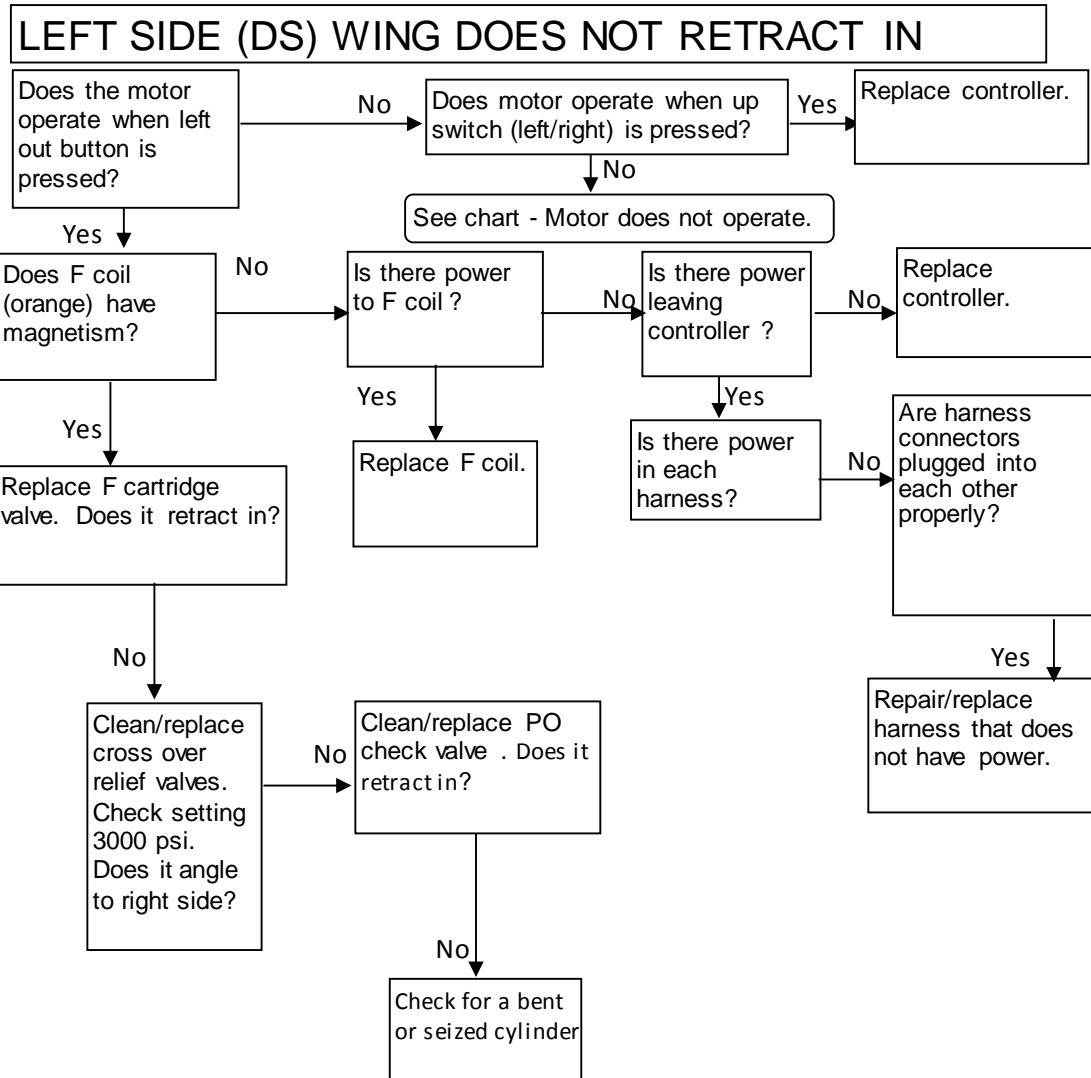


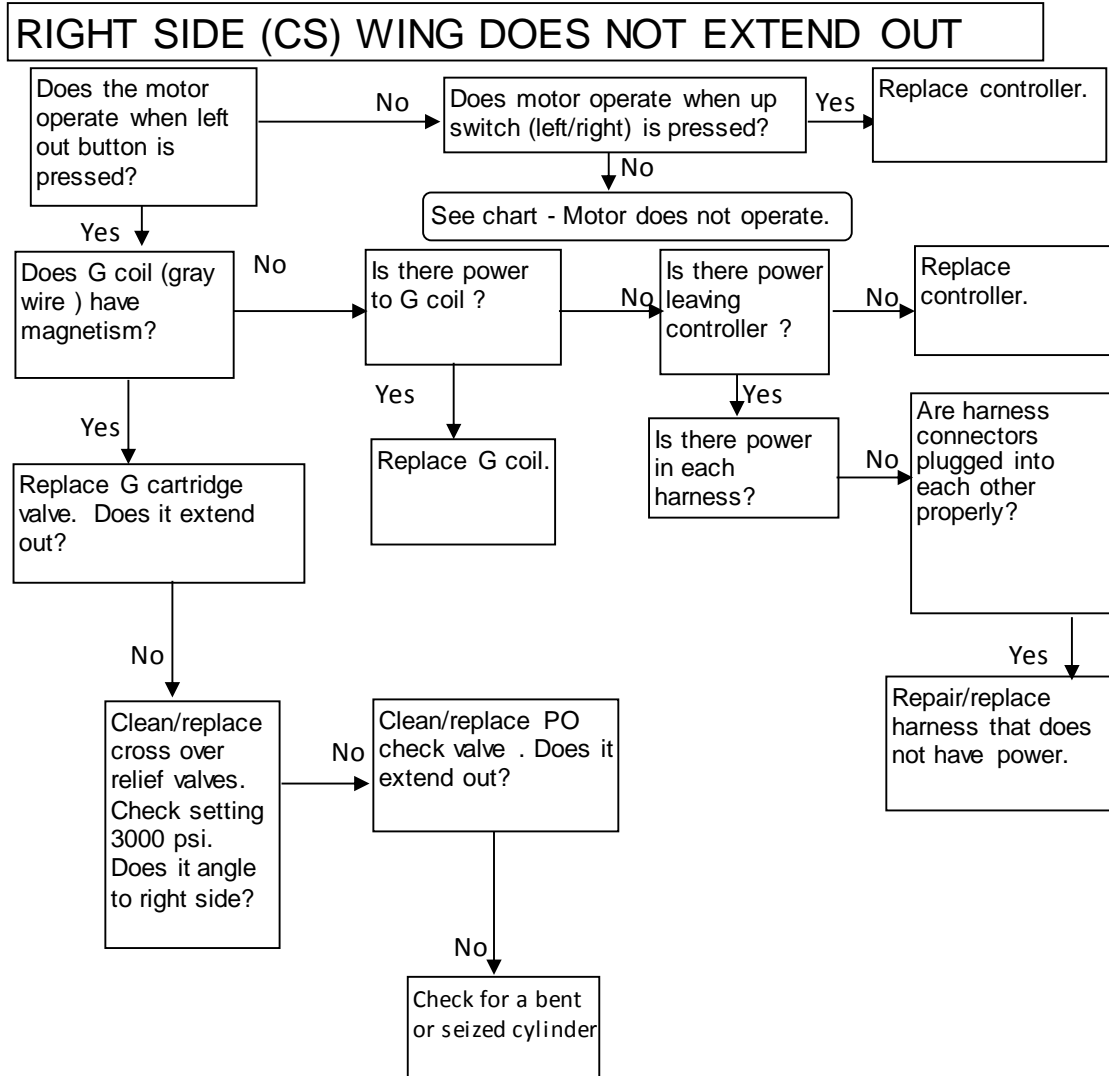
Note: Before start troubleshooting check that plow moves up and down. If plow does not move up and down see "plow does not raise".

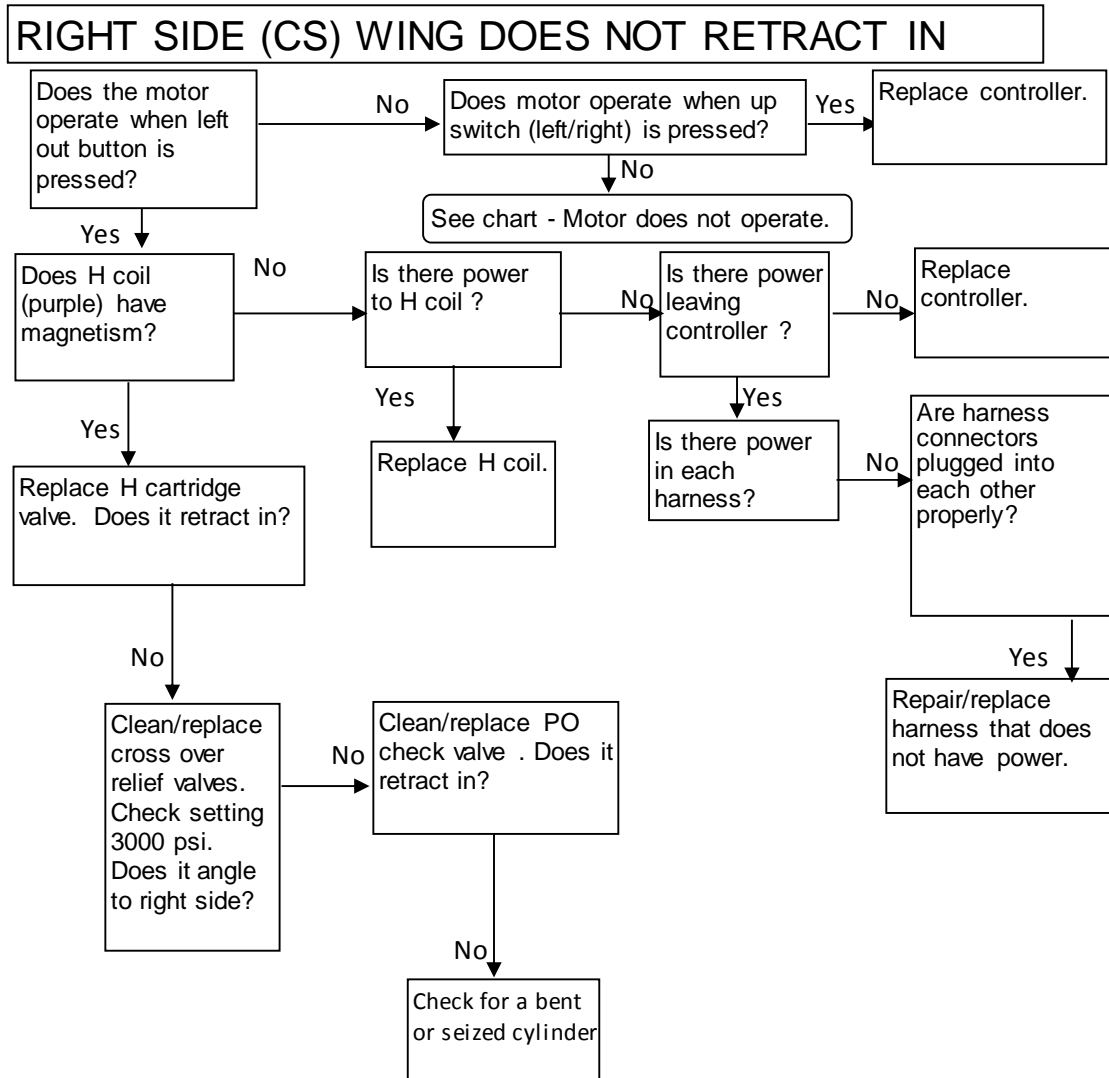
PLOW DOES NOT HOLD ANGLE M3593-WING











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