

Table of Contents

Operating information.....	2
Hydraulic operational diagrams.....	7
Hydraulic Installation instructions.....	12
Parts list.....	20
Controller for Straight Blade.....	24
Troubleshooting.....	25

M200 Operating Information



General Information about Power Unit M200-HOP

Warranty Identification

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

Maintenance

Under normal operating conditions, the M200 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. The replacement fluid recommended 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. The oil level in the reservoir is to 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 may be covered with grease for additional protection from corrosion.

Electric Motor

The 8053 electric motor is permanent magnet motor which consists of 3" diameter steel frame, armature, brushes and permanent magnet fields. Because fields are permanent magnets, they do not require electrical current to operate.

The power unit with this motor is equipped with the 190 pump. This combination of pump and motor 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 preset amount of precompression) 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 M200 is 1300 psi.

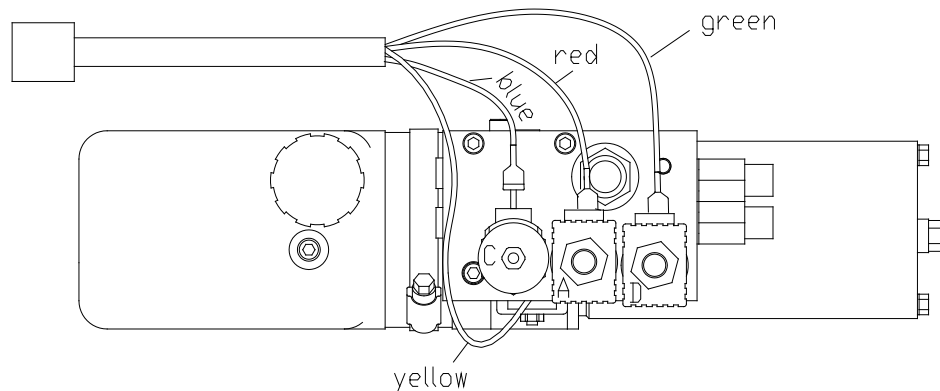
Directional Valves

The M200 circuit contains 4 directional valves identified as ‘A’, ‘B’, ‘C’ and ‘D’. Valves ‘A’ and ‘D’ are 3 way, 2 position spool valves. Valves ‘B’ and ‘C’ 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.

Directional Valve 'B' & 'C'



Directional valve 'C' operates the lift cylinder on C3 port (See Figure 1). Valve 'B' 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. See figure 2. Note: the lift cylinder is connected to C3.

Directional Valves 'A' & 'D'

Directional Valves 'A' and 'D' are 3 way, 2 position spool valves. Directional Valves 'A' and 'D' operate the left and right angling cylinders. Valve 'A' operates the angling cylinder on the right side of vehicle on C2 port (See Figure 3). Valve 'D' operates the angling cylinder on the left side of vehicle on C1 port (See Figure 4).

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.

Pressure Compensated Flow Control

When B valve is energized oil from a lift cylinder is going through the pressure compensated flow control in the tank. A pressure compensated flow control valve automatically compensates for pressure changes and maintains its setting even as work load changes.

Cross over relief valve

The cross over relief valves are provided to protect the valves and manifold from the pressure spikes created when the plow strikes an object. The cross over relief valves are similar in construction to a regular direct acting relief valve. Cross over valves when activated, bleed fluid from C1 to C2 or vice versa. In this manner both 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 2000 psi. See figure 3 and 4.

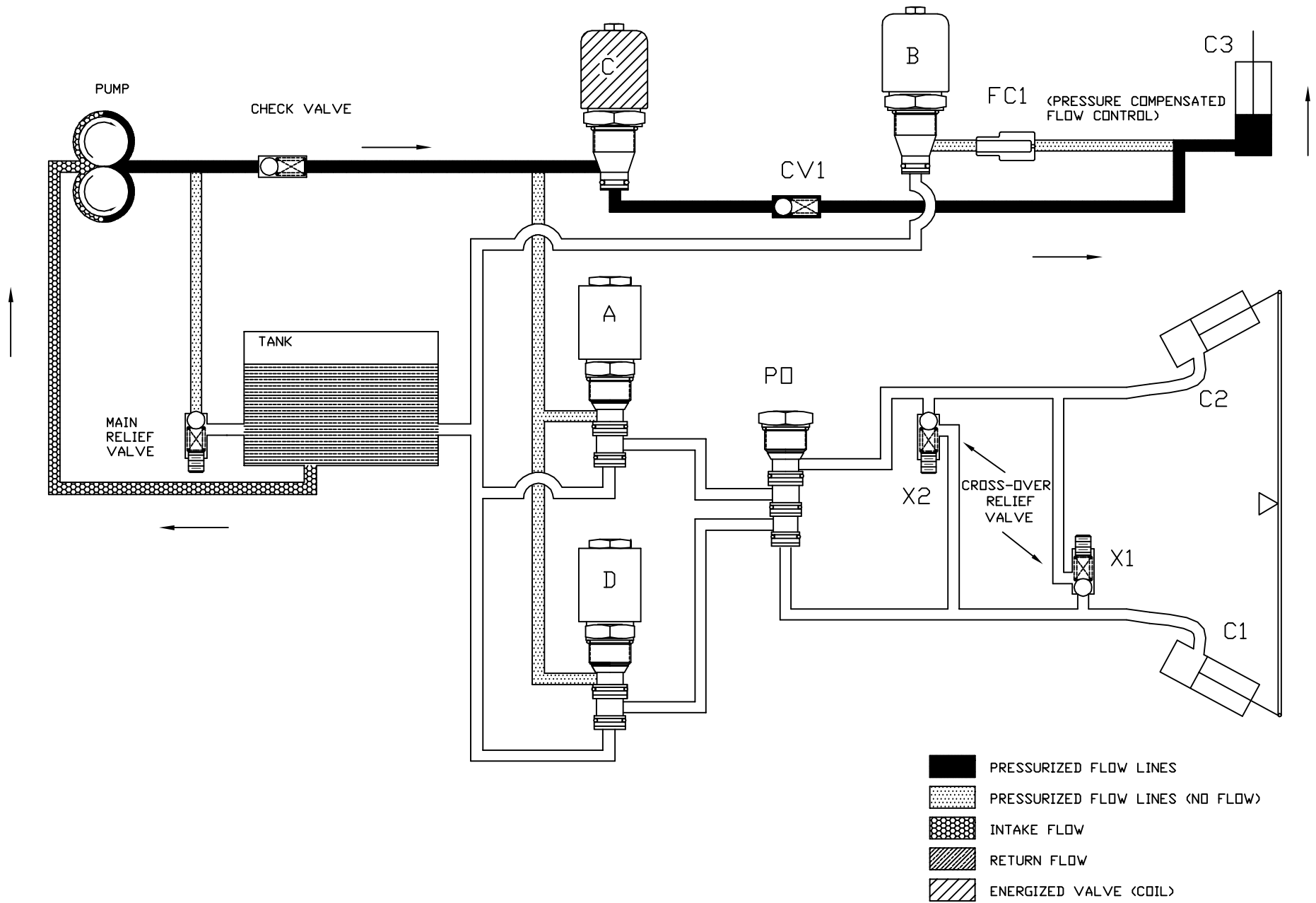
Pilot Operated (PO) Check Valve

A dual pilot operated check valve (PO Check Valve) is provided on ports C1 and C2 to hold the plow at the desired angle. Without the PO Check valves, leakage through directional valves 'A' and 'D' would allow the plow to drift.

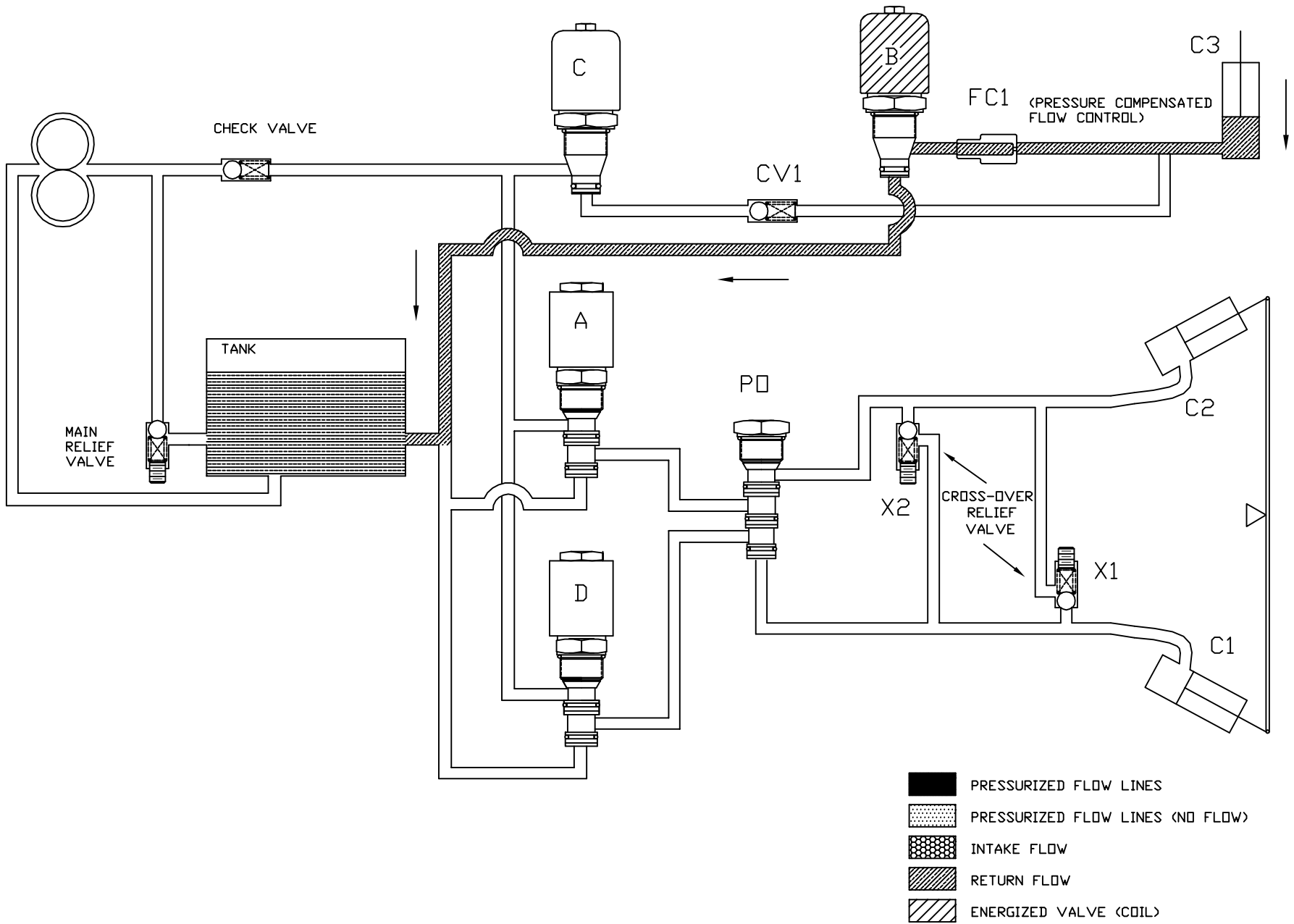
Without pilot pressure, a pilot operated check valve (PO check valve) allows flow in only one direction. In the free flow direction, oil flowing through the valve lifts the poppet of the seat. In the opposite direction, returning oil pushes the poppet against the seat thereby blocking flow. When pressure 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. See figures 3 & 4.

Control Switch

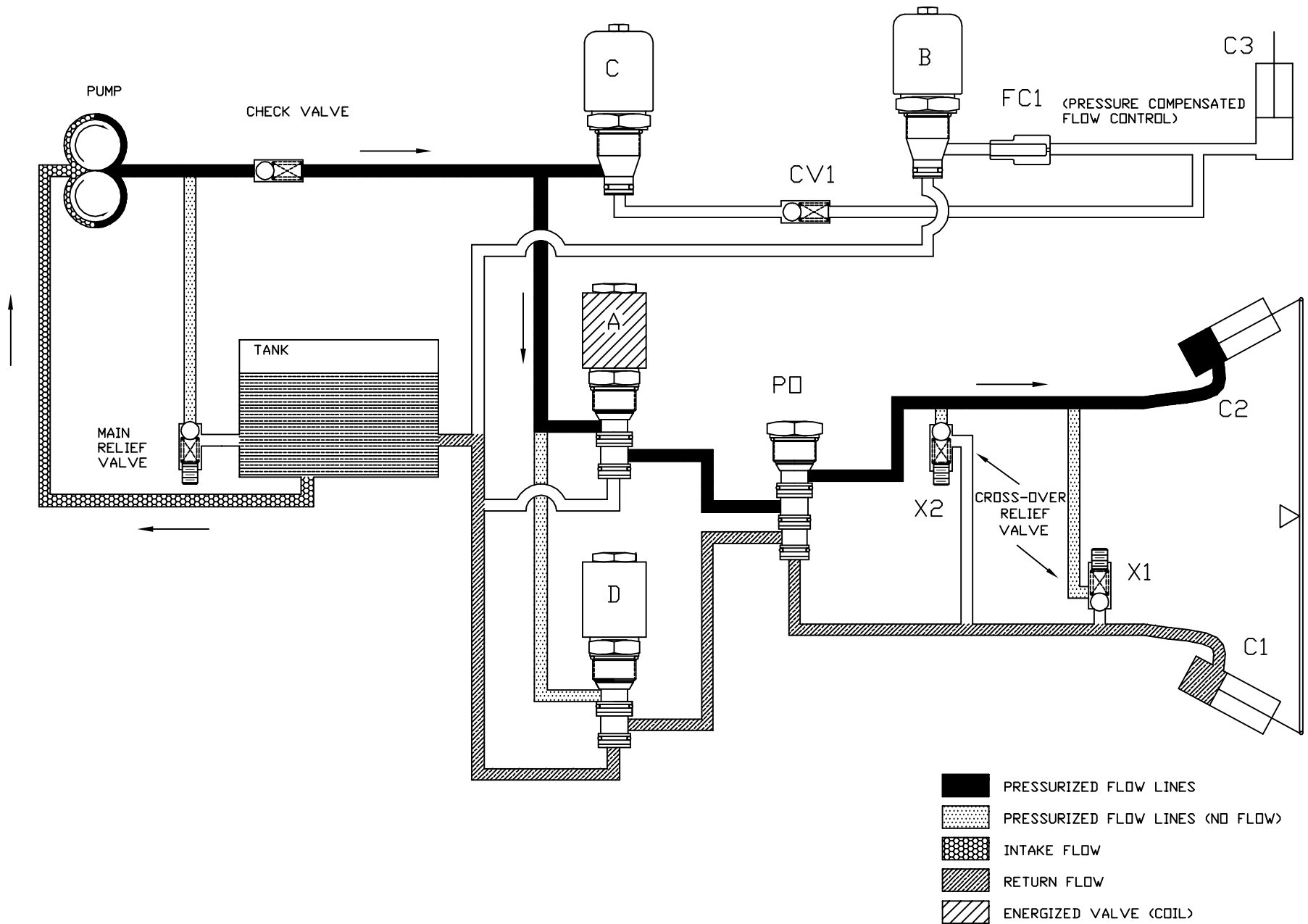
The M200-HOP uses two different control boxes: handheld controller and joystick. Both the control box performs same functions: up, down, angle left and angle right.



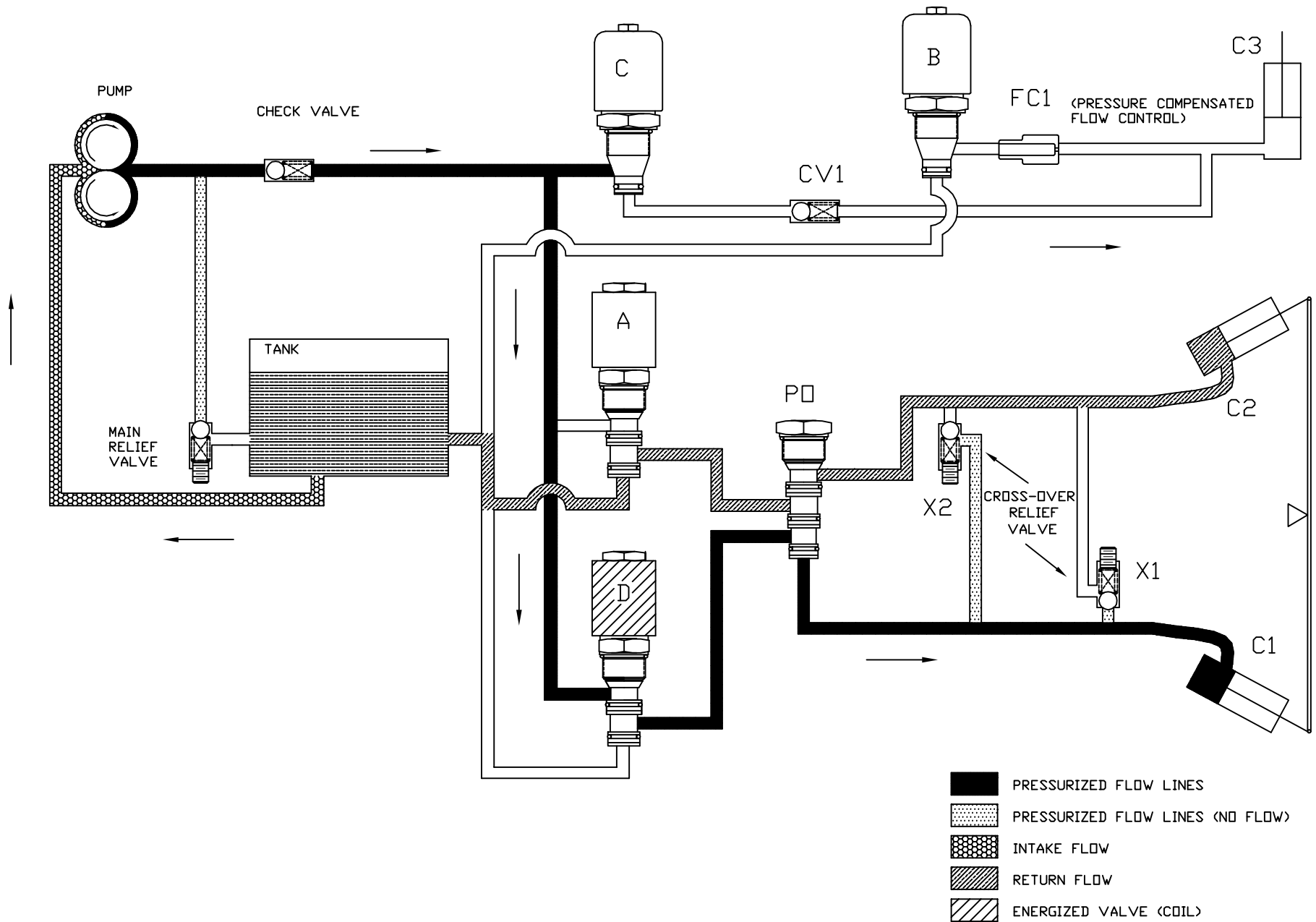
M200 PLOW GOES UP



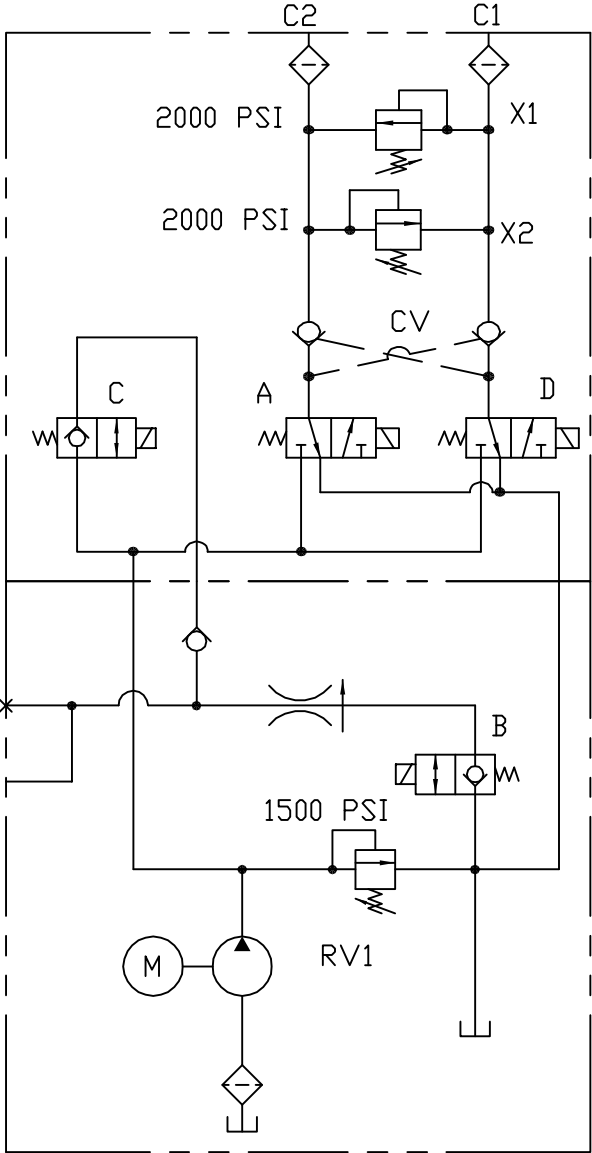
M200 PLOW LOWERS DOWN



M200 FLOW ANGLES TO RIGHT
(PASSENGER SIDE)



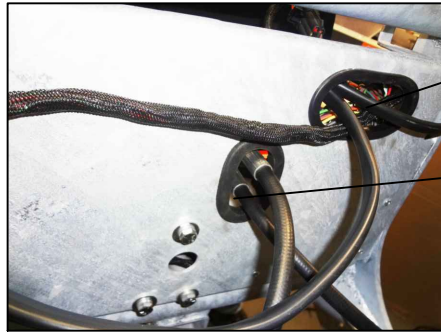
M200 FLOW ANGLES TO LEFT
(DRIVER SIDE)



M200 SCHEMATIC

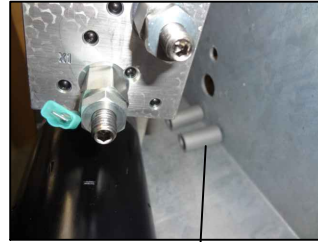
M200 hydraulic installation instructions

(It requires light kit 800084 or 800085 or 800086)



Harnesses

Hoses



Pipe Sleeve(Spacer)
Side view



Pipe Sleeve(Spacer) (15)
Top View



3 x $\frac{5}{16}$ " bolt (2 $\frac{1}{2}$ " long) (16) +
lock washer (17)+ flat washer (23)

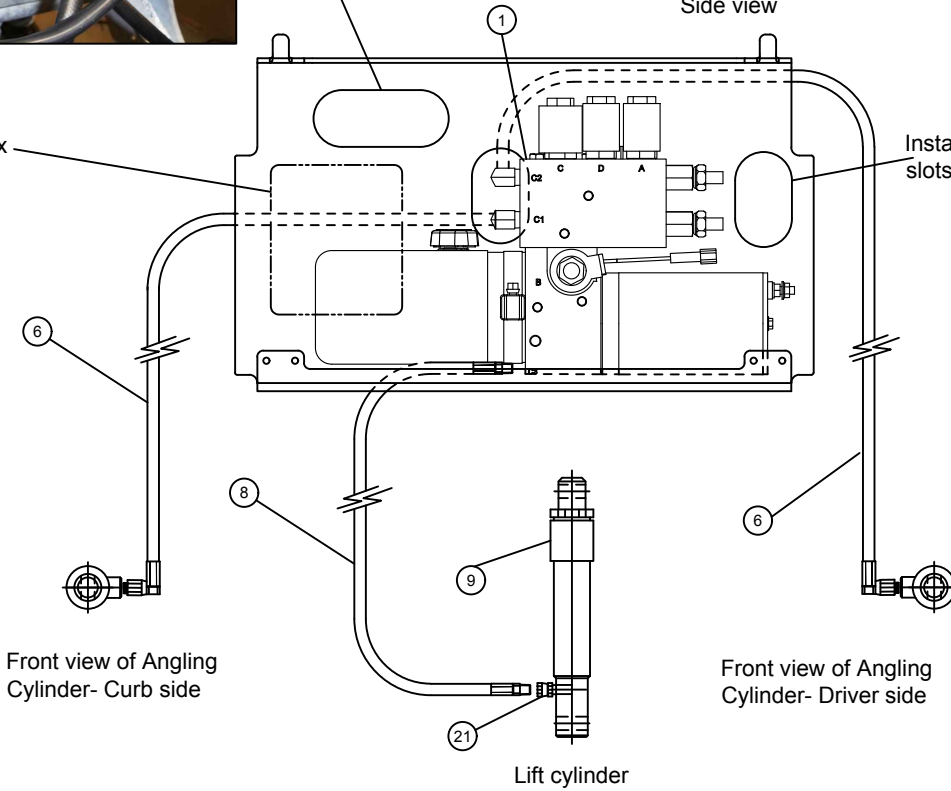
Install grommet (20)

Install grommet (19) on three other
slots of same size



Pipe Sleeve(Spacer) with bolts

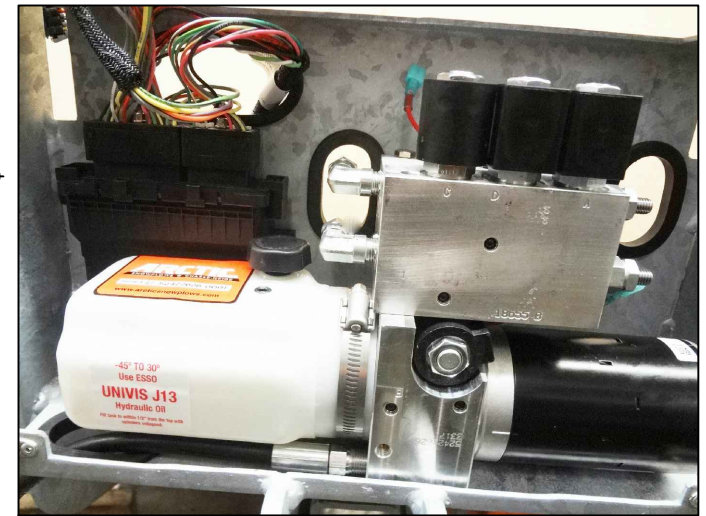
Place to mount Module box

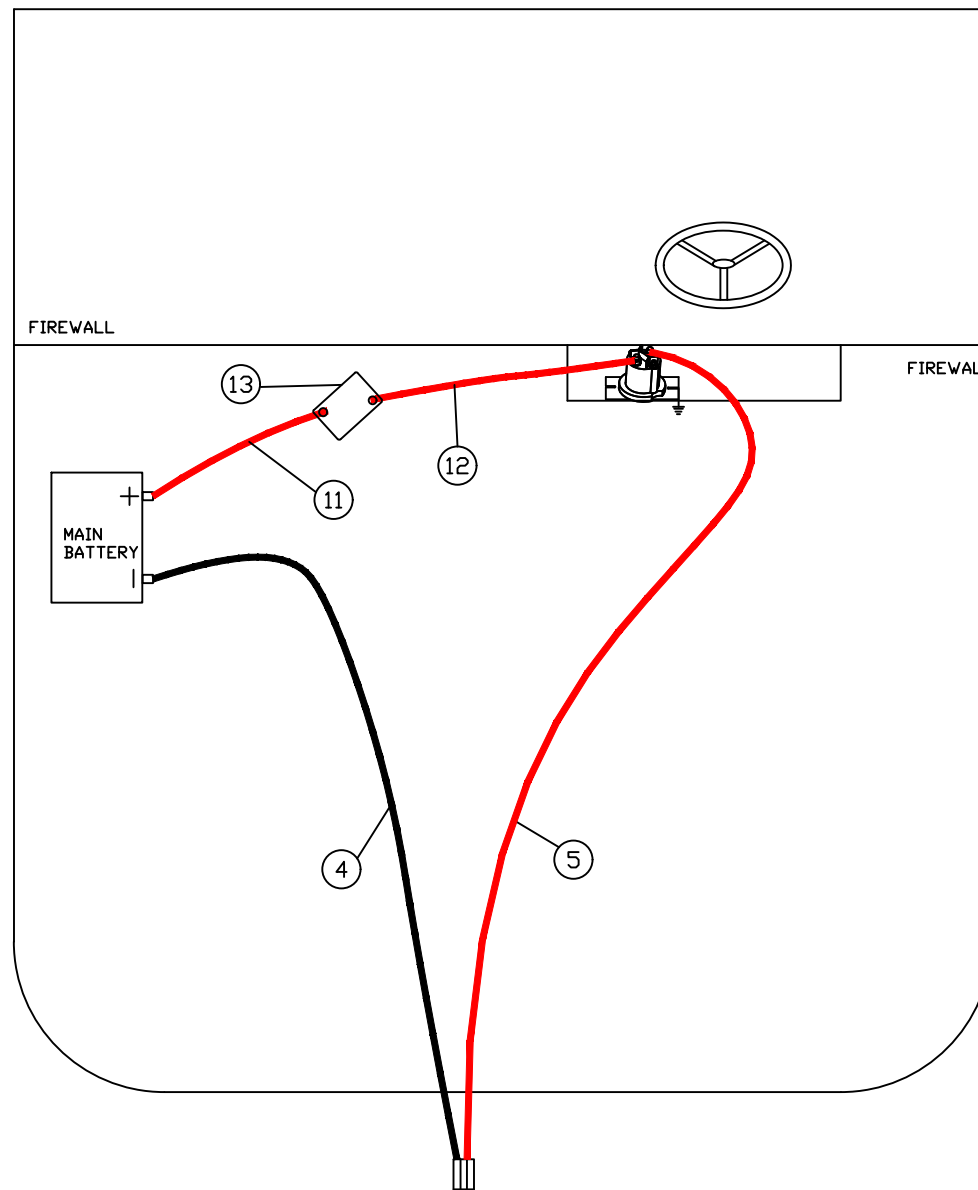


Front view of Angling
Cylinder- Curb side

Front view of Angling
Cylinder- Driver side

Lift cylinder





To avoid corrosion
keep connectors well-greased with dielectric grease.

53684-M- M200 power unit (Homeowner plow)			
Seq	Part#	Description	Quantity
1	M200	Power Unit	1
2	53663-C	Power unit mounting plate	1
3	53476-B	18" Cable Plug Assembly	1
4	53477-B	90" Ground Cable (Black)	1
5	53478-B	90" Power Cable (Red)	1
6	51904-M	¼" x 29" Hose Assembly	3
7	52429-01-C	Power unit Cover M200	1
8	51903-N	¼" x 18" Hose Assembly	2
9	CS150-06.00-NRS	1 1/2" x 6" Lift Cylinder	1
10	53560-A	Dummy plug (power and ground)	1
11	51335-22-M	Battery Cable, 22"	1
12	51335-56-M	Battery Cable, 56"	1
13	53608-N	Circuit Breaker 135 AMP	1
14	52427-N	Red Terminal Protector	1
15	53695-B	1 5/8" pipe sleeve – M200	3
16	HH-00293-034	5/16-18x2 ½" HHCS	3
17	HH-00457-007	5/16" lock washer	4
18	HH-00293-026	5/16-18x3/4" HHCS	1
19	52700-N	Grommet 1/8"x2 1/8"x2 7/8" (fits 2 ½" dia hole)	3
20	52700-01-N	Grommet 1/8"x3"x3 5/8" (fits 3 1/4" dia hole)	1
21	HH-00794-003	¼" Straight swivel	1
22	490056-01	½ oz tube dielectric grease (nyogel 760gm)	1
23	HH-00341-003	5/16" flat washer	3
24	FP17757	Solenoid	1

M200 installation instructions

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.).

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 Multiplexing installation instructions before proceed with the installation below.

For electrical installation read:

one piece harness installation 53617-M or multiplexing installation 53618-M.

1. Install three smaller grommets (19) and one bigger grommet (20) on the respective slots on power unit mounting plate.
2. Mount the module box along with lift frame harness (found in 53618-M kit) on the curb side (Picture 1) on power unit mounting plate using 4 screws; nylon inserts lock nuts (found under 53618-M).

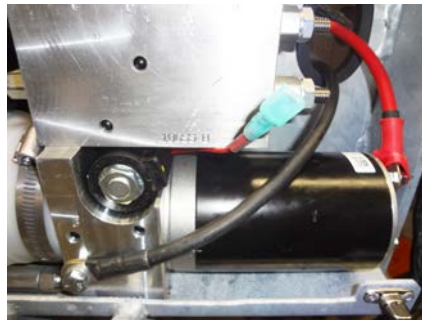


Picture 1

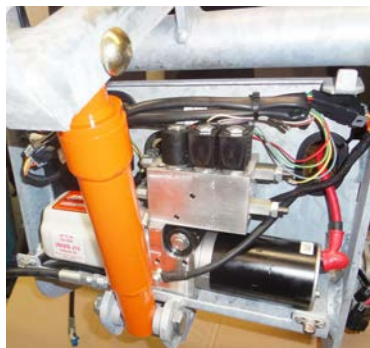
3. Mount power unit on power unit mounting plate using 3 x pipe sleeve (spacers) (15) on the back with 3 x 5/16" bolts (2 1/2") long (16), lock washers (17) and flat washers (23) as shown in picture 2. (Also refer to drawing on page 13 for details).

**Picture 2**

4. Install hoses and fittings as shown in diagram on Page 13.
5. Connect the power (red) and ground (black) cable to power unit (See picture 3), use 5/16" bolt (18) with lock washer (17) to connect ground cable to the pump base, apply dielectric grease on connections and slide the red terminal protective cover (14) on top of power cable.

**Picture 3**

6. After installing lift channel by using 3/4" x 3 1/2" on top lug of lift frame, secure the lift cylinder by pins on the front of lift channel and 3/4" x 4 1/2" bolt on bottom lug of lift frame (bolts and pin found under QL-HOP kit) (shown in Picture 4)
7. Install the plow headlights on the top of lift frame. Plug the connectors from headlight harness to lift frame harness inside pump cover (shown in Picture 4)

**Picture 4**

8. Secure lift frame harness and the cables using zip ties to lift frame (see picture 5). Secure hoses for angling cylinders to lift frame if necessary, so that it does not interfere with lock handle of lift frame.



Picture 5

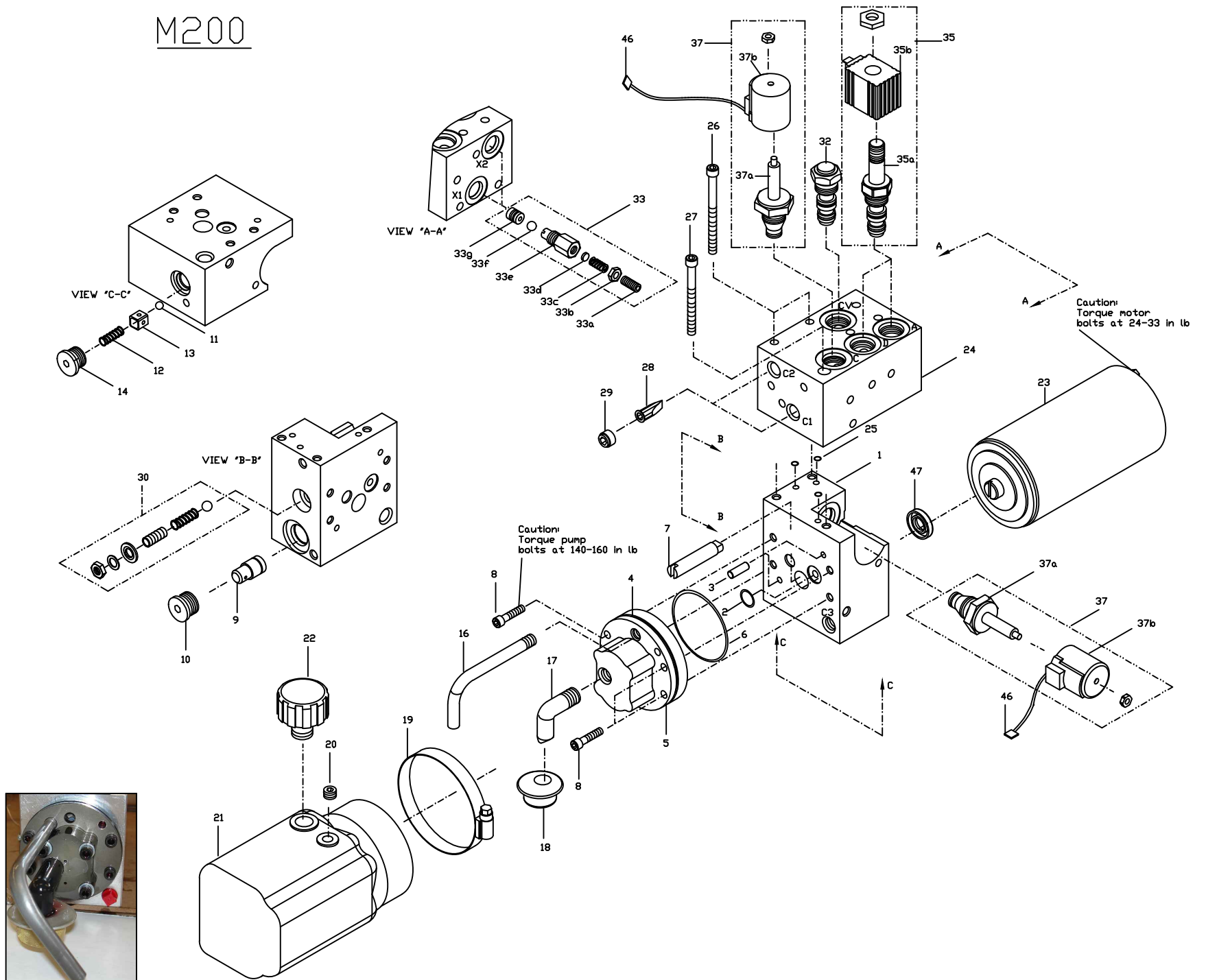
9. Mount the solenoid (24) to metal surface inside the hood; bend the solenoid bracket if necessary. Solenoid must be well grounded in order to function properly.
10. Secure the 90" red power cable (5) to one side of solenoid and 90" ground cable (4) to negative side of battery.
11. Install 56" power cable (12) from other side of solenoid to one terminal of 135 Amps circuit breaker (13). When installing a circuit breaker, locate a flat surface suitable for mounting.
12. Connect the other terminal of circuit breaker to positive side of battery by using 22" power cable (11).
13. Choose surface that is clear of moving parts and extreme heat. The firewall or fenders are possible mounting locations. Use ¼" bolts and locknuts. If an acceptable flat surface is not available, cable tie the circuit breaker securely to a harness or an existing bracket.
Note: Make sure that chosen location is in a spot that will allow the power cables to reach their destination.
14. 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 condition. Use of fluid other than J13 will void the warranty.

Move, operate the blade up and down, left and right and refill the reservoir

- Refer to 53618-M for further instructions of Installing Ignition (Red/White) wire and lighting System procedure.

M200 Parts list

M200



Ref #	Qty	Part #	Description
1	1	FP12731	Pump base (c/w relief valve, seal)
2	1	FP0120	O-ring, 1/16 x 1/2 x 5/8"
3	2	FP17018	Dowel, 0.25 DIA x 0.75 Lg
4	1	FP0116	O-ring, 1/16 x 2-1/4 x 2-3/8"
5	1	FP12819-190	Pump (used from 2009 and up)
6	1	FP5485	"O" ring, 1/16 x 3 x 3-1/8"
7	1	FP17121	Intermediate shaft
8	4	FP7763	Screw, SHCS, 1/4-20UNC x 1.25" Lg
9	1	FP1723-2.00	Pressure compensated flow control
10	1	FP3274	Plug, SAE #8
11	1	FP0126	Ball, 5/16
12	1	FP0130	Spring
13	1	FP2680	Ball follower
14	1	FP3276	Plug, #6 SAE
16	1	FP13059	Return tube
17	1	FP1564	Suction tube
18	1	FP1134	Suction filter
19	1	FP7890	Reservoir clamp
20	1	FP2355	Plug, 1/8 NPTF
21	1	FP6230	Reservoir, plastic
22	1	FPN0571	Breather, 3/8 NPT
23	1	FP8053	Motor, 12V DC
24	1	FPN0858-1	Manifold (only)
24a	1	FPN0858-SA	Manifold ass'y (c/w all valves)
25	3	FP0007	O-ring, 3/8 OD x 1/16"
26	2	FP7818	Screw, 1/4-20UNC x 3" Lg
27	1	FPN0401	Screw, SHCS, 1/4-20UNC x 2.5 Lg
28	2	FP1316	Port screen
29	2	FP7624	Retaining screw
30	1	FP7527	Relief valve (c/w flat washer FPN0575 & seal washer FP3874)
32	1	FP7346	PO check valve, dual #8
33	2	FP13023	X over valve kit
33a	1	FP7899	Screw, 3/8-16UNC * 1.25
33b	1	FP0386	Nut, sealing, 3/8-16UNC
33c	1	FP0147	Spring
33d	1	FP1288	Shim, spacer
33e	1	FP0379	Housing, adj. rel valve ball type
33f	1	FP0012	Ball, 1/4"
33g	1	FP0378	Seat, x over rel, ball type
35	2	FP7249-D	Valve 3w / 2p assembly (A,D)
35a	1	FP0679-D	Valve cartridge, 08, 3W / 2P
35b	1	FP18835-D	Coil, 10 VDC, single spade

Ref #	Qty	Part #	Description
37	2	FP0490-D	Valve 2W / 2P assembly (B,C)
37a	1	FP10907-D	Valve cartridge, #8, 2W / 2P NC poppet
37b	1	FP10861-D	Coil, 12VDC
46	1	761656	Spade connector, male ¼" tab insulated, 20g wire
47	1	FP2159	Pump seal

HANDHELD CONTROL for STRAIGHT 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 17 minutes, and the FLOAT indicator light will turn back to green. To restart FLOAT mode, repeat step 2.

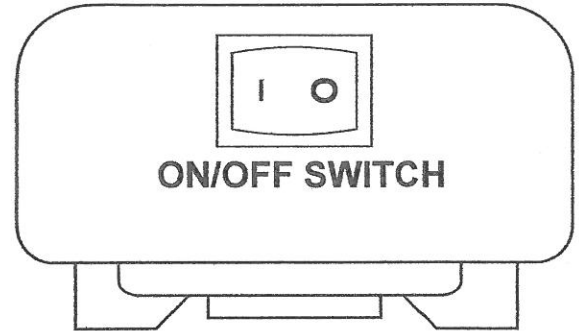
Blade Operation Time Outs

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.

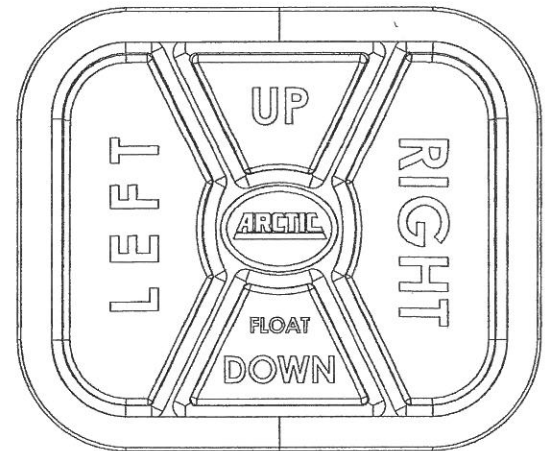
All functions will time out after 8.0 seconds.

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

Troubleshooting flow chart for power unit M200

- Motor does not operate.
- Motor operates continuously
- Snow plow does not raise.
- Snow plow raises up very slow.
- Snow plow will not lower.
- Snow plow leaks down.
- Snow plow angles before going up when up switch is pressed.
- Snow plow when is fully angled going up when angle switch is pressed.
- Snow plow does not angle to right.
- Snow plow does not angle to left.
- Snow plow does not hold angle.

For MPX system, refer to MPX troubleshooting on website.
For all electrical troubleshooting, we recommend Power probe III tool.
Follow the steps on the next page for troubleshooting of power unit.

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 replacing the motor or solenoid.
- 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.
- When adjusting the relief valve be sure to use a pressure gauge. Failure to accurately set the relief valve can cause failure resulting in damage to the equipment or cause bodily harm.

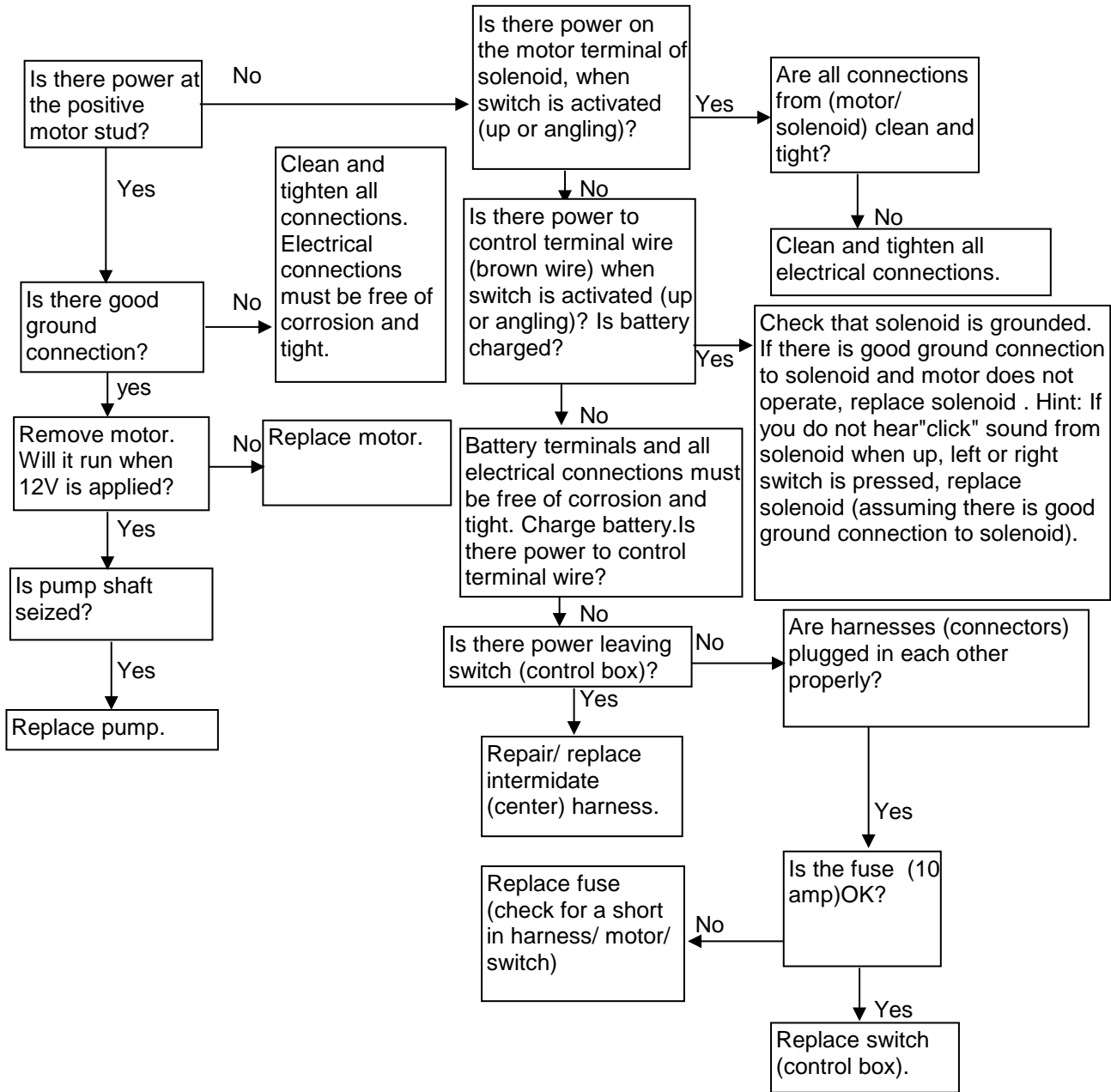
Specification:

- Max Amp Draw 90 AMP (AMP draw of motor should be measured at maximum raise or maximum angle when motor is running at pressure setting at 1500psi).
- Note: Do not operate motor continuously for more than 30 sec.
- Relief valve setting 1500 psi.
 - X-over relief valve setting 2000 psi.

Troubleshooting tips M200:

1. 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.
2. 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.
3. Measure pump pressure at an angle hose (at full angle) it has to be 1500 psi (assuming that cross over relief valve setting is 2000 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).
4. AMP draw of motor should be measured at maximum raise or maximum angle when motor is running at 1500 psi.
5. 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.
6. Do not screw cartridge valves into cavity too fast; use a back and forth motion and have O-rings well lubricated.
7. Clean all parts thoroughly before assembly and lubricate with clean oil.
8. 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.
9. X-over pressure could be set 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 gage. 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.
- 10 .To adjust relief valve:
 - a. Loosen jam nut counter-clockwise.
 - b. Turn screw clockwise to increase pressure or turn screw counter-clockwise to decrease pressure.
 - c. Tighten jam nut clockwise to 50in.lb. torque.
 - d. Check system pressure after jam nut is tight. Readjust pressure if screw is moved during tightening of jam nut.

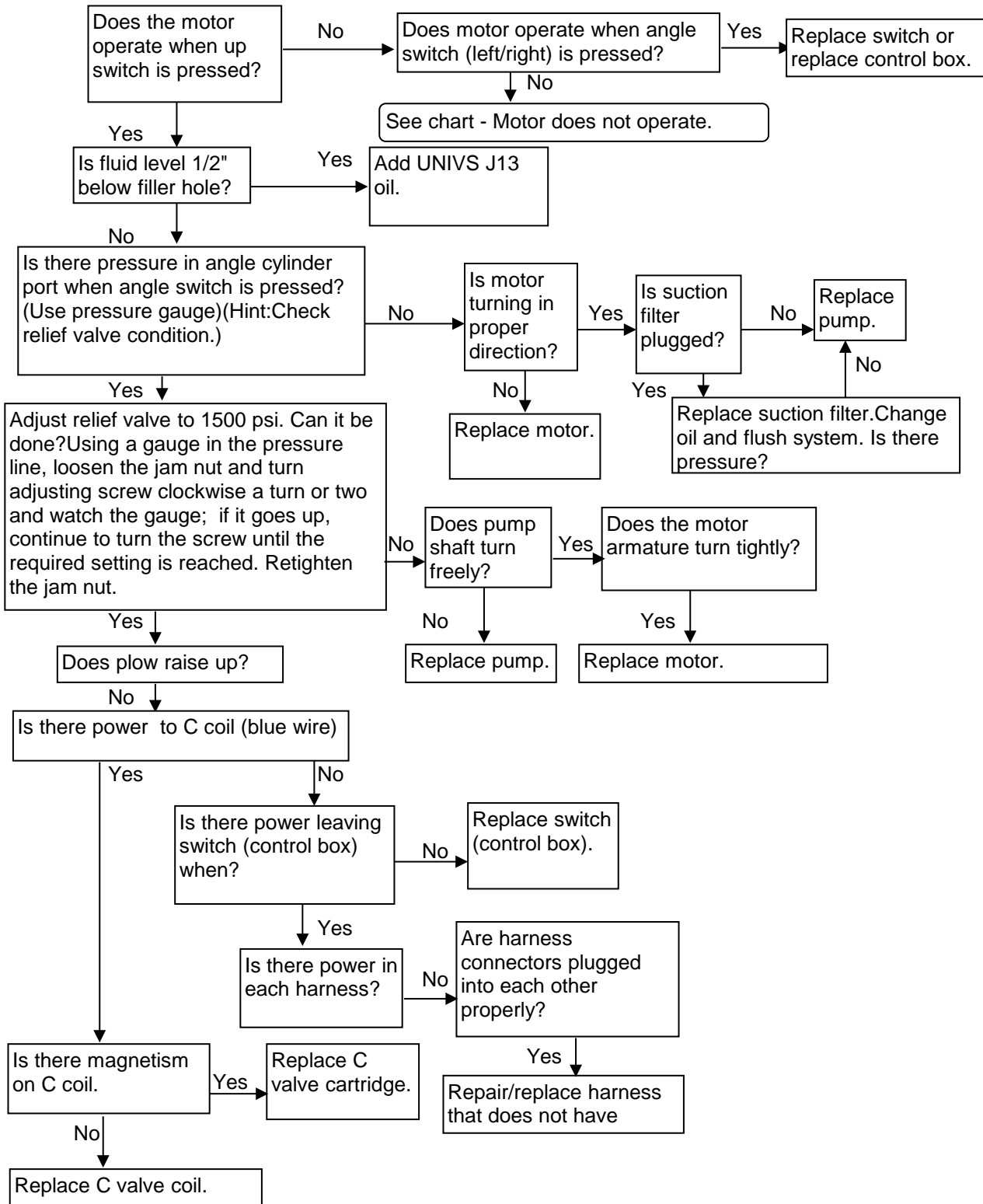
MOTOR DOES NOT OPERATE M200



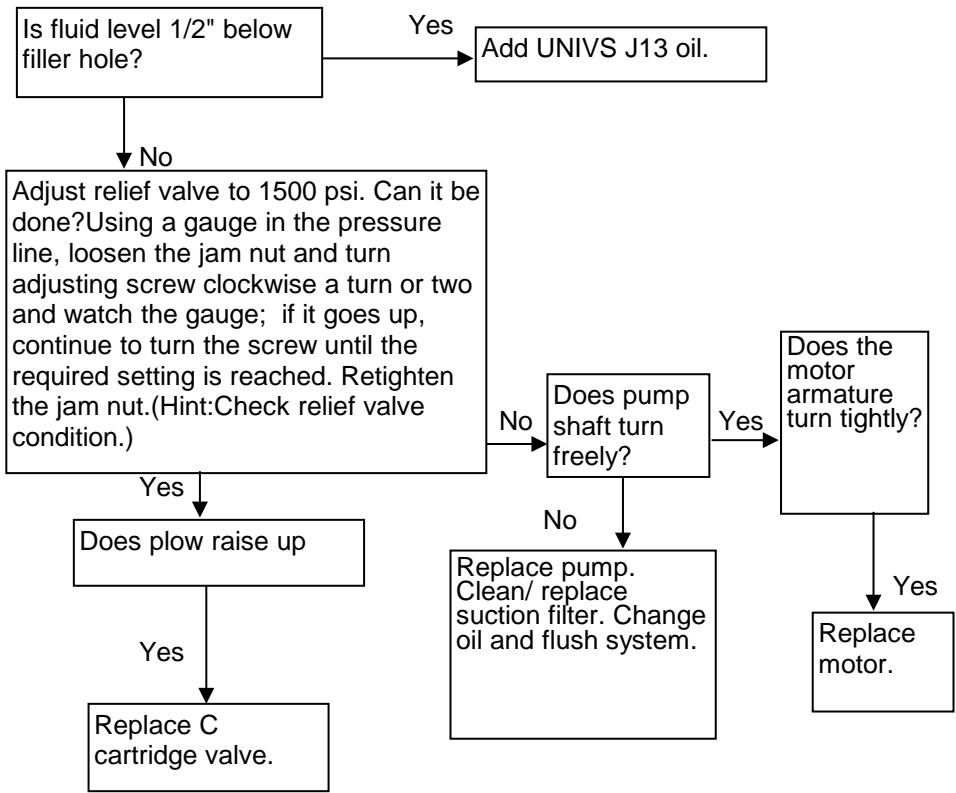
MOTOR OPERATES CONTINUOUSLY M200

If motor operates continuously, change solenoid.

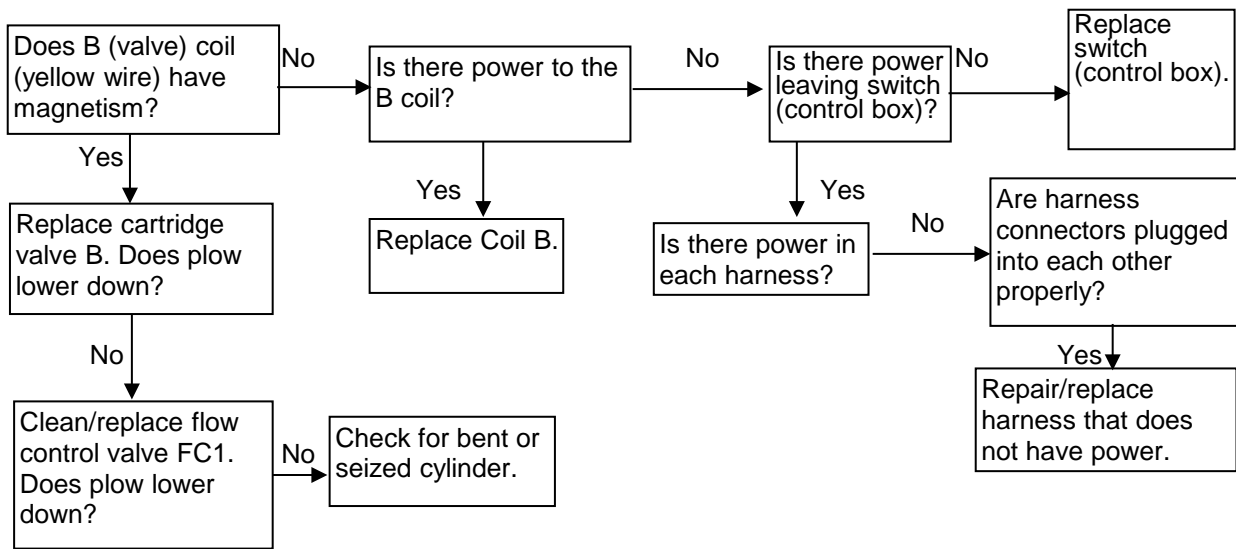
SNOW PLOW DOES NOT RAISE M200



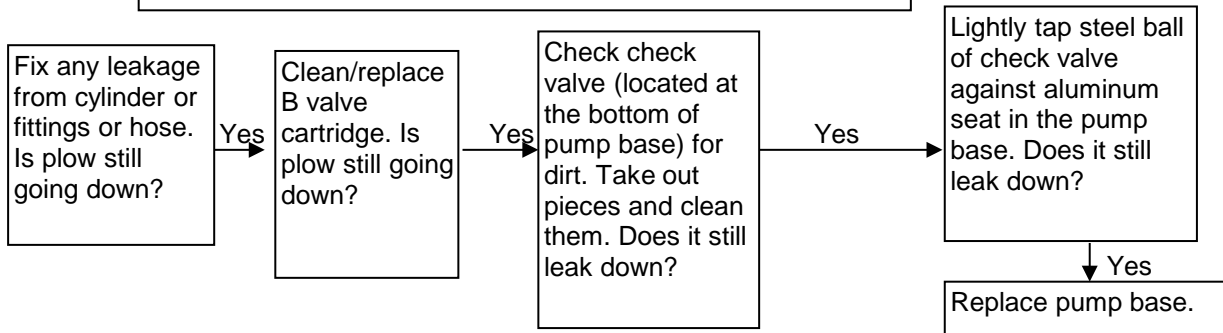
SNOW PLOW RAISE VERY SLOW M200



SNOW PLOW WILL NOT LOWER M200



SNOW PLOW LEAKS DOWN M200



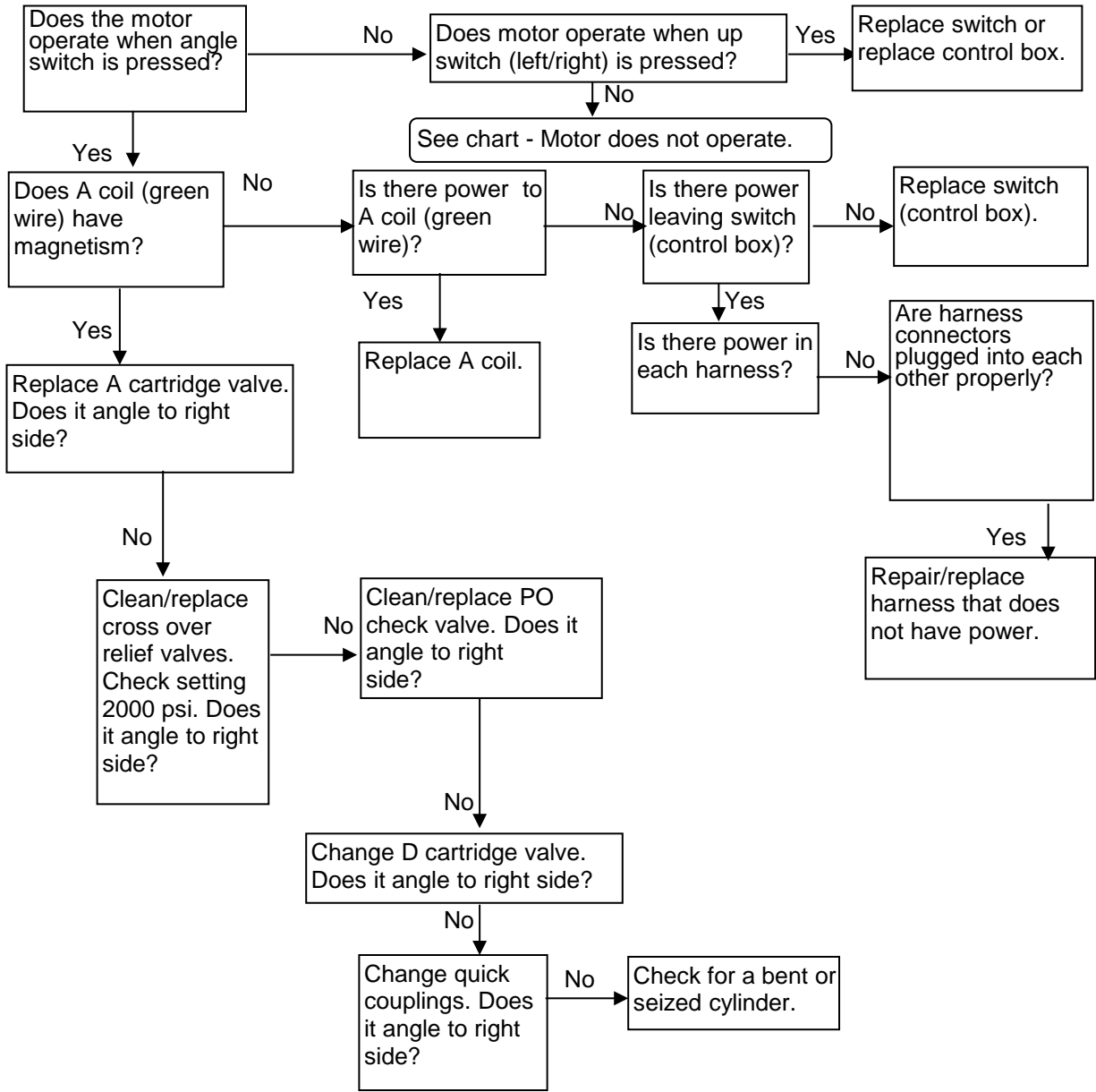
SNOW PLOW ANGLES BEFORE GOING UP WHEN

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 IT IS FULLY ANGLED GOES UP (WHEN ANGLE SWITCH IS PRESSED) M200

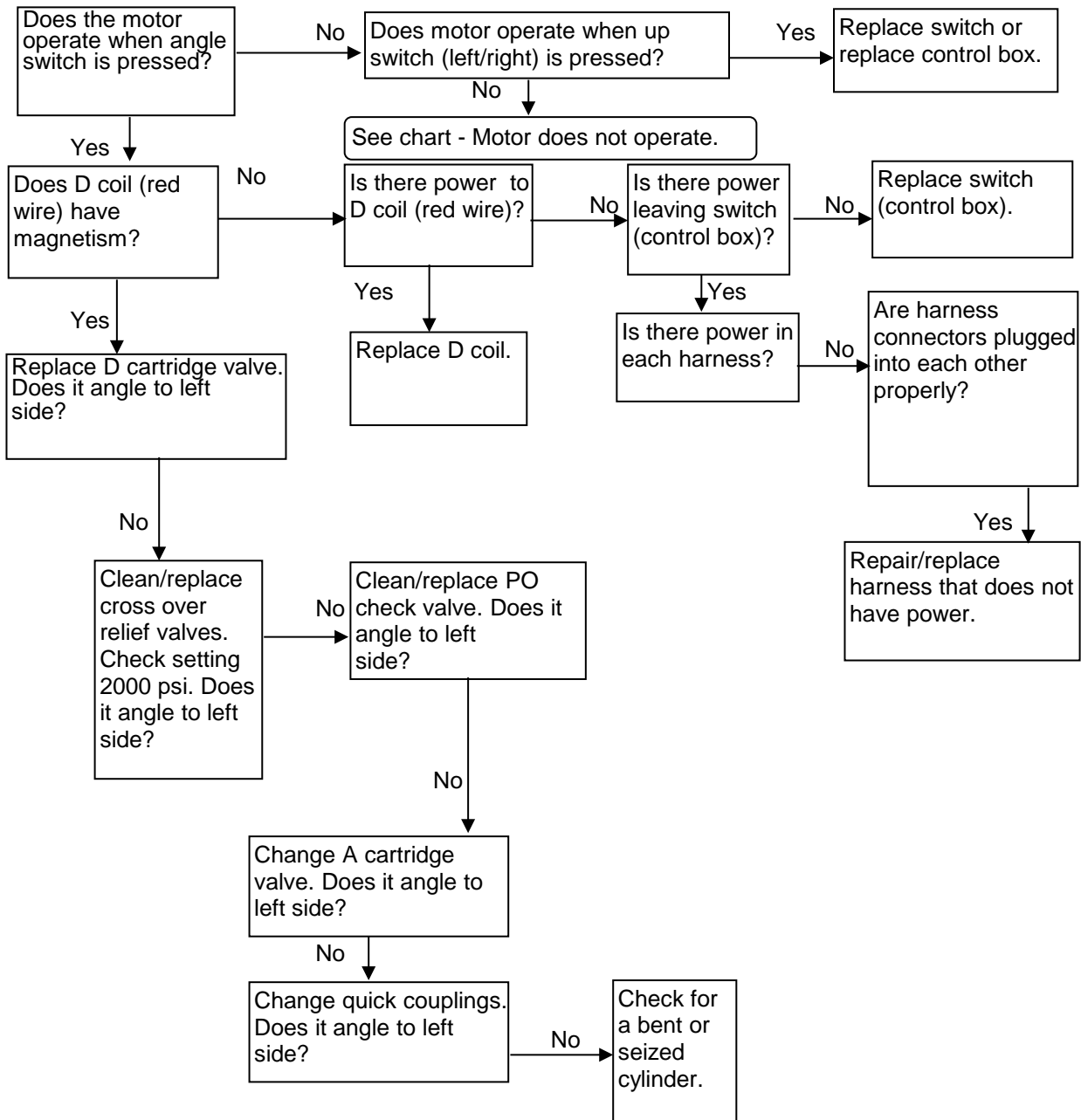
Change C Valve cartridge.

SNOW PLOW DOES NOT ANGLE TO RIGHT SIDE M200



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

SNOW PLOW DOES NOT ANGLE TO LEFT SIDE M200



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 M200

