

Arctic Equipment Manufacturing Corporation
M200 Hydraulic Power Unit

Table of Contents

General Information.....2
Hydraulic & Electrical Operation Diagrams.....8
Hydraulic & Electrical Installation.....13
Parts List.....19
Troubleshooting.....22

M200 Operating Information

General Information about Power Unit M200

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.

Sometimes, in order to **release pressure in angling cylinders** it is necessary to follow these instructions: when blade is angled to the right (curb side), angle blade to the left (driver side) and as blade is going to right side press release button.

Electrical System

Frequently problems develop due to an undersized electrical charging and storage system. Generally, the heavier the usage, the heavier the system should be. For a moderately light duty, the battery should not be less than 70 ampere-hours and the alternator should charge at a rate of not less than 60 amperes. For heavy usage and in the case where a number of other devices are run off the battery simultaneously, heavier ratings are strongly recommended.

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 1500 psi.

Directional Valves

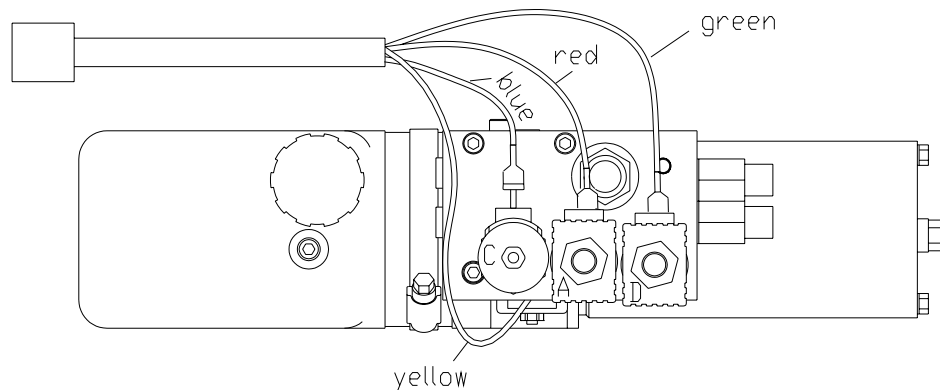
The M200 circuit contains 4 directional valves identified as ‘A’, ‘B’, ‘C’ and ‘D’. Valves ‘A’

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

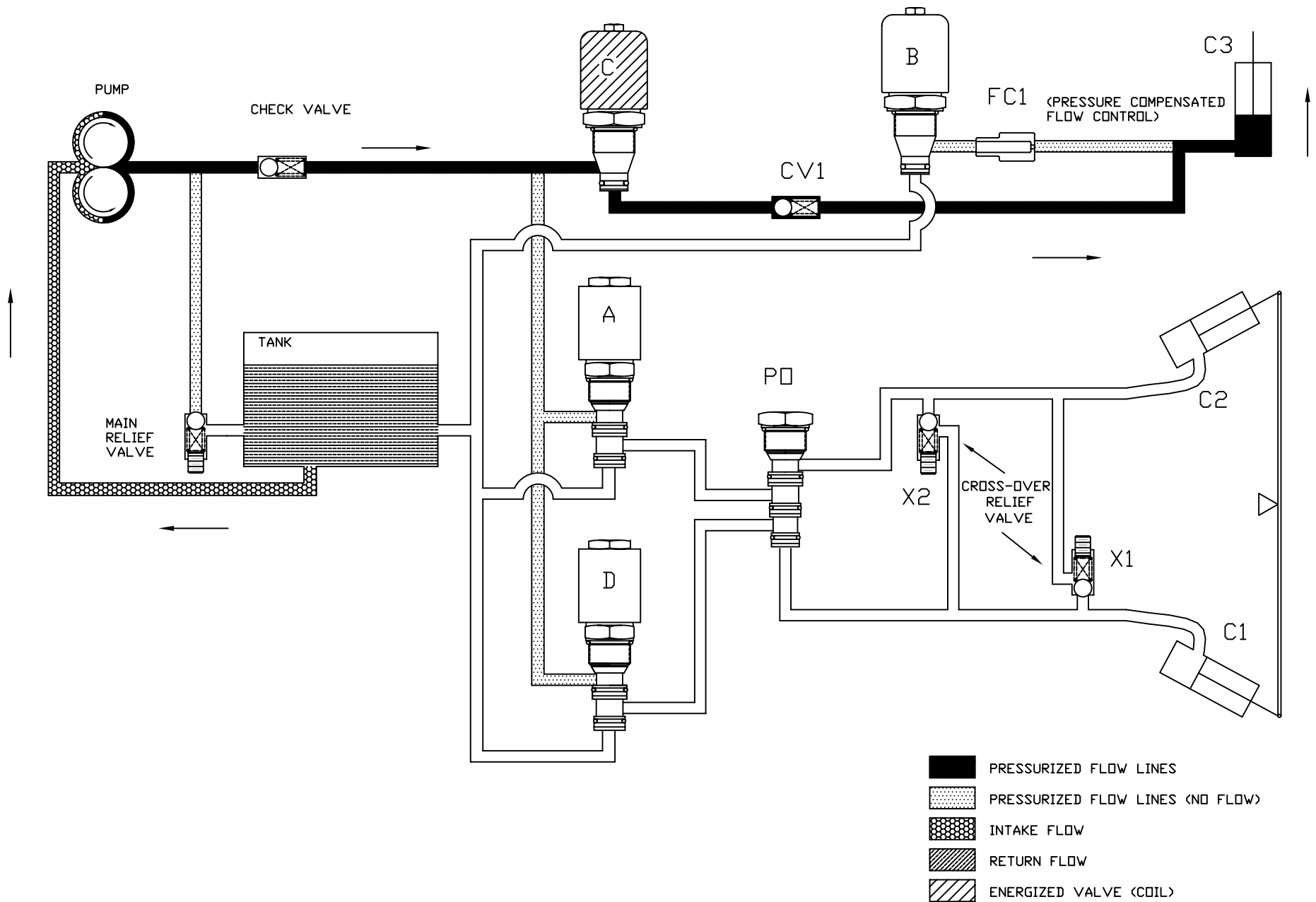
A dual pilot operated check valve (PO Check Valve) is provided on ports C1 and C2 to hold the plow at the desired angle. Without the PO Check valves, leakage through directional valves 'A' and 'D' would allow the plow to drift.

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

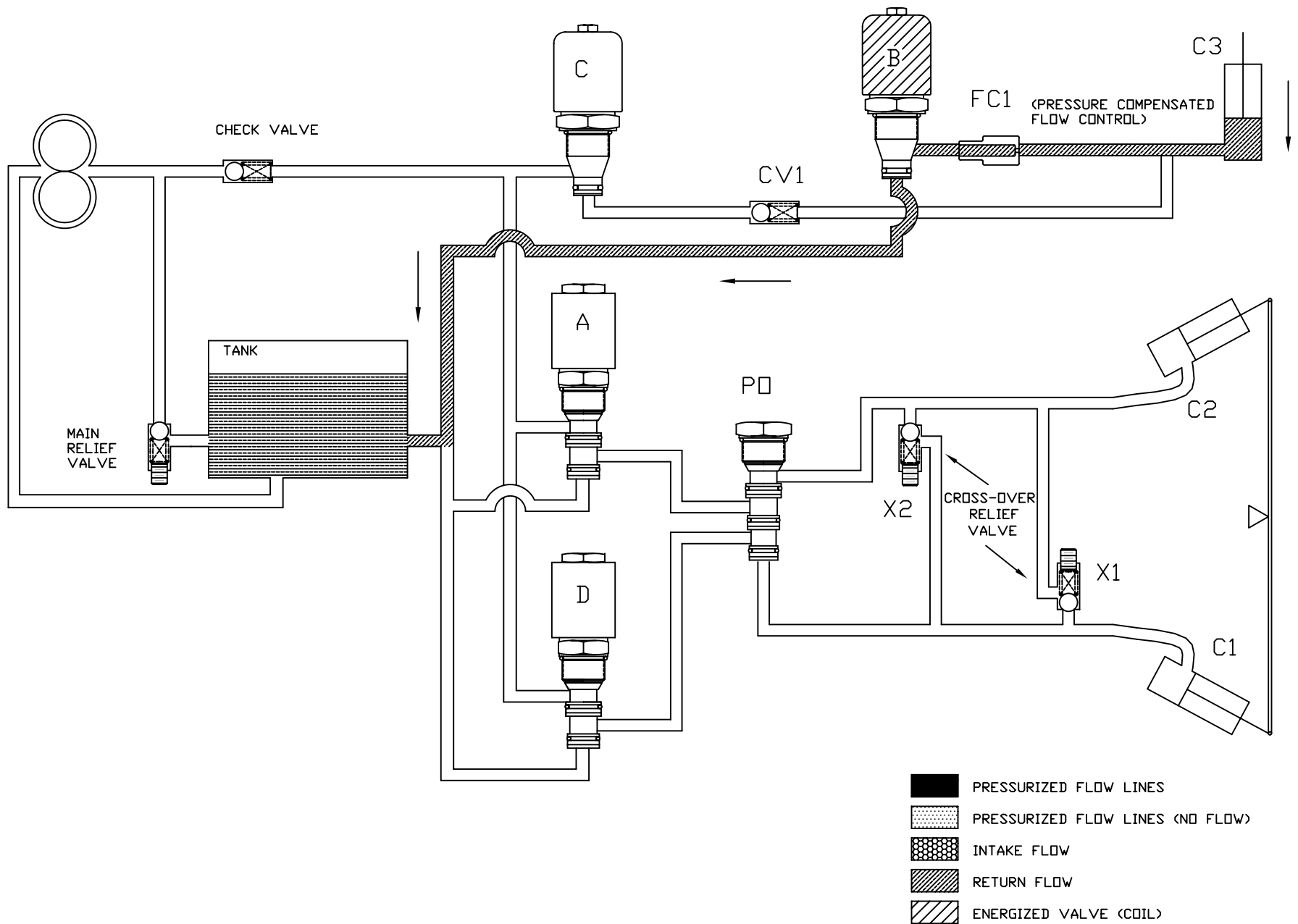
seat. In the opposite direction, returning oil pushes the poppet against the seat thereby blocking flow. When pressure is applied to the pilot piston, the poppet is lifted off the seat and flow in both directions is permitted. When angling, pilot pressure is provided for the check valve returning oil 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

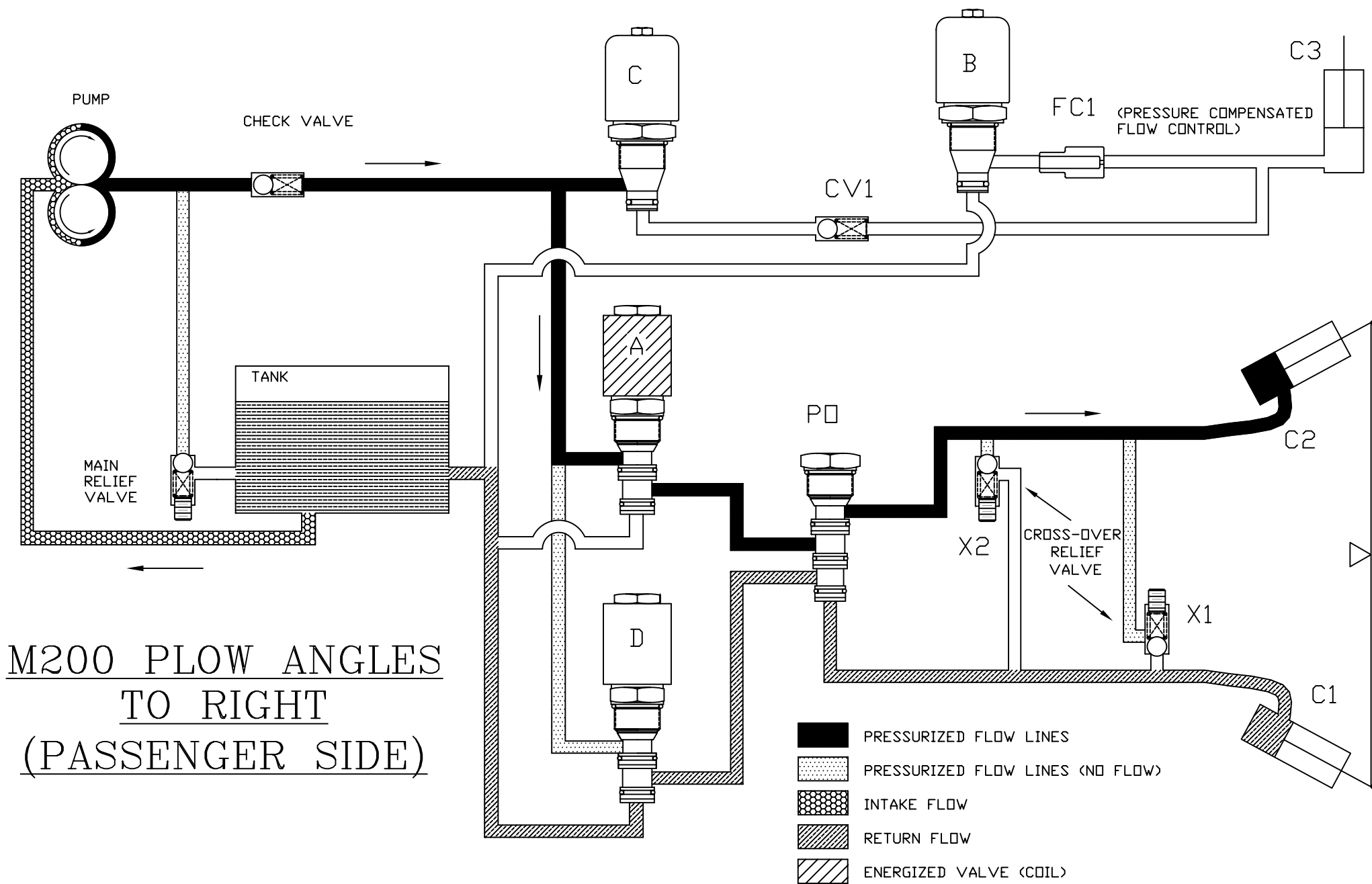
The M200 uses five different control boxes: control box with rocker switches, touchpad control box, handheld controller and joystick control box (big and small). Each control box performs same functions: up, down, angle left and angle right.

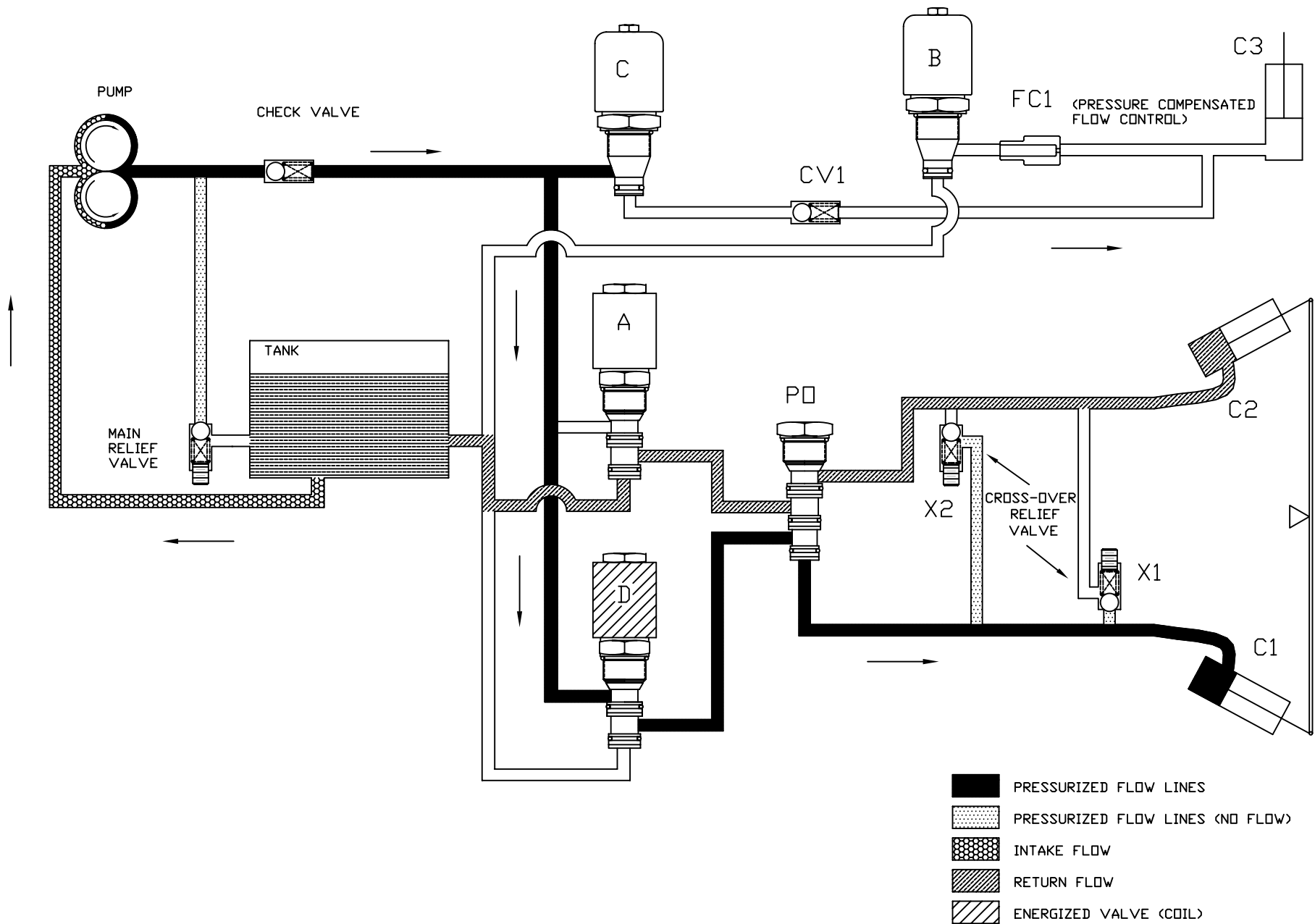


M200 PLOW GOES UP

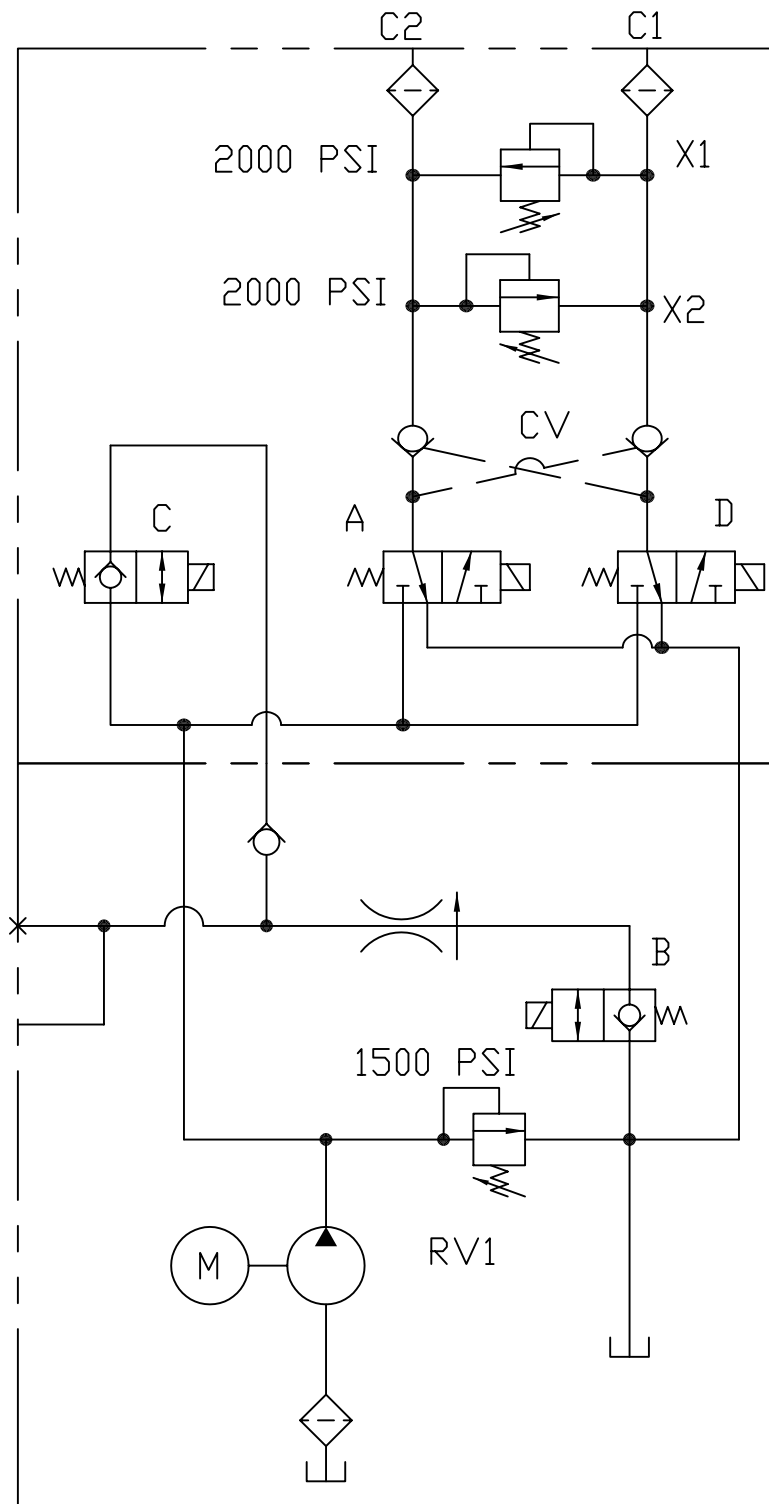


M200 PLOW LOWERS DOWN





M200 PLOW ANGLES TO LEFT
(DRIVER SIDE)



M200 SCHEMATIC

M200 power unit installation

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.

: All electrical connections must have die electric grease applied frequently

1. Install straight swivel (14) in C3 port of power unit and 18" hose (16) in port C3. Install power unit (1) on mounting plate with motor toward driver's side of truck. Power unit should be secure with three bolts 5/16", flat washer and lock washer (17)(18)(19) to the back of mounting plate.
2. Install colour co-ordinated weather cover on cable and plug assembly (9). Attach red lead to positive motor stud and black lead to the front of pump base using 5/16" x 3/4" bolt, flat washer and lock washer (17,18,19). Liberally coat connections with die electric grease then slide cover over the positive motor stud.
3. Route power unit harness through grommet in driver's side of mounting plate and secure using cable clamp and 1/4" x 1" bolt, lock washer and nut (20)(21)(22) .
4. Mount solenoid (24) to metal surface in engine compartment bending bracket if necessary. Be sure to locate the solenoid so that there is sufficient cable to reach to both the battery and the cable and plug assembly (9) on the power unit.
NOTE: Solenoid must be well grounded in order to function properly.
5. Slide weather cover over power (11) and ground (10) cables and route through grille of truck leaving sufficient length to attach to the cable and plug assembly (9). Secure the red power cable (11) to the large terminal on the solenoid and the black ground cable (10) to the negative terminal on the battery.
6. Secure power cable (5) from other large terminal on solenoid to positive terminal on battery.

M200 power unit installation

7. Plug intermediate harness into power unit harness and follow battery cable routing toward firewall. Locate a pass through hole in the firewall near the driver's side of the truck. Route other end of intermediate harness through the hole in firewall and attach control station.
NOTE: A smaller hole in the firewall can be used if the cable is fed into the engine compartment from the cab as the plug at the power unit end is smaller than at the control station end.
8. Attach white wire to ground, black wire to positive side of solenoid and brown wire to small terminal on top of the solenoid.
9. Neatly secure all excess cables and wires using tie straps. Silicone hole in firewall. Apply die electric grease to terminals on solenoid.

Note: Be sure all cables are properly protected from any sharp edges or hot or moving parts.
10. Install 18" hoses (15) from the back of mounting bracket into elbow swivels already attached to power unit .
11. Install two 90 deg swivel elbows (13) into angle cylinders.
12. Route hoses from port C2 through the driver side and from port C1 to passenger side on the back of mounting plate and loosely attach to the angle cylinders.
13. Install straight swivel (14) in lift cylinder. Route 18" hose (16) from port C3 through the hole on side of pump base cover and loosely attach to lift cylinder.
14. Remove vent cap and fill reservoir with 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 any fluid other than J13 will void warranty.
15. Jog the lift switch until no air is seen in the fluid passing through the loose connection. Tighten fittings.
16. Refill power unit so that oil level is 1/2" from the top of the reservoir. Clean up any spilled oil and check all functions several times making sure there is not excessive foaming in the reservoir. Compress the lift cylinder and double check the oil level. Check for leaks at all fittings.
17. Install power unit cover (2).

52699-M Power unit Kit			
Item	Part #	Description	Quantity
1	M200	Power Unit LD Blade	1

Arctic Equipment Manufacturing Corporation

R05

M200 power unit installation

52699-M Power unit Kit			
Item	Part #	Description	Quantity
**2	52785-C	LD-blade Pump Cover	1
3	CS150-06.00-NRS	1.1/2"x 6" Lift Cylinder	1
5	1306340	22" Battery Cable	1
**7	52427-N	Red Terminal Protector	1
**8	52315-N	Harness Dummy Plug	1
9	3004665	18" Cable & Plug Assembly	1
10	13061221	54" Ground Cable	1
11	1306120	63" Power Cable	1
**12	0203300	Dummy Plug (Power&ground)	1
13	HH-00790-002	90 Deg Swivel Elbow	2
14	HH-00794-003	1/4" Pipe to Pipe Internal Swivel	2
15	51002-M	18" Hose Assembly	2
16	51903-N	18" Hose Straight Ends	1
17	HH-00293-026	5/16-18x3/4 HHCS	4
18	HH-00341-003	5/16 flatwasher	4
19	HH-00457-007	5/16 Lockwasher	4
20	HH-00293-006	1/4-20x 1 HHCS	1
21	HH-00457-006	1/4 Lockwasher	1
22	HH-00294-001	1/4-20 Hex Nut	1
23	52435-N	Grommet 1/4" x 1 3/4"	1
*24	FP17757	Solenoid	1
***26	FPN0670	Valve Harness	1
27	FPN0457-SA	Centre section, control harness	1

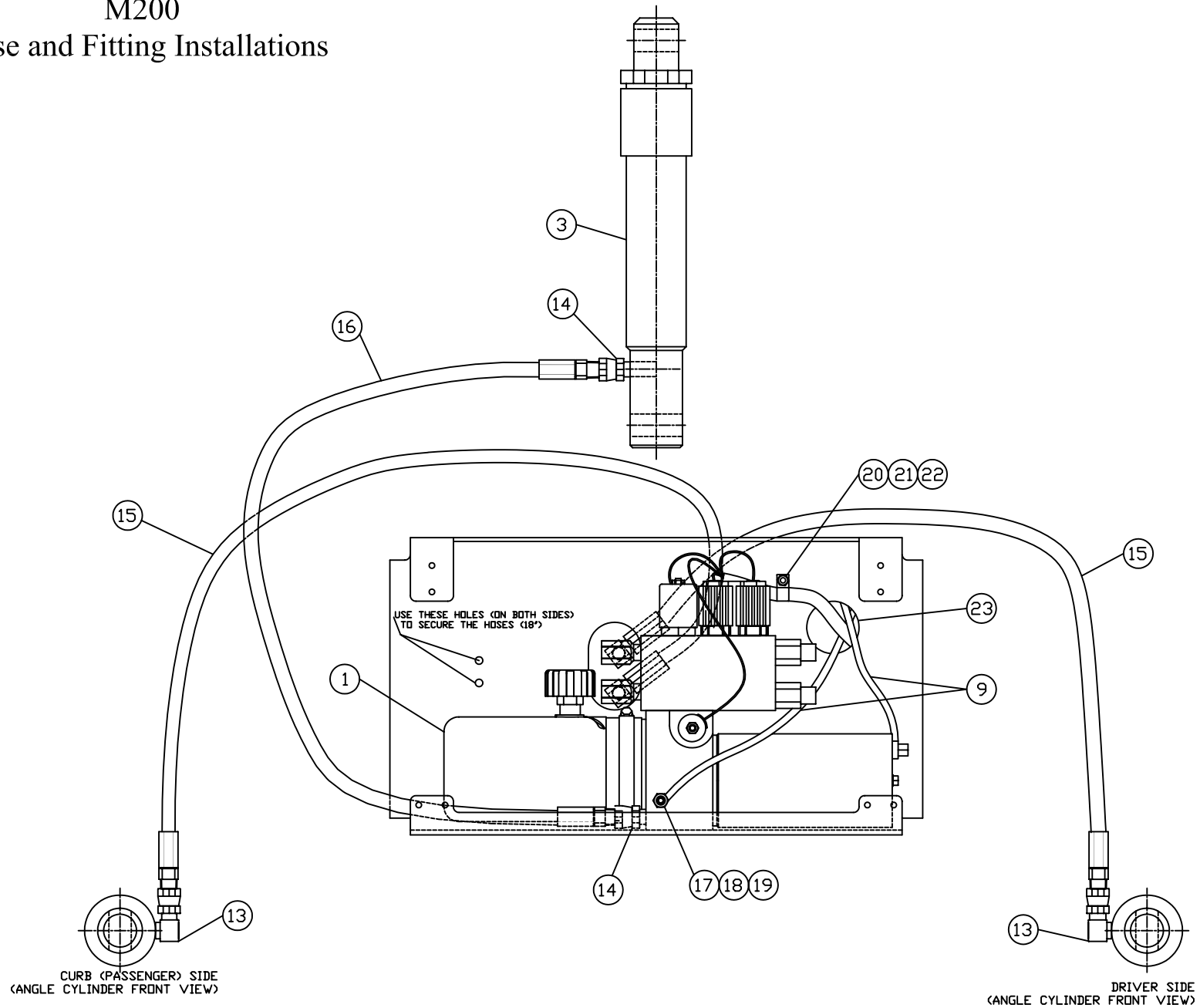
* Item 24 was FP7518

**not shown on drawing

***Item 26 was 52754-01-A

M200

Hose and Fitting Installations

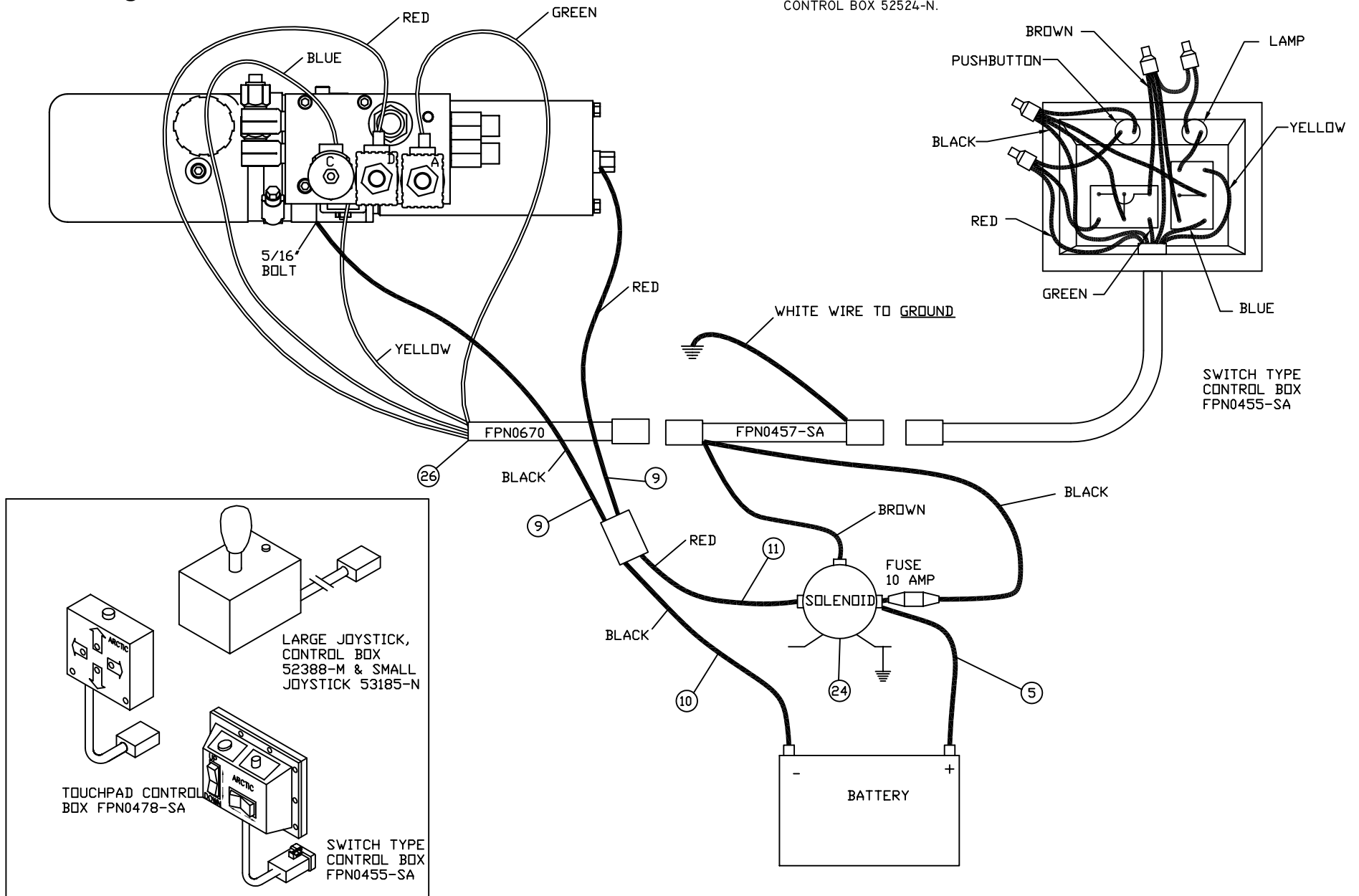


M200

Wiring Installation

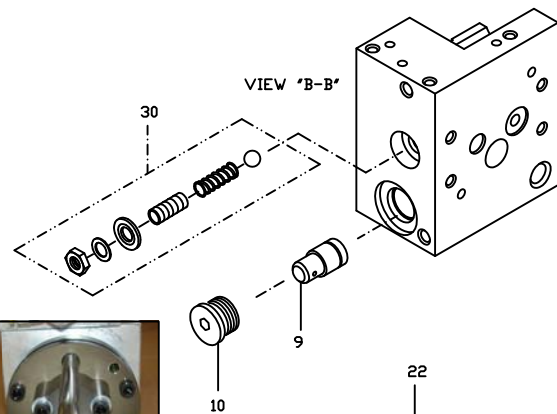
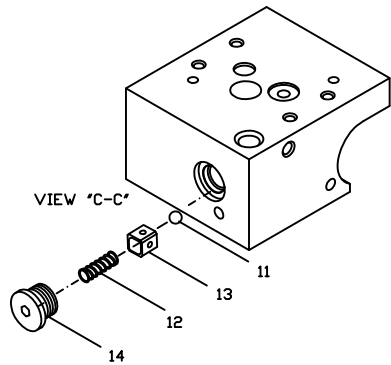
NOTES:

1) THE HARNESSES FPN0457-SA & FPN0670 ARE USED WITH ALL CONTROL BOXES: SWITCH TYPE FPN0455-SA (SHOWN), TOUCHPAD CONTROL BOX FPN0478-SA, BIG JOYSTICK CONTROL BOX 52388-M AND SMALL JOYSTICK CONTROL BOX 52524-N.



M200

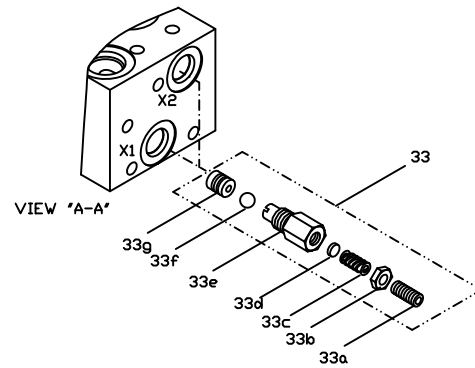
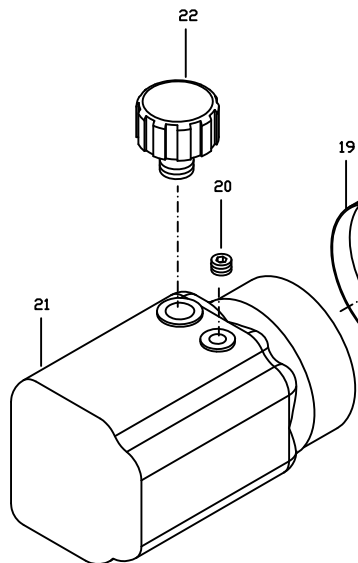
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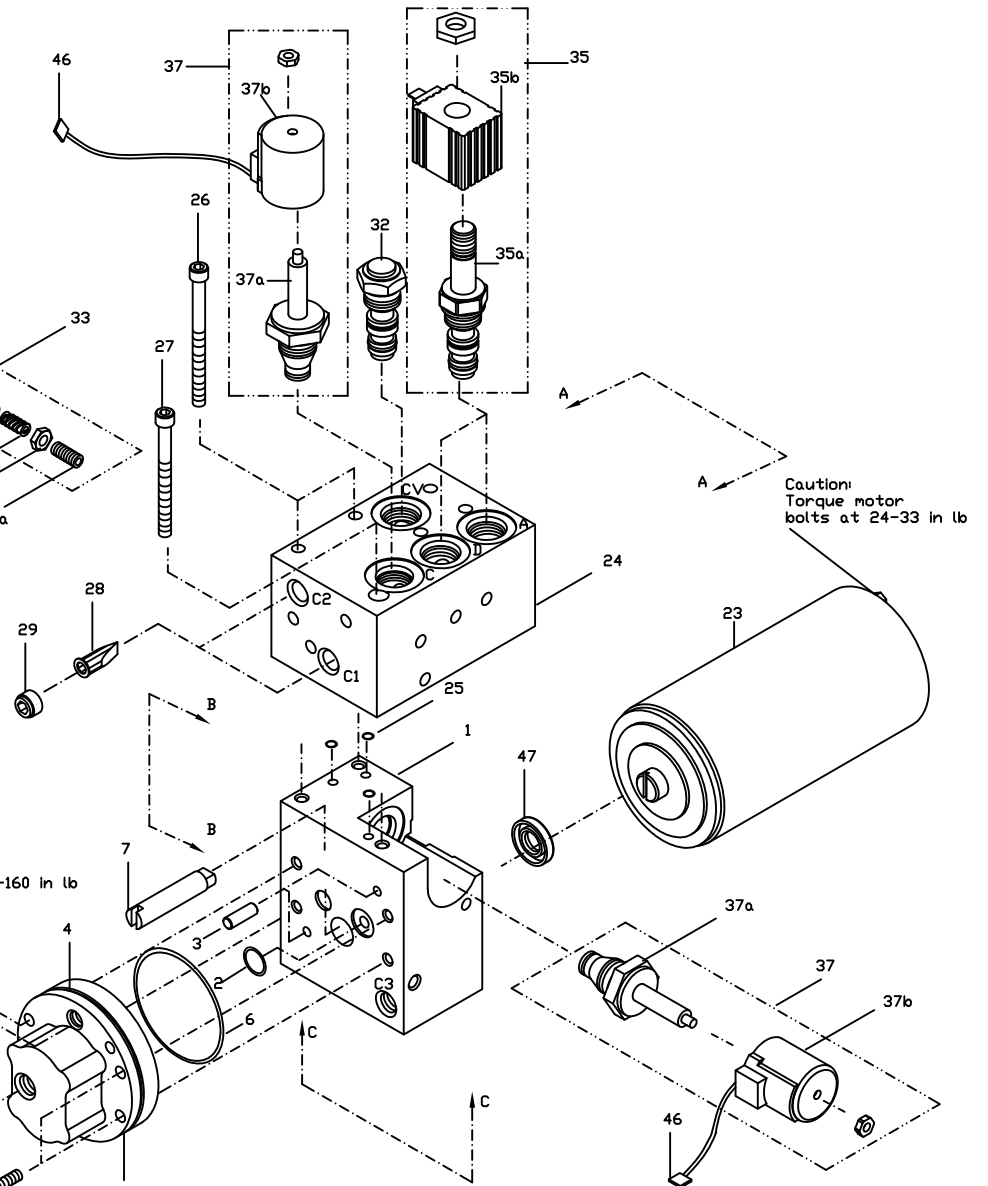
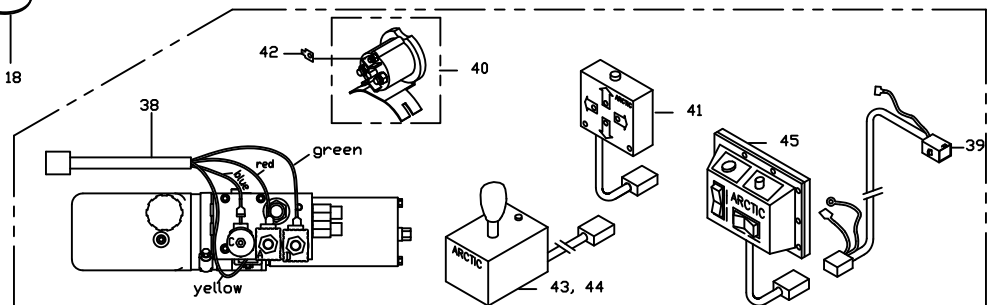
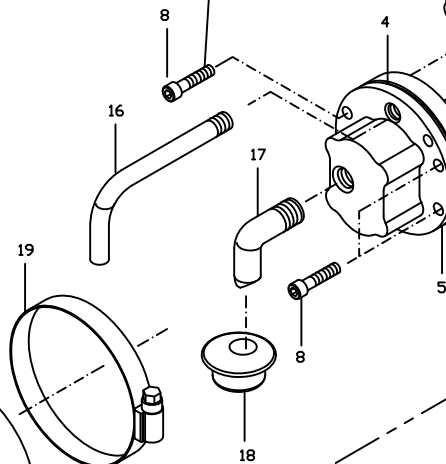
Used up to 2009
Pump #FP12637-190



Used 2009 and up
Pump# FP12819-190



Caution:
Torque pump
bolts at 140-160 in lb



Caution:
Torque motor
bolts at 24-33 in lb

M200 parts List				
Revision	Ref #	Qty	Part #	Description
	1	1	FP12731	Pump base (c/w relief valve, seal)
	2	1	FP0120	O-ring, 1/16 x ½ 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	FP12637-190	Pump (used up to 2009)
			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, ¼-20UNC 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, ¼-20UNC x 3" Lg
	27	1	FPN0401	Screw, SHCS, ¼-20UNC 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, ¼"
	33g	1	FP0378	Seat, x over rel, ball type
R01	35	2	FP7249-D	Valve 3w / 2p assembly (A,D)

M200 parts List				
Revision	Ref #	Qty	Part #	Description
R01	35a	1	FP0679-D	Valve cartridge, 08, 3W / 2P
R01	35b	1	FP18835-D	Coil, 10 VDC, single spade
R01	37	2	FP0490-D	Valve 2W / 2P assembly (B,C)
R01	37a	1	FP10907-D	Valve cartridge, #8, 2W / 2P NC poppet
R01	37b	1	FP10861-D	Coil, 12VDC
	38	1	FPN0670	Valve harness
	39	1	FPN0457-SA	Harness, center section
R02	40	1	FP17757	Solenoid
	41	1	FPN0478-SA	Touchpad
	42	1	FP3414	Terminal, #10 stud
	43	1	52388-M	Large joystick
	44	1	52524-N	Small joystick
	45	1	FPN0455-SA	Control box (rocker type switches)
	46	1	761656	Spade connector, male ¼" tab insulated, 20g wire
	47	1	FP2159	Pump seal
	48	1	53276-N	Handheld controller

*R01: FP7249-D replaces FP7249

If Parker cartridge FP0679 is replaced with Deltrol cartridge FP0679-D Parker coil

FP10977 must also be replaced with Deltrol coil FP18835-D

-FP18335-D replaces FP10977

-FP0490-D replaces FP0490

-FP10907-D replaces FP0307 *note: if Deltrol cartridge FP0307 is replaced with Deltrol cartridge FP10907-D Deltrol coil FP0496 must also be replaced with Deltrol coil FP10861-D

-FP10861—D replaces FP0496 *note: if Deltrol coil FP0496 is replaced with Deltrol Coil FP10861-D Deltrol cartridge FP0307 must also be replaced with FP10907-D

*R02 FP17757 replaces FP7518

Valves 2 way /2 position (2w/2p) cavity (O-ring) change

1. Power units manufactured prior to 2010

Typically manufactured with "Monarch-style" valve cavity, identifiable by:

- a) Cavity without identification mark (without Greek letter delta (triangle)) (see picture 1)
- b) Black O-ring, with 0.070" cross-section (see picture 3)

2. Units manufactured in 2010 and beyond

Typically manufactured with "Industry standard" valve cavity, identifiable by:

- a) Cavity with identification mark - Greek letter delta (triangle) (see picture 2)
- b) Blue O-ring, with 0.087" cross-section (see picture 3)



Valve replacement

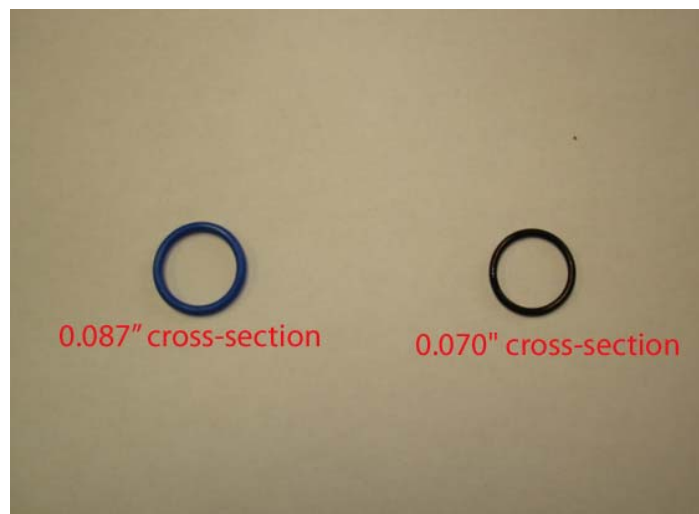
- a) Cavity and O-ring **must be selected correctly** for proper sealing function, the rest of the valve is the same. If necessary, replace O-ring with the proper O-ring to match the valve cavity:
- b) Cavity without identification mark requires black O-ring, with 0.070" cross-section (see picture 3)
- c) Cavity with identification mark requires blue O-ring, with 0.087" cross-section (see picture 3)



Picture 1



Picture 2



Picture 3

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.

WARNING

-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.

-Do not use Teflon tape on hydraulic fittings as it can easily jam valves and plug the filters in the system.

***Use of any fluid other than J13 will void warranty ***

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.

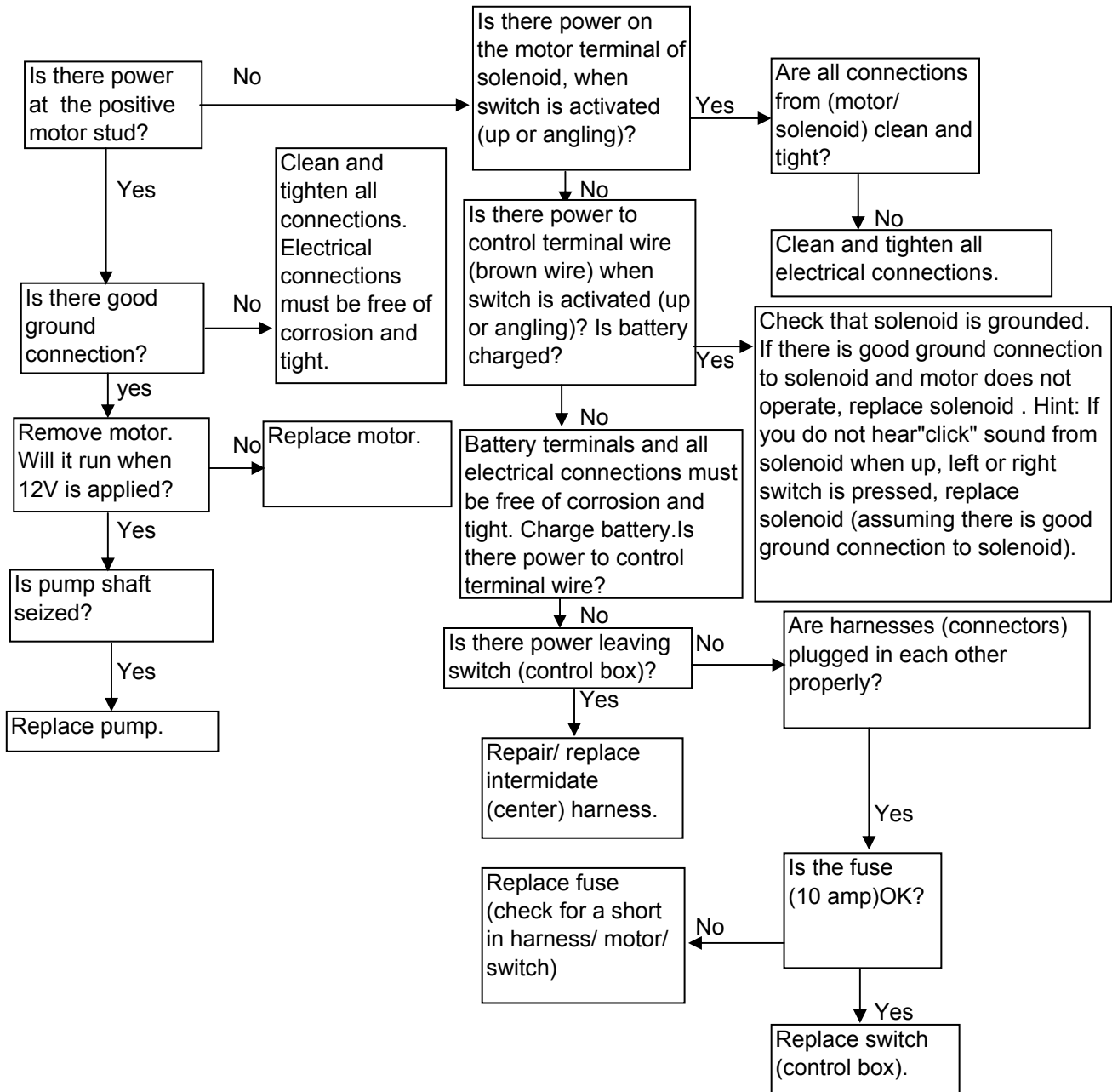
-X-over relief valve setting 2000 psi.

Note: Quick couplers are an optional item. If unit is not equipped with quick couplers, disregard troubleshooting steps involving them.

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.

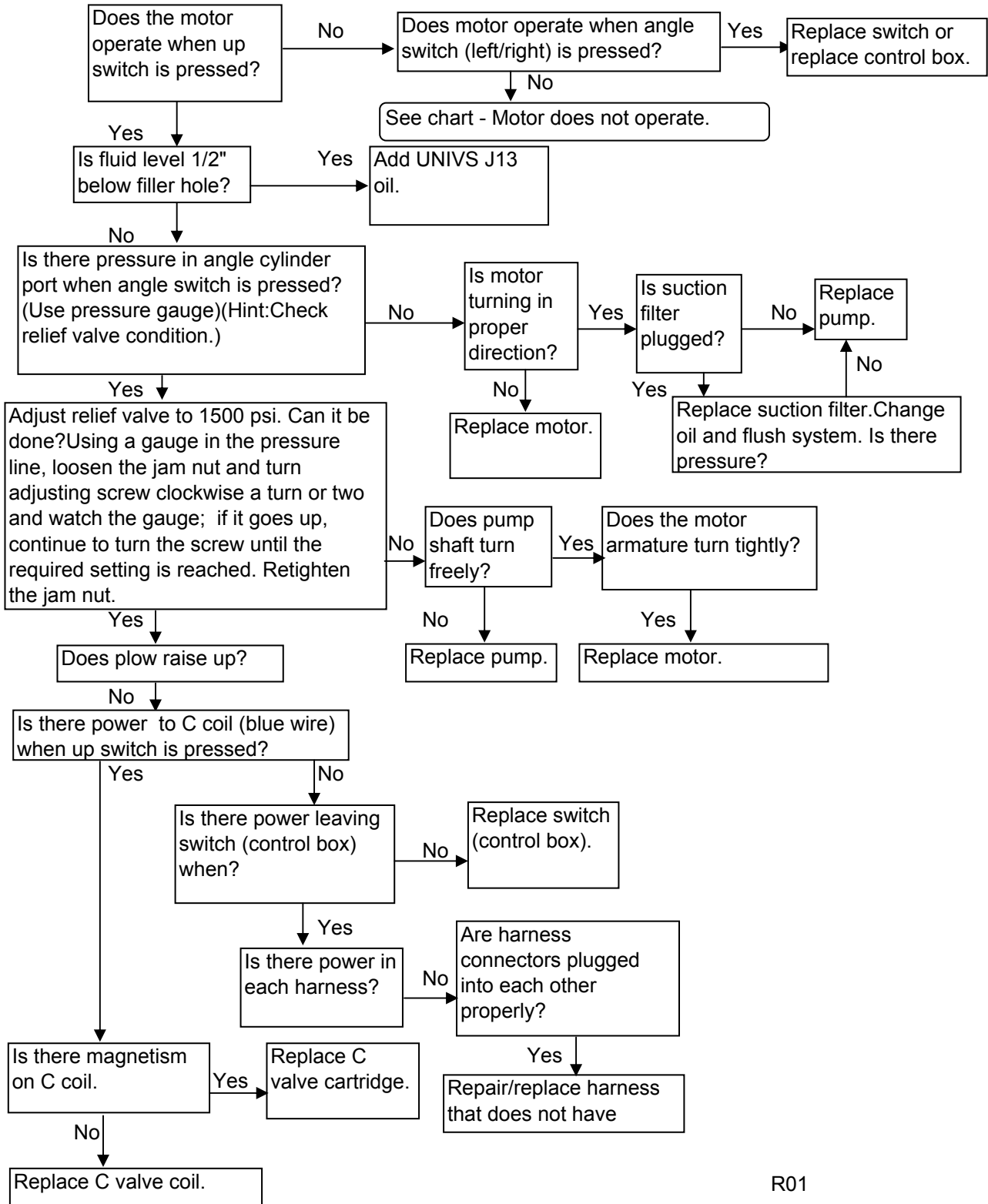
MOTOR DOES NOT OPERATE M200



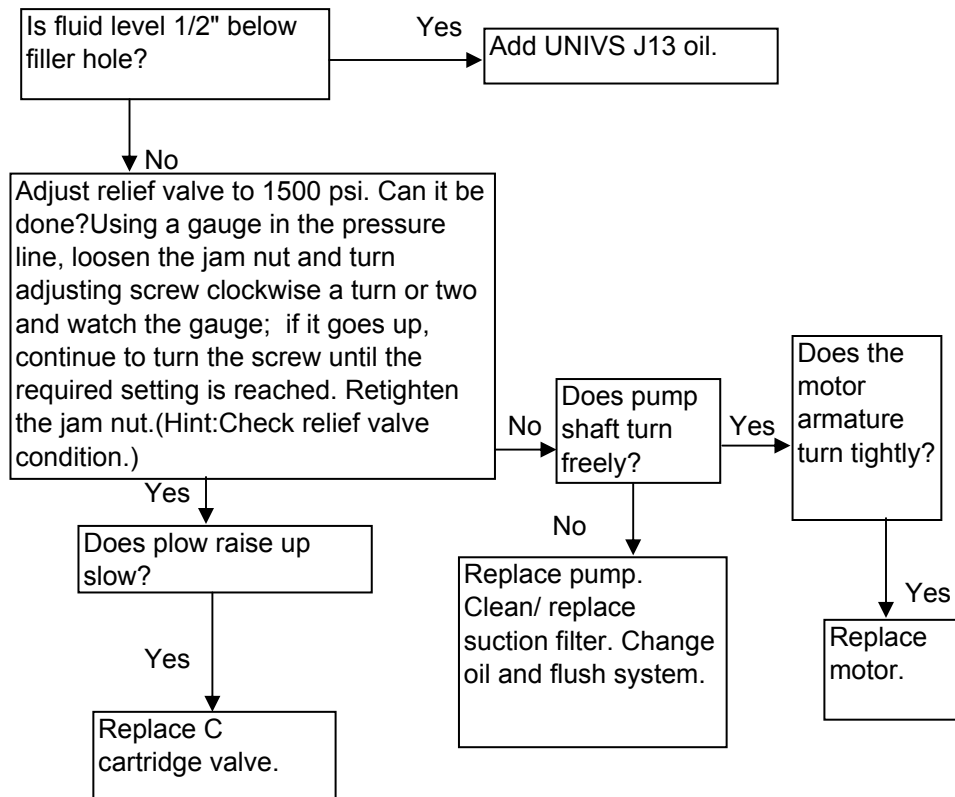
MOTOR OPERATES CONTINUOUSLY M200

If motor operates continuously, change solenoid.

SNOW PLOW DOES NOT RAISE M200

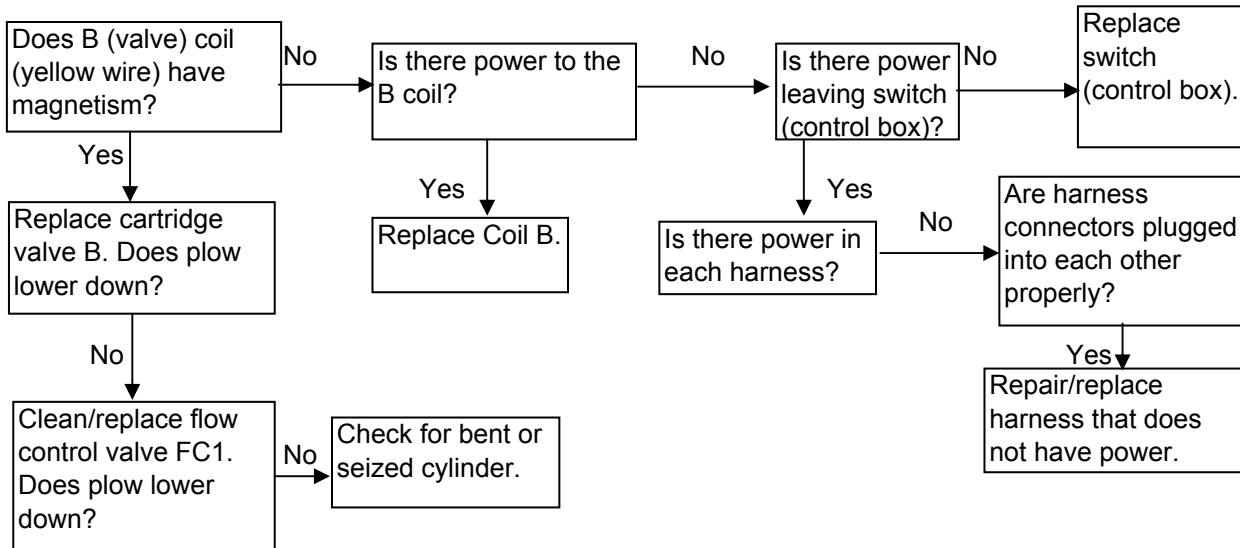


SNOW PLOW RAISE VERY SLOW M200

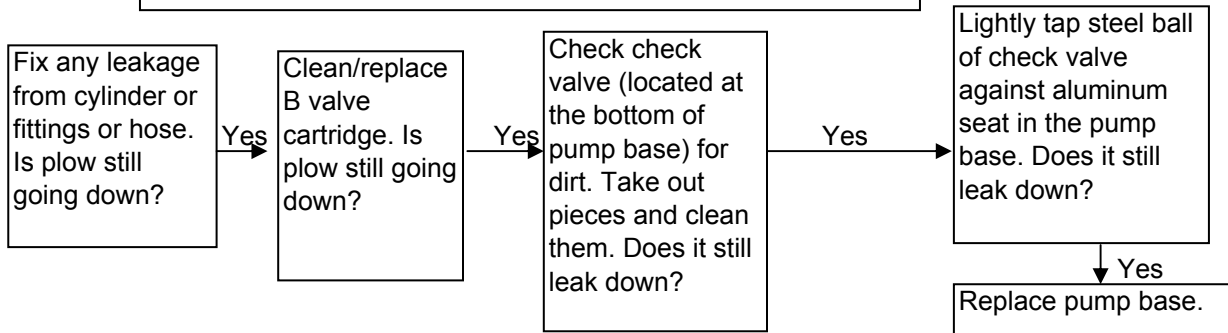


R0

SNOW PLOW WILL NOT LOWER M200



SNOW PLOW LEAKS DOWN M200



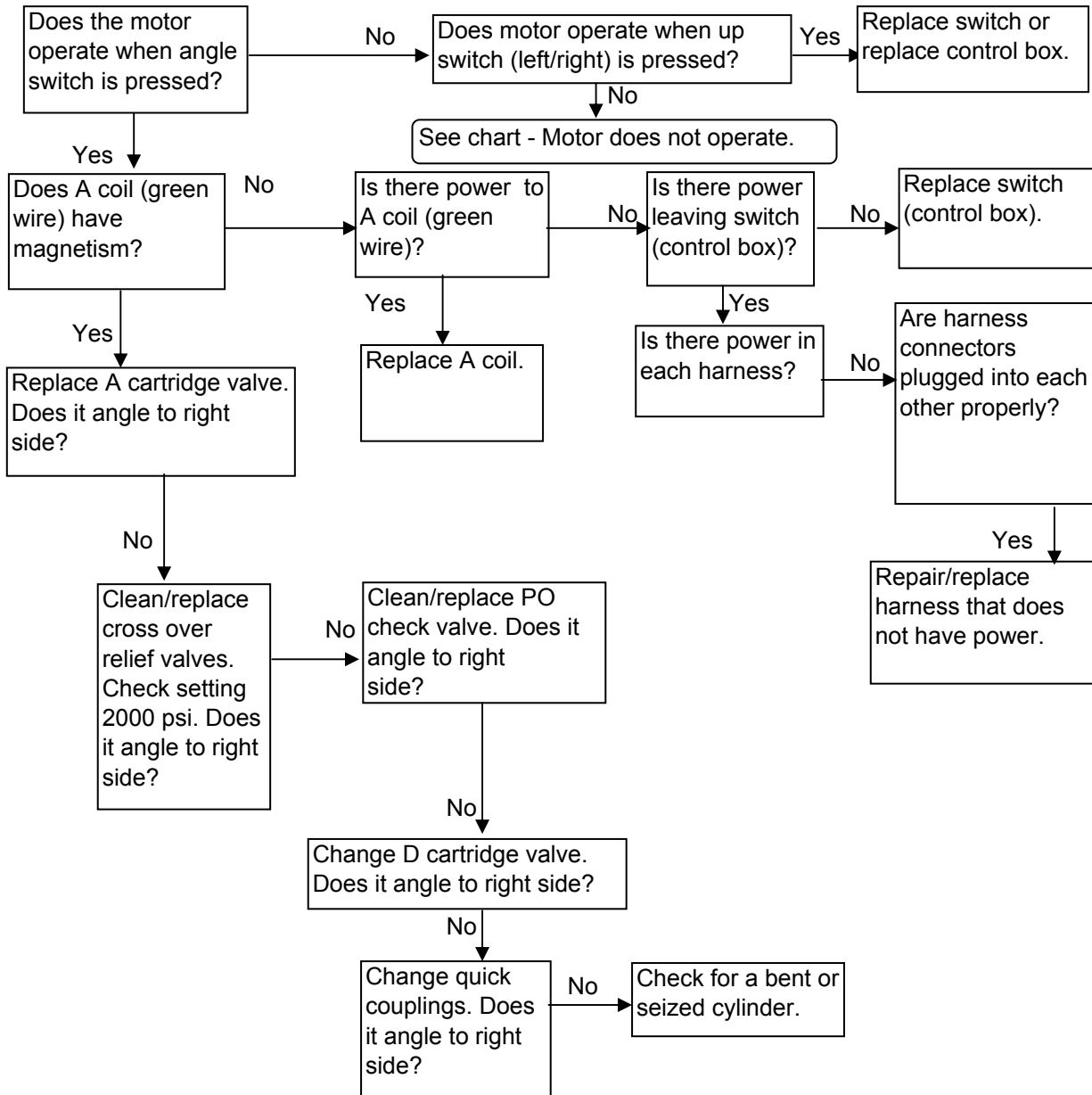
SNOW PLOW ANGLES BEFORE GOING UP WHEN UP SWITCH IS PRESSED M200

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

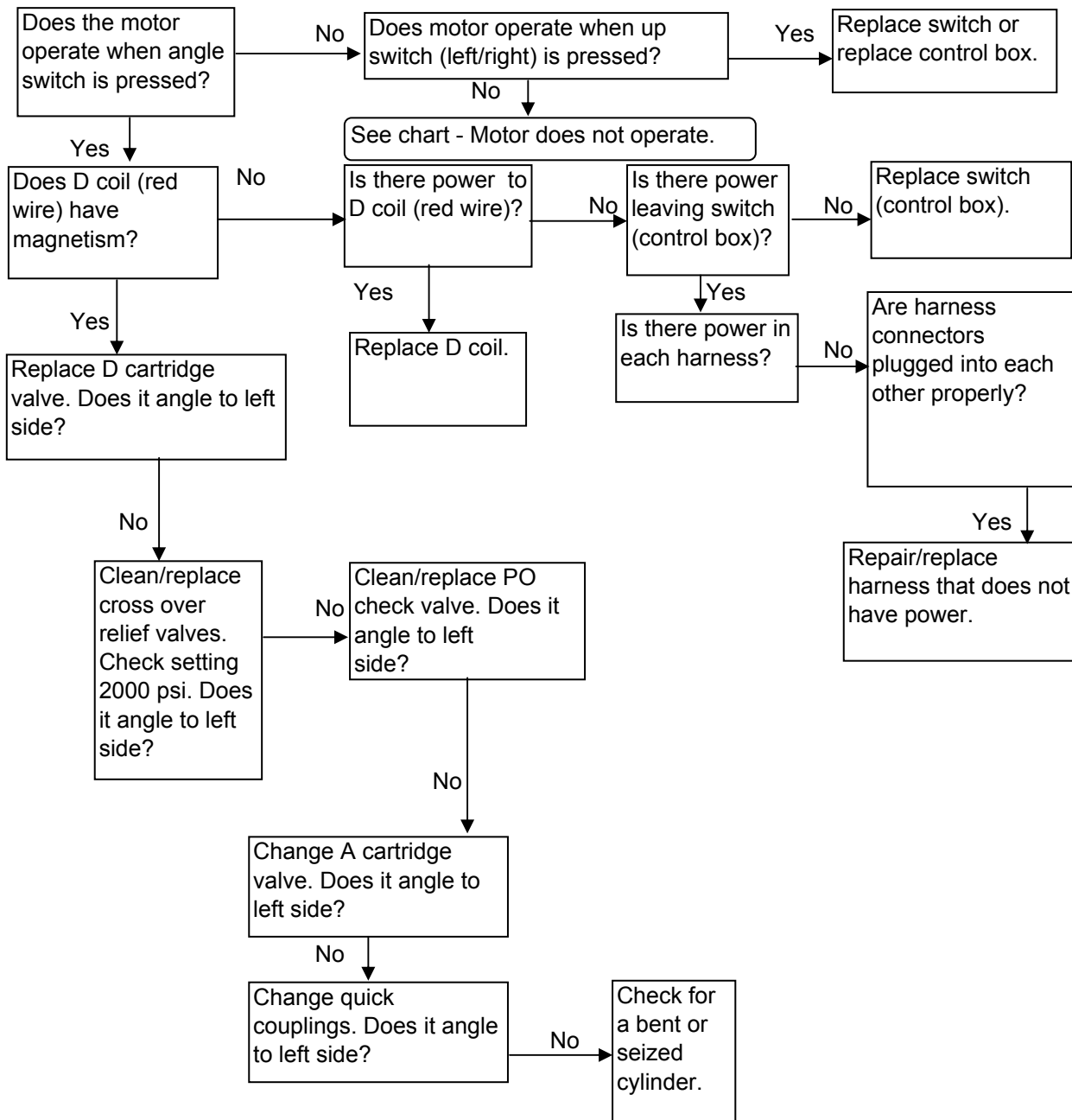
Change C Valve cartridge.

SNOW PLOW DOES NOT ANGLE TO RIGHT SIDE M200



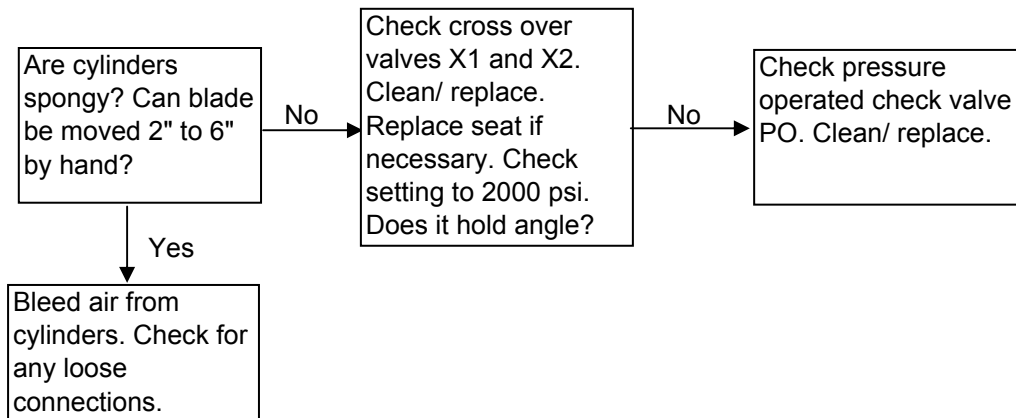
Note: Before start troubleshooting check that plow moves up and down. If plow does not move up and down see "plow does not raise".

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



R01