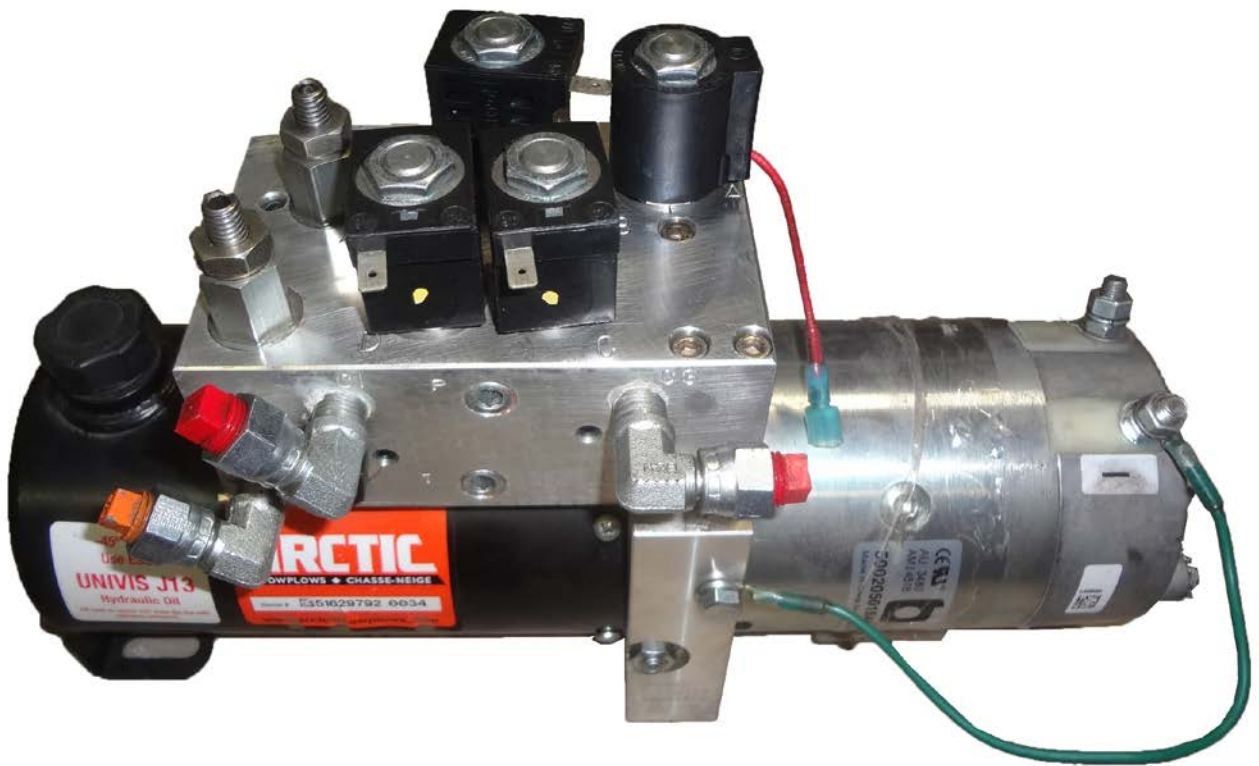


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M3593

Operating Information



General Information about Power Unit M3593

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 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.

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 angling press release button, than let go of both.

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 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 FP8111-I electric motor is two pole electromagnetic motor, consisting primarily of an armature/commutator, two field coils, four brushes in a brush holder set, and a tubular steel body with cast endcap. Although the motor is grounded through the body, an additional grounding stud is provided on the motor body.

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 M3593 is 1350 psi.

Directional Valves

The M3593 circuit contains 4 directional valves identified as ‘A’, ‘B’, ‘C’ and ‘D’. Valves ‘A’, ‘C’ and ‘D’ 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.

Directional Valve ‘B’

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.

See figure 2. Note: the lift cylinder is connected to C3.

Directional Valves 'A', 'C' & 'D'

Directional Valves 'A', 'C' and 'D' are 3 way, 2 position spool valves. Directional Valve 'C' operates the lift cylinder on C3 port (See Figure 1). 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 3,000 psi. See figure 3 and 4.

Pilot Operated (PO) Check Valve

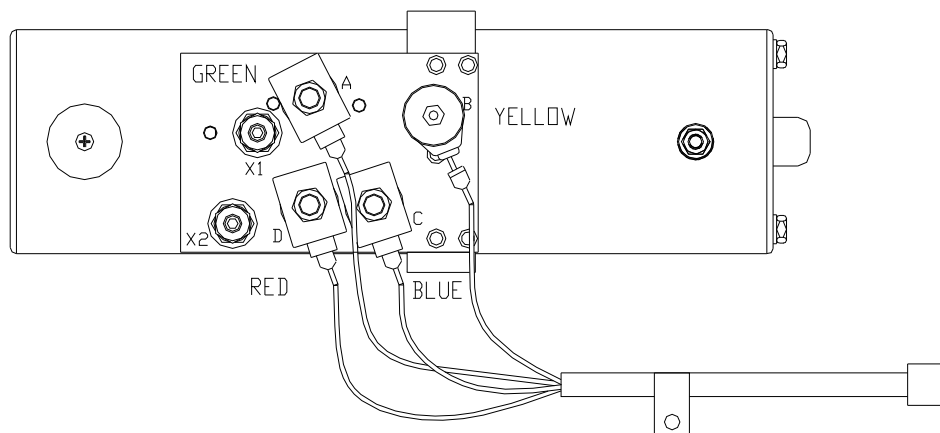
A dual pilot operated check valve (PO Check Valve) is provided on ports C1 and C2 to hold the plow at the desired angle. Without the PO Check valves, leakage through directional valves 'A' and 'D' would allow the plow to drift.

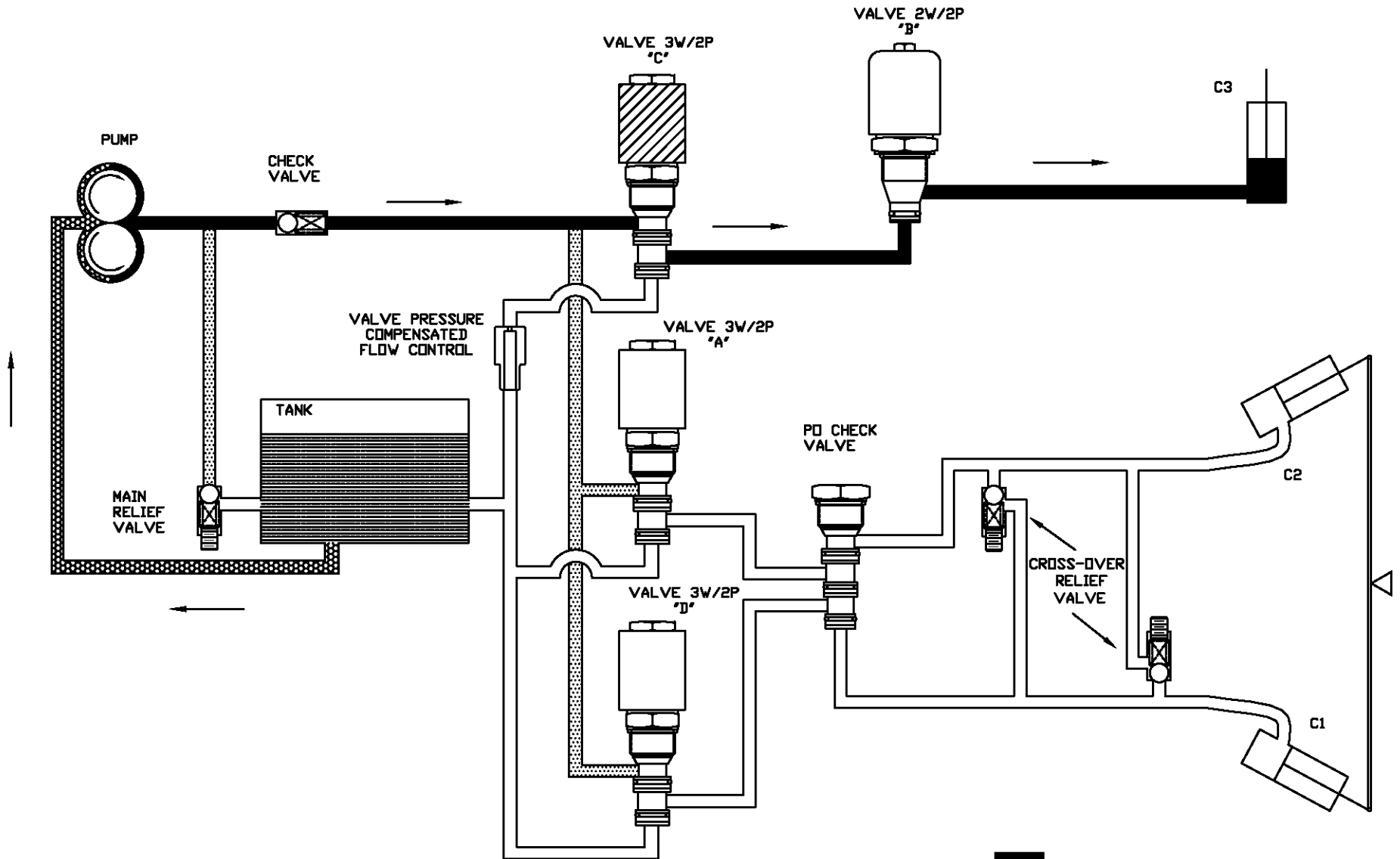
Without pilot pressure, a pilot operated check valve (PO check valve) allows flow in only one direction. In the free flow direction, oil flowing through the valve lifts the poppet of the seat. In the opposite direction, returning oil pushes the poppet against the seat thereby blocking flow. When pressure 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 M3593 uses four different control boxes: control box with rocker switches, touchpad control box, handheld controller and joystick control box. Each control box performs same functions: up, down, angle left and angle right.

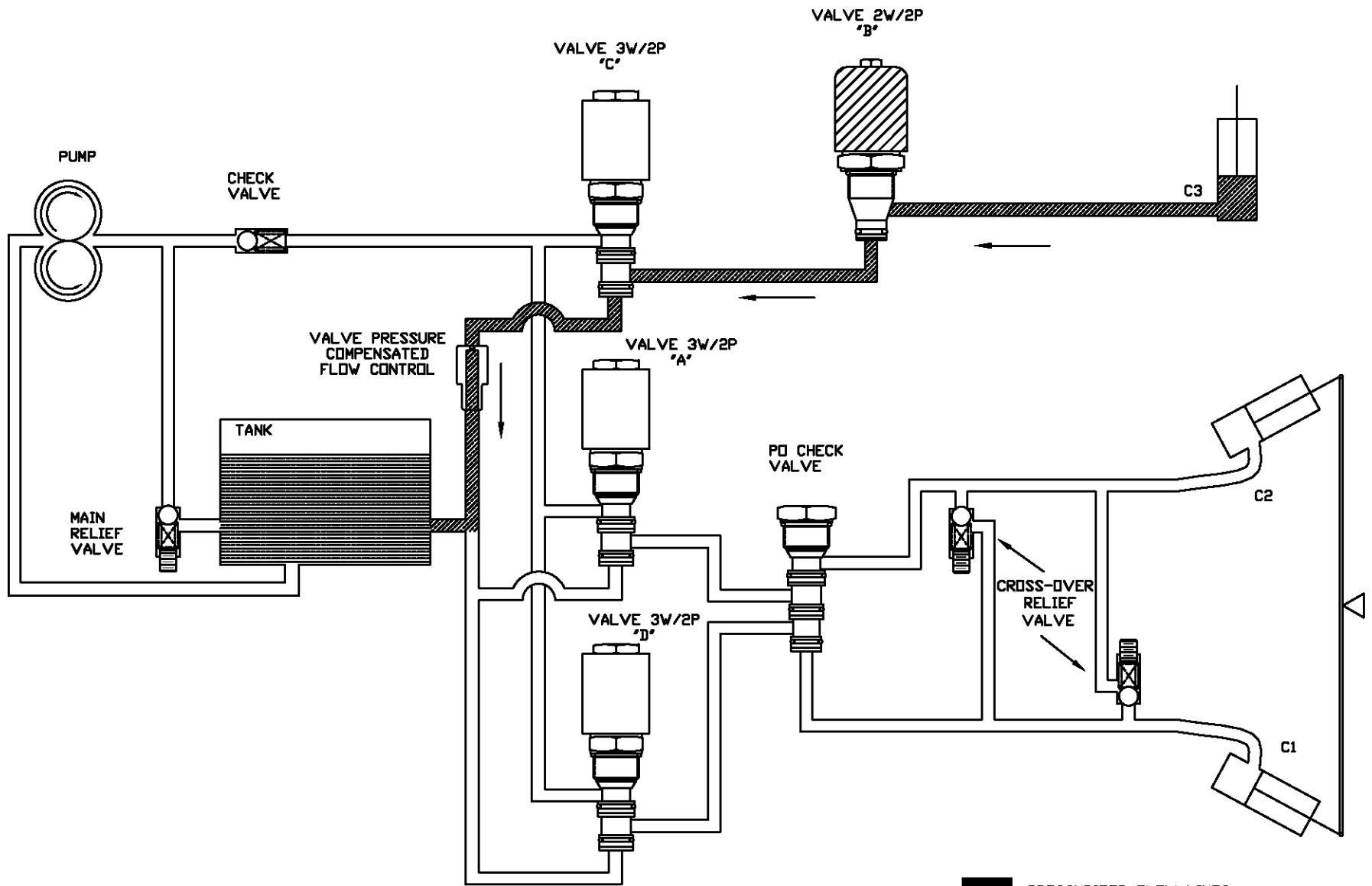




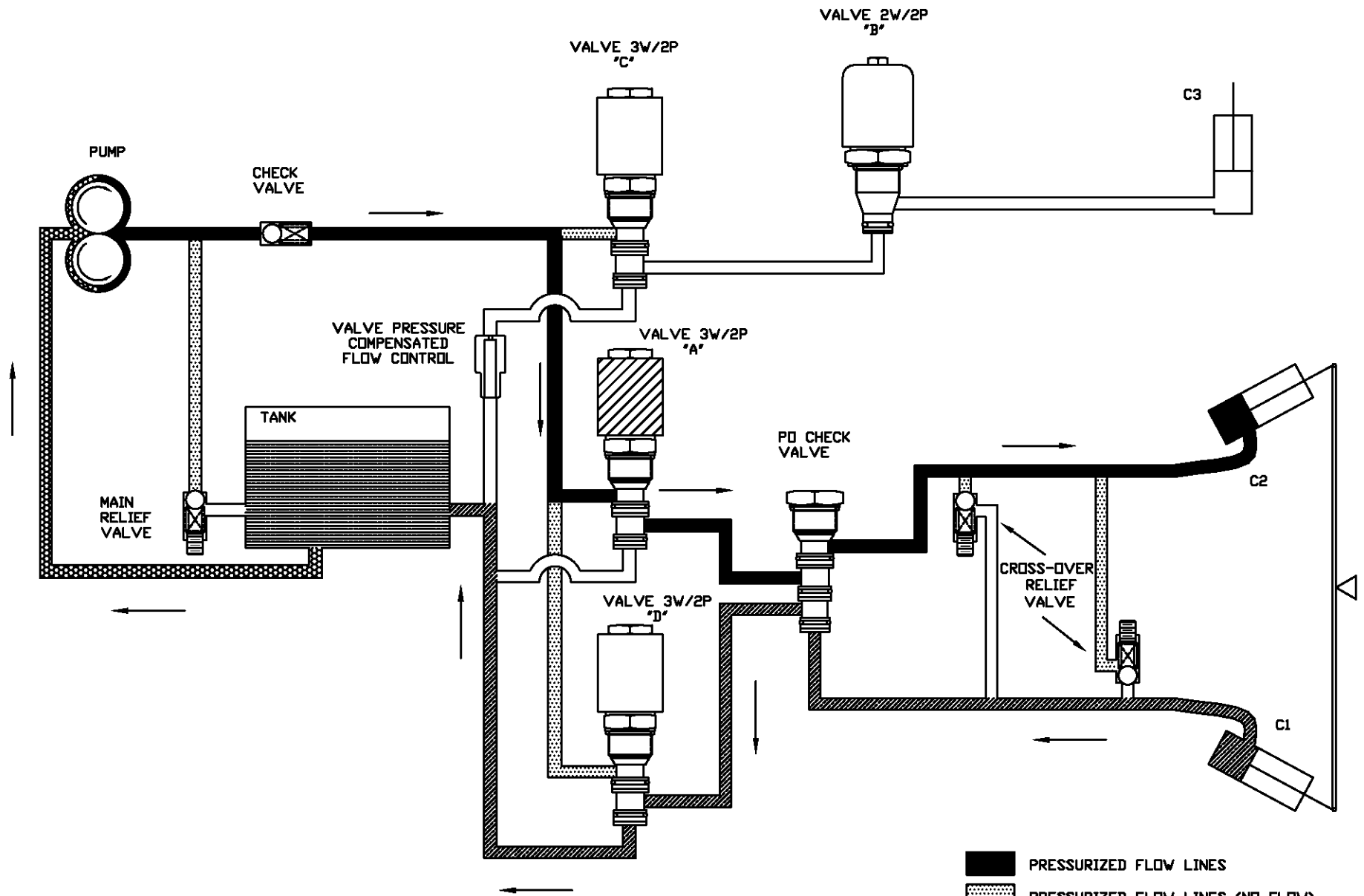
M3593010-01B02E

RAISE PLOW






FIGURE 1

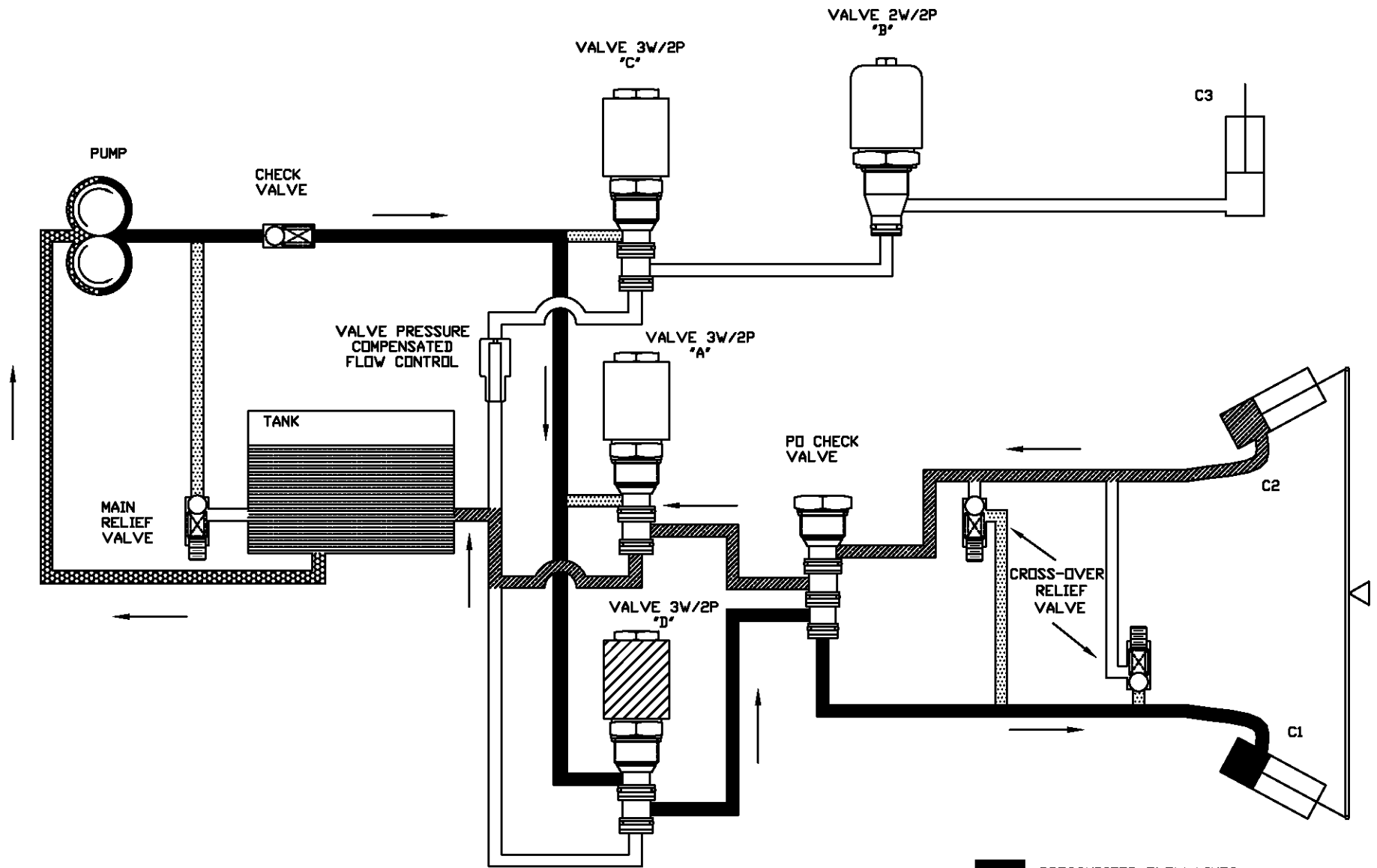


M3593010-01B02E
 LOWER FLOW
 FIGURE 2



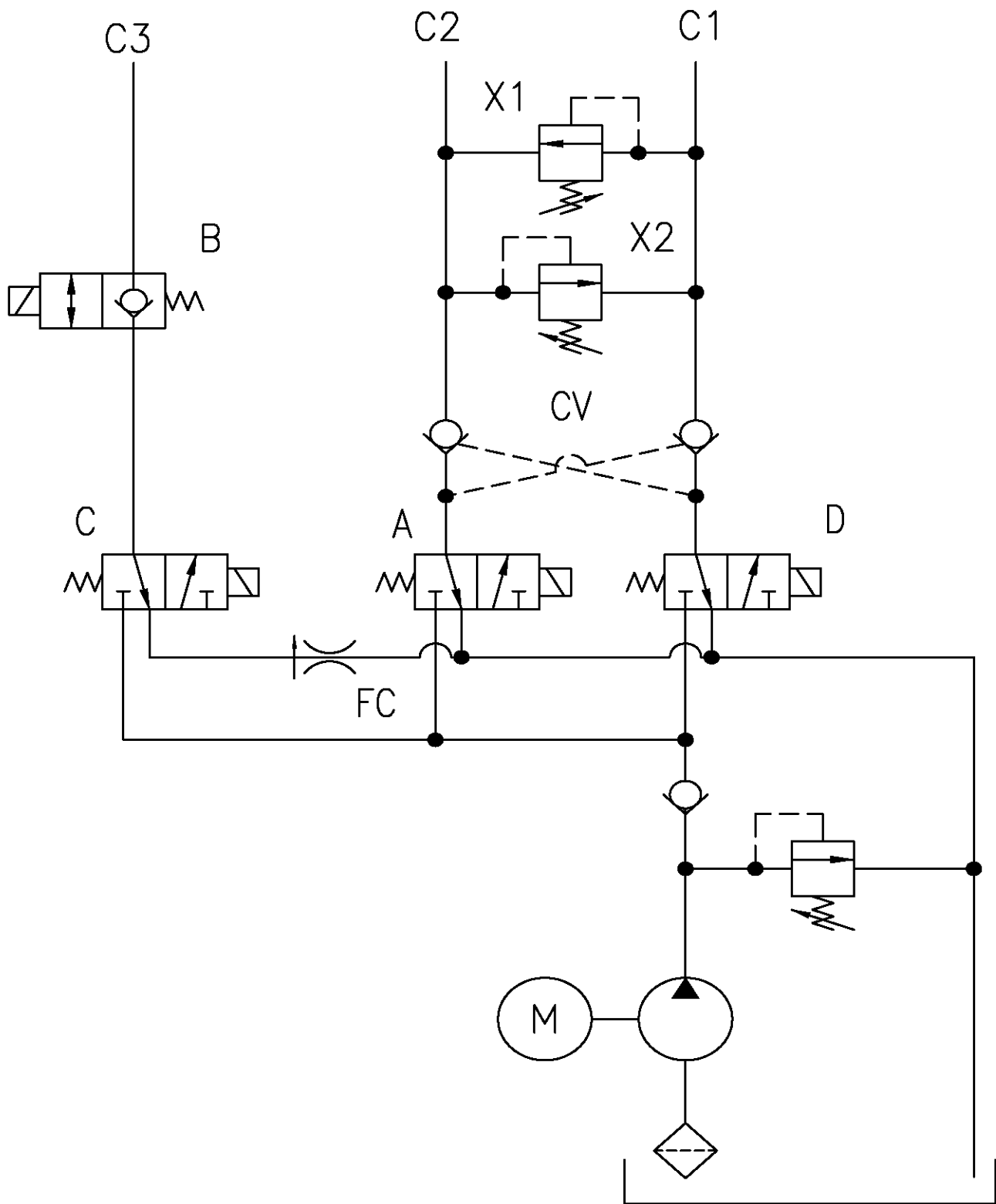
M3593010-01B02E
EXTEND C2
(ANGLE RIGHT)
 FIGURE 3

-  PRESSURIZED FLOW LINES
-  PRESSURIZED FLOW LINES (NO FLOW)
-  INTAKE FLOW
-  RETURN FLOW
-  ENERGIZED VALVE (COIL)



M3593010-01B02E
EXTEND C1
(ANGLE LEFT)

FIGURE 4



HYDRAULIC SCHEMATIC M3593010-01B02E

M3593

hydraulic installation instructions

(one piece harness and multiplexing installation)
(it requires light kit 800084 or 800085 or 800086)

M3593 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 one piece harness installation / Multiplexing installation instruction before proceed with installation bellow.

For electrical installation see:

[one piece harness installation](#)

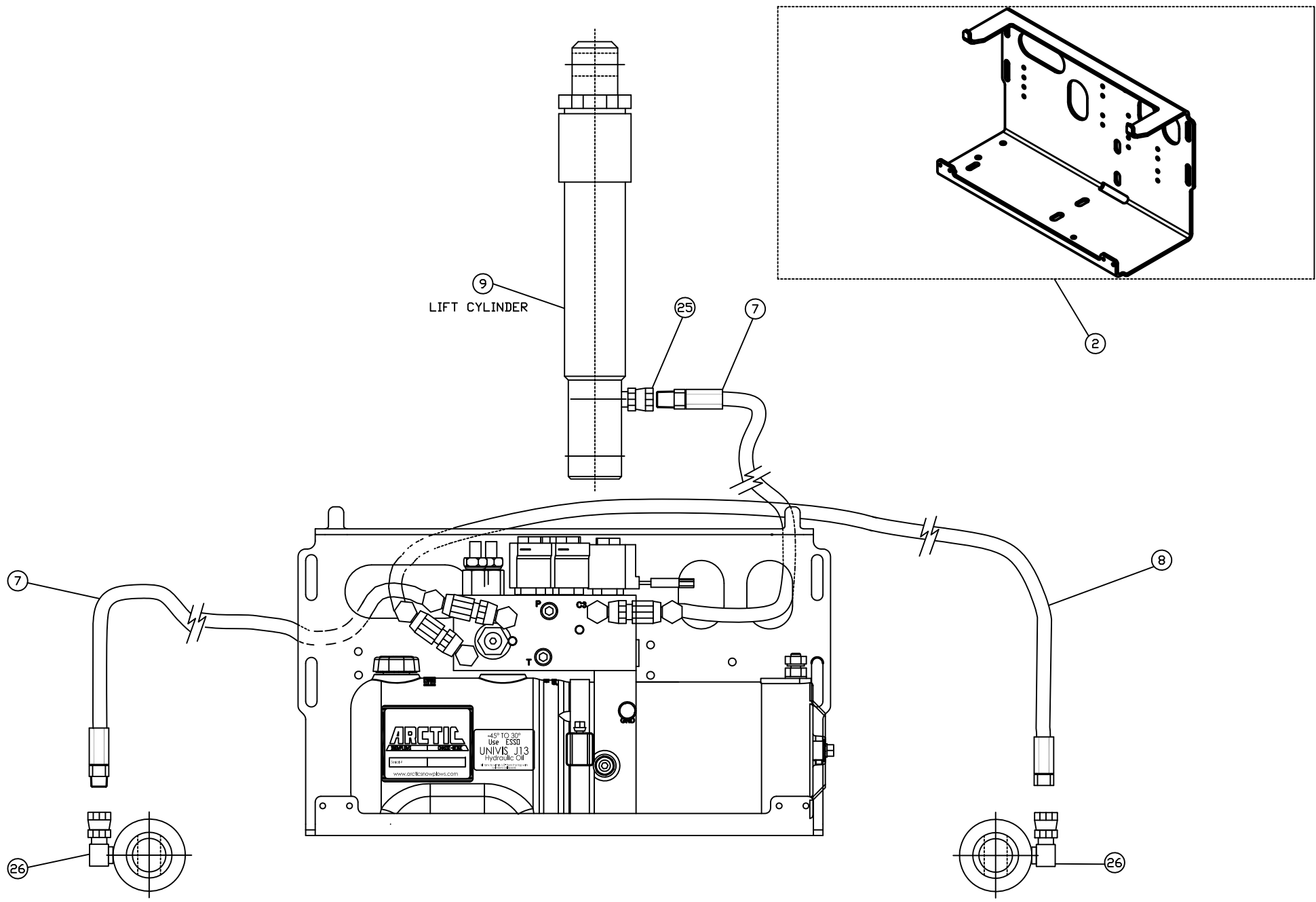
or

[multiplexing installation](#)

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. 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 1/2” from the top of the reservoir, and angle the blade to the curb side. Move, operate, the blade up and down, left and right and refill it up as necessary.

53623-M (M3593 Trip Edge Hi Boy pump kit)			
	Part#	Description	Quantity
1	M3593	Power Unit	1
2	52870-C-GA	Pump Plate	1
3	52429-C	Cover	1
4	53476-B	18" Cable Plug Assembly	1
5	53477-B	90" Ground Cable (Black)	1
6	53478-B	90" Power Cable (Red)	1
7	51904-M	29" Hose Assembly	2
8	51905-M	36" Hose Assembly	1
9	CS200-06.00-NRS	2" x 6" Lift Cylinder	1
10	52431-M-BB	Bolt Bag	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
Bolt bag 52431-M-BB (M3593 Hi Boy)			
	Part#	Description	Quantity
14	52436-N	Grommet 1/4"X1.3/4x2.1/2	2
15	HH-00293-006	1/4-20x1 HHCS	1
16	HH-00293-049	3/8-16x1 HHCS	2
17	HH-00971-043	5/16-18x1 Carriage	4
18	HH-00340-017	5/16-18 Nyl. Ins.	4
19	HH-00341-004	3/8 Flatwasher	2
20	HH-00457-004	3/8 Lockwasher	2
21	HH-00294-001	1/4-20 Hex Nut	1
22	HH-00457-006	1/4 Lockwasher	1
23	HH-00455-007	#8x3/4 SQ. DR. PAN	4
24	490056-01	1/2 Oz Tube Dielectric Grease	1
25	HH-00794-003	1/4" Pipe To Pipe Fitting	1
26	HH-00790-002	90 Deg Swivel Elbow Fitting	2
27	53560-A	Dummy Plug (Power & Ground)	1
28	52427-N	Red Terminal Protector	1
29	52700-01-N	Grommet 1/8 x 3 x 3.625	1
30	HH-00293-028	5/16-18x1 HHCS	1
31	HH-00457-007	5/16 Lockwasher	1



CURB (PASSENGER) SIDE
(ANGLE CYLINDER FRONT VIEW)

DRIVER SIDE
(ANGLE CYLINDER FRONT VIEW)

M3593 installation instructions Hi-boy & Hi-boy-DLC (multiple harnesses)

M3593 installation instructions Hi-Boy Hi-Boy DLC

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 start 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 be coated with die electrical grease to prevent corrosion.

1. Install colour co-ordinated weather covers (6)(7) on cable and plug assembly (2). Attach red lead to positive motor stud and black lead to negative motor stud. Liberally coat connections with di-electric grease then slide covers over the eyes on the end of the cables.
2. Install power unit (1) and mounting plate (3) with motor toward driver's side of truck (use star washers under bolts to bolt the pump plate to the lift frame and the power unit to the pump plate-use removable grade Loc Tite for these bolts also).
3. Route power unit harness through grommet in driver's side of mounting plate and secure using cable clamp (attached to power unit harness) and ¼" x 1" bolt.
4. Mount solenoid (4) 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 (2) on the power unit.
NOTE: Solenoid must be well grounded in order to function properly.
5. Slide weather cover (20) over power cable (8) and ground cable (9) and route through grille of truck leaving sufficient length to attach to the cable and plug assembly (2). Secure the red power cable (8) to the large terminal on the solenoid and the black ground cable (9) to the negative terminal on the battery.
6. Secure power cable (10) from other large terminal on solenoid to positive terminal on battery.
7. Plug intermediate harness (11) 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 (11) 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 (4).

Note: Apply dielectric grease to all electrical connections. Assure that all electrical connections are attached and secured properly.

9. Neatly secure all excess cables and wires using tie straps. Silicone hole in firewall.

Note: Be sure all cables are properly protected from any sharp edges or hot or moving parts !!

10. Install swivel elbows (13) in ports, C1 @ 10:00, C2 @ 11:00 and C3 @ 3:00.

11. Install 90 degree swivel elbow (14) into curb side (CS) angle cylinder @ 11:00.. Route hose from port C1 through curb side grommet in the back of the mounting plate and loosely connect the straight end of 29" hose (17) into the 90 degree swivel elbow on CS cylinder.

12. Install 90 degree swivel elbow (14) into driver's side angle cylinder @ 11:00. Connect 90 degree swivel end of 36" hose into port C2. Route straight end of 36" hose (18) from port C2 through the curb side grommet in the back of the mounting plate and loosely connect to the driver's side angle cylinder. Use a tie strap through the 2 small holes in the mounting plate to secure the hose across the back side of the plate.

13. Install straight swivel (19) in lift cylinder port facing the driver's side. Route 29" hose (17) from port C3 through driver's side grommet in mounting plate and loosely attach to lift cylinder (16).

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 conditions. Use of any fluid other than J13 will void warranty.

15. Manually angle the plow to one side before activating the power unit. This can be easily accomplished, as the hose connections are loose at the angling cylinders.

16. Jog the lift switch until no air is seen in the fluid passing through the loose connection. Tighten fittings.

17. Jog the angle switch in the direction of the retracted cylinder until no air is seen in the fluid passing through the loose connection. Tighten fittings. Fully extend this cylinder.

18. Jog the angling switch in the direction of the retracted cylinder until no air is seen in the fluid passing through the loosened connection. Tighten fittings.
19. Refill power unit so that oil level is 3/4" 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.
20. Apply die electric grease to all coil nuts and electrical connections to prevent corrosion and install power unit cover (12).

Power Unit Kit 52403-02-M Hi Boy & Power Unit Kit 52403-04-M Hi Boy-DLC			
Item	Part #	Description	Quantity
1	M3593	M3593-010-01B02E Power Unit	1
2	3004665	Cable and Plug Assembly	1
3	52870-C	Mounting Plate	1
**4	FP17757	Solenoid M3593	1
6	52427-N	Red Terminal Protector	1
7	52428-N	Black Terminal Protector	1
8	1306120	Power Cable 63"	1
9	13061221	Ground Cable 54"	1
10	1306340	22" Battery Power Cable	1
11	FPN0457-SA	Intermediate Harness	1
***12	52429-C	Power Unit Cover	1
13	HH-00790-002	90 Deg Swivel Elbow	5
16*	CS150-06.00-NRS	Lift Cylinder 1 1/2" x 6"	1
16a*	CS200-06.00-NRS	Lift Cylinder 2" x 6"	1
17	51904-M	Hose Assembly 29"	2
18	51905-M	36" Hose Assembly	1
19	HH-00794-003	1/4" Pipe to Pipe Swivel	1

Arctic Equipment Manufacturing Corporation

Power Unit Kit 52403-02-M & 52403-04-M

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Power Unit Kit 52403-02-M Hi Boy & Power Unit Kit 52403-04-M Hi Boy-DLC			
Item	Part #	Description	Quantity
***20	0203300	Weather cover for power and ground cable	1
21	52431-M-BB	Bolt Bag	1
***23	52315-N	Dummy Plug for intermediate harness	1
24	53218-N	Plastic Drain Hole Plug	1

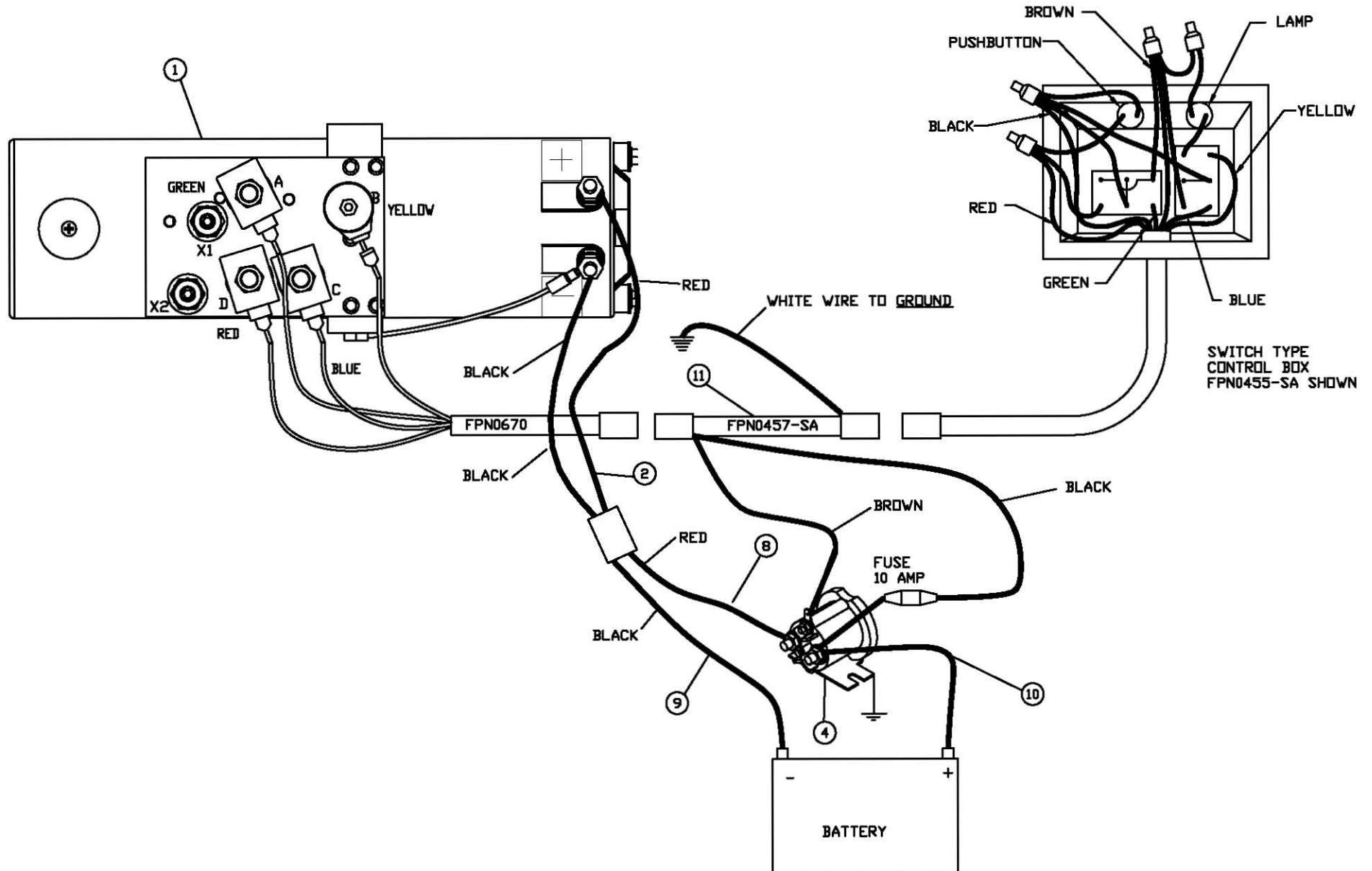
*Note: Item #16 is included in 52403-02-M kit & item #16 a is included in 52403-04-M.

**Item 4 was part number FP7518

***Items not shown on drawing

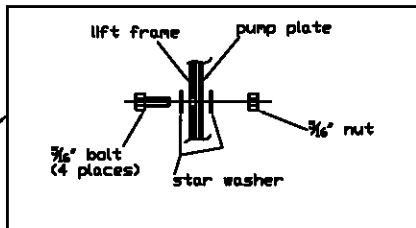
52403-02-M & 52403-04-M Power Unit Kit M3593010-01B02E WIRING INSTALLATION

NOTES:
1) THE HARNESSES FPN0670 & FPN0457-SA ARE USED WITH ALL CONTROL BOXES: SWITCH TYPE FPN0455-SA (SHOWN).

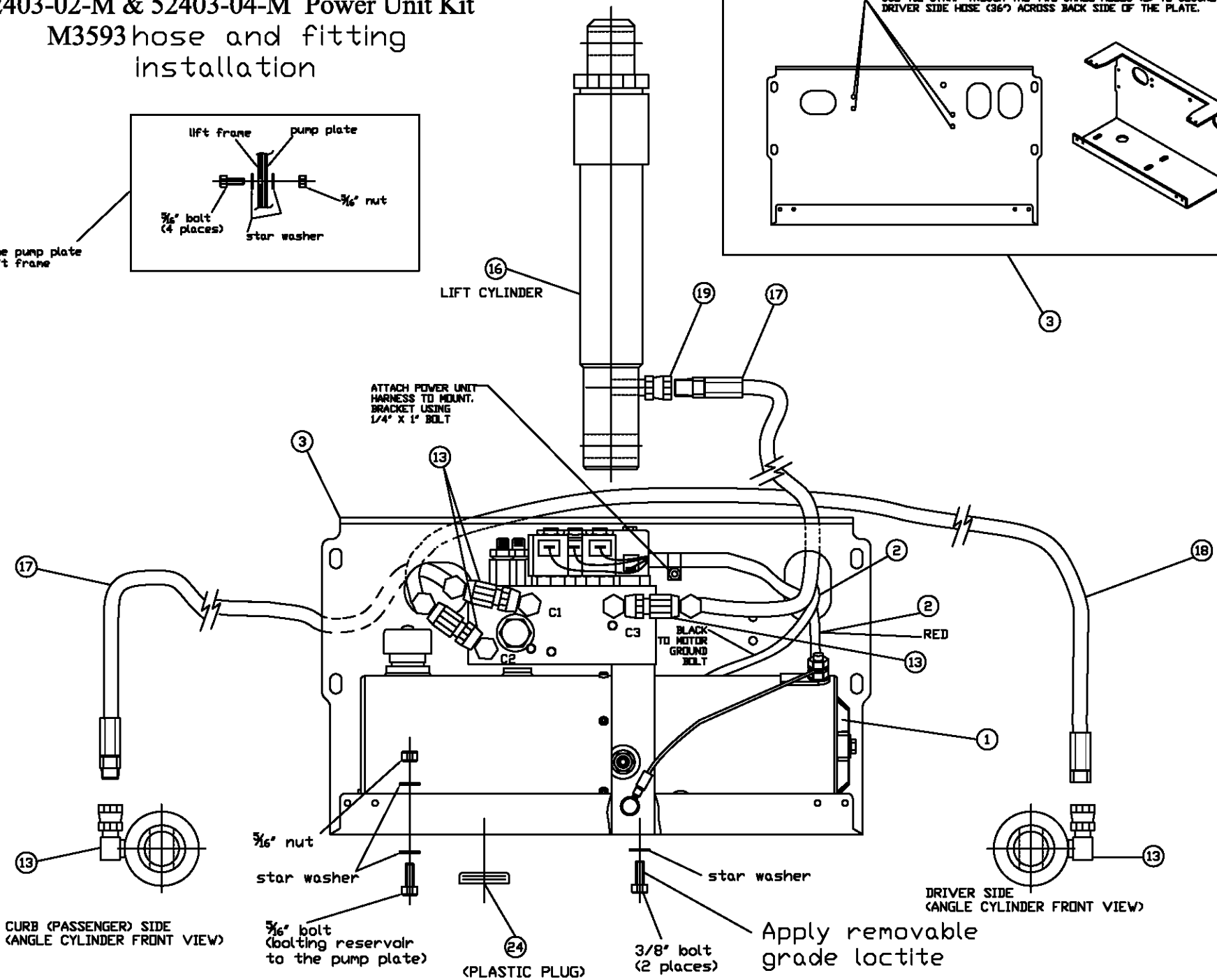
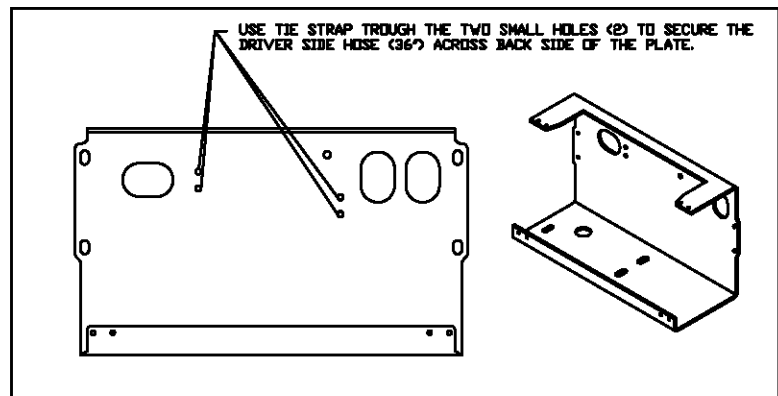


52403-02-M & 52403-04-M Power Unit Kit

M3593 hose and fitting installation



Bolting the pump plate to the lift frame



M3593 Hi-mount installation instructions

(multiple harnesses)

M3593 Hi-mount 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 start 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.).

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

-Apply die-electric grease to all electrical connections to prevent corrosion

1. Install colour co-ordinated weather covers on cable and plug assembly (2). Attach red lead to positive motor stud and black to negative motor stud. Liberally coat connections with die-electric grease then slide covers over the eyes on the end of the cables.
2. Install power unit (1) on mounting plate (3a) with motor toward driver's side of truck. Space adapter (17) needs to be installed under pump base. Power unit should be secure with one bolt on the bottom and one bolt on the side in the pump base, and also power unit needs to be secured with one bolt through the reservoir lug to mounting plate (3c) (add two washers under the lug).
Two brackets need to be installed on each side of pump plate picking up two holes on lift frame (for light brace) and one hole on the bottom of the pump plate. Install the plate between lights (to pick up both light holes) and bracket to centre of this plate to the pump plate. (See drawing 52377-01/02-M).
3. Route power unit harness through grommet in driver's side of mounting plate and secure using cable clamp and $\frac{1}{4}$ " x 1" bolt.
4. Mount solenoid (6) 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 (2) on the power unit.
NOTE: Solenoid must be well grounded in order to function properly.
5. Slide weather cover over power (8) and ground (9) cables and route through grille of truck leaving sufficient length to attach to the cable and plug assembly (2). Secure the red power cable (8) to the large terminal on the solenoid and the black ground cable (9) to the negative terminal on the battery.

6. Secure power cable (10) from other large terminal on solenoid to positive terminal on battery.
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.
Note: Apply dielectric grease to all electrical connections. Ensure that all electrical connections are attached and secured properly.
9. Neatly secure all excess cables and wires using tie straps. Silicone hole in firewall.
Note: Be sure all cables are properly protected from any sharp edges or hot or moving parts.
10. Install swivel elbows (13) in ports, C1 @ 9:00, C2 @ 3:00 and C3 @ 3:00.
11. Install 90 degree swivel elbow in curb side (CS) angle cylinder @ 1:00. Route straight end of 54" hose (14) from port C1 through curb side grommet in the bottom of the mounting plate and connect loosely to curb side angle cylinder. Connect 90 degree swivel end of 54" hose into C1 port.
12. Install 90 degree swivel elbow (13) into driver's side angle cylinder @ 11:00. Route 54" hose (14) from port C2 through the driver side grommet in the bottom of the mounting plate. Loosely connect the straight end of the 54" hose to the 90 degree swivel elbow on the DS angle cylinder. Connect the 90 degree swivel end of 54" hose into port C2.
13. Install straight swivel (17) in lift cylinder port facing the driver's side. Route 29" hose from port C3 through driver's side grommet in the bottom of mounting plate and loosely attach to lift cylinder.
14. Remove vent cap and fill reservoir with J13 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. **MANUALLY** angle the plow to one side before activating the power unit. This can be easily accomplished, as the hose connections are loose at the angling cylinders.
16. Jog the lift switch until no air is seen in the fluid passing through the loose connection. Tighten fittings.
17. Jog the angle switch in the direction of the retracted cylinder until no air is seen in the

- fluid passing through the loose connection. Tighten fittings. Fully extend this cylinder.
18. Jog the angling switch in the direction of the retracted cylinder until no air is seen in the fluid passing through the loosened connection. Tighten fittings.
 19. Refill power unit so that oil level is 3/4" 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.
 20. Install power unit cover (3b).

52403-01-M, M3593 Power unit kit - Hi-Mount			
Item	Part #	Description	Quantity
1	M3593	M3593-010-01B02E Power Unit	1
2	3004665	Cable and Plug Assembly	1
3	52377-02-M	M3593 Mounting Plate Kit	1
3a*	52377-C	Mounting Plate	1
3b*	52375-C	Power Unit Cover	1
3c*	52416-A	Adapter for M3593	1
***5	52428-N	Black Terminal Protector	1
**6	FP17757	Solenoid M3593	1
***7	52427-N	Red Terminal Protector	1
8	1306120	63" Power Cable	1
9	13061221	Ground Cable 54"	1
10	1306340	22" Battery Power Cable	1
***11	0203300	Weather Cover for power and ground cable	1
12	CS150-06.00-NRS	1 1/2" x 6" Lift Cylinder	1
13	HH-00790-002	90 Deg Swivel Elbow	5
14	51333-M	1/4"x54" Hose Assembly	2
17	HH-00794-003	1/4" Pipe to Pipe Internal Swivel	1
18	51904-M	29" Hose Assembly	1
***19	52315-N	Dummy Plug for intermediate harness	1
20	FPN0457-SA	96" Harness centre section	1
***21	490056-01	1/2 oz tube dielectric grease	1

Arctic Equipment Manufacturing Corporation

Hi Mount Mounting Kit M3593 52403-01-M

R10

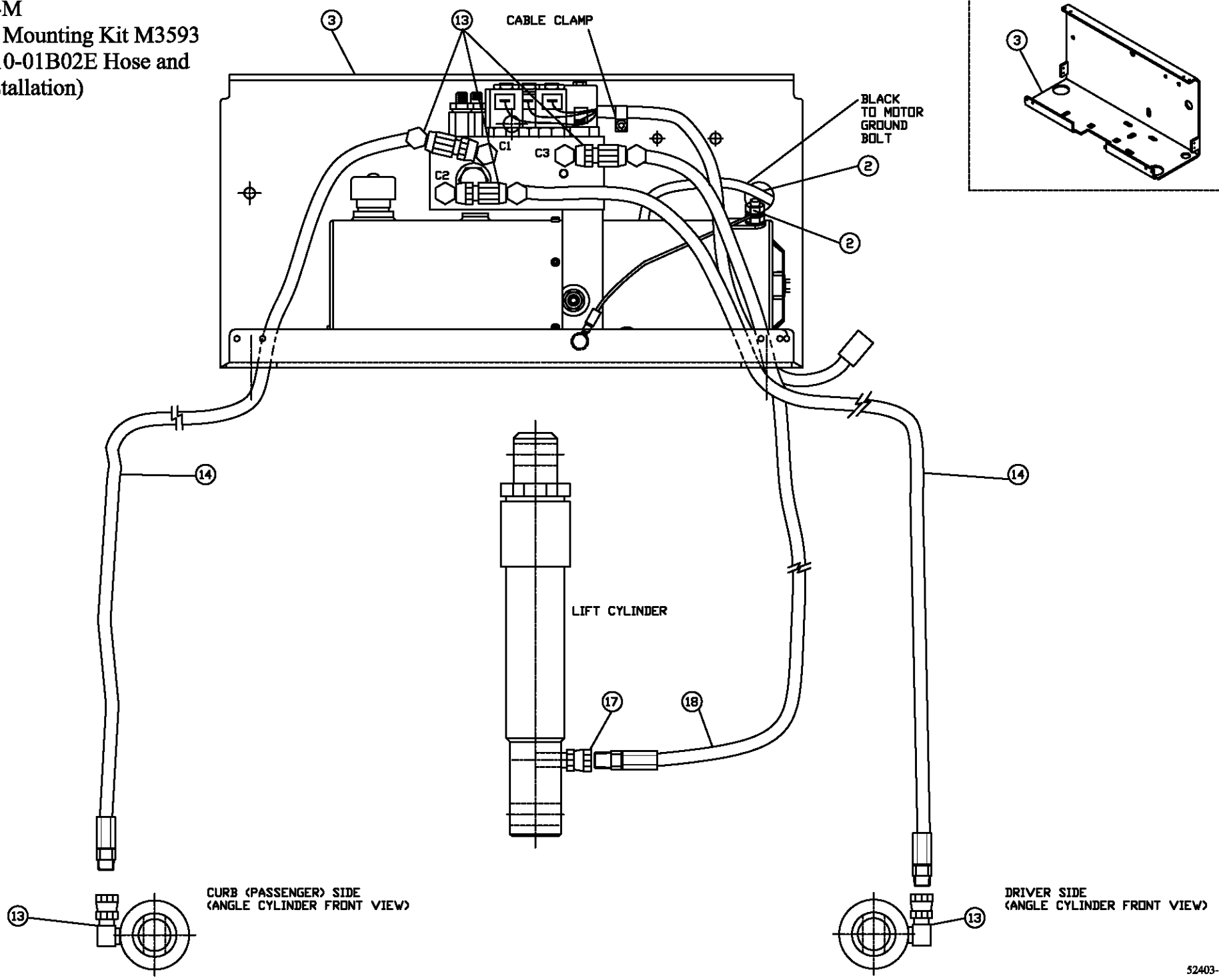
INST0016

*Note: Items are included in 52377-02-M kit (see drawing 52377-01/02-M (Hi Mount Mounting Plate Kit)).

**Item replaces part # FP7518

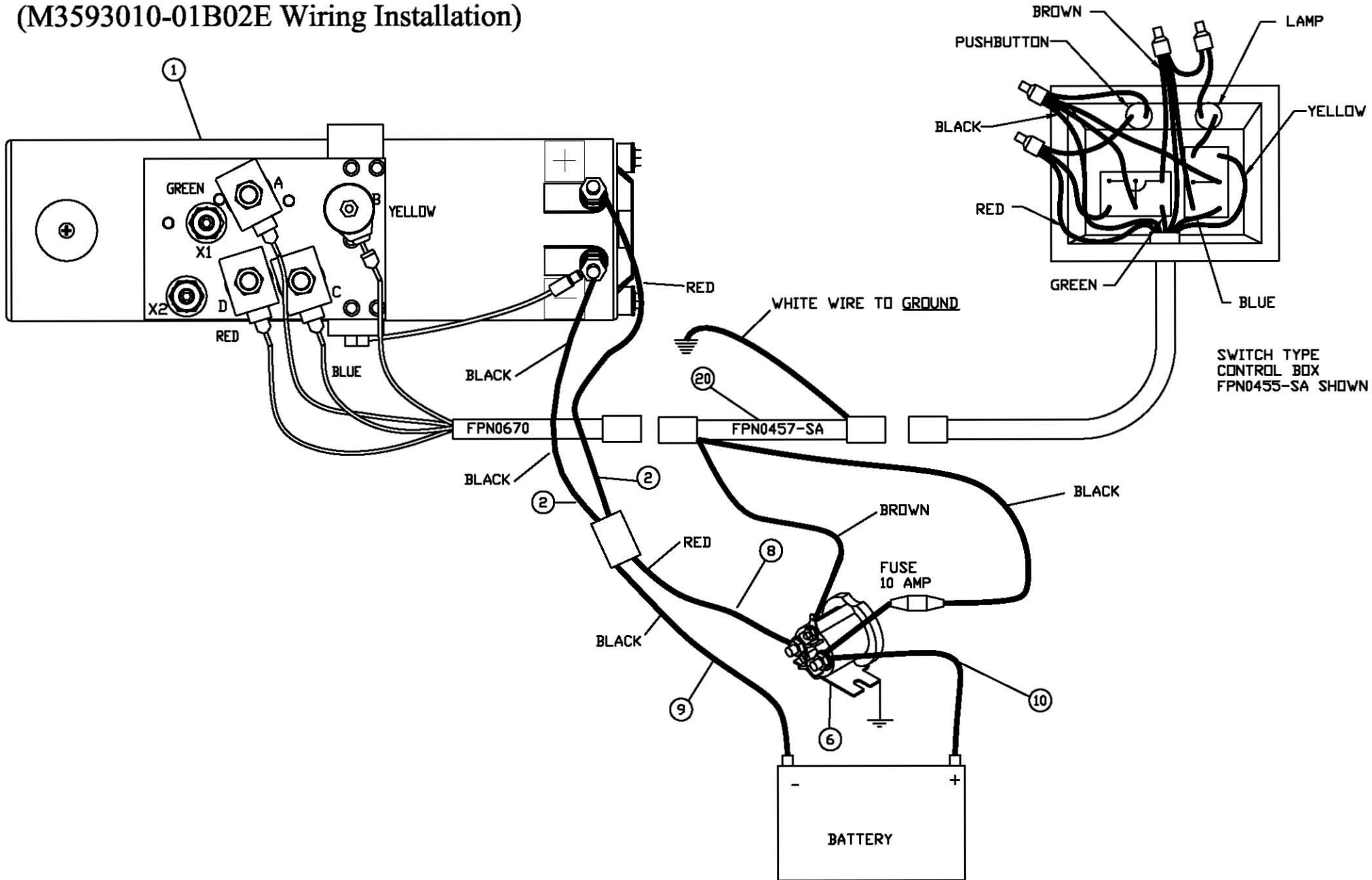
***Items not shown on drawing

52403-01-M
 Hi Mount Mounting Kit M3593
 (M3593010-01B02E Hose and
 fitting installation)



52403-01-M
 Hi Mount Mounting Kit M3593
 (M3593010-01B02E Wiring Installation)

NOTES:
 1) THE HARNESSES FPN0670 & FPN0457-SA ARE USED WITH ALL CONTROL BOXES: SWITCH TYPE FPN0455-SA (SHOWN).



Hi-Mount Mounting Plate Kit 52377-02-M

(M3593 hydraulic power unit fits in this mounting plate)

Arctic Equipment Manufacturing Corporation
 Hi-Mount Mounting Plate Kit 52377-02-M

R01
 April 2, 2002

52377-02-M-GA M3593 Mounting Plate Kit Galvanized							
Item	Part #	Description	MKB	MKB-QLII	MKPB	MKPB-QLII	52377-02-M-GA M3593 Mounting Plate Kit
1	52162-C	Q-Link I Lift Frame	1				
1a*	52365-D	Lift Frame, QLII		1			
2	52166-C	Q-Link I Spreader Bar					
2a*	52310-D-GA	Ford Q-Link I Spreader Bar Galvanized			1		
2b*	52363-C-G	Spreader Bar QLII Galvanized					
2c*	52364-C-G	Ford Spreader Bar QLII Galvanized				1	
3	52435-N	Grommet 1 ½" x 3/16" x 1 3/4"					2
4	52548-B-GA	Mounting Bracket Support Galvanized					2
5	50069-C-GA	Lift Channel Galvanized		1			
6	52208-B-GA	Light Brace Galvanized		2			
7	HH-00972-090	½" x 1½" Capscrew				4	
8	HH-00457-001	½" Lockwasher				4	
9	HH-00460-002	½" Hexnut				4	
10	HH-00972-153	¾" x 3½" UNF Capscrew				1	
12	HH-00973-007	¾" UNF Thin Collar Locknut				1	
13	52348-A	Mounting Pin		2			
13a	WA-34704	Mounting Pin, QLI	2				

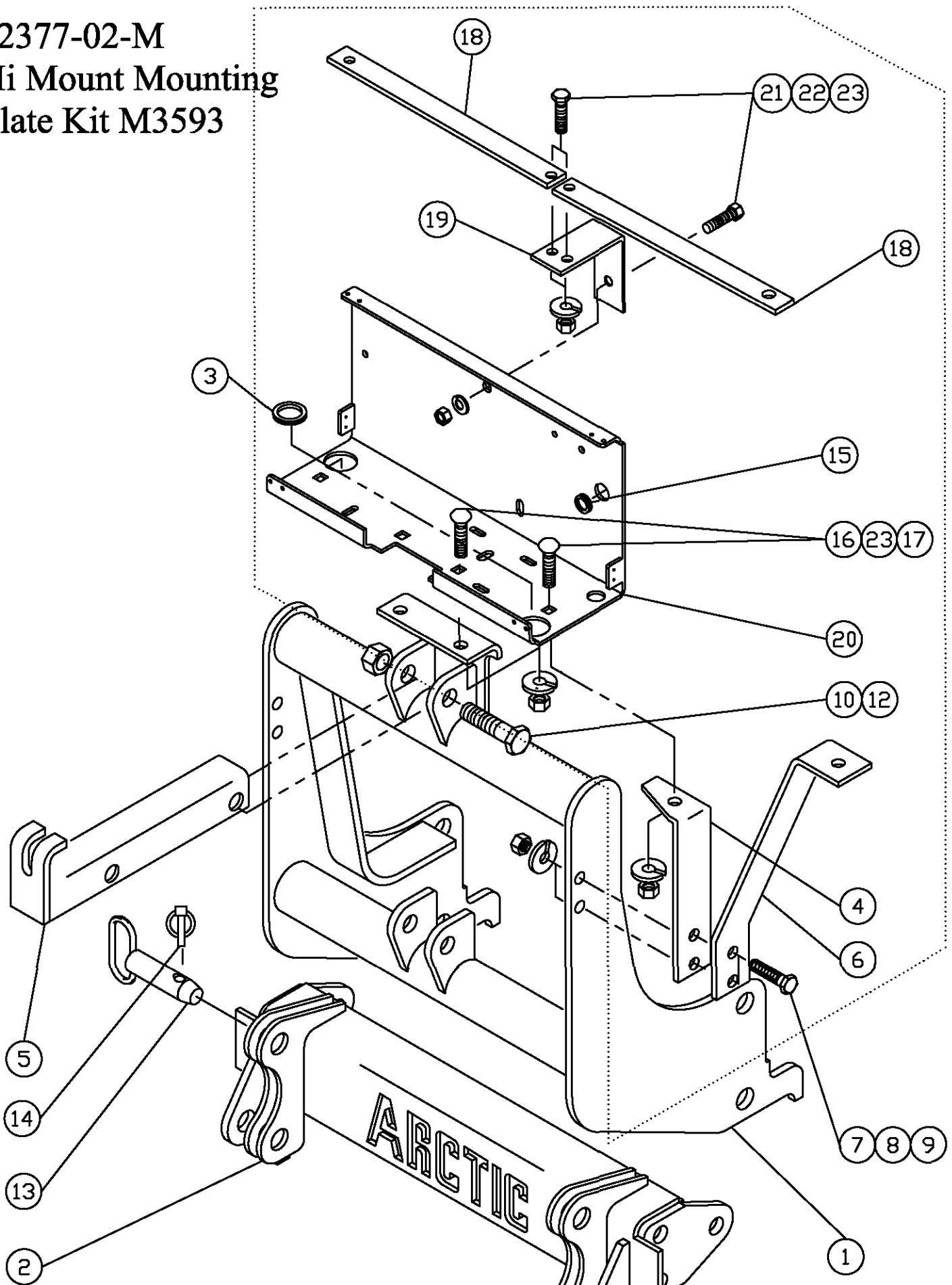
Arctic Equipment Manufacturing Corporation
 Hi-Mount Mounting Plate Kit 52377-02-M

R01
 April 2, 2002

52377-02-M-GA M3593 Mounting Plate Kit Galvanized							
Item	Part #	Description	MKB	MKB-QLII	MKPB	MKPB-QLII	52377-02-M-GA M3593 Mounting Plate Kit
14	50040-A	Lynch Pin		2			
15	52522-N	Grommet 11/16" x 3/16" x 1"					1
16	HH-00971-136	½"-13 x 1 ½" Carriage Bolt					4
17	HH-00294-005	½" - 13 Hex nut					4
18	52513-A-GA	Light Cross Bar Galvanized					2
19	52514-A-GA	Light Support Galvanized					1
20	52377-C	Pump Mounting Plate					1
21	HH-00972-089	½" - 20 X 1 1/4" Hex Head Cap Screw					3
22	HH-00460-002	½" - 20" Hex Head Nut					3
23	HH-00457-001	½" Lockwasher					7
*24	52416-A-GA	Adapter for M3593 Galvanized					1
*26	52375-C	Power unit Cover					1

*Note: These items are not shown on DWG.

52377-02-M
Hi Mount Mounting
Plate Kit M3593



1. Hi mount mounting plate shown by dotted lines (see more about this kit in BOM)

M3593 installation instructions

Heavy Duty Steel 10' Blade

(multiple harnesses 03 gear pump)

M3593 installation instructions

1. Install power unit (1) on mounting plate (see mounting plate drawings) on the side of the truck with most room.
2. Mount solenoid (20) to metal surface in engine compartment bending bracket if necessary. Be sure to locate the solenoid (20) so that there is sufficient cable to reach to both the battery and the power unit (1).
NOTE: Solenoid must be well grounded in order to function properly.
3. Attach red battery cable (11) to the solenoid (20) and to the positive side of battery. Install 78" red cable (10) on other side of solenoid (20) and on positive motor (power unit) stud. Attach black cable (19) to ground motor stud (-) and to truck body. Liberally coat connections with di-electric grease.
4. Secure power unit harness (valve harness) using cable clamp and ¼" x 1" bolt, lockwasher and nut (23)(18)(17).
5. 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.
6. Attach white wire to ground, black wire to positive side of solenoid (20) and brown wire to small terminal on top of the solenoid (20).
7. Neatly secure all excess cables and wires using tie straps. Silicone hole in firewall.
Note: Be sure all cables are properly protected from any sharp edges or hot or moving parts !!
8. Install swivel elbow fittings (8) in ports C1, C2 and C3. Attach straight swivel fittings (9) in one side (two 1/4" ports) of cross-over relief valve body (12), and on the second side of cross over relief valve body(12) (two 1/4" ports) first install to straight fittings 1/4" (22) and male and female quick disconnect (7). Cross over relief valve body (12) needs to be attached to the lift frame (on same side where power unit is installed) using two 1/4" bolts, lockwashers and nuts (16)(18)(17).
9. On the straight end of 29" hose (5) attach female part of quick disconnect (7) and on the straight end of 36" hose (6) attach male part of quick disconnect (7). Install straight swivel 1/4" to the lift cylinder (2).
10. Attach 54" hoses (3) to swivel elbow fittings (8) already installed in ports C1 and C2 and to the one side of cross over relief valve body where straight fittings (9) are attached.

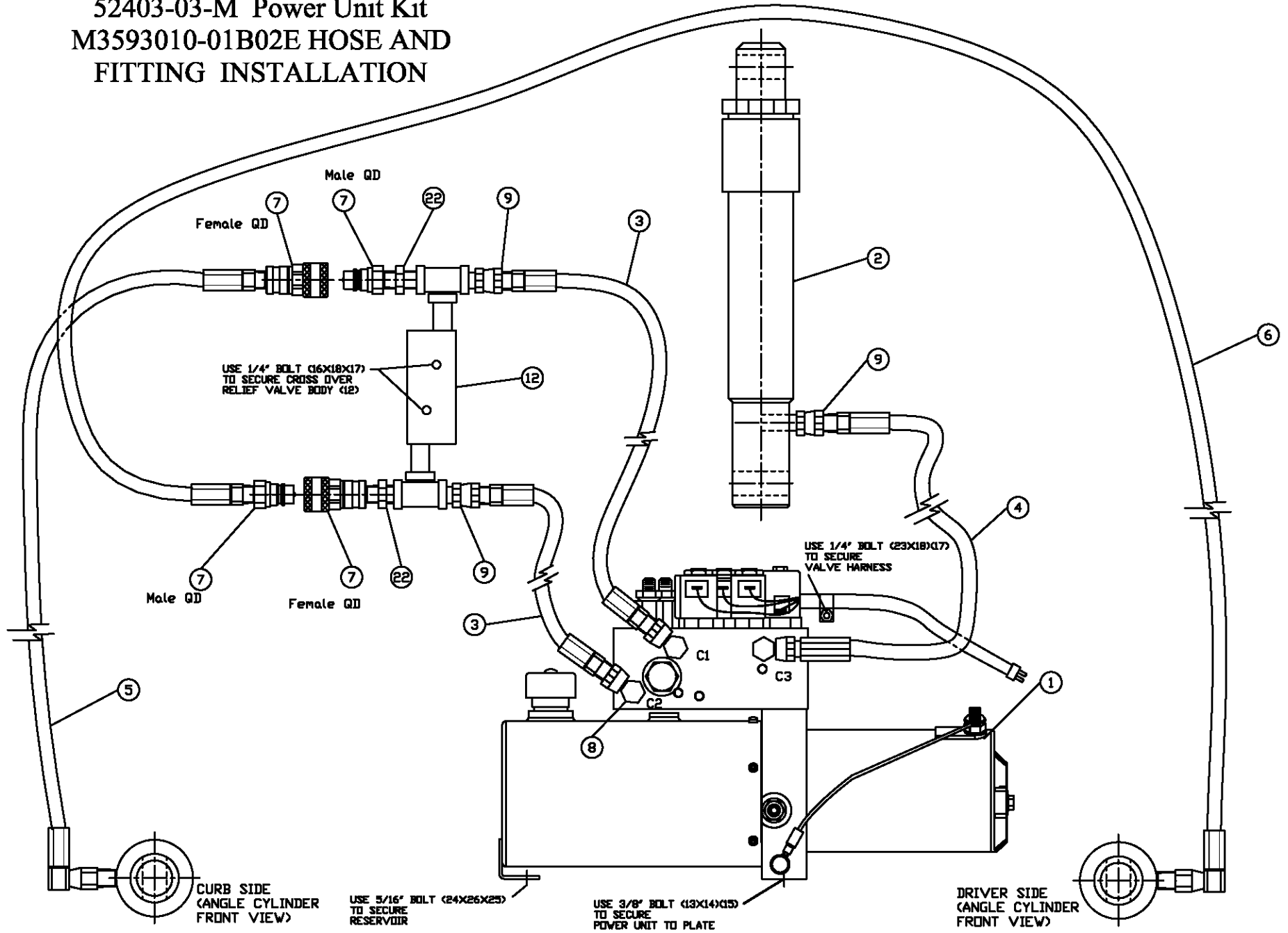
11. Install 29" and 36" hoses (5)(6) as shown on drawing quick coupling side to be attached to cross over relief valve body and other side to the angle cylinders.
12. Install one end of 54" hose (4) in C3 port and second end in lift cylinder (2).
13. Remove vent cap and fill reservoir with **UNIVS J13 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.
14. Manually angle the plow to one side before activating the power unit. This can be easily accomplished, as the hose connections are loose at the angling cylinders.
15. Jog the lift switch until no air is seen in the fluid passing through the loose connection. Tighten fittings.
16. Jog the angle switch in the direction of the retracted cylinder until no air is seen in the fluid passing through the loose connection. Tighten fittings. Fully extend this cylinder.
17. Jog the angling switch in the direction of the retracted cylinder until no air is seen in the fluid passing through the loosened connection. Tighten fittings.
18. Refill power unit so that oil level is $\frac{3}{4}$ " 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.

Power Unit Kit 52403-03-M			
Item	Part #	Description	Quantity
1	M3593	M3593-010-01B02E Power Unit	1
2	CS200-06.00-NRS	2" x 6" Lift Cylinder	1
3	51333-M	1/4" x 54" Hose Assembly	2
4	51334-M	1/4" x 66" Hose Assembly	1
5	51904-M	29" Hose Assembly	1
6	51905-M	36" Hose Assembly	1
7	51003-N	Quick Disconnect	2
8	HH-00790-002	90 Deg Swivel Elbow Fitting	3
9	HH-00794-003	1/4" Pipe to Pipe Internal Swivel Fitting	3

Power Unit Kit 52403-03-M			
Item	Part #	Description	Quantity
10	51335-M	4 Gauge Battery Cable, 78"	1
11	1306340	22" Battery Cable	1
12	FP0081	Crossover Relief Valve	1
13	HH-00293-049	3/8"-16x1 HHCS	2
14	HH-00457-004	3/8" Lockwasher	2
15	HH-00341-004	3/8" Flatwasher	2
16	HH-00293-008	1/4"-20x1.1/2 Hhes	2
17	HH-00294-001	1/4"-20 Hex Nut	2
18	HH-00457-006	1/4" Lockwasher	2
19	RA-504056	36" Black Cable	1
*20	FP17757	Solenoid M3593	1
21	52493-M	Solenoid Mounting Bracket	1
22	HH-00797-003	14" NPTF fitting (male to male)	2
23	HH-00293-006	1/4"-20 x 1" HHCS	1
24	HH-00972-028	5/16" - 24 x 1" HHCS	1
25	HH-00460-005	5/16" -24 Nut	1
26	HH-00457-007	5/16" Lockwasher	1

*FP17757 Replaces FP7518

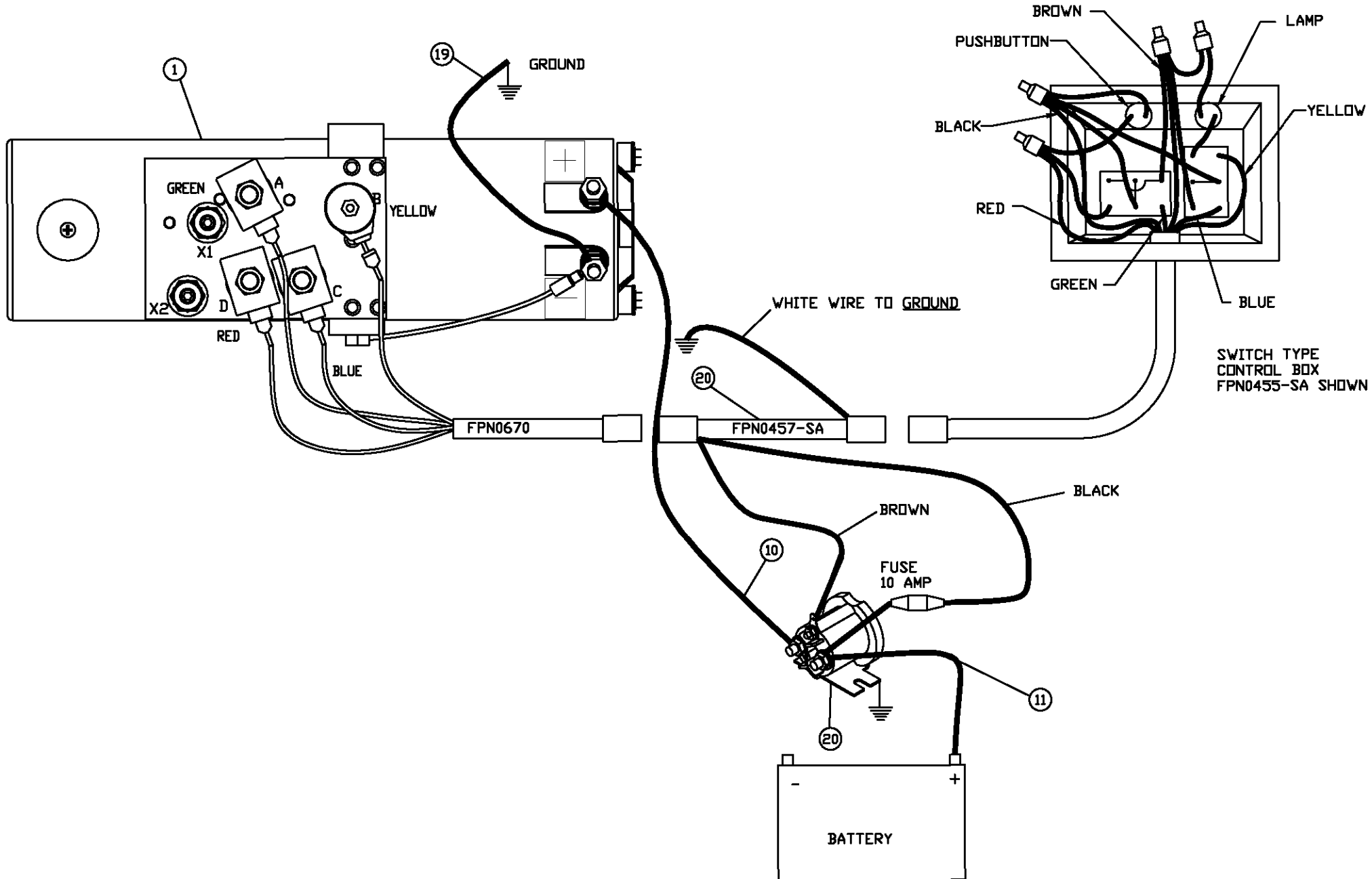
**52403-03-M Power Unit Kit
M3593010-01B02E HOSE AND
FITTING INSTALLATION**



52403-03-M Power Unit Kit

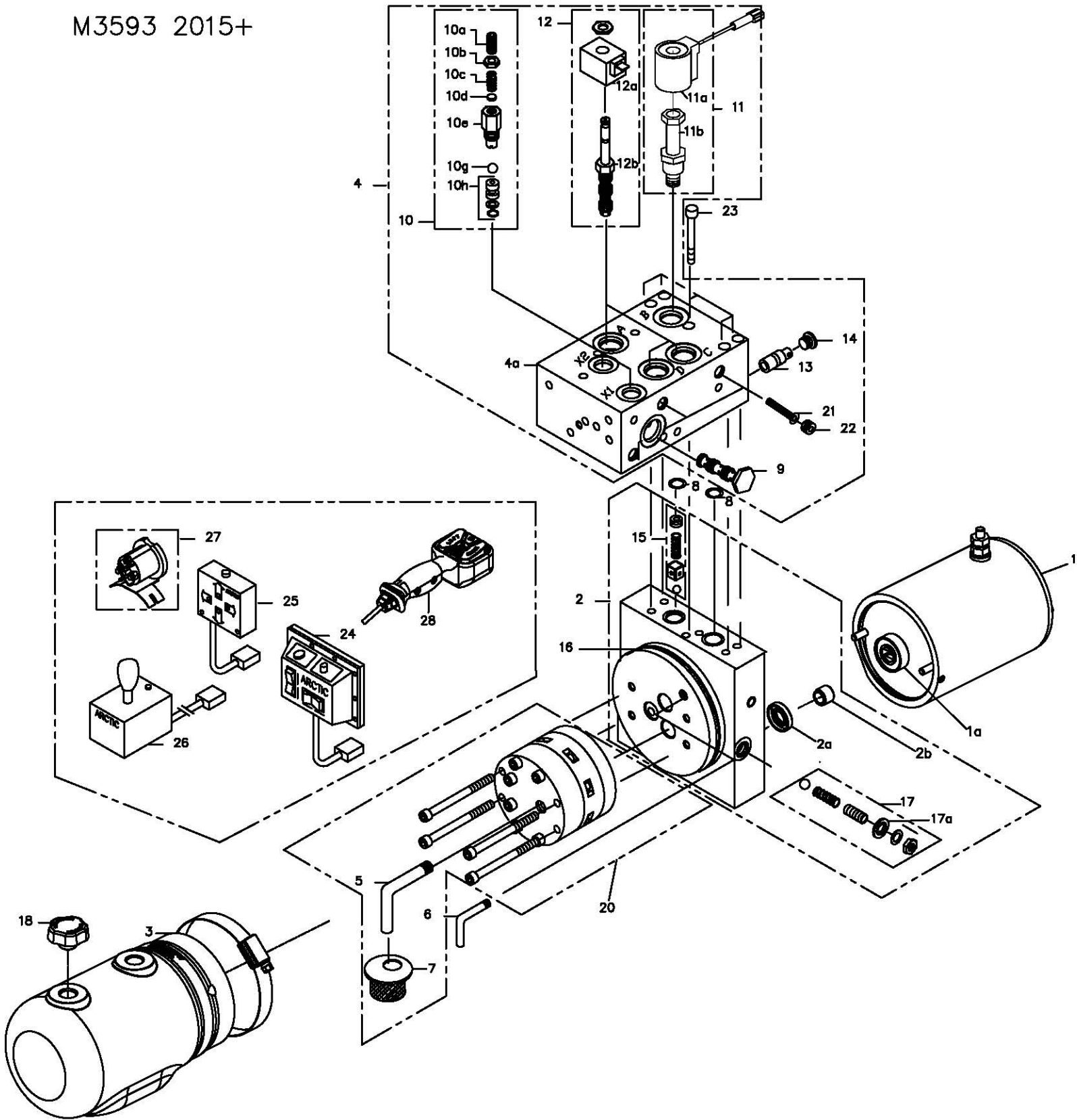
M3593010-01B02E Wiring Installation

NOTES:
 1) THE HARNESSES FPN0670 & FPN0457-SA ARE USED WITH ALL CONTROL BOXES: SWITCH TYPE FPN0455-SA (SHOWN).



M3593 Trip Edge Parts list (2015+)

M3593 2015+



M3593 Parts List			
	Part #	Description	Qty
1	FP8111-I	Motor, 12 VDC	1
	FP18442	Motor, 12 VDC, 2 studs, (prior to 2015)	
1a	FP2318	Motor to Pump Base Bearing	1
2	FP12345-1	Pump base assembly, M3593	1
2a	FP2159	Pump Shaft Seal	1
2b	FP7985	Needle Bearing (Pump Shaft to Pump Base)	1
3	FP6102	Reservoir (plastic)	1
4	FPN0720-SA	Manifold assembly	1
4a	FPN0720-1	Manifold only	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	FP7346	Valve, dual pressure operated check valve	1
10	FP13023	Cross over relief valve assembly	2
10a	FP7899	Screw	1
10b	FP0386	Sealing nut	1
10c	FP0147	Spring	1
10d	FP1288	Plate	1
10e	FP0379	Housing	1
10f	FP0114	O-ring	1
10g	FP0012	Ball	1
10h	FP0378	Seat	1
11	FP0490-D	Valve, #8 2W / 2P, NC pop, c/w male spade terminal	1
11a	FP10861-D	Coil #8 2W / 2P, 12V, c/w male spade terminal	1
11b	FP10907-D	Valve, cartridge, #8, NC poppet	1
12	FP7249-D	Valve, #8, 3W / 2P, spool, 12VDC, c/w spade terminal	3
12a	FP18835-D	Coil, 12VDC, #8, with spade terminal	1
12b	FP0679-D	Valve cartridge, #8 spool, 3W / 2P	1
13	FP1723-2.0	Pressure compensated flow control	1
14	FP3274	Plug, SAE #8	1
15	FP7526	Check valve kit	1
16	FP2352	O-ring 3-5/8 x 3-7/8 x 1/8, -239	1
17	FP7527	Relief valve kit	1
17a	FPN0575	Washer	1
18	FPN0572	Breather	1
19	FP7900	Clamp, (clamp up to 80inlb)	1
20	FP12171-380-SA	Pump assembly kit (relief valve setting 1350psi)	1
21	FP1316	Filter, screen	3
22	FP7624	Screw, filter retainer	3
23	FP7819	Screw, SHCS, 1/4-20 x 2-3/4"	5

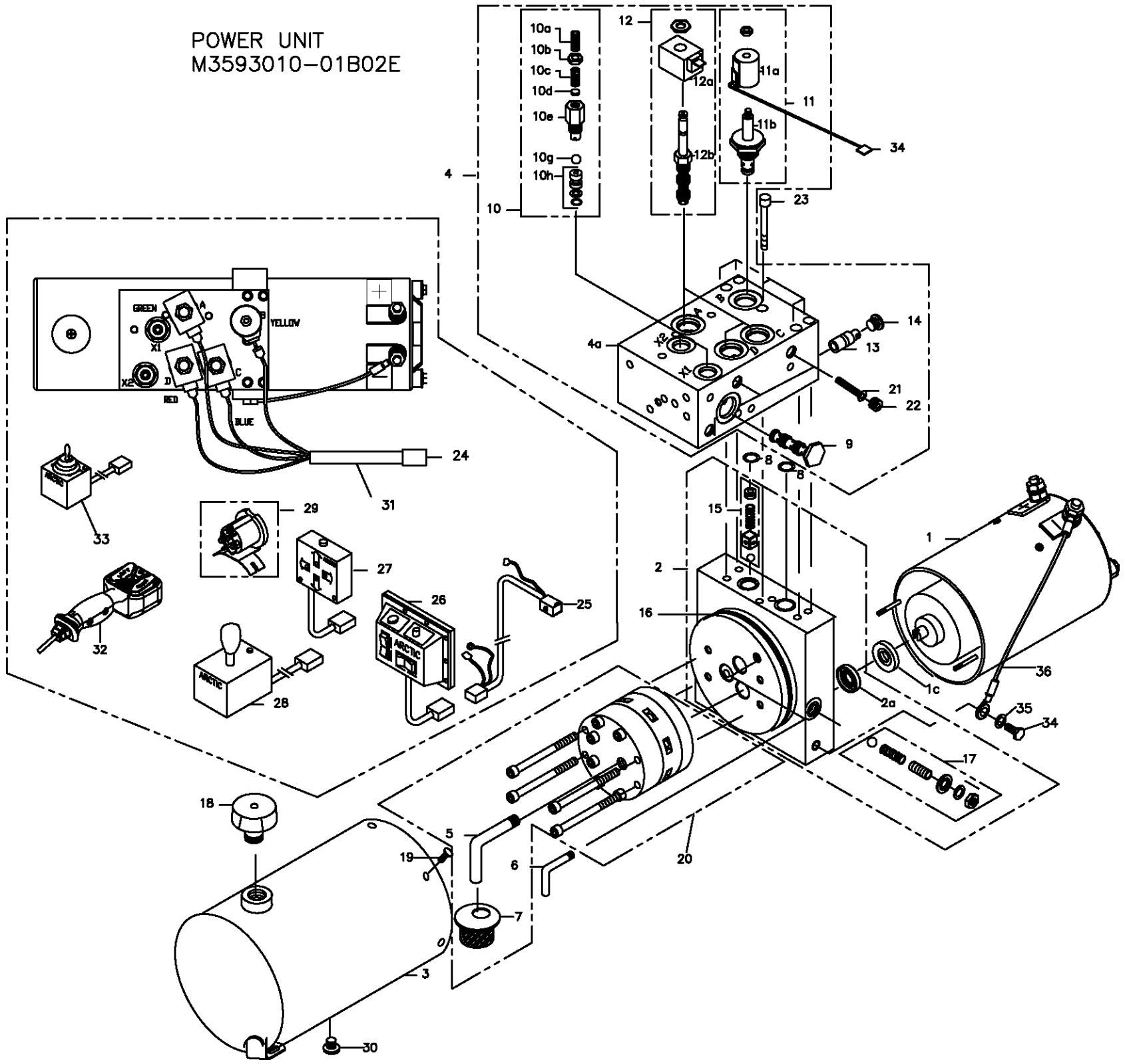
M3593 Parts List

	Part #	Description	Qty
24	FPN0455-SA	Control station, rocker switch	1
25	FPN0478-SA	Control station, touch pad	1
26	52388-M	Large joystick	1
27	FP17757	Solenoid	1
28	53282-N	Handheld controller	1



M3593 Trip Edge Parts list (prior to 2015)

POWER UNIT
M3593010-01B02E



M3593 Parts List

Revision		Qty	Part #	Description
R01	1	1	FP18442	Motor, 12 VDC with ground stud
R03	1a	1	FP8714	Brush Kit for ISKRA Motor (FP18442)
	1b	1	52589-M	Brush Kit for Prestolite Motor (FP8034)
	1c	1	FP2159	Pump Shaft Seal
	1d	1	FP7985	Needle Bearing (Pump Shaft to Pump Base)
	2	1	FP12345-1	Pump base assembly, M3593
	2a	1	FP2318	Motor to Pump Base Bearing
	3	1	FP6661-2	Reservoir, 4-1/2" DIA x 8" Lg
	4	1	FPN0720-SA	Manifold assembly
	4a	1	FPN0720-1	Manifold only
	5	1	FP1209	Suction tube
	6	1	FP13058	Return tube
	7	1	FP1134	Suction filter
	8	2	FP0118	O-ring, 5/8 x 3/4 x 1/16, -016
	9	1	FP7346	Valve, dual pressure operated check valve
	10	2	FP13023	Cross over relief valve assembly
	10a	1	FP7899	Screw
	10b	1	FP0386	Sealing nut
	10c	1	FP0147	Spring
	10d	1	FP1288	Plate
	10e	1	FP0379	Housing
	10f	1	FP0114	O-ring
	10g	1	FP0012	Ball
	10h	1	FP0378	Seat
R03	11	1	FP0490-D	Valve, #8 2W / 2P, NC pop, c/w male spade terminal
R03	11a	1	FP10861-D	Coil #8 2W / 2P, 12V, c/w male spade terminal
R03	11b	1	FP10907-D	Valve, cartridge, #8, NC poppet
R03	12	3	FP7249-D	Valve, #8, 3W / 2P, spool, 12VDC, c/w spade terminal
R03	12a	1	FP18835-D	Coil, 12VDC, #8, with spade terminal
R03	12b	1	FP0679-D	Valve cartridge, #8 spool, 3W / 2P
	13	1	FP1723-2.0	Pressure compensated flow control
	14	1	FP3274	Plug, SAE #8
	15	1	FP7526	Check valve kit
	16	1	FP2352	O-ring 3-5/8 x 3-7/8 x 1/8, -239
	17	1	FP7527	Relief valve kit
	17a	1	FPN0575	Washer
	18	1	FPN0572	Breather
	19	6	FP7703	Screw, 10-24 x 3/8 self tapping
	20	1	FP12171-250-SA	Pump assembly kit
	21	3	FP1316	Filter, screen
	22	3	FP7624	Screw, filter retainer

M3593 Parts List				
Revision		Qty	Part #	Description
	23	5	FP7819	Screw, SHCS, ¼-20 x 2-3/4"
	24	1	FPN0670	Harness valve section
	25	1	FPN0457-SA	Harness center section
	26	1	FPN0455-SA	Control station, rocker switch
	27	1	FPN0478-SA	Control station, touch pad
	28	1	52388-M	Large joystick
R02	29	1	FP17757	Solenoid, switch
	30	1	53220-N	Plug, SAE #4 (7/16")
	31	1	FPN0668	Cable clip, ½" cable & ¼ bolt
	32	1	53282-N	Handheld controller
	33	1	53185-N	Small joystick
	34	1	HH-00293-028	5/16 X ¾ NC bolt
	35	1	HH-00457-007	5/16 Lock washer
	36	1	53329-A	Motor to Base Ground Wire

- R01: FP18442 was FP8034
- R02: FP17757 was FP7518
- R03:
 - FP0490-D was FP0262-P
 - FP10907-D was FP0307 *note: if Deltrol cartridge with 3/8 stem FP0307 is replaced with Deltrol cartridge with ½ stem FP10907-D, coil must also be replaced with FP10861-D
 - FP10861-D was FP0496 *note: If coil FP0496 is replaced with FP10861-D, Deltrol cartridge with 3/8" stem must also be replaced with Deltrol ½ stem FP10907-D
 - FP7249-D was FP7249
 - FP0679-D was FP0679 *note: If Parker cartridge FP0679 is replaced with Deltrol cartridge FP0679-D, Parker coil must also be replaced w/ Deltrol coil FP18835-D
 - FP18835-D was FP10977

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.

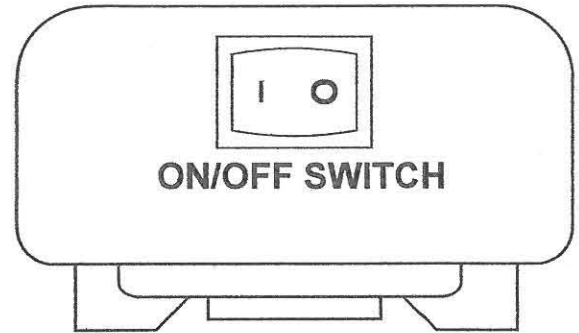
Blade Operation Time Outs

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.

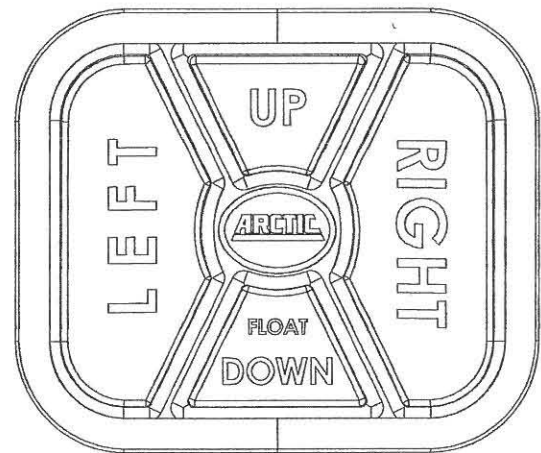
All functions will time out after 8.0 seconds.

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 M3593

- 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:

- 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 230 AMP (AMP draw of motor should be measured at maximum raise or maximum angle when motor is running at pressure setting at 1350 psi).

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

-Relief valve setting 1350 psi (for 03 gear pump 2250 psi).

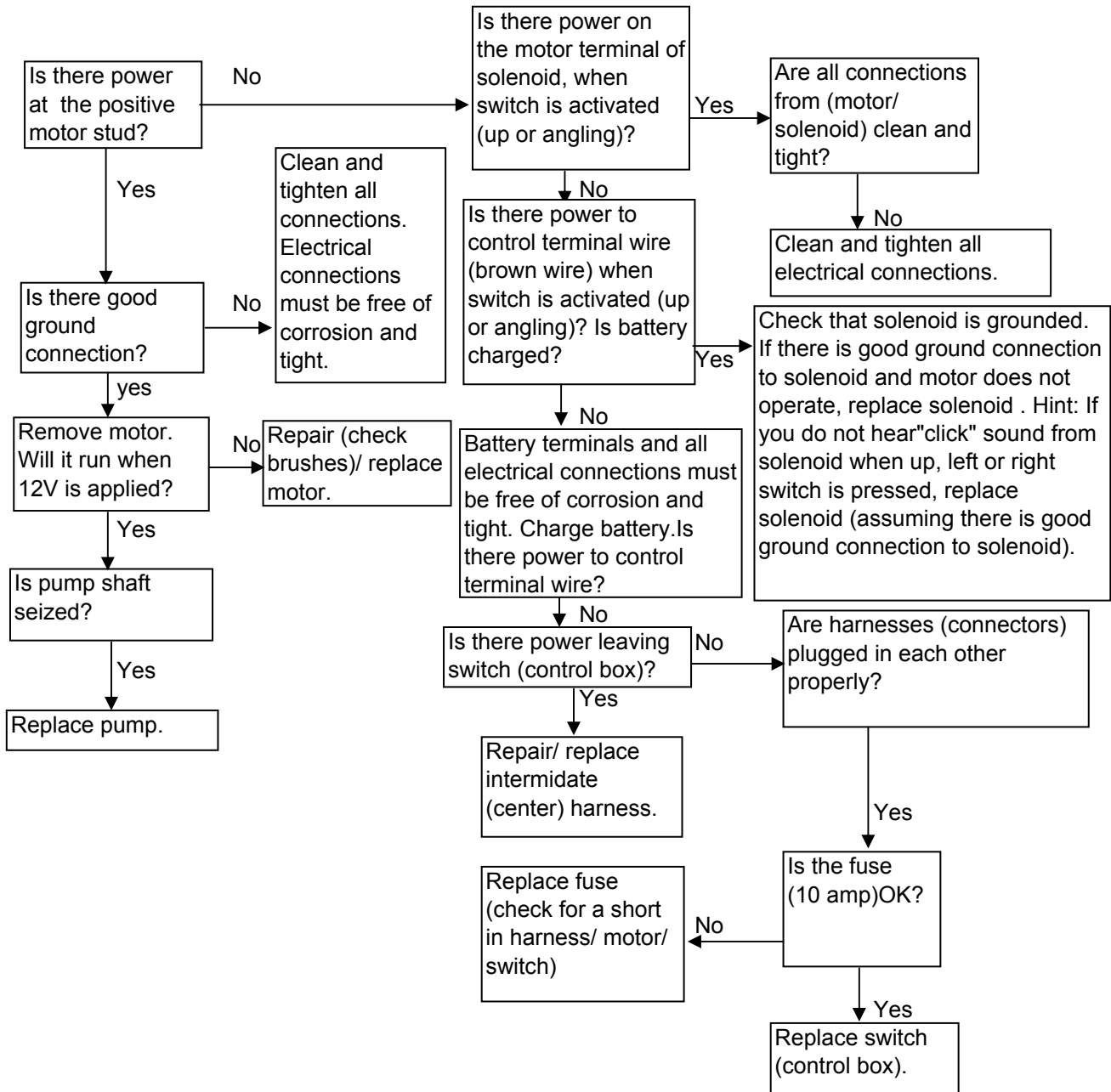
-X-over relief valve setting 3000 psi.

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

Troubleshooting tips M3593:

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 1350 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).
4. AMP draw of motor should be measured at maximum raise or maximum angle when motor is running at 1350 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.

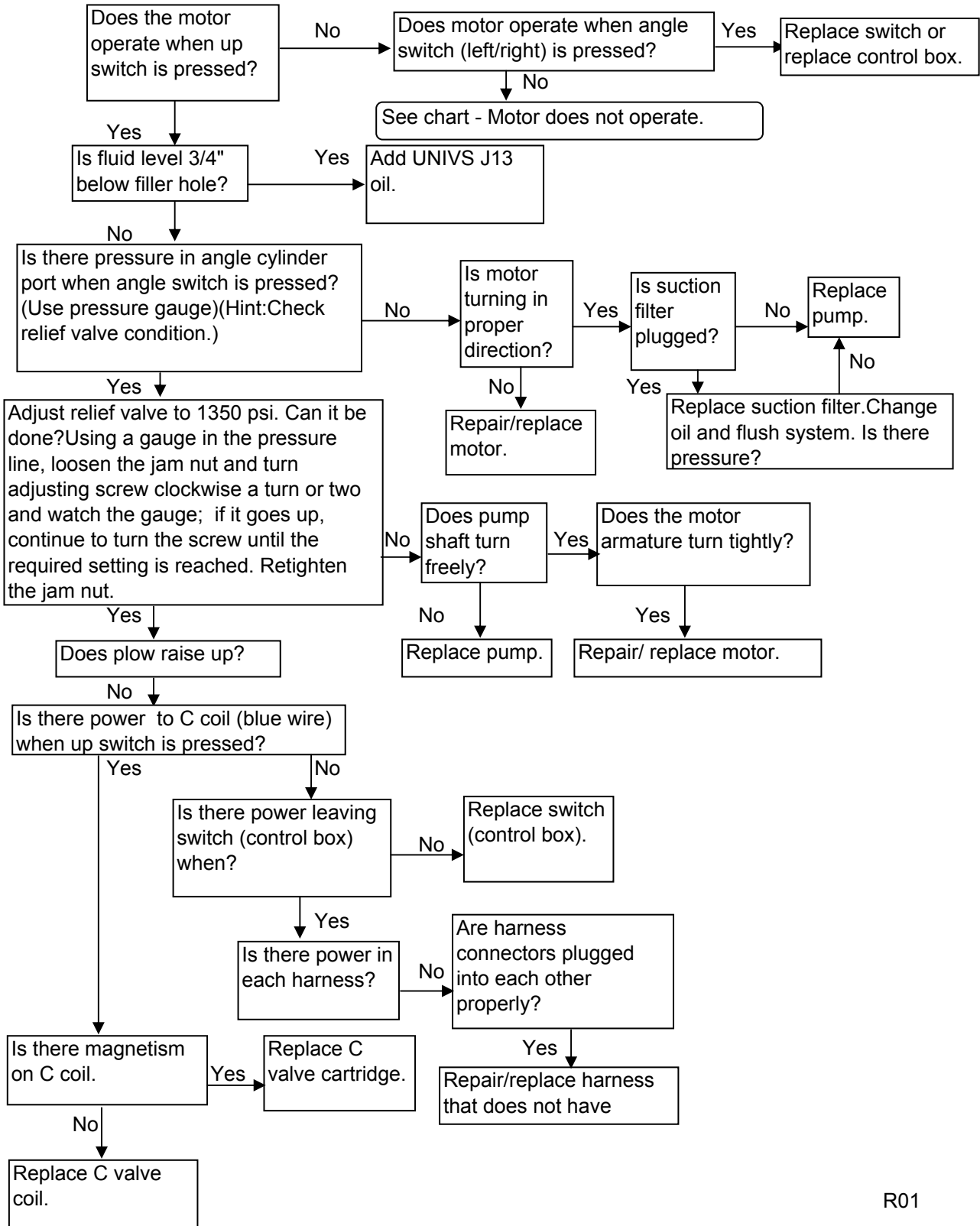
MOTOR DOES NOT OPERATE M3593



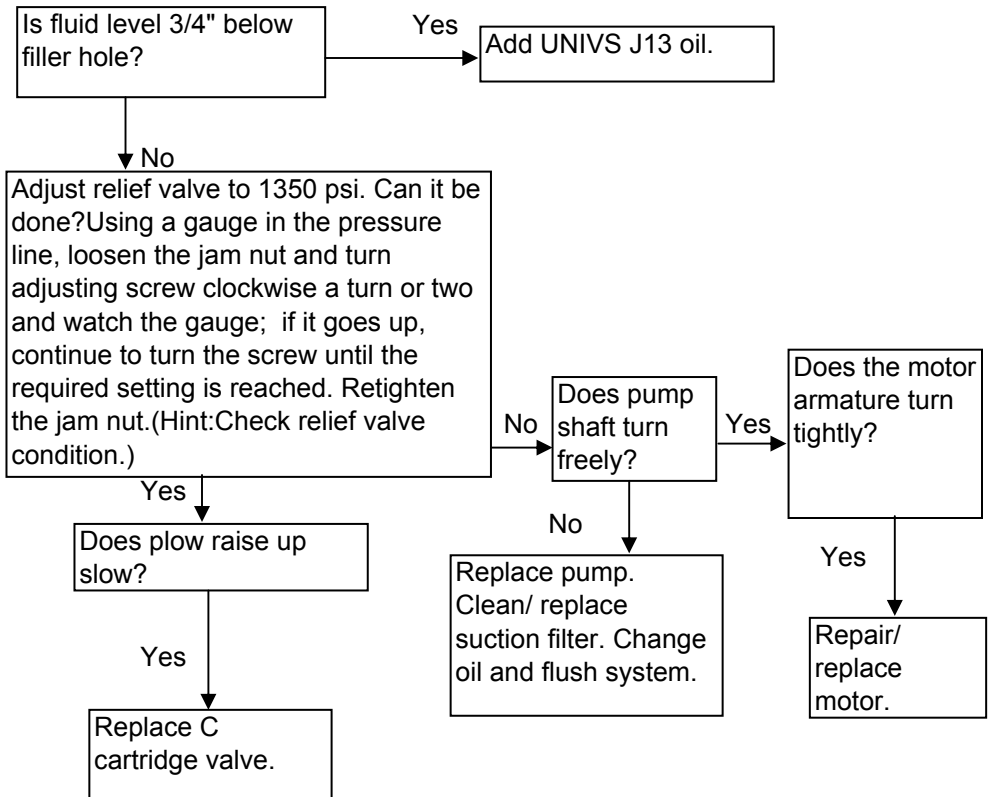
MOTOR OPERATES CONTINUOUSLY M3593

If motor operates continuously, change solenoid.

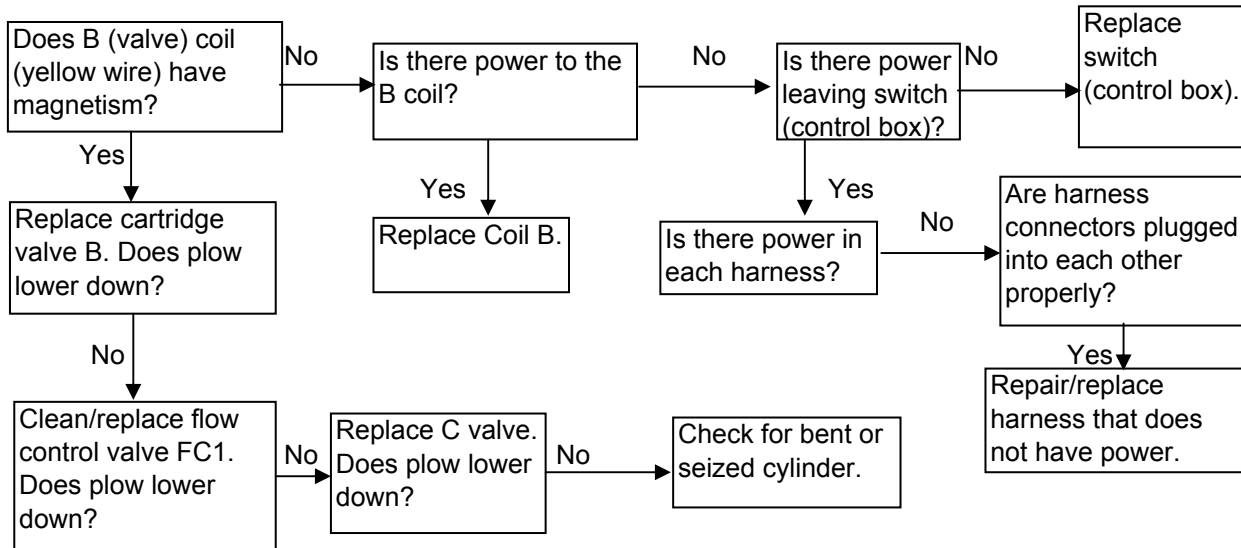
SNOW PLOW DOES NOT RAISE M3593



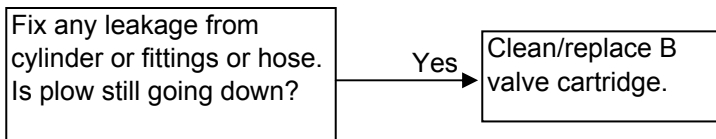
SNOW PLOW RAISE VERY SLOW M3593



SNOW PLOW WILL NOT LOWER M3593



SNOW PLOW LEAKS DOWN M3593



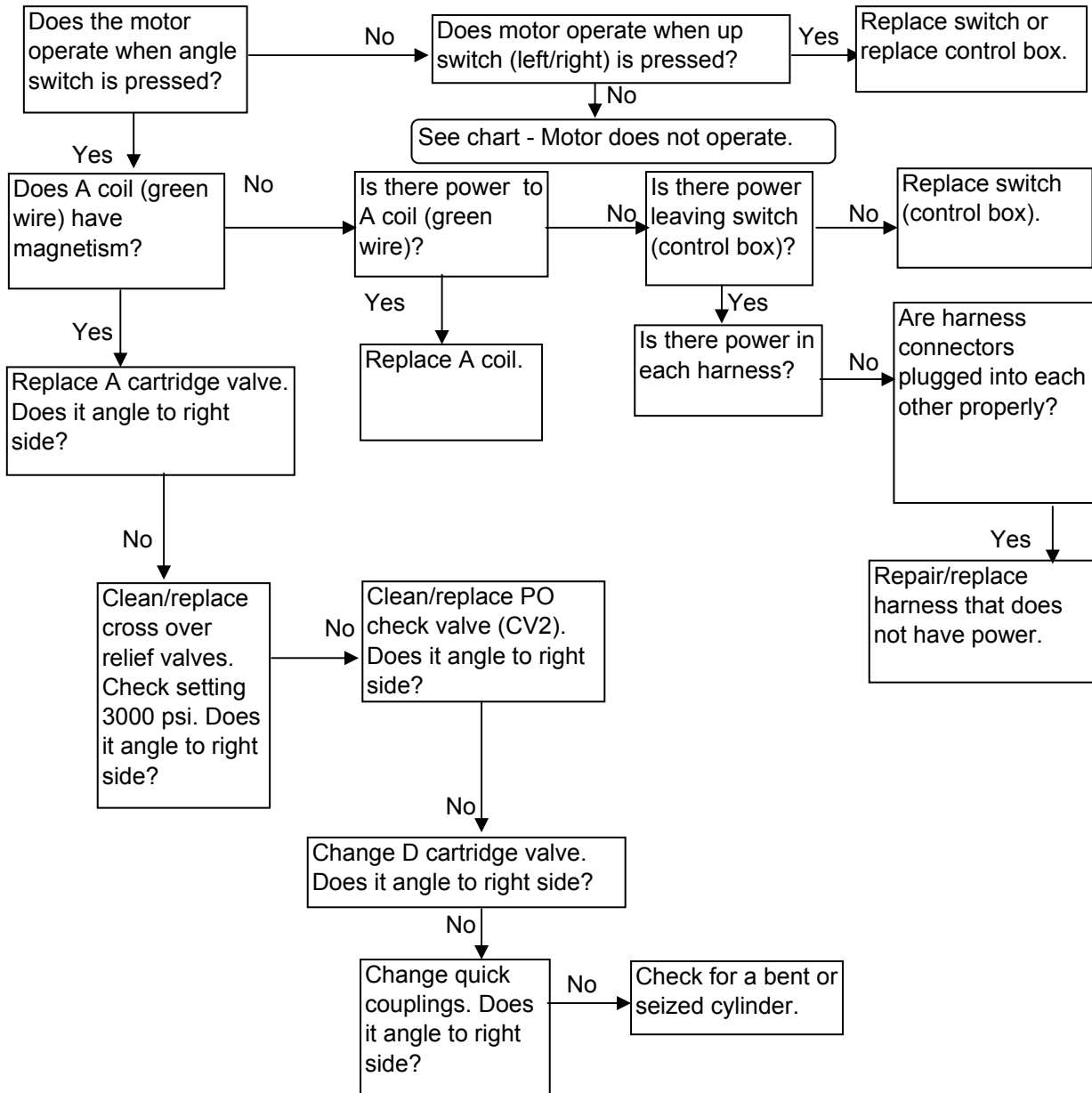
SNOW PLOW ANGLES BEFORE GOING UP WHEN UP SWITCH IS PRESSED M3593

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 IS FULLY ANGLED GOES UP (WHEN ANGLE SWITCH IS PRESSED) M3593

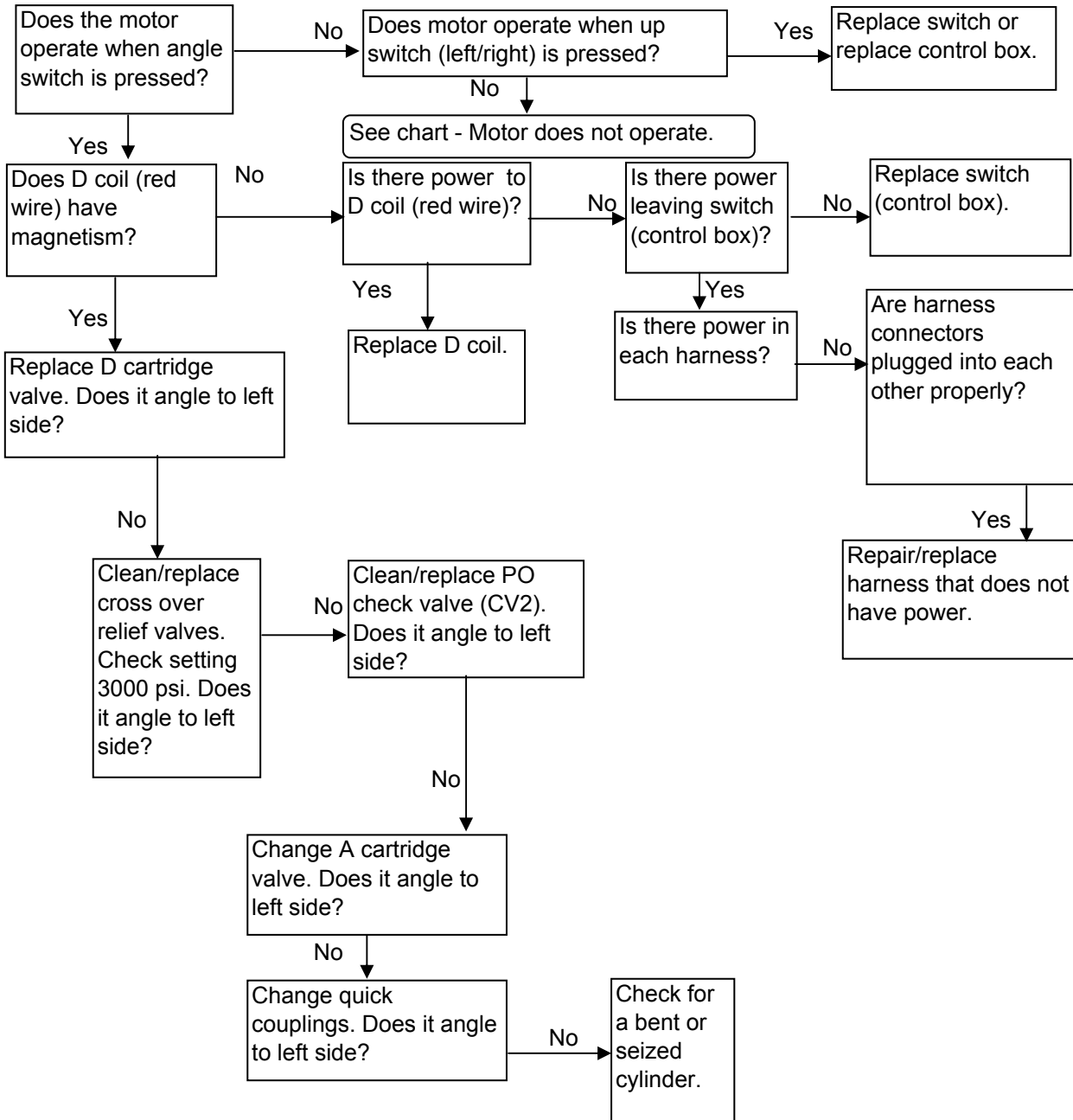
Change C Valve cartridge.

SNOW PLOW DOES NOT ANGLE TO RIGHT SIDE M3593



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 M3593



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

