



# MB Companies, Inc. MSV Multi Service Vehicle

## *Operation and Maintenance Manual*



### *Hydraulic Angling Plow Attachment for M-B Companies' Multi-Service Vehicle (MSV)*

**QUALITY YOU CAN SEE, PEOPLE YOU CAN TRUST™**

***Attachments Division, Brush Replacements, Administration***

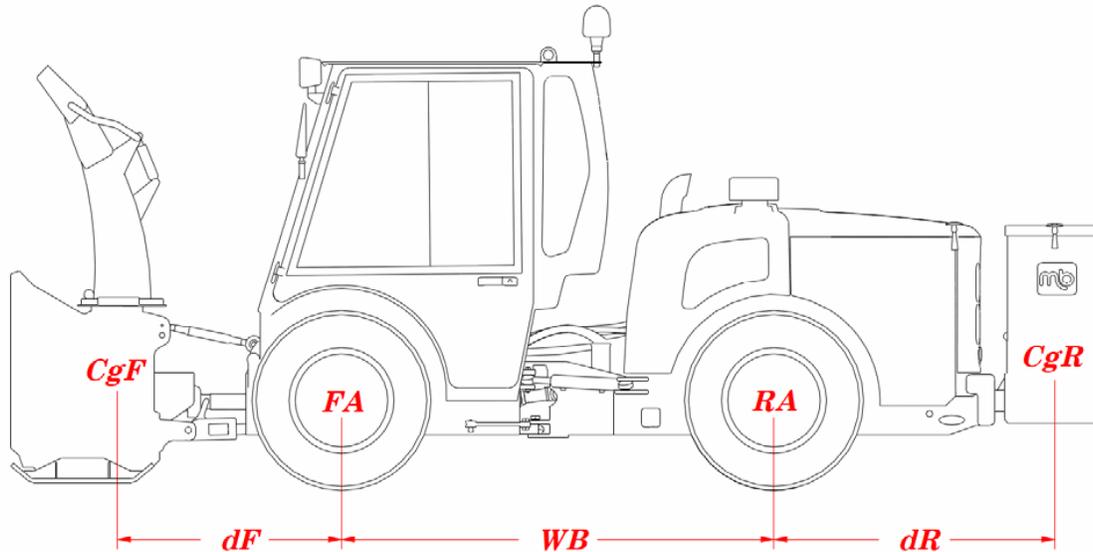
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# Ballast Calculations

Adding Attachments will affect the stability, performance, characteristics, and reduces safe operating grades.

- Never exceed the max rating of the weakest component: GVWR, max axle ratings, or tire capacity.
- All calculations should be verified by weighing the MSV with the attachments on a certified scale.
- Attachments such as sanders and sprayers should be checked when filled with desired particulate.
- A scale must be used to determine axle weights when using a dump body.
- Ballast Types include: Fluid filled tires, wheel weights, or another attachment.
- Never operate with less than 25% of the total load on the front axle.

**Caution: Whenever an attachment is mounted to the rear of the vehicle front ballast weight must be added.**



CW= Curb Weight for MSV-100501; 6620, Front-2140 lbs, Rear-4480 lbs

TW =FA+RA including attachments and or ballast.

WB = Wheel Base; 81in for MSV

TFA= Total Front Axle Weight

TRA= Total Rear Axle Weight

CgF= Weight at the center of gravity of front attachment or ballast

CgR= Weight at the center of gravity of rear attachment or ballast

FA = Front Axle

RA = Rear Axle

dF = dimension from center of front axle to Center of gravity on front attachment or ballast

dR = dimension from center of rear axle to Center of gravity on rear attachment or ballast

$$TFA = \frac{[CgF \times (dF + WB) + (2140 \times WB) - (CgR \times dR)]}{WB}$$

$$TW = FA + RA$$

$$TRA = TW - TFA$$

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# Safety



## WARNING:

Read this manual and any attachment owner's manuals before using this equipment. Failure to do so can result in serious injury or death. Call your dealer if you have any questions.

## HAZARD DEFINITIONS

For your safety, and to assure the long life of your equipment, be sure you understand the following signal words which will be seen throughout this manual:

- **DANGER:** Alerts you to an immediate hazard, which will always result in severe personal injury and possible death if it is not avoided.
- **WARNING:** Alerts you to a hazard which will result in a serious personal injury or possible death in some cases, if not avoided.
- **CAUTION:** Alerts you to a potential hazard which may result in a serious personal injury if not avoided. It also alerts against an unsafe practice that will permanently damage equipment or property.
- **IMPORTANT:** Points out a proper use that will avoid damage to the machine, and/or will extend the life of its parts.
- **NOTE:** Suggests how to use or adjust the equipment for best product results.

## IDENTIFICATION OF SAFETY LABELS

Safety labels are strategically located around the attachment to prevent potential hazards. The labels are a permanent part of the equipment. If they become separated from the product or illegible, contact M-B Companies Inc. for no-cost replacements. Understand the information the labels are communicating before operating or maintaining the equipment.

See Parts List section for safety labels associated with this equipment.

## GENERAL SAFETY

- This manual should be available during operation.
- Extra copies of this manual are available for purchase through the M-B Customer Service Department.
- To avoid serious injury or death, do not modify equipment. Any modifications made to equipment can be dangerous and can void equipment warranty.
- Never defeat a safety device to make a task easier.
- Never deface or remove factory-installed safety labels. If a label ever becomes lost, damaged, or illegible, report this condition to a supervisor and obtain a replacement label from the Customer Service department of M-B Companies, Inc.
- Always wear proper apparel when operating equipment; safety glasses, face shield or goggles, ear protection, and dust mask. Tie hair back. Never wear loose clothing or jewelry that could get caught in moving parts.
- Never operate equipment with covers or guards removed. Rotating parts can cause severe injury. Keep hands, feet, hair, jewelry and clothing away from all moving parts.
- Understand the operation of hydraulic and pneumatic controls.
- Understand which adjustments are operator and which are maintenance adjustments.
- Always shut OFF equipment when left unattended.
- Never operate or work around equipment if under the influence of alcohol, drugs or medications.

## **PRE-START-UP SAFETY**

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- Install any covers or guards which may have been removed for shipping purposes.
- Before starting equipment, walk around equipment, making a visual inspection that all safety devices are properly installed and secured.
- Check that all hardware, fasteners, hydraulic fittings, etc. are in good condition and properly fastened. Replace any fatigued or damaged items with proper replacements.
- Personnel who are not required to be in the work area should be kept away. Never start the equipment unless you are absolutely certain that everyone in the area is clear of the machine and aware it is being started.
- Follow the manufacturer's recommended start-up procedure.

## **PRESSURIZED SYSTEMS SAFETY**

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- Do not disassemble a pressurized system unless properly trained and equipped with adequate tooling.
- Familiarize yourself with the proper method of relieving pressure from pneumatic or hydraulic systems. Never perform maintenance on, or disassemble, pressurized systems without first locking out power to these systems and then relieving pressure to them.
- Oils and fluids can be very hot under pressure. Use caution and allow the system to cool before beginning maintenance work.
- Never operate or pressurize one of these systems with worn or damaged components. Replace hoses, fittings, valves or other components which appear defective.
- Never adjust pressurized systems beyond recommended levels to achieve higher operating pressures.

## **THE MANUAL**

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It is the purpose of this manual to provide complete instructions for service, maintenance disassembly, repair, and installation of the mechanical components for the M-B Multi-Service Vehicle Attachment.

### **Directional Reference**

All reference to left, right, front, or rear are given from the operator in the operator position and facing the direction of your unit.

## **REQUIRED OPERATOR TRAINING**

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Original purchaser of this unit was instructed by the seller on safe and proper operation. If unit is to be used by someone other than original purchaser; loaned, rented or sold, ALWAYS provide this manual and any needed safety training before operation.

The Operator Must Understand:

- How to operate all controls
- The functions of all controls
- How to STOP in an Emergency
- Speed Ranges



## WORK AREA

- ALWAYS check overhead and side clearances carefully before operation. ALWAYS be aware of traffic when operating along streets and curbs.
- Keep area of operation clear. Stay alert for hidden hazards.
- DO NOT run engine in an enclosed area. Always provide good ventilation.
- Abnormal Vibrations are a warning of trouble. Striking a foreign object can damage unit. Stop unit and engine. Wait for all moving parts to stop. Inspect unit and make any necessary repairs before restart.
- Protect eyes, face, and head from objects that may be thrown from unit. Wear appropriate hearing protection.
- Avoid Sharp Edges. Sharp edges can cause serious injury. Wear gloves to service unit when handling sharp edges.
- ALWAYS keep hands and feet away from all moving parts during operation. Moving parts can cause serious injury or death.
- Be aware of the surroundings. Look for blind spots from which pedestrians or vehicles may suddenly appear.
- Locate the emergency stop on the vehicle.
- Do not operate in crowded pedestrian areas. This equipment may cause serious injury or death if safety rules are not followed.
- The M-B Multiple Service Vehicle (M-B MSV) uses a level gauge. The gauge helps the operator determine the angle or slope of the surface being driven on. The gauge shows percent of grade.



### WARNING:

During normal operation the M-B MSV must not exceed 30% grade to either side. Adding any attachment to the M-B MSV will affect the safe maximum grade.



Figure 1

## MAINTENANCE SAFETY

- Do not remove guards while operating. After maintenance work, be sure all guards and other safety devices are installed and in proper working order.
- Never clean, lubricate, or adjust equipment while it is moving, has the potential to move or when engine is running.
- Always release pressure from pressurized systems before disassembling.
- Allow ample time for heated components to cool before working on or working close to them. Use temperature sticks or other appropriate devices to test temperatures.
- ALWAYS maintain unit in safe operation condition.
- Check the conditions of the unit at the end of each day and repair any damage or defects.
- Keep all fasteners properly torqued and in safe operating condition.
- Before maintenance, adjustments, or service (except where specifically recommended), shut off engine, and secure from moving.

### Storage

ALWAYS clean and lubricate equipment before extended storage. Clean and lubricate equipment every 6 months during prolonged storage.

## WELDING

Before welding on a machine/unit equipped with an electronic engine, the following precautions should be observed:

- Turn the engine control switch to the OFF position.
- Disconnect the negative battery cable at the battery. If a better disconnect switch is provided, open the switch.
- Connect the welder ground cable directly to the member to be welded. Place the ground cable clamp as close as possible to the weld to reduce the possibility of welding current damage to bearings, hydraulic components, electrical components and ground straps. Do not use electrical components, the ECM, or electronics ground stud for grounding of the welder.
- Protect wiring from welding debris or splatter.

# General Information

## INTRODUCTION

Thank you for choosing M-B Companies, Inc. as your equipment manufacturer and supplier. As part of our commitment to total customer satisfaction, we have strived to ensure that the information contained within this manual is complete and representative of the equipment you have purchased. The manual cannot, however, anticipate every possible contingency to be met in the installation, operation and maintenance for your equipment. If you require additional information not included in this manual, please contact our Service Department.

## MACHINE IDENTIFICATION

Each machine manufactured by M-B Companies, Inc. has an identification plate mounted to it as shown in Figure 2. This plate contains the serial number of your M-B equipment. Copy the information from the plate on your equipment into the appropriate space in Figure 2. This information is important to have available when communicating with M-B.



Figure 2

## CUSTOMER SERVICE

The serial number on your equipment is essential for proper service support. When contacting M-B Companies regarding service support, always provide the product serial number. This number is located on the identification plate mounted on your equipment, and should also have been recorded in the Machine Identification section.

Customer Service Department  
c/o M-B Companies, Inc.  
1615 Wisconsin Ave.  
PO Box 200  
New Holstein, WI 53061  
Phone: 1-888-558-5801 or 1-800-558-5800  
Fax: 920-898-4588



### **Manufacturer's Limited Warranty**

The M-B Companies, Inc. warrants all its M-B MSV products to be free from defects in materials and workmanship for 12 months, to begin with the delivery of said product to its original owner. This warranty is not transferable without the written consent of M-B.

M-B will, at its own expense and without expense to the owner, replace all failed parts for and make all repairs that may be required by reason of workmanship or material in any part of the assembly of the product and associated components.

Upon notice in writing, M-B will promptly repair or replace all defective or damaged items delivered under the contract. The batteries, tires, rubber materials, brushes and material normally consumed in operation, and major components such as engines, air compressors, and hydraulic pumps and motors are excluded from this warranty but shall, in any event, be guaranteed by M-B to the extent of any warranty received from its supplier.

Any components replaced under warranty will be warranted for the remainder of the original warranty. Replaced components do not restart the warranty period.

If requested by M-B, products or parts for which a warranty claim is made are to be returned, transportation prepaid, to M-B's factory. Any improper use, operation beyond capacity, or substitution of parts not approved by M-B, or alteration or repair by others in such a manner as in M-B's judgement materially and/or adversely affects the product shall void this warranty.

This warranty does not apply to defects caused by damage or unreasonable use while in the possession of the owner, including but not limited to: failure to provide reasonable and necessary maintenance, normal wear, routine tune-ups or adjustments, improper handling or accidents, operation at speed or load conditions contrary to published specifications, improper or insufficient lubrication, or improper storage.

The M-B Companies, Inc. shall not be liable for consequential damages of any kind, including, but not limited to, consequential labor costs or transportation charges in connection with the replacement or repair of defective parts, or lost time or expense which may have accrued because of said defect.

THE M-B COMPANIES DO NOT MAKE ANY WARRANTY OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE. THE ONLY WARRANTY MADE BY M-B COMPANIES IS AS SET FORTH HEREIN. THIS WARRANTY CANNOT BE EXTENDED, BROADENED OR CHANGED EXCEPT IN WRITING BY AN AUTHORIZED OFFICER OF M-B COMPANIES, INC.

(M-B's total liability hereunder in no event shall exceed the purchase price of the product.)

# Attachment Information

## INTRODUCTION

This section provides information that is specific to the M-B MSV Angling Plow. Each sub-section describes a component or system to give the reader a reasonable understanding of the topic. If a more in-depth knowledge is needed, contact M-B Companies Customer Support.

## SPECIFICATIONS

Model	APA50	APA60	APA72	APA84	APA96	APA120
Weight - lbs (kg)	430 (195)	500 (227)	570 (259)	640 (290)	710 (322)	780 (354)
Clearing Width when Angled 30° - inches (cm)	43 (109)	52 (132)	62 (157.5)	73 (185.4)	83 (211)	104 (264)
Blade Width - inches (cm)	50 (127)	60 (152.4)	72 (182.8)	84 (213.3)	96 (243.8)	120 (304.8)

## DIMENSIONS

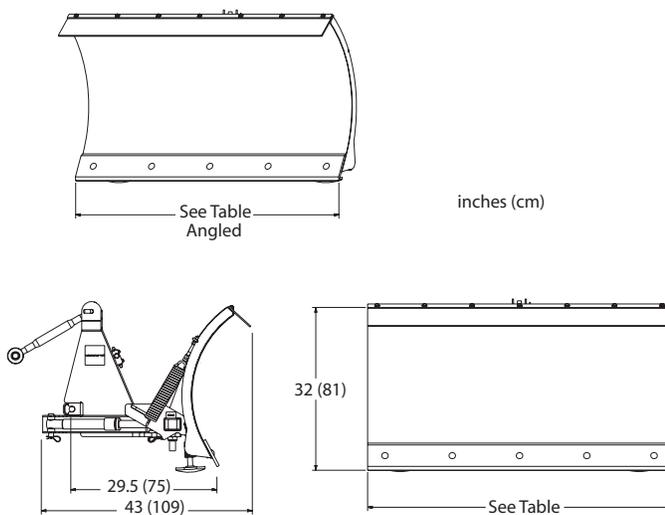


Figure 3

## LAYOUT OF MACHINE

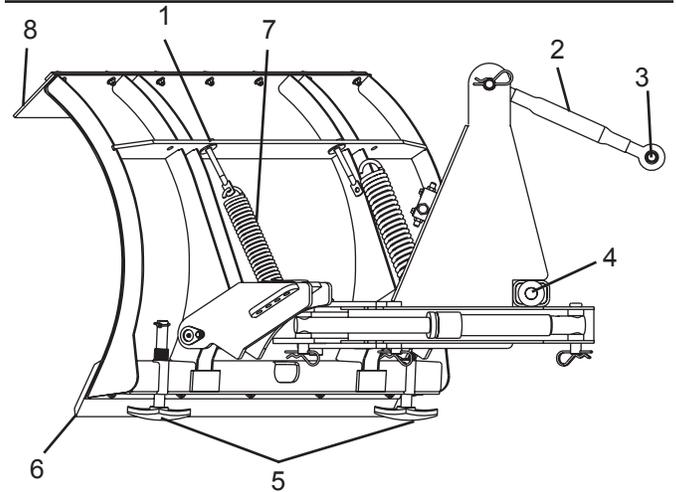


Figure 4

1. Trip Spring Adjustment
2. Adjusting Link
3. Top Hitch Point
4. Bottom Hitch Point
5. Skid Shoe
6. Cutting Edge
7. Trip Spring
8. Deflector



# Operation

## CONNECTING TO THE MSV

The Angling Plow attachment is connected to the MSV by a three-point hitch. Hydraulic connections are used to position the moldboard.

### Joystick Layout - Angling Plow

The joystick layout screen in the attachment section of the MDC is used to display all the joystick functions when the Plow attachment is used. Use the Attachment Selection screen to change Default to Yes (Figure 5). The joystick functions will perform as shown in Figure 6.

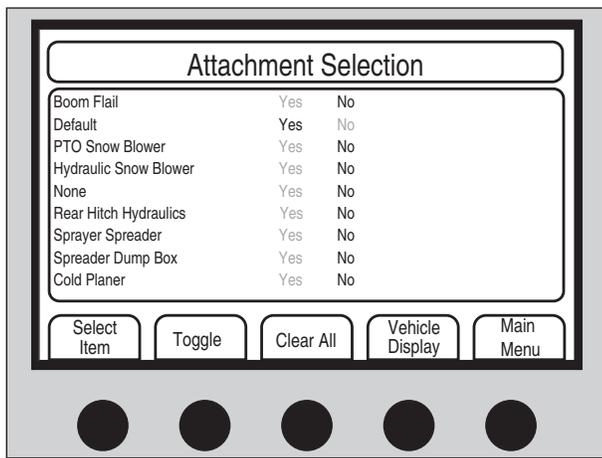


Figure 5

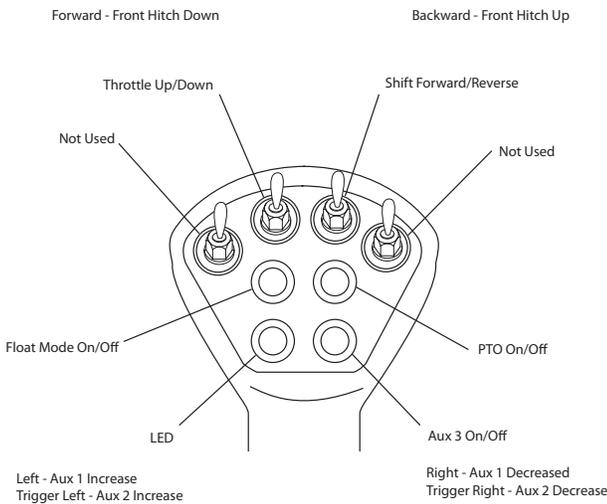


Figure 6

If the Spreader and/or other rear attachments will also be mounted on the M-B MSV, other selections may be used. The joystick functions will perform as shown in Figure 7 through Figure 10.

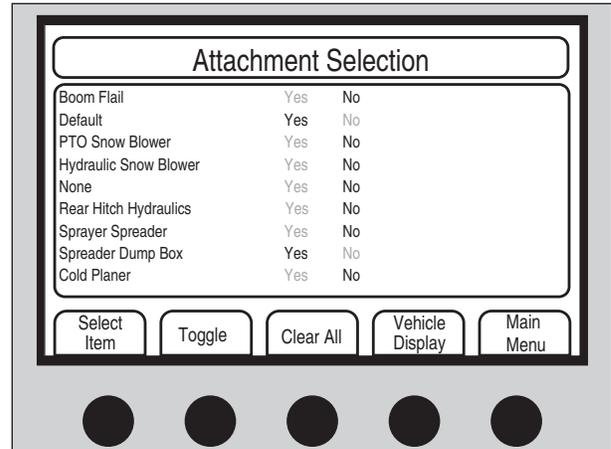


Figure 7

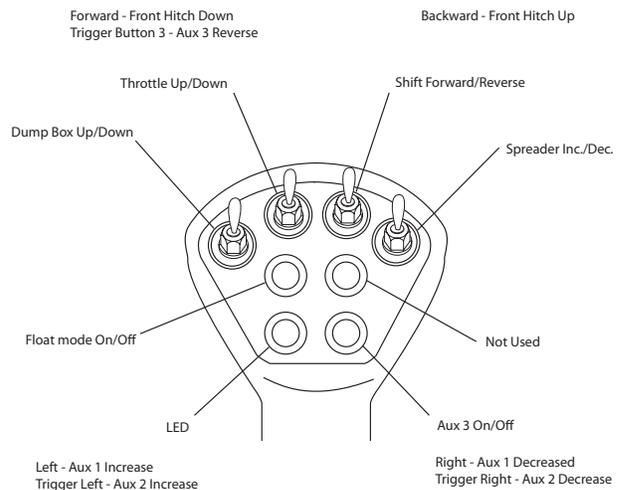


Figure 8

Use the Attachment Selection display, highlight Default and Rear Hitch Hydraulics. Toggle both to Yes.

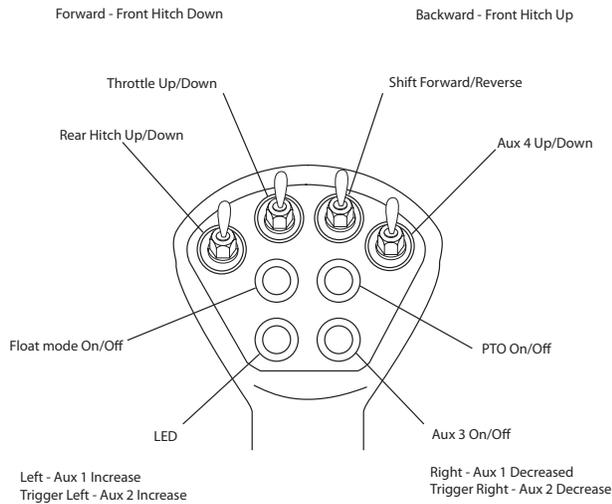


Figure 9

Use the Attachment Selection display, highlight Default and Sprayer Spreader. Toggle both to Yes.

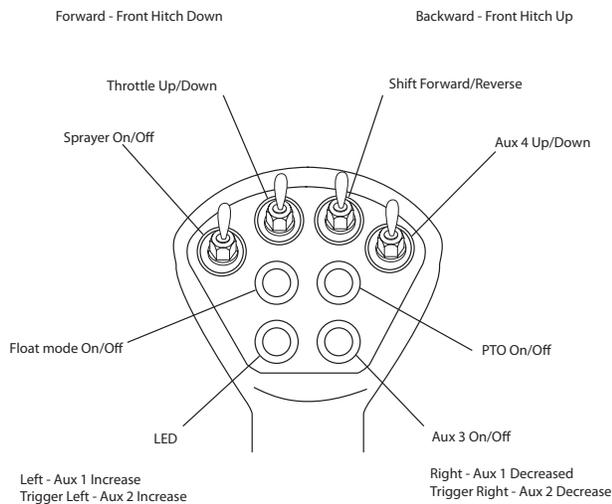


Figure 10

### Connecting the Three-point Hitch

The MSV front hitch has two clamps that lock on to the two pins of the plow. A third mounting point is to the adjustable link.

Align the two M-B MSV front hitch clamps with the lower hitch points of the plow. The hitch hooks must be tightened and centered to the vehicle. Open the front hitch clamps by removing safety pin, moving hitch lock to the open position and inserting safety pin. Drive the M-B MSV forward to engage.



#### CAUTION:

If the plow is not centered on the vehicle damage may occur. Keep the hitch hooks tightened in place.



#### CAUTION:

The hydraulic hoses must be kept clear from all interference points.

MSV front hitch clamps may need to be raised or lowered to align properly. Pull back on joystick to raise front hitch clamps and push forward on joystick to lower.

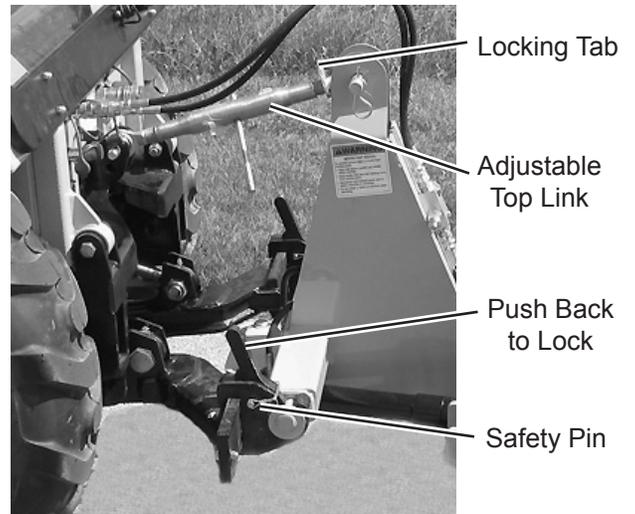


Figure 11

When the plow is properly aligned with the MSV hitch clamps remove the safety pins, push back on the clamps to lock position and use the appropriate pin and fasteners (Figure 11). Insert the safety pin.

Connect the top link to the MSV hitch.

To attach top link it may be necessary to raise or lower the hitch using the joystick or by changing the top link length. Adjust the link length by turning it to shorten or lengthen.



When the top link is connected to the MSV the snowblower attachment should be level. The top link is adjustable and is used to complete the leveling process.

To adjust the top link:

- Determine if the top link should get shorter or longer.
- Break loose the locking tab and screw it away from the body of the link.
- Screw the body of the link in or out as needed. A rod can be inserted into the hole in the body and used as a lever.
- Check the position of the attachment.
- Readjust as needed. Screw the locking tab against the link body. Strike the locking tab to force it into the body.

### Connect Hydraulic Hoses

The front of the MSV has several connections for hydraulic hoses. The MSV operator manual has specifications for the quick disconnect fittings.

The controls in the MSV cab will be setup to use the auxiliary connections. Hydraulic Angling Plow will be connected to Aux 1 connectors. See Figure 12.

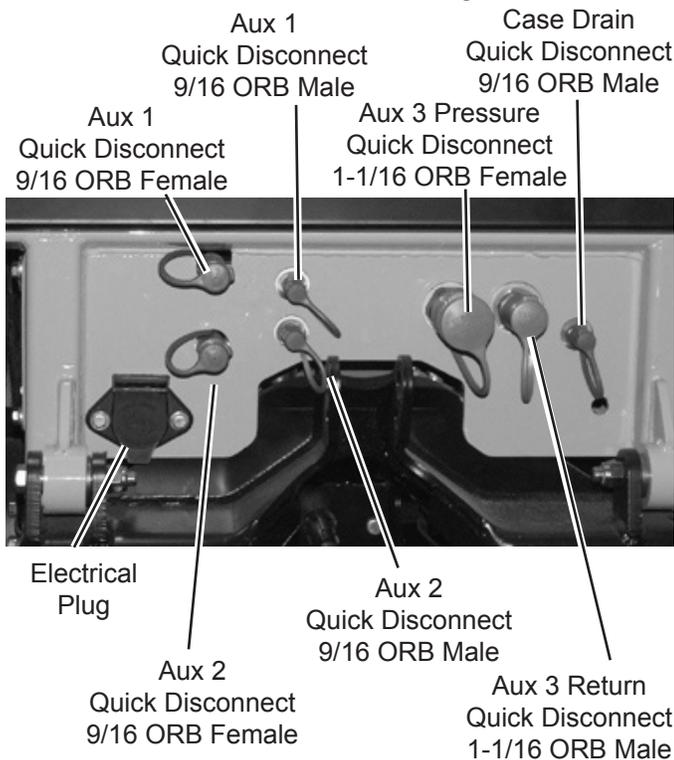


Figure 12

### Skid Shoe



#### WARNING:

When adjusting the skidshoes, the MSV engine must be off if the plow is connected. The preferred method is to disconnect the hydraulic hoses from MSV.

Add spacers to raise plow



Figure 13

When properly adjusted the plow will rest on the two skid shoes. There will be an even distance between the plow and the ground long the entire length of the cutting edge. Height adjustment is made by moving spacers between the top and the bottom of the skid shoe mount.

If the plow is on gravel or uneven surfaces, a lower skid shoe position is recommended. This will raise the cutting edge away from the ground and minimize the unwanted scraping of the surface being plowed.

To set the skid shoe height:

- Place shims under the cutting edge. The shims should have a thickness that will provide proper clearance for snow removal. Allow 1/8" (3mm) between cutting edge and hard smooth surface. Allow 1" (25mm) minimum between cutting edge and uneven surface(s).
- Stack washers and spacers on top to lower skid shoe. Re-install quick pin when adjustment is completed. Reverse procedure to raise skid shoes.
- With the unit set-up on a flat level surface adjust the skid shoes so that the plow cutting edge has even space along the full length of the blade edge.
- Raising the skid shoes away from the ground will create more cutting edge contact and cause more scraping of the ground.
- Once this adjustment is set, it can be confirmed by running the unit forward for about 30 seconds in the operating position. Stop and raise the plow, then back the unit away. The 'cleaned' portion of the surface should exhibit light ground contact with minimal snow leftover.

## OPERATION OF THE SNOWBLOWER ATTACHMENT

The M-B MSV controls the Plow Attachment. The Motor Diagnose Control (MDC) unit in the operators cab displays information regarding the operation of the attachment.

Review the Operation Section in the *M-B MSV Operators Manual* To become familiar with operation of the plow.

### Impact Protection

Hitting foreign objects with the cutting edge can cause severe damage to the system. The M-B Plow has a feature to help protect the unit during severe impacts.

The moldboard is mounted on a hinge and is spring loaded. When an object is struck the moldboard will pivot against the spring to reduce impact.

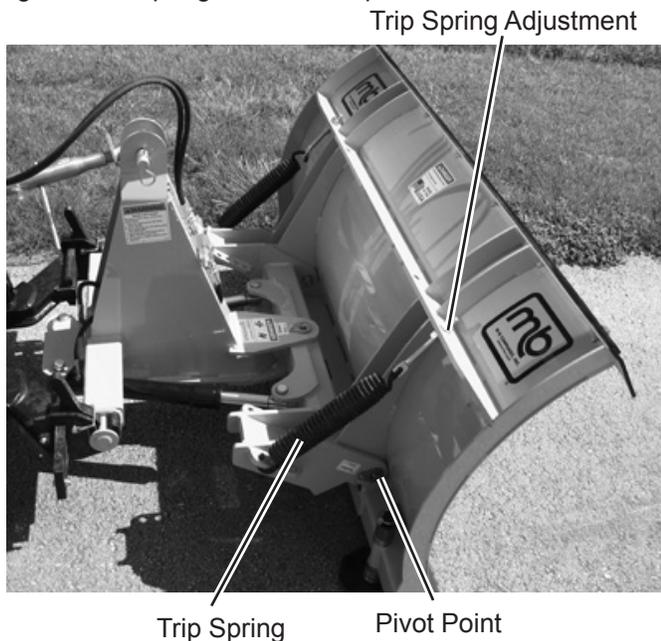


Figure 14

### Trip Spring Adjustment

Springs are installed at M-B company and do not require adjustment unless the spring is removed or replaced. Attach one end of spring to plow frame and the other end to trip spring adjustment link on the moldboard. Install nut and lock washer finger tight as far as possible. Tighten with a wrench so 1/2" (13 mm) of additional threads appear, on adjustment link. Tighten the jam nut.

### Starting Procedure

To start using the Plow:

- The M-B MSV should be running at less than 1250 RPM.
- The M-B MSV should be in either work mode or crawl mode.
- The operator must have the seat belt on and PTO hatch closed.

The joystick will control moldboard function using Aux 1 Hydraulic Hose Connection.



# Maintenance

The M-B Angling Plow should be kept clean. Pivot points require periodic grease.



### WARNING:

To prevent serious injury never perform maintenance on the equipment while the MSV engine is running, or the hydraulic hoses are connected.

## REPLACING THE CUTTING EDGES

The moldboard has a replaceable cutting edge. Replace or flip over the cutting edge when the edge in use wears down to expose the mold board.



Remove Bolts

Figure 15



### CAUTION:

To remove the cutting edge the plow must be supported off the ground. Use support jacks when performing this operation.

To remove the cutting edge:

1. Remove the bolts.

**NOTE: The bolts being removed may need to be cut or ground off. If bolts need to be replaced, use high quality grade 8 bolts and nuts.**

2. Replace the blade.
3. Add anti-seize to the threads and finger start all the bolts with nuts.
4. Tighten bolts.

## CLEAN THE CUTTING EDGE PIVOT

When the blade is supported off the ground having cutting edge replaced it is a good opportunity to inspect and grease pivot points.



Loosen to Remove Spring

Center Pivot

Left Side Pivot

Remove Screw to Remove Pin



Figure 16

To inspect pivot points the trip spring tension must be removed. Remove the trip springs by loosening and removing spring nuts from trip spring link located on the upper part of the moldboard. Springs can be removed and cleaned.

The three pivot points can be inspected for excessive wear and roughness by moving moldboard back and fourth. If it is determined that pins are excessively worn or rough they will require replacing.

Remove and replace one pin at a time. Do not replace pins with standard bolts. Pins are specially designed with lube fitting to lubricate pivot.

Replace trip springs by attaching one end of spring to plow frame and other end to trip spring adjustment link on the moldboard. Install nut and lock washer. Tighten nut finger tight as far as possible. Tighten with a wrench so 1/2" (13 mm) of additional of threads appear on adjustment link. Tighten the jam nut.





## LUBRICATION POINTS

### General Lubrication

**IMPORTANT: Wipe each fitting clean before and after lubrication.**

Apply grease to the lube fittings.

Apply oil at all pivot points and pin connections without lube fittings, see Figure 17.

Unit should be lubricated at beginning of season or every 25 operating hours. See Lubrication Chart.

### LUBRICATION CHART

Locations Refer to Figure 17	Number of Locations	Frequency				Lubrication Type	
		Before Each Use	Daily	Weekly	Monthly	Beginning of season and every 25 hours of operation	MOBILUX EP2 Type Grease
1. Hitch Pins	2					X	X
2. Pivot Pins	3					X	X
3. Hydraulic Cylinder Pins	4					X	X



Figure 17

# Troubleshooting

## OPERATION

Problem	Probable Cause	Corrective Action
No position functions work	MSV engine not running.	Run engine.
	MDC Controls.	Review connections to hydraulic AUX fittings and MDC settings.
	Hydraulic tank low on oil.	Add oil. See M-B <i>MSV Operations Manual</i> for proper filling procedures.
Some position functions work	Check the MSV electrical signals for each function.	Repair electrical signal.
	If electrical present check solenoid.	Replace solenoid if coil is open.
	Spool assembly bent.	Replace spool assembly.

## HYDRAULIC SYSTEM

Problem	Probable Cause	Corrective Action
Joystick does not operate any components	Low hydraulic oil level.	Add oil. See M-B <i>MSV Operations Manual</i> for proper filling procedures.
One hydraulic function inoperative	Hydraulic lines not connected.	Check connections.
Moldboard will not move	Hydraulic lines not connected.	Check connections.

# Replacement Parts

## REPLACEMENT PARTS



390-118352



390-118356



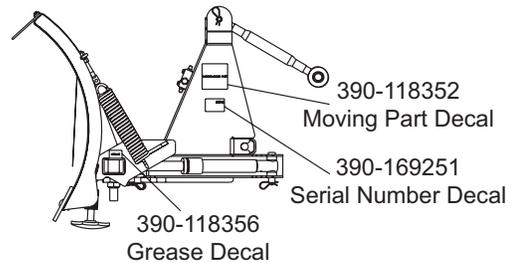
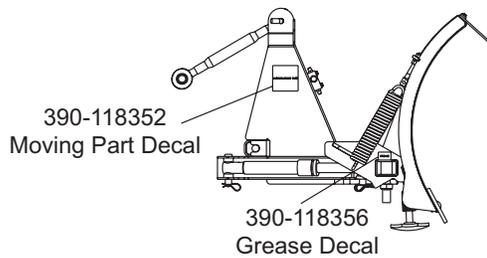
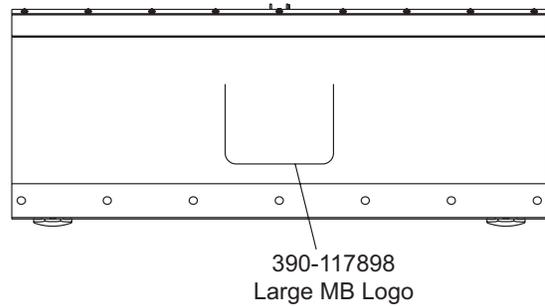
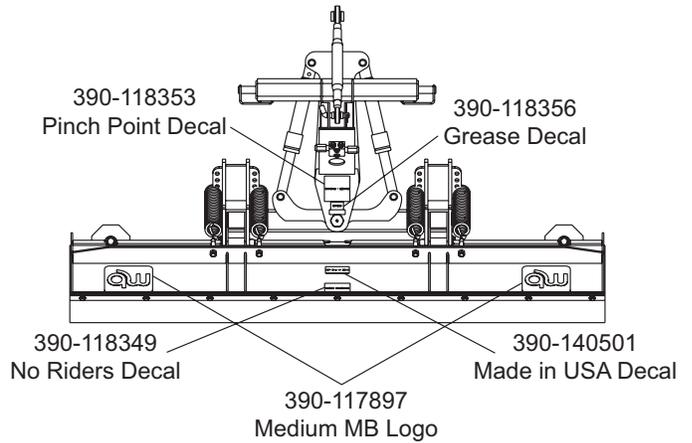
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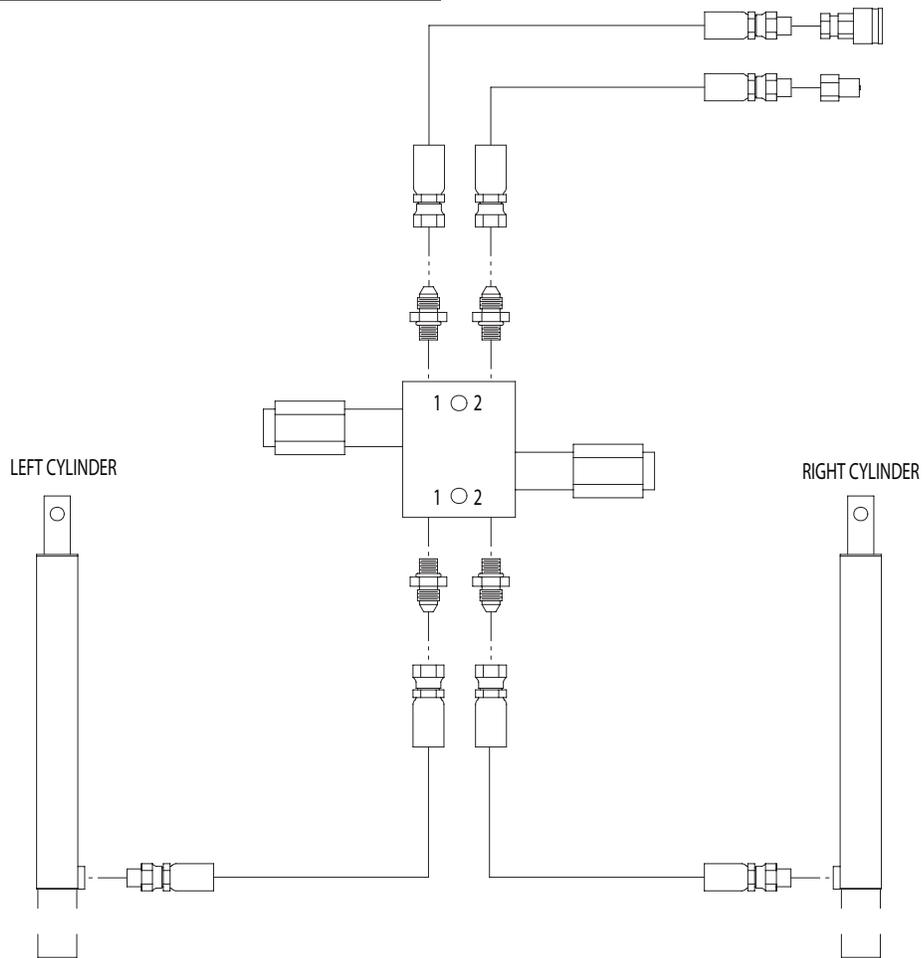
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390-118353



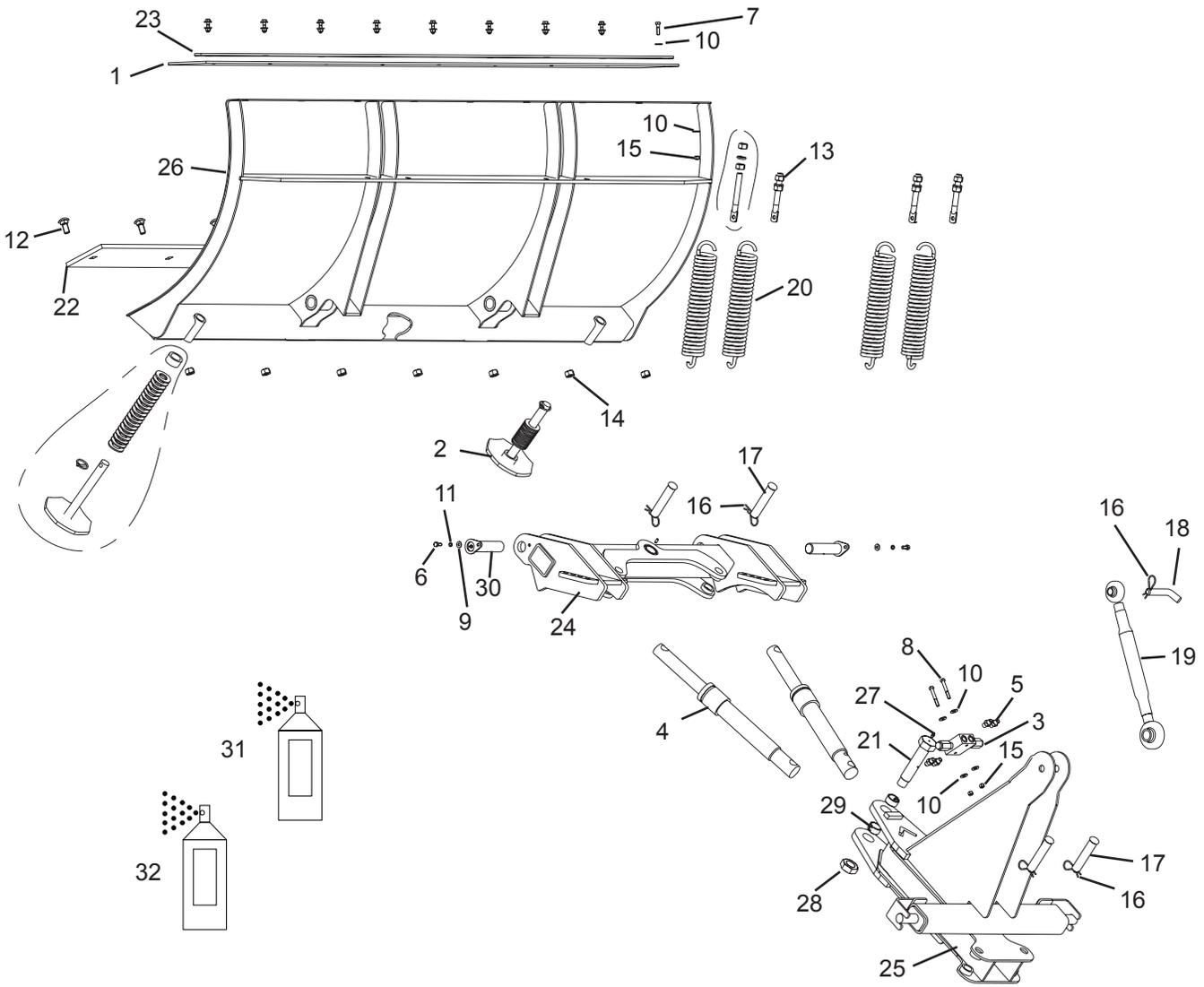
# ANGLING PLOW HYDRAULIC



Replacement Parts List			
Item	Part Number	Description	QTY
1	202-152440	Valve, Crossover Relief	1
2	203-152439	Cylinder, Hydraulic	2
3	207-157736	QD, 1/4 F NPT, Male Nipple	1
4	207-157737	QD, 1/4 F NPT, Female Coupler	1
5	211-66901	STR ADPT, 9/16 ORB, 9/16 JIC	4
6	213-152593	Hose Assy, 1/4 x 31"	2
7	213-163001	Hose Assy, 1/4 x 39"	2



# ANGLING PLOW



Replacement Parts List			
Item	Part Number	Description	QTY
1	See Table 1	Deflector, Snow	1
2	<b>104-147061</b>	<b>Skid Shoe - Standard (Non-Hardened)</b>	<b>2</b>
	<b>104-150592</b>	<b>Skid Shoe - Optional (Cast Hardened)</b>	<b>2</b>
3	202-152440	Valve, Crossover Relief #6 SAE Ports	1
4	203-152439	Cylinder, Hyd 1-1/2" x 10" Single Acting	2
5	211-66901	STR ADPT, Male ORB x JIC 9/16 JIC x 9/16 ORB	4
6	311-20750	HHCS .31-18 UNC x 0.750	2
7	311-21250	HHCS .31-18 UNC x 1.250	9
8	311-22250	HHCS .31-18 UNC x 2.250	2
9	341-10000	Washer, Flat - 1/4 STD Zinc Pl	2
10	341-20000	Washer, Flat - 5/16 STD Zinc Pl	22
11	351-10000	Washer, Lock - 1/4 STD Zinc Pl	2
12	370-138606	Carriage Bolt 5/8-11 UNC x 1.50	7
13	370-152409	Eyebolt, w/Nuts Plow Spring	See Table 2
14	371-136888	Nut, Hex Locking 5/8-11	7
15	371-81620	Nut, Hex ESNA, 5/16-18 UNC	11
<b>16</b>	<b>380-84739</b>	<b>Pin, Hair Clip #11</b>	<b>5</b>
<b>17</b>	<b>380-90800</b>	<b>Pin, Clevic, Yel Zinc 1 x 4 1/2</b>	<b>4</b>
<b>18</b>	<b>383-122610</b>	<b>Pin, Hitch, Bent Pull 3/4 x 3 1/2 Grip LG</b>	<b>1</b>
<b>19</b>	<b>401-152698</b>	<b>Top Link, MSV Cat 1 &amp; 2, 12" Body</b>	<b>1</b>
<b>20</b>	<b>382-144025</b>	<b>Spring Trip</b>	<b>See Table 2</b>
21	401-176989	Bolt, Grease (Zerk) 1-1/4 x 8	1
<b>22</b>	<b>See Table 1</b>	<b>Edge, Cutting Snow Plow</b>	<b>1</b>
23	See Table 1	Strap, Retainer	1
24	410-152410	Frame - WU Snow Plow Pivot	1
25	410-152416	Frame - WU Snow Plow Swing MSV MNT	1
26	See Table 1	Moldboard - WU Snow Plow	1
27	206-72100	Grease Zerk 1/4-28	1
28	371-176992	Nut, Hex Jam UNC 1-1/4-7	1
29	603-176987	Bushing, Split Steel 1.5 OD x 1.25 ID x .75	2
30	410-132762	Pin, WU, Swing	2
<b>31</b>	<b>109-131128</b>	<b>Yellow Touch-up Paint</b>	
<b>32</b>	<b>249-92005</b>	<b>Primer, Aerosol Can</b>	

Parts listed in bold letters are considered to be a Maintenance, Service or Wear part. These parts will generally be stocked by dealers.



Table 1:

Plow Size	Moldboard - WU	Strap, Retainer	Edge, Cutting	Deflector, Snow
50"	410-157987	401-157964	401-157984	101-157967
5'	410-152448	401-152458	401-152446	101-152455
6'	410-152447	401-152457	401-152445	101-152454
7'	410-152400	401-152456	401-152435	101-152453
8'	410-157988	401-157965	401-157985	101-157968
10'	410-157989	401-157966 QTY 2	401-157986	101-157969

Table 2:

Plow Size	Spring QTY.
50"	2
5'	2
6'	2
7'	2
8'	4
10'	4



## HYDRAULIC FITTING INSTALLATION TORQUE RECOMMENDATION

Table 3: For 37° & 45° (Machined or Flared) and MegaSeal®

Size		Steel				Brass			
Dash	Fractional (In.)	Ft-Lbs.		Newton-Meters		Ft-Lbs.		Newton-Meters	
		Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
-4	1/4	10	11	13	15	5	6	6-3/4	9
-5	5/16	13	15	18	20	7	9	10	13
-6	3/8	17	19	23	26	12	15	17	20
-8	1/2	34	38	47	52	20	24	27-2/3	33
-10	5/8	50	56	69	76	34	40	46-1/3	55
-12	3/4	70	78	96	106	53	60	72-1/3	82
-16	1	94	104	127	141	74	82	100-1/2	111
-20	1-1/4	124	138	169	188	75	83	101-1/2	113
-24	1-1/2	156	173	212	235	79	87	107	118
-32	2	219	243	296	329	158	175	214	237

Table 4: For Flat-Face “O” Ring Seal (Steel)

Size		Ft-Lbs.		Newton-Meters	
Dash	Fractional (In.)	Min.	Max.	Min.	Max.
-4	1/4	10	12	14	16
-6	3/8	18	20	24	27
-8	1/2	32	40	43	54
-10	5/8	46	56	60	75
-12	3/4	65	80	90	110
-14	7/8	65	80	90	110
-16	1	92	105	125	240
-20	1-1/4	125	140	170	190
-24	1-1/2	150	180	200	245



**Table 5: For SAE O-Ring Boss (Steel) & Gates Adapterless**

Size		Ft-Lbs. Working Pressures 4,000 psi (27.5 Mpa) and below		Newton-Meters Working Pressures 4,000 psi (27.5 Mpa) and below		Ft-Lbs. Working Pressures Above 4,000 psi (27.5 Mpa)		Newton-Meters Working Pressures Above 4,000 psi (27.5 Mpa)	
Dash	Fractional (In.)	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
-3	3/16	—	—	—	—	8	10	11	13
-4	1/4	14	16	20	22	14	16	20	22
-5	5/16	—	—	—	—	18	20	24	27
-6	3/8	24	26	33	35	24	26	33	35
-8	1/2	37	44	50	60	50	60	68	78
-10	5/8	50	60	68	81	72	80	98	110
-12	3/4	75	83	101-1/2	113	125	135	170	183
-14	7/8	—	—	—	—	160	180	215	245
-16	1	111	125	150	170	200	220	270	300
-20	1-1/4	133	152	180	206	210	280	285	380
-24	1-1/2	156	184	212	250	270	360	370	490

**Table 6: Maximum Recommended Torque for dry NPTF (Tapered) Pipe Threads\***

Size	Ft-Lbs.	Newton-Meters
-2	20	25
-4	25	35
-6	35	45
-8	45	60
-12	55	75
-16	65	90
-20	80	110
-24	95	130
-32	120	160

\*NOTES:

1. The torque values obtained from tightening pipe threads can vary considerably depending on thread condition. Adequate sealing can occur at values much lower than the maximum values listed above. Only enough torque to achieve adequate sealing should be used.
2. When using a male tapered pipe thread with a female straight or parallel pipe thread, maximum values are 50% of those listed in the table.
3. If threaded sealant is used, maximum values shown should be decreased by 25%

# FASTENER TORQUE RECOMMENDATION

**Table 7: Torque for Standard Fasteners**

Nominal Dia. (in.)	Threads per inch	Grade 2			Grade 5			Grade 8			Grade 9		
		Tightening Torque			Tightening Torque			Tightening Torque			Tightening Torque		
		Lubed	Dry Plated	Dry Plain	Lubed	Dry Plated	Dry Plain	Lubed	Dry Plated	Dry Plain	Lubed	Dry Plated	Dry Plain
		K = 0.15	K = 0.17	K = 0.20	K = 0.15	K = 0.17	K = 0.20	K = 0.15	K = 0.17	K = 0.20	K = 0.15	K = 0.17	K = 0.20
<b>Unified Coarse Thread Series</b>													
1/4	20	49 in-lbs	59 in-lbs	66 in-lbs	76 in-lbs	86 in-lbs	101 in-lbs	107 in-lbs	122 in-lbs	143 in-lbs	126 in-lbs	143 in-lbs	168 in-lbs
5/16	18	101	122	135	157	178	209	221	251	295	259	294	346
3/8	16	15 ft-lbs	18 ft-lbs	20 ft-lbs	23 ft-lbs	26 ft-lbs	31 ft-lbs	33 ft-lbs	37 ft-lbs	44 ft-lbs	38 ft-lbs	43 ft-lbs	51 ft-lbs
7/16	14	24	29	32	37	42	49	52	59	70	61	70	82
1/2	13	37	44	49	57	64	75	80	90	106	94	106	125
9/16	12	53	63	70	82	92	109	115	130	154	135	153	180
5/8	11	73	87	97	113	126	150	159	180	212	186	211	248
3/4	10	129	155	172	200	227	267	282	320	376	331	375	441
7/8	9	125	160	167	322	365	429	455	615	606	633	604	710
1	8	187	225	250	483	547	644	681	722	909	799	905	1065
1-1/8	7	266	319	354	596	675	794	966	1095	1288	1132	1283	1510
1-1/4	7	375	450	500	840	952	1121	1363	1545	1817	1597	1810	2130
1-1/2	6	652	783	869	1462	1657	1950	2371	2688	3162	2779	3150	3706
<b>Fine Thread Series</b>													
1/4	28	56 in-lbs	68 in-lbs	75 in-lbs	87 in-lbs	99 in-lbs	116 in-lbs	123 in-lbs	139 in-lbs	164 in-lbs	144 in-lbs	163 in-lbs	192 in-lbs
5/16	24	112	135	150	174	197	231	245	278	327	287	325	383
3/8	24	17 ft-lbs	20 ft-lbs	23 ft-lbs	26 ft-lbs	30 ft-lbs	35 ft-lbs	37 ft-lbs	42 ft-lbs	49 ft-lbs	43 ft-lbs	49 ft-lbs	58 ft-lbs
7/16	20	27	32	36	41	47	55	58	66	78	68	78	91
1/2	20	41	49	55	64	72	85	90	102	120	105	120	141
9/16	18	59	71	78	91	103	121	126	146	171	151	171	201
5/8	18	82	99	110	127	144	170	180	204	240	211	239	281
3/4	16	144	173	192	223	253	297	315	357	420	369	418	492
7/8	14	138	165	184	355	403	474	502	568	669	588	666	784
1	14	210	252	280	542	614	722	765	867	1020	896	1016	1195
1-1/8	12	298	357	397	668	757	890	1083	1227	1444	1269	1439	1693
1-1/4	12	415	493	553	930	1055	1241	1509	1710	2012	1768	2004	2358
1-1/2	12	734	880	978	1645	1865	2194	2668	3024	3557	3127	3544	4169
<p>Torque values for 1/4 and 5/16-in series are in inch-pounds. All other torque values are in foot-pounds            Torque values calculated from formulas <math>T=KDF</math>, where            K = 0.15 for "lubricated" conditions            K = 0.17 for zinc plated and dry conditions            K = 0.20 for plain and dry conditions            D = Nominal Diameter            F = Clamp Load</p>													



**Table 8: Torque-Tension Relationship for Metric Fasteners**

Nominal Dia.	Pitch	 <b>Class 4.6</b>			 <b>Class 8.8</b>			 <b>Class 10.9</b>			 <b>Class 12.9</b>	
		Tightening Torque			Tightening Torque			Tightening Torque			Tightening Torque	
		Lubed	Dry Plated	Dry Plain	Lubed	Dry Plated	Dry Plain	Lubed	Dry Plated	Dry Plain	Lubed	Dry Plain
		K = 0.15 (ft-lbs)	K = 0.17 (ft-lbs)	K = 0.20 (ft-lbs)	K = 0.15 (ft-lbs)	K = 0.17 (ft-lbs)	K = 0.20 (ft-lbs)	K = 0.15 (ft-lbs)	K = 0.17 (ft-lbs)	K = 0.20 (ft-lbs)	K = 0.15	K = 0.20
(mm)												
3	0.5	0.28	0.32	0.38	0.73	0.82	0.97	1.0	1.2	1.4	1.2	1.6
3.5	0.6	0.44	0.50	0.59	1.1	1.3	1.5	1.6	1.9	2.2	1.9	2.5
4	0.7	0.66	0.74	0.87	1.7	1.9	2.3	2.4	2.7	3.2	2.8	3.8
5	0.8	1.3	1.5	1.8	3.4	3.9	4.5	4.9	5.5	6.5	5.7	7.6
6	1	2.3	2.6	3.0	5.8	6.6	7.7	8.3	9.4	11	9.7	13
6	1.25	2.1	2.3	2.7	5.3	6.0	7.0	7.6	8.6	10	8.8	12
7	1	3.8	4.3	5.0	9.7	11	13	14	16	19	16	22
8	1	5.9	6.6	7.8	15	17	20	22	24	29	25	34
8	1.25	5.5	6.2	7.3	14	16	19	20	23	27	24	31
10	1.25	11	13	15	29	33	39	42	48	56	49	66
10	1.5	11	12	14	28	32	37	40	45	53	47	62
12	1.25	21	23	28	53	60	71	76	86	101	89	119
12	1.5	20	22	26	51	58	68	73	82	97	85	113
12	1.75	19	21	25	49	55	65	70	79	93	81	108
14	1.25	26	29	34	66	75	89	95	106	127	111	148
14	1.5	28	32	37	72	82	96	103	117	138	121	161
14	2	30	34	40	78	88	104	111	126	148	130	173
16	1.5	50	57	67	129	146	171	184	208	245	215	287
16	2	47	53	62	121	137	161	173	196	230	202	269
18	1.5	73	82	97	187	212	249	266	303	357	313	417
18	2.5	65	73	86	167	189	222	239	270	318	279	372
20	2.5	91	104	122	236	267	314	337	382	449	394	525

Clamp load calculated as 75% of the proof load for specified bolts.  
 All Torque values are listed in foot-pounds  
 Torque values calculated from formulas  $T=KDF$ , where  
 K = 0.15 for "lubricated" conditions  
 K = 0.17 for zinc plated and dry conditions  
 K = 0.20 for plain and dry conditions  
 D = Nominal Diameter  
 F = Clamp Load



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