



MB Companies, Inc. MSV Multi Service Vehicle

Operation and Maintenance Manual



Rear Drop Spreader Attachment for M-B Companies' Multi-Service Vehicle (MSV)

QUALITY YOU CAN SEE, PEOPLE YOU CAN TRUST™

Attachments Division, Brush Replacements, Administration

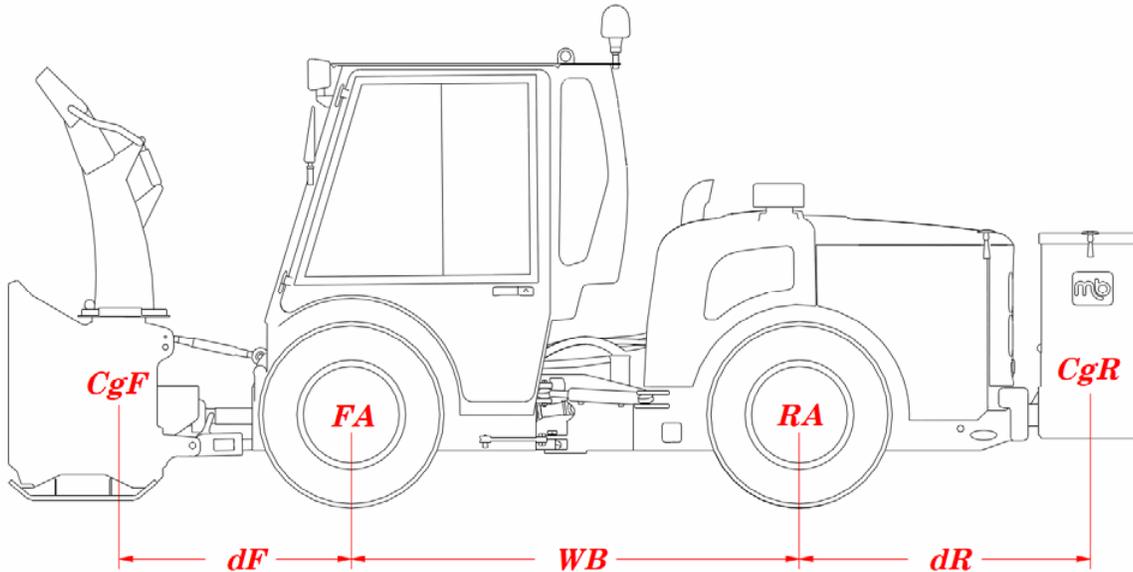
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Ballast Calculations

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

- 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

- 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

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

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 PTO Dual Auger Snowblower Attachment. 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 (ESTIMATED)

Model	Rear Drop Spreader
Drop Width	31 inches (79 cm)
Spreading Distance	Up to 5 miles (8 km)
Capacity	0.5 cu Yards (0.38 m ³)
Operating Weight (Empty)	275 lbs. (125 kg)
Operating Weight with Course Salt	950 lbs. (431 kg)
Operating Weight with Fine Salt	1288 lbs. (584 kg)
Operating Weight with Dry Sand	1625 lbs. (737 kg)
Operating Weight with Wet Sand	1865 lbs. (860 kg)

DIMENSIONS

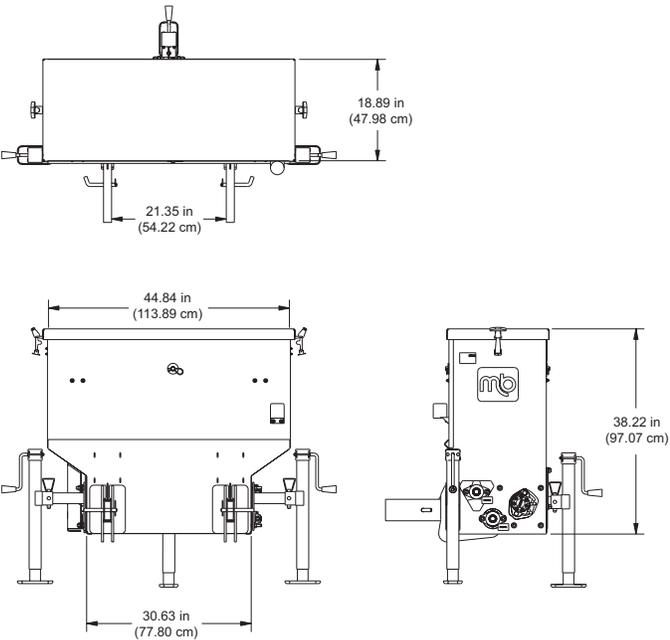


Figure 3

LAYOUT OF MACHINE

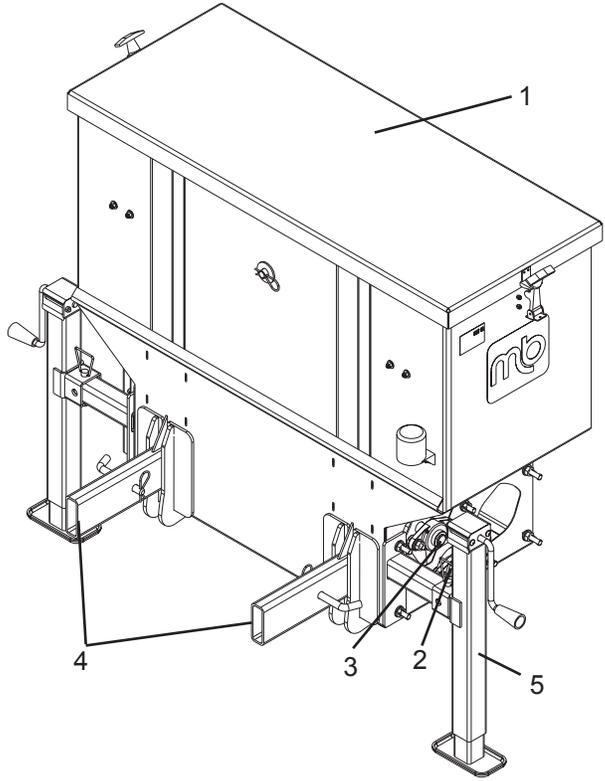


Figure 4

- 1. Cover
- 2. Dispenser
- 3. Auger
- 4. Mounting Arms
- 5. Jackstand



Operation

CONNECTING TO THE MSV

The Rear Drop Spreader attachment is connected to the rear of the MSV by two arms inserted into the frame.

Joystick Layout - Rear Spreader

The joystick layout screen in the attachment section of the MDC is used to display all the joystick functions when the Rear Spreader attachment is used. Use the Attachment Selection screen to change selection to Yes (Figure 5). The joystick functions will perform as shown in Figure 6 and Figure 7.

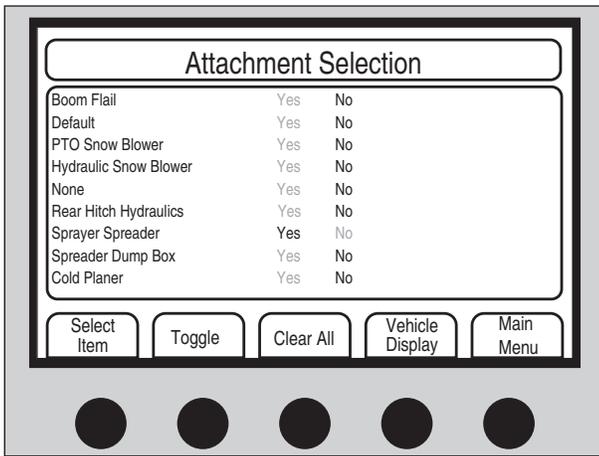


Figure 5

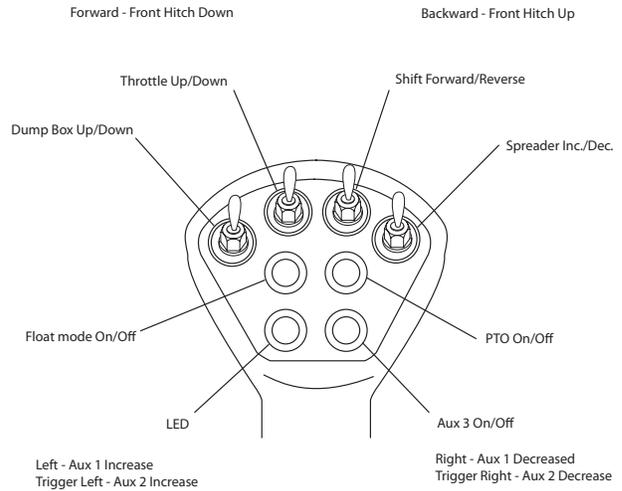


Figure 7

Other attachments may also be used with the Rear Spreader. The joystick functions will perform as shown in Figure 8 through Figure 10.

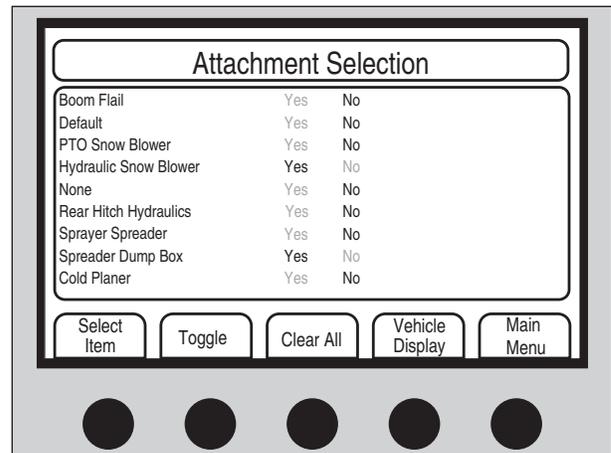


Figure 8

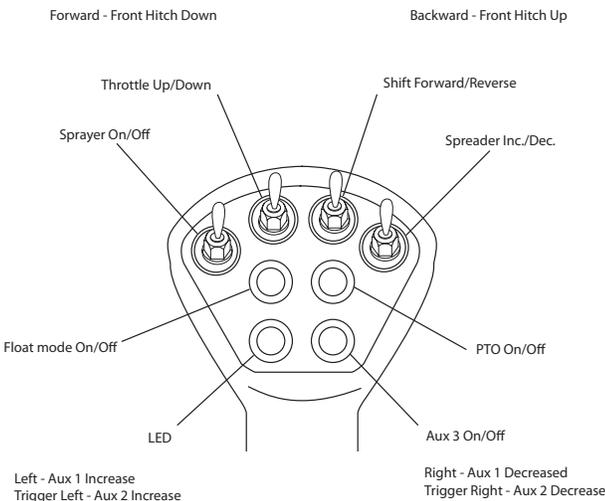


Figure 6

Use the Attachment Selection display, highlight Spreader Dump Box. Toggle to Yes.

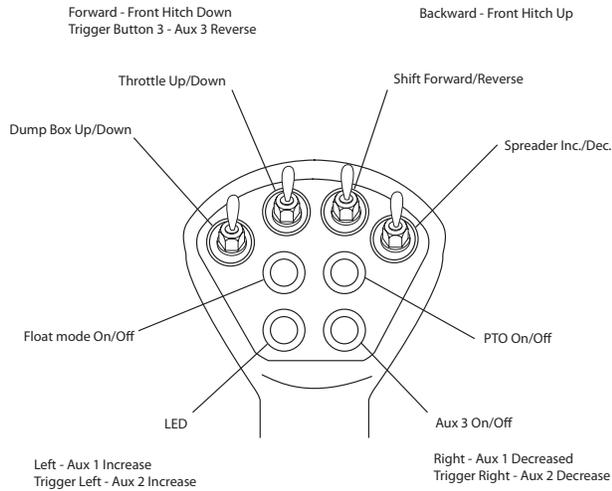


Figure 9

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

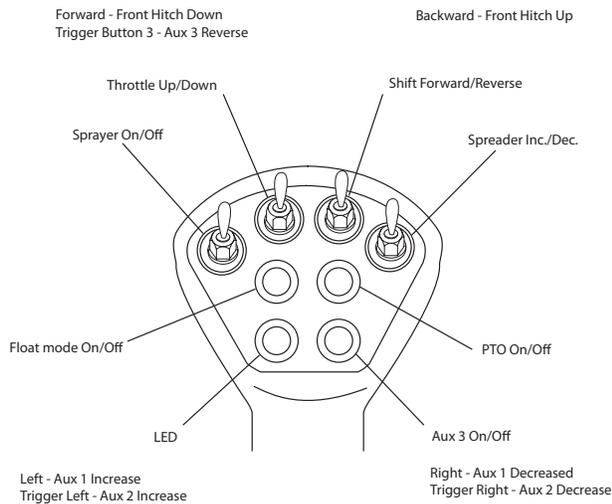


Figure 10

Connecting the Spreader

The MSV rear frame has two slots in the bumper. The spreader has two arms that will fit into the slots and be pinned in place (Figure 11).

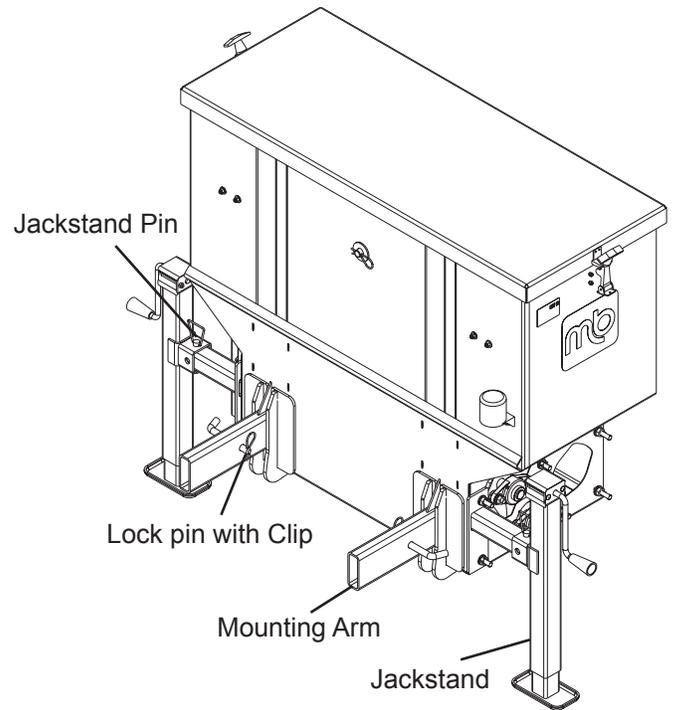


Figure 11

To connect the spreader:

1. Position the MSV in front of the spreader.
2. Remove the two pins.
3. Adjust the three jackstands to line up the mounting arms with the MSV slots.
4. Back up the MSV or move the spreader so the arms enter the slots completely.
5. Insert the lock pins thru the frame of the MSV and the arms of the spreader. Insert the clip thru the pin to prevent the pin from backing out.
6. Raise the three jackstands and remove the pin that holds them in place.
7. Remove the jackstands. They can either be stored remote from the spreader or attached to the spreader. To store them on the spreader, rotate the jackstand 90° and put it back on the mounting point. Replace the jackstand pin.
8. Connect the hydraulic lines to the Aux 4 quick connections (Figure 12).

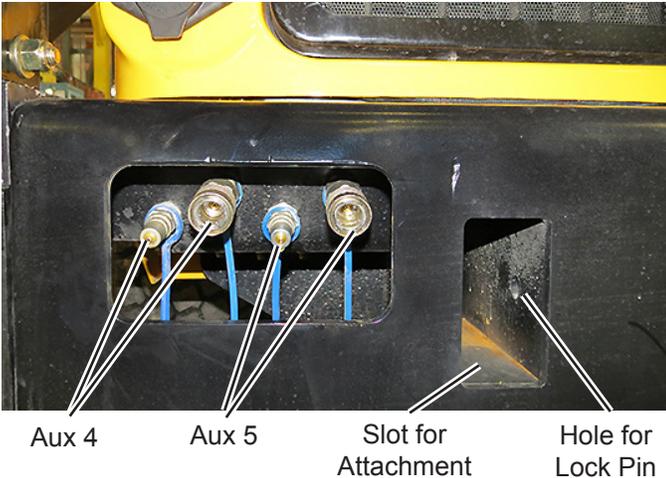


Figure 12

To remove the spreader:

The removal of the spreader is the reverse process of connecting it.

- Disconnect the hydraulic lines.
- Position the three jack stands. Lower them to support the spreader.
- Remove the lock pins.
- Separate the MSV and the spreader.

NOTE: If the spreader contains material that will not tolerate short or long term storage, that material should be removed. Clean and grease the spreader before storage.

OPERATION OF THE REAR SPREADER ATTACHMENT

The MB MSV controls the Spreader Attachment. The motor diagnose control (MDC) display screen in the operators cab will display information regarding the operation of the attachment.

Review the Operation Section in the *MB MSV Operators Manual* to become familiar with the controls.

Hydraulic Hoses

The rear of the MSV has several connections for hydraulic hoses. The *MSV Operator Manual* has specifications for the quick disconnect fittings.

For the Aux 4 connections to function properly enter the MDC set up menus. In the Attachment page highlight “yes” for the spreader attachment. See *MSV Operator Manual* for more details. The spreader hydraulic hoses should be connected to the Aux 4 connection.

When the hydraulic hoses are connected, engage the spreader and observe the direction of the chain travel. Figure 13 shows the correct rotation of the sprockets.

	CAUTION: Do not operate the spreader with the sprockets rotating in the reverse direction. Excessive wear and mechanical jamming will result.
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If the rotation needs to be changed, switch the hose connections at the rear of the MSV and reconnect.

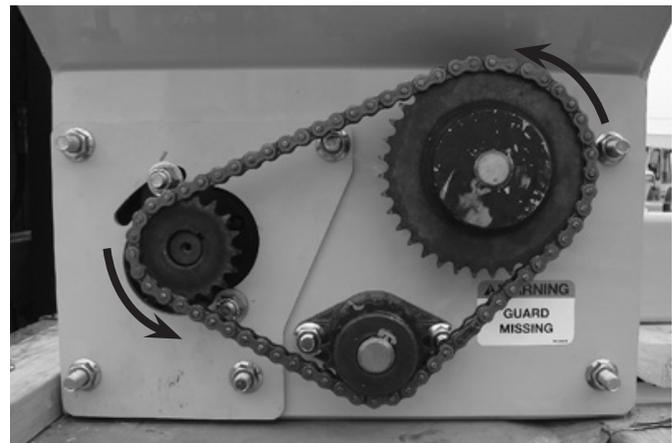


Figure 13

Connect Lights

The rear lights of the spreader will operate as running and brake lights. Plug the electric harness into the proper connection of the MSV. When the spreader is not attached to the MSV the light connector should be stored in the plug protector located at the left front of the spreader.

CAUTION:
 The spreader will hide the tail lights of the MSV. Be certain to connect the spreader lights.

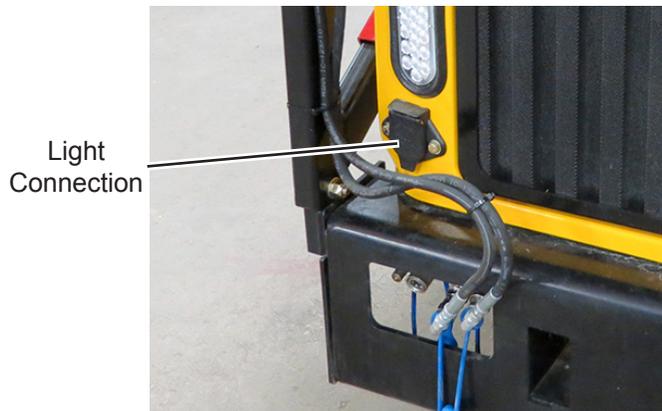


Figure 14

of sand placed on the ground at the three spreader speeds. As the ground speed of the MSV changes the spreader will speed up or slow down. When the MSV stops the spreader will stop.

Using the Empty feature, the spreader will run at high speed when the MSV is stopped or moving. It may take up to 30 minutes to completely empty a full spreader.



Figure 15

STARTING PROCEDURE

To start using the spreader:

- The MSV must be running at required RPM.
- The MSV should be in either work mode or crawl mode.
- The operator must have the seat belt on.

The vehicle display screen of the (MDC) shows the speed of the vehicle.

The joystick will now control spreader functions.

The spreader has four drop speeds:

- Low - Push Joystick Aux 4 toggle switch up once.
- Medium - Push Joystick Aux 4 toggle switch up twice.
- High - Push Joystick Aux 4 toggle switch up three times.
- Empty - Push Joystick Aux 4 toggle switch up four times.

To turn the spreader off pull down on the Aux 4 toggle switch.

At low, medium and high speeds the amount of material spread at each speed will vary with the type and coarseness of the material. Figure 15 shows the amount



LUBRICATION POINTS

General Lubrication

Grease all lubrication points per the maintenance schedule using Chevron Ultra Duty II Grade 2 or equivalent high temperature grease.

LUBRICATION CHART

	Figure	Number of Locations	Frequency					Lubrication Type	
			Before Each Use	Every 10 Hours	Daily	Weekly	Monthly	Annually	Chevron Ultra Duty Grade 2 Type Grease
1. Chain Drive		1		x					x
2. Shaft Bearings Left Side		2		x				x	
3. Shaft Bearings Right Side		3		x				x	



DRIVE CHAIN ADJUSTMENT

The drive chain must be kept clean and lubricated. Inspect the drive chain by removing the cover.

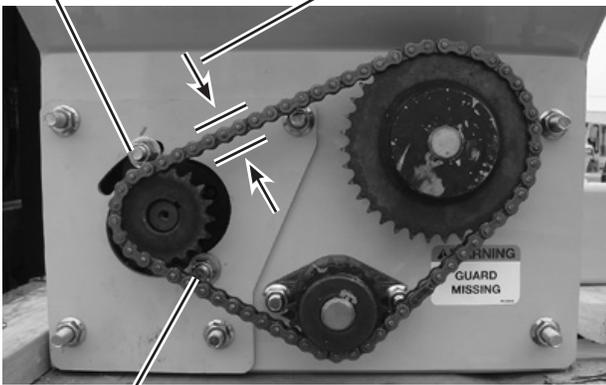


WARNING:

Do not remove the chain cover while the MSV is running. Turn off the MSV and disconnect the hydraulic hoses before removing cover to avoid serious injury.

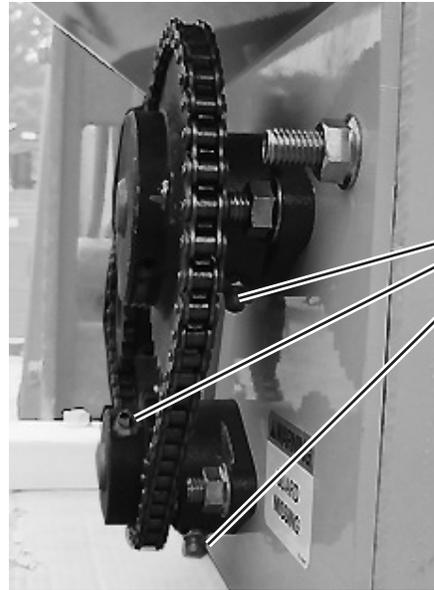
Measure the chain deflection as shown in Figure 16. The deflection should be from 1/8-inch to 1/4-inch. If adjustment is needed loosen the motor pivot nut. Loosen the motor adjustment nut and move the hydraulic motor as needed.

Motor Adjustment Nut Measure Chain Deflection



Motor Pivot Nut

Figure 16



Grease Fittings

Figure 18

Grease Fittings

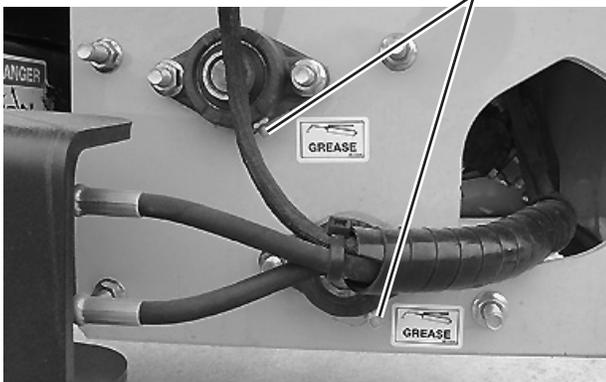


Figure 17

Troubleshooting

HYDRAULIC SYSTEM

Problem	Probable Cause	Corrective Action
Joystick does not operate any components	Low hydraulic oil level.	Add oil.
Auger will not rotate	No hydraulic pressure.	Connect hoses.
		Check controller function in the MSV.



Replacement Parts

REPLACEMENT PARTS



390-118352



390-157201



390-140501



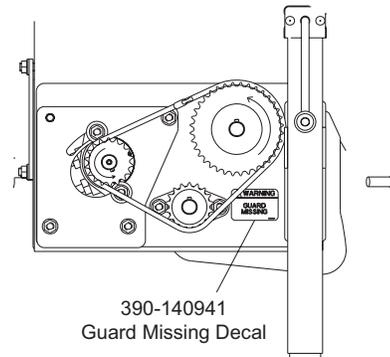
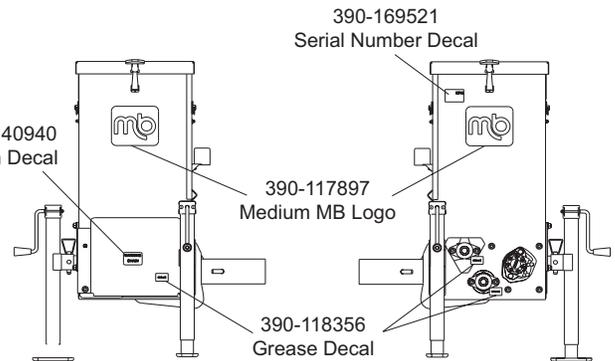
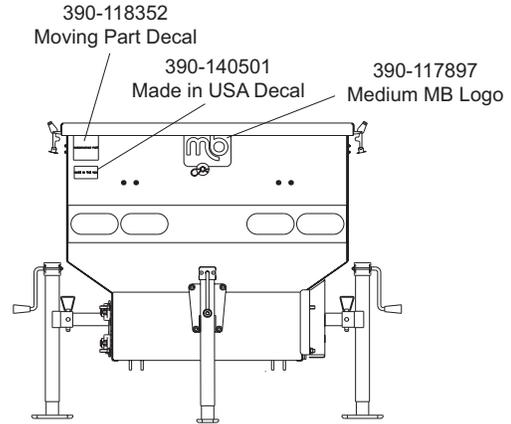
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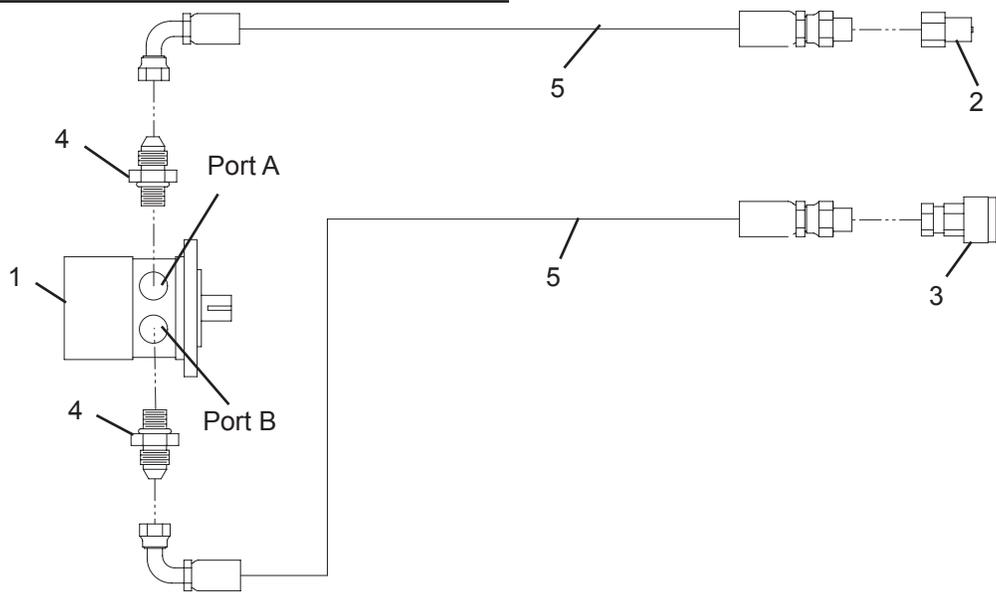
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390-140941



REAR SPREADER HYDRAULIC

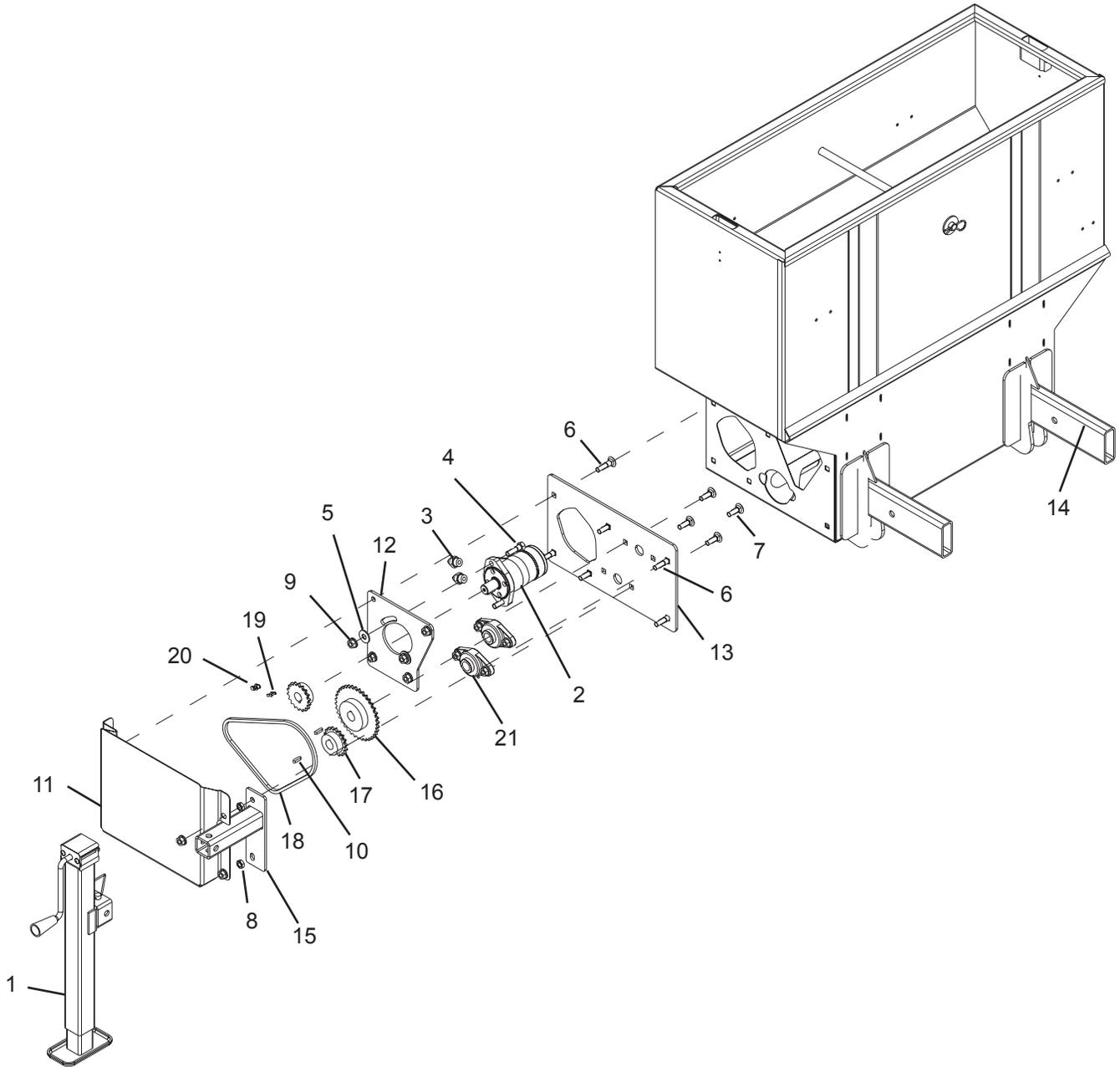


Replacement Parts List			
Item	Part Number	Description	QTY
1	201-157051	Motor, Hydraulic	1
2	207-157736	QD, 1/4 F NPT, Male Nipple	1
3	207-157737	QD, 1/4 F NPT, Female Coupler	1
4	211-51987	STR ADPT, 7/8 ORB x 9/16 JIC	2
5	213-157668	Hose Assy, 1/4 x 45"	2

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



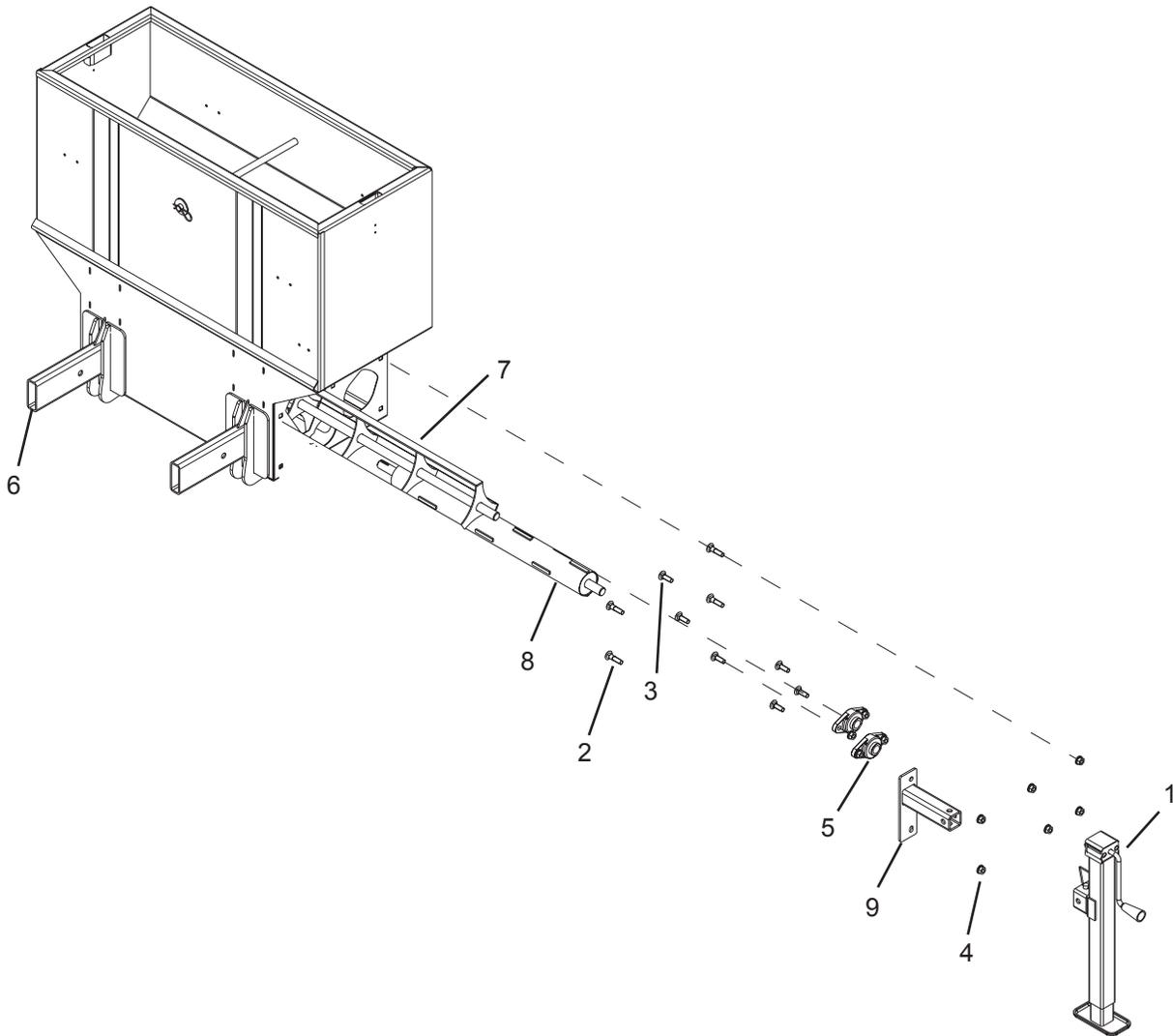
MSV SPREADER PARTS PG 1



Replacement Parts List			
Item	Part Number	Description	QTY
1	103-163760	Jack, SQ, Side Crank, 5000 lb, 15 inch TRVL	1
2	201-157051	Motor, HYD LSHT 11.3 Cir 2 Bolt FLG	1
3	211-51987	STR ADPT, Male ORB x JIC 9/16 JIC x 7/8 ORB	2
4	311-51750	HHCS .50-13 UNC x 1.750	2
5	341-50000	Washer, Flat - 1/2 STD Zinc PL	2
6	370-84388	Carriage Bolt 1/2-13 UNC x 2	4
7	370-92051	Carriage Bolt 1/2-13 UNC x 1.5	6
8	371-84080	Nut, Hex, Jam 1/2-13 UNC	2
9	371-92056	Serrated Flange Locknut 1/2-13 UNC	14
10	386-91178	Key, Round End .25 x 1	2
11	401-157424	Cover, Chain	1
12	401-157425	Mount, Motor	1
13	401-157426	Mount, Bearing	1
14	410-157423	Hopper, Weldment	1
15	410-163786	Mount, RT Jackstand, Drop Spreader, MSV	1
16	506-92049	SPRKT, 36T NO. 40, 1" Bore, 1/4 Keyway	1
17	506-92050	SPRKT, 18T NO. 40, 1" Bore 1/4 Keyway	2
18	508-157480	Chain Roller #40 1/2P 66 Roller 65 LKS	1
19	508-75408	Link Connecting #40	1
20	508-92060	Offset Link, #40 1/2P REF #508-01061	1
21	600-157410	Bearing Ball, 1 IN ID 2 Bolt Flange	2



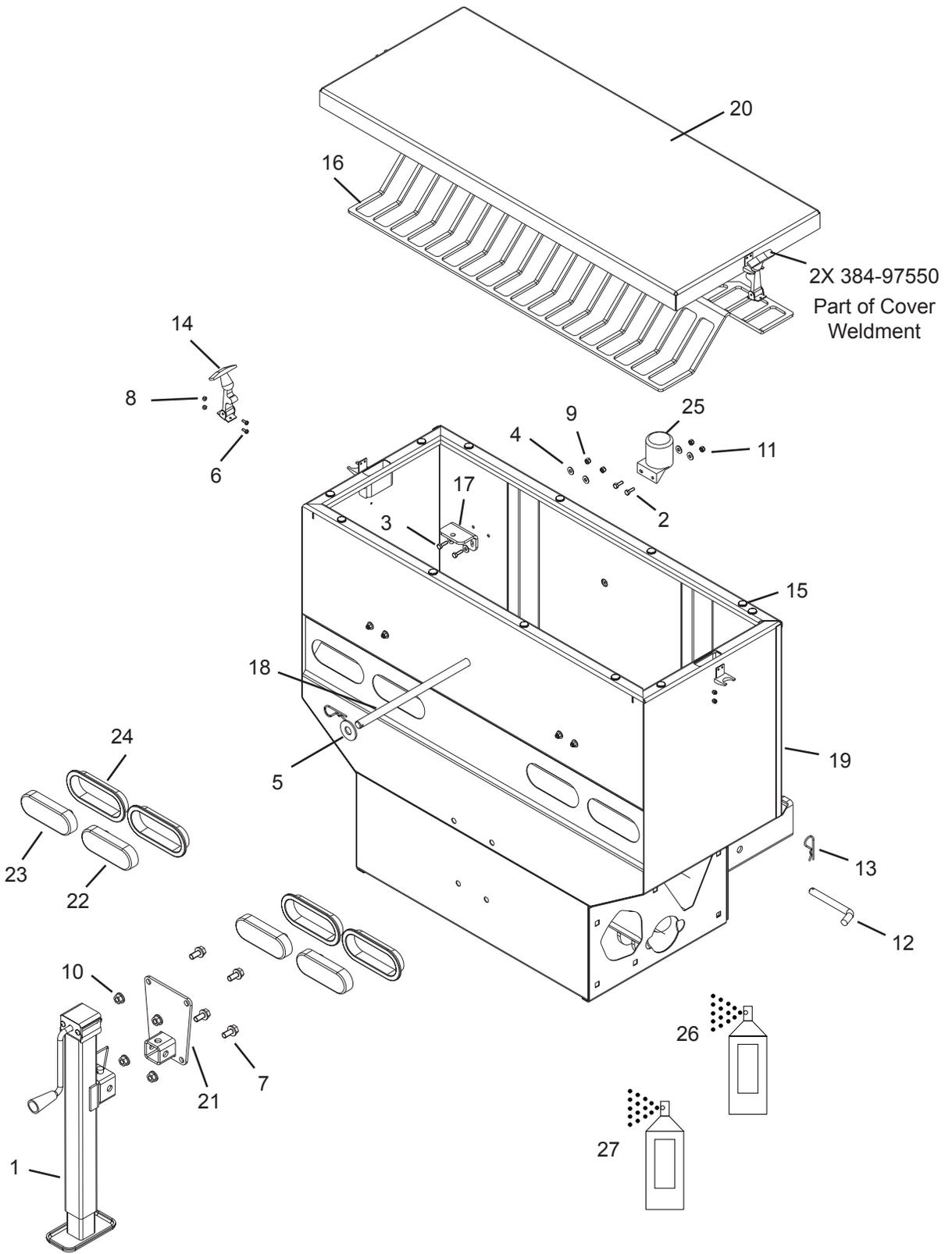
MSV SPREADER PARTS PG 2



Replacement Parts List

Item	Part Number	Description	QTY
1	103-163760	Jack, SQ, Side Crank, 5000 lb, 15 inch TRVL	1
2	370-84388	Carriage Bolt 1/2-13 UNC x 2	4
3	370-92051	Carriage Bolt 1/2-13 UNC x 1.5	6
4	371-92056	Serrated Flange Locknut 1/2-13 UNC	10
5	600-157410	Bearing Ball, 1 IN ID 2 Bolt Flange	2
6	410-157423	Hopper, Weldment	1
7	410-157429	Auger, Weldment	1
8	410-157430	Dispenser, Weldment	1
9	410-163784	Mount, LT Jackstand, Drop Spreader, MSV	1
Not Shown	401-157426	Mount, Bearing	1

MSV SPREADER PARTS PG 3

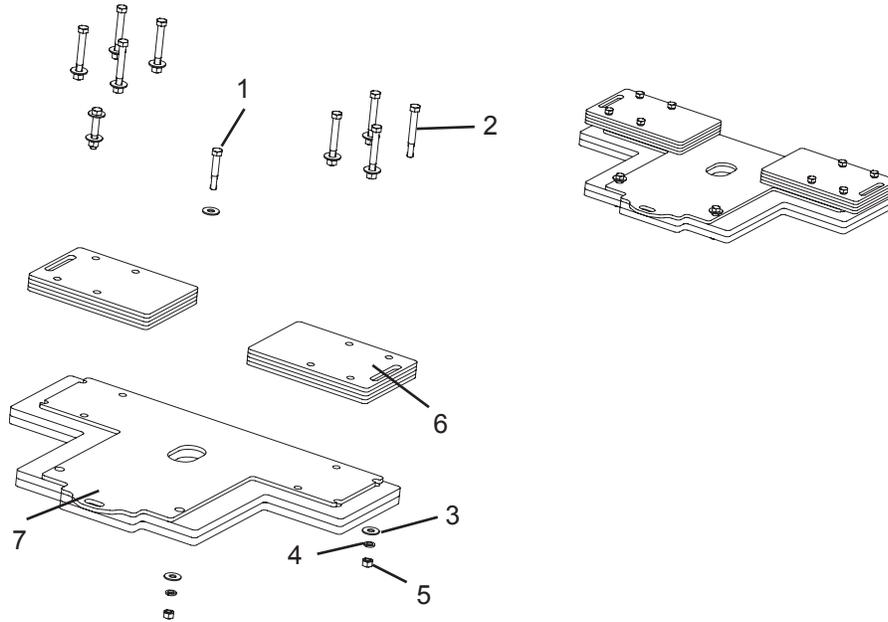




Replacement Parts List			
Item	Part Number	Description	QTY
1	103-163760	Jack, SQ, Side Crank, 5000 lb, 15 inch TRVL	1
2	310-10750	HHCS .25-20 UNC x 0.750	2
3	311-10875	HHCS .25-20 UNC x 0.875	8
4	341-10000	Washer, Flat - 1/4 STD Zinc PL	18
5	341-80000	Washer, Flat - 3/4 STD Zinc PL	2
6	370-169154	Machine Screw - RDHD Phillips Drive 8-32 x 1/2	4
7	370-92156	HHCS Flanged GR 5 1/2-13 x 1	4
8	371-169151	Nut, #8-32 Nylon Insert Lock	4
9	371-81299	Nut, Hex, ESNA, 1/4-20 NC	8
10	371-92056	Serrated Flange Locknut 1/2-13 UNC	4
11	371-97100	Nut, Hex Jam ESNA 1/4-20 UNC	2
12	380-140297	Pin, Bent Hitch 5/8 x 5	2
13	380-84739	Pin, Hair Clip #11	4
14	384-87550	Latch, Hood 260	2
15	388-157798	Adhesive-Backed, Polyurethane Bumper Flat	12
16	401-157481	Mesh, Steel Spreader, MSV	1
17	401-169367	Angle, Support	4
18	401-190024	Shaft 19.75	1
19	410-157423	Hopper, Weldment	1
20	410-157901	Assy, Cover MSV Spreader	1
21	410-163785	Mount, Rear Jackstand, Drop Spreader, MSV	1
22	703-144657	Light, Backup Oval Grommet Mount	2
23	703-144729	Light S/T/T, Red, LED Oval, Grommet Mount	2
24	703-144730	Grommet, Oval Tail Light	4
25	703-92194	Stor-A-Way Holder, 7 Pole Plug	1
26	109-131128	Yellow Touch-UP Paint	
27	249-92005	Primer, Aerosol Can	

CHASSIS WEIGHTS

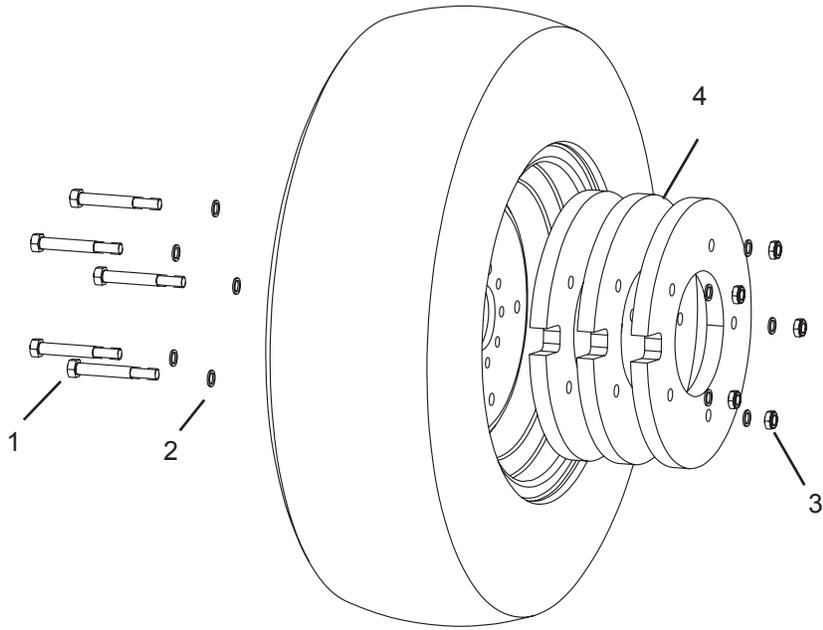
Use only on MSV units with Serial No 9-2051 and below.



Replacement Parts List			
Item	Part Number	Description	QTY
1	311-84500	HHCS .75-10 UNC x 4.500	2
2	311-86000	HHCS .75-10 UNC x 6.000	8
3	341-80000	Washer, Flat - 3/4 STD Zinc PL	12
4	351-80000	Washer, Lock - 3/4 YLW Zinc PL	10
5	361-80000	Nut, Hex, UNC, 3/4-10	10
6	401-152673	Weight, Wing 25 lbs	8
7	410-157630	Weight, Chassis MSV Front	1
—	VCW-100184	Vehicle Chassis Weight Kit Complete	1



WHEEL WEIGHTS (OPTIONAL)



Replacement Parts List

Item	Part Number	Description	QTY
1	311-74750	HHCS .625-11 UNC x 4.750	10
2	343-70000	Washer, SAE 5/8	20
3	371-97104	Nut, Hex ESNA Jam 5/8-11 UNC	10
4	401-163645	Wheel Weight, MSV	6



HYDRAULIC FITTING INSTALLATION TORQUE RECOMMENDATION

Table 1: 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 2: 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 3: 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 4: 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 5: 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
Unified Coarse Thread Series													
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
Fine Thread Series													
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 $T=KDF$, 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</p>													



Table 6: Torque-Tension Relationship for Metric Fasteners

Nominal Dia.	Pitch	 Class 4.6			 Class 8.8			 Class 10.9			 Class 12.9	
		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 Plain
(mm)		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
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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