



**OPERATING INSTRUCTIONS**

**GENERAL MAINTENANCE**

# **LUGGER SERIES**

**IMPORTANT**

**KEEP THIS MANUAL FOR FUTURE REFERENCE.**

**Study these instructions before operating and/or maintenance of this equipment**

**FACTORY:**

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**WHEN ORDERING YOUR PARTS, SPECIFIES MODEL NUMBER, PART NUMBER AND SERIAL NUMBER LISTED BELOW.**

**MODEL # \_\_\_\_\_**

**SERIAL # \_\_\_\_\_**

# **Brothers Equipment Inc.**

## **LIMITED WARRANTY**

Brother's Equipment warrants the reservoir, pump, hydraulic control valve, and hydraulic cylinders against operational failure caused by defective material or workmanship, **which occurs during normal use within one (1) years from date of shipment from our factory.**

Brother's Equipment warrants all other products of it's manufacture against operational failure caused by defective material or workmanship, **which occurs during normal use within one year from date of shipment from our factory.**

Brother's Equipment will replace all parts of our manufacture free of charge that our inspection at our factory shows to us to be defective in accordance with the above paragraph. **Written permission must be obtained from authorized Brother's Equipment personnel for any repairs performed other than in our factory.** All claims for reimbursement must be filed with proper documentation no later than forty-five (45) days after occurrence to be allowed.

All products purchased by Brother's Equipment from an outside vendor shall be covered by the warranty of that respective vendor only, and Brother's Equipment does not participate in or obligate itself to any such warranty.

No freight, travel cost, meals, lodging, or loss of hydraulic oil shall be covered by this warranty, all labor costs allowed shall be in accordance with Brother's Equipment established rate; in case of alleged defect, product shall be returned to Brother's Equipment with transportation charges prepaid. No freight collect shipment will be accepted.

Brother's Equipment makes no warranty on any of it's equipment used in any way except as it was designed, intended, and sold to perform.

DISCLAIMER OF WARRANTIES. THE LIMITED AND CONDITIONAL WARRANTY AND REMEDIES SET FORTH ABOVE ARE EXCLUSIVE AND IN LIEU OF ANY AND ALL REPRESENTATIONS, SPECIFICATIONS, WARRANTIES AND REMEDIES, EITHER EXPRESS OR IMPLIED, HEREIN OR ELSEWHERE, OR WHICH MIGHT ARISE UNDER LAW OR EQUITY, OR PURSUANT TO ANY COURSE OF DEALING OR CUSTOM OR USAGE OF TRADE, INCLUDING WITHOUT LIMITATION, ANY WARRANTIES OF MERCHANTABILITY AND OF FITNESS FOR ANY SPECIFIED OR INTENDED PURPOSE.

LIMITATION OF REMEDIES AND LIABILITY. PURCHASER'S SOLE AND EXCLUSIVE REMEDY AGAINST GALBREATH SHALL BE THE REMEDY OF DEFECTS IN PRODUCTS DELIVERED HEREUNDER AS PROVIDED BY, AND WITHIN THE TIME PERIOD SPECIFIED IN, BROTHER'S EQUIPMENT'S LIMITED WARRANTY SET FORTH ABOVE. BROTHER'S EQUIPMENT'S LIMITED WARRANTY CONSTITUTES THE SOLE REMEDY WITH RESPECT TO OR ARISING OUT OF THE EQUIPMENT, PRODUCTS OR SERVICES OF BROTHER'S EQUIPMENT. NOTWITHSTANDING ANY OTHER PROVISIONS HEREOF, IN NO EVENT SHALL ACE EQUIPMENT SALS BE LIABLE IN CONTRACT, TORT OR EQUITY FOR ANY LOSS OF ANTICIPATED PROFITS, LOST SALES, INJURY TO PERSONS OR PROPERTY, LOSS BY REASON OF PLANT SHUTDOWN, NON-OPERATION OR INCREASED EXPENSE OF OPERATION, SERVICE INTERRUPTIONS, CLAIMS OF CUSTOMERS, COST OF MONEY, LOSS OF USE OF CAPITAL OR REVENUE, OR FOR ANY SPECIAL, INCIDENTAL OR CONSEQUENTIAL LOSSES OR DAMAGES OF ANY KIND WHATSOEVER.

All claims shall be processed through the Brother's Equipment Customer Service Department or your authorized Brother's Equipment dealer.

Brother's Equipment

## IMPORTANT SAFETY NOTICE

Proper service and repair to the safe, reliable operation of the Brother's Equipment Body's products. Service procedures recommended by Brother's Equipment are described in this service manual and are effective for performing service operations. Some of these service operations may require the use of tools or blocking devices specially designed for the purpose. Special tools should be used when and as recommended. It is important to note that some warnings against the use of specific methods that can damage the product or render it unsafe are stated in the service manual. It is also important to understand these warnings are not exhaustive. Brother's Equipment Body Co. could not possibly know, evaluate and advise the service trade of all conceivable ways in which service might be done or of the possible hazardous consequences of each way. Consequently, Brother's Equipment has not undertaken any such broad evaluations. Accordingly, anyone who uses service procedures or tools which are not recommended by Brother's Equipment must first satisfy himself thoroughly that neither his safety nor the product safety will be jeopardized by the method he selects.

## SOLID WASTE SYSTEMS WARRANTY

The Brother's Equipment warrants its Solid Waste Collection, Handling and Transfer Equipment to be free from defects in material and workmanship under normal use, service and maintenance as described in its bulletins and operation manuals for a period of (6) six months from the date when the products are first placed in operation.

This warranty is expressly limited to the replacement or repair at its factory or such place as the Brother's Equipment may designate, of such parts, of such products as shall be returned to it with transportation charges prepaid and which to its satisfaction, upon inspection at such factory or other place designated by it, to have been defective in material or workmanship.

This warranty does not obligate the Brother's Equipment to bear the cost of labor in replacing defective parts. The Brother's Equipment makes no warranty of products manufactured by others and supplied by us, the same being subject to warranties, if any, of their respective manufacturers.

Any service parts sold by the Brother's Equipment shall carry a (30) thirty day warranty for replacement only, providing the factory inspection reveals a material or workmanship defect. Labor to replace such part shall be borne by the owner.

**WE MAKE NO OTHER WARRANTY, EXPRESS OR IMPLIED, AND MAKE NO WARRANTY OF MERCHANTABILITY OR OF FITNESS FOR ANY PARTICULAR PURPOSE.** The Brother's Equipment does not assume liability for loss of product, time, or any other consequential damages. Any improper use, operation beyond rated capacity, substitution of parts not approved by us, or any alteration or repair by others in such manner as in our judgment affects the product materially and adversely, shall void this warranty. **NO EMPLOYEE OR REPRESENTATIVE IS AUTHORIZED TO CHANGE THIS WARRANTY IN ANY WAY OR GRANT ANY OTHER WARRANTY.**

***\*\* The above warranty supercedes and is in lieu of all other warranties expressed or implied.***

## SECTION 1

### GENERAL INFORMATION

#### 1.1 INTRODUCTION

The Ace Luger, mounted on a suitable truck chassis, is capable of lifting, hauling and dumping detachable containers weighing from 14,000 lbs. to 60,000 lbs. depending on the unit. It is designed to perform these functions simply, safely, and efficiently. This manual has been prepared to acquaint you with the features of its design, and to instruct you in its proper operation and maintenance.

#### 1.2 DESCRIPTION

The Ace Luger hoisting unit consists of an arm assembly pivoted at the rear of a flat-bed sub frame, Jack leg stabilizers to provide support for the overhung load during lifting, and a trip hook for tilting the containers to discharge the load, or contact cylinders (hook cylinders). Each of these elements is actuated by hydraulic cylinders controlled by the operator from his normal position in the truck cab. Power for the hydraulic system is provided by a high pressure pump driven by the truck engine through a power take-off gear box on the truck transmission.

##### 1.2.1

#### *Arm Assembly*

The arm assembly consists of a pair of lift arms interconnected at the bottom by a load shaft or hinge pins which pivots in the sub frame and at the top by a cross shaft from which the lifting chains are suspended. The arm assembly is actuated by a pair of double-acting hydraulic cylinders, one connected to each arm.

Loads must be lifted by the complete arm assembly so that each arm carries its share of the load. Lifting with one arm only can twist and misalign the arms.

##### 1.2.2

#### *Jackleg Stabilizers*

The jacklegs, mounted in outrigger extensions at the rear of the sub frame are required to stabilize the truck when the load is suspended to the rear during the loading and unloading operations. Without the support of the jacklegs, the truck can be overbalanced by the overhung load, tipping about the rear axle and lifting the front wheels off the ground. Solid footing for both jacklegs is essential for stable operations. The truck should never be moved with the jacklegs down, particularly if the jacklegs are under load. Always apply the brakes before lowering the jacks and **DO NOT** release the brakes until the jacks are retracted.

##### 1.2.3

#### *Trip Hook*

The trip hook is pivoted on the load shaft at the bottom of the arm assembly. It extends through the slot in the deck at the rear of the sub frame. In its upright position, it projects above the deck where it will engage the dumping bar on the container as the container is swung to the rear by the arm, causing it to tilt over the rear of the vehicle and dump its load. In the retracted position, the hook lays back in the slot where it will not interfere with on or off-loading operations.

A longer auxiliary trip hook is used for dumping short containers which are lifted too high to engage the primary trip hook. When not in use, it is laid forward into a receptacle in the deck.

##### 1.2.4. *Power System*

The power system and hydraulic circuit are designed for operation at moderate engine speeds to conserve fuel and avoid undue wear or strain on the engine, transmission, power take-off and pump. Normal engine speed for operating the arm is 1500 to 1800 rpm, based on the use of recommended PTO ratios shown in Section 3.2.

Cycle times for ground-level operation at 1500-1800 rpm engine speed are:

Container on	46-51 seconds
Container off	52-57 seconds

Jacklegs should be operated at an engine speed of approximately 1000 rpm.



Contact Pins (hook cylinder)

Contact pins located in mid of each arm. extend contact pins out to stop rear chains. rotating container to dump load. Contact pins are also used to prevent the container from moving to comply with the cargo secure-ment requirements. Do Not Retract contact pins while under load, resulting in damage to the unit or serious bodily injury

***OVER SPEEDING THE ENGINE IN AN ATTEMPT TO DECREASE CYCLE TIMES  
WILL ONLY RESULT IN WASTED POWER AND ABNORMAL WEAR!!***

The oil passage in the hydraulic circuit – the lines, fittings and valves – can accept a limited amount of oil without excessive turbulence, heat and pressure build-up. When the pressure builds up to the relief valve setting, excessive oil from the pump, beyond the circuit's capacity, is dumped back to the tank and does no useful work. Not only is the power required to pump this oil wasted, but the gears, bearings, and other wearable parts of the pump, PTO, the transmission and the engine are subjected to unproductive wear and tear.

## **Safety Decals**

**Must be on Each unit. Please call factory and get replacement decals if decals is unnoticeable**

### **WARNING**

Return line **MUST** be properly connected before operation

**Do Not** use less than 1-1/4 return line hose.

**Do Not** use quick connect fittings

Only Use 1-1/4 wing nut connectors

### **WARNING**

Do Not operate or service this machine until Operations Manual supplied

with this unit has been fully read

Do Not operate any malfunctioning equipment

Replace unreadable safety decals

Failure to operate as instructed could result in serious damage to the machine, and result in death or serious injury to operator, helpers, and/or bystanders

Manuals can also be obtained from  
BROTHER'S EQUIPMENT.

### **WARNING**

Do Not Drive Or Operate Machinery or Equipment when intoxicated or under the influence of drugs.

### **Danger**

Do Not Climb on or Around Equipment While in Operation.

### **Caution**

Don't transport until unit is in the full safe

travel position. Cargo is properly secured  
and  
PTO Disengaged

## SECTION 2

### OPERATIONS

#### INTRODUCTION

Operation of Ace Lugger may begin after operator has read and understood the "Operation and Maintenance Manual" for this equipment.

**CAUTION: WHEN STARTING UP OR OPERATING THE ACE LUGGER, BE SURE AREA IS CLEAR OF ALL PERSONS THAT MAY BE INJURED BY ACE LUGGER MOVEMENT.**

#### DEFINITION OF OPERATOR

An Operator as referred to herein is a competent person who has read and understands the "Operation and Maintenance Manual".

#### 2.1 CONTROLS

Controls for operating the Ace Lugger are located in the cab of the truck.

##### 2.1.1. *Power Take-Off (PTO) Control*

This control is used to engage the power take-off with the driving gear in the truck transmission, thus transmitting power from the engine to the hydraulic pump.

The standard manual-shift PTO control is a flexible wire control of the push-pull type, usually mounted on the dashboard. It has two (2) working positions: (1) to engage the PTO and drive the pump and (2) to disengage. The control **MUST** always be shifted fully into one position or the other.

Instead of a manual-shift PTO, an air or vacuum shifter may be employed. The control for this type is a small valve, usually mounted on the dash, with a 2-position switching lever for engaging and disengaging the PTO.

For trucks equipped with manual transmissions, operation of the PTO control is similar to shifting gears; the clutch is disengaged and the control actuated to put the PTO in or out of gear. With Allison automatic transmissions, the selector lever for the transmission must be put in one of the drive ranges before the PTO is shifted. (The truck is held in place with the brake during this operation).

In most cases, to keep from driving the truck while running the pump, the transmission must be in *NEUTRAL*. (On Mack trucks equipped with Maxi torque Extended Range Transmissions; the auxiliary shift lever should be in *NEUTRAL* and the main shift lever in *fifth (5<sup>th</sup>) gear*).

The PTO should be engaged only when the Ace Lugger is to be operated. **NEVER** leave the PTO in gear when traveling.

##### 2.1.2 *Arm Control*

This three (3) – position, self-centering lever controls the direction of travel of the arm by shifting the spool of the hydraulic control valve to direct the flow of oil from the pump through the appropriate port to extend or retract the arm cylinders.

In the *NEUTRAL* (or center) position, the oil returns directly to the tank; the arm will not move with the control in this position. Shifting the lever to the *DOWN* position diverts the oil to the base end ports on the cylinders, extending them to swing the arm back and down. The *UP* position supplies oil to the rod end ports, retracting the cylinders to pull the arm up and forward.

Oil coming out of the cylinders must pass through a flow regulator valve. This valve will not open to allow returning oil to pass unless there is positive pressure from the pump feeding into the opposite end of the cylinders; therefore, the pump must be running in order to actuate the arm.

This flow regulator also provides the speed control for the arm. Decreasing engine speed causes the regulator to close off the return line from the cylinder, thereby slowing the motion of the arm. Accelerating the engine opens the regulator wider, thus achieving a faster speed. Once the regulator has reached its maximum opening, speeding up the engine will produce no appreciable increase in arm speed, but will only waste power and cause abnormal wear. Optimum performance is usually attained at an engine speed of 1500 to 1800 rpm.

### 2.1.3 *Jackleg and Trip Hook Control*

This lever is similar to the arm control, but operates both the jacklegs and the trip hook. Shifting it to *JACKS DOWN* moves the control valve spool to divert oil from the pump to extend the jackleg cylinders. Since the trip hook actuator cylinder is connected to the same hydraulic line, it also extends, compressing a spring to release tension on the trip hook cable, allowing the trip hook to retract. Shifting the control to *JACKS UP* directs the oil pressure to the opposite port on the jackleg cylinders causing them to retract. With the control valve spool in this position, the other port is open back to the oil tank allowing the spring in the trip hook actuator to push the trip hook cylinder back in and pull on the cable to raise the hook. When the jacklegs go down, the hook goes down; when the jacklegs come up, the hook comes up.

Since the jackleg circuit is equipped with locking valves which require pressure from the pump to unlock them, the pump must be running before the jacklegs can be moved in either direction. The trip hook cylinder, being spring-actuated one way, can be retracted whether the pump is running or not. The hook can be raised at any time by shifting the control lever to the *UP* position.

When operating the jacklegs, the engine should be run no faster than 1000 rpm or much of the oil will by-pass through the relief valve.

#### ***CAUTION: THE TRUCK MUST NOT MOVE WHILE THE JACKLEGS ARE DOWN!!***

Always apply the brakes before lowering the jacklegs and keep the brakes on until the jacklegs are retracted. **DO NOT** rely on "Emergency" or "Parking" brakes as they are seldom as effective as the regular service brakes in preventing movement of the truck. (Brake locking devices which lock the service brakes after they are applied may be used if desired.)

Since the brakes cannot hold the truck in place unless the tires have sufficient traction, the jacklegs **MUST NOT** be allowed to lift the rear of the truck.

- 2.1.3.1 When a short container requiring the use of auxiliary trip hook (§ 1.2.3) is to be handled, the auxiliary trip hook must be connected to the primary hook before lifting the container on the truck. With the primary hook standing upright, swing the auxiliary hook out of its stowed position and remove the quick-release pin which is inserted through its legs. Pull the auxiliary hook back until its cross-bar contracts the shank of the primary hook, then reinsert the quick-release pin. The two (2) hooks are now connected and can be operating using normal procedures.

## 2.2 *SAFETY PRECAUTIONS*

When properly operated and maintained, the Ace Luger will perform all the functions for which it is designed without undue hazard; however, the operator must always bear in mind the possibility of accidents and take whatever precautions are appropriate and necessary to eliminate any danger to life or limb.

- 2.2.1 Before starting the day's operation, inspect the lifting chains and trip hook for signs of damage, wear, or distortion. Loads should never be handled with weakened chains or hooks.
- 2.2.2 **ALWAYS** check the area in which operations are to be performed for possible hazards before proceeding. Watch particularly for persons who might be endangered by movement of the truck or container, and for overhead clearances of power lines, building structures, etc.

Whenever a load is suspended from the arm or the trip hook, clear the area where it might fall in case of equipment failure.

- 2.2.3 While operating the vehicle, be alert for signs of possible malfunction, such as unusual noises, unexpected or erratic responses, oil leaks, etc. Report such occurrences in detail for remedial action.
- 2.2.4 Before traveling on the highway, be sure that:
- The container is resting flat on the deck
  - All four chains are reasonably taut without excessive slack
  - Both jacklegs are fully retracted
  - The PTO is completely disengaged
  - All Ace Lugger controls are in neutral
- 2.2.5 Whenever the vehicle is unattended, all cylinders should be fully retracted, the engine turned off, and the ignition key removed.

### 2.3 NORMAL OPERATING PROCEDURE

#### 2.3.1 *Raising the Load*

- Back the truck into alignment with the container, engage the power take-off, and lower the arm to the desired position.
- Attach the key plates at the ends of the lift chains to the four (4) lugs on the sides of the container. Be sure the chains are not twisted.
- Raise the arm until all four (4) chains tighten and the front of the truck starts to lift. This will load the rear axle for the best braking effect.
- Apply the foot brake and hold, (or activate the brake lock if the truck is so equipped), and lower the jacklegs just far enough to seat them.
- With the jacklegs down and the brakes still locked, raise the load onto the Lugger deck, using the accelerator to control the speed. Hold the control in *RAISE* position until the cylinders retract completely and the relief valve opens.
- Raise the jacklegs, release the brakes, and disengage the power take-off.

#### 2.3.2 *Dumping the Load*

- With the truck in the desired position, engage the power take-off and shift the arm control lever back. The container will engage the trip hook as it moves to the rear and will be tilted over the rear apron. Shift the control to *NEUTRAL* to stop the arm when the container reaches an angle steep enough to discharge the load.
- When the container is empty, shift the arm control lever *FORWARD* until the container settles on the deck and the relief valve opens. Neutralize the control and disengage the power take-off.
- Contact Pins( Hook Cylinder) Extend contact pins, out till they connect with the container. lower arms, rear dump keys make contact with contact pins. Do not retract pins while under load. serious damage may occur.

When dumping heavy loads or materials which do not discharge freely, the jacklegs should be lowered to provide support for the overhung load. This can be accomplished by first lowering the jacklegs and stopping them when they touch the ground by depressing the clutch pedal. The trip hook can then be extended for dumping by shifting the control lever to the *UP* position and then to *NEUTRAL* before releasing the clutch.

#### 2.3.3 *Lowering the Load*

- Engage the power takeoff
- Apply the foot brake and **HOLD** (or activate the brake lock), and lower the jacklegs just far enough to seat them.
- Shift the arm control lever back until the container settles on the ground and the chains go slack, the shift to *NEUTRAL*.
- Raise the jacklegs and release the brakes
- Detach the chains from the container Lift Lugs, raise the arm and disengage the power take-off.

## SECTION 3

### HYDRAULIC CIRCUIT AND COMPONENTS

#### 3.1 SPECIFICATIONS

The hydraulic circuit and its components are designed for intermittent operation at pressures up to 2500 psi at a flow rate of 35 gallons per minute. Overloading the circuit through excessive pressure or excessive flow can damage the components; in which case all warranties are void. Proper Relief Valve Settings must be maintained to limit operating pressures, and suitable Pump and Power Take-Off Combinations employed to control the flow conditions.

#### 3.2 PUMP AND PTO

The standard pump normally supplied as original equipment produces a flow of 16 gpm per 1000 rpm at 2500 psi. The ideal PTO ratio for driving this pump is 67% of engine speed. A smaller pump should be used if the PTO ratio exceeds 80%. A larger pump should never be substituted unless the PTO ratio is lower than 56%. The pump and power take-off used in combination should produce a flow of 18 to 20 gallons per minute at an engine speed of 1500 to 1800 rpm.

#### 3.3 CONTROL VALVE

The control valve is two-spool stack type with individual sections bolted together.

The inlet section, to which the high pressure line from the pump is connected, contains the main system relief valve, set at 2500 psi. This relief limits the pressure from the pump and thus regulates the maximum operating pressure of the hydraulic system.

The next two (2) working sections control the direction of travel of the hydraulic cylinders to which they are connected. When the spools or plungers are in the neutral (centered) position, flow from the pump passes through the stack and back to the tank. Pushing the spool in directs the flow from the pump out through "A" port located adjacent to the operating end of that spool's section. Pulling the spool out directs the pump flow through the "B" port at the other end of that section. Oil returning from the system enters the valve through the opposite port and flows back to the tank.

3.3.1 The spool nearest the inlet controls the jacklegs and the trip hook. Pushing the spool in directs the oil out the "A" port to extended both the jackleg and the trip hook cylinders; pulling it out directs oil out the "B" port to the retract port on the jacklegs only (the trip hook cylinder, being a single-acting push type, has just one port). Since shifting the spool out to retract the jacklegs opens the "A" port of the valve back to the tank, a spring inside the trip hook actuator (which was compressed when the trip hook cylinder was extended) will push the rod of the trip hook cylinder back into its retracted position.

3.3.2 The second spool from the inlet controls the arm cylinders. Normally, the line to the "A" port connects to the base end (forward) port on the cylinders so that pushing the spool in causes them to extend, and pulling the spool out retracts them. However, the connections in the arm circuit are reversible so that the lines to the cylinders can be connected to make the reaction of the cylinders correspond to the marking on the control lever in the truck cab.

#### 3.4 FLOW REGULATOR VALVE (Optional)

The flow regulator valve in the arm circuit requires positive input pressure in one (1) port before it will allow oil from the cylinder to flow back through the other port, thus providing a hydraulic "lock" for the arm cylinders when there is no pressure applied by the pump. In addition, it acts as a throttling device to prevent the oil from returning to the tank from one (1) end of the cylinder faster than it is being supplied by the pump to the opposite end, thus making the cylinder speed responsive to engine speed rather than to external loads.

The pressure setting of this valve must be higher than the main system relief for it to function properly. However, it should be set low enough that pilot pressure required to unlock it is low. The recommended setting is 3000 psi, applied to the "C" ports (connected to the cylinder lines). The pilot pressure required to open the valve will be approximately 20% of the differential between this setting and the actual pressure in the return side of the cylinder.

## SECTION 4

### ***MAINTENANCE***

#### 4.1 GENERAL

Proper maintenance is more than the repair or replacement of worn or broken parts. It is also the anticipation of problems before they develop, or determination of their cause after they appear; and elimination of them at their source. In order to perform these services effectively, personnel responsible for the upkeep of this equipment must have a basic knowledge of hydraulic equipment in general and a specific understanding of the function of the Ace Luger and its normal operation as described in Sections 1, 2, and 3 of this manual.

Maintenance can be separated into two (2) categories: (1) Preventive Maintenance and (2) Corrective Maintenance.

*Preventive Maintenance* is a routine procedure, preferably applied on a regularly scheduled basis, for keeping the equipment in good working condition. As the name implies, its purpose is to prevent or at least detect at an early stage any mechanical or hydraulic problems which, if neglected, might result in malfunction or failure.

*Corrective Maintenance*, on the other hand, is the diagnosis and treatment of such problems after malfunction or failure has occurred. A good preventive maintenance program, conscientiously applied, will help insure continuous trouble-free performance and keep costly corrective maintenance and down-time at a minimum.

#### 4.2 SAFETY PRECAUTIONS

Certain precautionary measures should always be followed during maintenance procedures:

- a. Person(s) not involved in performing or directing the work should be cleared from the area.
- b. The parking brake (or other brake locking device) should be set and the truck wheels chocked.
- c. The power take-off should be disengaged, the truck engine turned off, and the keys in the possession of the mechanic at all times when operation of the equipment is not required.
- d. Before working on the hydraulic system, relieve trapped pressure by shifting all control valve spools both ways. When loosening hydraulic connections, hold a rag around the joint while gradually turning the fitting.
- e. Hydraulic oil can catch fire!!! Keep it from spraying on hot surfaces or around open flames. Clean up spills.
- f. If lines in the jackleg circuit are to be disconnected, first extend the jacklegs fully or secure them in the raised position to prevent them from dropping.
- g. If the job requires disconnecting the hydraulic lines from the arm cylinders or the cylinders from the arm, the arm should be securely supported against falling. A chain hoist is recommended for this purpose.

***CAUTION: IF BLOCKS ARE USED FOR SUPPORT, DO NOT POWER THE ARM DOWN AGAINST THE BLOCKS!! INSTEAD, PUT THE ARM IN THE DESIRED POSITION AND WEDGE THE BLOCKS INTO PLACE.***

- h. **DO NOT** operate the trip hook cylinder without the spring housing securely bolted to the cylinder unless some other positive stop is improvised to prevent the cylinder rod from coming completely out. The cylinder itself has no built-in stop.
- i. Before loosening the bolts attaching the spring housing to the trip hook cylinder, first exhaust any pressure in the cylinder, then turn the ham nut for the yoke down on the rod to the bottom of the threads. This will relieve the spring force trying to separate the cylinder and the housing.
- j. Remove all tools or other extraneous equipment and clean off any oil, dirt, or similar accumulations before putting the vehicle back in operation.



#### 4.3 PREVENTIVE MAINTENANCE

For effective preventive maintenance, a regularly scheduled program of inspection and servicing should be established. In addition to those services required for the truck, the Ace Luger mechanism should receive the following attention:

##### 4.3.1 *Daily*

- a. Inspect the lift chains for badly worn or damaged links and attachments.
- b. Inspect the trip hook for cracks and distortion, and for proper adjustment. It should pivot freely on the load shaft when there is no spring tension on the actuating cable (jack down), and snap smartly into the full upright position when pulled down against tension (jack up) and released.
- c. Check the oil level (¶ 4.5.2).

##### 4.3.2 *Weekly*

- a. Clean off all accumulated dirt and debris, particularly from the recess for the trip hook and from the top cover plate on the jackleg outriggers.
- b. Inspect all mounting attachments between the Ace Luger and the truck chassis for loose or missing bolts and nuts.
- c. Check the cap screws securing the cylinder pins to the sub frame at the front and to the lift arms at the rear.
- d. Check the drive line from the PTO to pump making sure all set screws are secured.
- e. Inspect for leaky seals on the PTO and pump shafts.
- f. Check the control linkage to the valve for missing cotter pins and loose clevis jam nuts.
- g. Inspect the oil tank filler cap making sure the breather is not clogged.
- h. Look for signs of oil leaks in the hydraulic system.

##### 4.3.3 *Monthly*

- a. Check the hydraulic pressure at the control valve inlet (¶ 4.5.5).
- b. Check the time required to (1) extend and (2) retract the arm cylinders full stroke with no container at 1800 rpm engine speed.

*NOTE:* Recording the results from (a) and (b) for comparison with subsequent readings is recommended as a means of detecting deterioration in pump performance.

- c. Tighten all bolts, nuts and cap screws (¶ 4.3.2).
- d. Tighten all connections in the hydraulic system.
- e. Lubricate the moving parts (¶ 4.4).
- f. Adjust the lift chains (¶ 5.2).
- g. Drive the taper pins connecting lift arms to the load shaft to seat tightly.

##### 4.3.4 *Semi-Annually*

- a. Check arm position and adjust if necessary (¶ 5.1).
- b. Change the hydraulic oil and the oil filter (¶ 4.5).

##### 4.3.5 *Annually*

- a. Remove and inspect the power take-off (¶ 4.6.1).

#### 4.4 LUBRICATION

Those parts of the unit subject to friction (pivot pins, bearings, etc.) must be kept well lubricated. Use the same grease for the Ace Luger as that recommended by the truck manufacturer for lubricating the truck chassis.

#### 4.4.1 Grease Fittings

During lubrication, check all grease fittings for closing or damage which might prevent free passage of the lubricant. Replace them if necessary.

Grease fittings are located at the following points:		
Universal Joint	PTO End	1 fitting
Universal Joint	Pump End	3 fittings
Arm Cylinders	Forward Eye	1 fitting each eye
Arm Cylinders	Front Pin Support	1 fitting each support
Arm Cylinders	Rear Pin	1 fitting each pin
Load Shaft Support	Both Sides each arm	1 fitting each support
Trip Hook		1 fitting
Lift Chain Saddles		1 fitting each saddle
Jackleg Cylinders	Upper Pin	1 fitting each pin

#### 4.4.2 Oil Can Lubrication

All pins in the control linkage (except those inside the console mounted in the truck cab) should be lubricated by squirt can. Wipe off all the excess oil.

#### 4.5 HYDRAULIC SYSTEM

Contamination is the chief cause of premature failure of hydraulic components. Care must be taken to prevent dirt or other foreign matter from entering the system. When excessive contamination is evident, the entire system should be cleaned. Hydraulic oil should be changed at least every six months.

##### 4.5.1 Hydraulic Oil

For the hydraulic system, hydraulic oil containing rust and oxidation inhibitors, an anti-foamant, and an anti-wear additive is recommended. (If such is not available, an API engine oil, designation SE, having SAE viscosity rating of 10W/30 may be used). DO NOT use low viscosity naphtha base motor oil, hydraulic brake fluid or aircraft hydraulic fluid.

##### 4.5.2 Oil Level

An inadequate supply of oil in the tank can cause the pump to suck in air and pump it into the system. In addition to creating a spongy or jerky cylinder movement, air can cause premature pump failure.

The proper oil level for the Ace Luger is 4 to 5 inches below the top of the filler neck on the oil tank when all cylinders are fully retracted.

When changing the oil, or when more than (2) gallons must be added, operate all cylinders through several cycles and recheck the oil level before placing the unit back in operation.

##### 4.5.3 Changing the Oil

When changing the oil in the hydraulic system, as much of the old oil as possible should be drained from the cylinders as well as from the tank. Collect the drained oil in clean receptacles so it can be checked for signs of harmful contamination. (All components in the system should be dismantled and cleaned if the oil is severely contaminated).

The following procedure for draining the system is suggested:

- a. Before draining the tank, extend the jacklegs completely and disconnect the hose at the trip hook cylinder.
- b. Extend the arm to the rear and support it in this position ¶ 4.2.g). Disconnect the cylinders from the arms by removing the pin. With the rear of the cylinder barrels supported so the rod end will clear the arms, first extend the cylinders fully and then completely retract them. Disconnect the hoses feeding the forward ports at the cross-tube on the back of the oil tank.
- c. Drain the tank by removing the plug from the bottom.
- d. Disconnect the hoses at the pump.

- e. Remove the cover from the clean-out port on the bottom of the tank, and clean the interior.
- f. Remove the used oil filter and install a new one ¶ 4.5.4).
- g. Replace the clean-out port cover (using copper washers on each bolt), install the drain plug, and reconnect the pump hoses.
- h. Fill the tank with new oil to (4) four inches below the top of the filler neck.
- i. Reconnect the hoses for the forward port on the arm cylinders, and disconnect hose feeding the rear ports (at the larger adjacent cross-tube on the back of the tank).
- j. Slowly extend the arm cylinders approximately halfway (2 ft. of stroke), expelling the oil from the rod end through the disconnected hoses. Add 10 gallons of oil to the tank, and then slowly complete the extension. When the cylinders bottom out and the relief valve opens, oil may flow out of the open cross-tube on the tank until the control valve is shifted to neutral. This condition is normal. However, if flow occurs while the cylinders are retracting or with the control valve in neutral, it is an indication of internal leakage in either the flow regulator or the main control valve.
- k. With the arm cylinders fully extended, reconnect the hoses to the cross-tube and add (5) five more gallons of oil to the tank.
- l. Reconnect the arm cylinders to the arms and retract them.
- m. Slowly retract the jacklegs. Oil expelled from the jackleg cylinders will flow out of the disconnected trip hook cylinder hose.
- n. With the jacklegs fully retracted, reconnect the trip hook cylinder hose and check for proper oil level in the tank.
- o. Cycle both the arms and the jacklegs several times to purge air from the system, and then recheck the oil level.

#### 4.5.5. *Replacing the Oil Filter*

The oil filter is installed in the return line between the control valve and the tank. It is mounted between the side plates at the right front corner of the Ace Lugger beneath the removable top cover plate.

The lower section of the filter is a throw-away canister which unscrews from the manifold block on top, so it is not necessary to disconnect the lines or dismount the filter to replace the element. Before installing the new element, coat the gasket on top of the canister with hydraulic oil. Screw the canister onto the manifold until the gasket makes contact, then tighten it an additional  $\frac{1}{2}$  (minimum) to  $\frac{3}{4}$  (maximum) turn using a wide strap wrench around the canister next to the bottom.

#### 4.5.6 *Checking System Pressure*

A  $\frac{1}{4}$  NPT tapped hole for connecting a pressure gauge is provided in the end of the fitting on the high pressure hose at the inlet of the control valve. By installing a 0-3000 psi gauge at this point, the pump pressure available to operate the system can be read.

To determine the maximum pressure available, retract the arm or jackleg cylinders at a low engine speed until they bottom out, and then gradually increase the engine speed to 1800 rpm while still holding the valve open. The gauge should register 2500 psi. If the gauge indicates more than 2600 psi, the relief valve is either set too high or not functioning properly.

If the reading is less than 2400 psi, the problem can lie in either the relief valve or the pump. Before tampering with the relief valve setting, first determine which of these the source of the problem is.

### 4.6 REPAIRS

The working components of the hoisting unit can be expected to deteriorate or wear out simply due to use. Repair or replacement of these elements should be undertaken whenever such deterioration first becomes apparent; "making do" until a serious malfunction or complete failure occurs can be costly and possibly hazardous.

#### 4.6.1 *Power Take-Off*

The power take-off should be removed from the truck transmission for inspection of the following parts:

- a. Gears: Look for excessive or uneven wear and broken, chipped, or pitted teeth.
- b. Bearings: Check for excessive side play (more than 1/64 inch).
- c. Seals: Look for worn or ragged lips and soft consistency.

Replacement parts should be obtained from the local PTO distributor.

If the complete PTO must be replaced, be sure one having the proper ratio for the pump being driven by it. Ref. Hydraulic Circuit ¶ 3.2 for information.

#### 4.6.2 *Universal Joints*

The universal joints should be checked for excessive play in the knuckle joint.

#### 4.6.3 *Hydraulic Pump*

Field repairs to the pump generally should be limited to the replacement of seals. Pumps receiving more extensive repairs should be bench tested before being put back in service.

When replacing the pump, be sure the replacement is compatible with the PTO. An oversized pump can cause serious damage in the hydraulic system. Ref. Hydraulic Circuit paragraph 3.2 for information on pump size/PTO speed combinations.

Always clean the oil tank and change the filter whenever the pump is replaced, and check the main relief valve setting (¶ 4.5.5) before resuming normal operation.

#### 4.6.4 *Control Valve*

The control valve consists of individual sections bolted together (¶ 3.3) making it possible to replace a complete section assembly as well as individual parts. Since the spools and housings are fitted to exact tolerances, they are not available separately; therefore, it is best to replace the complete section if either of these items is required. Be sure the replacement section is the same as the originals.

When reassembling the valve stack, tighten the stud nuts holding the sections together to 20 ft. lbs. torque. **DO NOT** use lock washers under these nuts.

#### 4.6.5 *Cylinders*

When cylinders are reassembled after servicing, be sure seals are properly oriented as shown on the drawings.

One-piece molded rings, such as "U" shaped sections and "O"-rings must **NOT** be split. A coat of grease is sometimes helpful getting them to slide into position. **DO NOT** roll "O"-rings into place.

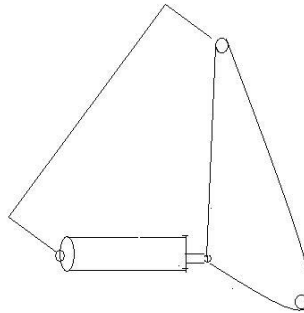
Where one back-up ring is called for in conjunction with an "O"-ring, it should be installed on the side away from the hydraulic pressure. If two back-up rings are required, the "O"-ring goes between them.

## SECTION 5

### ADJUSTMENTS

#### 5.1 ARM

The retracted length of the arm cylinders must be so adjusted that both arms are positioned at the same angle and in the proper relationship to the sub frame. This can most easily be determined by measuring in a direct line from the center of the front arm cylinder mounting pin diagonally up to the center of the cross-shaft at the top of the arm with the cylinders fully retracted (see diagram below). DO NOT measure to the retaining washers to the ends of the cross-shaft since they may be off center.



This dimension for current standard 120-RC-50 model Ace Lugger should be:

96-RC-50	Series 4696	85-3/4 inches
120-RC-50	Series 7420	86-3/8 inches

The dimension can vary from that tabulation above, but both sides on a given unit must measure the same.

Adjustment of this position is accomplished by screwing the rod of the cylinder in or out of the eye connected to the arm, using the following procedure:

- a. Remove the two setscrews and the nylon plugs from the shank of the eye.
- b. Back the jam nut away from the eye.
- c. Using a wrench on the flats of the cylinder rod, turn the rod into the eye to decrease the distance measured above, or out of the eye to increase it.
- d. When the proper adjustment has been achieved, tighten the jam nut securely against the eye, replace the nylon plugs in the setscrew holes, and screw the setscrews down tight.

#### 5.2 CHAINS

The lift chains should be adjusted so there is no appreciable slack in any of the chains with the container resting on the deck and the arm cylinders fully retracted.

The following procedure is suggested:

- a. With the chains hanging loose, push the U-bolts to which they are connected up through the chain saddles as far as possible, and then turn the bottom nuts down against the top of the saddles to hold this position.
- b. Connect the chains to a container of the same series number as the Lugger and lift it into the transport position (arm cylinders fully retracted). The container should be suspended above the deck.
- c. Lower the U-bolt on each side by turning the bottom nuts until the container bottom rests on the deck.
- d. Screw the top nuts down tight against the bottom nuts to lock them in place.

#### 5.3 TRIP HOOK

a. *Primary Hook Adjustment*

Extend the trip hook actuator cylinder full stroke by lowering the jacklegs. Loosen the (2) two cable clamps. With the primary trip hook lying all the way back against the top, take up all slack from the cable and tighten the cable clamps.

b. *Auxiliary Trip Hook*

After adjusting the primary trip hook, shift the control valve to "Jack UP" so the primary hook is erect. Connect the auxiliary trip hook (¶ 2.1.3.1).

With both hooks upright, loosen the cable clamps on the cable connect to the auxiliary hook, take up all cable slack, and tighten the clamps.

Disconnect the auxiliary hook and lay it forward into its stowed position. Loosen the jam nut and turn the adjusting screw on the side of the auxiliary hook down against the cable connecting link until there is just enough tension on the cable to allow the hook to rest lightly in the receptacle without protruding above deck level. Lock the screw by tightening the jam nut.

5.4 HYDRAULIC PRESSURE ADJUSTMENTS

Adjustment of the pressure settings in the hydraulic system should never be attempted without first installing a reliable pressure gauge in the line where the pressure is introduced.

A snubber must be used to dampen vibration of the gauge's indicator needle so accurate readings can be taken.

A separate pressure limiting valve, preset at 3500 psi and installed between the pump and the inlet connection to the valve being adjusted, is recommended as protection against excessive pressure in case the valve being adjusted is faulty.

5.4.1 *Relief Valve Settings*

The main system relief, located in the inlet section of the control valve bank, should by-pass at 2500 psi when hydraulic pressure is applied through the inlet port.

Adjustment is accomplished by adding shim washers to the shank of the poppet between the spring and the poppet shoulder if the setting is too low, or by removing shim washers if the setting is too high.

5.4.2 *Flow Regulator Valve Setting*

The flow regulator valve should be set to by-pass at 3000 psi when pressure is applied through the port marked "C" on the flow regulator valve body. (The by-passing oil will flow out through the closest port marked "V". Be sure this port is left open for oil to escape.)

To adjust the setting, first back out the adjusting screw projecting from the end of the valve adjacent to the port being regulated; then apply hydraulic pressure and gradually turn the screw in until the pressure gauge registers 3000 psi, lock the screw in this position by tightening the jam nut.

Each of the (2) two "C" ports must be individually regulated by following the above procedure.

## **PARTS INFORMATION**

### **TO THE OWNER**

If you should need information not given in this manual or require the service of a trained mechanic, we urge you to use the extensive facilities offered by the authorized Brother's Equipment Body Distributor in your locality.

### **INSTRUCTIONS FOR ORDERING REPLACEMENT PARTS**

For ease in ordering of Ace Luggers parts, a system of part and assembly numbers is used. It is important these numbers be used wherever and whenever possible.

All parts listed on the proceeding drawings, repair parts sheets or exploded views shown parts in their proper relationship. Each individual part is identified by name and part number.

Use the following suggestions and you should have little difficulty in getting quick and efficient part delivery.

#### ***IMPORTANT***

1. Give model, serial, and identification numbers found on Identification Plate of the unit. Be sure numbers are complete and include the prefix and suffix, if applicable.
2. Order by Part Number Only – Not by item number.
3. Check every part number for accuracy. The part numbers are sometimes very similar and can be easily transposed.
4. Be careful to order correct quantity.
5. When ordering an assembly, make sure all the parts you need are included in the assembly.
6. Common hardware is not listed
7. Say whether shipment is to be made Express, Parcel Post or Freight. Give freight shipping point if different from mailing point.
8. Order parts from your nearest Brother's Equipment distributor.

PLEASE READ BEFORE OPERATING

1. Familiarize yourself with controls and labeling located in cab.
- Read operating instructions.
- WARNING** - Do not operate this unit when anyone is standing or watching in nearby vicinity.

CONTROL INSTRUCTIONS

The following are the control levers located in the cab.

1. Power Take Off (PTO) Control
2. Arm Lifting Control
3. Rear Stabilizer (Jack Leg) Control
4. Dump Cylinder (Hook Cylinder) Control.

Following is an explanation of their use:

- 1) **Power Take Off Control (PTO)**  
This is the lever control: the first control lever nearest to the driver in the control boxes. This lever is used to engage the PTO which results in transmitting power from transmission to hydraulic pump. To operate - put transmission in neutral. Disengage clutch, move control lever to PTO N position. Engage clutch so PTO is in operation.
- 2) **Arm Lifting Control**  
This control is used for raising or lowering the arms. When control lever is moved from Neutral (center position) to Arms Up, the arms will rotate upward. From Neutral to Arms Down, the arms will rotate downward. To increase or decrease the speed of arm rotation a) increase or decrease engine speed or b) move lever closer towards neutral position. **Note: At neutral position arms stop rotation.**
- 3) **Rear Stabilizer (Jack Leg) Control**  
This control is used for raising or lowering the jack leg to give more stability to the unit. When control lever is moved from Neutral (center position) to Jack Leg Down, the jack legs should be lowered until just touching the ground. **Note: Jack legs should not be allowed to lift rear of truck off the ground or damage may occur.** When control lever is moved from Neutral to Jack Leg Up, the jack legs will retract. **Note: Jack legs must be fully retracted before moving truck, otherwise severe damage may occur.**
- 4) **Dump Cylinder (Hook Cylinder) Control**  
This control is used for dumping containers. When the control lever is moved from Neutral to Hook Cylinder **IN**, the cylinders in each arm will extend inwards until touching side of container. **Note: a) Check for full extension b) Hook should be between the rear channel and the dump lift key but not pressing either one.** When control lever is moved from Neutral to Hook Cylinder **OUT**, the hook cylinder in each arm will retract into arms. **Note: Never retract hook cylinder while in dump position.**



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## OPERATING PROCEDURES

1. Picking Up Container
  - i. Back truck up until centered with container. Engage PTO and lower arms until just touching container. Move truck backwards or forwards until centered on container.
  - b. Attach double lift keys to front of container and dump lift keys to rear of container. Make sure your chains are not twisted.
  - c. Raise arms until all chains become tight and front of truck starts to leave ground.
  - d. Engage parking brakes and lower jack legs until just touching ground.
  - e. Raise arms and load container on to deck. Make sure arms are fully forward.
  - f. Retract jack legs, disengage PTO, then release brakes.
2. Dumping Container
  - a. Engage PTO, put on parking brakes.
  - b. Run hook cylinder to **IN** position, until touching container. Note: Driver should look to check position of hook cylinder for dumping.
  - c. Move arm lever to **DOWN** position and container will rotate over into dump position. Stop arms when container has dumped. Note: When dumping heavy loads or materials that seem stuck or frozen, you may need to lower jack legs.
  - d. When container is empty, move arms to **UP** position until container rests completely on deck.
  - e. Retract Dump cylinders. Lift jack legs and disengage PTO.
3. Lowering Container to Ground
  - a. Engage PTO
  - b. Apply brakes
  - c. Move arms to **DOWN** position until container leaves deck and rests on ground. Make sure chains are slack to facilitate removal from container. Remove chains.
  - d. Raise arms until all the way up.
  - e. Disengage PTO and brakes.

### IMPORTANT ITEMS

1. Do not drive with PTO in gear.
2. Make sure jack legs are fully retracted before moving.
3. Do not retract dump cylinder while in dumping position.
4. Arms should be fully retracted, UP position, both for storage and for driving.
5. Unit should be operated at a speed not to exceed 1800 RPM.



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## GENERAL MAINTENANCE

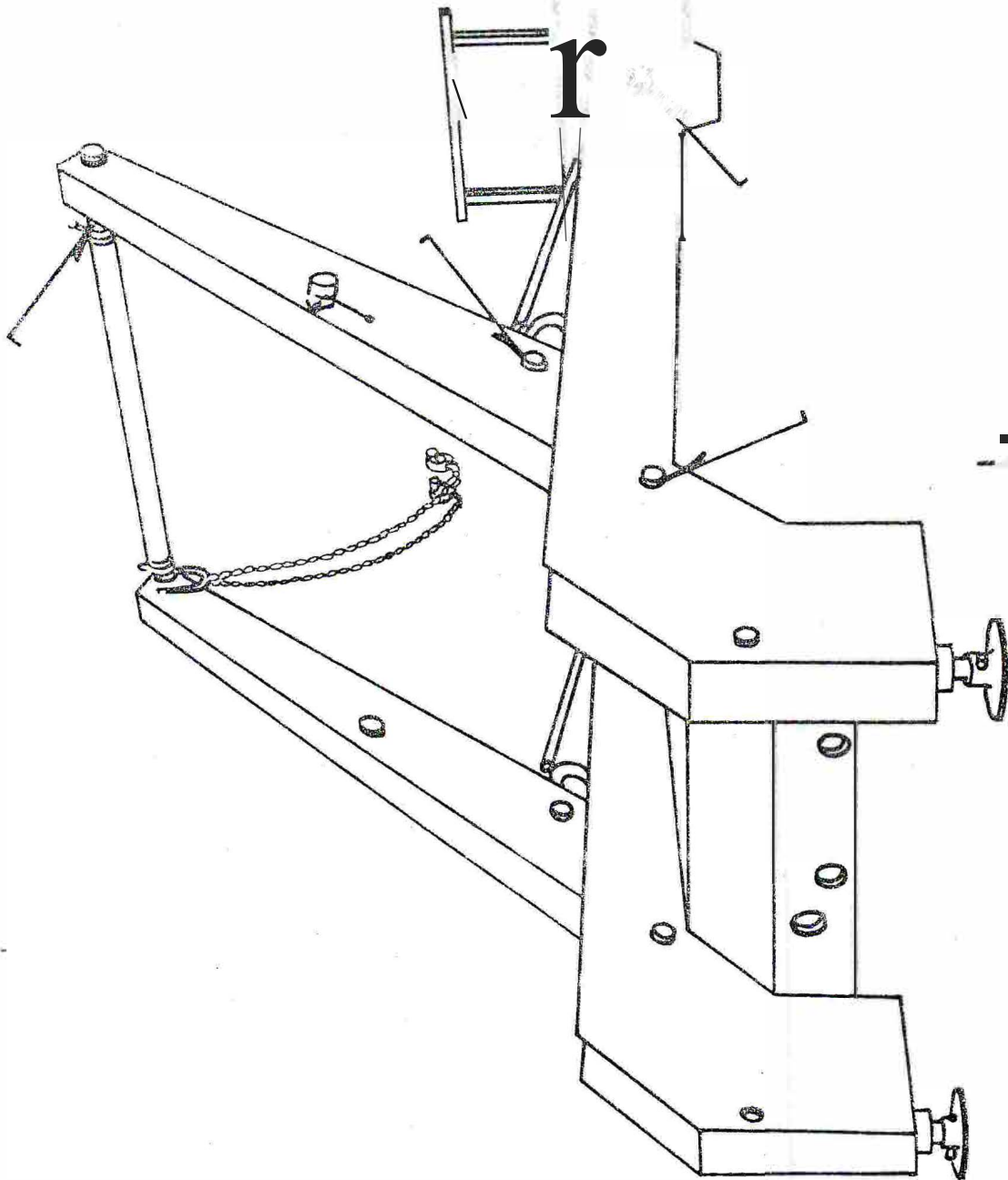
1. Keep chassis clean off unit.
  2. Check lubricating drawing **Page 4**. There are four grease fittings per side, and three on drive shaft. Lubricate no less than once a month.
  3. Oil filter should be changed originally during the first month to six weeks of operation. Thereafter, every six months.
  4. Never put any type of contaminated oil in unit. You should use a 10 viscosity weight, non-detergent hydraulic oil (petroleum, not synthetic).
  5. Make sure periodically, that all nuts and bolts are tight.
  6. Check periodically for wear on chains and lift keys.
  7. Beware of low bridges and low clearances.
- Remember, regular maintenance is a must to extend life of unit.

Note: When ordering parts, refer to part number, model number and letter code (front page).



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NOTES LUBRICATION POINTS  
4 ON EACH SIDE

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Part No.

Name

LUBRICATION CHART

DATE 4-06-78

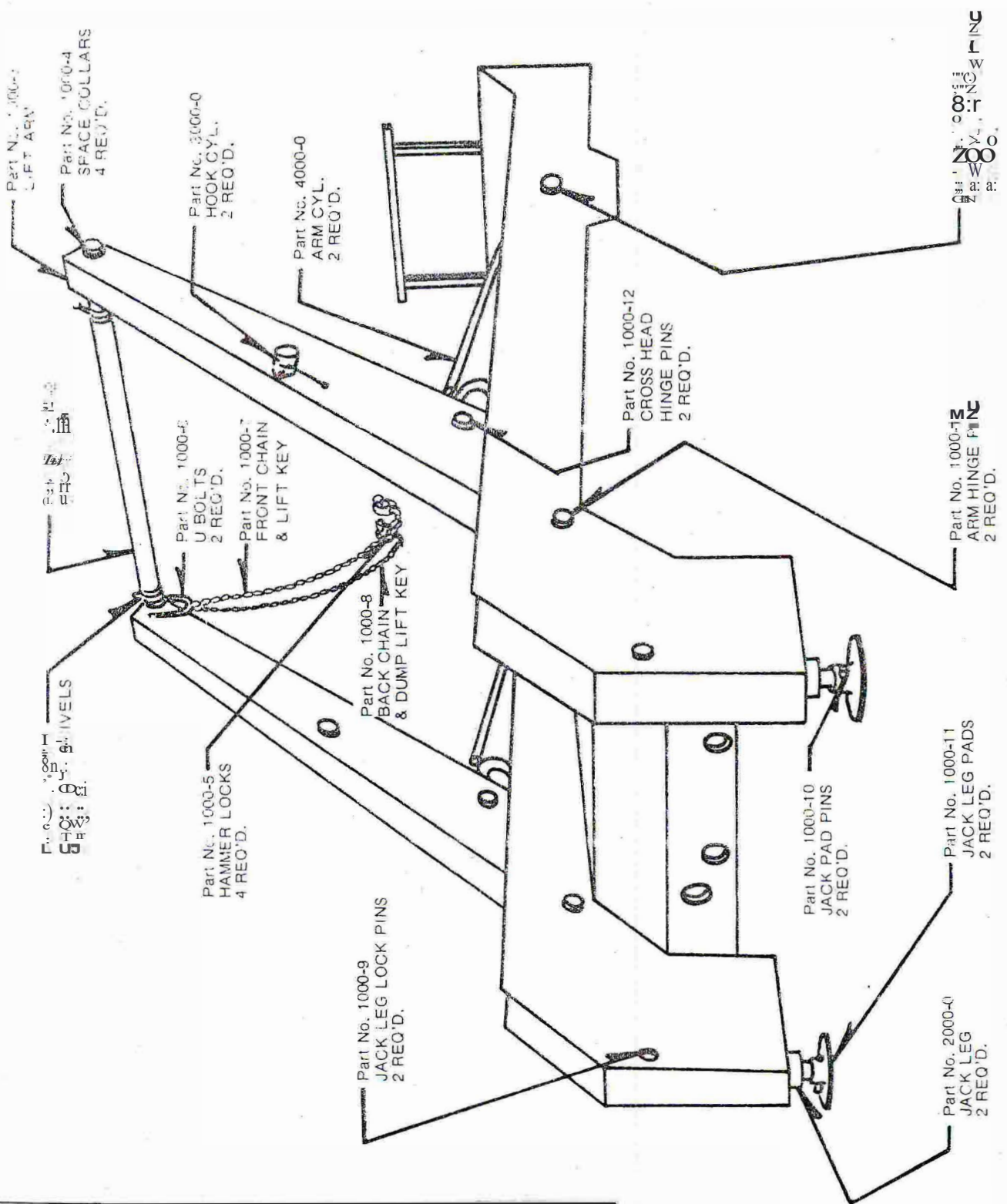
OWN  
CHKD  
APVO  
ENG

JR!



CLEVELAND, OHIO 44104

REV	DATE	CHANGE	APVD

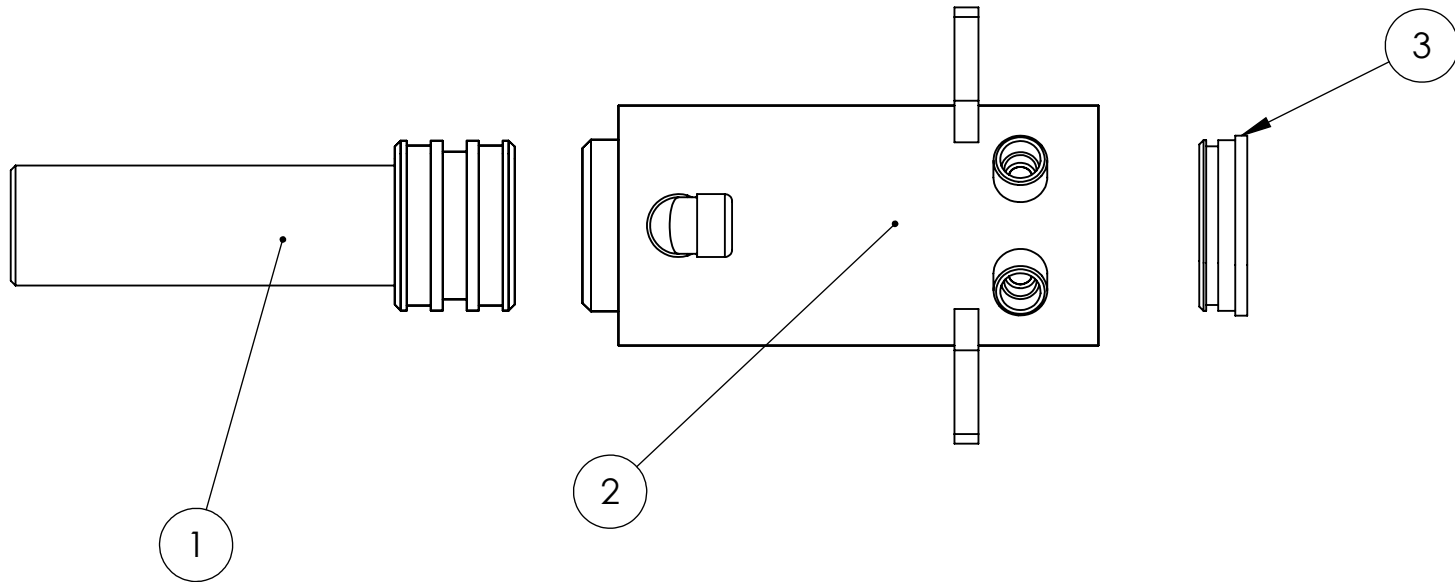


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Part No.	Name
120-RC-26	ACE LUGGER

REV	DATE	CHANGE	APVD	 CLEVELAND, OHIO 44104	DATE	4-06-78	OWN CHKD APVD ENG,
					1000-		

ITEM NO.	PartNo	DESCRIPTION	exploded view/QTY.
1	8-2001	Hook Cyl. Shaft 60,50,40,35	1
2	9-2002	Hook Cylinder barrel	1
3	177-2001	hook cyl. base plate	1
4	272-2004	Seal Kit	1



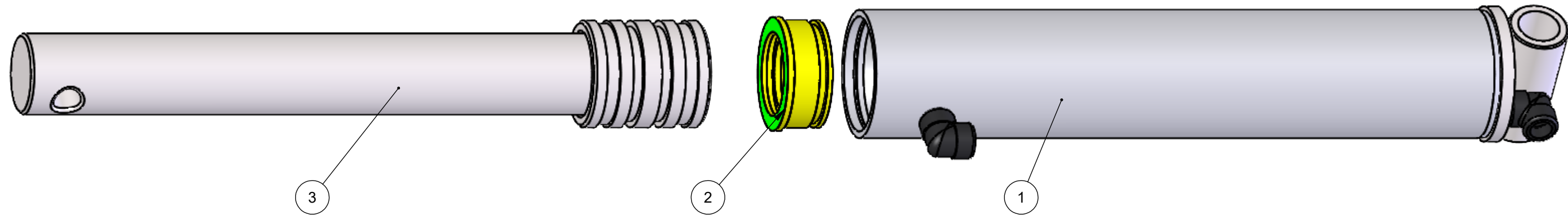
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UNLESS OTHERWISE SPECIFIED:		NAME	DATE	<b>BROTHERS EQUIPMENT</b>	
DIMENSIONS ARE IN INCHES		DRAWN			
TOLERANCES:		CHECKED		SIZE <b>A</b> PART NUMBER <b>1-2003</b> REV	
FRACTIONAL ± .005		ENG APPR.			
ANGULAR: MACH ± .005		MFG APPR.			
BEND ± .005		Q.A.			
TWO PLACE DECIMAL ± .01		COMMENTS			
THREE PLACE DECIMAL ± .005					
INTERPRET GEOMETRIC TOLERANCING PER:					
MATERIAL					
FINISH					
DO NOT SCALE DRAWING					



# 1-2002 Jackleg Complete Assembly



ITEM NO.	PART NO.	DESCRIPTION
1	9-2001	JACKLEG BARREL
2	35-1003	Jackleg/Revvng Brass Gland
3	8-2002	Jackleg Cylinder rod/piston assy
4	2000-10	Seal Kit

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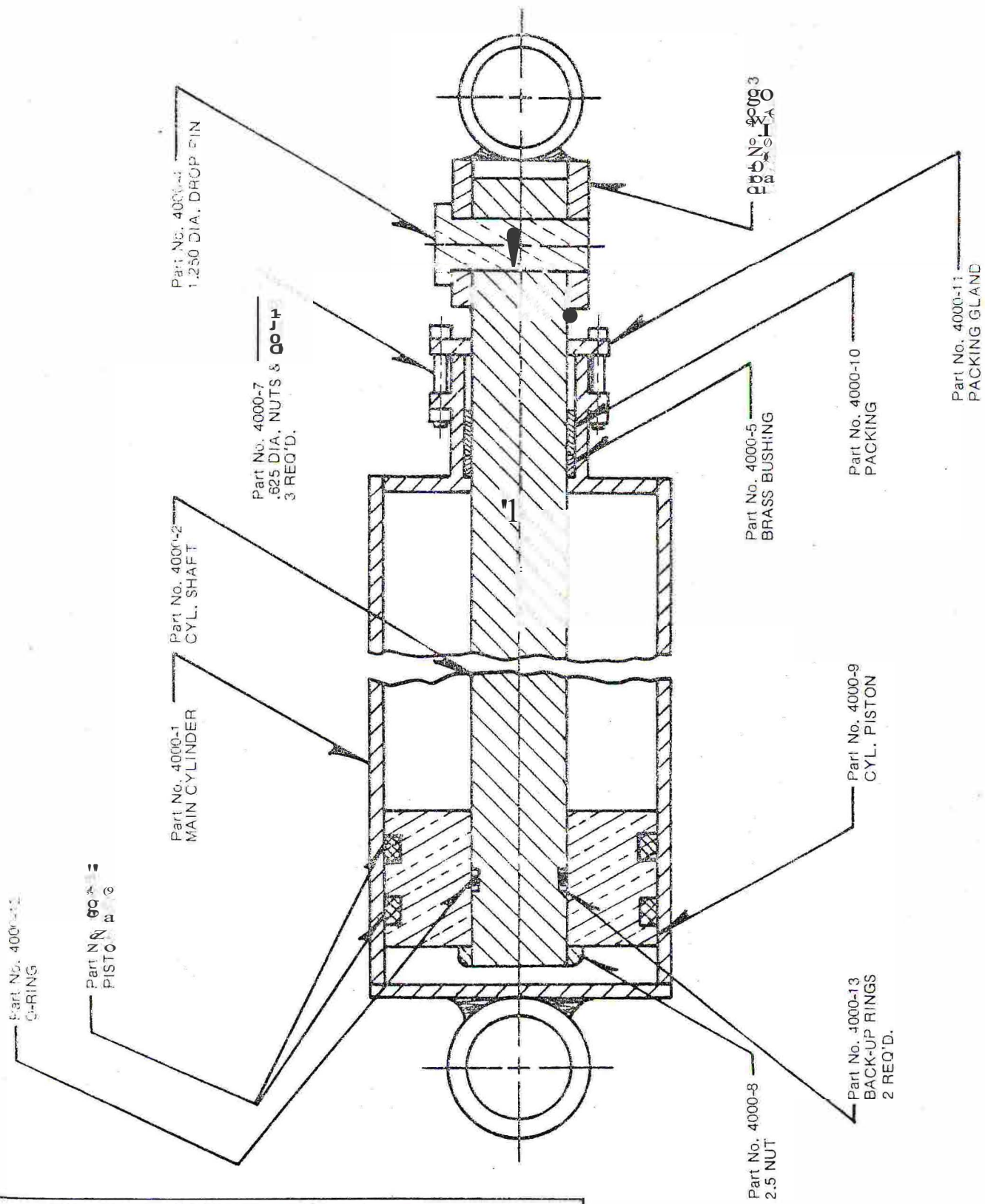
TOLERANCES:  
FRACTIONS: ± 1/16  
ANGLES: ± 1°  
.XX: ± .015  
.XXX: ± .005

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES



CAD FILE	1-2002, Jackleg Complete Assy
MATERIAL	
WEIGHT	97.75 lb.
DRAWN	LK 1/9/2020

<b>JACKLEG ASSY</b>			
PART NO.	<b>1-2002</b>		
SIZE T	SCALE 1:4	SHEET 1 OF 1	REV <b>A</b>



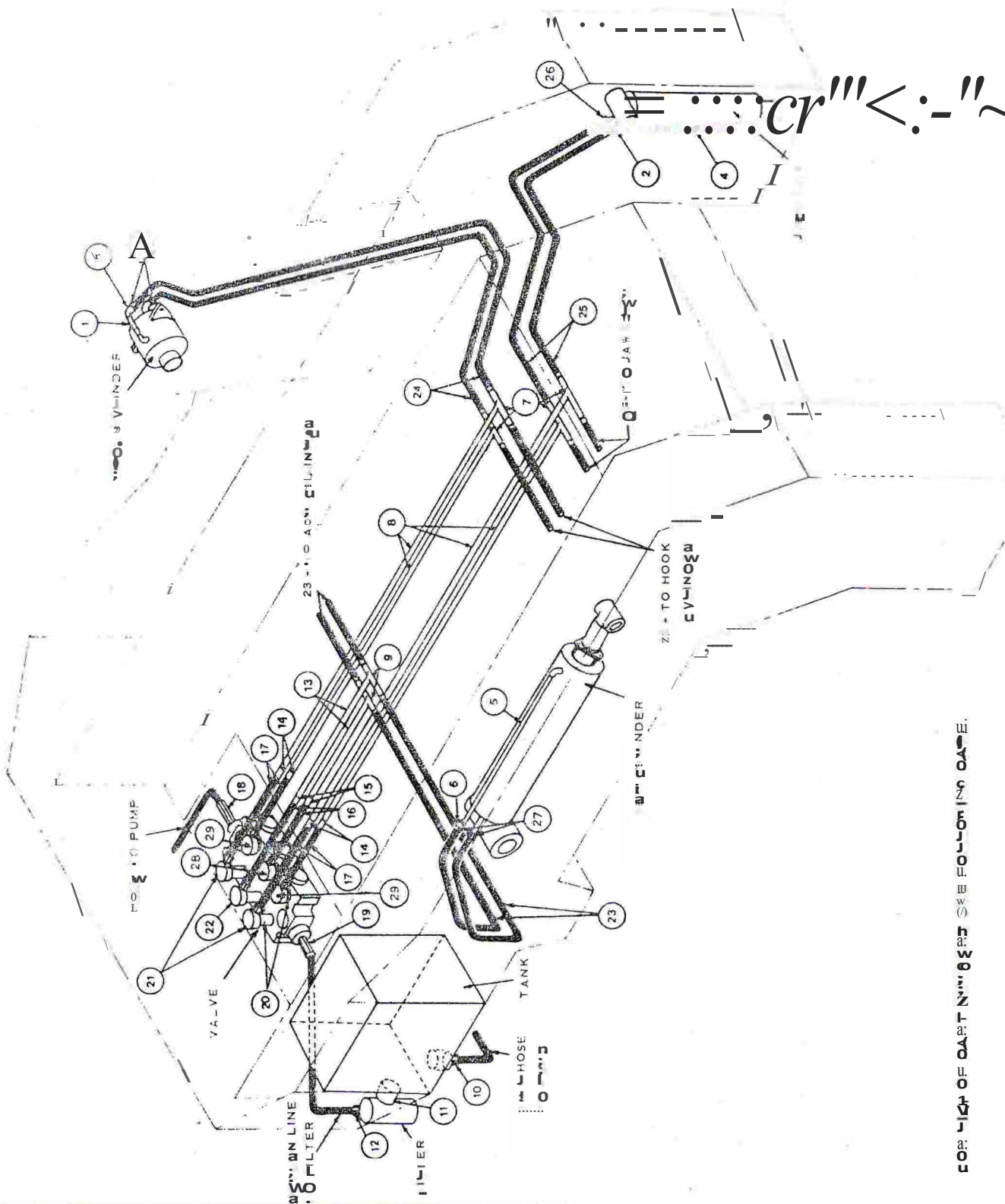
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Part No.	Name
4000-0	ARM CYLINDER

REV	DATE	CHANGE	APVD

  
 CLEVELAND, OHIO 44104

DATE **4-06-78** CHKD  
**4000-**  
 OWN *flj*  
 APVO  
 ENG.



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Part No.	Name
	HYDRAULIC SYSTEM

REV	DATE	CHANGE	APVO	CLEVELAND, OHIO 44104
-----	------	--------	------	-----------------------



DATE	4-06-78	OWN CHKO APVO ENG.
	8000-	

FOR LIGHT OF PART NUMBER SEE FOLLOWING PAGE.



ITEM NO.	PART NO.	DESCRIPTION
1	8000-1	PIPE
2	8000-2	ELBOW
3	8000-3	UNION
4	8000-4	PIPE
5	8000-5	PIPE
6	8000-6	COUPLING
7	8000-7	TEE
8	8000-8	PIPES
9	8000-9	TEE*
10	8000-10	UNION
11	8000-11	NIPPLE
12	8000-12	UNION
13	8000-13	PIPE*
14	8000-14	COUPLING
15	8000-15	COUPLING*
16	8000-16	HOSE *
17	8000-17	HOSE
18	8000-18	UNION
19	8000-19	UNION
20	"8000-20	REDUCER
21	8000-21	UNION
22	8000-22	STACKER*
23	8000-23	HOSE
24	8000-24	HOSE
25	8000-25	HOSE
26	8000-26	UNION
27	8000-27	UNION
28	8000-28	UNION*
29	8000-29	UNION

\* Denotes change in size to applicable Valve.



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## ACE Lugger Hoist 120-RC Series PRICE LIST

*For unlisted items, call us at phone number  
\*Bulk pricing applies to quantities of 4 or more units*

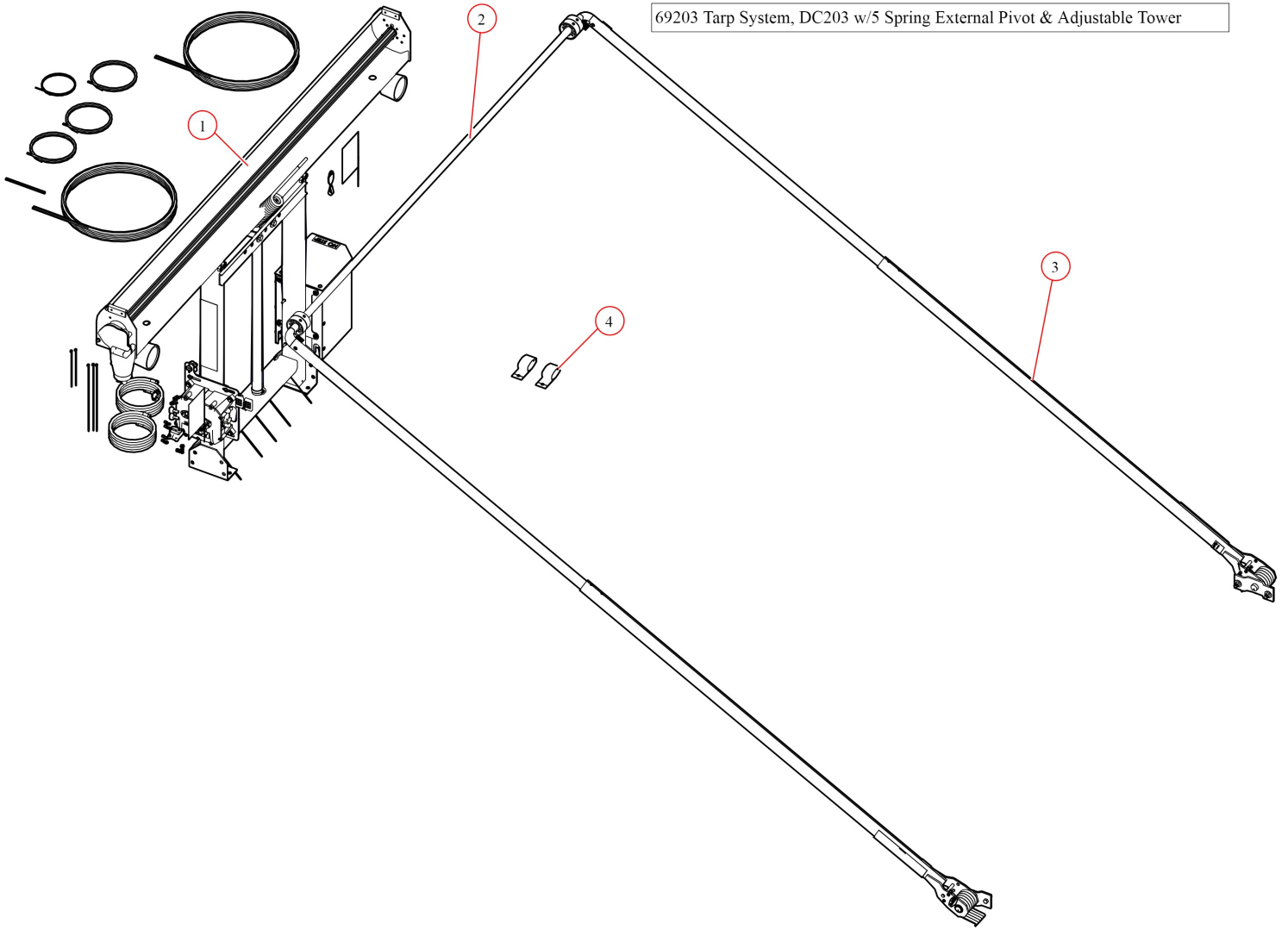
*Last Updated: 1/31/2018*

PRODUCT NUMBER	NAME	DESCRIPTION	RETAIL PRICE/UNIT	Quantity Required
14-2001	Crossbar Saddleblocks	Cross Bar Swivel		2
21-2001	Crossbar - 200 lbs. @ Market Value	3" Crossbar 120-RC-Series Lugger Hoists		1
93-2002	Lift Arm	120" Lift Arm with Contact Cylinder Slot		2
1000-4	Space Collar	3/8" Space Collar		4
13-2001	Hammer Locks	1/2" Connector- Connects Keys to Chain		8
47-2001	U-Bolt	24" U-Bolt with Nuts		2
13-2001	Lift Key	Front Container Lift Key		2
13-2002	Rear Dump Key	Dump Plate for Chain		2
1000-9	Outrigger Cylinder Lock Pin	Outrigger Cylinder Mount Pins		2
58-1005	Outrigger Pad Pin	5/8" Pin with Bolt		2
1000-11	Outrigger Pad	Outrigger Pad		2
48-2003	Crosshead Hinge Pin	3" Connects Lift Arm to Cylinder		2
48-2001	Lift Arm Hinge Pin	3" Hinge Pin for Arm Cylinder		2
48-2004	Arm Cylinder Hinge Pin	3" Pin with 3.8" "Ear" Plate and Bolt		2

### Cylinders

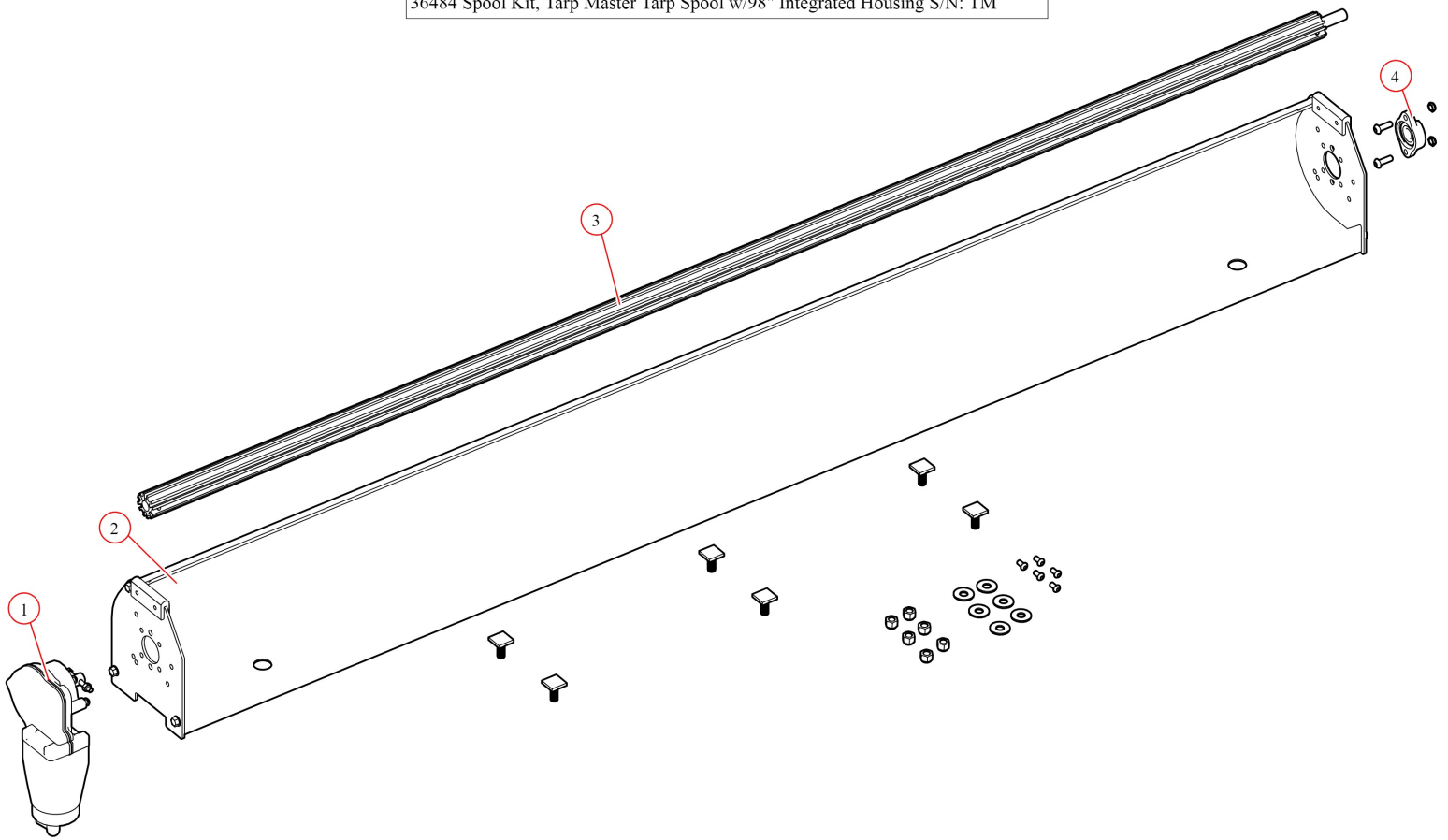
1-2001.	Lift Arm Cylinder	9.5" Bore Arm Cylinder with External Packing - 64" Stroke		2
1-2002.	Outrigger Cylinder	5.5" Bore Cylinder 18" Stroke		2
1-2003.	Contact Cylinder	Pin Cylinder for Dumping Container		2

69203 Tarp System, DC203 w/5 Spring External Pivot & Adjustable Tower



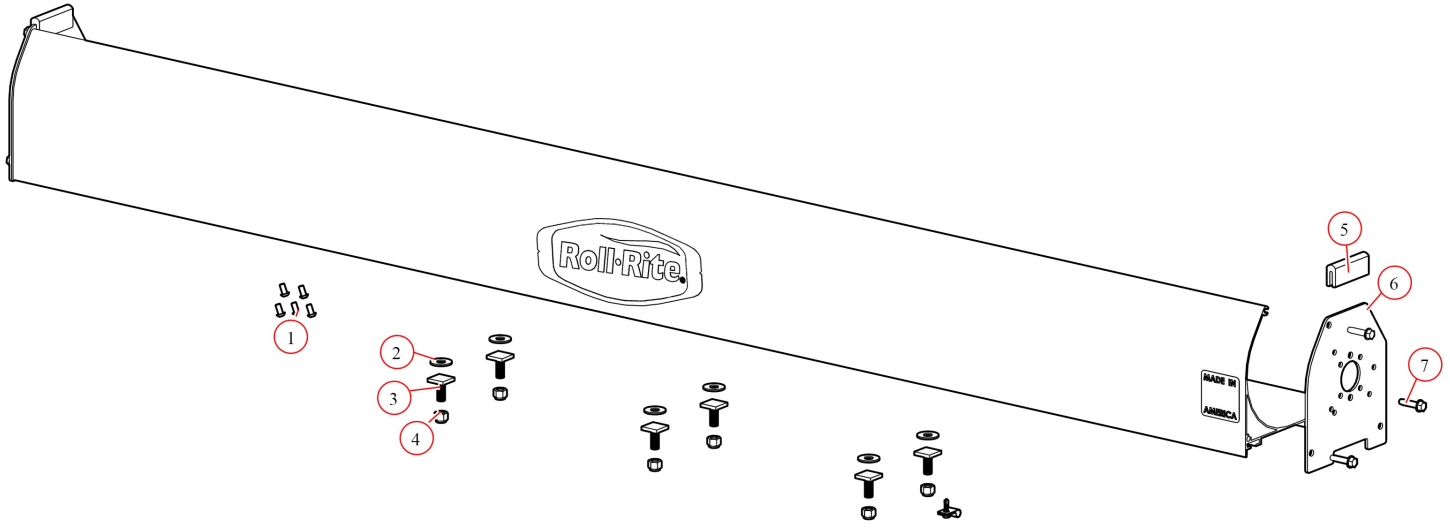
Bom ID	Part#	Description	qty
1	101614	Tarp System, TarpMaster Adjustable Tower with Pump & Control B...	1
2	76720	Bow Set, 103 1/2" Wide Top Tube and 103 1/2" Side Arms	1
3	46450	Pivot Set, 5 Spring w/ 84" Aluminum Pivot Tube	1
4	76831	Bracket, Pivot Arm Tie Down	2

36484 Spool Kit, Tarp Master Tarp Spool w/98" Integrated Housing S/N: TM



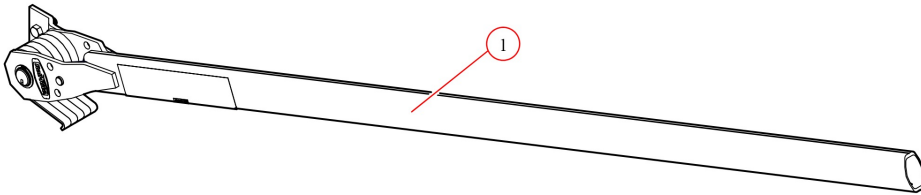
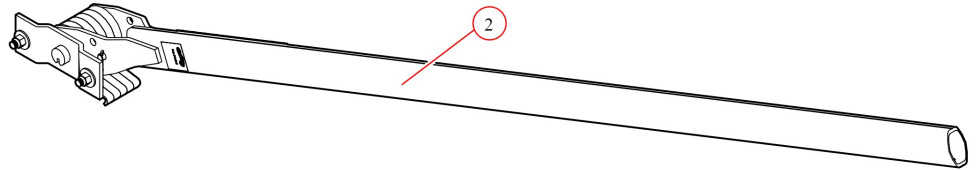
Bom ID	Part#	Description	qty
1	10310	TarpMaster Motor 12V, 3 Year Warranty :S/N:	1
2	36164	Housing, Spool 98" Aluminum Integrated Housing	1
3	31030	Axle, 97" Pre-Threaded Tarp Axle w/Stub Shaft	1
4	31050	Bearing, 3/4" Flanged Axle Bearing with bolts	1

36164 Housing, Spool 98" Aluminum Integrated Housing



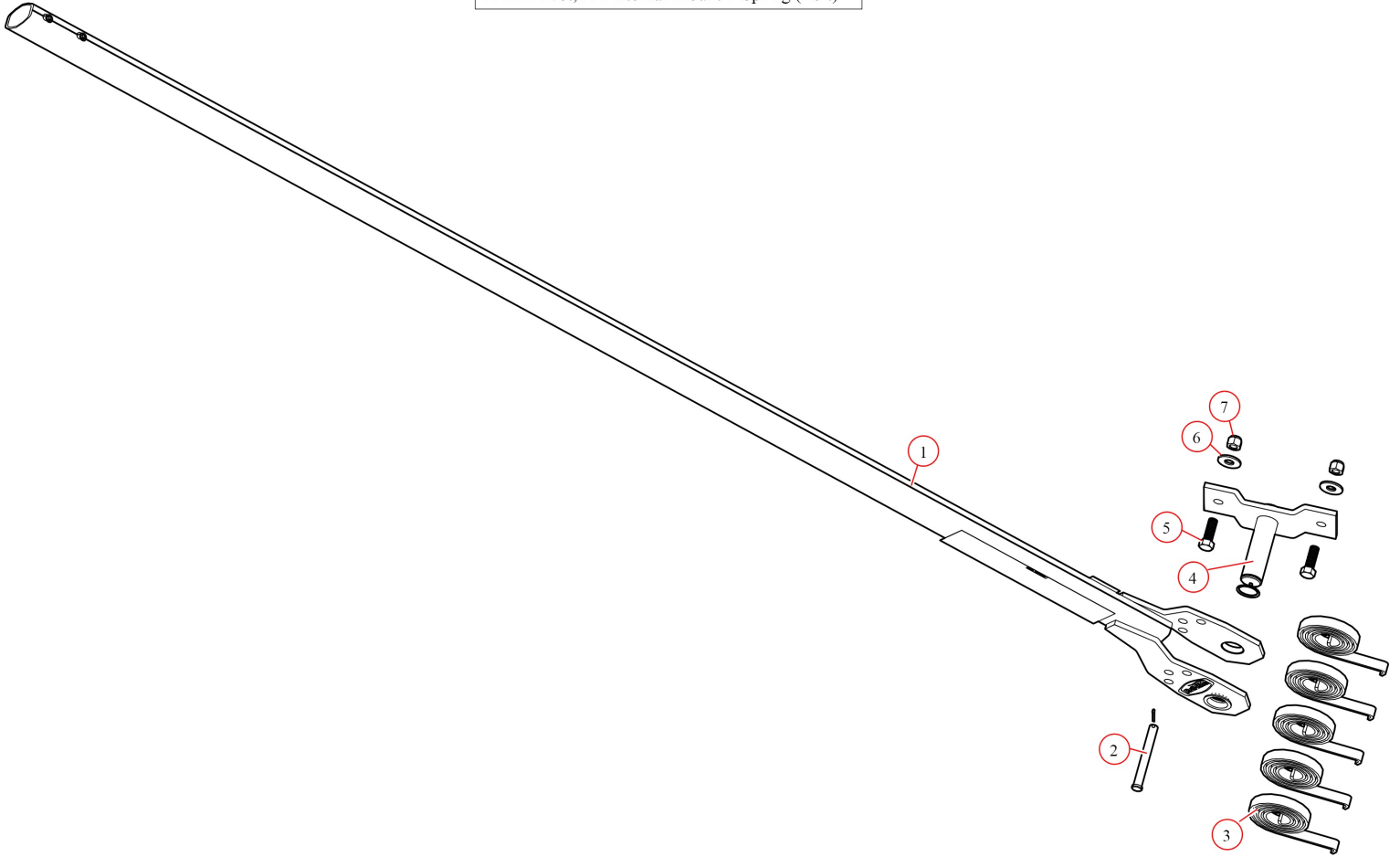
Bom ID	Part#	Description	qty
1	18260	Bolt, 5/16" x 5/8" Button Head Bolt - Zinc Plated	5
2	18412	Washer, 1/2" Flat Zinc	6
3	18245	Bolt, T-Bolt 1/2-13NCx1.75 for GAB	6
4	18631	Nut, 1/2" Nylock Nut	6
5	36300	Bumper, Rubber Bumper for Tarp Spool (each)	2
6	36331	Bracket, Int Housing Aluminum Endcaps - Drivers Side	2
7	18120	Bolt, 3/8" x 1-1/2" Thread Cutting Screw Hex Washer Hd	6

46450 Pivot Set, 5 Spring w/ 84" Aluminum Pivot Tube



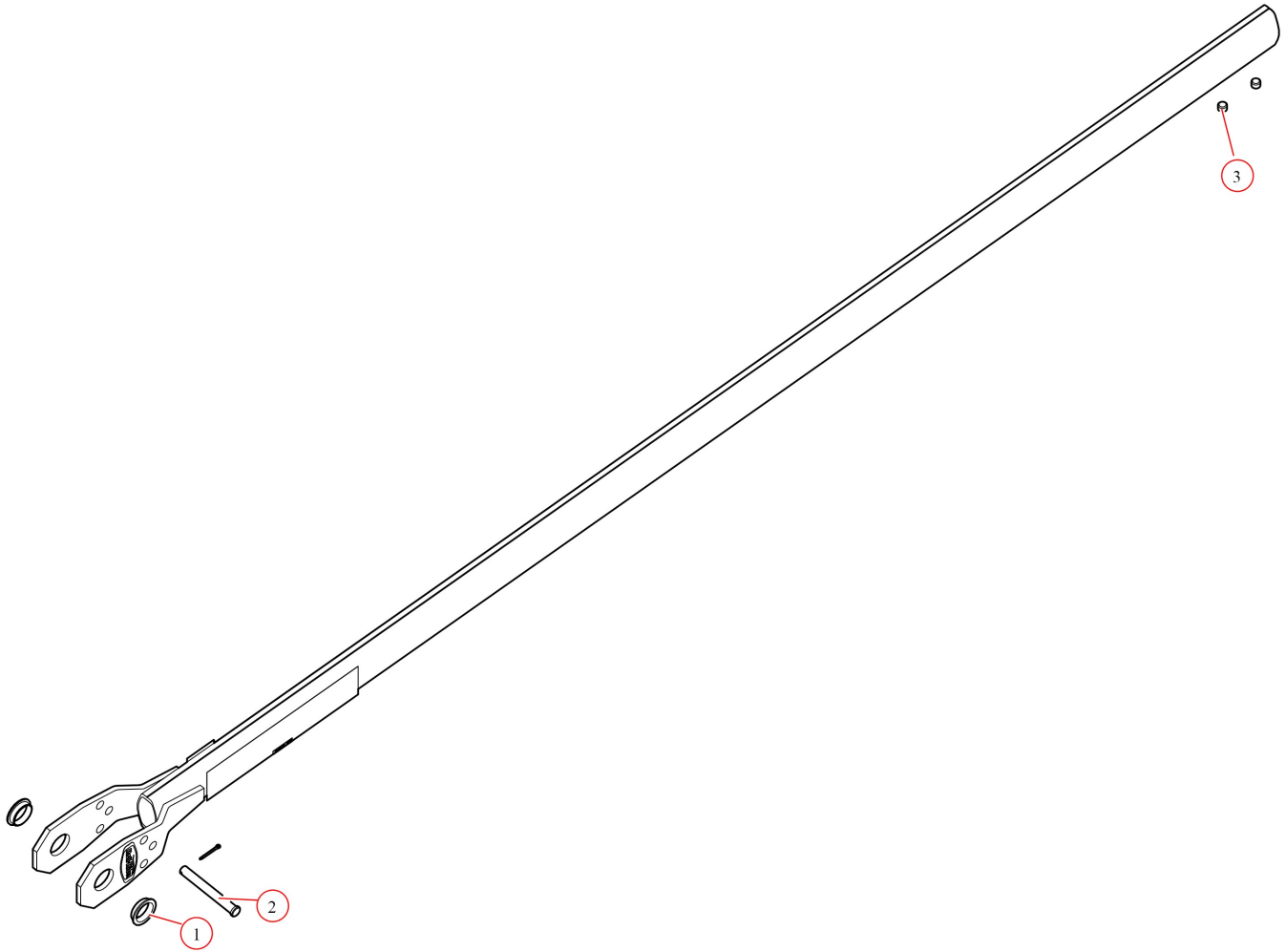
Bom ID	Part#	Description	qty
1	4645D	Pivot, AL External Mount 5-Spring(Drivers Side)	1
2	4645P	Pivot, AL External Mount 5-Spring (Passenger)	1

4645D Pivot, AI External Mount 5-Spring (Left)



Bom ID	Part#	Description	qty
1	46150	Pivot Tube, w/ side plates, set screws for 5-spr ex	1
2	18560	Pin, 1/2 x 4 1/8 Special Clevis	1
3	47230	Spring, Spiral Torsion Spring 1 1/4	5
4	45350	Pivot Pin, 5-Spring	2
5	18296	Bolt, 1/2" x 1 1/2" Hex Head Bolt	2
6	18412	Washer, 1/2" Flat Zinc	2
7	18631	Nut, 1/2" Nylock Nut	2

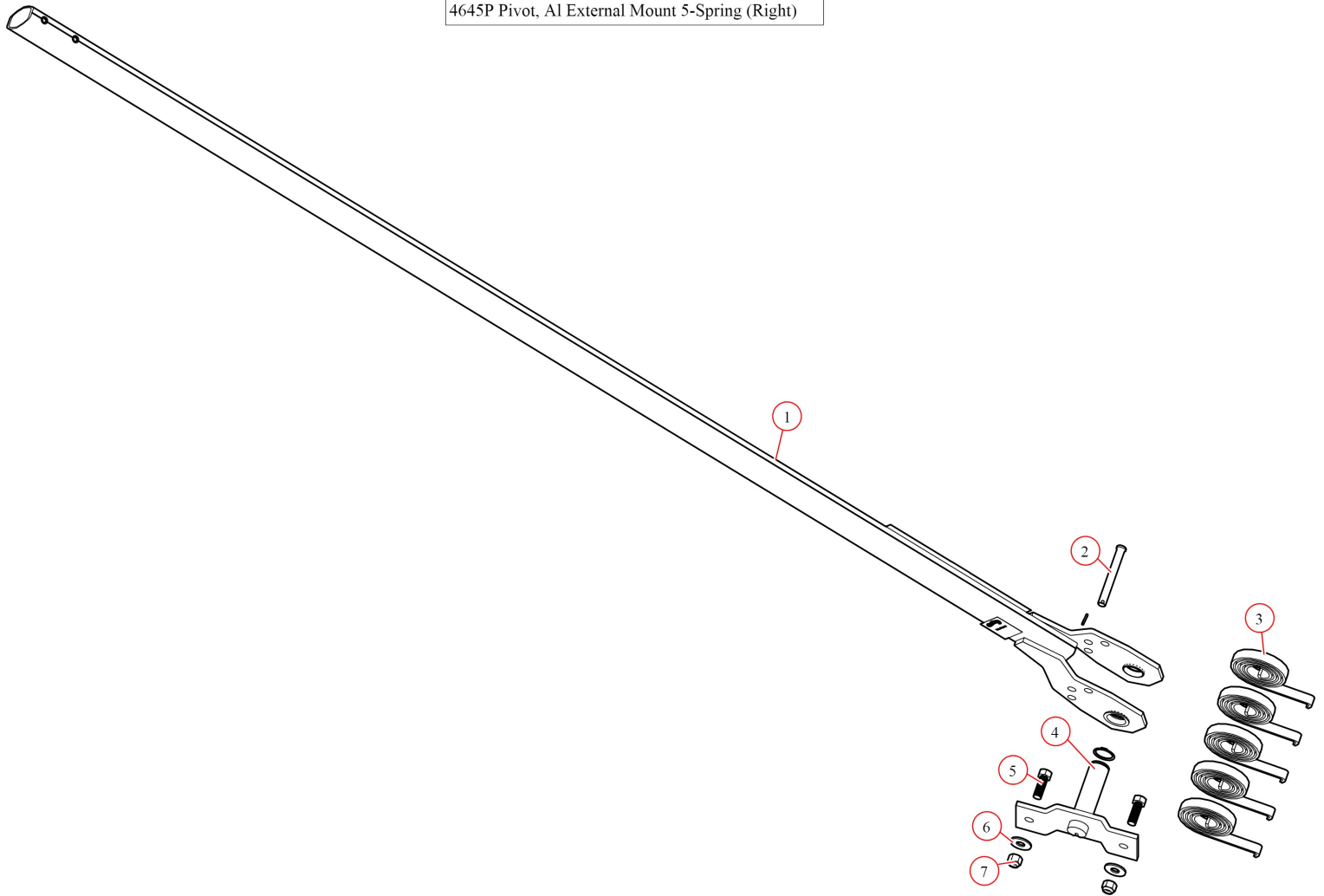
46150 Pivot Tube, w/ side plates, set screws for 5-spr ex



Bom ID	Part#	Description	qty
1	47040	Bushing, 1 1/4 Poly T- Bushing for Pivot Pin	2
2	18560	Pin, 1/2 x 4 1/8 Special Clevis	1
3	18293	Screw, 1/2" x 3/8" Set Screw	2

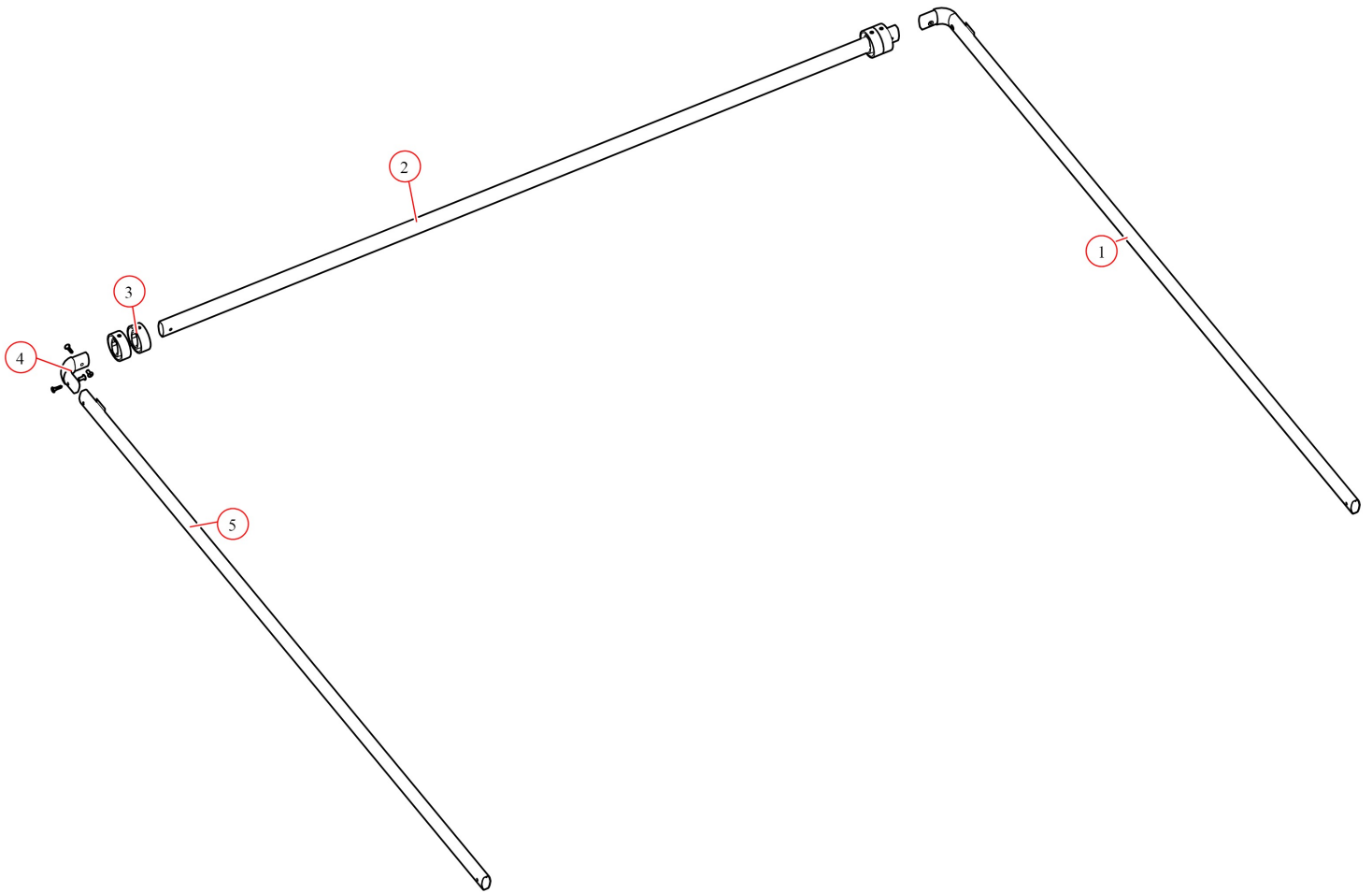


4645P Pivot, Al External Mount 5-Spring (Right)



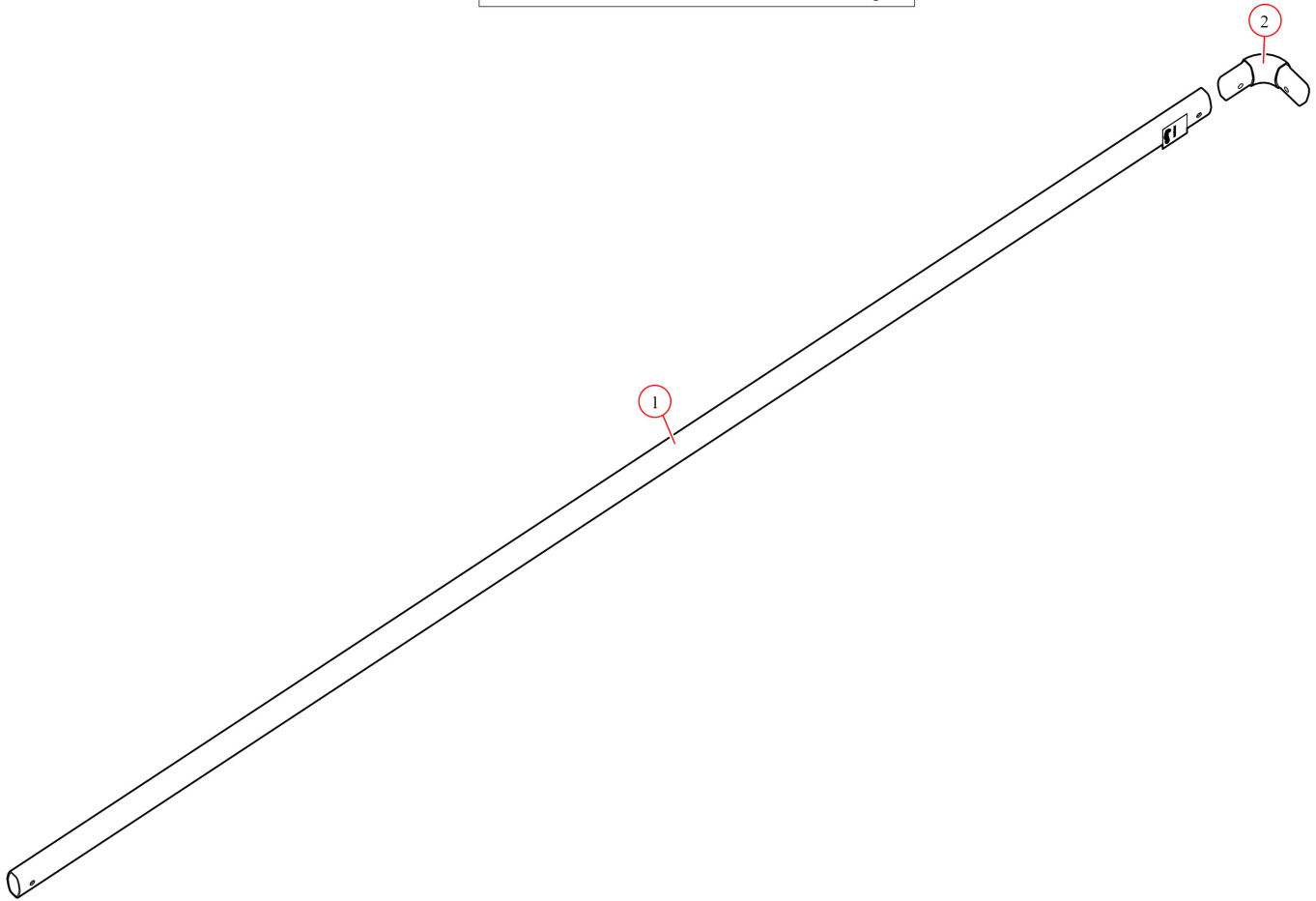
Bom ID	Part#	Description	qty
1	46150	Pivot Tube, w/ side plates, set screws for 5-spr ex	1
2	18560	Pin, 1/2 x 4 1/8 Special Clevis	1
3	47230	Spring, Spiral Torsion Spring 1 1/4	5
4	45350	Pivot Pin, 5-Spring	1
5	18296	Bolt, 1/2" x 1 1/2" Hex Head Bolt	2
6	18412	Washer, 1/2" Flat Zinc	2
7	18631	Nut, 1/2" Nylock Nut	2

76720 Bow Set, 103 1/2" Wide Top Tube w/ 98" Bow Arms



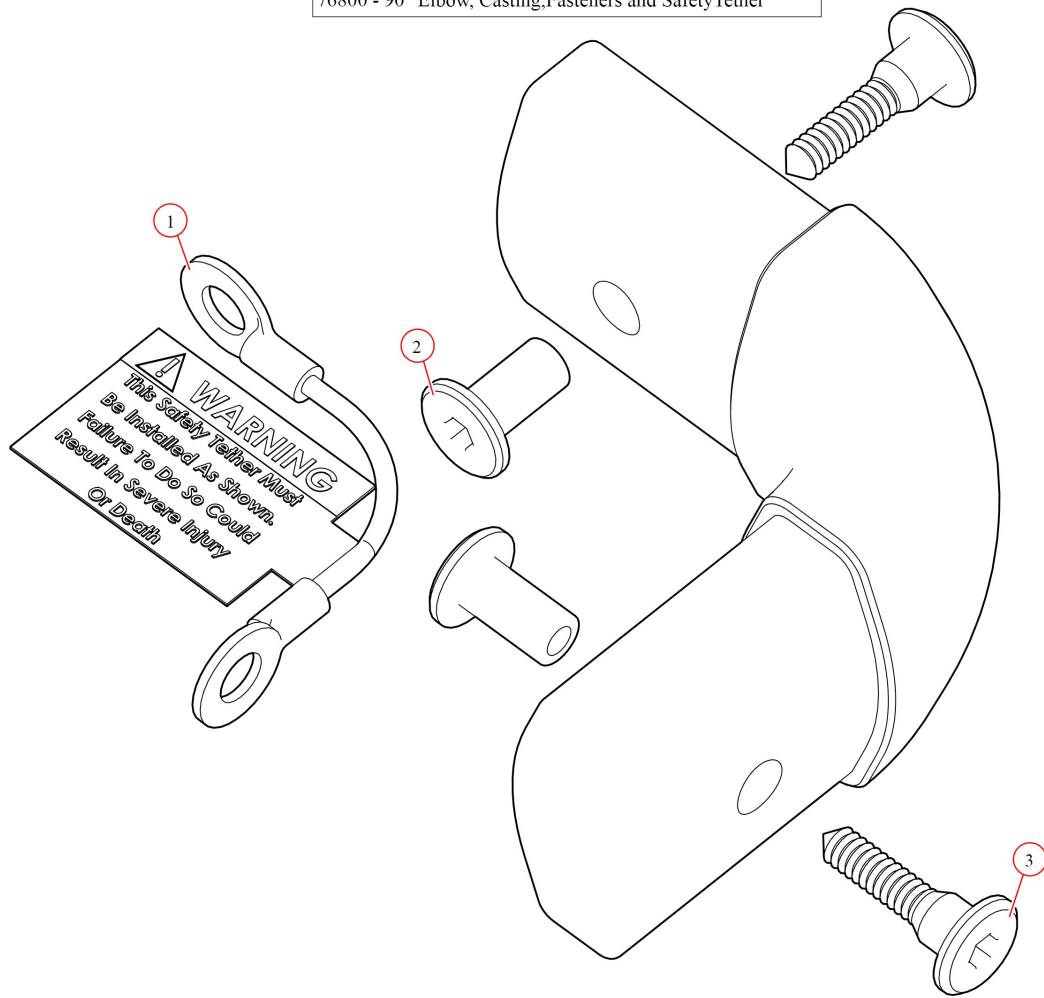
Bom ID	Part#	Description	qty
1	76760	Bow Tube, 98" Side Arm w/ 90 Corner	1
2	76870	Bow Tube, 103 1/2" AL Wide Top Tube for Tarp Bow	1
3	76810	Bow Tube, Tarp Flange (Pair)	2
4	76800	Casting, Aluminum Corner - 90 Degree With Fasteners and Tether	2
5	76770	Bow Tube, 98" AL Top Tube for Tarp Bow	1

76760 Bow Tube, 98" AL Side Arm W. Corner tarp



Bom ID	Part#	Description	qty
1	76770	Bow Tube, 98" AL Top Tube for Tarp Bow	1
2	76800	Casting, Aluminum Corner - 90 Degree With Fasteners and Tether	1

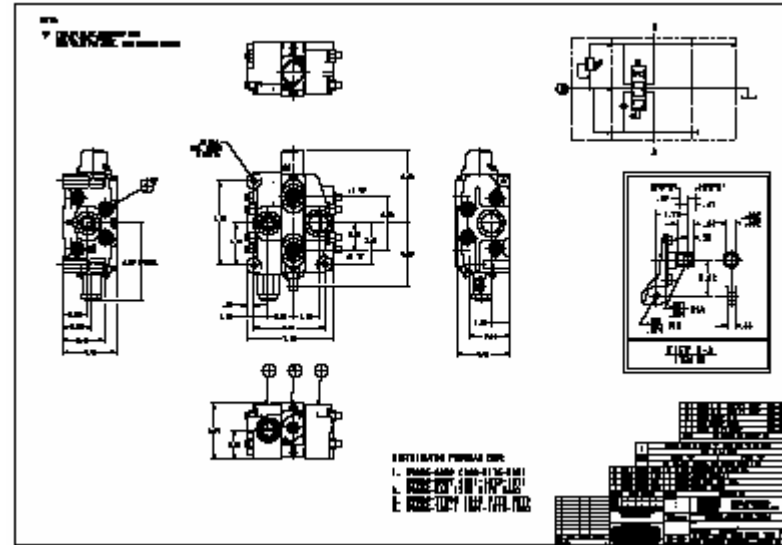
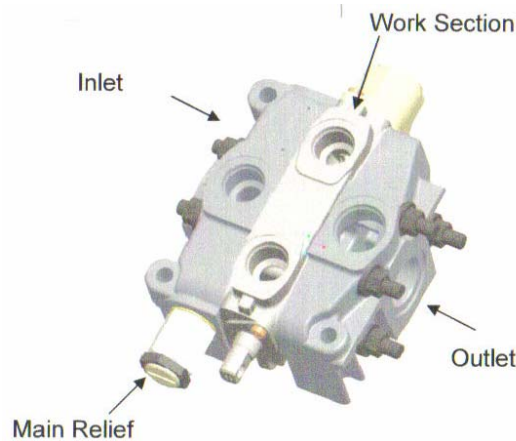
76800 - 90° Elbow, Casting, Fasteners and Safety Tether



Bom ID	Part#	Description	qty
1	103533	Tether, Cable with Install Label for 90 degree corner	1
2	18719	Nut, 1/4-20 Cap Conn Nut Clear Zinc - Post bolt for 90 degree corne...	2
3	18718	Bolt, 1/4-20 x 1 3/16 Bolt Clear Zinc - Post bolt for 90 degree corners	2



# 348-9201-709 VG35 O Ring Straight Thread O-Ring Ports 4 Way 3 Position Manual



<b>Inlet</b>	<b>DVG35-A880</b>	<b>348-9175-008</b>
<b>Relief Valve</b>	<b>DVG35-HMRV</b>	<b>391-1873-135</b>
<b>Work Section</b>	<b>DVG35-DA8</b>	<b>348-9172-048</b>
<b>Outlet</b>	<b>DVG35-TTR-99</b>	<b>348-9176-007</b>
<b>Stud Kit</b>	<b>DVG35-TSK-1</b>	<b>391-1873-138</b>

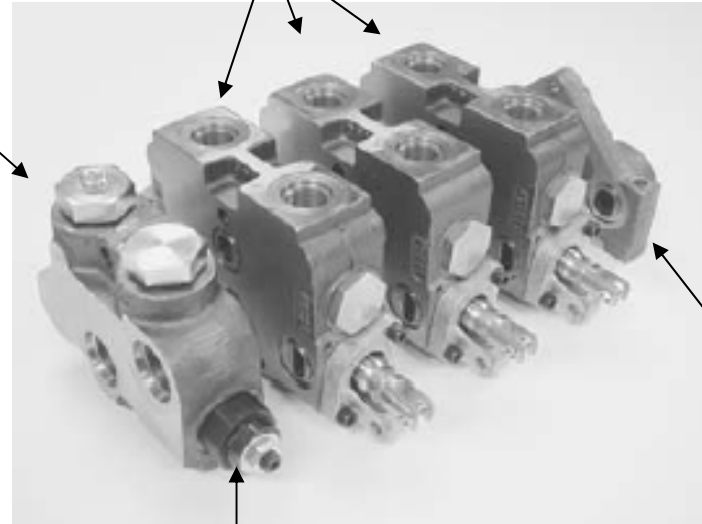




# Basic Construction

Work Section

Inlet



Outlet

Main Relief

**All Valves Have  
And Inlet – Outlet  
And Work Sections**

**Work Port Plugs  
This is Where Work  
Port Reliefs are Installed**

**Torque for Valves**

**Gresen V20 Series  
Commercial DVA20 Series  
Commercial DVA35 Series**

**Studs**

**384 In. lbs**

**350 In. lbs**

**400 In. lbs**

**Main  
Relief**

**75 ft. lbs**

**90 ft. lbs**





## V20 Flow and Pressure Rating



**Flow Rating 25 GPM**

**Pressure Rating 3500 PSI**

**Inlets & Outlets**

**NPT 3/4"**

**SAE 12**

**Work Ports**

**NPT 1/2"**

**SAE 10**





# V20 SAE Straight Thread O-Ring

## V20 INLET

20-LC-12  
 RP51A-3000  
 WH-1700  
 WH-1950  
 WH-2550  
 20-12-CF

## Gresen# DESCRIPTION

08650029 V20 Inlet SAE 12 Plugged Relief  
 Same Main Relief Adjustable 3000 PSI  
 08650418 Main Relief Non Adjustable  
 08650419 Main Relief Non Adjustable  
 08650420 Main Relief Non Adjustable  
 08650003 Combined Flow Mid-Inlet

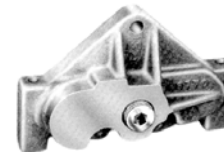


8398 Left Cover

## V20 OUTLETS

20-RC-12-E  
 20-RC-12-E-MY  
 K-20-10-Y

13650146 Standard Outlet  
 08650024 Power Beyond Outlet  
 08650103 SAE 10 Power Beyond Sleeve



SAE 10 Power Beyond Sleeve

## V20 Work Sections

20-10-04 08650020 V20 D/A Cylinder SAE 10  
 20-10-03 08650016 V20 S/A Cylinder SAE 10  
 20-10-K4 08650015 D/A FLOAT  
 20-10-F4 08650019 V20 D/A Motor Spool

For Single Acting Float use 20-10-03 and K-20-R



Model V20P  
(8072 Section)

All Work Sections are Ported for Work Port Relief's and Plugged "Add Port Options"







# V20 Handle and Stud Kits

## V20 Handle End Options

Handle Kits Contain Necessary Links and Pins.

Item No.	Model Number	Part Number	Description
1	K-20-VH-B	8650151	Vertical Handle (Black)
2	K-20-VH-P	8650153	Vertical Handle (Plain)
3	K-20-HH-B	8650154	Horizontal Handle (Black)
4	K-20-HH-P	8650156	Horizontal Handle (Plain)
5	K-20-RET	8650107	Standard Seal Retainer Plate
6	K-20-RET-HD	8650108	Heavy Duty Seal Retainer
7	K-20-WIPER	8650097	Sec. Spool Wiper
8	K-20-HBO-CI	8650113	Complete Bracket (Cast Iron) less Handle and Links
9	K-20-BOOT	8650112	Spool Boot Assembly



Vertical Handle Assemblies

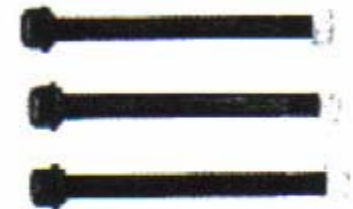


Horizontal Handle Assemblies

## V20 Standard Section Stud Assembly Kits

Includes Section Seals and Nuts. (Stud Kits Do Not include 21866-001 Load Sensing and Solenoid Pilot Passage Section Seals. These seals must be purchased separately if required.)

Item No.	Model Number	Part Number	Description
1	K-20-1	8650087	One Section
2	K-20-2	8650088	Two Section
3	K-20-3	8650089	Three Section
4	K-20-4	8650090	Four Section
5	K-20-5	8650091	Five Section
6	K-20-6	8650092	Six Section
7	K-20-7	8650093	Seven Section
8	K-20-8	8650094	Eight Section
9	K-20-9	8650095	Nine Section
10	K-20-10	8650096	Ten Section
11	K-20-SECT-SEAL ♦	13850405	Section seal for load sensing and/or solenoid pilot passages.



Stud Assembly Kit

When using an 8644 Right End Cover add one section to assure proper stud length.

♦ Kit includes 25 pieces of seal number 21866001.





## DVA DVG 20 Flow and Pressure Rating



**Flow Rating**                      **40 GPM**

**Pressure**

**DVA**                                      **2500 PSI**

**DVG**                                      **3500 PSI**

**Inlets & Outlets**

**NPT**                                      **1"**

**SAE**                                      **16**

**Work Ports**

**NPT**                                      **3/4"**

**SAE**                                      **12**





# DVG20 SAE Straight Thread O-Ring

## DVG20 Inlets

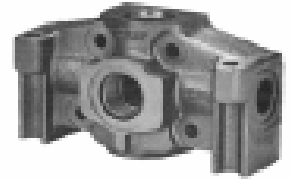
DVG20-A880

## 10 Digit #

347-9175-010

## Description

Inlet SAE 16



## DVG20 Main Relief Valve

DVG20-HMRV

391-1873-128

Main Relief 2500 to 3500 PSI

DVG20-MRVP

391-1873-002

Main Relief Valve Plug



## DVG20 Outlets

DVG20-TTR88

347-9176-007

Standard Outlet SAE 16

DVG20-TPB80

347-9175-010

Outlet Power Beyond SAE 16



## DVG20 Work Sections

DVG20-DA7

347-9172-052

D/A Cylinder SAE 12

DVG20-DV7

347-9172-067

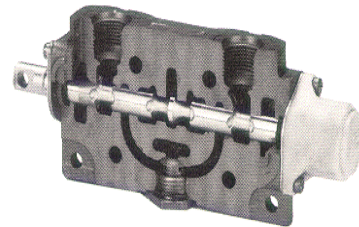
D/A Cylinder Air Shift

DVG20-MA7

347-9172-053

D/A Motor Float in Neutral SAE 12

## Low Boy



## DVG20 Work Sections

DVG20-JA705

347-9171-007

S/A Cylinder SAE 12

DVG20-HA755

347-9172-056

D/A Cylinder SAE 12

DVG20-LA755

347-9172-057

D/A Motor Float in Neutral SAE 12

## High Boy





# DVA DVG 20 Accessories

## Stud Kits

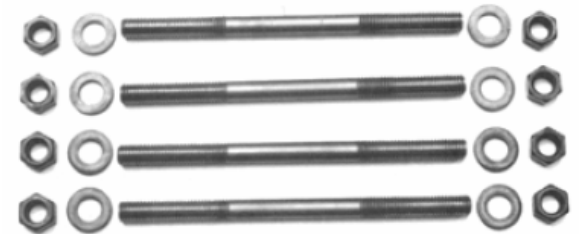
DVA20-SK-1	391-1873-045
DVA20-SK-2	391-1873-046
DVA20-SK-3	391-1873-047
DVA20-SK-4	391-1873-048
DVA20-SK-5	391-1873-049
DVA20-SK-6	391-1873-050
DVA20-SK-7	391-1873-051
DVA20-SK-8	391-1873-052
DVG20-TSK-1	391-1873-129
DVG20-TSK-2	391-1873-130
DVG20-TSK-3	391-1873-131
DVG20-TSK-4	391-1873-132
DVG20-TSK-5	391-1873-133
DVG20-TSK-6	391-1873-134
DVG20-TSK-7	391-1873-135
DVG20-TSK-8	391-1873-136

## Work Port Accessories

DV-PRAVC	391-1873-006
DV-PRVS-1	391-1873-344
DV-PRVS-2	391-1873-345
DV-PRV-1	391-1873-007
DV-PRV-2	391-1873-008
DV-PRV-3	391-1873-009
DV-PRL-12	391-1873-016
DV-PRV-SK	391-1873-080
DV-PRT-12	391-1873-234

## # Work Sections

- One
- Two
- Three
- Four
- Five
- Six
- Seven
- Eight
- One
- Two
- Three
- Four
- Five
- Six
- Seven
- Eight



- Screw Adj. Relief 2500 PSI
- Adj. Relief 500-1000 PSI
- Adj. Relief 1000-2500 PSI
- WPR Shim Adj. 500-1000 PSI
- WPR Shim Adj. 1000-2500 PSI
- WPR Shim Adj. 2500-3000 PSI
- Work Port Plug
- Shim Kit
- Work Port Restrictor





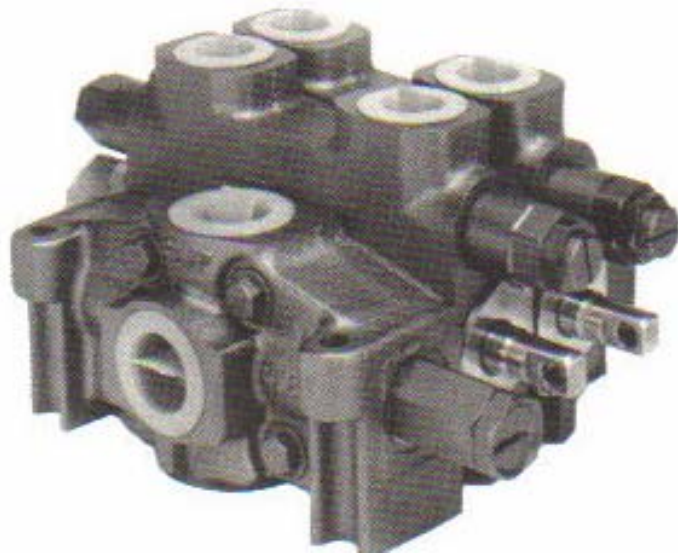
## DVA DVG 20 Accessories

<b>Handle Assemblies</b>	<b>10 Digit #</b>	<b>Description</b>
DV20-H-3	391-1873-093	6" Std Handle
DV20-H-4	391-1873-098	8" Std Handle
DV20-H-6	391-1873-061	6" Handle for High Boy
DV20-H-8	391-1873-062	8" Handle for High Boy
<b>Seal Kits</b>		
DV20-K-1	391-1873-035	Work Section Assembly
DV20-K-2	391-1873-036	Work Section , Spool, Check Seals
<b>Spool Action Kits</b>		
DV20-K-100	391-1873-019	Spring Center Kit
DV20-K-101	391-1873-020	3 Position Detent
DV20-K-113	391-1873-206	Air Shift
DV20-K-114	391-1873-206	Detent In , Single Acting Float





## DVA DVG 35 Flow and Pressure Ratings



**Flow Rating**                    **70 GPM**

**Pressure Rating**

**DVA**                    **2500 PSI**

**DVG**                    **3500 PSI**

**Inlet and Outlets**

**NPT**                    **1 1/4"**

**SAE**                    **20**

**Work Ports**

**NPT**                    **1"**

**SAE**                    **16**







# DVA35 SAE Straight Thread O-Ring

## DVA35 Inlet

DVA35-A880  
DVA35-A980

## 10 Digit #

348-9175-005  
348-9175-002

## Description

Inlet SAE 16 Need To Add Relief  
Inlet SAE 20 Need To Add Relief



## Main Relief

DVA35-MRV-1  
DVA35-MRV-2

391-1873-003  
391-1873-004

800-2000 PSI  
2000-2500 PSI



## Outlet

DVA35-TR99  
DVA35-PB90

348-9176-002  
348-9176-004

Standard Outlet  
Power Beyond



## Work Sections

DVA35-SA8  
DVA35-DA8  
DVA35-MA8  
DVA35-SV8  
DVA35-DV8

348-9171-003  
348-9172-003  
348-9171-016  
348-9171-016  
348-9172-030

## Low Boy

S/A Cylinder SAE 16  
D/A Cylinder SAE 16  
D/A Motor Float In Neutral  
S/A Cylinder Air Shift  
D/A Cylinder Air Shift



## Work Sections

DVA35-JA805  
DVA35-HA855  
DVA35-GC855

348-9171-006  
348-9172-009  
348-9172-032

## High Boy

S/A Cylinder  
D/A Cylinder  
D/A Detent Float In Neutral





# DVG35 SAE Straight Thread O-Ring

## DVG35 Inlets

DVG35-A880  
DVG35-A980

## 10 Digit #

348-9175-008  
348-9175-004

## Description

Standard Inlet SAE 16  
Inlet SAE 20



## DVG35 Main Relief

DVG35-HMRV 391-1873-137  
DVG35-MRVP 391-1873-005

2800 to 3500 PSI  
Main Relief Plug



## DVG35 Outlets

DVG35-TTR99 348-9176-007  
DVG35-TPB99 348-9176-008

Standard Outlet SAE 20  
Power Beyond Outlet SAE 20



## DVG35 Work Sections

DVG35-DA8 347-9172-048  
DVG35-MA8 348-9172-049

## Low Boy

D/A Cylinder SAE 16  
D/A Motor Float in Neutral

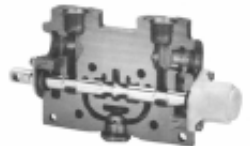


## DVG35 Work Sections

DVG35-JA805 348-9171-001  
DVG35-HA855 348-9172-065  
DVG35-GC855 348-9172-099

## High Boy

S/A Cylinder SAE 16  
D/A Cylinder SAE 16  
D/A Detent Float In Neutral







# DVA DVG 35 Valve Accessories

## DVA/DVG Stud

DVA35-SK-1	391-1873-053
DVA35-SK-2	391-1873-054
DVA35-SK-3	391-1873-055
DVA35-SK-4	391-1873-056
DVA35-SK-5	391-1873-057
DVA35-SK-6	391-1873-058
DVA35-SK-7	391-1873-059
DVA35-SK-8	391-1873-060

DVG35-TSK-1	391-1873-138
DVG35-TSK-2	391-1873-139
DVG35-TSK-3	391-1873-140
DVG35-TSK-4	391-1873-141
DVG35-TSK-5	391-1873-142
DVG35-TSK-6	391-1873-143
DVG35-TSK-7	391-1873-144
DVG35-TSK-8	392-1873-145

## DVG35 Work Port Accessories

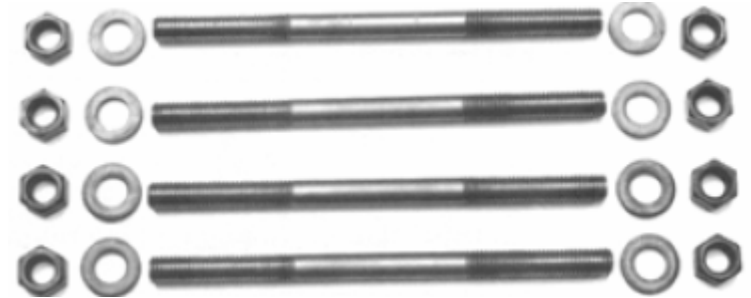
DV-PRAVC	391-1873-006
DV-PRVS-1	391-1873-344
DV-PRVS-2	391-1873-345
DV-PRV-1	391-1873-007
DV-PRV-2	391-1873-008
DV-PRV-3	391-1873-009
DV-DPL-16	391-1873-017
DV-PRV-SK	391-1873-080

## # Work Sections

- One
- Two
- Three
- Four
- Five
- Six
- Seven
- Eight



- One
- Two
- Three
- Four
- Five
- Six
- Seven
- Eight



- Screw Adj. Relief 2500 PSI
- Adj. Relief 500-1000 PSI
- Adj. Relief 1000-2500 PSI
- WPR Shim Adj. 500-1000 PSI
- WPR Shim Adj. 1000-2500 PSI
- WPR Shim Adj. 2500-3000 PSI
- Work Port Plug
- Shim Kit





## DVA DVG 35 Valve Accessories

### Handle Assembly

DV35-H-3	391-1873-096	6" Standard Handle
DV35-H-4	391-1873-097	8" Standard handle
DV35-H-6	391-1873-064	6" Handle For High Boy
DV35-H-8	391-1873-065	8" Handle For High Boy

### Seal Kits

DV35-K11	391-1873-040	Work Section Assembly Seals
DV35-K12	391-1873-041	Work Section, Spool, Check Seals

### Spool Action Kits

DV35-K-200	391-1873-026	Spring Return
DV35-K-201	391-1873-027	3 Position Detent
DV35-K-213	391-1873-203	Air Shift



# Basic Formulas

## Cylinders

$$F = PXA$$

$$P = F/A$$

$$A = F/P$$

$$\text{Area of a Circle} = D \text{ Sq.} \times .7854$$

## Hydraulic Pumps

$$\text{GPM} = [\text{RPM} \times \text{CID}] / 231$$

$$\text{CID} = [\text{GPM} \times 231] / \text{RPM}$$

$$T = [\text{CID} \times \text{PSI}] / 75.36 \text{ LBS FT.}$$

$$T = [\text{CID} \times \text{PSI}] / 6.28 \text{ LBS Inch}$$

$$T = [\text{HP} \times 5252] / \text{RPM LBS FT.}$$

$$T = [\text{HP} \times 63025] / \text{RPM LBS Inch}$$

$$\text{HP} = [T \times \text{RPM}] / 5252 \text{ LBS FT.}$$

$$\text{HP} = [T \times \text{RPM}] / 63025 \text{ LBS Inch}$$

## Hydraulic Motors

$$\text{RPM} = [\text{GPM} \times 231 / \text{CIR}]$$

$$\text{CIR} = [\text{GPM} \times 231 / \text{RPM}]$$

$$T = [\text{CIR} \times \text{PSI}] / 75.36 \text{ LBS FT.}$$

## Glossary of Terms

**F = Force**

**A = Area**

**P = Pressure**

**HP = Horse Power**

**GPM = Gallons Per Minute**

**PSI = Pressure Per Sq. Inch**

**RPM = Revolutions Per Min.**

**231 = Cubic Inches in 1 Gallon**

**T = Torque**

**CID = Cubic Inches Displaced  
Per Revolution Pump**

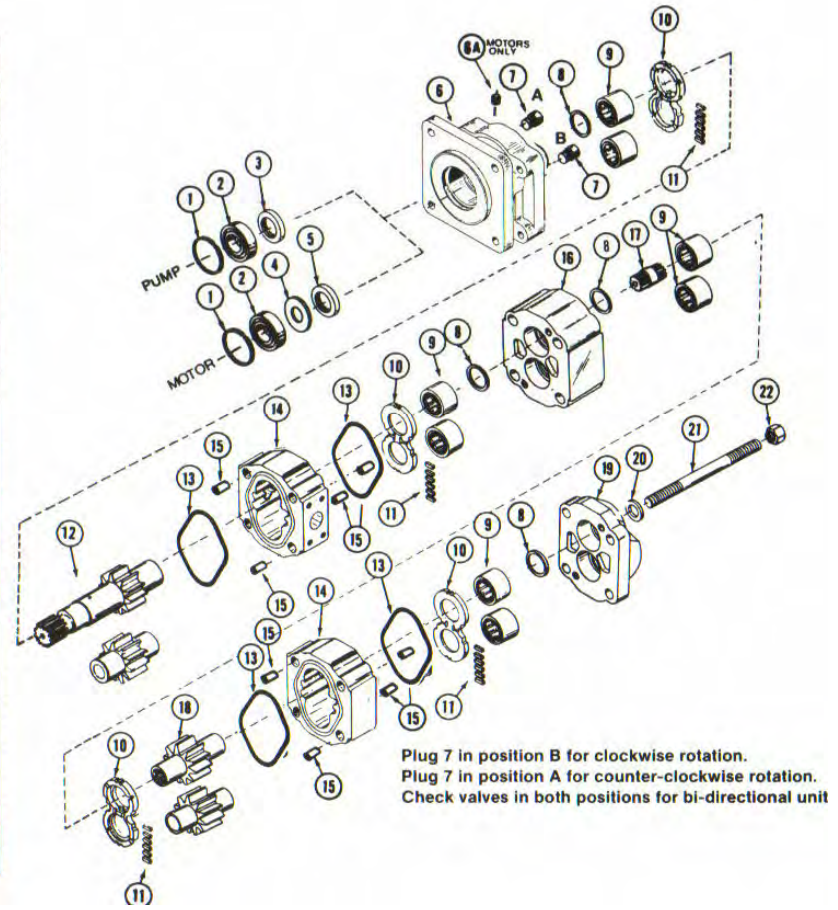
**CIR = Cubic Inches Displaced  
Per Revolution Motor**



## PGP/PGM050/051 Pumps and Motors

### PGP/PGM050/051 Standard Parts List

Item No.	Description	Required	Ten Digit No. (TDN)
1	Snap Ring	1	391-2686-065
2	Outboard Bearing	1	391-0381-077
	Outboard Spacer	1	391-3383-087
3	Lip Seal (pump)	1	391-2883-103
4	Seal Retainer (motor)	1	391-3383-020
5	Lip Seal (motor)	1	391-2883-115
6	Shaft End Cover	1	313-50XX-XXX
6A	Drain Plug (motor)	1	391-2282-XXX
7	Check Assemblies for Motors & Bi-Rotational Pumps	2	391-3681-001
	Plugs (pumps only)	1	391-2286-004
8	Ring Seals (per gear section)	2	391-2585-009
9	Roller Bearings (per gear section)	4	391-0381-905
10	Thrust plates (motor) (per gear section)	2	391-2185-912
	Thrust plates (pump) (per gear section)	2	391-2185-929
11	Pocket Seals (per gear section)	1 strip	391-2882-022 (Viton) 391-2882-051 (Buna)
12	Drive Shaft Gear Set	1 Set	313-29XX-XXX
13	Gasket Seals (per gear section)	2	391-2884-021
14	Gear Housing	1	313-8XXX-XXX
15	Dowel Pins (series 51) (per gear section)	4	391-2082-032
16	Bearing Carrier	-	313-7XXX-XXX
17	Connecting Shaft	-	313-1133-001
18	Gear Set	set	313-28XX-XXX
19	Port End Cover	1	313-3XXX-XXX
20	Washers	4	391-3784-028
21	Cap Screws (single units)	4	391-1401-XXX
	Studs (multiple units)	4	391-1425-XXX
22	Nuts (multiple units)	4	391-1451-076



# PGP/PGM 051 Series Parts

## Item # 6 Shaft End Covers

### Pump

Description	Code	Part Number
4 Bolt SAE B	42	313 5037 201
2/4 Bolt B Type II	46	313 5057 204
SAE C 4 Bolt	78	313 5037 202
2 Bolt SAE B	97	313 5027 201

### Motor

4 Bolt B	42	313 5037 401
2/4 Bolt B	46	313 5057 204
SAE C 4 Bolt	78	313 5037 402
2 Bolt B	97	313 5027 401
Item # 6 A Drain Plug		391 2282 056



# Item # 12 Drive Shaft Gear Sets

## Description

<u>Gear Size</u>	<u>Code</u>	<u>Part Number</u>	
<b>1 1/4" Keyed Shaft</b>			
1.00" Gear	11	313 2910 750	
1.25" Gear	11	313 2912 750	
1.50" Gear	11	313 2915 750	
1.75" Gear	11	313 2917 750	
2.00" Gear	11	313 2920 750	
2.25" Gear	11	313 2922 750	
2.50" Gear	11	313 2925 750	
Key		391 1781 045	
<b>7/8" 13 Tooth Code 25</b>			
Continental	25	313 1000 300	Shaft Only
1.00" Gear	25	313 2910 230	
1.25" Gear	25	313 2912 230	
1.50" Gear	25	313 2915 230	
1.75" Gear	25	313 2917 230	
2.00" Gear	25	313 2920 230	
2.25" Gear	25	313 2922 230	
2.50" Gear	25	313 2925 230	



# Item # 12 Drive Shaft Gear Sets

## 1" Diameter Code 43

Continental	43	313 1500 400
1.00" Gear	43	313 2910 740
1.25" Gear	43	313 2912 740
1.50" Gear	43	313 2915 740
1.75" Gear	43	313 2917 740
2.00" Gear	43	313 2920 740
2.25" Gear	43	313 2922 740
2.50" Gear	43	313 2925 740
Key		391 1781 021

## 7/8" 13 Tooth Code 65 Short Shaft Type II

1.00" Gear	65	313 2910 430
1.25" Gear	65	313 2912 430
1.50" Gear	65	313 2915 430
1.75" Gear	65	313 2917 430
2.00" Gear	65	313 2920 430
2.25" Gear	65	313 2922 430
2.50" Gear	65	313 2925 430

## 1" Diameter Keyed Short Shaft Code 67 Type II

1.00" Gear	67	313 2910 940
1.25" Gear	67	313 2912 940
1.50" Gear	67	313 2915 940
1.75" Gear	67	313 2917 940
2.00" Gear	67	313 2920 940
2.25" Gear	67	313 2922 940
2.50" Gear	67	313 2925 940
Key		391 1781 021

## Item # 12 Drive Shaft Gear Sets

### 1" 15 Tooth Code 98

Continental	98	313 1000 400	Shaft Only
1.00" Gear	98	313 2910 140	Not Available in Tandem
1.25" Gear	98	313 2912 140	Not Available in Tandem
1.50" Gear	98	313 2915 140	Not Available in Tandem
1.75" Gear	98	313 2917 140	
2.00" Gear	98	313 2920 140	
2.25" Gear	98	313 2922 140	
2.50" Gear	98	313 2925 140	

**Continental Connecting Shaft**      313 1133 001

#### Note:

Integral Gear Sets include the shaft , drive gear and idler gear as one unit.  
Continental Gear Sets include the drive gear and idler gear and the shafts are carried separately. Special machining is manufacturer in the drive Continental Gear so multiple shafts can be installed.



# Item # 14 Gear Housings

## Blank

Code AB		Standard	Wide Port
<u>Gears Sizes</u>	<u>Code</u>	<u>Part Number</u>	<u>Part Number</u>
1.00" Gear	AB10	313 8210 100	N/A
1.25" Gear	AB12	313 8212 100	N/A
1.50" Gear	AB15	313 8215 100	315 8215 102
1.75" Gear	AB17	313 8217 100	315 8217 102
2.00" Gear	AB20	313 8220 100	315 8220 102
2.25" Gear	AB22	313 8222 100	315 8222 101
2.50" Gear	AB25	313 8225 100	315 8225 101

## NPT

### 3/4" BI Rotational NPT

1.00" Gear	IR10	313 8210 116	
1.25" Gear	IR12	313 8212 116	

### 1" BI Rotational NPT

1.50" Gear	YF15	313 8215 127	
1.75" Gear	YF17	313 8217 127	
2.00" Gear	YF20	313 8220 127	
2.25" Gear	YF22	313 8222 127	
2.50" Gear	YF25	313 8225 127	

### 1 1/4" BI Rotational NPT

1.50" Gear	YL15	313 8215 132	315 8215 132
1.75" Gear	YL17	313 8217 132	315 8217 132
2.00" Gear	YL20	313 8220 132	315 8220 132
2.25" Gear	YL22	313 8222 132	N/A
2.50" Gear	YL25	313 8225 132	315 8225 132

### 1 1/2" BI Rotational NPT

2.00" Gear	YR20	313 8220 137	N/A
2.25" Gear	YR22	313 8222 137	315 8222 137
2.50" Gear	YR25	313 8225 137	315 8225 137

# Item # 14 Gear Housings

## NPT

### 1 1/4" X 1" CW NPT

<u>Gear Size</u>	<u>Code</u>	<u>Part Number</u>
1.50" Gear	YJ15	313 8215 128
1.75" Gear	YJ17	313 8217 128
2.00" Gear	YJ20	313 8220 128
2.50" Gear	YJ25	313 8225 128

### 1 1/4" X 1" CCW NPT

1.50" Gear	YG15	313 8215 128
1.75" Gear	YG17	313 8217 128
2.00" Gear	YG20	313 8220 128
2.50" Gear	YG25	313 8225 128

### 1 1/2" X 1 1/4" CW NPT

2.50" Gear	YP25	313 8225 133
------------	------	--------------

### 1 1/2" -X 1 1/4" CCW NPT

2.50" Gear	YM25	313 8225 133
------------	------	--------------

## O-Ring

### 3/4" X 3/4" BI Rotational ODT

<u>Gear Size</u>	<u>Code</u>	<u>Part Number</u>
1.25" Gear	EF12	313 8212 316
1.50" Gear	EF15	313 8215 316
1.75" Gear	EF17	313 8217 316
2.00" Gear	EF20	313 8220 316
2.25" Gear	EF22	313 8222 316

### 1" X 1" BI Rotational ODT

1.50" Gear	AF15	313 8215 327
1.75" Gear	AF17	313 8217 327
2.00" Gear	AF20	313 8220 327
2.25" Gear	AF22	313 8222 327
2.50" Gear	AF25	313 3225 327

# Item # 14 Gear Housings

## O-Ring

### 1 1/4" X 1 1/4" Bi Rotational ODT

<u>Gear Size</u>	<u>Standard Code</u>	<u>Wide Port Part Number</u>	<u>Part Number</u>
1.50" Gear	AL15	N/A	315 8215 332
1.75" Gear	AL17	N/A	315 8217 332
2.00" Gear	AL20	313 8220 332	315 8220 332
2.25" Gear	AL22	313 8222 322	315 8222 332
2.50" Gear		313 8225 322	315 8225 332

### 1 1/2" X 1 1/2" BI Rotational ODT

2.25" Gear	AR22	313 8222 337
2.50" Gear	AR25	313 8225 337

### 1 1/4" X 1" CW ODT

1.50" Gear	AJ15	313 8215 328
1.75" Gear	AJ17	313 8217 328
2.00" Gear	AJ20	313 8220 328
2.25" Gear	AJ22	313 8222 328
2.50" Gear	AJ25	313 8225 328

### 1 1/4" X 1" CCW ODT

1.50" Gear	AG15	313 8215 328
1.75" Gear	AG17	313 8217 328
2.00" Gear	AG20	313 8220 328
2.25" Gear	AG22	313 8222 328
2.50" Gear	AG25	313 8225 328

### 1 1/2" X 1 1/4" CW ODT

2.00" Gear	AP20	313 8220 333
2.25" Gear	AP22	313 8222 333
2.50" Gear	AP25	313 8225 333

### 1 1/2" X 1 1/4" CCW ODT

2.00" Gear	AM20	313 8220 333
2.25" Gear	AM22	313 8222 333
2.50" Gear	AM25	313 8225 333

## Item # 16 Bearing Carriers

<u>Description</u>	<u>Code</u>	<u>Part Number</u>
Bi-Rotational No Ports	B	313 7740 100
Clockwise No Ports	C	313 7723 100
Counter Clockwise	D	313 7723 100

## Item # 18 Gear Sets

### Continental or Downstream Gear Sets

<u>Gear Size</u>	<u>Part Number</u>	<u>Notes</u>
1.00" Gear	313 2810 000	Gear Set Only
1.25" Gear	313 2812 000	Gear Set Only
1.50" Gear	313 2815 000	Gear Set Only
1.75" Gear	313 2817 000	Gear Set Only
2.00" Gear	313 2820 000	Gear Set Only
2.25" Gear	313 2822 000	Gear Set Only
2.50" Gear	313 2825 000	Gear Set Only

## Item # 19 Port End Covers

Description	Code	Ext. Studs	Standard Part Number	Wide Port Part Number
No Ports	BE	BY	313 3120 100	N/A
<b>NPT</b>				
3/4" BI Rotational	ME	MY	313 3120 116	N/A
1" BI Rotational	**	**	313 3120 127	N/A
1 1/4" BI Rotational	**	**	N/A	315 3220 132
1 1/2" BI Rotational	**	**	N/A	315 3220 137
<b>O-Ring</b>				
3/4" Bi Rotational	FE	FY	313 3120 316	N/A
1 1/4" Bi	**	**	N/A	315 3220 332

## Item # 21 Fasteners

Description	Standard Part Number	Wide Port Part Number
<b>Cap Screws</b>		
<u>Gear Size</u>	<u>Part Number</u>	<u>Part Number</u>
1.00" Gear	391 1401 088	N/A
1.25" Gear	391 1401 069	N/A
1.50" Gear	391 1401 027	391 1401 076
1.75" Gear	391 1401 025	391 1401 090
2.00" Gear	391 1401 103	391 1401 090
2.25" Gear	391 1401 089	391 1401 105
2.50" Gear	391 1401 095	391 1401 111
<b>Studs</b>		
1.00" Gear	391 1425 107	N/A
1.25" Gear	391 1425 107	N/A
1.50" Gear	391 1425 111	391 1425 092
1.75" Gear	391 1425 111	391 1425 093
2.00" Gear	391 1425 110	391 1425 001
2.25" Gear	391 1425 110	391 1425 002
2.50" Gear	391 1425 092	391 1425 003
Washers	391 3784 028	
Nuts	391 1451 076	

# Seal & Component Parts

item #	Description	Part Number	Pump	Tan	O/B	Motor
1	Snap Ring	391 2686 065	X	X	1	1
	Ring Retainer	391 2686 016	X	X	1	1
2	Outboard Bearing	391 0381 077	X	X	1	1
	Outboard Spacer	391 3383 087	X	X	X	1
3	Lip Seal	391 2881 103	1	1	1	X
4	Seal Retainer	391 3383 020	X	X	1	1
5	Lip Seal [High Press]	391 2883 115	X	X	X	1
7	Checks	391 3681 001	2	2	2	2
8	Ring Seals	391 2585 009	2	4	2	2
9	Roller Bearings	391 0381 905	4	8	4	4
10	Thrust Plates	391 2185 912	2	4	2	2
11	Pocket Seals	391 2882 051	1	2	1	1
13	Gasket Seals	391 2884 021	2	4	2	2
15	Dowel Pins	391 2082 032	4	8	4	4

**\* Note: When building a Wide Port pump or motor remove the Standard Gasket Seal for the kit and place on the shelf for future use.**



## **Warning----- User Responsibility**

**FAILURE OR IMPROPER SELECTION OR IMPROPER USE OF THE PRODUCTS DESCRIBED HEREIN OR RELATED ITEMS CAN CAUSE DEATH PERSONAL INJURY AND PROPERTY DAMAGE.**

This document and other information from Parker-Hannifin Corporation, its subsidiaries and authorized distributors provide product or system options for future investigation by users having technical expertise.

The user, through its own analysis and testing, is solely responsible for making the final selection of the system and components and assuring that all performance, endurance, maintenance, safety and warning requirements of the application are met. The user must analyze all aspects of the application, follow applicable industry standards, and follow the information concerning the product in the current catalog and in any other materials provided from Parker or its subsidiaries or authorized distributors.

To the extent that Parker or its subsidiaries or authorized distributors provide component or system options based upon data or specifications provided by the user, the user is responsible for determining that such data and specifications suitable and sufficient for all applications and reasonably foreseeable uses of the components or systems.

# PNEUMATIC CONTROL VALVES

## DAV1221 VALVES



**Stackable Valves** using one common inlet and exhaust ports with one standard bolt length. Provides various bankable applications - *wet line kits, dump pump controls, municipal snowplow vehicles, dump bodies, refuse vehicles and more.*

*Various bent handles available for installation*

### FEATURES:

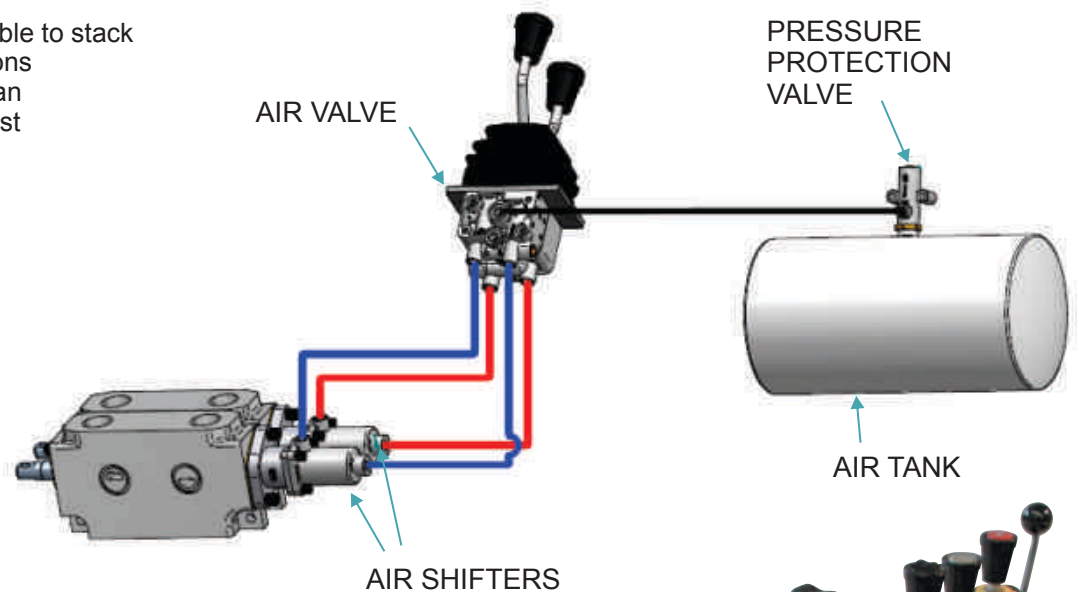
- 0-120 PSI proportional control, able to stack valves into bankable configurations
- Offset handles allow for very clean installation that reduces labor cost

### OPTIONS:

- Lit Knobs for all driving conditions, even at night.
- Neutral Detent
- 3-Position Detent
- Detent Clip
- Spacer to accept various straight-handle configurations
- Magnifying Cap and Decal clearly shows functions and control instructions

### NOTE:

**ALL 1220 SERIES  
PNEUMATIC CONTROL  
VALVES FEATHER IN  
BOTH DIRECTIONS**



## DAV-1221

FEATHERING VALVE - STRAIGHT HANDLE	1221-99-01
VALVE SHORT STRAIGHT HANDLE, 3"	1221-99-10
VALVE INLET MANIFOLD	1221-2-25
VALVE, WILLIAMS VALVE, 521A SLIM VERSION	1221-99-41
VALVE, SINGLE DETENT	1222-99-01
VALVE, DOUBLE DETENT	1223-99-01
O-RINGS FOR INLET and EXHAUST PORTS	DAV1221-ORING
ASSEMBLY SCREW	DAV1221-SCREW
RUBBER BOOT	DAV1221-RBT





# PNEUMATIC CONTROL VALVES

## DAV1221 VALVES



### DAV-1221

1221 VALVE  
HALF BENT  
HANDLE

1221-99-02



### DAV-1221

1221 VALVE  
QUARTER BENT  
HANDLE

1221-99-07



### DAV-1221

1221 VALVE  
FULL BENT  
HANDLE

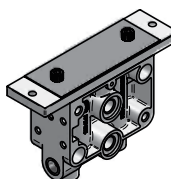
1221-99-03



### DAV-1221UH

1221 UPPER  
HANDLE  
ASSEMBLY

DAV1221UH



### 1221SPCR

1221 SPACER  
MANIFOLD BLOCK -

BANKABLE

DAV1221SPCRS

### DAV-1221 BANKED

2 BANK VALVE	1221-2B-01
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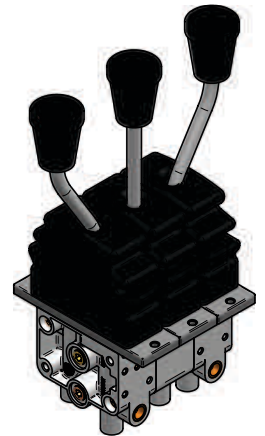
3 BANK VALVE	1221-3B-01
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4 BANK VALVE	1221-4B-01
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5 BANK VALVE	1221-5B-01
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6 BANK VALVE	1221-6B-01
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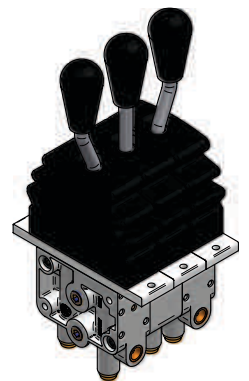
7 BANK VALVE	1221-7B-01
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### DAV-1221 SLIM BANKED (WM521A)

2 BANK VALVE, WM521A	1221-2B-41
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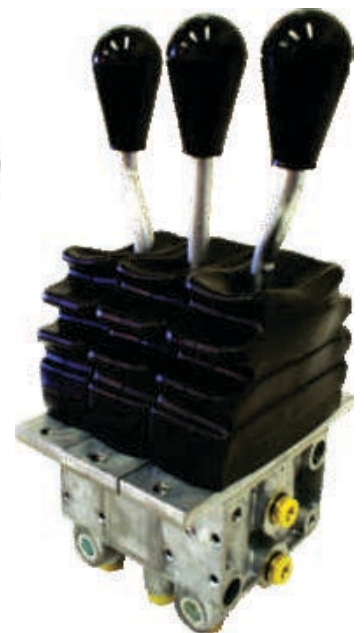
3 BANK VALVE, WM521A	1221-3B-41
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### DAV-1221 3 BANK



### DAV-1221 3 BANK SLIM



Call us for your pneumatic control applications.

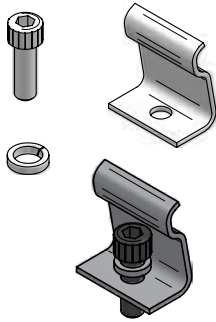
# PNEUMATIC CONTROL VALVES

## DAV1221 VALVES

### SPRING DETENT

DETENT  
CLIP

DETENTCLIPS



### 1221MNRE

MINOR  
REPAIR  
KIT

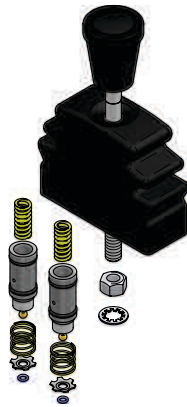
DAV1221MNRE



### 1221MJRE

MAJOR  
REPAIR  
KIT

DAV1221MJRE



## DAV1224 VALVES

### DAV-1224

VALVE, LOCK IN NEUTRAL 1224-99-03

VALVE, LOCK IN NEUTRAL,  
DOUBLE DETENT 1224-99-04

VALVE, LOCK IN NEUTRAL,  
TRIPLE DETENT 1224-99-05

VALVE, LOCK IN NEUTRAL,  
INLET MANIFOLD 1224-99-21

VALVE, LOCK IN NEUTRAL,  
WILLIAMS PLATE 1224-99-20

VALVE, DUAL 1224  
VALVE ASSEMBLY 1224-1224

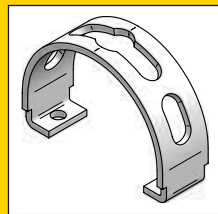
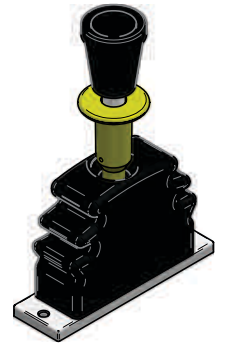


### DAV-1224UH

UPPER HANDLE ASSEMBLY DAV1224-UH-03

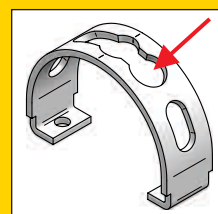
UPPER HANDLE ASSEMBLY DAV1224-UH-04

UPPER HANDLE ASSEMBLY DAV1224-UH-05



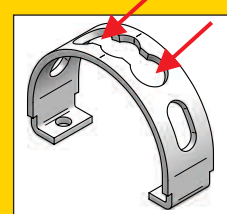
**STEEL  
TRACK**  
FOR 1224-03

1264-84-21



**STEEL  
TRACK**  
FOR 1224-04

1264-84-22



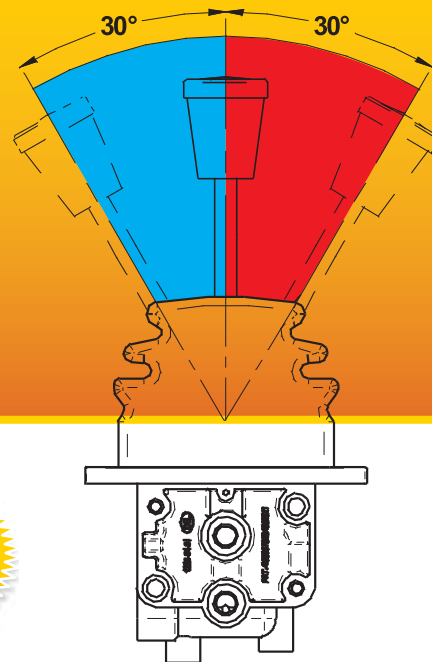
**STEEL  
TRACK**  
1224-05

1264-84-23

# PNEUMATIC CONTROL VALVES

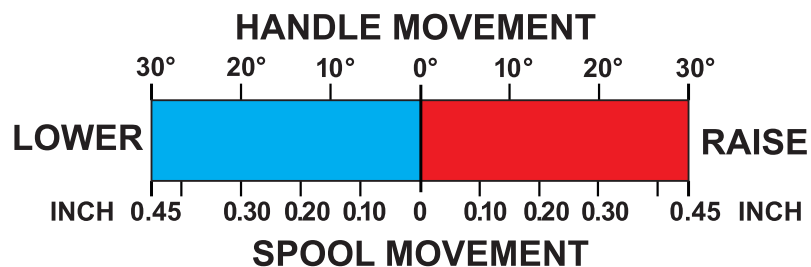
## HYDRAULIC VALVE ACTUATORS

APPLICATION		PART NO.	APPLICATION		PART NO.
PARKER	A20	ASC-A20	FLODRAULICS	HYDROCONTROL-D16	3039-99-03
PARKER	A20-K4 FLOAT	3009-99-01	HUSCO	5000 SERIES	3038-99-03
PARKER	A35	3019-99-03	HUSCO	6000 SERIES - 375	3037-99-03
PARKER	25P	3017-99-03	WALVOIL	DLS8	3060-99-03
PARKER	V20	ASC-V20	SALAMI	VD6A	3061-99-03
PARKER	V20-K4 FLOAT	3023-99-03	SALAMI	VDM6	3063-99-03
PARKER	V40	3027-99-03	SALAMI	VD8A	3062-99-03
PARKER	V42	3015-99-03	SALAMI	VDM8	3064-99-03
PARKER	S75	3033-99-01	SALAMI	VD10A	3071-99-03
PARKER	DS75	3029-99-01	SALAMI	VD12A	3072-99-03
PARKER	S-100	3034-99-01	BLB	150 SERIES	3075-99-03
PARKER/KONTAK	K-18	3050-99-03	SAUER DANFOSS	PVG32-EL-SL	3082-99-04
REXROTH	MP-18	3018-99-03	SAUER DANFOSS	PVG32-MAN	3083-99-06
REXROTH	MP-4	3059-99-03	WILLIAMS	08 SERIES	3025-99-03
CROSS	BA	3026-99-03			
CROSS	S-100	3081-00-01			
HEIL	031-6131-HPT	3043-99-01			
PRINCE	20 SERIES	3013-99-06			
PRINCE	5100 MONOBLOCK	3024-99-03			
PRINCE	SS2A10	3054-99-03			
PRINCE	SV	3055-99-03			
PRINCE	DS41AE	3056-99-03			
PRINCE	DS41AE	3057-99-03			



**Self Alignment  
Feature Eliminates  
Binding**

The actuators are designed to control the closing and opening of hydraulic valves by installing a pneumatic shift cylinder to the end of the hydraulic spool. They provide balanced areas for true proportional control. Simple installation with no exterior moving parts.



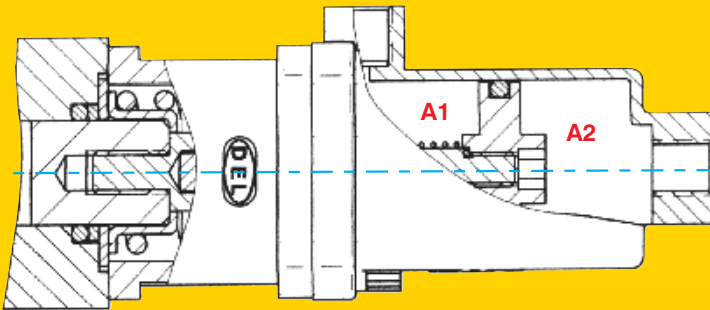
# PNEUMATIC CONTROL VALVES

## E-Z FIT PNEUMATIC SHIFT CYLINDERS HYDRAULIC VALVE APPLICATIONS

PRE-ASSEMBLED!

ULTRA COMPACT!

SIMPLER INSTALLATION!



These Cylinders Fit Various Valves, such as PARKER, GRESN, COMMERCIAL, REXROTH, CROSS, VALVOIL, PRINCE, SALAMI and more.

*Tighten the assembly with a hex wrench*

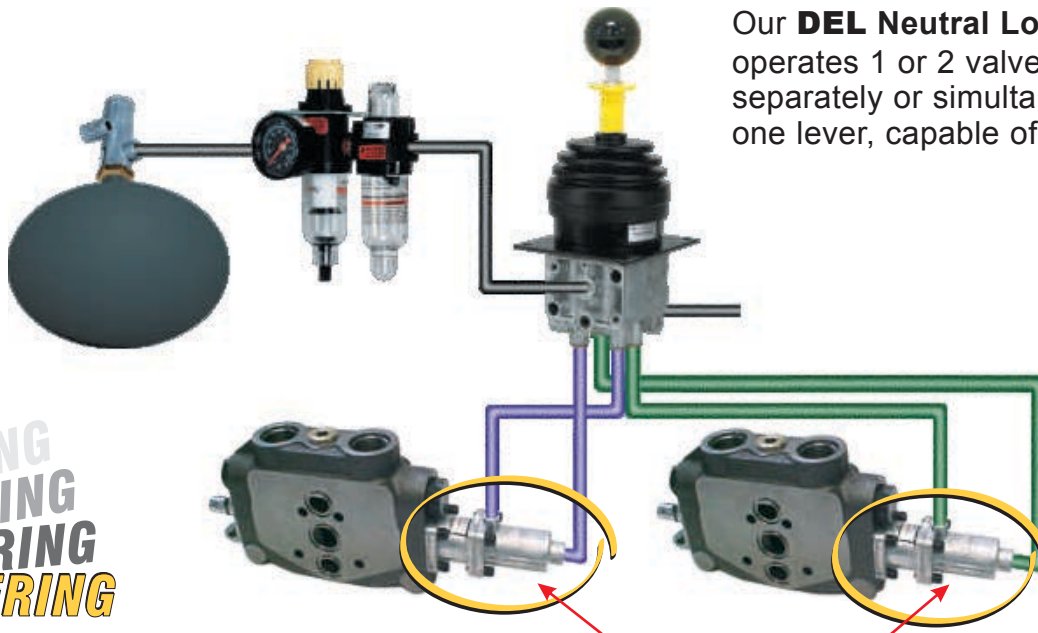
**All moving parts are TOTALLY ENCLOSED!**

**Only DEL Pneumatic Shift Cylinders have these Important Safety Features!**

Unique Design allows balanced areas **A1** and **A2** for consistent proportional control in both Directions. Self-alignment feature for aligned and misaligned hydraulic spools eliminates binding & jamming.

### DON'T GET CAUGHT IN A BIND!

*Only DEL E-Z Fit Pneumatic Shift Cylinders offer these important safety features.*



Our **DEL Neutral Lock Joystick** operates 1 or 2 valve functions separately or simultaneously with one lever, capable of rotating 360°.



**EZ-FIT SHIFT CYLINDERS**

# 50251

## 50 SERIES, 3 PLUG, RH SIDE, 139.5 IN. BACK-UP, STOP/TURN/TAIL HARNESS, W/ S/T/T BREAKOUT, 14 GAUGE, RIGHT ANGLE PL-3, RIGHT ANGLE PL-2, RING TERMINAL

- Dimensions "A" indicate standard stocked length harness.
- A range of custom length harnesses are available in 12" increments.
- Contact Customer Service for lead time and availability.

### SPECS

- **Catalog Number:**50251
- **Warranty:**5-Year
- **Brand:**TL
- **Number of Plugs:**3
- **Number of Conductors:**5
- **Series:**50 Series
- **Packaging Type:**Standard
- **Std Carton Qty:**1
- **Plug Side One:**Right Angle PL-3|Right Angle PL-2
- **Plug Side Two:**Ring Terminal
- **KIT (Y/N):**No
- **Wire Color:**Black|Brown|Green|Red|White
- **VMRS:**034-002-036
- **Position:**Right Hand Side
- **Length:**139.5 inch
- **Breakout:**S/T/T
- **Product Type:**Harness
- **Long Description:**50 Series, 3 Plug, RH Side, 139.5 in. Back-Up, Stop/Turn/Tail Harness, W/ S/T/T Breakout, 14 Gauge, Right Angle PL-3, Right Angle PL-2, Ring Terminal
- **Short Description:**50 Series, 3 Plug, RH Side, 139.5 in. Back-Up, Stop/Turn/Tail Harness, W/ S/T/T Breakout
- **UPC:**0735111015444
- **Wire Gauge:**14
- **Cable Type:**Round
- **Harness Type:**Back-Up|Stop/Turn/Tail
- **Weight:**2.90 pound

# 50250

## 50 SERIES, 3 PLUG, LH SIDE, 139.5 IN. BACK-UP, STOP/TURN/TAIL HARNESS, W/ S/T/T BREAKOUT, 14 GAUGE, RIGHT ANGLE PL-3, RIGHT ANGLE PL-2, RING TERMINAL

- Dimensions "A" indicate standard stocked length harness.
- A range of custom length harnesses are available in 12" increments.
- Contact Customer Service for lead time and availability.

### SPECS

- **Catalog Number**50250
- **Warranty**5-Year
- **Brand**:Truck-Lite
- **Number of Plugs**:3
- **Number of Conductors**:5
- **Series**:50 Series
- **Packaging Type**:Standard
- **Std Carton Qty**1
- **Plug Side One**:Right Angle PL-3|Right Angle PL-2
- **Plug Side Two**:Ring Terminal
- **KIT (Y/N)**No
- **Wire Color**:Black|Brown|Red|Yellow|White
- **VMRS**:034-002-036
- **Position**:Left Hand Side
- **Length**:139.5 inch
- **Breakout**:S/T/T
- **Product Type**:Harness
- **Long Description**:50 Series, 3 Plug, LH Side, 139.5 in. Back-Up, Stop/Turn/Tail Harness, W/ S/T/T Breakout, 14 Gauge, Right Angle PL-3, Right Angle PL-2, Ring Terminal
- **Short Description**:50 Series, 3 Plug, LH Side, 139.5 in. Back-Up, Stop/Turn/Tail Harness, W/ S/T/T Breakout
- **UPC**0735111015376
- **Wire Gauge**:14
- **Cable Type**:Round
- **Harness Type**:Back-Up|Stop/Turn/Tail
- **Weight**2.90 pound





## 50 Gallon Side Mount Steel Hydraulic Reservoir

Buyers Part Number: SMS50S

Buyers Products Side Mount Steel Reservoir is built of tough 13 Ga steel and is designed to install on the side of your truck.

- Tough, durable 13 Ga steel construction.
- Fully baffled to keep oil cool and moving correctly.
- Includes level/temperature sight gauge.



### Specifications

Capacity	50 Gal	Color	Black
Depth	25.00"	Filter Head Material_1	Aluminum
Finish	Powder Coat	Hardware and Brackets Included (y/n)	No
Height	23"	Included Valve (y/n)	No
Integral Brackets (y/n)	Yes	Integral Level Gauge (y/n)	Yes
Material	Carbon Steel	Material Gauge	13
Mount Position	Upright	Mount Style	Side
Oil Level Gauge (y/n)	Yes	Reservoir Shape	Rectangle
Style 1 Port Diameter	2"	Suction Port Size	2 NPT
Temperature Gauge (y/n)	Yes	Usable Capacity	50 Gal
Width	23.020"	Shipping Weight	108 lb