NEW LEADER

MODEL L–2020

MANUAL NUMBER 44000–N

UNIT SERIAL NUMBER _____

EFFECTIVE 3/97

HIGHWAY EQUIPMENT COMPANY –– 616 D AVENUE N.W.
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BUILDING THE BEST SINCE 1939.

A

PREFACE

PLEASE -- ALWAYS THINK SAFETY FIRST !!!

The purpose of this manual is to familiarize the person (or persons) using this unit with the information necessary to properly install, operate, and maintain this system. These instructions cannot replace the following: the fundamental knowledge that must be possessed by the installer or operator, the knowledge of a qualified person, or clear thinking necessary to install and operate this equipment. Since the life of any machine depends largely upon the care it is given, we suggest that this manual be read thoroughly and referred to frequently. If for any reason you do not understand the instructions, please call your authorized service center or our Cedar Rapids, Iowa, Service Department at (319) 363-8281.

It has been our experience that by following these installation instructions, and by observing the operation of the SPREADER, you will have sufficient understanding of the machine enabling you to troubleshoot and correct all normal problems that you may encounter. Again, we urge you to call us at our Cedar Rapids Service Department if you find the SPREADER is not operating properly, or if you are having trouble with repairs, installation, or removal of this machine.

Many owners of NEW LEADER products use our Authorized Service Centers for all work other than routine care and adjustments. We strongly urge you to use genuine NEW LEADER parts and service to protect your investment.

Highway Equipment Company reserves the right to make alterations or modifications in this equipment at any time. The manufacturer shall not be obligated to make such changes to machines already in the field.

When this manual was originally supplid, it was accompanied by the Highway Equipment Company "Operating and Maintenance SAFETY MANUAL." The Safety Manual should be read thoroughly and referred to frequently. If you do not have the Safety Manual, we recommend that you obtain one from your dealer or from Highway Equipment Company before any installation, operation or maintenance of the spreader is attempted.

ACCIDENTS HURT !!!

ACCIDENTS COST !!!

ACCIDENTS CAN BE AVOIDED !!!

SAFETY

TAKE NOTE ! THIS SAFETY ALERT SYMBOL FOUND THROUGHOUT THIS MANUAL IS USED TO CALL YOUR ATTENTION TO INSTRUCTIONS INVOLVING YOUR PERSONAL SAFETY AND THAT OF OTHERS. FAILURE TO FOLLOW THESE INSTRUCTIONS CAN RESULT IN INJURY OR DEATH.

In this manual and on the safety signs placed on the unit, the words "DANGER," "WARNING," "CAUTION," and "IMPORTANT," are used to indicate the following:

DANGER — Indicates an imminently hazardous situation that, if not avoided, WILL result in death or serious injury. This signal word is to be limited to the most extreme situations and typically for machine components that, for functional purposes, cannot be guarded.

WARNING — Indicates a potentially hazardous situation that, if not avoided, COULD result in death or serious injury, and includes hazards that are exposed when guards are removed. It may also be used to alert against unsafe practices.

CAUTION — Indicates a potentially hazardous situation that, if not avoided, MAY result in minor or moderate injury. It may also be used to alert against unsafe practices.

IMPORTANT — Is used for informational purposes in areas which may involve damage or deterioration to equipment but generally would not involve the potential for personal injury.

The need for safety cannot be stressed strongly enough in this manual. At Highway Equipment Company, we urge you to make safety your top priority when operating any equipment. We firmly advise that anyone allowed to operate this machine be thoroughly trained and tested, to prove they understand the fundamental of safe operation.

The following guidelines are intended to cover general usage and to assist you in avoiding accidents. There will be times when you will run into situations that are not covered in this section. At those times the best standard to use is common sense. If, at any time, you have a question concerning these guidelines please call your authorized service center or our factory at (319–363–8281).

SAFETY DECALS CONTINUED

MAINTENANCE INSTRUCTIONS

1. Keep safety decals and signs clean and legible at all times.
2. Replace safety decals and signs that are missing or have become illegible.
3. Replaced parts that displayed a safety sign should also display the current sign.
4. Safety decals or signs are available from your Dealer Parts Department or our Cedar Rapids factory.

INSTALLATION INSTRUCTIONS

1. Clean Surface
   Wash the installation surface with a synthetic, free-rinsing detergent. Avoid washing the surface with a soap containing creams or lotions. Allow to dry.
2. Position Safety Decal
   Decide on the exact position before application. Application marks may be made on top or side edge of the substrate with a lead pencil, marking pen, or small pieces of masking tape. NOTE: Do not use a chalk line, china marker or grease pencil. Safety decals will not adhere to these.
3. Remove the Liner
   A small bend at the corner or edge will cause the liner to separate from the decal. Pull the liner away in a continuous motion at a 180° angle. If the liner is scored, bend at score and remove.
4. Apply Safety Decal
   a. Tack decal in place with thumb pressure in upper corners.
   b. Using firm intial squeegee pressure, begin at the center of the decal and work outward in all directions with overlapping strokes. NOTE: Keep squeegee blade even, nicked edges will leave application bubbles.
   c. Pull up tack points before squeegeeing over them to avoid wrinkles.
5. Remove Premask
   If safety decal has a premask cover remove it at this time by pulling it away from the decal at a 180° angle. NOTE: It is important that the premask covering is removed before the decal is exposed to sunlight to avoid the premask from permanently adhering to decal.
6. Remove Air Pockets
   Inspect the decal in the flat areas for bubbles. To eliminate the bubbles, puncture the decal at one end of the bubble with a pin (never a razor blade) and press out entrapped air with thumb moving toward the puncture.
7. Re-Squeegee All Edges.

AVOID ACCIDENTS

Most accidents, whether they occur in industry, on the farm, at home, or on the highway, are caused by the failure of some individual to follow simple and fundamental safety rules or precautions. For this reason, most accidents can be prevented by recognizing the real cause and doing something about it before the accident occurs.

Regardless of the care used in the design and construction of any type of equipment, there are many conditions that cannot be completely safeguarded against without interfering with reasonable accessibility and efficient operation.

A CAREFUL OPERATOR IS THE BEST INSURANCE AGAINST AN ACCIDENT. THE COMPLETE OBSERVANCE OF ONE SIMPLE RULE WOULD PREVENT MANY THOUSAND SERIOUS INJURIES EACH YEAR. {THAT RULE IS:}

NEVER ATTEMPT TO CLEAN, OIL OR ADJUST A MACHINE WHILE IT IS IN MOTION.

NATIONAL SAFETY COUNCIL

CAUTION **If spreader is used to transport chemicals, check with your chemical supplier regarding DOT (Department of Transportation) requirements.**

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GENERAL DESCIPTION

The Model L-2020 is a hopper-type spreader intended for spreading free-flowing granular agricultural materials, such as chemical fertilizers, agricultural limestone and gypsum. It is intended for truck chassis or flotation vehicle mounting. It also may be incorporated into a towed trailer unit.

The unit is powered hydraulically and provides independent variable speed control for the spinner and full automatic ground speed coordinated control for the conveyor by means of the Synco-Matic Mark II control system. The hydraulic pump which provides the hydraulic power is a gear-type pump and it is driven by means of a transmission PTO.

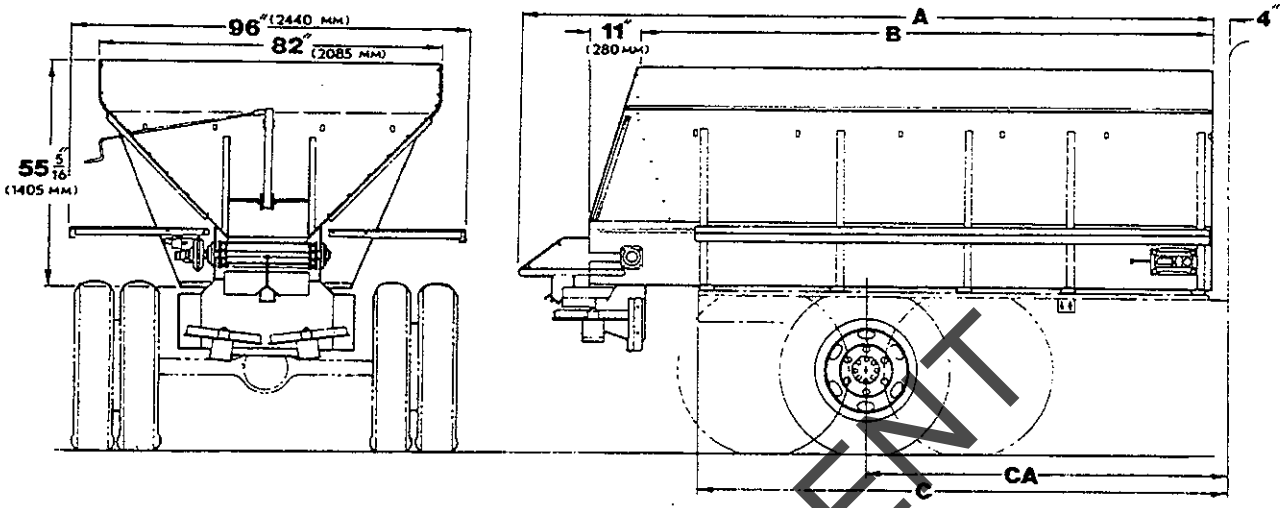
The conveyor runs the full length of the hopper bottom to deliver material to the spinner through an adjustable metering gate at the rear of the hopper body. It is driven by an orbital type hydraulic motor integrally mounted to a 6:1 ratio spur gear box. The standard chain conveyor is a #2 type having parallel strands of roller chain joined by cross bars every other link.

Optional conveyors for lower application rates as well as maximum rates are:

1. Number three chain conveyor w/cross bars every link.
2. Number four type Belt-Over-Chain conveyor.
3. Number five type Straight Belt conveyor with stainless steel slatted bottom and inverted "V" over conveyor.
4. Number six type stainless steel "Doormat" conveyor chain.

The distributor spinner assembly has two 24 inch diameter discs canted upward at outer edges by 5°. Each disc has three formed and heat treated fins that are adjustable as to radial angle. Spinners are fed through an adjustable material flow divider.

GENERAL DESCRIPTION CONT'D



Weights and Dimensions				
Body Length	Over-All A	Inside B	Frame C	Cab to Axle C.A.
10'	148" (3760mm)	120" (3050mm)	111" (2820mm)	84" (2135mm)
11'	160" (4065mm)	132" (3355mm)	123" (3125mm)	84" (2135mm)
12'	172" (4370mm)	144" (3660mm)	135" (3430mm)	102" (2590mm)
13'	184" (4675mm)	156" (3960mm)	147" (3735mm)	102-108" (2590-2745mm)
14'	196" (4980mm)	168" (4265mm)	159" (4040mm)	120" (3050mm)
15'	208" (5285mm)	180" (4570mm)	171" (4345mm)	120" (3050mm)
16'	220" (5590mm)	192" (4875mm)	183" (4650mm)	138" (3505mm)

Capacities Struck — Cu. Yds.(CuM)Cu. Ft.				
Body Length	Standard	w/6" Lower Sides	w/6" Higher Sides	Basic Spreader Weight-Approx.
10'	6.3 (4.9) 171	5.1 (3.9) 137	7.6 (5.8) 206	2852 lb. (1203 kg)
11'	7.0 (5.4) 189	5.6 (4.3) 152	8.4 (6.4) 227	2852 lb. (1294 kg)
12'	7.7 (5.9) 207	6.2 (4.7) 166	9.2 (7.0) 248	2952 lb. (1339 kg)
13'	8.4 (6.4) 225	6.7 (5.1) 181	10.0 (7.6) 270	3052 lb. (1384 kg)
14'	9.0 (6.9) 244	7.3 (5.5) 196	10.8 (8.3) 291	3152 lb. (1430 kg)
15'	9.7 (7.4) 262	7.8 (6.0) 210	11.6 (8.9) 313	3352 lb. (1520 kg)
16'	10.4 (7.9) 280	8.3 (6.4) 225	12.4 (9.5) 334	3552 lb. (1611 kg)

INSTALLATION INSTRUCTIONS

SELECTION OF FRICTION WHEEL, PUMP AND PTO

Since the amount of material per acre to be spread depends upon the match between friction wheel size, rear axle ratio, rear tire size, pump size, pump speed (which depends upon engine speed and PTO percent), conveyor delivery rate and feedgate opening, it is essential that a correct match between these factors be made. This matching is called "sizing."

SIZING DATA REQUIRED

1. Correct sizing requires accurate and complete information.
   - A. PTO Data
     1. Make and Model of PTO.
     2. PTO percentage of Engine RPM.
     3. Direction of PTO Rotation (Engine Direction or Opposite of Engine Direction).
   - B. Propellor Shaft Diameter.
   - C. Rear Axle Ratio. If two speed, give ratio in which spreading is to be done.
   - D. Auxiliary transmission (if so equipped) gear ratio to be used while spreading.
   - E. Rear tire size and type. From tire size and type, tire revolutions per mile may be obtained from a tire manual or tire distributor. The following lists some typical values:

HIGHWAY TIRES		
Tube Type	Tubeless Type	Tire Revolutions Per Mile
8.25 x 20	9.00 x 22.5	543
9.00 x 20	10.00 x 22.5	523
10.00 x 20	11.00 x 22.5	507
11.00 x 20		492
10.00 x 22	11.00 x 24.5	488

(Chart continued on next page.)

INSTALLATION INSTRUCTIONS CONT'D

HIGH FLOTATION TIRES		
Tube Type	Tubeless Type	Tire Revolutions Per Mile
	16.5 x 19.5	511
	18.5 x 19.5	498
	15 x 22.5	495
18.00 x 20		457
	48 x 25	450
	48 x 31	450
	66 x 43	315
	67 x 34	310

F. Engine RPM range while spreading. IMPORTANT: Excessive engine speed will cause more hydraulic oil to be pumped than is required to drive spinners and conveyor and may result in overheating the oil. Too low an engine speed may not provide sufficient hydraulic oil flow to keep conveyor running at speed required to deliver desired quantity of material being spread. For popular medium duty V-8 engines recommended operating range would be 2800 to 3200 engine RPM. NOTE: With lower speed engines such as diesels and heavy duty gasoline engines it may be necessary to select a higher percentage PTO or a larger pump than standard. Consult your dealer in such cases. It is desirable to install a tachometer in order to maintain proper engine speeds.

2. Friction Wheel Diameter determination:
From the data obtained in (1) above, the Friction Wheel Diameter is obtained using the following formula:

$$FWD = \frac{TRM \times RA \times PSD}{K}$$

Where FWD is Friction Wheel Diameter in inches.
TRM is Tire Revolutions per Mile.
RA is the gear reduction behind the point where the friction wheel is

INSTALLATION INSTRUCTIONS-CONT'D

mounted. For trucks without an auxiliary transmission or for trucks with an auxiliary transmission where the friction wheel is mounted behind the auxiliary transmission (between auxiliary transmission and rear axle), RA equals Rear Axle ratio. If a truck is equipped with an auxiliary transmission and friction wheel is mounted between the main transmission and the auxiliary transmission, RA equals the Rear Axle ratio times the auxiliary transmission ratio.

NOTE: The above rear axle ratio and auxiliary tranmission ratio (if applicable) are the ratio(s) in which spreading is to be done.

IMPORTANT: Do not change the rear axle ratio from the one used in determining friction wheel diameter as this will change spread rates. This also applies to the auxiliary transmission if the friction wheel is mounted between the main transmission and the auxiliary transmission.

PSD is Propellor Shaft Diameter in inches at the point where the friction wheel contacts the shaft. (Hint: If the propellor shaft diameter is not available, take a piece of string and wrap it wround the shaft. Then measure the string and divide the length by 3.14. This will give you the shaft diameter. Example: If the length of the string is 11 inches, you would have a 3.5 inch diameter shaft (11÷3.14=3.5").

K is 1776 for #5 conveyor (3:1 2-speed).
K is 2192 for #2, 3 or 4 conveyor (3:1 2-speed).
K is 2058 for #6 conveyor (3:1 2-speed).

Example: If truck to be used has 48 x 31 tubeless type tires, TRM would be 450. If it has a two-speed rear axle with a high speed ratio of 5.57:1 and a low speed ratio of 7.75:1 and spreading is to be done in the low speed ratio, RA would be 7.75. If the propellor shaft diameter is 3 inches, PSD would be 3. If a #5 belt conveyor on an L-2020 is used, K would be 1776. Friction Wheel Diameter would be calculated as follows:

$$FWD = \frac{450 \times 7.75 \times 3}{1776} = 5.89$$

Select the nearest diameter-in this case 6 inches. NOTE: Friction wheels are available in the following diameters: 3", 3½", 4", 5" and 6". Also available are a step-up (2.00) and a step-down (.005) adapter which would be used, for example, when FWD is 8.12. You would select a 4" wheel with a .500 step-down adapter.

INSTALLATION INSTRUCTIONS CONT'D

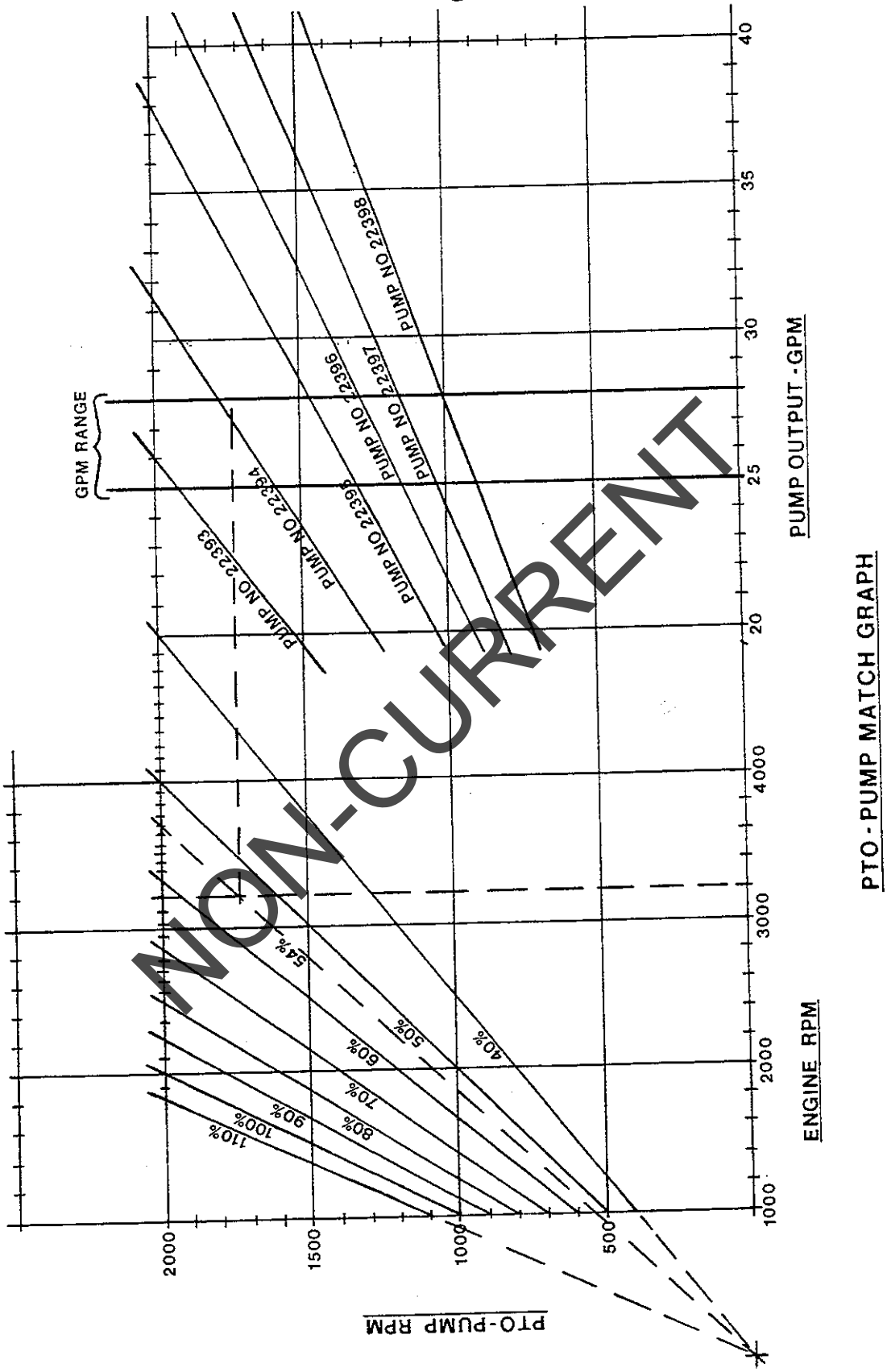
3. Pump PTO Selection:
Determine the maximum engine speed of the truck to be used. On the PTO-Pump Match Graph, locate the maximum speed on the Engine RPM scale. Draw a line up from this point until it reaches the 2000 RPM horizontal line of the PTO-Pump RPM scale. The maximum PTO percentage to be used will be at the point where the maximum engine RPM line crosses the 2000 RPM line. Determine a PTO percentage at or below the maximum PTO percentage which fits your particular transmission application.

Draw a line over from the point where the chosen PTO percent line crosses the maximum engine RPM line. The correct pump to use will be the one which intersects this line in the GPM range required. For the L-2020 hydraulic system, this range is 25 to 28 GPM.

For example, if the maximum engine RPM of the truck to be used is 3200 RPM, a vertical line from this point would intersect the 2000 PTO-Pump RPM scale at the 62% PTO hash mark. If the nearest available PTO at or below 62% for the transmission is 54%, drawing in the line for the 54% PTO and drawing a line over from where this line intersects the maximum engine RPM line crosses the 22394 pump curve in the desired GPM range. This would be the correct pump to use for the particular engine speed-PTO percentage used in this example.

Please note that unless otherwise specified, the L-2020 spreader will be shipped with Pump Number 22394.

If the PTO-Pump matching will not fit in to the speed and delivery volumes required for the spreader, refer to your New Leader dealer.


PTO - PUMP MATCH GRAPH
PUMP OUTPUT - GPM
ENGINE RPM
PTO-PUMP RPM
GPM RANGE
PUMP NO 22398
PUMP NO 22397
PUMP NO 22396
PUMP NO 22395
PUMP NO 22394
PUMP NO 22393
40%
50%
54%
60%
70%
80%
90%
100%
110%
40
35
30
25
20
4000
3000
2000
1000
2000
1500
1000
500

INSTALLATION INSTRUCTIONS CONT'D

GENERAL INSTALLATION INSTRUCTIONS

In mounting the L-2020 spreader on a truck, the following major questions must be considered:

1. Is the CA (Cab to Axle) dimension of the truck correct for the length of the spreader?

   To answer this question, the following chart will assist in matching spreader to truck.

Spreader Inside Body Length-Ft.	Single Rear Axle Truck CA Dimension-Inches	Tandem Rear Axle Truck CA (CT) Dimension-Inches
10-11	84	
12	102	102
13	108	102
14		120
15		120
16		138

2. Is the truck's GAWR (Gross Axle Weight Rating) and GVWR (Gross Vehicle Weight Rating) adequate to carry the fully loaded spreader?

   To answer this question refer to your New Leader dealer. He knows where to find the GAWR and GVWR for most trucks, and how to calculate the weight distribution on each axle and total loaded vehicle weight. [Reference New Leader Spred-O-Gram #23 (Revised)].

INSTALLATION INSTRUCTIONS CONT'D

Recommended sequence of installation is:

1. Mounting of pump and pump drive.
2. Installation of friction wheel.
3. Installation of cab controls.
4. Mounting of spreader.
5. Installation of hydraulic hose and electrical wiring.
6. Installation of optional attachments.
7. Filling of hydraulic tanks and lubrication.
8. Checking for leaks and proper functioning.

HYDRAULIC PUMP INSTALLATION

A mounting bracket for the hydraulic pump is shipped with the spreader. It may be necessary to modify this bracket to fit your truck since many variable factors such as PTO make and model, muffler position, transmission make and model, etc., all affect the mounting position. DO NOT WELD THE BRACKET TO THE TRUCK FRAME To do so may void the truck manufacturer's warranty.

Position the mounting bracket so that the pump drive shaft will be as straight as possible. In no case should the angle of any universal joint exceed 15°. The pump shaft and PTO shaft should be parallel. (Figure 1)

Hydraulic Pump Drive Shaft Installation (Figure 1)

The pump drive shaft included may be too long for some installations. It may be cut and redrilled as necessary. When redrilling the shaft, be sure that universal joints are properly "timed".

Install the slip joint at the end of the pump drive shaft. Failure to install the slip joint will result in bearing failure in pump or PTO, or both.

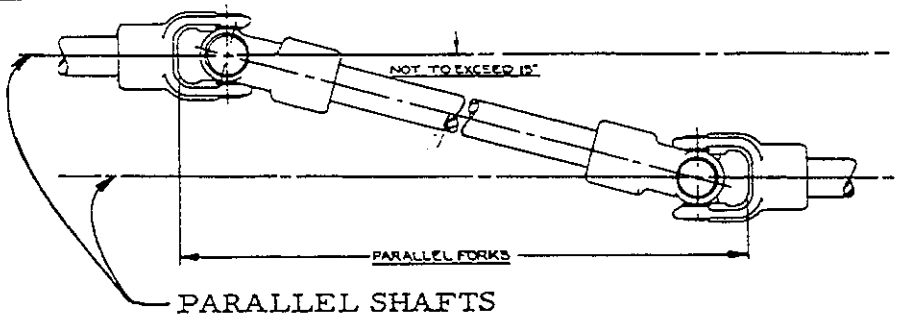


FIGURE 1 - TIMING OF UNIVERSAL JOINTS

INSTALLATION INSTRUCTIONS-CONT'D

Friction Wheel Installtion:

The friction wheel assembly is bolted to the inside web of the truck frame left hand rail. DO NOT WELD TO TRUCK FRAME and DO NOT BOLT TO TOP OR BOTTOM FRAME RAIL FLANGES. To do so may void truck manufacturer's warranty.

Position the assembly so that the friction wheel will contact the truck propellor (drive) shaft as close to rear of the transmission as possible. The assembly should be tilted down toward the rear of the truck so that the friction wheel shaft is parallel to the centerline of the propellor shaft. Use the four pipe spacers behind the mounting plate to insure that these shafts are parallel and also to allow mounting plate to clear any rivets, bolts, brake lines or other obstructions. Clamp the assembly in position and drill four mounting holes. Keep holes away from frame rail flanges as far as possible. Be careful to avoid damaging any wires, brake lines or other parts. Bolt securely to frame. There should be adequate spring force on the wheel when it is engaged with propellor shaft to avoid slippage. On units with auxiliary transmissions, determine where the friction wheel is to be mounted (See Friction Wheel Diameter determination section). If it is to be mounted behind the auxiliary transmission, locate about 2-3" behind the universal or slip joint immediately behind the auxiliary transmission. Mount bracket in a convenient location between the main transmission and the auxiliary transmission if that is the desired mounting arrangement.

Control Installation:

In selecting the location of the control panel (electric/hydraulic actuated), the following must be considered:

1. The ON-OFF switch for the electric/hydraulic actuated friction wheel must be conveniently located for the operator to use.
2. The panel must be located so that it will not get in the way of entrance to or exit from the truck cab.
3. Be sure that panel will not interfere with operation of other controls of either truck or other equipment being used.
4. Check that panel will not catch or snag parts of body or clothing or operator or passengers.

INSTALLATIONS INSTRUCTIONS CONT'D

5. Check to insure wiring and hose to control panel can be run without interference.

CAUTION: All holes in the truck cab walls, floor and firewall for control wires, hoses and cables are to be grommetted, plugged and sealed to prevent entrance of engine fumes, dust, dirt, water and noise.

MOUNTING OF SPREADER BODY

Truck Frame Length:

In many cases with a new truck, the truck frame must be shortened. The length from the rear of the cab to the rear end of the frame should be approximately as shown on the Dimensions and Capacity Chart on page 2 under "C".

Wood Filler Strips:

Hardwood filler strips (not supplied with spreader), 1" by 3", must be installed the length of the frame behind the truck cab. Cut the filler strip to length and place on top of the truck frame rails. With a heavy hammer strike directly above each rivet head to mark the position of the rivet, if frame has rivets in top flange. Remove the filler strips and counterbore for rivet head clearance. Replace the filler strips and hold them in place by bending anchor clips as shown in Figure 6. If the truck frame has fishplates on the top flange, it will be necessary to provide a level top surface by adding steel shim bars or strips of the same thickness as the fishplates and as wide as the frame channel top flange. These shim bars or strips must be drilled out to clear any rivet or bolt heads. DO NOT WELD these bars or strips to the truck frame. To do so may void truck manufacturer's warranty. Place the wood filler strips on top of them and secure both steel shims and wood strips by means of bending the anchor clips around them and the frame top flanges as shown in Figure 5. Each steel shim bar or strip and each separate wood filler strip should have three anchor clips. Locate anchor clips between spreader body cross sills. Secure each anchor clip by driving 1/4" sheet metal screw through clip into wood filler strip as shown in Figure 6.

Positioning Body:

Place the spreader body on the truck frame. Position body centrally with respect to the truck frame rails and approximately 4" to the rear of the cab. Check the position of the spreader at the rear to insure that the rear mounting angle can be properly positioned on truck frame and centered on rear cross sill.

Installing Rear Mounting Angles:

Position the rear mounting angles with the slotted faces against the side of the truck frame and centered on the rear cross sill. Mark the location of the slots on the truck frame. Drill two 9/16" diameter holes through the truck frame at the bottom end of the slots. (See Figure 2).

INSTALLATION INSTRUCTIONS CONT'D

Installing Front Mounting Angles:

Position the two front mounting angles with the slotted faces against the side of the truck frame centered on the second cross sill from front of spreader. Mark the location of the slots on the truck frame. Drill two 9/16" diameter holes through the truck frame 1-1/4" from the bottom of the slots. (See Figure 3)

Installing Center Angle (12 foot through 16 foot bodies only:)

Position the center mounting angles at a convenient location near the center of the body with the slotted faces against the truck frame, and mark the location of the slots on the truck frame. Drill two 9/16" diameter holes through the truck frame approximately 3/4" from the bottom of the slot. (See Figure 4).

NOTE: The position of the center mounting angles will vary from truck to truck due to obstructions such as spring shackles, etc.

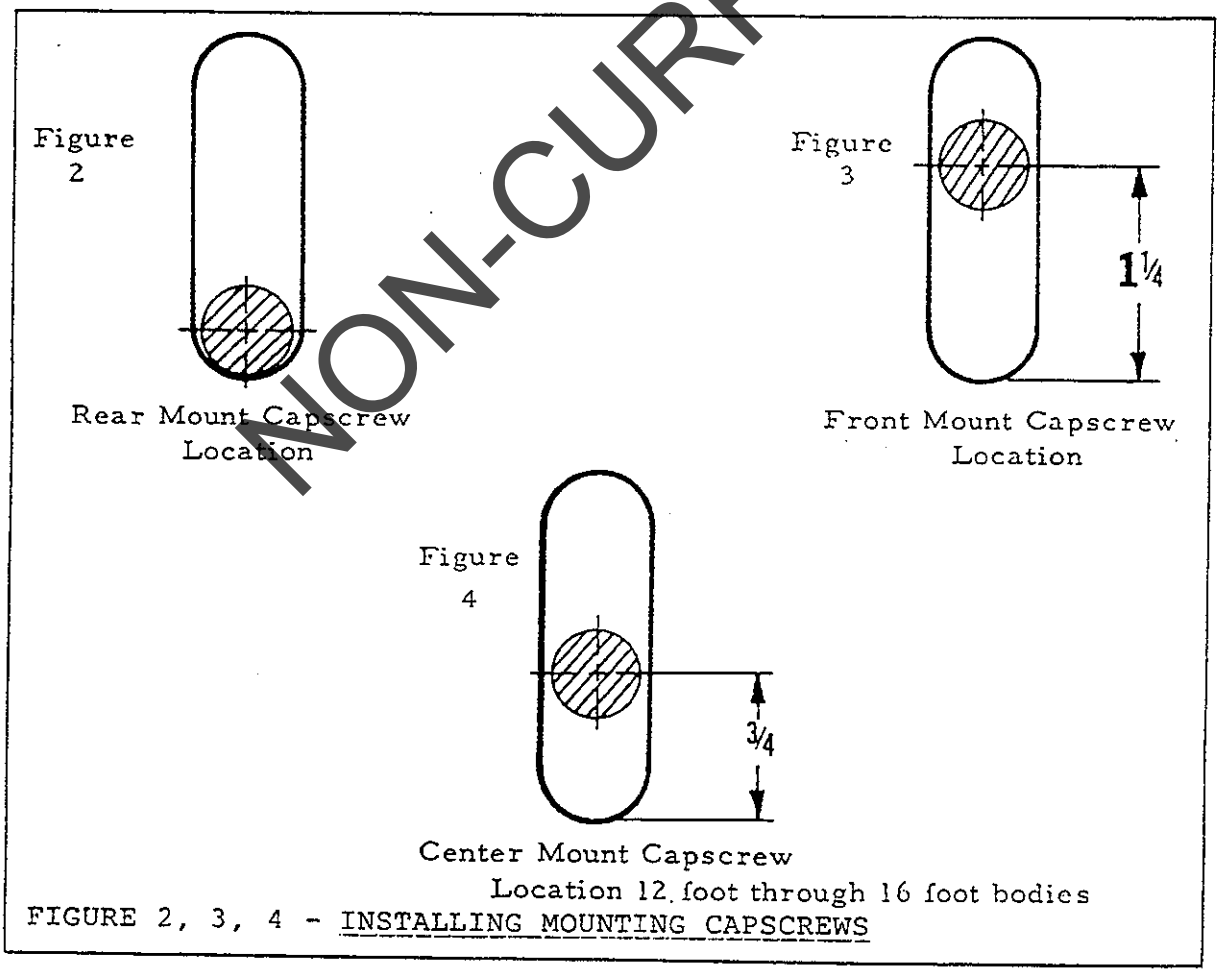


FIGURE 2, 3, 4 - INSTALLING MOUNTING CAPSCREWS

WOOD FILLER STRIPS

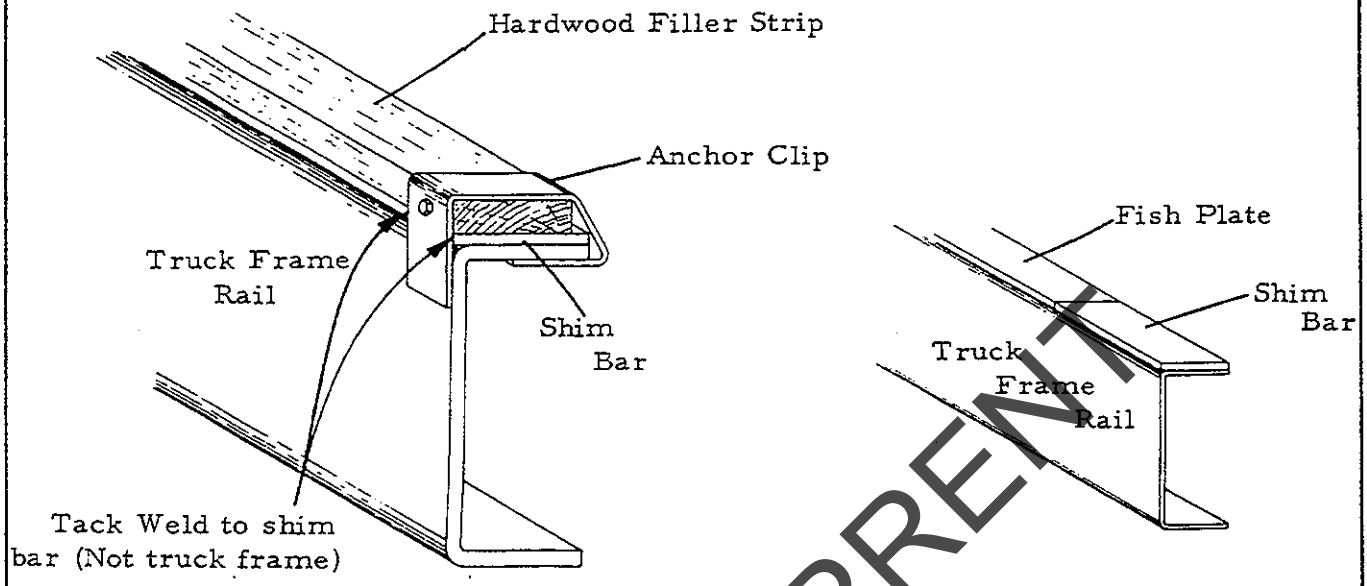


Figure 5

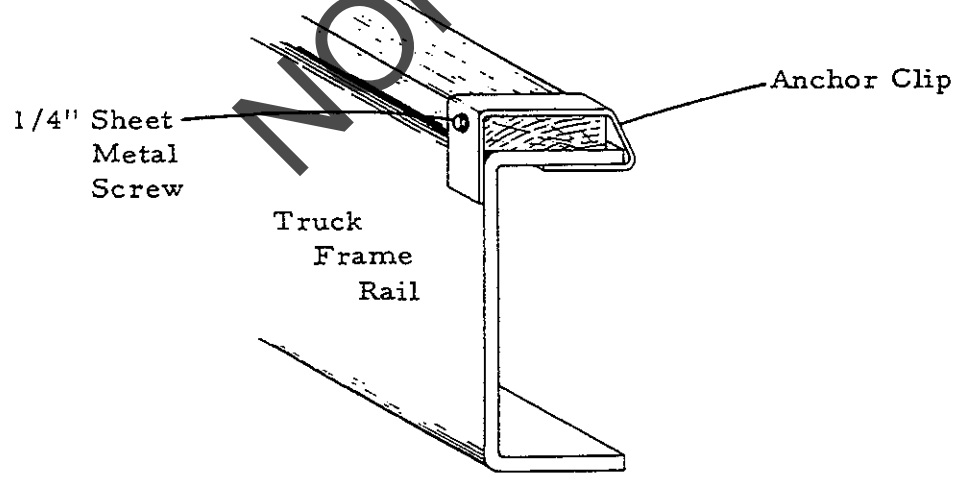


Figure 6

FIGURE 5, 6 - INSTALLING WOOD FILLER STRIPS

INSTALLATION INSTRUCTIONS CONT'D

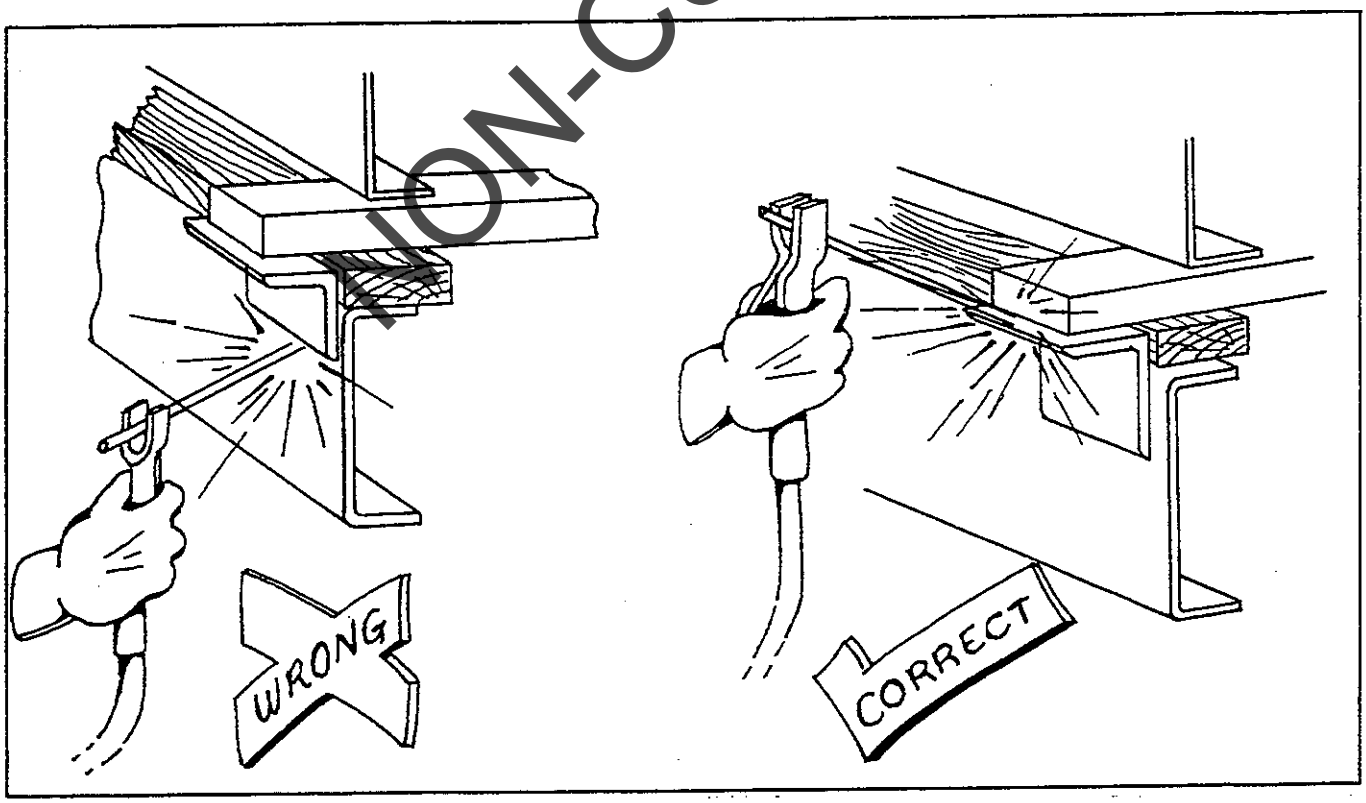
Securing Spreader Body to Frame:

Install the mounting angles and tighten the mounting bolts. Position the angles as described in the steps listed above. Weld the mounting angles to the spreader cross sills by welding them on the front, outer and rear sides. (See Figure 7).

DO NOT WELD ON VEHICLE FRAME as such welding can lead to fatigue cracking and must be avoided. When drilling holes in frame members, drill only through vertical web portions - DO NOT PUT HOLES INTO TOP OR BOTTOM FLANGES. To do so may void truck manufacturer's warranty.

Be sure welds between mounting bars and sill or between mounting angles and spreader cross sills are sound full fillet welds. Center mounting angles so good fillet welds can be made on three sides - an edge bead weld is not satisfactory weld for this service. Use dry E6013 or E7018 rod for normal steels. On stainless steel bodies, use SAE grade 5 bolts - welding is recommended if type 308 welding rod is available. (See Figure 7).

Check for vehicle visibility, especially toward the rear. Reposition or add mirrors so adequate rearward visibility is maintained. Check installation completely to be sure all fasteners are secure and that nothing has been left undone.



INSTALLATION INSTRUCTIONS CONT'D

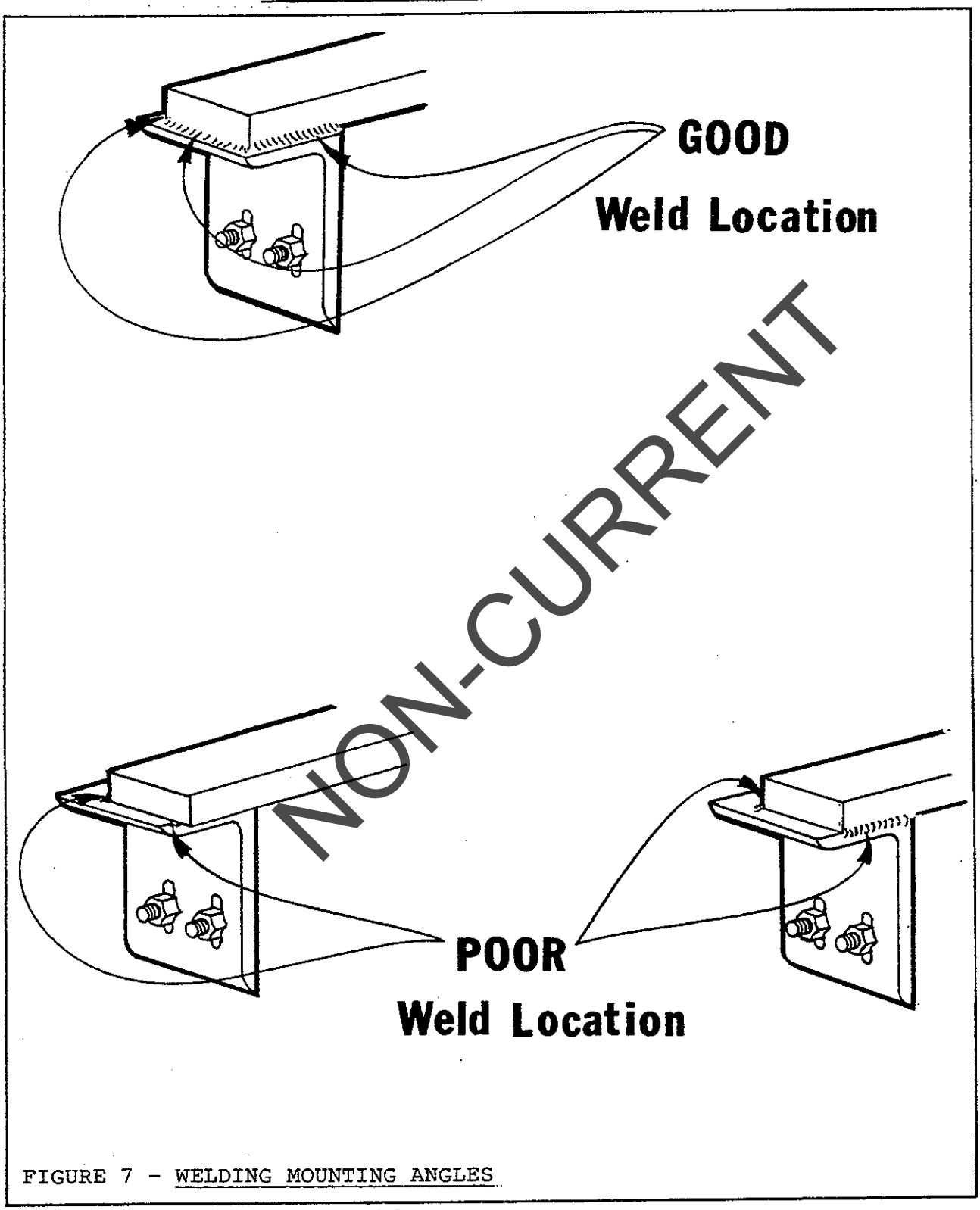


FIGURE 7 - WELDING MOUNTING ANGLES

INSTALLATION INSTRUCTIONS CONT'D

SPINNER ASSEMBLY INSTALLATION

Using any suitable hoist or jack with a 500 lb. minimum capacity, lift the spinner assembly into position under the sills and block in place. See Figure 10 to determine which set of mounting holes to use. Install hardware and tighten nuts finger tight only with the assembly in place against the bottom of the sills. Measure diagonally from the corner of the conveyor shield to the spinner hub (See Figure 9). Shift the assembly sideways as necessary to equalize the two measurements. Tighten all hardware securely and recheck the diagonal measurements.

FLOW DIVIDER INSTALLATION

Standard Flow Divider:

Slide flow divider onto tee-bar until locking pin will engage seventh hole from rear end. Engage locking pin and anchor with hair pin. This is a starting position. Further adjustment may be necessary.

Red-E-Vider:

Slide lower section onto tee-bar and secure by bolting through the rear two holes in the tee-bar. Assembly should be level with the conveyor and centered with respect to the conveyor shields. (See Figure 9).

Bolt upper section in place using the last two conveyor shield bolts on each side. Center member must be vertical and centered on the conveyor. (See Figure 8).

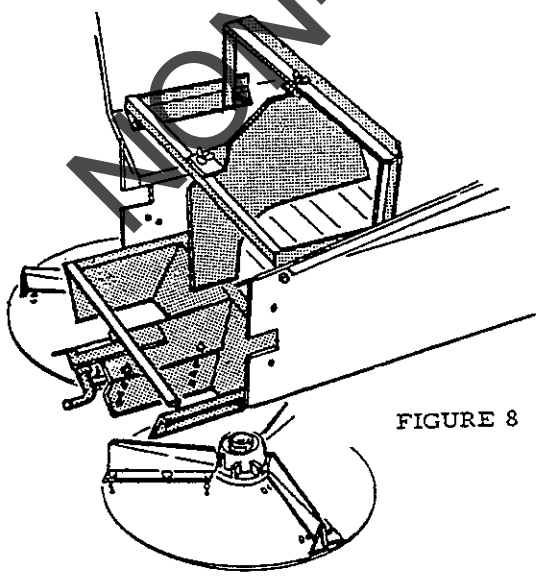


FIGURE 8

Make certain centerline-of-spinner and centerline-of-flow divider is "centered" **properly** by measuring from Points A to Points B and Points A to Points C.

FIGURE 9

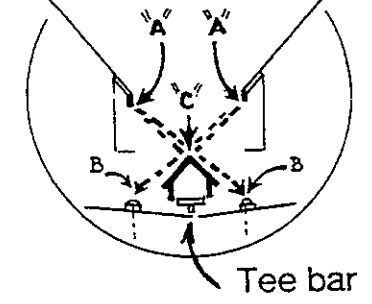
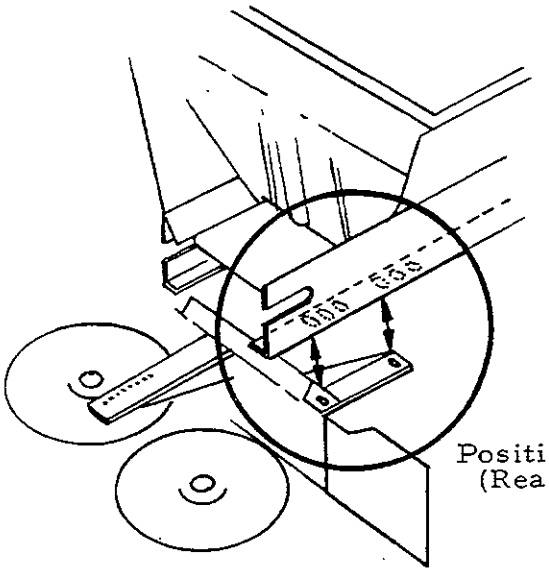
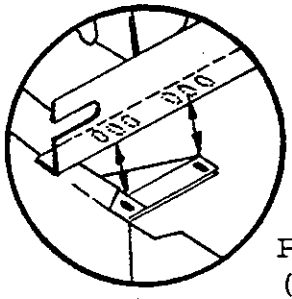


FIGURE 8, 9 - INSTALLING RED-E-VIDER

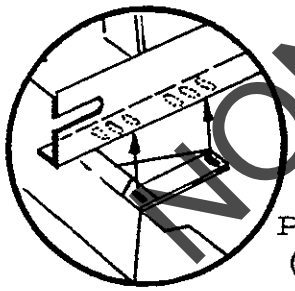
INSTALLATION INSTRUCTIONS CONT'D



Position A
(Rear)

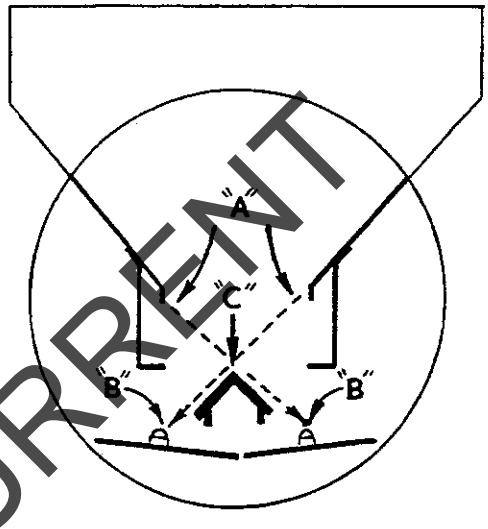


Position B
(Middle)



Position C
(Forward)

Make certain centerline-of-spinner and centerlineof flow divider is "Centered" properly by measuring from Point A to Points B and Points A to Point C.



Position A. (Rear)	To be used when mounting a 24" Twin Spinner Assembly with a Standard Flow Divider and #5 Belt conveyor or #6 Chain belt conveyor.
Position B. (Middle)	To be used when mounting a 24" Twin Spinner Assembly with a Red-E-Vider and a #5 Belt conveyor or with Standard Flow Divider and a #2, #3 or #4 conveyor.
Position C. (Forward)	To be used when mounting a 24" Twin Spinner Assembly with a Red-E-Vider and #2, #3 or #4 conveyor or when mounting an 18" Twin Spinner Assembly with either Flow Divider.

FIGURE 10 - INSTALLING SPINNER ASSEMBLY

INSTALLATION INSTRUCTIONS CONT'D

HYDRAULIC HOSE INSTALLATION

Determine the pressure port of the pump. Install the pressure hose into this port as shown in Figure 11. Connect the suction hose to the opposite port and to the tank outlet on the reservoir. If necessary, use plastic tie straps to support hoses so that they will not catch on field obstructions, contact the muffler or moving parts.

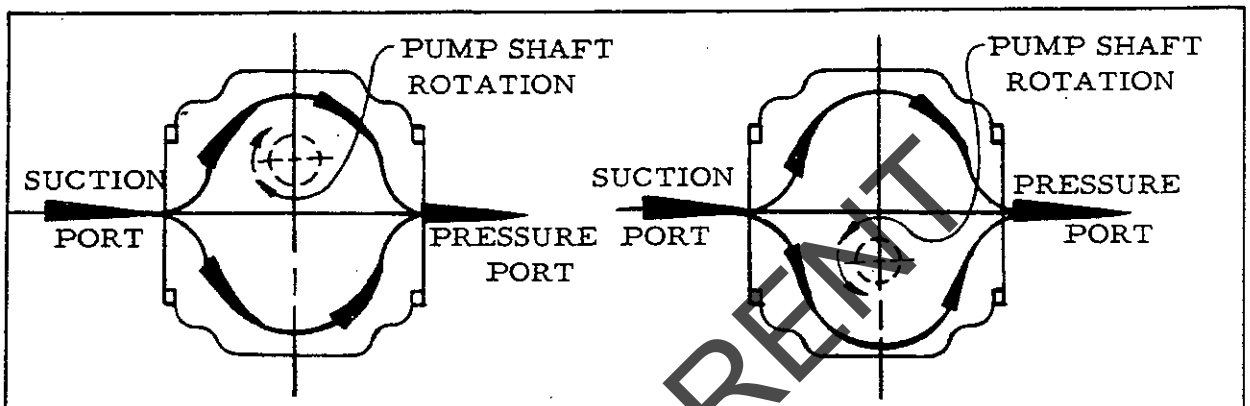


FIGURE 11 - HYDRAULIC PUMP, REAR VIEW

Use thread sealer on all fittings, except "O" ring and JIC adapters, "O" ring valves and motors, etc. When using thread sealer, do not put it on the first three threads of the fitting. Too much on the fitting or on the first three threads will force it into the oil stream where it could damage the system.

CAUTION: If a threaded connection is tightened too tightly, the fitting or housing into which the fitting is placed could be distorted and an unstoppable leak could occur.

Assemble the system as shown in the schematic. Place the hose clamps as needed to keep hoses away from hot or moving parts. Do not let hoses hang so low as to be snagged. Do not stretch hoses tight.

The Hydraulic Hoses supplied are as follows:

Pressure line - Two wire braid hose, one end fitting crimped on, other end fitting to be field installed after cutting hose to length. See assembly instructions on the following page.

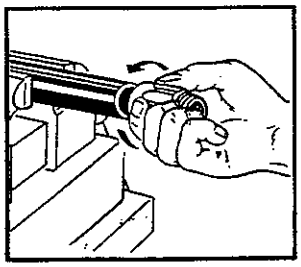
Suction line - Single spiral wire reinforced to be cut to length. Fittings to be assembled with double hose clamps.

All return lines - Double cotton braid to be cut to length as necessary. Fittings to be assembled with single hose clamps.

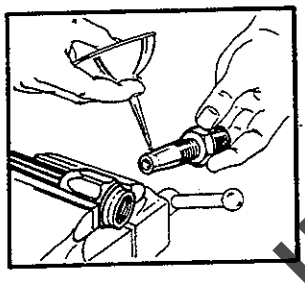
INSTALLATION INSTRUCTIONS CONT'D

ASSEMBLY INSTRUCTIONS - AEROQUIP REUSABLE NON-SKIVE TYPE ENDS:

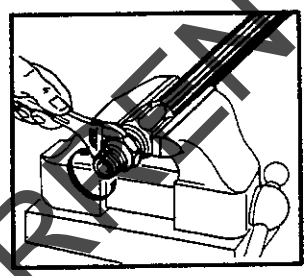
Thru-the-cover style reusable fittings
2663, 2793



Step 1
Liberally oil hose cover with Aeroquip lube oil, place hose in vise just tight enough to prevent it from turning. Screw socket onto hose counter-clockwise until it bottoms. Back off ½ turn.



Step 2
Oil nipple threads and inside of hose liberally.



Step 3
Screw nipple clockwise into socket and hose. Leave 1/32" to 3/16" clearance between nipple hex and socket. Clean and inspect all assemblies

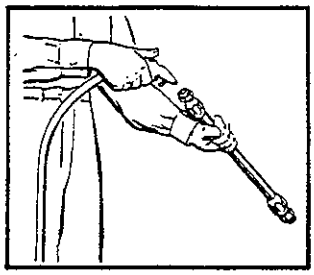
Disassemble in reverse order.

Used with the permission of the Aeroquip Corporation.

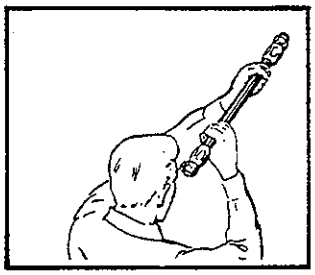
CAUTION: Do not use one manufacturer's hose with another manufacturer's fittings. Such use will void any warranty and may cause premature burst or leak of hydraulic fluids. Such bursting or leaking may cause severe injury and/or fire.

INSTALLATION INSTRUCTIONS CONT'D

Cleaning, inspection, testing and storage



Clean



Inspect

Maintenance....

Hose assemblies in operation should be inspected frequently for leakage, kinking, abrasion, corrosion or any other signs of wear or damage. Worn or damaged hose assemblies should be replaced immediately.

Clean....

Clean assembly by blowing out with clean compressed air. Assemblies may be rinsed out with oleum spirits if the tube stock is compatible with oil, otherwise hot water at 180°F. max. may be used. Consult Aeroquip for special cleaning equipment.

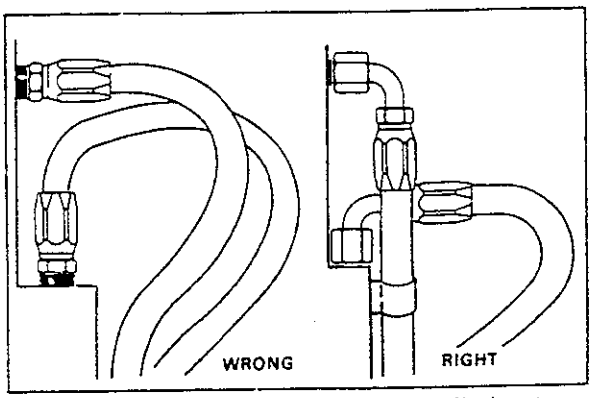
Inspect....

Examine hose assembly internally for cut or bulged tube, obstructions, and cleanliness. For segment style fittings, be sure that the hose butts up against the nipple shoulder, band and retaining ring are properly set and tight, and segments are properly spaced. Check for proper gap ($^1/_{32}$" to $^1/_{16}$") between nut and socket or hex and socket. Nuts should swivel freely. Check the layline of the hose to be sure that the assembly is not twisted. Cap the ends of the hose with plastic covers to keep clean.

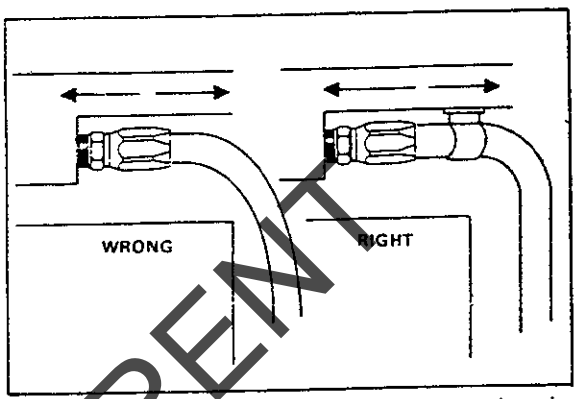
Used with permission of the Aeroquip Company.

INSTALLATION INSTRUCTIONS CONT'D

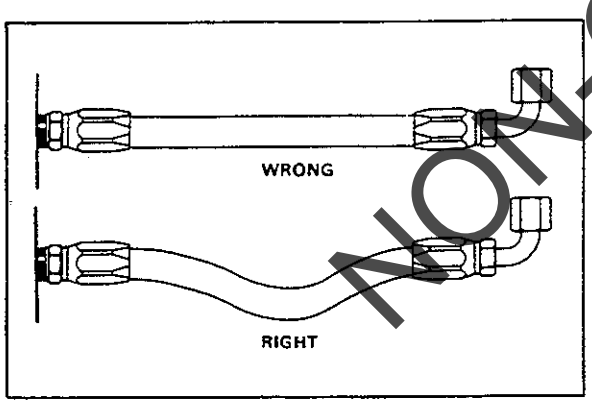
Installation Guide



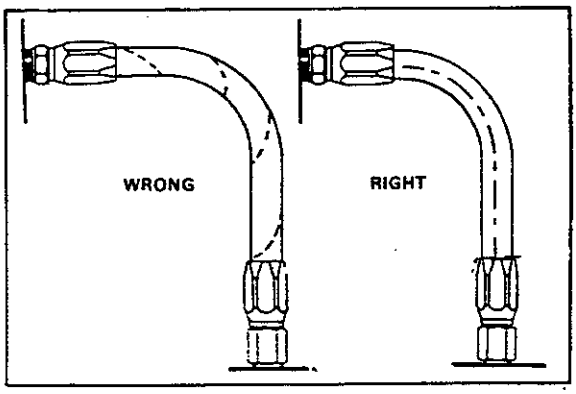
1. Use elbows and adapters in the installation to relieve strain on the assembly, and to provide easier and neater installations that are accessible for inspection and maintenance. Remember that metal end fittings cannot be considered as part of the flexible portion of the assembly.



2. Install hose runs to avoid rubbing or abrasion. Clamps are often needed to support long runs of hose or to keep hose away from moving parts. It is important that the clamps be of the correct size. A clamp that is too large will allow the hose to move in the clamp causing abrasion at this point.



3. In straight hose installations allow enough slack in the hose line to provide for changes in length that will occur when pressure is applied. This change in length can be from +2% to −4%.

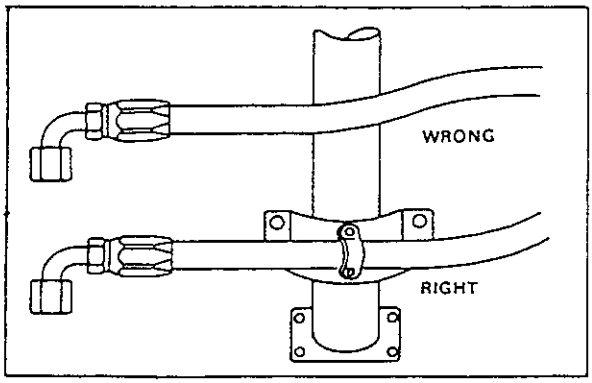


4. Do not twist hose during installation. This can be determined by the printed layline on the hose. Pressure applied to a twisted hose can cause hose failure or loosening of the connections.

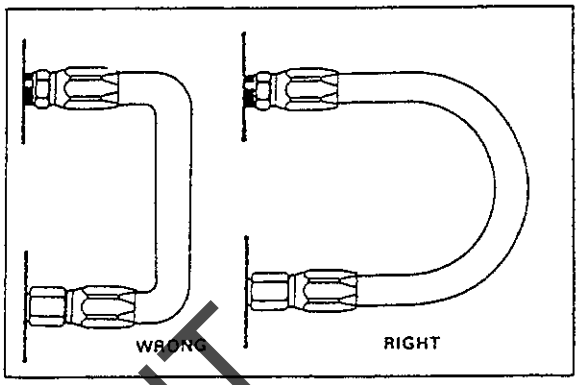
Used with permission of The Weatherhead Company

INSTALLATION INSTRUCTIONS CONT'D.

INSTALLATION GUIDE CONT'D.



5. Keep hose away from hot parts. High ambient temperature will shorten hose life. If you can not route it away from the heat source, insulate it.



6. Keep the bend radii of the hose as large as possible to avoid collapsing of the hose and restriction of flow. Follow catalog specs on minimum bend radii.

ELECTRICAL CONNECTIONS

Connect all electrical control circuits. The supply conductor should be connected to the accessory terminal of the truck ignition switch through the 15 amp. circuit breaker provided in the control panel. All wiring should be approved automotive insulated wire, should be supported adequately with insulating ties or straps, should be located where it will not interfere with any control or access, does not contact any moving part or sharp edge and is kept away from any hydraulic line or any heated part. Lights and Reflectors are provided to meet FMVSS 108 requirements but not necessarily any other applicable local, regional or national codes.

FILLING HYDRAULIC SYSTEMS

IMPORTANT: DO NOT ATTEMPT TO RUN PUMP WITHOUT FIRST FILLING HYDRAULIC OIL RESERVOIR AND OPENING SUCTION LINE GATE VALVE, or pump may be ruined. Fill reservoir with hydraulic oil as specified in the Lubrication Specifications section of this manual. Be sure oil is clean, free from dirt, water and other contaminants.

Lubricate all points requiring lubrication per Lubrication Chart in this manual.

CHECKING INSTALLATION: See "Initial Start-Up" Procedure.

INSTALLATION INSTRUCTIONS CONT'D

MODEL P-250 SPREADING HOOD INSTALLATION (Optional)

CAUTION: In mounting the spreader hood, as some of the parts are fairly heavy, be sure to have suitable hoisting and blocking equipment with a 500 lb. minimum capacity available. A "Come-Along" would be suitable for the hoisting gear provided a suitable overhead attachment is available. Use care when working around heavy components. Do not work under suspended loads unless they are securely blocked against falling or tipping. Do not install belting until all assembly is complete. Refer to end of parts listing for assembly diagram.

1. Remove spinner guard and store it for future use.
2. Bolt R. H. and L. H. Hood Mounting Angles (Items 17 &18) to the R. H. and L. H. sills using the two 7/16" diameter holes at the rear of each sill. Use 3/8" x 1-1/4" capscrews. The leg of each mounting angle containing the slotted holes should face to the rear with the slotted holes toward the upper end and the legs turned outward.
3. Raise Center Section (Item 5) and block in place. Bolt to R. H. and L. H. Hood Mounting Angles using 1/2" x 1-1/4" capscrews.
4. Bolt Door Extension Weldment (Item 7) to upper edge of Center Section so that it extends over conveyor. Use 1/4" x 1" capscrews.
5. Loosely bolt Extension Panels (Item 14) to Door Extension sides with 1/4" x 1" capscrews. Adjust Extension Panels to fit against spreader rear endgate. Tighten screws.
6. Drill two 5/16" diameter holes through endgate using Bolting Ears (Item 13) for alignment. Attach Bolting Ears to Extension Panels and endgate with 1/4" x 1" capscrews.
7. Bolt on Rear Flap (Item 9) and adjust so that there is no opening between Rear Flap and Center Section when flap is hanging straight down. Use 3/8" x 1" carriage bolts.
8. Bolt on Door (Item 6). Use 1/4" x 1" capscrews.
9. Bolt on R. H. and L. H. Drops (Items 10 and 11) and Hood Drop Brace Bars (Item 15) using 3/8" x 1" capscrews.
10. Bolt on Gear Case Filler Plate (Item 10), front Filler Plate (Item 29), and Bearing Filler Plate (Item 20) using 1/4" x 1" capscrews. (These items may need to be trimmed to fit).
11. Bolt Hood Storage Support (Item 35) in place using 3/8" x 1" carriage bolts at the center supports and 3/8" x 1" capscrews at the side braces.
12. Bolt the Front and Rear Guide Lips (Items 25 and 26) with Guide Tabs (Item 27) to the front and rear vertical edges of each Fiberglass Hood (Item 24). Bolt Wing Tip Brace Bars (Item 28) to underside of each Fiberglass Hood at large end. Bolt Wing Skids (Item 16) to inside of each Fiberglass Hood near outer tip. Use 1/4" x 1" capscrews.

NOTE: Use 1" diameter flat washers (Item 34) against Fiberglass Hood at all places where bolt head or nut or lockwasher would otherwise bear on fiberglass material to avoid cracking or tearing out of material.

INSTALLATION INSTRUCTIONS CONT'D

13. Raise Fiberglass Hoods in place and bolt them to the hinge plates at each side of Center Section. Use 1/4" x 1" capscrews and 1" diameter flat washers as required.
14. Fold Fiberglass Hoods against Hood Storage Supports. Locate Wing Rest Weldments (Item 8), drill 9/32" diameter holes in Fiberglass Hoods and bolt in place using 1/4" x 1 capscrews and 1" diameter flat washers as required.
15. Install belting (Item 2) on Rear Flap, (Item 23) front and rear edges of Fiberglass Hoods, and (Item 1) on R.H. and L.H. Drops using 1/8" x 1" Belt Retainer Strips (Items 30, 31, 32 and 33) against belt and 1/4" x 1" capscrews. One-inch diameter flat washers should be used on fiberglass as required.

NOTE: In each Fiberglass Hood in the third hole from the center section on the rear face use special Tie Down Bolt Weldments (Item 12) to anchor one end of the Rubber Tension Hook (Item 4). The other Tie Down Weldments are used on Rear Flap in the second hole from each end. Attach Rubber Tension Hooks. Front Center Belt (Item 3) is bolted to front of spinner frame with 1/4" x 1" capscrews but without 1/8" x 1" retainer strip.

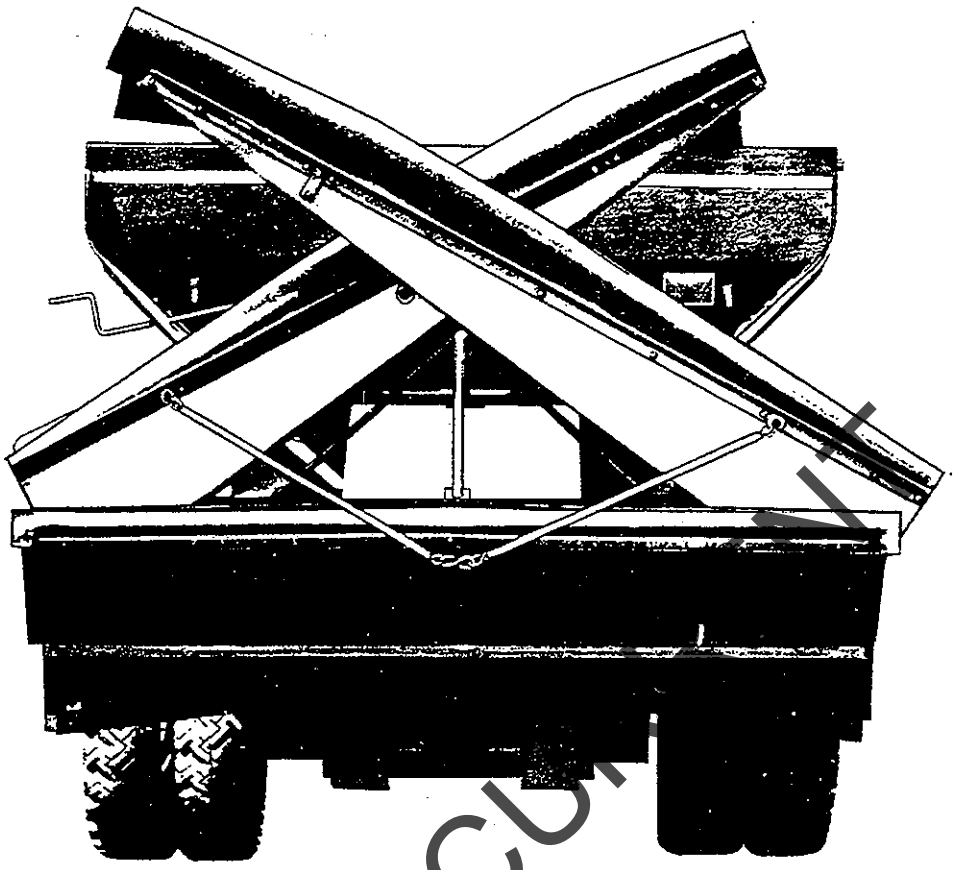
When transporting with P-250 Hood installed, Fibergalss Hoods MUST be folded by unhooking the Rubber Tension Hooks from the Rear Flap and swinging hoods against Hood Storage Support. Rear Flap is to be folded up and Rubber Tension Hooks engages in figure "8" hook on inner face of Rear Flap.

When unfolding hoods for use, be sure that Front and Rear Guide Lips straddle the Rear Flap and Drops, and that the belts lap properly.

CAUTION: If P-250 Spreading Hood is removed, it is essential that Spinner Guard is re-installed.

Figures shown on following page.

P - 250 HOOD IN TRANSPORT POSITION



P - 250 HOOD IN SPREADING POSITION

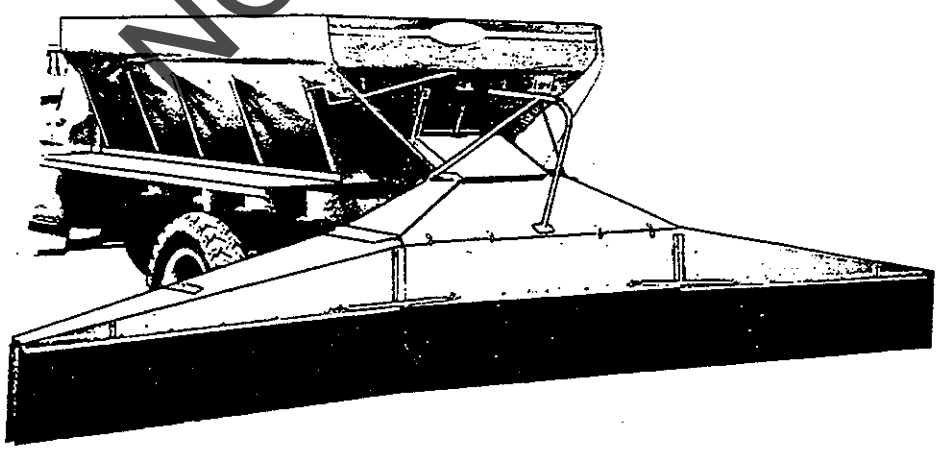


FIGURE 12 - P-250 HOOD ASSEMBLY

INITIAL START - UP

Check over entire unit to be sure all fasteners are in place and properly tightened per "Fastener Torque Chart" in this manual. Disengage transmission PTO driving pump. Check friction wheel to be sure it is in raised (disengaged) position.

NOTE: Stand clear of moving machinery. Do not load spreader with material.

1. Check to see that no loose parts are in the body or on conveyor or spinner. Be sure to remove any loose pieces.
2. Open feedgate until it is completely clear of conveyor.
3. Fill the hydraulic reservoir with oil. Refer to the "Lubricant Specification" section of this manual for proper oil. Open the gate valve under the reservoir fully (rotate counterclockwise to open).
4. Place Synco-Matic Mark II Function Knob in "Automatic" position and spinner control valve in "O" position.
5. Start truck engine and set throttle so engine runs at about 1000 RPM. Engage PTO driving pump. Allow pump to run and circulate oil for several minutes. In cold weather increase warm-up time.
6. Move spinner control valve to position "3". Spinner should run at slow speed. Allow to run until it is operating smoothly and all air has been purged. Move spinner control valve to "O" position.
7. Pull out inner Function Knob (white nylon) located adjacent to conveyor gear drive box on "Synco-Matic" Mark II control valve assembly to disengage automatic ground control feedback. Slowly rotate this knob until all air is purged and conveyor is operating smoothly.
8. Move spinner control valve to position "5" and allow both spinner and conveyor to run. Shut down system. When all parts have come to rest check all hydraulic system connections for leaks.

CAUTION: Do not check leaks with hands while system is operating as high pressure leaks are very dangerous! Do not check for leaks adjacent to moving parts while system is operating as there may be danger of entanglement.

9. With pump PTO disengaged push the inner Function Knob of the Synco-Matic in while rotating it slowly so that it fully engages in the "Automatic"

INITIAL START-UP CONT'D

Cont'd.
position. When properly engaged it should seat fully and rotation of knob will stop. Do Not Force! Place the Two Speed Shift Knob (white nylon) located at the outer end of the Synco-Matic Mark II housing, in the central or neutral position (fully in is "Low" position--fully out is "High" position). Engage PTO and run engine at low speed. Slowly rotate Two Speed Shift Knob counterclockwise. Conveyor should run while knob is being turned, stop when knob is stopped. If knob is rotated in a clockwise direction, conveyor will move in an intermittent manner - moving quickly for a short distance, then stopping until knob has been turned about 1-1/4 turns, then running rapidly for a short period, etc. This action is normal and merely indicates that Two Speed Shift Knob is being turned in the wrong direction. When turning knob in this direction (clockwise), the buzzer and warning light on the control panel will also be actuated intermittently (each time knob is rotated about six turns).

10. Check hydraulic oil reservoir and refill to "full" mark on dipstick. Unit is now ready for road testing.

ROAD TESTING

Prior to first use of machine, prior to each spreading season's use, and following major overhaul or repair work, unit should be road tested to verify that all components and systems are functioning properly. Road testing may be done over any suitable course which will allow vehicle to be driven at speeds to be used while spreading. The following procedure is given as a guide:

1. Be sure machine has been properly serviced, that oil reservoir is full and gate valve under reservoir is fully open. Do not put any load in spreader.
2. Put Function Knob on inner side of Synco-Matic Mark II housing into "Automatic" by pushing in and rotating until it seats.
3. Put Two Speed Shift Knob on outer end of Synco-Matic Mark II housing in "Low" position by pushing in and rotating until it seats.
4. Set spinner control valve at position number 5.
5. Start truck engine, engage PTO and allow to run at fast idle for 5-10 minutes to bring hydraulic oil up to operating temperature. Spinners should revolve at moderate speed; conveyor should not move.
6. Engage friction wheel to truck propellor shaft by:
   a. turning the friction wheel valve handle (hydraulic-actuated). Check indicator light on control panel to insure friction wheel is in the down position.
   b. flipping switch on control panel upward (electric-actuated).
7. Start forward travel. Conveyor should start immediately and should continue to run at speeds which should vary directly with vehicle's road speed; i. e. conveyor should speed up as truck speed increases and slow down as truck speed reduces. Spinner speed should remain constant when engine speed is above minimum operating range.

CAUTION: To observe conveyor and spinner speed while vehicle is in motion, proper safety precautions should be observed. These may include use of suitable mirrors clamped to permit observation by a safely seated observer, following the spreader in another vehicle at a safe distance, or other suitable means. Do not stand on fenders, in body or on any part of spreader as there is danger of falling off vehicle or into moving machinery. Use great care in performing this test.

8. Pull out on Two Speed Shift Knob to "High" position and repeat above tests. All functions should be the same except that conveyor should run three times as fast. Observe Caution in (7) above. NOTE: Avoid operating truck in "Reverse" with cab control in "On" position.

LUBRICATION AND MAINTENANCE

PREVENTIVE MAINTENANCE PAYS!

The handling and spreading of commercial fertilizers is a most severe operation with respect to metal corrosion. Unless a frequent, periodic preventive maintenance program is established, rapid damage to spreading equipment can occur. Proper cleaning, lubrication and maintenance will give you longer life, more satisfactory service and more economical use of your equipment.

HYDRAULIC SYSTEM

The use of proper oil in the hydraulic system is one of the most important factors for satisfactory operation. Utmost cleanliness in handling the oil cannot be stressed enough. Keep the hydraulic oil in original closed containers, clean top of container before opening and pouring, and handle in extremely clean measures and funnels.

Refer to the Lubricant and Hydraulic Oil Specifications section of the manual for selection of the proper hydraulic fluid for use in the hydraulic system.

SERVICE SCHEDULE

1. Check the hydraulic oil daily by means of dipstick. Add oil if required. Periodically inspect the hoses and fittings for leaks.

2. CHANGE THE HYDRAULIC OIL FILTER AFTER THE FIRST WEEK (OR NOT MORE THAN 50 HOURS) OF OPERATION ON A NEW UNIT.

3. After first filter change, replace filter when indicator reaches Red Zone.
4. The reservoir should be drained through drain plug (Not through suction outlet), flushed, and refilled and filter element changed annually, or the oil and filter should be changed if oil shows any signs of breaking down under continued high-pressure operation. Discoloration of oil is one sign of breakdown.

CONVEYOR GEAR CASE

The oil in a new unit should be drained at the end of the first two weeks (or not more than 100 hours) of operation and the case should be thoroughly flushed with light oil. Refill gear case with one (1) pint (.47 liters) of recommended lubricant. After the initial change, the oil should be changed every 2000 hours of operation or annually, whichever occurs first. Check the level of the gear case monthly.

LUBRICATION AND MAINTENANCE CONT'D

CONVEYOR CHAIN

Hose down the machine, and remove any material build-up on the sprockets or beneath the chain. If material is allowed to build up, the chain may ride up and damage the body. NOTE: If material builds up under the chain, the chain will ride on the material instead of the bottom panel. The more material allowed to build, the closer the chain will come to the chain shields. If the chain should catch a chain shield, it could permanently distort the chain, the chain shields, or the body. In the same manner, if material is allowed to build up on the sprockets, the chain will have a larger diameter to follow. The more material allowed to build up, the closer the chain will run to the chain shields, until damage has occurred. Do not remove material while conveyor or spinner is running.

The conveyor chain should be lubricated at least once every week. Use a mixture of 75% fuel oil and 25% SAE 10 oil in a pressurized hand spray can.

CAUTION!! When conveyor is running stay out of body--stay clear of all moving parts. Entanglement of clothes, or any part of your body or anything you have in your hands can cause serious injury. Do not use a bar, rod or hammer on conveyor while it is moving--if it gets caught it could be very dangerous. With the spinner shut down and the conveyor running slowly spray the mixture of oil between the links of the chain by spraying through openings at rear ends of sill, or from front outside body when access clearance is adequate. Do this at least once a week and after each time the machine is washed down. Allow to become dry before lubricating.

If a chain oiler is used, the oiler reservoir should be filled daily with a mixture of 75% fuel oil and 25% SAE 10 oil. Before each filling of spreader with material to be spread, open petcock and run conveyor until full length of chain has been oiled, then shut petcock.

Proper chain tension is also a factor in chain and sprocket life. The proper chain tension is illustrated on the following page. Be sure the chain is tensioned equally on both sides. This adjustment is made on each side of the unit at the idler bearings.

Conveyor chains that are too tight will tend to stretch. This will cause excess sprocket wear and eventually cause breakage. Excess slack presents the possibility of the chain catching on sub-frame parts. Bent or distorted chain bars will cause damage to the body also. Straighten or replace bent or distorted chain bars immediately.

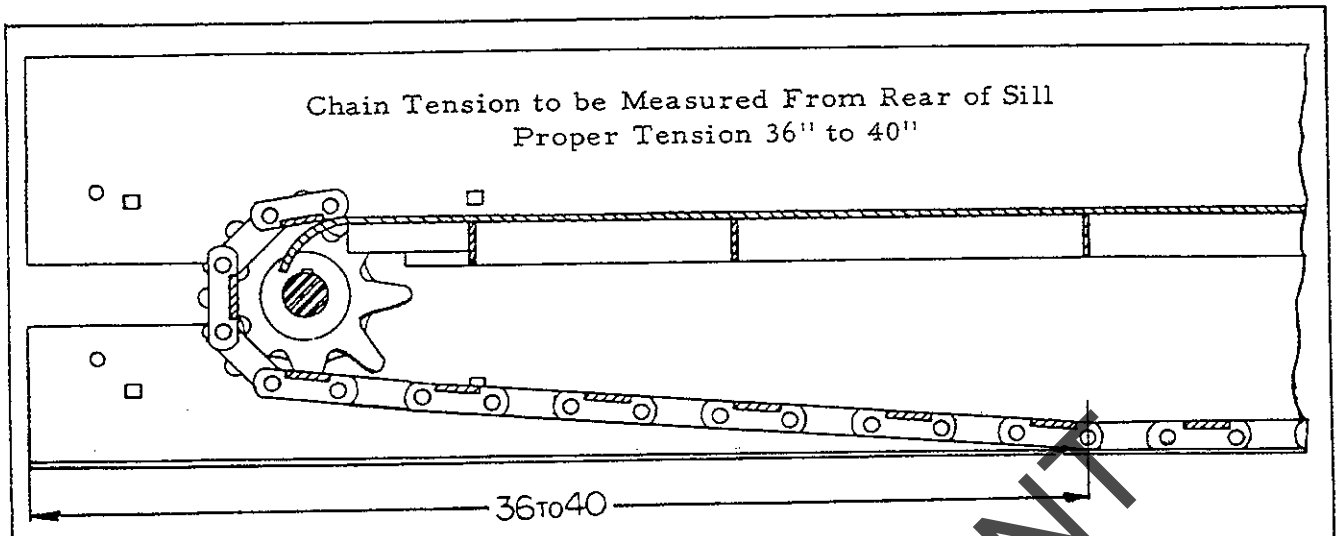


FIGURE 13 - ADJUSTING CHAIN TENSION

LUBRICATION OF BEARINGS

Grease in a bearing acts to prevent excessive wear of parts, protects ball races and balls from corrosion and aids in preventing excessive heat within the bearing. It is very important the grease maintains its proper consistency during operation. It must not be fluid, and it must not channel.

Bearings should be lubricated by pumping grease in slowly until a slight bead forms around the seals. This bead indicates adequate lubrication and also provides additional protection against the entrance of dirt.

Be sure that all fittings are thoroughly cleaned before grease is injected.

Points to be lubricated by means of a grease gun have standard grease fittings.

CLEAN UP

For maintaining a minimum maintenance operation, this equipment should be thoroughly washed every two or three days during the operating season. Hose the unit down under pressure to free all sticky and frozen material.

It is important that the machine be thoroughly cleaned at the end of each operating season. All lubrication and maintenance instructions listed in this section should be closely followed. For longer body life, repaint worn spots to prevent formation of rust.

LUBRICATION AND MAINTENANCE CONT'D

FASTENERS

Tighten all screw fasteners to recommended torques after first week of operation and annually thereafter. If loose fasteners are found at anytime, tighten to recommended torques. Replace any lost or damaged fasteners or other parts immediately upon finding such damage or loss. Check body mounting bolts every week.

CONVEYOR BELT MAINTENANCE

The conveyor belt should be checked daily for proper tension and tracking. A conveyor belt that is tracking properly runs in the center of the trough without curling or scuffing the ends. (See tracking instructions in the Belt Conveyor Adjustment Section).

Do not be alarmed as the sides of the belt wear unless the belt is out of track. The belt has a nylon fabric that is impervious to moisture, weathering or chemical action. The belt operates satisfactorily even with a total of 1" worn from the sides. Inspect the belt fastener occasionally for wear or "raveling" of the belt grip area and loosening hardware. Retighten loose nuts and peen the end of the lacing screw into the slot of the nut as required.

BELT CONVEYOR ADJUSTMENT

1. TENSION:
   Belt tension should be just tight enough to prevent slippage- no tighter. Generally speaking, if the "flats" on the conveyor drive pulley are visible through the belt, tension is high enough.

2. TRACKING:
   To check the tracking, be sure spreader is empty. Then take the following steps:
   A. With truck engine shut off, move spinner control valve to "0" position. Start truck engine and engage pump drive PTO. Spinners should not turn. If they do, correct the problem before proceeding.

WARNING: Rotating spinners are very dangerous. Be sure spinners are turned off when performing this maintenance.

   B. Pull out inner Function Knob (white nylon) located adjacent to conveyor drive gear box on "Synco-Matic" Mark II control valve assembly to disengage ground control feed-back. With truck engine running rotate Function Knob until conveyor runs at a maximum speed.

LUBRICATION AND MAINTENANCE CONT'D

CAUTION: As conveyor is running, exercise great care to avoid entanglement with any moving part.

A properly adjusted belt will either remain in a steady position centered on the pulleys or more often will "Wander" back and forth 1/4 to 1/2 inch across the pulley but remain generally centered on the pulley.

Improper tracking may be due to three basic causes. These causes and their repective solutions are listed below:

PROBLEM 1: (See Illustration)

Belt tracks to one side, contacts side of conveyor. Contact is more severe at the front and may not quite touch at the rear.

SOLUTION:

Tighten idler bearing at the side in contact with the belt. Move this adjustment 1 turn at a time. Operate conveyor 10 to 15 minutes at a high speed to allow the belt to react to the adjustment. Repeat if necessary.

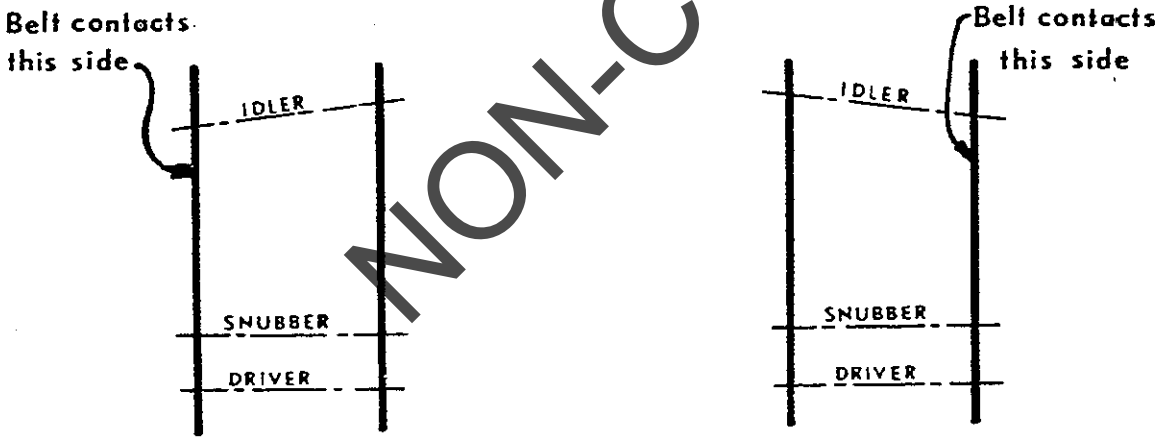


FIGURE 14 - BELT TRACKING

PROBLEM 2: (See Illustration)

Belt contacts side panel at the front on side and contacts the other side at the rear.

SOLUTION:

If adjusting as in Problem 1 does not remedy the situation, adjustment of the drive pulley is necessary. Mark the illustration with the location of the adjustment screw on your unit, (R.H. side). Check the illustration for the situation present. From the location of the screw adjustment on the illustration, note which direction the shaft should be moved to compensate. Loosen the screw to move the shaft forward; tighten the screw to move the shaft rearward.

NOTE: The illustration is exaggerated. Only move the adjustment screw 1/4 turn at a time after loosening the bolts holding the bearing. Usually, 1/64 to 1/32 inch adjustment is all that is necessary.

Retighten the bearing. Operate the conveyor for 10 to 15 minutes at a high speed to allow the belt to react to the adjustment. The problem should change to Problem 1. Adjust as in Problem 1 to track belt properly.

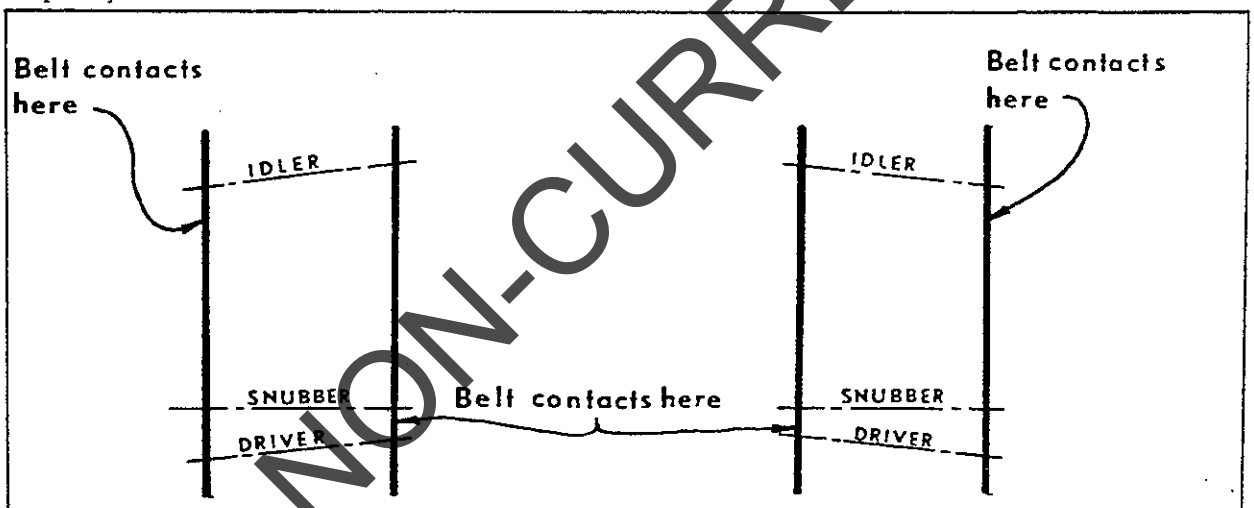


FIGURE 15 - BELT TRACKING

PROBLEM 3: (See Illustration)

Belt contacts side as in Problem 1, but contacts more heavily at a point approximately three (3) feet from the rear.

SOLUTION:

Realign snubber pulley. Note point on side of contact from the illustration. This side of the snubber is too low.

NOTE: This pulley moves up and down ONLY.

LUBRICATION AND MAINTENANCE CONT'D

Problem 3, Solution cont'd:

Loosen belt, raise or lower as necessary. Loosen the two (2) bolts holding the snubber bearing on the side to be adjusted after marking old location. Move approximately 1/16" at a time and retighten. Retighten belt the exact number of turns previously loosened. Operate the conveyor 10 to 15 minutes to allow the belt to react to the adjustment. Refer to Problem 1 and readjust. If the adjustment does not compensate, repeat.

If the adjustments do not correct the situation, sight down the body under the belt shields. The only point which should come close or slightly contact the belt, is the lowest point on the shield. If the belt should contact the shield firmly at any other point, tracking will be impossible. See your dealer immediately. Only your dealer can correct the situation.

If there is no contact between the belt shields and the conveyor belt and the belt does not track despite continued adjustment, remove the belt and check it for squareness in the following manner:

Measure in from the sides and establish a center line at least eight (8) feet long. Use an accurate two (2) foot square to mark the belt. Cut the minimum amount off the ends of the belt square with the eight (8) foot center line. Replace using a new lacing kit. Do this only as a last resort. Use only genuine New Leader parts.

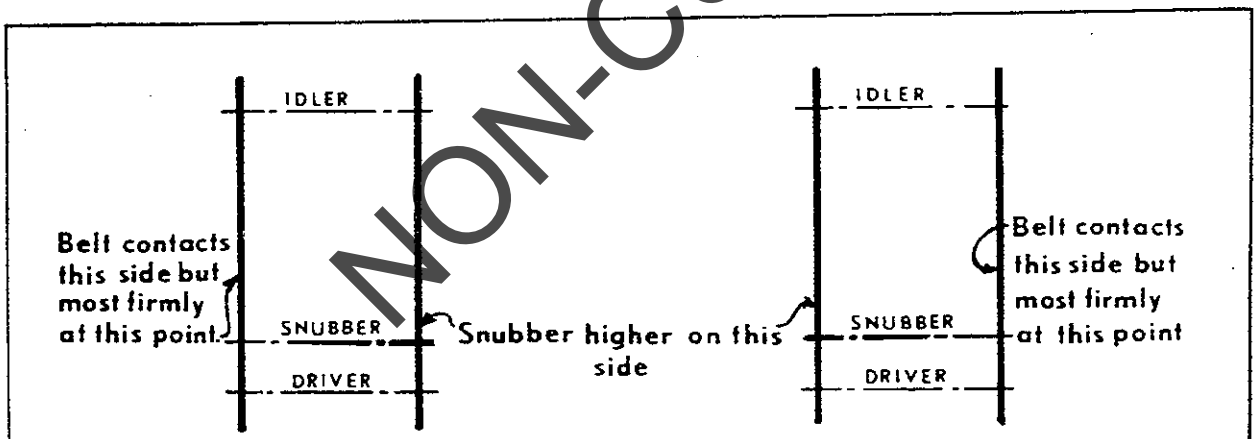


FIGURE 16 - BELT TRACKING

#5 Belt Conveyor Belt Shield Fit:

With a properly adjusted belt without any load, the belt shields along each side of the belt inside the spreader body should be just contacting the belt. If a shield has clearance along it length, it can be moved down until it just contacts belt by loosening the fastening bolts and allowing the shield to slide downward and then retightening the bolts. If the shield is tending to cut into the belt along it full length, loosening the bolts and raising the shield until it just contacts the belt will correct the problem.

LUBRICATION AND MAINTENANCE CONT'D

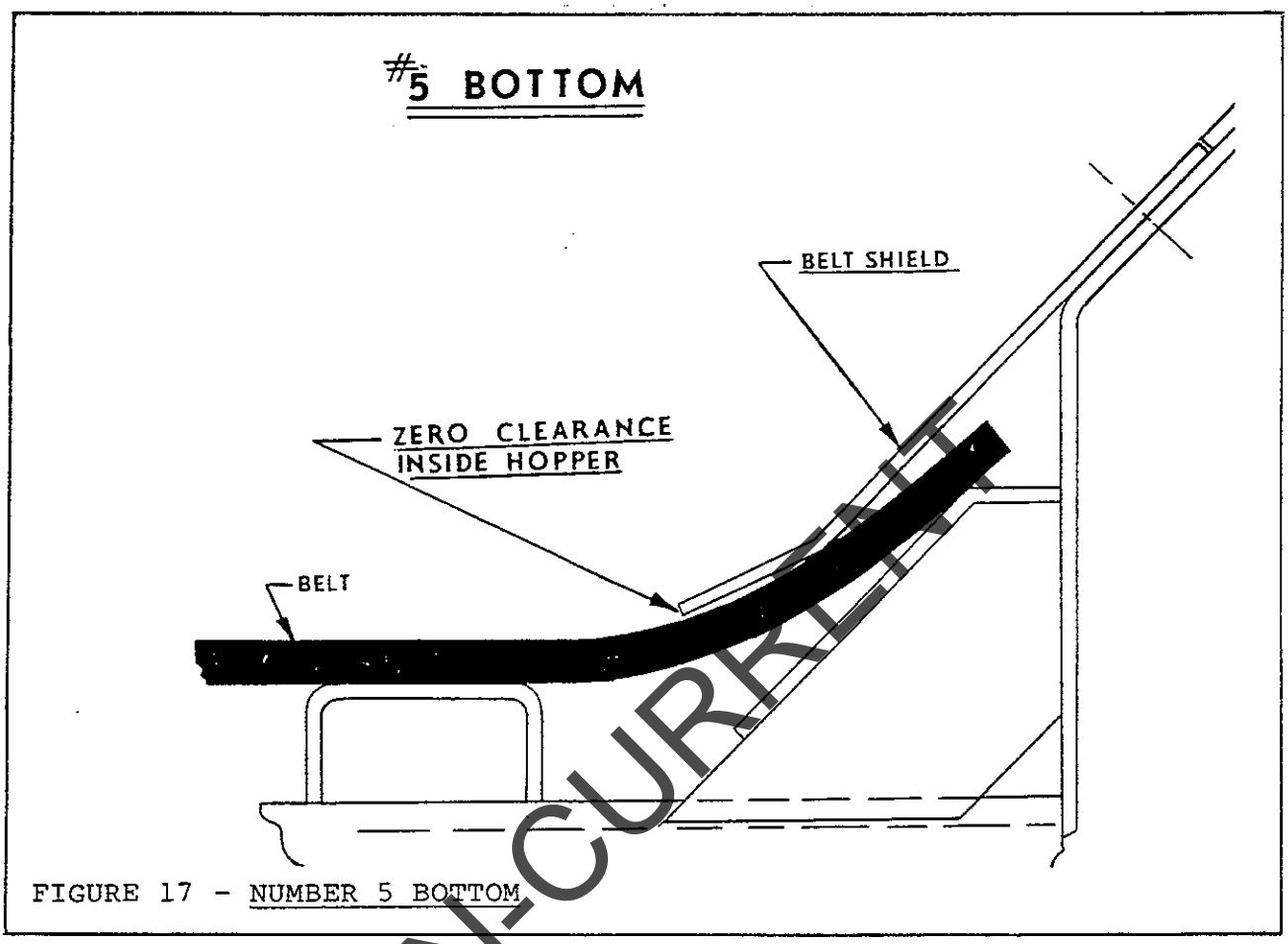


FIGURE 17 - NUMBER 5 BOTTOM

If the shield cuts the belt at one or more points or if it gaps at one or more points it should be replaced.

CONVEYOR BELT - REMOVAL & REPLACEMENT:

TOOLS & EQUIPMENT REQUIRED:

1. 1-1/2" Hex Wrench.
2. 25-30 feet of 1/4"-3/8" rope.
3. 3 or 4 pieces of 2 x 4 lumber about 3 feet long.
4. 10 feet of 14 gauge or 16 gauge soft iron wire.

HINT: Best results are achieved it two men are used to remove and replace the belt.

LUBRICATION AND MAINTENANCE CONT'D

PARTS REQUIRED: See Page 8 - 82.

PROCEDURE:

1. Set spinner control valve at "0" position to stop spinners.
2. Remove both belt shields, clean thoroughly and repaint.
3. Pull out inner Function Knob located adjacent to conveyor drive gear box on "Synco-Matic" Mark II control valve assembly to disengage ground control feed-back. Rotate knob to run conveyor until lacing is exposed on the rear face of the drive pulley. Rotate knob until conveyor stops with splice pin in line with slots in sills.
4. Move the front idler adjustment bolts to extreme rear position.
5. Pull out splice pin to separate belt splice.
6. Rotate Function Knob so that conveyor operates slowly while one man stands on the drive pulley thus "walking" the old belt out of the machine.

CAUTION: Use extreme care to avoid entanglement. Hold on to end-gate to maintain balance. One man must stay at control to stop conveyor instantly if required.

7. Shut down spreader. Using any suitable tool at hand, remove any caked material from the drive pulley, snubber pulley, idler pulley and from inside the frame channels. Clean and repaint as required.
8. Thread OLD splice pin through one end of new belt splice. Connect wire to pin about 1/4" in from each side of belt forming a loop.
9. Thread the rope along the top of the belt channel, around the front idler pulley, over the snubber pulley, and under the drive pulley.

CAUTION: Be sure power is shut off during this threading operation.

10. Tie the end of the rope which is under the drive pulley to the wire loop. Wrap the other end of the rope once around the drive pulley and out to the rear.
11. Start conveyor drive and set Function Knob to cause drive pulley to turn slowly. With one man pulling on the rope, and another feeding the belt into the machine from the rear, pull the new belt under the drive pulley, over the snubber pulley, along the frame channels, around the front idler pulley, and back to the drive pulley.

LUBRICATION AND MAINTENANCE CONT'D

CAUTION: Use extreme care to avoid entanglement. Stand well back of drive pulley.

12. Shut off all power and insert the three foot pieces of lumber under the belt at the bottom to support its weight as shown in the illustration.
13. Insert a plastic tube in each splice and across the full width of the belt and pull the two ends together at the center of the rear face of the drive pulley.
14. Insert the splice pin (flexible, plastic covered).
15. Snug the belt up by tightening the idler pulley.
16. Tighten the belt until the edge of the belt is approximately 2" above the lower edge of the sill lower flange on each side. Remove three foot long wood blocks.
17. Adjust for proper tracking as outlined in the Belt Conveyor Adjustment Section of this manual.

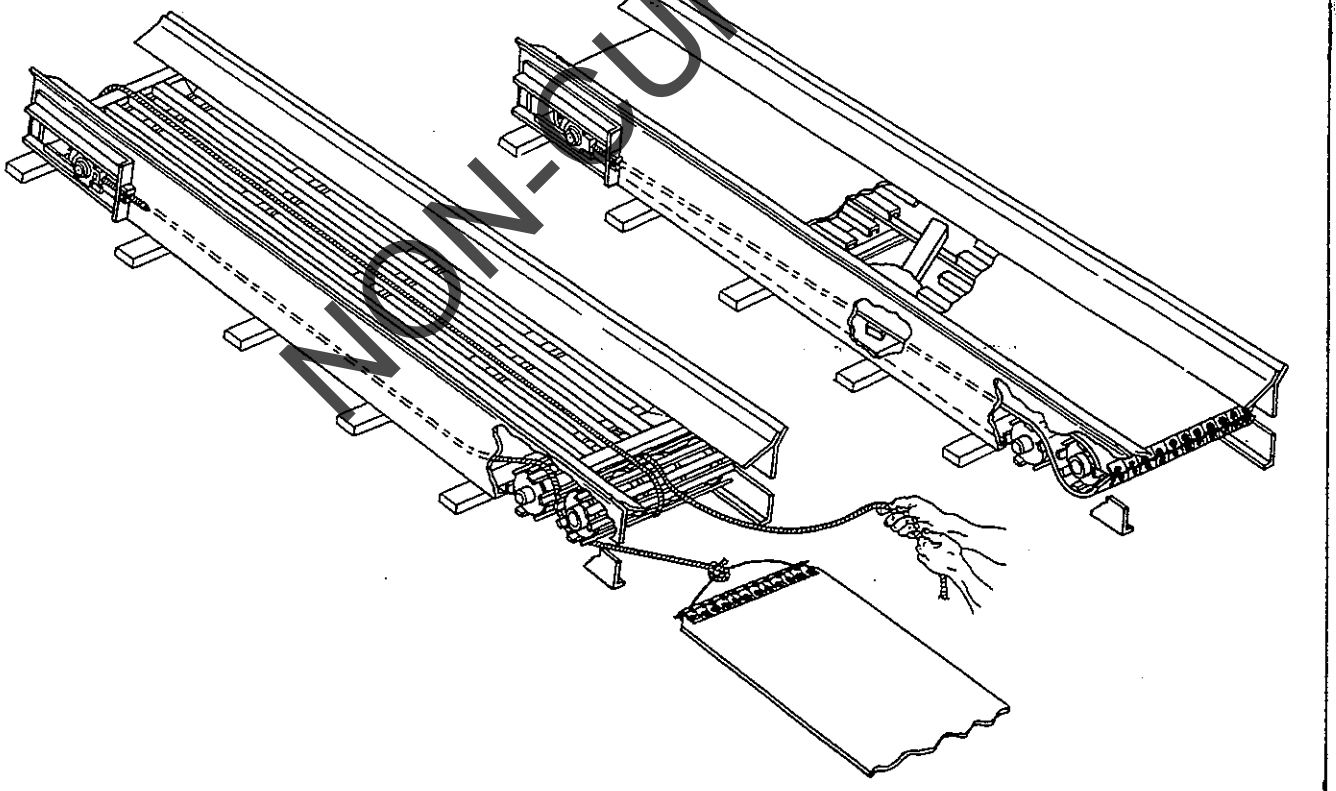


FIGURE 18 - INSTALLING NUMBER 5 BELT

LUBRICATION AND MAINTENANCE CONT'D

SYNCO - MATIC CONTROL REPLACEMENT:

SYNCO - MATIC MARK II - REMOVAL:

Repairs to Synco - Matic Mark II control box and valve assembly require special techniques and should not be attempted in the field. The complete unit should be removed in one piece and returned to your dealer for repair or replacement. The following instructions cover removal: (See Figure 19).

1. Thoroughly clean Synco - Matic unit and area around it.
2. Unscrew flexible drive cable connection at "A" and remove.
3. Cut signal wire coming from top of gear train housing at "B". NOTE: Leave at least 6" of wire on housing so that wire can be respliced.
4. Remove two hydraulic hose connections at top of control block at "C". Close holes with wads of clean cloth to keep dirt out of block.
5. Loosen four capscrews in saddle under hydraulic motor at "D".
6. Remove two pan head screws from cog-belt housing at "E".
7. Holding unit in both hands move up and down to release from any sealing between unit and other parts and remove by drawing off motor.

REPLACEMENT:

1. Using clean wiping cloth and a non-toxic, non-flammable degreasing solvent, thoroughly clean mating surfaces between control block, hydraulic motor, and cog-belt housing.
2. Replace "O" rings in hydraulic motor ports. Be sure threaded inset sleeves in motor ports are slightly below flush with surface. These sleeves must not protrude at all.
3. Apply a narrow line of sealing compound around edges of cog-belt housing and flat upper surface of motor where control block will seat. Be careful not to use too much.
4. Start four capscrews through saddle and into underside of control block.

LUBRICATION AND MAINTENANCE CONT'D

5. Slip unit into place on motor and into cog-belt housing being sure shaft engages cogged pulley in cog-belt housing and shaft slot engages cross-pin.
6. Tighten the two pan head screws at "E" and then uniformly snug up the four cap screws at "D".
7. Connect hydraulic hoses at "D".
8. Splice wire at "B". Either solder splice or use crimped sleeve. Tape over splice.
9. Insert flexible drive connection at "A" and tighten firmly.
10. Road test unit per "Road Testing" procedure in this manual to check unit for proper functioning.

REMOVAL OF COMPLETE SYNCO-MATIC MARK II CONTROL WITH CONVEYOR GEAR CASE ASSEMBLY

1. Thoroughly clean Synco - Matic unit and area around it.
2. Unscrew flexible drive cable connection at "A" and remove.
3. Cut signal wire coming from top of gear train housing at "B". NOTE: Leave at least 6" of wire on housing so that wire can be respliced.
4. Remove two hydraulic hose connections at top of control block at "C". Close holes with wads of clean cloth to keep dirt out of block.
5. Remove the conveyor gear case torque arm bolt, and slide the complete assembly off the conveyor drive pulley shaft.

LUBRICATION AND MAINTENANCE CONT'D

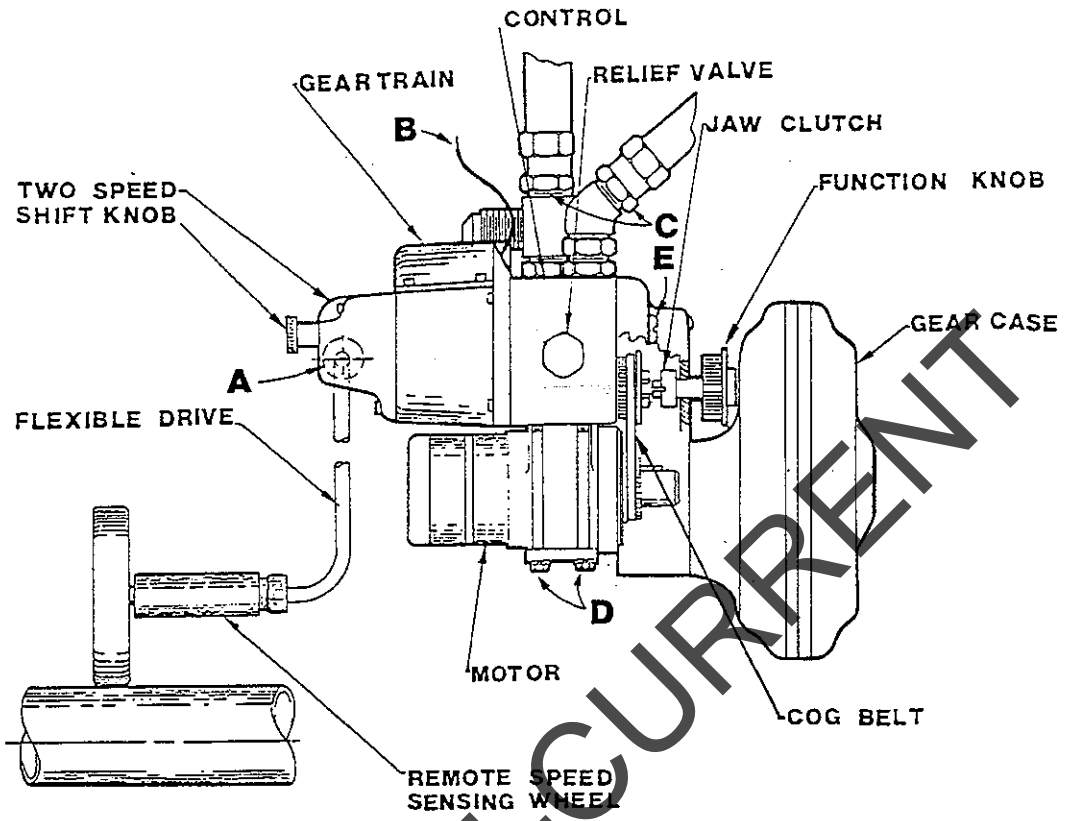


FIGURE 19 - SYNCO-MATIC MARK II ASSEMBLY

LUBRICANT AND HYDRAULIC OIL SPECIFICATIONS

IMPORTANT

The lubricant distributor and/or supplier is to be held responsible for the results obtained from their products. Procure lubricants from distributors and/or suppliers of unquestioned integrity, supplying known and tested products. Do not jeopardize your equipment with inferior lubricants. No specific brands of oil are recommended. Use only products qualified under the following oil viscosity specifications and classifications and recommended by reputable oil companies.

HYDRAULIC SYSTEM

The following are the recommended procedures for selecting the proper hydraulic fluid for use in the hydraulic system. Select a major brand industrial PREMIUM QUALITY (anti-wear type) hydraulic oil to provide viscosity between 100-200 SSU at operating temperature. Premium hydraulic oils with viscosity indexes of 95 or above will provide the following temperature ranges:

INDUSTRY IDENTIFICATION VISCOSITY GRADE	OPERATING TEMPERATURE	VISCOSITY
150 SSU	122° F	100 SSU
	84° F	200 SSU
225 SSU	140° F	100 SSU
	107° F	200 SSU
300 SSU	150° F	100 SSU
	116° F	200 SSU
450 SSU	165° F	100 SSU
	130° F	200 SSU
600 SSU	182° F	100 SSU
	145° F	200 SSU

If, because of necessity or convenience it is desirable to use an automotive engine oil, multi-viscosity oils of SC rating (formerly MS Quality) which will provide between 100 and 200 SSU at operating temperature can be used. These will provide proper viscosity over a wide range. See example on next page.

LUBRICANT AND HYDRAULIC OIL SPECIFICATIONS CONT'D

SAE VISCOSITY GRADE	OPERATING TEMPERATURE	VISCOSITY
10W-30	130°F	100 SSU
	100°F	200 SSU
10W-40	190°F	100 SSU
	140°F	200 SSU

The above recommendations cover the normal system operating temperatures. For system temperatures above or below those shown in the charts above, contact the Service Department of Highway Equipment Company. For additional information contact your Highway Equipment Company dealer. (Refer to Hi-Way-New Leader Bulletin H-24 NL-32).

GEAR BOX LUBRICANT

Lubricate these assemblies with a non-corrosive type SAE 90 E. P. (extreme pressure) gear oil conforming to MIL - L 2105B multi-purpose gear lubricating oil requirements (API Service GL 4) with ambient temperatures from 40 to 100 degrees F. Ambient temperatures below 40°F. require an SAE 80 E. P. lubricant; above 100°F. use an SAE 140 E. P. grade oil.

PRESSURE GUN LUBRICANT

Use a ball and roller bearing lithium base lubricant with a minimum melting point of 300°F. This lubricant should have a viscosity which assures easy handling in the pressure gun at prevailing atmospheric temperatures. The lubricant must be waterproof. The grease should conform to NLGI No. 2 consistency.

CHAIN OILER LUBRICANT

Use a mixture of 75% No. 1 or No. 2 Diesel fuel or kerosene mixed with 25% SAE 10 engine oil.

FRICTION WHEEL ACTUATOR LUBRICANT

Use a light penetrating oil dispensed by aerosol or atomizer spray.

WARNING: Shut off all power and allow all moving parts to come to rest before performing any maintenance operation.

The spreader should be regularly lubricated with the lubricants recommended in this manual in accordance with the following chart:

LUBRICATION CHART

	DESCRIPTION	LOCATION	NO. OF POINTS	*METHOD OF LUBRICATION	FREQUENCY DAILY	WEEKLY	MONTHLY	ANNUALLY
Hydraulic Pump System Drive	Transmission PTO	Slip Yoke	1	Grease Gun		X		
		Universal Joint	2	Grease Gun			X	
	Reservoir		1		Check			Change
	Filter		1		Check Indicator. Change element when indicated (RED)			
Friction Wheel	Shaft Housing	Friction Wheel Ass'y	1	Grease Gun		X		
	Tube Spacer	Friction Wheel Ass'y	1	Grease Gun		X		
	Actuator	Operating Mechanism	1	Spray Oil			X	
	Speedometer Cable	Friction Wheel to Synco 2-speed	1	Grease				X
Conveyor	All Except #5 Conveyor	Dragshaft Brgs.	2	Grease Gun		X		
		Idler Shaft Spkts.	2	Grease Gun	X			
		Idler Adjusting	2	Hand Grease		X		
		Chain	2 Strands	Spray Oil		X		
		Chain Oiler (if so Equipped)	1	Oil	X			
	#5 Conveyor	Dragshaft Brgs.	2	Grease Gun		X		
		Idler Shaft Brgs.	2	Grease Gun		X		
		Snubber Pulley	2	Grease Gun		X		
		Idler Adjusting Screws	2	Hand Grease		X		
	Gear Case		1	Gear Box Oil			Check	Change
Feed-gate	Jack Assembly	Gears	1	Hand Grease				X
		Tube	1	Grease Gun			X	
Screw Conv. Discharge Elevator		Outer Bearing	1	Grease Gun		X		

NOTE: Unusual conditions such as excessive dust, temperature extremes or excessive moisture may require more frequent lubrication of specific parts.

* See Lubricant and Hydraulic Oil Specifications for types of lubricants and oil to be used.

ALWAYS GIVE PART NAME. NUMBER AND MACHINE SERIAL NUMBER WHEN ORDERING PARTS

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TROUBLE SHOOTING PROCEDURES

Symptom	Reason	Correction
1. Spinner motors do not turn when spinner control valve is in running position, or conveyor does not run when function knob is pulled out and manually rotated.	Hydraulic Oil level low	Fill reservoir.
	Shut-Off valve on oil reservoir not open.	Open valve fully by turning counter-clockwise until it stops.
	Hydraulic Pump is not rotating.	PTO is disengaged. Shift into engagement.
		Drive line has failed. Repair or replace.
		Key in pump shaft has failed. Replace key.
		U-joint pin or key has failed. Replace pin or key.
	In-line relief valve set too low.	In-line relief valve pressure should be 2500 PSI. Set spinner control valve to "O". Disconnect the hydraulic line to the percent of power gauge and plug elbow with 1/4" pipe plug as gauge will be damaged by full relief pressure. Disconnect pressure line at Synco-Matic Mark II Control which comes from the rear port on the spinner control valve. Reconnect this line to flowmeter inlet port. Disconnect the return line from the Mark II Control where it joins the return tube running to the reservoir. Connect the flowmeter load valve to the return tube. Open the load valve fully, run truck engine at about 2500 RPM. Slowly close load valve until pressure reaches 2500 PSI. If this pressure cannot be reached, valve adjustment should be set up until gauge reads 2500 PSI. CAUTION: Do Not set pressure above 2500 PSI.
	Worn pump	With flow meter arranged to check relief valve setting above, open load valve fully. Read flow rate with truck engine running at 2500 RPM. Close load valve until pressure reads 2000 PSI. Flow rate should not fall off more than three (3) GPM. If flow loss is greater, replace pump.
	Jammed or frozen spinner motors, conveyor, or conveyor motor.	Free up. If not possible, replace as required.
2. Spinners turn but conveyor does not run when function knob is pulled out and manually rotated.	Mark II relief valve open to return line.	Using relief valve testing adapter and flow meter, test valve for opening pressure. If not 1500 PSI, replace relief valve.
	Jammed or frozen conveyor.	Free up conveyor.
	Jammed or frozen conveyor hydraulic motor.	Replace motor.
	Conveyor hydraulic motor shaft key sheared.	Replace key.
	Mark II Control Gears stripped or unpinned.	Remove Mark II control cover. When function knob is rotated manually, idler arm should rotate. If it doesn't, examine for stripped gears or unpinned gears. Replace as required. Check also for jammed valve spool. If jammed, replace control unit.
3. Spinner speed does not stay constant.	Pump speed is not adequate to provide sufficient flow to maintain spinner speed.	Increase engine speed.
	Worn pump	Use method for testing of worn pump given in Symptom (1). Replace pump if worn.
	In-line relief valve setting too low.	Use method for testing of in-line relief valve given in Symptom (1). Setting should be 2500 PSI.
	Insufficient hydraulic oil flow at normal driving speeds.	Check PTO-Pump matching. If insufficient flow results install higher percent PTO or use larger pump (Special).
	Defective spinner control valve.	Replace valve metering spool spring. If no improvement, replace spinner control valve.
4. Hydraulic oil overheats (200°F or hotter).	Oil level is low.	Add hydraulic oil up to "Full" mark.
	Excessive oil is being pumped.	PTO percentage too high--do not operate pump over 2000 RPM. Change PTO to smaller percentage or use smaller pump.
	Pump	Pump is too large--do not exceed 30 GPM pumping rate. Change to smaller pump or use smaller percentage PTO.
	Worn motor (spinner or conveyor).	Motor heats up at an excessive rate (check for this heating when system is cold). Replace motor.
	Improper or deteriorated hydraulic oil.	Replace hydraulic oil with proper specification oil and replace filter.

Chart continued on following page.

TROUBLE SHOOTING PROCEDURES
CONT'D

Symptom	Reason	Correction
4. Hydraulic oil overheats (200°F or hotter). Cont'd.	Relief valve set too low allows oil to throttle through valve and generates heat.	Check in-line relief valve as described in Symptom (1) and Mark II relief valve as in Symptom (2). Reset or replace as required.
	Pinched or obstructed hose, hydraulic line or fitting.	Clear obstruction or replace part. Straighten out kinked hoses.
	Driving too fast, especially with Mark II two-speed in "High" range.	Do not drive over 10 MPH with Synco-Matic Mark II two-speed in "High" range.
5. Spinners run with cab control in "Off" position.	Cab control is for conveyor only. Spinners run anytime vehicle engine is running, PTO is engaged and spinner control valve is in a running position.	None required. This is a normal condition. To stop spinners, set spinner control valve at "O" position, disconnect PTO, or shut-off vehicle engine.
6. Red light flashes on control panel and buzzer sounds intermittently. Conveyor runs in jerks.	Driving too fast.	Shift Truck transmission to a lower gear. Will not normally occur if Mark II, two-speed is in "LO" range.
	Synco-Matic Mark II cog-belt drive has failed.	With function knob pushed fully in and engaged in automatic position with spreader shut down, knob should not be able to be turned by hand. Cog-belt is broken or disengaged. Reset or replace. Cog drive pulleys may be unpinned. Re-pin to shaft. Function knob clutch may be stripped. Replace.
	Synco-Matic Mark II control gears failed.	Examine gears for stripping or being disconnected. Replace.
7. Red light flashes and buzzer sounds either continuously or erratically.	Electrical ground in control panel or in wire running back to Mark II control.	Insulate against grounding at control panel or on wire.
8. Conveyor does not run with cab control "On", PTO engaged, and vehicle driving forward.	Friction wheel slips on truck propellor shaft.	Increase spring tension so that friction wheel bears more firmly.
		Friction wheel shaft is not parallel to propellor shaft. Adjust mounting so that shafts are parallel.
	Friction wheel does not engage propellor shaft when cab control is placed in "On" position.	Friction wheel actuator is defective. Replace.
		"On" - "Off" switch is defective. Replace.
		Electric wires to actuator broken or loose. Splice wires or reconnect loose or broken connections.
	Flexible cable from friction wheel to Mark II control does not transmit rotation of friction wheel.	Flexible cable broken. Replace.
		Flexible cable rotating element disengaged from traction wheel shaft or Mark II connection. Rotating element engaged too deeply at one end allowing other end to disengage. Engagement of "tang" should be 5/8". If greater, plug central hole with short pin to limit engagement to 5/8"
	Mark II two-speed gear box worn, stripped or out of engagement.	Two-speed knob must not be in "neutral". Pull out fully while rotating it to put it into "High" position. Push in on knob while rotating it to put it into "Low" position.
		Open two-speed gear box and check gears. Replace worn or stripped gears. Replace loose or sheared pins. Replace defective pin-jaw clutches.
	Mark II Function Knob in "Manual" (Disengaged) position.	Push in on knob while rotating it to engage it into "Automatic" position.
	Defective gear train in Mark II control.	Pull function knob out to "Manual" position. Remove cover from Mark II Control. Rotate function knob slowly by hand. Idler arm should rotate around connection gear. If not, replace gear train.
	Locked spool in Mark II control valve.	Check as for defective gear train above. If arm does not rotate check for stripped gears in gear train. Replace gears if stripped. With new gears if function knob will not turn with hand pressure, check for locked valve spool. Replace Mark II control if spool is jammed. Check also for damaged two-speed gears and replace if required.
9. Conveyor runs when control switch in cab is in "Off" position.	Pump is delivering excess amount of oil.	Pressure drop in Mark II valve is sufficient to run lightly loaded conveyor motor. Shut-off pump drive by disengaging PTO shaft.
		PTO-Pump match provides excess oil flow. Install correct PTO-Pump arrangment.

GENERAL OPERATING PROCEDURES

To operate the L-2020 Synco-Matic Mark II spreader the following sequence should be followed:

1. Be sure unit has been properly serviced and is in good operating condition.
2. Close feed gate, turn valve or switch to the "OFF" position to disengage the friction wheel. Disengage pump drive PTO.
3. Fill body with material to be spread.
4. Push in Function Knob on Mark II control, rotating it until it fully engages into "Automatic" position.
5. On Mark II Two Speed Knob, push in and rotate until it engages fully into "Low" position for low rate applications such as fertilizer, or pull out while rotating until it engages fully into "High" position for high rate applications such as lime.
6. Drive to location where spreading is to be done.
7. Adjust spinner control valve to setting required for material used to give spread width desired. See Spinner Adjustment pages 48-49.
8. Adjust material flow divider or Red-E-Vider to give spread pattern desired. See Spread Pattern Adjustment, pages 48-52.
9. Using Spread Rate charts on pages 54-55, set feed gate opening to obtain yield desired for spread width, material, and material weight per cubic foot used.
10. If truck has a two-speed rear axle place it into "Low" range.
11. Be sure shut-off valve on hydraulic reservoir is fully opened.
12. Start truck engine.
13. Depress clutch pedal, engage pump drive PTO, and shift into transmission gear at which spreading is to be done.
14. Engage Friction Wheel. Spreading will start as soon as truck moves.
15. Drive at speeds which will allow high speed engines (gasoline) to turn at about 3000 RPM, or low speed engines (diesel) to turn at about 2000 RPM. These speeds should not exceed 10 MPH with Mark II Two Speed in "High" position or 30 MPH in "Low" position.
16. To shut-off delivery momentarily while turning or for other reasons, disengage friction wheel for about three seconds and then re-engage friction wheel.

CAUTION: Drive only at speeds which permit good control of vehicle. For "High" range materials, use only lower transmission gears and do not drive above 10 MPH.

For "Low" range materials, higher transmission gears may be used with speeds to 30 MPH. If lower speeds must be used, shift transmission into lower gears so that engine speed can be maintained to allow adequate hydraulic oil delivery from pump.

GENERAL OPERATING PROCEDURES CONT'D

ADJUSTING THE SPREAD PATTERN:

IMPORTANT: Spinner assembly and material flow divider have NOT been adjusted at the factory. Before spreading material, spread pattern tests must be conducted to properly adjust the spread pattern. A Spread Pattern Test Kit, part number 70889, is available for this purpose. THE MANUFACTURER OF THIS SPREADER WILL NOT BE LIABLE FOR MISAPPLIED MATERIAL DUE TO AN IMPROPERLY ADJUSTED SPREADER.

It is recommended that spread pattern tests be conducted prior to each spreading season, after any spreader maintenance, and periodically during the spreading season. Spread pattern tests must be conducted whenever a new product is to be applied.

Spread pattern is affected by many factors. Among the more significant of these are:

1. Spinner speed.
2. Material weight per cubic foot.
3. Material granule size.
4. Material flow characteristics.
5. Rate of delivery of material.
6. Point of delivery of material on spinner discs.
7. Balance between deliveries to both spinner discs.
8. Angle of the distributor fins on the spinner discs.
9. Cleanliness of the spinner fins and discs.
10. Level of Spreader.
11. Wind.
12. Spacing of swaths.

Since many of these factors will vary for each job, trial and experience must be used to determine the adjustments which must be made to obtain the spread width and spread pattern desired. The following instructions are given to cover the adjustments available and the effect that each will have on the spread pattern.

CAUTION: As contact with spinners and other moving parts is very dangerous, great caution must be used while working around the spreader. Do not adjust while machinery is moving, wear eye protection, and avoid discharge from spinners. Do not ride on moving spreader.

A. SPINNERS:

IMPORTANT: Spinner discs and fins must be kept clean and polished. Even a small build-up on a spinner fin has disastrous effects on the spread pattern. Rusty, rough fins will produce poor spread patterns.

Fan speed is adjustable from approximately 400 to 800 RPM. This is accomplished by moving the spinner speed control valve lever.

GENERAL OPERATING PROCEDURES CONT'D

Proper fan speed adjustment is very important in obtaining good spread patterns. The best fan speed to use will depend entirely on the material being spread, and must be determined by trial and error. Once established for the materials you use, paint marks should be made on the control valve body as shown.

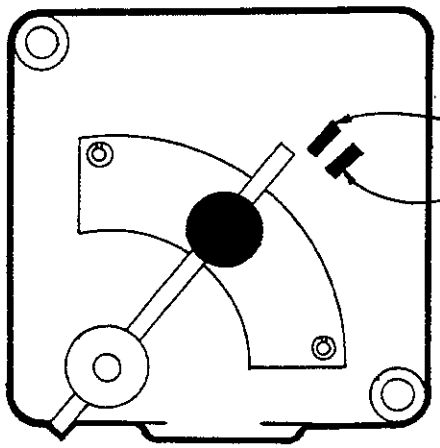


FIGURE 20 - CONTROL VALVE

Maximum pattern width is determined by particle size. This may vary anywhere from 25 feet for very finely ground dry lime up to 80 feet or even more for extremely large fertilizer pellets.

For every particle size and density, there is a critical fan speed. In other words, there is a speed which will result in the maximum width obtainable. Going beyond this speed will not increase spread width, but will result in poor patterns.

Too high a fan speed will result in a heavy deposit behind the truck. This upper speed limit will be quite low for finely powdered material, and will be very high for extremely coarse materials. In general, this critical speed will fall somewhere between 500 and 650 RPM for ordinary materials.

One way to adjust fan speed is to stand on the fender and watch the material leaving the fans. At slow speed the material leaves the blades in bands. At medium speed it forms wide bands in the air. At somewhat higher speed, the bands close into a uniform blur. At very high speed, a ridge of material flows over the tops of the blades and falls directly behind the spreader. Normally, the proper fan speed is just higher than that when the bands close to a blur.

GENERAL OPERATING PROCEDURES CONT'D

CAUTION: DO NOT STAND ON FENDER WHILE VEHICLE IS IN MOTION.

Pattern: (Figure 21).
Two heavy swaths located directly behind the fans; material is seen blowing over the tops of the fans.
Cause:
Fan speed too fast, material blows over the tops of the fans and falls to the ground directly behind the unit.
Cure:
Decrease the fan speed.

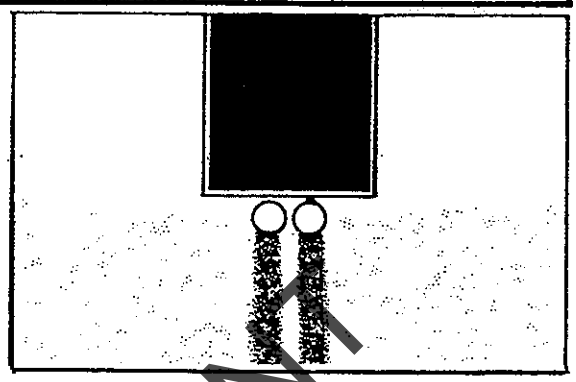


FIGURE 21 - ADJUSTING SPREAD PATTERN

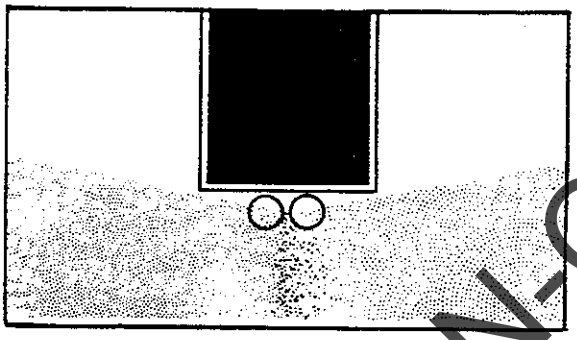


FIGURE 22 - ADJUSTING SPREAD PATTERN

Pattern: (Figure 22)
Pattern is heavy on one side only.
Cause:
1. More material is being deposited on one fan. 2. Material has collected on divider panels.
Cure:
1. Measure accurately the position of the material divider. These units must be centered and the fans must be parallel to the spreader's sills. 2. Keep the divider scraped clean of material build up.

Pattern: (Figure 23)
Pattern is heavy in center 30% of total spread width. No material exits ahead of fans.
Cause:
1. Divider is too far forward.
2. Divider back plate is too far forward.
Cure:
1. Move divider rearward.
2. Move back plate rearward.

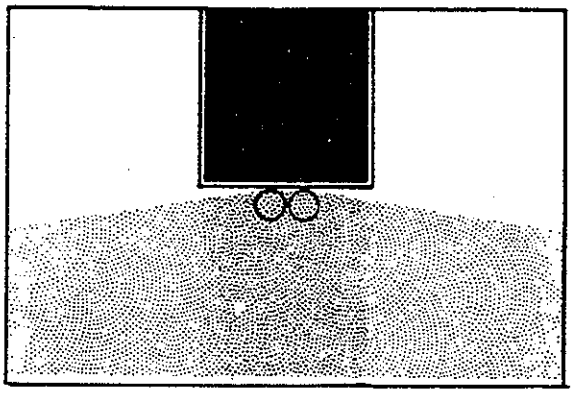


FIGURE 23 - ADJUSTING SPREAD PATTERN

GENERAL OPERATING PROCEDURES CONT'D

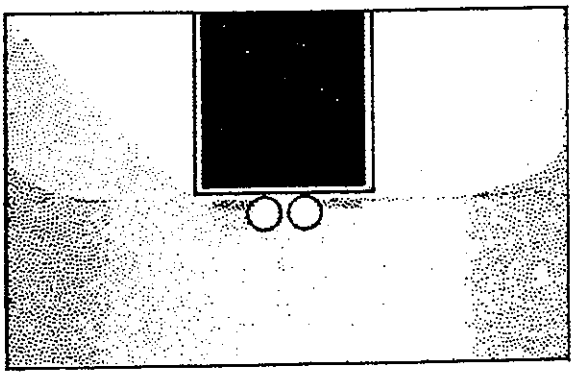


FIGURE 24 - ADJUSTING SPREAD PATTERN

Pattern: (Figure 24)
Pattern is heavy at outer edges. Excessive material strikes front deflector panels.
Cause:
1. Deflector is too far rearward. 2. Fan speed too fast. 3. Back plate is too far to rear.
Cure:
1. Adjust divider forward. 2. If adjusting divider does not work, decrease fan speed. 3. Move back plate forward.

B. MATERIAL DIVIDER CENTERING:

Material divider must be properly centered to avoid a pattern which is heavier on one side than on the other. See Figure 22.

C. MATERIAL DIVIDER ADJUSTMENT:

Moving the divider forward will increase the amount of material deposited behind the truck. Moving to the rear will decrease it. See Figures 22 and 23.

D. DIVIDER BACK PLATE ADJUSTMENT:

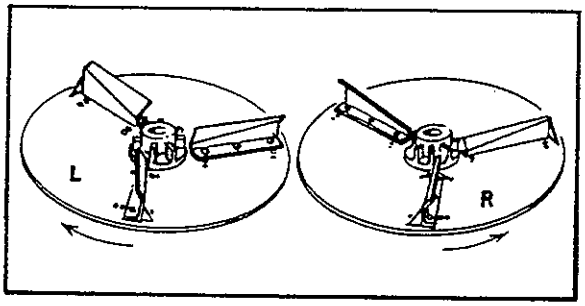
Adjust Material Divider per (C) above first. Then adjusting the divider to a wider position (moving back plate rearward) will throw material to the outside of the pattern. Adjusting to a narrower position (moving back plate forward) will throw it to the center. See Figures 23 and 24.

E. DISTRIBUTOR FIN ANGLE ADJUSTMENT:

Angling the outer ends of the fins forward (in the direction of rotation) will increase the deposit at the outside of the pattern. Angling backward (opposite the direction of rotation) will decrease deposits at the outside of the pattern.

CAUTION: Be sure capscrews and nuts are in good condition when tightening per torque chart in this manual. If fasteners are damaged, worn or corroded, replace immediately with new SAE Grade 5 or Grade 8 fasteners.

GENERAL OPERATING PROCEDURES CONT'D



Spreader is equipped with adjustable fins. These may be adjusted as required, according to the following:

If material deposit is excessive at the outside of the pattern, with a great deal of the material striking the deflector plates, rotate the outer end of the fin in the opposite direction of rotation of the spinner to assist in correcting this problem.

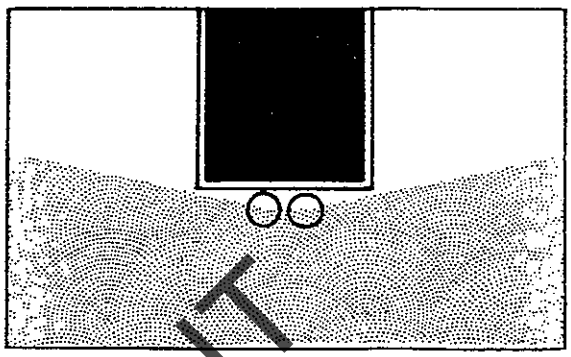


FIGURE 25 - ADJUSTING SPREAD PATTERN

Pattern:
Good pattern.
Cause:
Proper fan speed and divider setting.
Effect:
Material exits on an arc from near fan ℄ to near front deflector. Pattern density tapers off to nothing on outer 10% each side of total width.

F. PROPER ADJUSTMENT:

With correct spinner speeds and flow divider settings, uniform material distribution should be obtained. See Figure 25.

SPREAD RATE CHARTS:

How to use these charts:

1. Select the chart for the material to be spread.
2. At the top of this chart locate the section headed by the weight per cubic foot of the material being spread.
3. In this section locate the column headed by the spread width to be used.
4. In this column find the line with the spread rate in pounds per acre desired.
5. On this line in the column at the left edge of the chart, read the feedgate opening required to obtain this spread rate.

GENERAL OPERATING PROCEDURES CONT'D

NOTE: These charts are based on the rear tire size of the vehicle, the propellor shaft diameter, and (normally) the "LO" side of the rear axle (if vehicle is equipped with a two-speed rear axle) for selection of the friction wheel diameter. If the rear axle is shifted into "HI" range, the chart values must be corrected as follows:

A. Determine "Rear Axle Ratio" originally used to calculate friction wheel size.
B. Determine "Rear Axle Ratio" to be used while spreading.
C. Multiply chart values by ratio in step B and divide by ratio in step A. Result will be corrected chart values for the different rear axle ratio to be used.

If the vehicle is equipped with an auxiliary transmission and the friction wheel is mounted behind the auxiliary transmission, no chart correction will be required when auxiliary transmission shifts are made. If friction wheel is mounted ahead of auxiliary transmission, charts must be corrected when auxiliary is shifted, as follows:

D. Determine Auxiliary Transmission Ratio used when friction wheel size was determined.
E. Determine Auxiliary Transmission Ratio to be used when spreading.
F. Multiply chart values by ratio in step E and divide by ratio in step D. Result will be corrected chart values for the different auxiliary transmission ratio to be used.

Changes in friction wheel diameters will also affect delivery rates. To correct chart values of such changes, multiply chart values by original friction wheel diameter and divide by new friction wheel diameter.

IMPORTANT: These charts and chart corrections are theoretical only. Variations in weights per cubic foot of material, flow of material, tire inflation, tire slippage and embedment, overlap, spread uniformity, wind, equipment and other factors beyond the control of Highway Equipment Company will affect the actual delivery rates obtained.

THEORETICAL SPREAD RATE CHART

GATE OPENING (INCHES)	50 Lb. Per Cu. Ft. Material SPREAD WIDTH *				55 Lb. Per Cu. Ft. Material SPREAD WIDTH *				60 Lb. Per Cu. Ft. Material SPREAD WIDTH *				65 Lb. Per Cu. Ft. Material SPREAD WIDTH *				70 Lb. Per Cu. Ft. Material SPREAD WIDTH *			
	50	55	60	65	50	55	60	65	50	55	60	65	50	55	60	65	50	55	60	65
1	95	86	79	73	105	95	87	80	114	104	95	88	124	112	103	95	133	121	111	102
1-1/4	119	108	99	91	131	119	109	100	143	130	119	110	154	140	129	119	166	151	139	128
1-1/2	143	130	119	110	157	143	131	121	171	155	143	132	185	168	154	143	200	181	166	153
1-3/4	166	151	139	128	183	166	152	141	200	181	166	153	216	196	180	166	233	212	194	179
2	190	173	158	146	209	190	174	161	228	207	190	175	247	225	206	190	266	242	222	205
2-1/4	214	194	178	164	235	214	196	181	257	233	214	197	278	253	232	214	299	272	249	230
2-1/2	230	216	198	183	261	238	218	201	285	259	238	219	309	281	257	238	333	302	277	256
2-3/4	261	238	218	201	287	261	239	221	314	285	261	241	340	309	283	261	366	333	305	281
3	285	259	238	219	314	285	261	241	343	311	285	263	371	337	309	285	399	363	333	307
3-1/4	309	281	257	238	340	309	283	261	371	337	309	285	401	365	334	309	432	393	360	333
3-1/2	333	302	277	256	366	333	305	281	399	363	333	307	432	393	360	333	466	423	388	358
3-3/4	356	324	297	274	392	356	327	301	428	389	356	329	463	421	386	356	499	453	416	384
4	380	345	317	292	418	380	348	322	456	415	380	351	494	449	412	380	532	484	443	409
4-1/4	404	367	336	311	444	404	370	342	485	440	404	373	525	477	437	404	565	514	471	435
4-1/2	428	389	356	329	470	428	392	362	513	466	428	395	556	505	463	428	599	544	499	460
4-3/4	451	410	376	347	496	451	414	382	542	492	451	417	587	533	489	451	632	574	526	486
5	475	432	396	365	523	475	435	402	570	518	475	438	618	561	515	475	665	605	554	512
5-1/4	499	453	416	384	549	499	457	422	599	544	499	460	648	589	540	499	698	635	582	537
5-1/2	523	475	435	402	575	523	479	442	627	570	523	482	679	618	566	523	732	665	610	563
5-3/4	546	497	455	420	601	546	501	462	656	596	546	504	710	646	592	546	765	695	637	588

FERTILIZER-LBS. PER ACRE
Synco-Matic Mark II In "LO"

*Spread width is defined as the effective spread pattern width or the driving centers in the field.

THEORETICAL SPREAD RATE CHART

GATE OPENING (INCHES)	80 Lb. Per Cu. Ft. Material				85 Lb. Per Cu. Ft. Material				90 Lb. Per Cu. Ft. Material				95 Lb. Per Cu. Ft. Material				100 Lb. Per Cu. Ft. Material			
	SPREAD WIDTH				SPREAD WIDTH				SPREAD WIDTH				SPREAD WIDTH				SPREAD WIDTH			
	35	40	45	50	35	40	45	50	35	40	45	50	35	40	45	50	35	40	45	50
1	0.33	0.29	0.25	0.23	0.35	0.30	0.27	0.24	0.37	0.32	0.29	0.26	0.39	0.34	0.30	0.27	0.41	0.36	0.32	0.29
1-1/2	0.49	0.43	0.36	0.34	0.52	0.45	0.40	0.36	0.55	0.48	0.43	0.38	0.58	0.51	0.45	0.41	0.61	0.53	0.48	0.43
2	0.65	0.57	0.51	0.46	0.69	0.61	0.54	0.48	0.73	0.64	0.57	0.51	0.77	0.68	0.60	0.54	0.81	0.71	0.63	0.57
2-1/2	0.81	0.71	0.67	0.61	0.92	0.80	0.71	0.64	0.97	0.85	0.75	0.68	1.02	0.89	0.79	0.71	0.98	0.86	0.76	0.68
3	1.04	0.91	0.81	0.73	1.10	0.96	0.86	0.77	1.16	1.00	0.89	0.80	1.28	1.12	1.00	0.90	1.35	1.18	1.05	0.95
3-1/2	1.14	1.00	0.89	0.80	1.21	1.06	0.94	0.85	1.28	1.12	1.00	0.90	1.35	1.18	1.05	0.95	1.43	1.25	1.11	1.00
4	1.30	1.14	1.01	0.91	1.38	1.21	1.08	0.97	1.47	1.28	1.14	1.03	1.55	1.35	1.20	1.08	1.63	1.43	1.27	1.14
4-1/2	1.47	1.28	1.14	1.03	1.56	1.36	1.21	1.09	1.65	1.44	1.28	1.15	1.74	1.52	1.35	1.22	1.83	1.60	1.43	1.28
5	1.63	1.43	1.27	1.14	1.73	1.51	1.35	1.21	1.83	1.60	1.43	1.26	1.93	1.69	1.50	1.35	2.04	1.78	1.58	1.43
5-1/2	1.79	1.57	1.39	1.25	1.90	1.67	1.48	1.33	2.02	1.76	1.57	1.41	2.13	1.86	1.65	1.49	2.24	1.96	1.74	1.57
6	1.95	1.71	1.52	1.37	2.06	1.82	1.62	1.45	2.20	1.92	1.71	1.54	2.32	2.03	1.81	1.62	2.44	2.14	1.90	1.71
6-1/2	2.12	1.85	1.65	1.48	2.25	1.97	1.75	1.57	2.38	2.08	1.85	1.67	2.51	2.20	1.96	1.76	2.65	2.32	2.06	1.85
7	2.28	2.00	1.77	1.60	2.42	2.12	1.88	1.70	2.57	2.24	2.00	1.80	2.71	2.37	2.11	1.90	2.85	2.49	2.22	2.00
7-1/2	2.44	2.14	1.90	1.71	2.60	2.27	2.02	1.82	2.76	2.40	2.14	1.92	2.90	2.54	2.26	2.03	3.05	2.67	2.38	2.14
8	2.61	2.28	2.03	1.82	2.77	2.42	2.15	1.94	2.93	2.57	2.28	2.05	3.09	2.71	2.41	2.17	3.26	2.85	2.53	2.28
8-1/2	2.77	2.42	2.15	1.94	2.94	2.57	2.29	2.06	3.11	2.72	2.42	2.18	3.29	2.88	2.56	2.30	3.46	3.03	2.69	2.42
9	2.93	2.57	2.28	2.05	3.11	2.73	2.42	2.18	3.30	2.89	2.57	2.31	3.48	3.05	2.71	2.44	3.66	3.21	2.85	2.57
9-1/2	3.09	2.71	2.41	2.17	3.29	2.88	2.56	2.38	3.48	3.05	2.71	2.44	3.67	3.22	2.66	2.56	3.87	3.38	3.01	2.71
10	3.26	2.85	2.53	2.28	3.46	3.03	2.69	2.42	3.66	3.21	2.85	2.57	3.87	3.38	3.01	2.71	4.07	3.56	3.17	2.85
10-1/2	3.42	2.99	2.66	2.39	3.63	3.18	2.83	2.54	3.85	3.37	2.99	2.69	4.06	3.55	3.16	2.84	4.28	3.74	3.33	2.99

LIME-TONS PER ACRE
Synco-Matic Mark II In "HI"

*Spread width is defined as the effective spread pattern width or the driving centers in the field.

Manual Hydraulic System I

When the L-2020 is equipped with the manual hydraulic system I, it is powered hydraulically and provides independent variable speed control for the spinners and for the conveyor, both by means of manually set priority flow control valves. On-Off conveyor control is accomplished by using an electric solenoid valve in parallel with the conveyor motors. The solenoid valve is controlled at the operator's discretion with an in-cab On-Off switch. When the switch is On and the current energizes the solenoid valve, the valve blocks the path around the motors causing the oil to flow through the motors thus driving the conveyor. In the Off switch position the solenoid valve is de-energized and opens the path around the motors causing them to stop.

The spinner speed is set by the operator for the material being spread. Once the operator becomes familiar with the material being spread and the spreader, a minimum of adjusting will be required. For additional information refer to the section on spinners under GENERAL OPERATING PROCEDURES.

With a system using the priority flow control valve for conveyor control, certain responsibilities fall upon the operator since the system is without automatic ground control. The conveyor control valve will maintain a constant flow of oil and consequently a constant speed of the conveyor motors after the hydraulic pump delivers the flow demanded by the valve setting. The conveyor control valve by-passes the excess oil which permits the operator to run his spreader vehicle from the minimum speed of the engine which will satisfy the valves' oil demand to some higher speed depending on the pump-PTO engine speed relationship. Systems are generally sized for gasoline engine speeds of 3000-3200 RPM, 1800-2000 RPM for low speed diesels and 2600-2800 RPM for the higher speed diesels. The desired flow at the above engine speeds is 25-28 GPM. For additional information concerning the pump and PTO selection, refer to the Pump-PTO Selection section under INSTALLATION INSTRUCTIONS.

Since the conveyor control valve maintains a constant flow of oil to the conveyor motors regardless of engine speed beyond the minimum flow-engine speed relationship called for by the valve, a constant ground speed must then be maintained to apply a constant amount of material per acre. During spreading the engine speed, transmission gear range, or the two-speed axle (if the unit is so equipped) must not change in order to maintain a constant delivery rate.

To determine the spread rate using this system, the two following formulas are useful:

1. $Y=\frac{(CRPM)\ (495)\ (G)\ (MW)\ (CFR)}{(SW)\ (MPH)}$ (For spread rate)

2. $MPH=\frac{(ERPM)\ (60)}{(TR)\ (RA)\ (TRM)}$ (For ground speed)

Where Y=Pounds applied per acre.
CRPM=Drag shaft speed in revolutions per minute at the conveyor

Manual Hydraulic System I-cont'd

control valve setting at the field spreading engine speed. (This must be determined before going to the field.)

G=Feedgate opening in inches.

MW=Material weight in pounds per cubic foot.

CFR=Conveyor delivery in cubic feet per drag shaft revolution per inch of gate opening. The CFR values for the various conveyors are as follows:

.192 for the #1, #2, #3 and #4 BOC conveyors.

.237 for the #5 Straight Belt conveyor.

.203 for the #6 Stainless Steel Flat Wire Belt conveyor.

SW=Swath width (driving centers) measured in feet.

MPH=Spreading speed in miles per hour.

ERPM=Engine spreading speed in revolutions per minute.

TR=Transmission ratio in spreading gear range.

RA=Rear axle ratio in spreading range.

TRM=Tire revolutions per mile of vehicle rear tires. See chart on pages 3 and 4 for specific values.

For best results, it is recommended that conveyor revolutions per minute be determined by running the spreader at field spreading engine speed after a suitable warm-up and counting the drag shaft revolutions per minute. As noted before, the conveyor speed is set by the operator with the conveyor control valve. Adjusting the conveyor speed in the range of 10-15 CRPM will provide a speed usable for a trial calculation. For example, if the following conditions existed with a spreader truck:

CRPM=10 RPM (Determined and pre-set as discussed above.)

G=2" gate opening.

MW=60 pounds per cubic foot

SW=50 foot swath.

ERPM=2800 RPM.

TR=2.09:1 in spreading transmission gear.

RA=9.77:1 (Spreading rear axle ratio.)

TRM=507 (For 10.00 x 20 tires.)

First, solve for spreading speed:

$$MPH=\frac{(ERPM)(60)}{(TR)(RA)(TRM)}$$

$$=\frac{(2800)(60)}{(2.09)(9.77)(507)}=16.23 \text{ MPH}$$

Using the formula to determine ground speed is preferred to using speedometer readings.

Solve for yield per acre using the above data:

$$Y=\frac{(CRPM)(495)(G)(MW)(CFR)}{(SW)(MPH)}$$

$$=\frac{(10)(495)(2)(60)(.237)}{(50)(16.23)}=156 \text{ \#/acre}$$

Manual Hydraulic System II

This hydraulic system can be described as an open loop system wherein application rate per acre remains constant as ground speed varies with engine speed within the system capabilities. Since it is an open loop system there are no provisions for sensing ground speed or conveyor errors. Accuracy is dependent upon proper selection of the hydraulic pump, operating within the proper oil viscosity range for the temperatures of the oil encountered during spreading, maintaining a constant swath width and not exceeding the system capabilities.

When the L-2020 is equipped with the manual hydraulic system II, it is powered hydraulically and provides independent variable speed control for the spinners by means of a manually set priority flow control valve. Two-speed variable conveyor speed control is available through the use of a selector valve which provides a speed range for fertilizer and one for lime. When set for fertilizer the selector valve directs the oil flow to a proportional divider valve which divides flow into 1/3 and 2/3's of the total flow with the 1/3 flow going to the dual motor conveyor gear case. The remainder of the flow is directed to the reservoir. When the selector valve is in the lime mode all of the system oil flow is directed to the dual motor gear case. The proportional flow divider is used since the ratio of the outlets remains constant. As the input flow varies the output varies through each port at a constant ratio but in proportion to the input. For example, if input to the valve was 15 GPM, the division would be 5 GPM and 10 GPM. If the inlet flow was increased to 21 GPM, the division would be 7 GPM and 14 GPM, respectively, thereby resulting in engine speed coordination which will give conveyor speed coordination with ground speed provided the transmission gear ratio and/or the rear axle ratio are not changed during the spreading operation.

Similarly, when the selector valve is in the high or lime mode, the proportional flow divider is not active but the conveyor speed is ground speed coordinated directly by the hydraulic pump and engine speed provided the transmission and rear axle ratio are not changed while spreading.

In-cab ON/OFF conveyor control is attained by use of an electric solenoid valve connected in parallel with the conveyor motors as described in System I. For satisfactory results, it is necessary to provide this system with the proper hydraulic oil flow. In order to do this the normal spreading engine speed must be determined and a pump must be selected to deliver 25 to 28 GPM at that engine speed. After the vehicle's transmission make and model is established, a PTO in the 45% to 85% range must be selected. The pump must be chosen next. Reference to the Pump-PTO Selection section on pages 6 and 7 will be helpful in making the selection.

To determine the spread rate using this system, the two following formulas are useful:

1. $Y = \frac{(CRPM)\ (495)\ (G)\ (MW)\ (CFR)}{(SW)\ (MPH)}$ (For Spread Rate)

2. $MPH = \frac{(ERPM)\ (60)}{(TR)\ (RA)\ (TRM)}$ (For Ground Speed)

Manual Hydraulic System II-cont'd

Where Y=Pounds applied per acre.
CRPM=Drag shaft speed at engine spreading speed in revolutions per minute.
G=Gate opening in inches.
MW=Material weight in pounds per cubic foot.
CFR=Conveyor delivery in cubic feet per drag shaft revolution per inch of gate opening. Values for various conveyor can be found on page 57.
SW=Swath width (driving centers) measured in feet.
MPH=Spreading speed in miles per hour.
ERPM=Engine spreading speed in revolutions per minute.
TR=Transmission ratio in spreading gear range.
RA=Rear axle ratio in spreading range.
TRM=Tire revolutions per mile of vehicle rear tires. Refer to chart on pages 3 and 4 for specific values.

For best results it is recommended that conveyor revolutions per minute be determined by running the spreader at field spreading engine speed after a suitable warm-up and counting the drag shaft revolutions per minute. Two or three readings should be taken to assure maximum accuracy. The selector valve should be pushed IN for fertilizer application and pulled OUT for lime and like materials.

Using the formula to determine ground speed is preferred to using speedometer readings.

The following example shows how the calculations are made:

CRPM=10RPM (with selector valve IN).
G=2" gate opening.
MW=60 pounds per cubic foot.
SW=50 foot swath.
ERPM=2800 RPM.
TR=2.09:1.
RA=9.77:1.
TRM=507 (for 10.00 x 20 tires).

Solve for spreading speed:

$$MPH=\frac{(2800)(60)}{(2.09)(9.77)(507)}=16.23 \text{ MPH}$$

Solve for yield per acre:

$$Y=\frac{(10)(495)(2)(60)(.237)}{(50)(16.23)}=156 \text{ \#/acre}$$

If the gate opening is needed to set the spreader for a given yield, the following formula may be used:

$$G=\frac{(Y)(SW)(MPH)}{(CRPM)(495)(MW)(CFR)}$$

If Y=312#/acre applied fertilizer and all other conditions remain as listed:

$$G=\frac{(312)(50)(16.23)}{(10)(495)(60)(.237)} \qquad G=4.0 \text{ inches}$$

GENERAL OPERATING PROCEDURES CONT'D

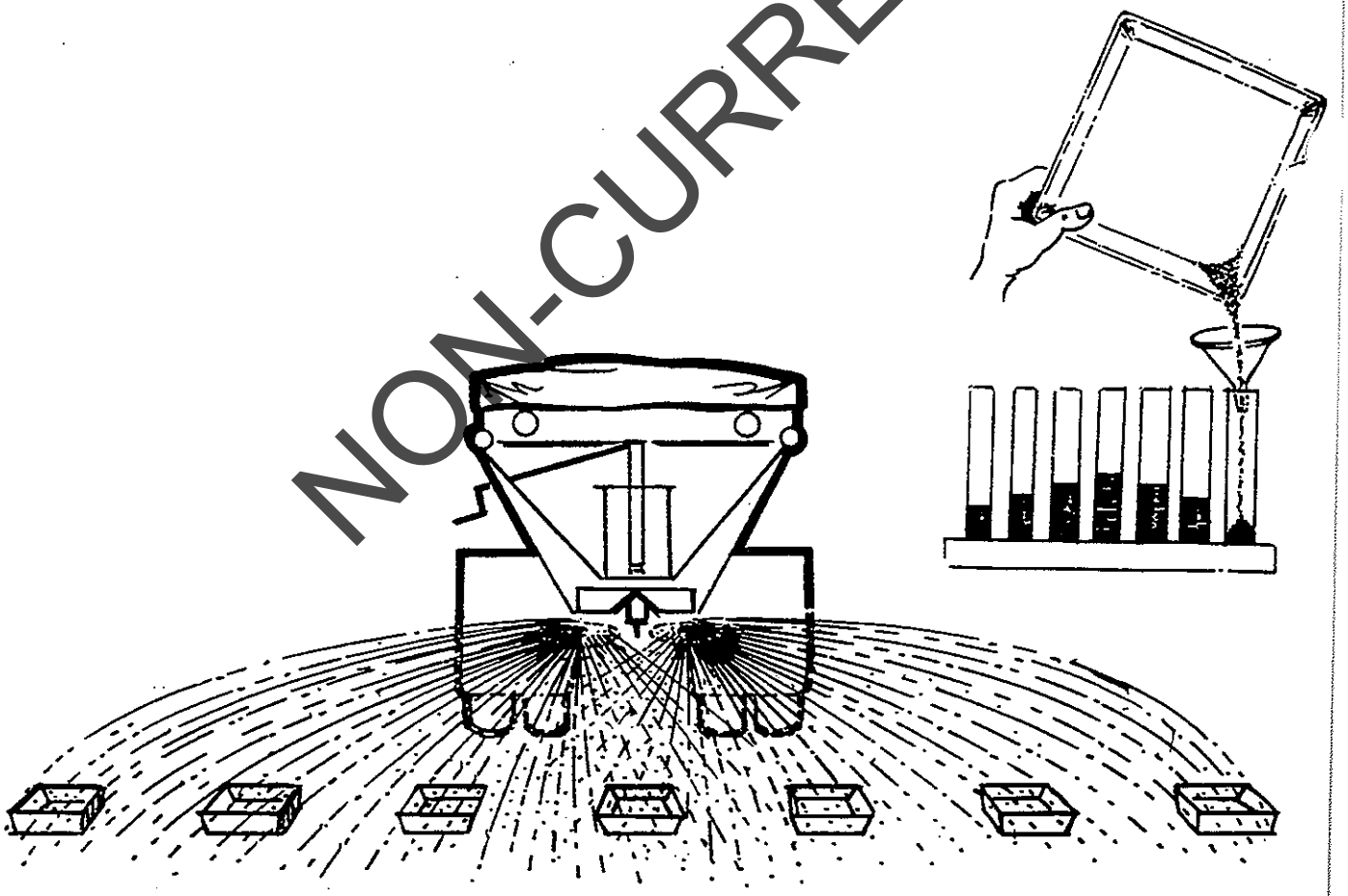
HOW TO CHECK YOUR SPREAD PATTERN:

It is highly recommended that a spread pattern test be performed for all products you handle.

We at NEW LEADER have developed a Spread Pattern Test Kit. This kit is available from all NEW LEADER DEALERS and can be ordered under part number 70889.

The kit contains all the necessary devices, along with instructions and data sheets which will allow you to perform the most professional of tests.

Once initial testing is completed, testing should be repeated at the beginning of every season, or any time repair work is performed on any component affecting spread patterns.



STANDARD TORQUES

CAPSCREW GRADE IDENTIFICATION - Capscrew heads are marked as follows:

SAE GRADE 2  NO MARKS

SAE GRADE 5  THREE MARKS - 120° APART

SAE GRADE 8  SIX MARKS - 60° APART

The following torques are for threads lubricated with oil.

CAPSCREW SIZE	POUNDS - FOOT - TORQUE					
	GRADE 2		GRADE 5		GRADE 8	
	NC	NF	NC	NF	NC	NF
1/4"	5-7	6-8	9-11	11-13	12-14	14-16
5/16"	11-13	13-15	18-20	21-23	25-27	28-30
3/8"	18-21	19-22	28-33	30-35	41-46	43-48
7/16"	30-33	32-35	44-49	50-55	69-74	72-77
1/2"	45-50	45-50	68-73	68-73	95-105	95-105
9/16"	60-65	60-65	95-105	95-105	130-140	130-140
5/8"	75-85	75-85	125-135	125-135	170-190	170-190
3/4"	105-115	105-115	210-230	210-230	290-310	290-310
7/8"	125-135	125-135	290-310	290-310	450-500	450-500
1"	140-150	140-150	380-410		600-630	

When replacing hardware on unit, use Grade 5 or Grade 8 capscrews and always use a plated washer between aluminum and capscrew head and/or nut.

TABLE OF WEIGHTS AND MEASURES

Dry Measure

2 pints = 1 quart
1 quart = 67.2 cu. in.
1 British bushel = 1.032 U.S. bushel
8 quarts = 1 peck
4 pecks = 1 bushel

Liquid Measure

4 gills = 1 pint
16 fluid ounces = 1 pint
2 pints = 1 quart
4 quarts = 1 gallon
1 British Imperial gallon = 1.2 U.S. gals.
1 cu. ft. of water contains 7.48 gallons and weighs 62.321 lbs.
1 gallon = 231 cubic inches
31-1/2 gallons = 1 barrel
2 barrels = 1 hogshead

Weight of:

1 gal. water = approx. 8.33 lbs.
1 gal. gasoline = approx. 6.1 lbs.
1 gal. L.P.G. = approx. 4.25 lbs.
1 gal. Diesel Fuel = approx. 7.0 lbs.

Linear Measure

1 mil. = 0.001 inch
12 inches = 1 foot
3 feet = 1 yard
5-1/2 yards = 1 rod
40 rods = 1 furlong
8 furlongs = 1 statute mile
5280 feet = 1 statute mile
3 miles = 1 league

Square Measure

1 circular mil. = 0.7854 square mils
1,000,000 sq. mils = 1 square inch
144 square inches = 1 sq. ft.
9 sq. ft. = 1 sq. yard
30-1/4 sq. yds. = 1 sq. rod
40 sq. rods = 1 rood
4 roods = 1 acre = 43560 sq. ft.
640 acres = 1 sq. mile

Surveyor's Measure

7.92 inches = 1 link
25 links = 1 rod
4 rods = 1 chain
10 sq. chains or 160 sq. rods = 1 acre
36 sq. miles (6 miles square) = 1 township
43560 sq. ft. = 1 acre
640 acres = 1 sq. mile

Cubic Measure

1 cu. cm. = .061 cu. in.
27 cu. ft. = 1 cu. yd.
40 cu. ft. = 1 ton (shipping)
231 cu. in. = 1 U.S. gallon
1728 cu. in. = 1 cu. ft.
128 cu. ft. = 1 cord (wood)
2150.42 cu. in. = 1 std. bushel
1 cu. ft. = 4/5 of a bushel

Linear Measure

1 millimeter = 0.03937 inches
1 centimeter = 0.3937 inches
1 decimeter = 3.937 in. = 0.328 ft.
1 meter = 39.37 in. = 1.0936 yards
1 dekameter = 1.9884 rods
1 kilometer = 0.62137 mile
1 inch = 2.54 centimeters
1 foot = 3.048 decimeters
1 rod = 9.5029 dekameters
1 yard = 0.9144 meter
1 mile = 1.6093 kilometers

Square Measure

1 sq. cm. = 0.1550 sq. in.
1 sq. decimeter = 0.1076 sq. ft.
1 sq. meter = 1.196 sq. yds.
1 hectare = 2.47 acres
1 sq. kilometer = 0.386 sq. miles
1 sq. in. = 6.452 sq. cm.
1 sq. ft. = 9.2903 sq. decimeters
1 sq. yd. = 0.8361 sq. meter
1 sq. mile = 2.59 sq. kilometers

Weights

1 gram = 0.03527 ounces
1 kilogram = 2.2046 lbs.
1 metric ton = 2205 lbs.
1 pound = 0.4536 kilograms
1 metric ton = 1.1023 short tons
1 ounce = 28.35 grams = 437.5 grains

HIGHWAY EQUIPMENT COMPANY
CONVERSION TABLES

CEDAR RAPIDS, IOWA

DECIMAL AND METRIC EQUIVALENTS

Inches			Millimeters	Inches			Millimeters
Fractions	Decimals	*Nom. Dec.		Fractions	Decimals	*Nom. Dec.	
1/64	.015625	.02	.397	33/64	.515625	.52	13.097
1/32	.03125	.03	.794	17/32	.53125	.53	13.494
3/64	.046875	.05	1.191	35/64	.546875	.55	13.891
1/16	.0625	.06	1.588	9/16	.5625	.56	14.288
5/64	.078125	.08	1.984	37/64	.578125	.58	14.684
3/32	.09375	.09	2.381	19/32	.59375	.59	15.081
7/64	.109375	.11	2.778	39/64	.609375	.61	15.478
1/8	.125	.12	3.175	5/8	.625	.62	15.875
9/64	.140625	.14	3.572	41/64	.640625	.64	16.272
5/32	.15625	.16	3.969	21/32	.65625	.66	16.669
11/64	.171875	.17	4.366	43/64	.671875	.67	17.066
3/16	.1875	.19	4.763	11/16	.6875	.69	17.463
13/64	.203125	.20	5.159	45/64	.703125	.70	17.859
7/32	.21875	.22	5.556	23/32	.71875	.72	18.256
15/64	.234375	.23	5.953	47/64	.734375	.73	18.653
1/4	.250	.25	6.350	3/4	.750	.75	19.050
17/64	.265625	.27	6.747	49/64	.765625	.77	19.447
9/32	.28125	.28	7.144	25/32	.78125	.78	19.844
19/64	.296875	.30	7.541	51/64	.796875	.80	20.241
5/16	.3125	.31	7.938	13/16	.8125	.81	20.638
21/64	.328125	.33	8.334	53/64	.828125	.83	21.034
11/32	.34375	.34	8.731	27/32	.84375	.84	21.431
23/64	.359375	.36	9.128	55/64	.859375	.86	21.828
3/8	.375	.38	9.525	7/8	.875	.88	22.225
25/64	.390625	.39	9.922	57/64	.890625	.89	22.622
13/32	.40625	.41	10.319	29/32	.90625	.91	23.019
27/64	.421875	.42	10.716	59/64	.921875	.92	23.416
7/16	.4375	.44	11.113	15/16	.9375	.94	23.813
29/64	.453125	.45	11.509	61/64	.953125	.95	24.209
15/32	.46875	.47	11.906	31/32	.96875	.97	24.606
31/64	.484375	.48	12.303	63/64	.984375	.98	25.003
1/2	.500	.50	12.700	1	1.000	1.00	25.400

VOLUME AND WEIGHT CONVERSION CONSTANTS — U.S. TO METRIC

Pints x .4732 = Liters
Quarts x .9463 = Liters
Gallons x 3.7853 = Liters
Pounds x .4536 = Kilograms
Cubic Yards x .7645 = Cubic Meters

LENGTH CONVERSION CONSTANTS — U.S. TO METRIC

Inches x 25.400 = Millimeters
Inches x .0254 = Meters
Feet x .3048 = Meters
Statute Miles x 1.60935 = Kilometers

*Nominal decimals are used in place of fractions of an inch, with exception of such items as bolts, screws, washers, tubing, wire, etc.

ALWAYS GIVE PART NAME, NUMBER AND MACHINE SERIAL NUMBER WHEN ORDERING PARTS

Printed in U.S.A.

INSTRUCTIONS FOR ORDERING PARTS

Use only genuine NEW LEADER parts and order from the **AUTHORIZED DEALER** in your area.

1. **Always give the pertinent model and serial number.**

2. **Give part name, part number and the quantity required.**

3. **Give the correct address to where the parts are to be shipped, and the carrier if there is a preference.**

Unless claims for shortages or errors are made immediately upon receipt of goods they will not be considered. Any part returns should be directed through the dealer from which they were purchased.

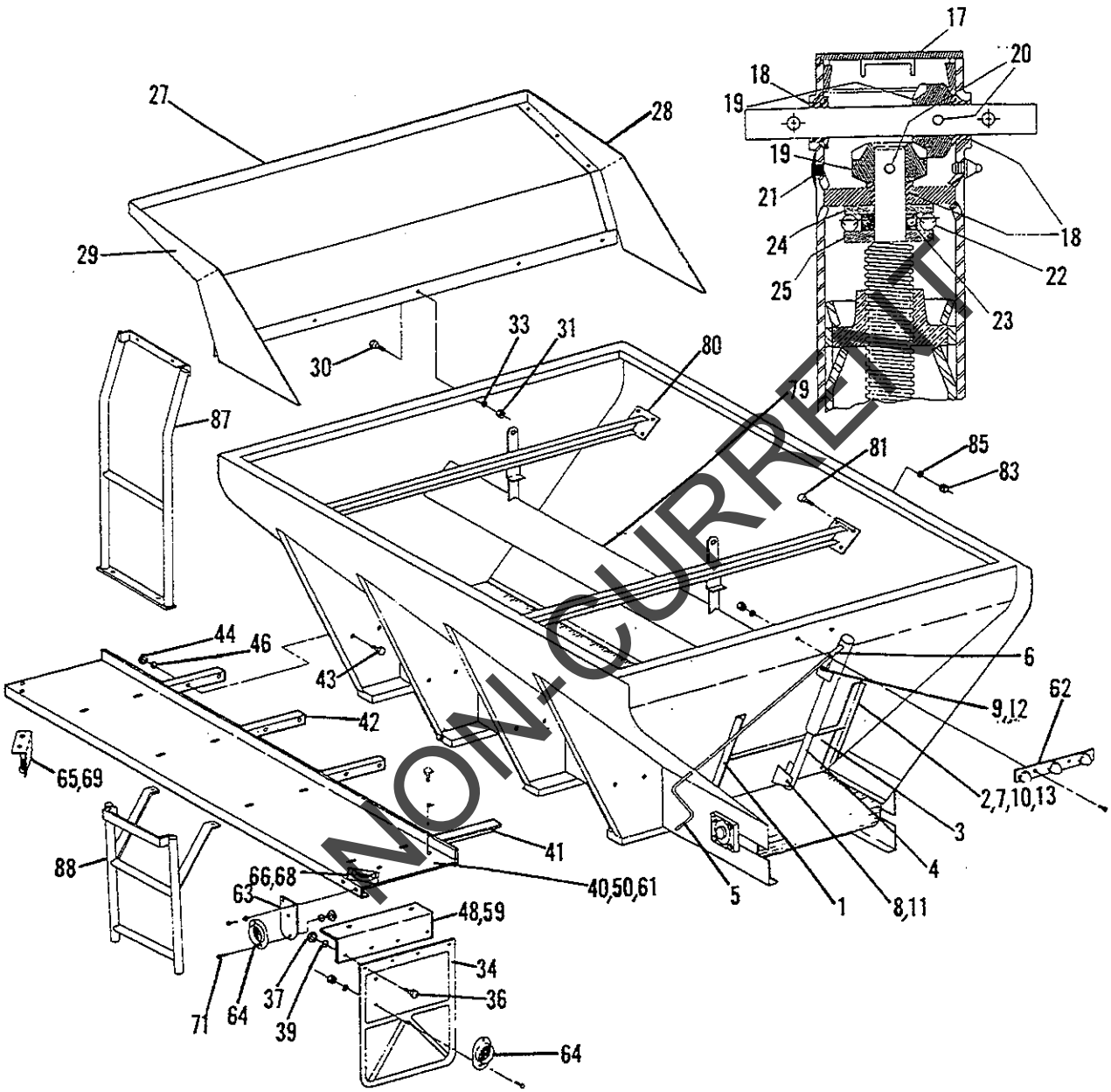
When broken goods are received, a full description of the damage should be made by the carrier agent on the freight bill. If this description is insisted upon, full damage can always be collected from the transportation company.

No responsibility is assumed for delay or damage to merchandise while in transit. Our responsibility ceases upon delivery of shipment to the transportation company from whom a receipt is received showing that shipment was in good condition when delivered to them, therefore, claims (if any) should be filed with the transportation company and not with Highway Equipment Company.

If your claims are not being handled (by the transportation company) to your satisfaction, please call the Parts Manager at Highway Equipment Company (319 363-8281) for assistance.

ASSEMBLY - GROUPS

FEEDGATE & JACK, CAB PROTECTOR, MUDFLAPS, FENDERS , LIGHTS, INVERTED VEE, LADDER



ASSEMBLY - FEEDGATE & JACK

ITEM	PART NO.		DESCRIPTION	QTY.
1	2884		Slide - Feedgate, L.H.	1
2	2885		Slide - Feedgate, R.H.	1
3	13812		Assembly - Feedgate Consisting of:	1
		13813	Weldment - Feedgate	1
		13816	Belt - Sealer	1
		7084	Retainer - Sealer	1
		20619	Screw - Machine	5
		20642	Nut - Hex	5
		20710	Washer - Lock	5
	38755		Assembly - Feedgate (409 Stainless Steel) Consisting of:	1
		38757	Weldment - Feedgate	1
		13816	Belt - Sealer	1
		38756	Retainer-Sealer	1
		36405	Screw - Machine	5
		36412	Nut - Hex	5
		36418	Washer - Lock	5
	36387		Assembly - Feedgate (304 Stainless Steel) Consisting of:	1
		36389	Weldment - Feedgate	1
		13816	Belt - Sealer	1
		36388	Retainer - Sealer	1
		36405	Screw - Machine	5
		36412	Nut - Hex	5
		36418	Washer - Lock	5
4	40735		Assembly - Jack	1
5	23799		Handle	1
6	26986		Pin - Roll	1
7	20005		Screw - Cap	6
	36395		Screw - Cap (Stainless Steel)	6
8	20074		Screw - Cap	1
	36296		Screw - Cap (Stainless Steel)	1
9	20135		Screw - Cap	1
	36297		Screw - Cap (Stainless Steel)	1
10	20642		Nut - Hex	6
	36412		Nut - Hex (Stainless Steel)	6
11	20678		Nut - Lock	1
12	20680		Nut - Lock	1
13	20710		Washer - Lock	6
	36418		Washer - Lock (Stainless Steel	6
14	*13898		Indicator - Feedgate	1
	*36392		Indicator - Feedgate (Stainless Steel)	1

* Not Shown

ALWAYS GIVE PART NAME. NUMBER AND MACHINE SERIAL NUMBER WHEN ORDERING PARTS

Printed in U.S.A.

ASSEMBLY - FEEDGATE & JACK CONT'D

ITEM	PART NO.	DESCRIPTION	QTY.
15	40734	Kit-Repair, Jack Assembly (Consists of Items 6, 16-26)	1
16	*40707	Cap-Tube, Lower	1
17	40708	Cap-Tube, Upper	1
18	40709	Bearing-Flange	3
19	40710	Gear-Bevel	2
20	40725	Pin-Roll	2
21	40726	Grommet	1
22	40727	Bearing	1
23	40731	Spacer	1
24	40732	Washer-Thrust	1
25	40733	Washer-Support	1
26	40705	"U" Joint	1
	71486	Shaft	1

GROUP - CAB PROTECTOR

	31786	Assembly Group - Cab Protector 57" Cab Height	
	39811	Assembly Group - Cab Protector 63" Cab Height	
	39817	Assembly Group - Cab Protector 69" Cab Height	
27	31787	Panel - Shield 57" Cab Height	1
	39812	Panel - Shield 63" Cab Height	1
	39818	Panel - Shield 69" Cab Height	1
28	31788	Weldment - R.H. Support 57" Cab Height	1
	39813	Weldment - R.H. Support 63" Cab Height	1
	39819	Weldment - R.H. Support 69" Cab Height	1
29	31789	Weldment - L.H. Support 57" Cab Height	1
	39815	Weldment - L.H. Support 63" Cab Height	1
	39821	Weldment - L.H. Support 69" Cab Height	1
30	20067	Screw - Cap 3/8-16 UNC x 1	A.R.
31	20644	Nut - Hex 3/8-16 UNC	A.R.
32	20693	Washer - Flat 3/8	A.R.
33	20712	Washer - Lock 3/8	A.R.

GROUP - MUDFLAPS

	46564	Assembly Group - Mudflaps	
34	7793	Mudflap - NEW LEADER	2
35	*36844	Rod - Mudflap	2
36	20067	Screw - Cap 3/8-16 UNC x 1	8
37	20644	Nut - Hex 3/8-16 UNC	8
38	20693	Washer - Flat 3/8	8
39	20712	Washer - Lock	8

* Not Shown

GROUP-FENDERS

ITEM	PART NO.	DESCRIPTION	QTY
	73137	Assembly Group-Fenders (10' Unit)	
	73138	Assembly Group-Fenders (11' Unit)	
	73139	Assembly Group-Fenders (12' Unit)	
	73140	Assembly Group-Fenders (13' Unit)	
	73141	Assembly Group-Fenders (14' Unit)	
	73142	Assembly Group-Fenders (15' Unit)	
	73143	Assembly Group-Fenders (16' Unit)	
40	73146	Fender (10' Unit)	2
	73147	Fender (11' Unit)	2
	73148	Fender (12' Unit)	2
	74149	Fender (13' Unit)	2
	73150	Fender (14' Unit)	2
	73151	Fender (15' Unit)	2
	73152	Fender (16' Unit)	2
41	46432	Angle-Mounting, RH	A.R.
42	46433	Angle-Mounting, LH	A.R.
43	20318	Bolt-Carriage, 3/8-16 UNC x 1	A.R.
44	20644	Nut-Hex, 3/8-16 UNC	A.R.
45	20693	Washer-Flat, 3/8	A.R.
46	20712	Washer-Lock, 3/8	A.R.
47	46434	Panel-Mudflap Mounting, RH	1
48	46435	Panel-Mudflap Mounting, LH	1

GROUP-RAISED FENDERS

	73181	Assembly Group-Raised Fenders (10' Unit)
	73182	Assembly Group-Raised Fenders (11' Unit)
	73183	Assembly Group-Raised Fenders (12' Unit)

NOTE: The above groups include items 43-48.

	73262	Assembly Group-9" Wider Raised Fenders (10' Unit)
	73263	Assembly Group-9" Wider Raised Fenders (11' Unit)
	73264	Assembly Group-9" Wider Raised Fenders (12' Unit)

NOTE: The above groups include items 43-46.

49	73146	Fender-RH (10' Unit) -Raised	1
	73147	Fender-RH (11' Unit) -Raised	1
	73148	Fender-RH (12' Unit) -Raised	1
	73149	Fender-RH (13' Unit) -Raised	1
	73227	Fender-RH, 9" Wider (10' Unit)	1
	73228	Fender-RH, 9" Wider (11' Unit)	1
	73229	Fender-RH, 9" Wider (12' Unit)	1
	73230	Fender-RH, 9" Wider (13' Unit)	1
50	73185	Fender-LH (10' Unit) -Raised	1
	73186	Fender-LH (11' Unit) -Raised	1
	73187	Fender-LH (12' Unit) -Raised	1
	73188	Fender-LH (13' Unit) -Raised	1
	73266	Fender-LH, 9" Wider (10' Unit)	1

RAISED FENDER GROUP-CONT'D

ITEM	PART NO.	DESCRIPTION	QTY
50	73267	Fender-LH, 9" Wider (11' Unit)	1
	73268	Fender-LH, 9" Wider (12' Unit)	1
	73269	Fender-LH, 9" Wider (13' Unit)	1
51	46445	Angle-Mounting, RH	A.R.
52	46446	Angle-Mounting, LH	A.R.
53	*46447	Angle-Mounting, LH	1
54	*46448	Angle-Mounting, LH	1
55	55238	Angle-Mounting, RH 9" Wider	A.R.
56	55239	Angle-Mounting, LH 9" Wider	A.R.
57	*55240	Agnle-Mounting, LH 9" Wider	1
58	55242	Panel-Mudflap Mounting, RH 9" Wider	1
59	55243	Panel-Mudflap Mounting, LH 9" Wider	1

FENDER GROUP-FOR AUGER DISCHARGE

73161	Assembly Group-Fenders (10' Unit)	
73162	Assembly Group-Fenders (11' Unit)	
73163	Assembly Group-Fenders (12' Unit)	
73164	Assembly Group-Fenders (13' Unit)	
73165	Assembly Group-Fenders (14' Unit)	
73166	Assembly Group-Fenders (15' Unit)	
73167	Assembly Group-Fenders (16' Unit)	

NOTE: The above groups include items 43-46.

60	73146	Fender-RH (10' Unit)	1
	73147	Fender-RH (11' Unit)	1
	73148	Fender-RH (12' Unit)	1
	73149	Fender-RH (13' Unit)	1
	73150	Fender-RH (14' Unit)	1
	73151	Fender-RH (15' Unit)	1
	73152	Fender-RH (16' Unit)	1
61	73168	Fender-LH (10' Unit)	1
	73169	Fender-LH (11' Unit)	1
	73170	Fender-LH (12' Unit)	1
	73171	Fender-LH (13' Unit)	1
	73172	Fender-LH (14' Unit)	1
	73173	Fender-LH (15' Unit)	1
	73174	Fender-LH (16' Unit)	1

LIGHT GROUP

	39830	Kit-Lights	
62	6114	Lamp-Cluster, Red	1
63	3824	Mount-Belt, Reflector	4
64	6107	Reflector-Red	4

*-Not Shown
A.R.-As Required

GROUP - LIGHTS CONT'D

ITEM	PART NO.	DESCRIPTION	QTY.
65	6108	Clearance Lamp - Amber	2
66	6110	Clearance Lamp - Red	2
67	*21580-600	Wire - 14 Ga. (Black)	1
68	3775	Bracket - Clearance Lamp	2
69	38611	Bracket - Clearance Lamp	2
70	20003	Capscrew - 1/4-20 UNC x 3/4	24
71	20572	Screw - Machine, 3/16UNC x 3/4	33
72	20641	Nut - Hex, 3/16UNC	33
73	20642	Nut - Hex, 1/4-20 UNC	24
74	20691	Washer - 1/4	24
75	20709	Washer - Lock	33
76	20710	Washer - Lock	8
77	6198	Clip - Wire	21
78	21986	Grommet - Rubber, 3/16	10

GROUP - INVERTED VEE

	54934	Assembly - Inverted Vee (10' Unit)	
	54935	Assembly - Inverted Vee (11' & 12' Unit)	
	54936	Assembly - Inverted Vee (13' & 14' Unit)	
	54937	Assembly - Inverted Vee (15' & 16' Unit)	
	38760	Assembly - Inverted Vee 409 S.S. (10' Unit)	
	38761	Assembly - Inverted Vee 409 S.S. (11' & 12' Unit)	
	38762	Assembly - Inverted Vee 409 S.S. (13' & 14' Unit)	
	46982	Assembly - Inverted Vee 409 S.S. (15' & 16' Unit)	
	36488	Assembly - Inverted Vee 304 S.S. (10' Unit)	
	36489	Assembly - Inverted Vee 304 S.S. (11' & 12' Unit)	
	36490	Assembly - Inverted Vee 304 S.S. (13' & 14' Unit)	
	54183	Assembly - Inverted Vee 304 S.S. (15' & 16' Unit)	
79	54938	Weldment - Adjustable Vee (10' Unit)	1
	54939	Weldment - Adjustable Vee (11' & 12' Unit)	1
	54940	Weldment - Adjustable Vee (13' & 14' Unit)	1
	54941	Weldment - Adjustable Vee (15' & 16' Unit)	1
	38763	Weldment - Adjustable Vee 409 Stainless Stl. (10' Unit)	1
	38770	Weldment - Adjustable Vee 409 Stainless Stl. (11' & 12' Unit)	1
	38772	Weldment - Adjustable Vee 409 Stainless Stl. (13' & 14' Unit)	1
	46983	Weldment - Adjustable Vee 409 Stainless Stl. (15' & 16' Unit)	1
	36491	Weldment - Adjustable Vee 304 Stainless Stl. (10' Unit)	1

* - Not Shown

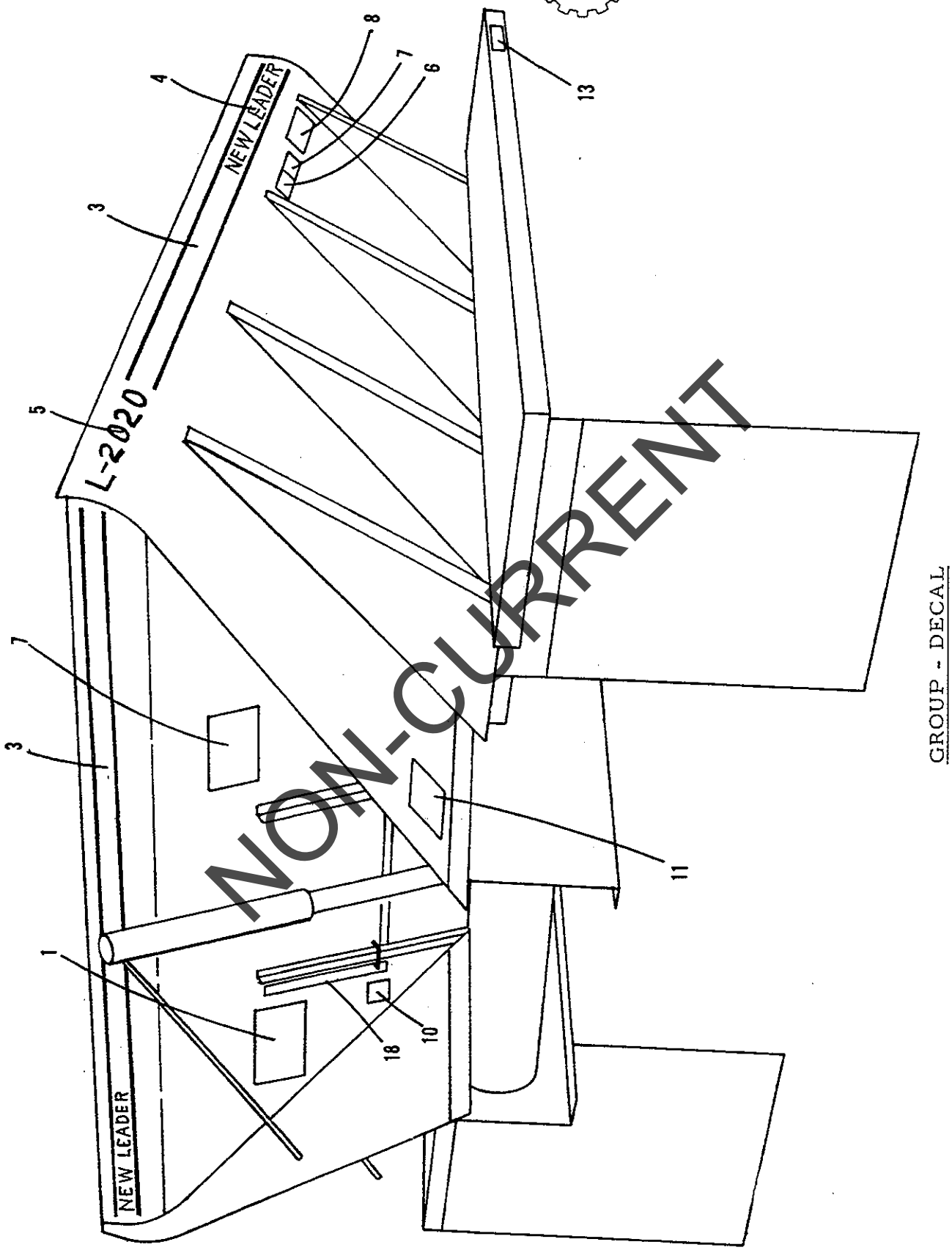
GROUP - INVERTED VEE CONT'D

ITEM	PART NO.	DESCRIPTION	QTY.
	36492	Weldment - Adjustable Vee 304 Stainless Stl. (11' & 12' Unit)	1
	36493	Weldment - Adjustable Vee 304 Stainless Stl. (13' & 14' Unit)	1
	54187	Weldment - Adjustable Vee 304 Stainless Stl. (15' & 16' Unit)	1
80	19686	Weldment - Hanger	A.R.
	38766	Weldment - Hanger (409 Stainless Stl.)	A.R.
	36494	Weldment - Hanger (304 Stainless Stl.)	A.R.
81	20067	Capscrew - 3/8-16 UNC x 1	A.R.
	36398	Capscrew - 3/8-16 UNC x 1 (Stainless Stl.)	A.R.
82	*20128	Capscrew - 1/2-13 UNC x 1-1/4	A.R.
	*36402	Capscrew - 1/2-13 UNC x 1-1/4 (S.S.)	A.R.
83	20644	Nut - Hex, 3/8-16 UNC	A.R.
	36414	Nut - Hex, 3/8-16 UNC (Stainless Stl.)	A.R.
84	*20646	Nut - Hex, 1/2-13 UNC	A.R.
	*36416	Nut - Hex, 1/2-13 UNC (Stainless Stl.)	A.R.
85	20712	Washer - Lock, 3/8	A.R.
	36420	Washer - Lock, 3/8 (Stainless Stl.)	A.R.
86	*20714	Washer - Lock, 1/2	A.R.
	*36422	Washer - Lock, 1/2 (Stainless Stl.)	A.R.

GROUP - LADDER

	46458	Group - Ladder	
	46460	Group - Ladder for Units w/Raised Fenders	
	53955	Group - Ladder for 96" wide Units	
	53951	Group - Ladder for 96" wide Units w/Raised Fenders	
87	46451	Ladder - Upper	1
	46461	Ladder - Upper for Units w/Raised Fenders	1
	53956	Ladder - Upper for 96" wide Units	1
	53952	Ladder - Upper for 96" wide Units w/Raised Fenders	1
88	46452	Ladder - Lower	1
	46464	Ladder - Lower for Units w/Raised Fenders	1
89	*46459	Hardware Group	1
90	46569	Hooks-Tarp	A.R.

*-Not Shown
A.R.-As Required



GROUP - DECAL

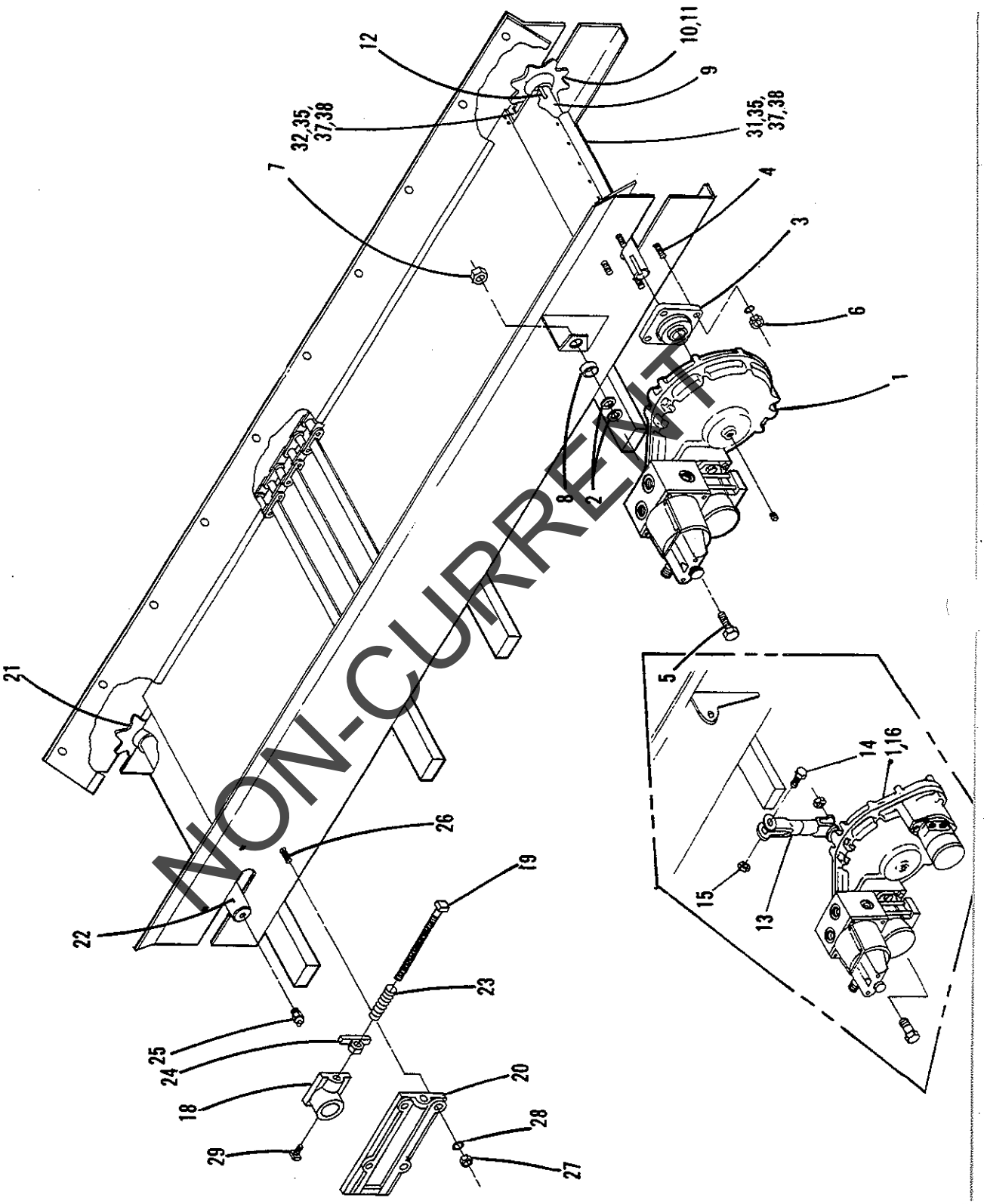
PAINT & DECAL GROUP

ITEM	PART NO.	DESCRIPTION	QTY
1	71526	Decal-Important, Adjust Spinner (On Divider)	1
2	*71527	Decal-Important, Adjust Spinner	1
3	58935-470	Decal-Scotchcal White	1
	58935-470	Decal-Scotchcal Red	1
4	58937	Decal-New Leader White	3
5	58941	Decal-L-2020, White	2
	58942	Decal-L-2020, Red	2
6	150034	Decal-Caution, Improper Operation	1
7	321	Decal-Caution, Material To Be Spread	1
8	364	Decal-Warning, Stay Out of Box	2
9	368	Decal-Flying Material	1
10	6541	Decal-Oil Lube Chart	1
11	21476	Decal-Important, Conveyor Chain Life (Use with Chain Conveyor)	1
12	21477	Decal-Important, Spreader Hopper Life (Use with #5 Straight Belt)	1
13	39200	Decal-Fender Capacity	2
14	*55630	Decal-Warning, No Step	2
15	*55631	Decal-Warning, Guard is For Your Protection	1
16	* 8664	Decal-Caution, Keep Valve Open	1
17	* 8665	Decal-Caution, Hydraulic Oil Only	1
18	23769	Decal-Feedgate Slide Scale	1
	31736	Pain-Touch Up, New Leader Red	A.R.
19	*39379	Decal-Filter	1
20	* 308	Decal-Synco Matic	1
	58938	Decal-New Leader - Red	1

*-Not Shown
A.R.-As Required

ASSEMBLY GROUPS

GROUP CONVEYOR DRIVE, GROUP CONVEYOR IDLER,



ASSEMBLY GROUP-CONVEYOR DRIVE

ITEM	PART NO.	DESCRIPTION	QTY
1	See Chart	Assembly-Gear Case w/Valve & Motor	1
2	2716	Washer-Flat	A.R.
3	6465	Bearing-Flange, 2"	2
4	20262	Screw-Cap	8
5	20205	Screw-Cap	1
6	20648	Nut-Hex	8
7	20649	Nut-Hex	1
8	36678	Spacer	1
9	39582	Shaft-Drive (For Single Pinion Gear Case)	1
	55999	Shaft-Drive (For Twin Pinion Gear Case)	1
10	27275	Sprocket-Drive	2
11	20748	Screw-Allen Head	2
12	6131	Key-Square	2
13	38590	Weldment-Torque Arm	1
14	20131	Screw-Cap	2
15	20680	Nut-Lock	2
16	38930	Screw-Allen Head	1
17	44495	Key-Square (Included w/Item 1)	A.R.

ASSEMBLY GROUP-CONVEYOR IDLER

18	2121	Bearing-Idler	2
19	2124	Bolt-Machine	2
20	2126	Bracket-Bearing	2
21	2130	Sprocket-Idler	2
22	2134	Shaft-Idler	1
23	2704	Spring-Take Up	2
24	3908	Weldment-Tightener Nut	2
25	6071	Zerk-Grease	2
26	20294	Bolt-Carriage	8
27	20643	Nut-Hex	8
28	20711	Washer-Lock	8
29	20781	Screw-Set	2
30	*20836	Pin-Cotter	2

SEALER AND WIPER BELTS

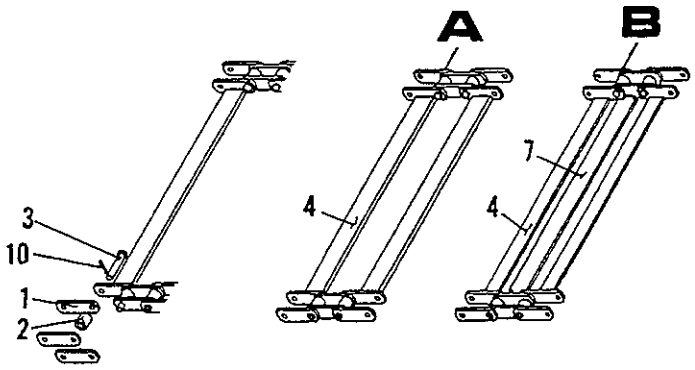
31	3735	Belt-Rear Wiper	1
32	33207	Belt-Sealer	2
33	*39426	Belt-Front Wiper	1
34	*39408	Retainer-Front Wiper Belt	1
35	20619	Screw-Machine	10
36	*20583	Screw-Machine	5
37	20642	Nut-Hex	15
38	20692	Washer-Flat	10
39	*20710	Washer-Lock	5

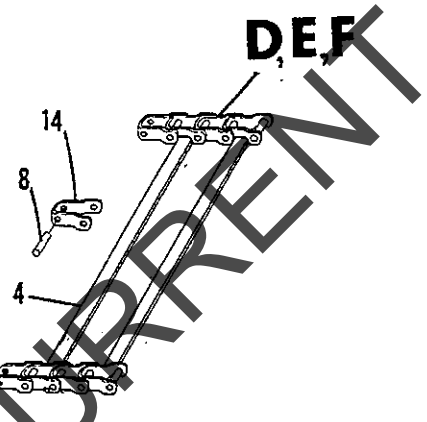
*-Not Shown

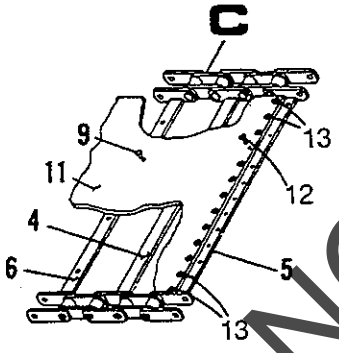
CHART

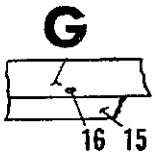
PART NO.	TYPE	MOTOR SIZE	PRESSURE
57301	Manual-Single Pinion	1.5"	
55363	Mark II-Single Pinion	2"	
57302	Manual-Single Pinion	2"	
57304	Manual-Twin Pinion	1.5"	
57305	Manual-Twin Pinion	2"	
57812	Mark II-Twin Pinion	1"	2000 PSI
70395	Mark II-Twin Pinion	1.5"	1500 PSI
70830	Mark II-Single Pinion	1.5"	2000 PSI
70831	Mark II-Single Pinion	2"	2000 PSI
71345	Mark II-Twin Pinion	1.5"	2000 PSI
71346	Mark II-Twin Pinion	2"	1500 PSI
71347	Mark II-Twin Pinion	2"	2000 PSI
55973	Mark II-Twin Pinion	1"	1500 PSI

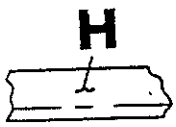
ASSEMBLY GROUP - CONVEYOR CHAIN











ASSEMBLY GROUP-CONVEYOR CHAIN

ITEM	PART NO.	DESCRIPTION	QTY
A		Assembly-Conveyor Chain, #2 for:	
	2026	10' Unit	1
	7128	11' Unit	1
	12646	12' Unit	1
	7129	13' Unit	1
	12647	14' Unit	1
	7130	15' Unit	1
	46292	16' Unit	1
B		Assembly-Conveyor Chain, #3 for:	
	35153	10' Unit	1
	35154	11' Unit	1
	35155	12' Unit	1
	35156	13' Unit	1
	35157	14' Unit	1
	35158	15' Unit	1
	35159	16' Unit	1
C		Assembly-Conveyor Chain, #4 for:	
	19982	10' Unit	1
	19983	11' Unit	1
	12645	12' Unit	1
	19984	13' Unit	1
	48508	14' Unit	1
	19985	15' Unit	1
	46294	16' Unit	1
D		Assembly-Conveyor Chain, #2 Pintle for:	
	12993	10' Unit	1
	12994	11' Unit	1
	12995	12' Unit	1
	12990	13' Unit	1
	39605	14' Unit	1
	12996	15' Unit	1
	46598	16' Unit	1
E		Assembly-Conveyor Chain, #4 Pintle for:	
	70460	10' Unit	1
	70461	11' Unit	1
	70462	12' Unit	1
	70463	13' Unit	1
	70464	14' Unit	1
	70465	15' Unit	1
	70466	16' Unit	1
F		Assembly-Conveyor Chain #3 Pintle for:	
	58910	10' Unit	1
	58911	11' Unit	1
	58912	12' Unit	1
	58913	13' Unit	1

ASSEMBLY GROUP-CONVEYOR CHAIN, CONT'D

ITEM	PART NO.	DESCRIPTION	QTY
F cont'd		Assembly-Conveyor Chain, #3 Pintle for:	
	58914	14' Unit	1
	58915	15' Unit	1
	58916	16' Unit	1
1	2127	Link-Side	A.R.
2	29919	Roller-Chain	A.R.
3	6119	Pin-Shear	2
	33720	Pin-Chain	A.R.
4	7142	Weldment-Cross Bar, Roller	A.R.
	13018	Weldment-Cross Bar, #2 Pintle	A.R.
	13018	Weldment-Cross Bar, #3 Pintle	A.R.
5	7136	Weldment-Splicer Bar, #4 Roller	1
	70755	Weldment-Splicer Bar, #4 Pintle	1
6	19986	Weldment-Cross Bar w/Rivet Holes, #4 Roller	A.R.
	70756	Weldment-Cross Bar w/Rivet Holes, #4 Pintle	A.R.
7	33721	Weldment-Cross Bar, Long (#3 Roller)	A.R.
8	21118	Pin-Connecting (#2, #3, #4 Pintle)	A.R.
9	6245	Rivet	A.R.
10	20816	Pin-Cotter	A.R.
11		Belt-Conveyor (Specify Body Length)	1
12	20624	Screw-Machine, Truss Head	32
13	20617	Screw-Machine, Flat Head	4
14	21120	Link-Connecting (#2 or #4 Pintle)	A.R.
	21119	Link-Connecting (#3 Pintle)	A.R.

GROUP-CHAIN AND BELT SHIELD

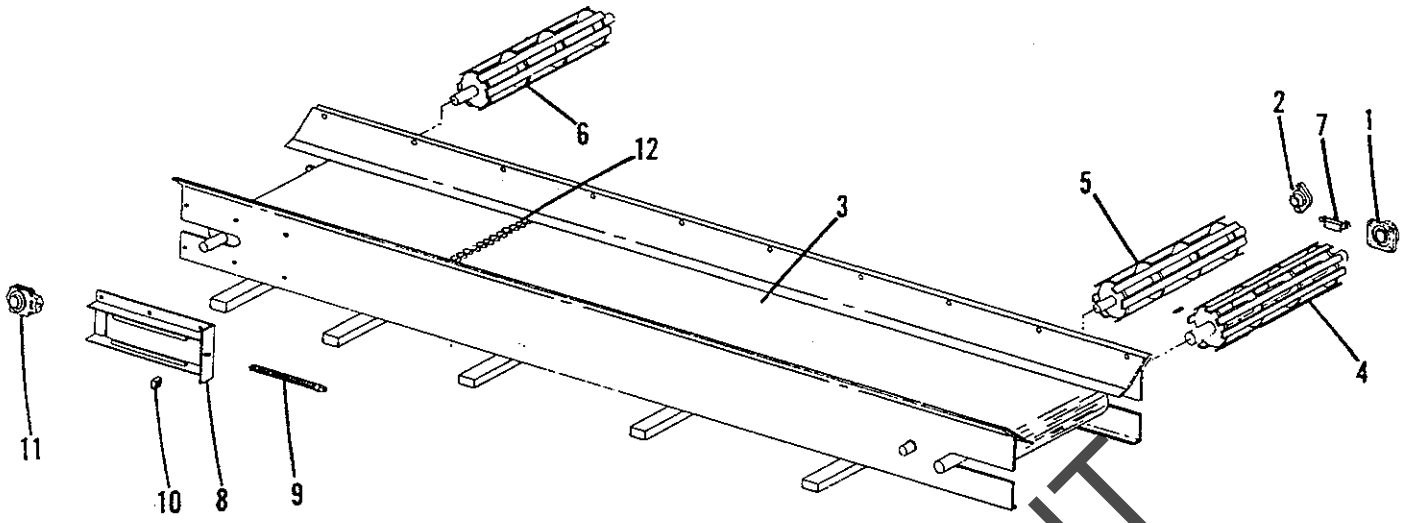
G		Assembly-Chain Shield, #4 Chain Only for:	
	37367	10' Unit	1
	43816	10' 409 S.S. Unit	1
	54143	10' 304 S.S. Unit	1
	37368	11' Unit	1
	43818	11' 409 S.S. Unit	1
	54144	11' 304 S.S. Unit	1
	37369	12' Unit	1
	43820	12' 409 S.S. Unit	1
	54145	12' 304 S.S. Unit	1
	37370	13' Unit	1
	43824	13' 409 S.S. Unit	1
	54146	13' 304 S.S. Unit	1
	39625	14' Unit	1
	43827	14' 409 S.S. Unit	1
	54147	14' 304 S.S. Unit	1
	37371	15' Unit	1
	46993	15' 409 S.S. Unit	1
	54148	15' 304 S.S. Unit	1
	46302	16' Unit	1
	46994	16' 409 S.S. Unit	1
	54149	16' 304 S.S. Unit	1

A.R.-As Required

GROUP-CHAIN AND BELT SHIELD, CONT'D

ITEM	PART NO.	DESCRIPTION	QTY
H		Chain & Belt Shield for:	
	39615	10' Unit	1
	43697	10' 409 S.S. Unit	1
	54119	10' 304 S.S. Unit	1
	39616	11' Unit	1
	43698	11' 409 S.S. Unit	1
	54120	11' 304 S.S. Unit	1
	39617	12' Unit	1
	43699	12' 409 S.S. Unit	1
	54121	12' 304 S.S. Unit	1
	39618	13' Unit	1
	43700	13' 409 S.S. Unit	1
	54122	13' 304 S.S. Unit	1
	39619	14' Unit	1
	43701	14' 409 S.S. Unit	1
	54123	14' 304 S.S. Unit	1
	46297	15' Unit	1
	46987	15' 409 S.S. Unit	1
	54124	15' 304 S.S. Unit	1
	46298	16' Unit	1
	46988	16' 409 S.S. Unit	1
	54125	16' 304 S.S. Unit	1
15		Belt-Sealer for:	
	7687-132	10' Unit	1
	7687-144	11' Unit	1
	7687-156	12' Unit	1
	7687-168	13' Unit	1
	7687-180	14' Unit	1
	7687-192	15' Unit	1
	7687-204	16' Unit	1
16	6245	Rivet	A.R.
17	*20318	Bolt-Carriage, 3/8-16 UNC x 1	A.R.
	*36408	Bolt-Carriage, 3/8-16 UNC x 1 S.S.	A.R.
18	*20644	Nut-Hex, 3/8-16 UNC	A.R.
	*36414	Nut-Hex, 3/8-16 UNC S.S.	A.R.
19	*20712	Washer-Lock, 3/8	A.R.
	*36420	Washer-Lock, 3/8 S.S.	A.R.

*-Not Shown
A.R.-As Required



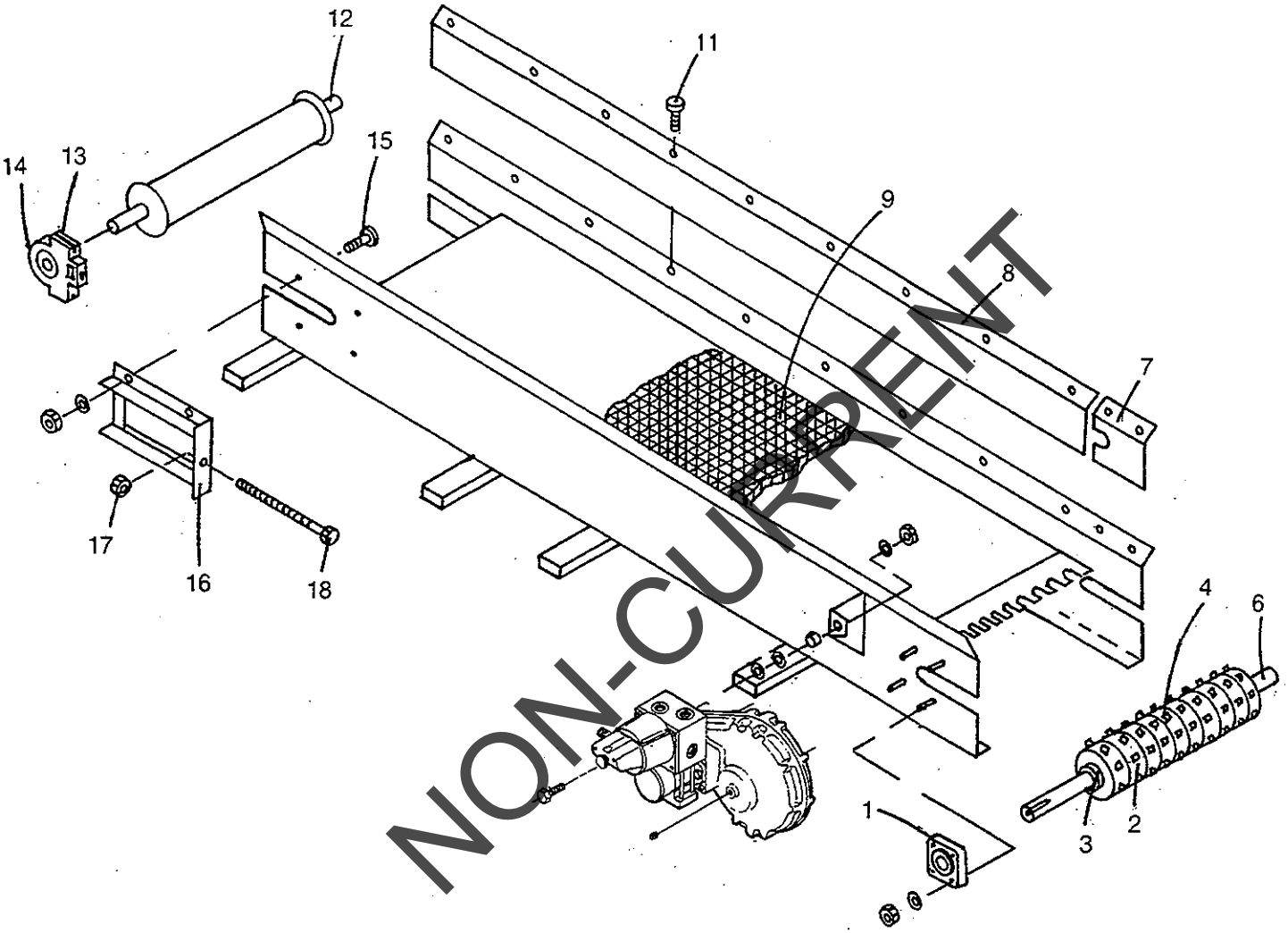
ASSEMBLY GROUP - #5 BOTTOM

ITEM	PART NO.	DESCRIPTION	QTY.
	53982	Assembly - #5 Belt (10' Unit)	
	53983	Assembly - #5 Belt (11' Unit)	
	53984	Assembly - #5 Belt (12' Unit)	
	53985	Assembly - #5 Belt (13' Unit)	
	NOTE:	The above assemblies include Item 3 & 12.	
1	6465	Bearing	2
2	32468	Bearing	2
3	39597	Belt Only (10' Unit)	1
	39598	Belt Only (11' Unit)	1
	39599	Belt Only (12' Unit)	1
	39600	Belt Only (13' Unit)	1
4	39572	Pulley - Drive	1
	43793	Pulley - Drive (Stainless Steel)	1
5	33875	Pulley - Snub	1
	36366	Pulley - Snub (Stainless Steel)	1
6	33878	Pulley - Idler	1
	36368	Pulley - Idler (Stainless Steel)	1
7	20800	Screw - Adjusting	2
	36372	Screw - Adjusting (Stainless Steel)	2
	40349	Assembly - Take-up	2
	36507	Assembly - Take-up (Stainless Steel)	2
	NOTE:	The above assemblies include Items 8 - 11.	
8	7895	Bracket	1
9	30726	Screw - Adjusting	1
	36508	Screw - Adjusting (Stainless Steel)	1
10	20260	Nut	1
	36509	Nut (Stainless Steel)	1
11	22511	Bearing	1

ASSEMBLY GROUP - #5 BOTTOM CONT'D

ITEM	PART NO.	DESCRIPTION	QTY.
12	53995	Assembly Group - Belt Splicing Kit Consisting of:	1
	53992	Fastener - Hinge 1 Bolt	4
	53993	Fastener - Hinge 2 Bolt	2
	53994	Fastener - Hinge 3 Bolt	4
	33884-23	Tape - Belt Stiffener	2
	33884-17	Tape - Belt Stiffener	2
	39603	Pin - Hinge	1
	39604-23	Tube - Sealer	2

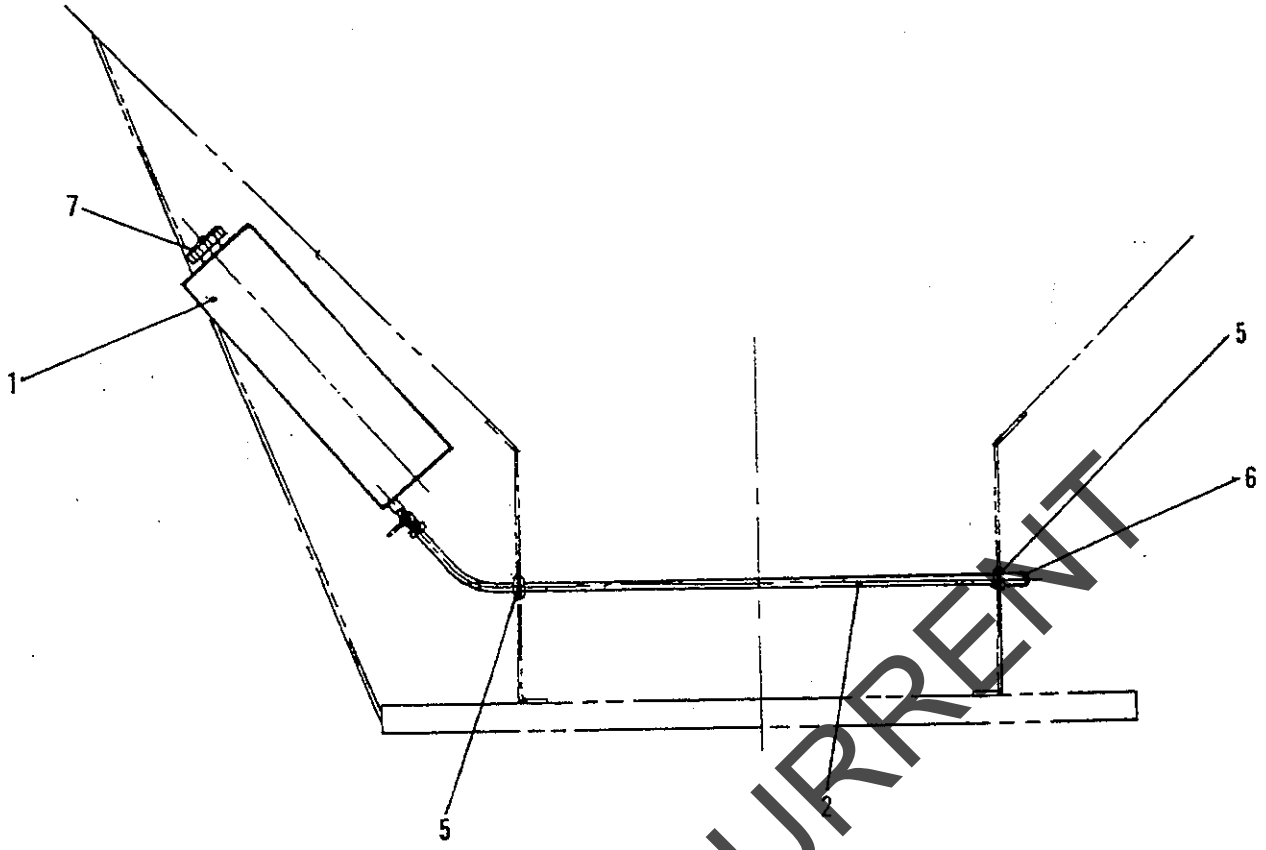
ASSEMBLY-CONVEYOR DRIVE, #6 CHAIN



ASSEMBLY-CONVEYOR DRIVE, #6 CHAIN

ITEM	PART NO.	DESCRIPTION	QTY
1	6465	Bearing-Flange	2
2	72954	Assembly-Drive Roller	1
3	57378	Collar-Set	2
4	72952	Sprocket	10
5	* 6164	Key	10
6	57380	Shaft	1
7	57357	Filler Shield-RH, Mild Steel	1
	57358	Filler Shield-LH, Mild Steel	1
	57406	Filler Shield-RH, 409 S.S.	1
	57407	Filler Shield-LH, 409 S.S.	1
	57408	Filler Shield-RH, 304 S.S.	1
	57409	Filler Shield-LH, 304 S.S.	1
8	57354	Shield-Chain, 10' Unit (Mild Steel)	2
	57355	Shield-Chain, 11' Unit (Mild Steel)	2
	57356	Shield-Chain, 12' Unit (Mild Steel)	2
	57420	Shield-Chain, 10' Unit (409 S.S.)	2
	57421	Shield-Chain, 11' Unit (409 S.S.)	2
	57422	Shield-Chain, 12' Unit (409 S.S.)	2
	57423	Shield-Chain, 10' Unit (304 S.S.)	2
	57424	Shield-Chain, 11' Unit (304 S.S.)	2
	57425	Shield-Chain, 12' Unit (304 S.S.)	2
9	57393	Chain-10' Unit	1
	57394	Chain-11' Unit	1
	57395	Chain-12' Unit	1
10	*57359	Pin-w/Nut	1
11	36408	Screw-Cap, 3/8 x 1	A.R.
	36414	Nut-Hex, 3/8	A.R.
	36420	Washer-Lock, 3/8	A.R.
12	57387	Weldment-Idler Pulley	1
13	22511	Bearing	2
14	22071	Fitting-Grease	2
15	36399	Screw-Cap, 3/8 x 1¼	8
	36414	Nut-Hex, 3/8	8
	36420	Washer-Lock, 3/8	8
16	38594	Weldment-Frame	2
17	36509	Nut-1"	2
18	38595	Screw-Take Up	2

*-Not Shown

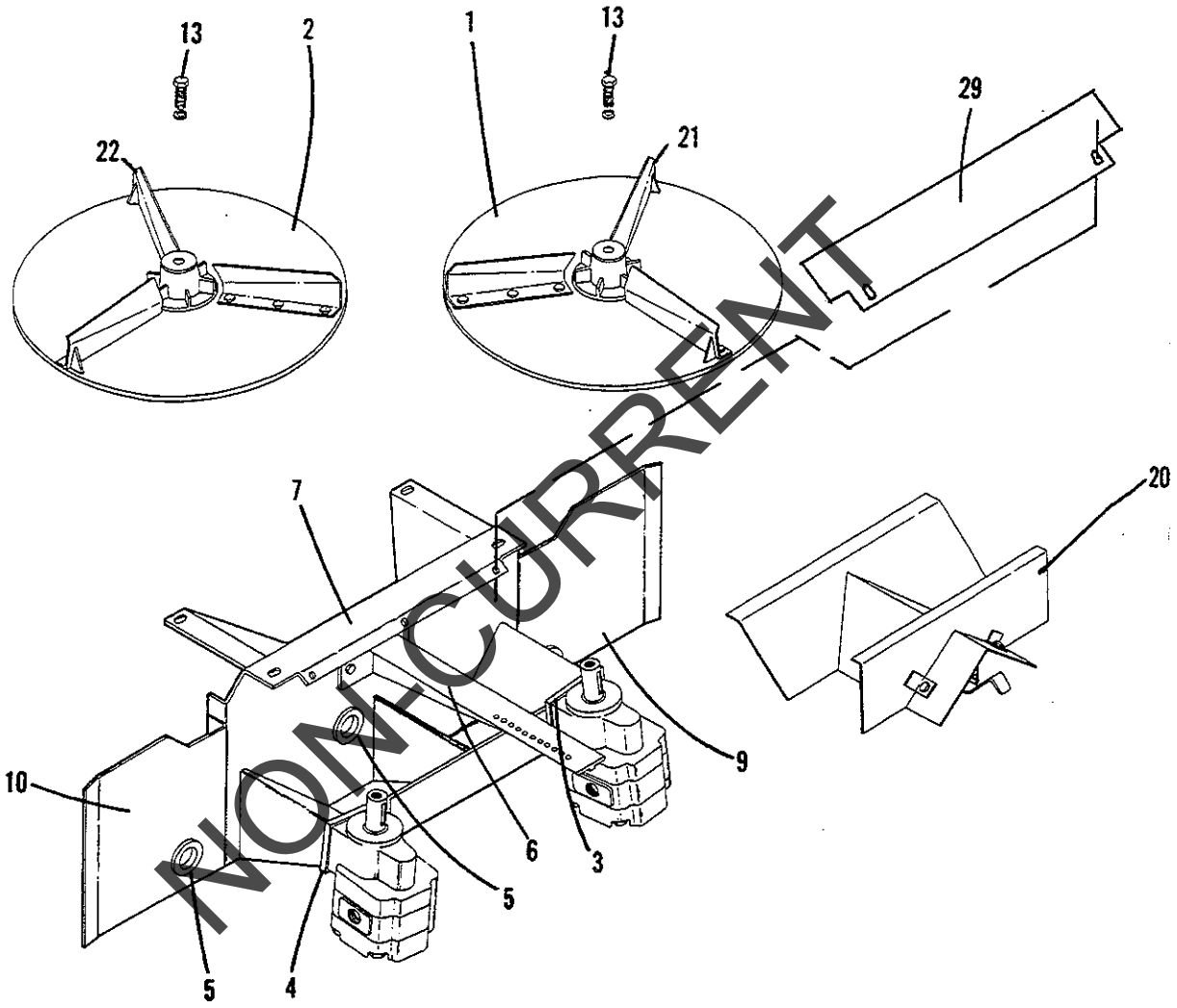


CONVEYOR CHAIN OILER

ITEM	PART NO.	DESCRIPTION	QTY.
	44573	Conveyor Chain Oiler Assembly	
1	1571	Oiler Tank Assembly	1
2	1582	Tube - Oiler	1
3	*20004	Screw - Cap, 1/4" - 20 UNC x 7/8	4
4	*20710	Washer - Lock, 1/4"	4
5	21983	Grommet - Rubber	2
6	21984	Sleeve - Plug	1
7	21980	Cap - Tank (Included in Item 1)	1

* Not Shown

ASSEMBLY - 24" HYDRAULIC FANS



ASSEMBLY - 24" HYDRAULIC FANS

ITEM	PART NO.	DESCRIPTION	QTY.
	43508	Assembly - 24" Hydraulic Fans	
	43850	Assembly - 24" Hydraulic Fans (409 S.S.)	
	54198	Assembly - 24" Hydraulic Fans (304 S.S.)	
1	14372	Assembly - Fan, R.H.	1
2	14373	Assembly - Fan, L.H.	1
3	14394	Plate - Adapter, R.H.	1
4	14395	Plate - Adapter, L.H.	1
5	21653	Grommet - Ruber	2
6	44365	Weldment - Tee Bar	1
	44366	Weldment - Tee Bar (Stainless Steel)	1
7	14340	Weldment - Frame (Includes Item #6)	1
	38821	Weldment - Frame, 409 S.S. (Incl. Item #6)	1
	36434	Weldment - Frame, 304 S.S. (Incl. Item #6)	1
8	*43511	Bracket - Valve Mounting	1
	*43851	Bracket - Valve Mounting (Stainless Steel)	1
9	14359	Extension - Shield, R.H.	1
	38847	Extension - Shield, R.H. (409 S.S.)	1
	54199	Extension - Shield, R.H. (304 S.S.)	1
10	14360	Extension - Shield, L.H.	1
	38848	Extension - Shield, L.H. (409 S.S.)	1
	54200	Extension - Shield, L.H. (304 S.S.)	1
11	*20013	Capscrew	2
	*36396	Capscrew - Stainless Steel	2
12	*20067	Capscrew	4
	*36398	Capscrew - Stainless Steel	4
13	20127	Capscrew	2
	36401	Capscrew - Stainless Steel	2
14 14	*20129	Capscrew	10
	*36539	Capscrew - Stainless Steel	10
15	*21103	Screw - Socket Flat Head	4
	*36406	Screw - Socket Flat Head (Stainless Steel)	4
16	*20642	Nut - Hex	2
	*36412	Nut - Hex (Stainless Steel)	2
17	*20644	Nut - Hex	6
	*36414	Nut - Hex (Stainless Steel)	6
18	*20646	Nut - Hex	8
	*36416	Nut - Hex (Stainless Steel)	8
19	-----		
20	19470	Weldment - Flow Divider	1
	38849	Weldment - Flow Divider (409 S.S.)	1
	36467	Weldment - Flow Divider (304 S.S.)	1

* - Not Shown

ALWAYS GIVE PART NAME. NUMBER AND MACHINE SERIAL NUMBER WHEN ORDERING PARTS

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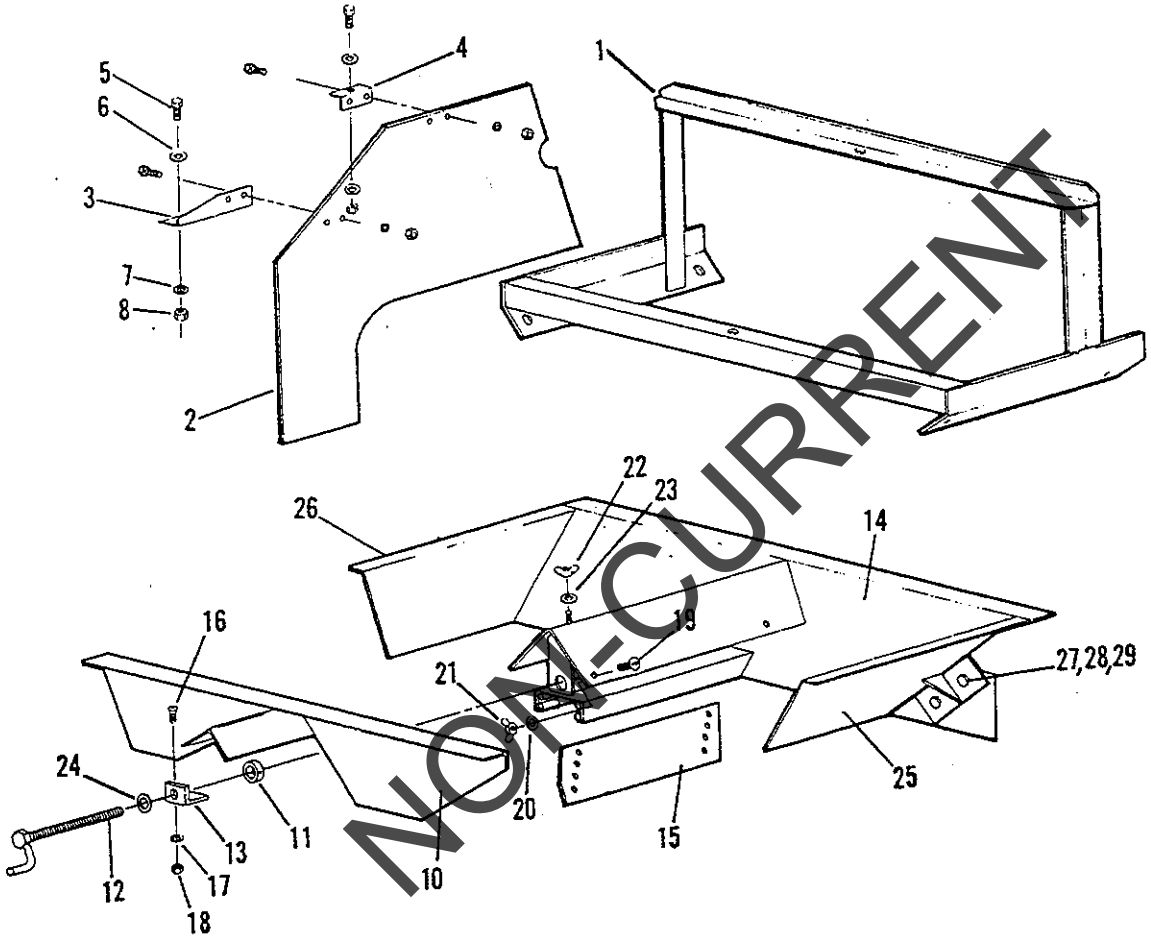
ASSEMBLY - 24" HYDRAULIC FANS CONT'D

ITEM	PART NO.	DESCRIPTION	QTY.
21	25870	Weldment - Fin, R. H.	3
22	25871	Weldment - Fin, L. H.	3
23	*21431	Screw - Cap 5/16	9
24	*20677	Nut - Hex, Locking	9
25	*10877	Hub	2
26	*20008	Screw - Cap 1/4	12
27	*20676	Nut - Hex, Locking 1/4	12
28	*27056	Disc - Distributor	2
29	20000	Plate-Material Baffle (MS)	1
	38837	Plate-Material Baffle 409SS	1
	54201	Plate- Material Baffle-304SS	1

NOTE: (Item 29) Not required with #4 B.O.C. Conveyor

*-Not Shown Individually

ASSEMBLY - HILLSIDE FLOW DIVIDER AND RED-E-VIDER



ASSEMBLY - HILLSIDE FLOW DIVIDER AND RED-E-VIDER

ITEM	PART NO.	DESCRIPTION	QTY.
	56928	Kit - Shipping, Red-E-Vider	
	56918	Kit - Shipping, Red-E-Vider (409 S.S.)	
	56923	Kit - Shipping, Red-E-Vider (304 S.S.)	
	37500	Assembly - Hillside Flow Divider	
	56922	Assembly - Hillside Flow Divider (S,S.)	
1	37490	Weldment - Support	1
	56926	Weldment - Support (S.S.)	1
2	37497	Panel - Divider	1
	56878	Panel - Divider (S.S.)	1
3	37498	Bracket - Clamp	1
	56879	Bracket - Clamp (S.S.)	1
4	37499	Angle - Clamp	1
	56880	Angle - Clamp (S.S.)	1
5	20036	Capscrew - 5/16-18 NC x 1	6
	36580	Capscrew - 5/16-18 NC x 1 (S.S.)	6
6	20692	Washer - Flat, 5/16"	8
	36424	Washer - Flat, 5/16" (S.S.)	8
7	20711	Washer - Lock, 5/16"	4
	36419	Washer - Lock, 5/16" (S.S.)	4
8	20643	Nut - Hex, 5/16-18 NC	4
	36413	Nut - Hex, 5/16-18 NC (S.S.)	4
9	*20677	Nut - Lock, 5/16-18 NC	2
	56892	Assembly - Red-E-Vider	
	56904	Assembly - Red-E-Vider (409 S.S.)	
	56916	Assembly - Red-E-Vider (304 S.S.)	
10	32483	Weldment - Back Plate	1
	56903	Weldment - Back Plate (409 S.S.)	1
	56915	Weldment - Back Plate (304 S.S.)	1
11	17078	Collar - Shaft	1
12	56834	Weldment - Adjusting Screw	1
13	32439	Outer Screw Support	1
14	56890	Weldment - Deflector Plate	1
	56901	Weldment - Deflector Plate (409 S.S.)	1
	56913	Weldment - Deflector Plate (304 S.S.)	1
15	32440	Extension - Vee Divider	2
	56820	Extension - Vee Divider (409 S.S.)	2
	56838	Extension - Vee Divider (304 S.S.)	2
16	32447	Screw - Flat Head, 5/16-18 NC x 1-1/4	2
17	36419	Washer - Lock, 5/16"	2
18	36413	Nut - Hex, 5/16-18 NC	2

* - Not Shown A.R. - As Required

ALWAYS GIVE PART NAME. NUMBER AND MACHINE SERIAL NUMBER WHEN ORDERING PARTS

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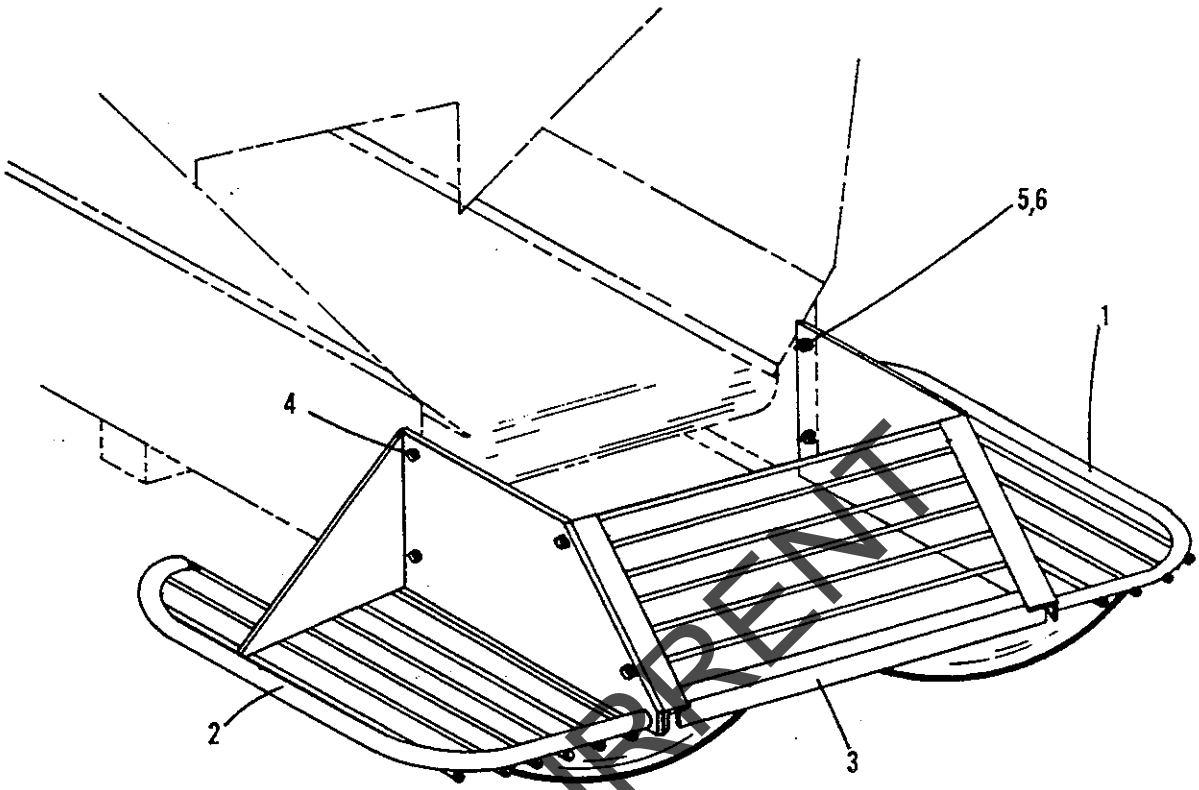
ASSEMBLY - HILLSIDE FLOW DIVIDER & RED-E-VIDER CONT'D

ITEM	PART NO.	DESCRIPTION	QTY.
19	32446	Screw - Truss Head, 1/4-20 NC x 3/4"	4
20	36418	Washer - Lock, 1/4"	4
21	32445	Nut - Wing, 1/4-20 NC	4
22	37786	Nut - Wing, 5/16-18 NC	1
23	36424	Washer - Flat, 5/16	1
24	20697	Washer - Flat, 5/8"	1
	56857	Washer - Flat, 5/8" (S.S.)	1
25	56891	Weldment - Side Plate, R.H.	1
	56898	Weldment - Side Plate, R.H. (409 S.S.)	1
	56910	Weldment - Side Plate, R.H. (304 S.S.)	1
26	56927	Weldment - Side Plate, L.H.	1
	56899	Weldment - Side Plate, L.H. (409 S.S.)	1
	56911	Weldment - Side Plate, R.H. (304 S.S.)	1
27	56858	Capscrew - 5/16-18 NC x 3/4	4
28	36419	Washer - Lock, 5/16"	4
29	36413	Nut - Hex, 5/16-18 NC	4

* - Not Shown
S.S. - Stainless Steel

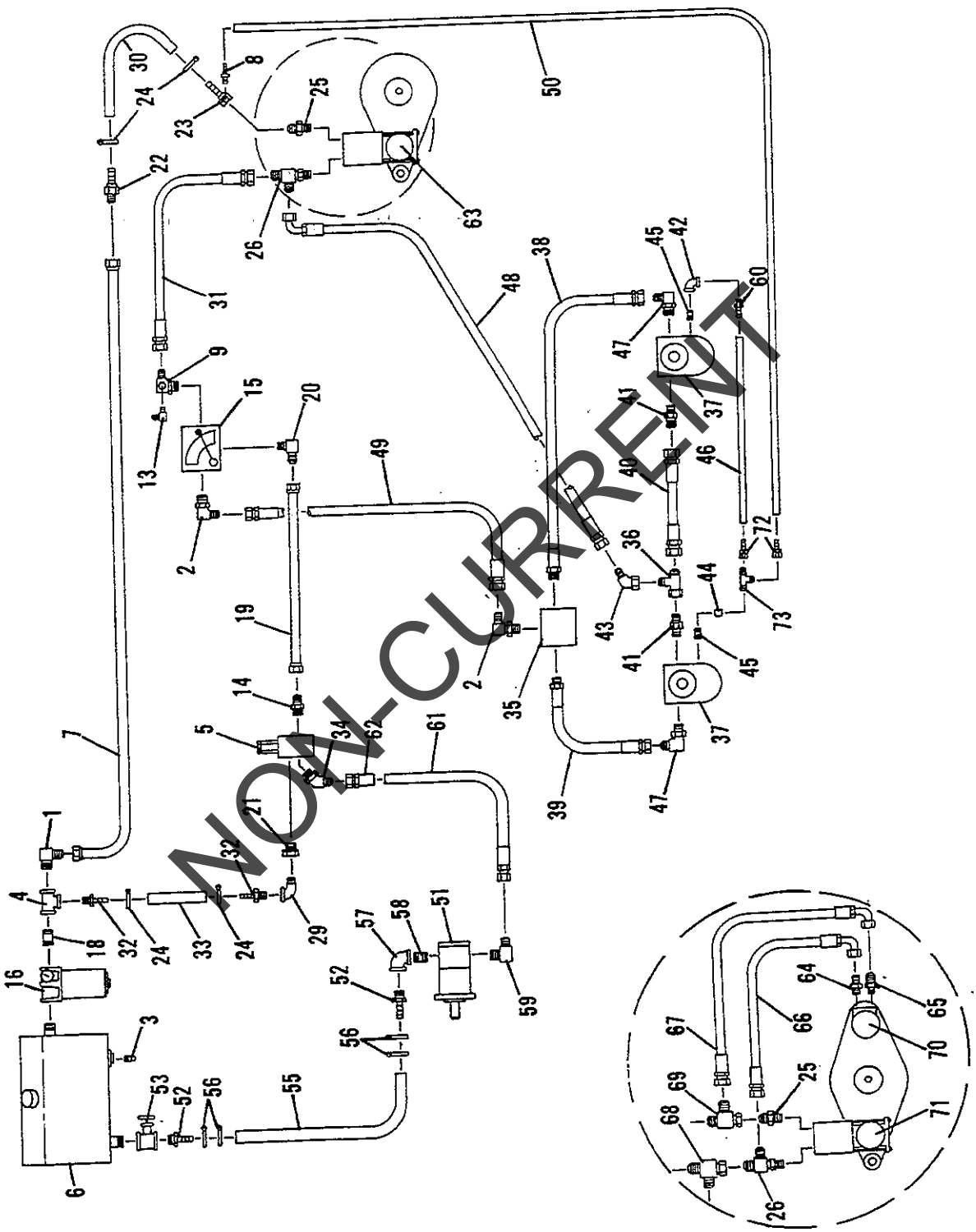


KIT - SHIPPING, SPINNER GUARD

ITEM	PART NO.	DESCRIPTION	QTY.
*	47346	Kit - Shipping, Spinner Guard for Single Pinion Units	
**	55216	Kit - Shipping, Spinner Guard for Twin Pinion Units	
1	47328	Weldment - Guard R. H.	1
2	*47325	Weldment - Guard L. H.	1
	**55218	Weldment - Guard L. H.	1
3	47336	Weldment - Guard, Center Section	1
4	20067	Screw - Cap 3/8 - 16 UNC x 1	8
5	20644	Nut - Hex 3/8 - 16 UNC	8
6	20714	Washer - Lock 3/8	8

NOTE: Guards are intended to reduce hazard of entanglement with machinery an injury. All guards must be installed per this drawing before spreader is put into operation.

HYDRAULIC SCHEMATIC



ASSEMBLY GROUP - HYDRAULICS

ITEM	PART NO.	DESCRIPTION	QTY.
1	29763	Adapter - 90° Elbow	1
2	29847	Adapter - 90° Elbow	2
3	6033	Plug - Pipe	1
4	6318	Tee - Pipe	1
5	37447	Valve - Relief	1
6	31140	Tank - Hydraulic	1
7		Assembly - Tube For:	
	58694	10' Unit	1
	58695	11' Unit	1
	58696	12' Unit	1
	58697	13' Unit	1
	58698	14' Unit	1
	58699	15' Unit	1
	58700	16' Unit	1
8	34760	Fitting - Hose End	1
9	34725	Adapter - 90°, Tapped	1
10	*20908	Screw - Self Drilling	A.R.
11	*20067	Screw - Cap	4
12	*20644	Nut - Hex	4
13	34732	Adapter - 90° Elbow	1
14	29803	Adapter - Connector	1
15	32485	Valve - Control	1
16	39845	Filter - Oil	1
17	*21994	Clamp - Conduit	A.R.
18	6028	Nipple - Close	1
19		Assembly - Tube For:	
	43538	10' Unit	1
	43539	11' Unit	1
	43540	12' Unit	1
	43541	13' Unit	1
	43542	14' Unit	1
	46532	15' Unit	1
	46533	16' Unit	1
20	29838	Adapter - 90° Elbow	1
21	22017	Adapter - Bushing	1
22	39368	Hose End	1
23	46556	Hose End	1
24	6335	Clamp - Hose	4
25	29775	Adapter - Connector	1
26	29791	Adapter - Run Tee	1
27	*20011	Screw - Cap	2
28	*20642	Nut - Hex	2

* - Not Shown

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ASSEMBLY GROUP - HYDRAULICS CONT'D

ITEM	PART NO.	DESCRIPTION	QTY.
29	6016	Elbow - Street	1
30	16521-37	Hose - Return	1
31	29726	Assembly - Hose (Single Pinion Gear Case)	1
	56111	Assembly - Hose (Twin Pinion Gear Case)	1
32	22426	Nipple - Hose End	2
33	16521-28	Hose-- Bypass	1
34	34726	Adapter - 45° Elbow	1
35	43510	Valve - Flow Divider	1
36	29781	Adapter - Tee	1
37	23800	Motor - Spinner	2
38	29714	Assembly - Hose	1
39	29713	Assembly - Hose	1
40	29689	Assembly - Hose	1
41	34717	Adapter - Connector	2
42	6007	Elbow - 90°	1
43	29782	Adapter - 45° Elbow	1
44	6001	Coupling - Pipe	1
45	4343	Nipple - Close	2
46	34195-29	Hose - Push-On	1
47	29761	Adapter - 90° Elbow	2
48	29724	Assembly - Hose	1
49	29725	Assembly - Hose	1
50	34195-88	Hose - Push-On	1
51	22393	Assembly - Pump, 1-1/4"	1
	22394	Assembly - Pump, 1-1/2"	1
	22395	Assembly - Pump, 1-3/4"	1
	22396	Assembly - Pump, 2"	1
	22397	Assembly - Pump, 2-1/4"	1
	22398	Assembly - Pump, 2-1/2"	1
52	24502	Nipple - Hose End	2
53	22155	Valve - Gate	1
54	*22206	Bushing - Pipe (Use with 1-1/4" & 1-1/2" Pumps)	1
55	21878-72	Hose - Suction	1
56	6288	Clamp - Hose	4
57	6011	Elbow - 90°	1
58	6027	Nipple - Close (Use with 1-1/4" & 1-1/2" Pumps)	1
	6028	Nipple - Close (Use with 1-3/4" - 2-1/2" Pumps)	1
59	29763	Adapter - 90° Elbow (Use with 1-1/4" & 1-1/2" Pumps)	1
	29794	Adapter - 90° (Use with 1-3/4" - 2-1/2" Pumps)	1
60	34760	Hose End	1
61	29610	Assembly - Hose	1
62	56509	Fitting - Hose End	1

* - Not Shown

ALWAYS GIVE PART NAME. NUMBER AND MACHINE SERIAL NUMBER WHEN ORDERING PARTS

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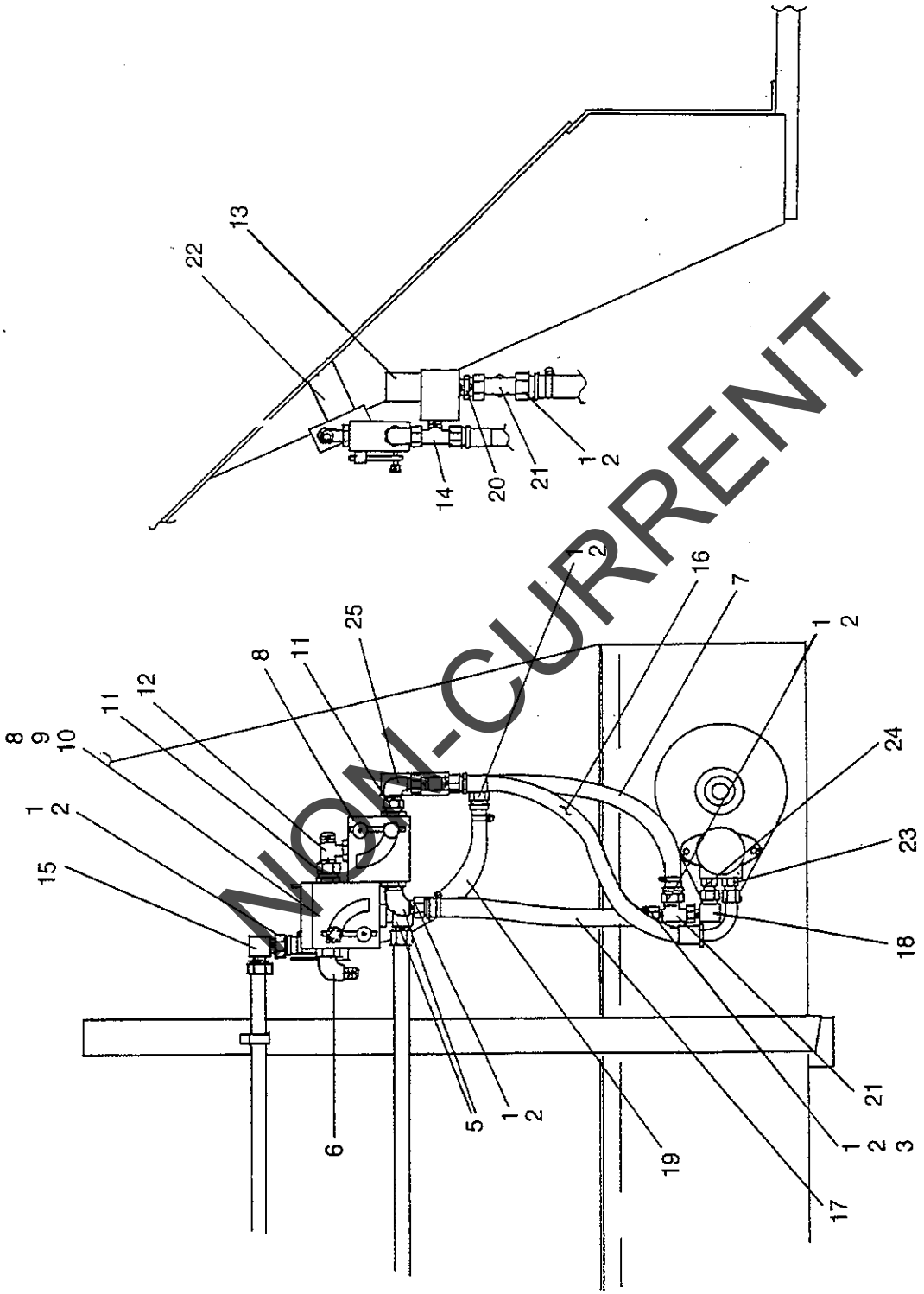
ASSEMBLY GROUP - HYDRAULICS CONT'D

ITEM	PART NO.	DESCRIPTION	QTY.
63	46395	Motor - Conveyor, 1-1/2"	1
	46396	Motor - Conveyor, 2"	1
64	29753	Adapter - Connector	1
65	29778	Adapter - Connector	1
66	56107	Assembly - Hose	1
67	56121	Assembly - Hose	1
68	29781	Adapter - Tee	1
69	29850	Adapter - Tee	1
70	55970	Motor - Conveyor, 1"	1
71	55972	Motor - Conveyor, 1"	1
72	34761	Fitting - Hose End	2
73	34762	Adapter - Tee	1

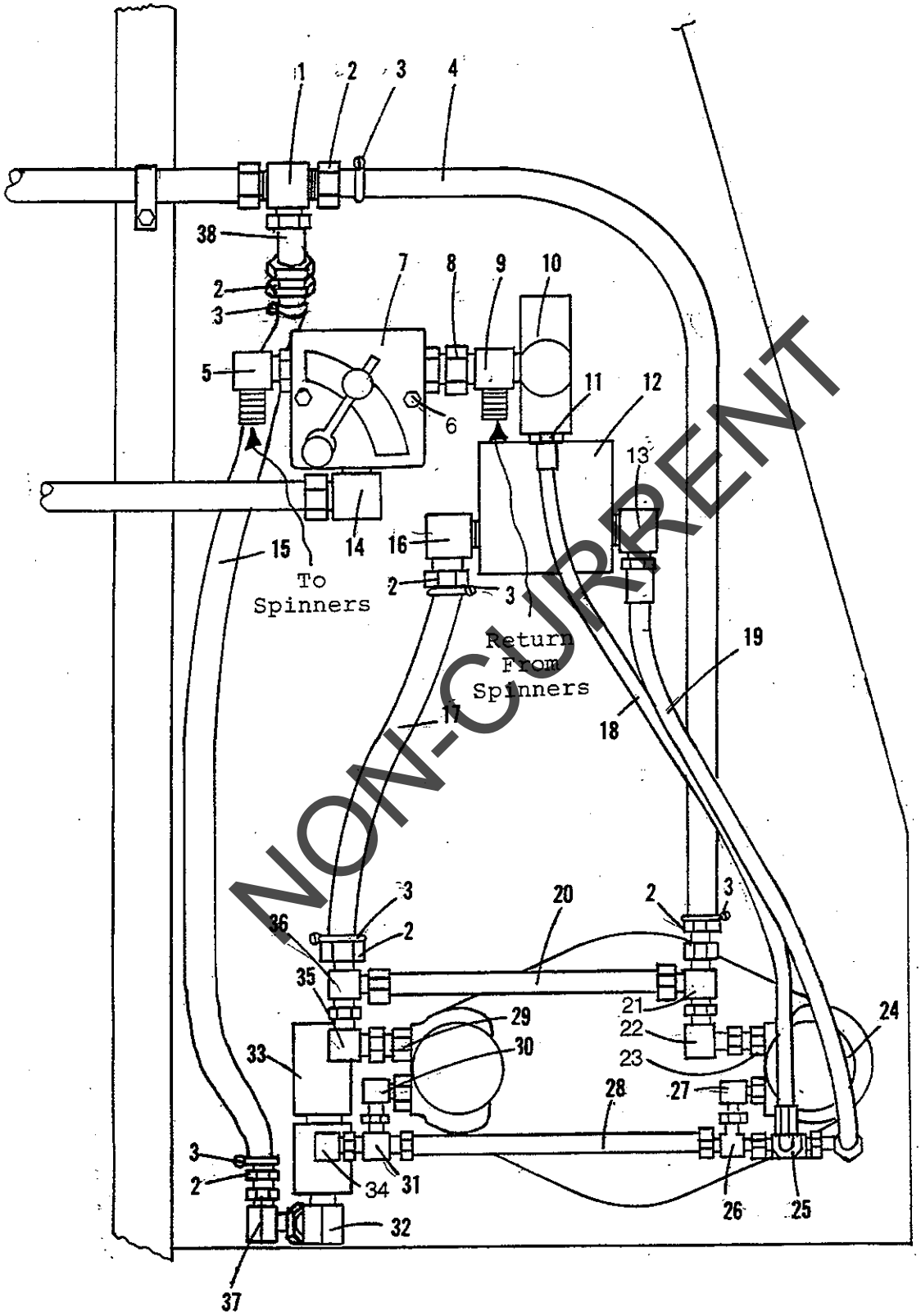
ASSEMBLY-HYDRAULICS W/O MARK II, SINGLE PINION
MANUAL SYSTEM I



ASSEMBLY-HYDRAULICS W/O MARK II, SINGLE PINION MANUAL SYSTEM I

ITEM	PART NO.	DESCRIPTION	QTY
1	36802	Hose End	5
2	6335	Clamp-Hose	6
3	46556	Hose End-Tapped	3
4	34760	Hose End	1
5	29838	Adapter-Elbow, 90°	2
6	29847	Adapter-Elbow, 90°	1
7	16521-12	Hose-Return	1
8	32485	Valve-Control	2
9	20011	Screw-Cap, ½ x 2½	2
10	20642	Nut-Hex, ¼	2
11	29788	Adapter-Connector	2
12	34715	Adapter-Tee	1
13	33712	Valve-Dump	1
14	29834	Adapter-Tee	1
15	29783	Adapter-Elbow, 90°	1
16	71473	Assembly-Hose	1
17	16521-14	Hose-Return	1
18	29807	Adapter-Elbow, 90°	1
19	16521-26	Hose-Return	1
20	29757	Adapter-Connector	1
21	29850	Adapter-Tee	2
22	43550	Bracket-Valve	1
23	29753	Adapter-Connector	1
24	29778	Adapter-Connector	1
25	34709	Adapter-Elbow, 90°	1

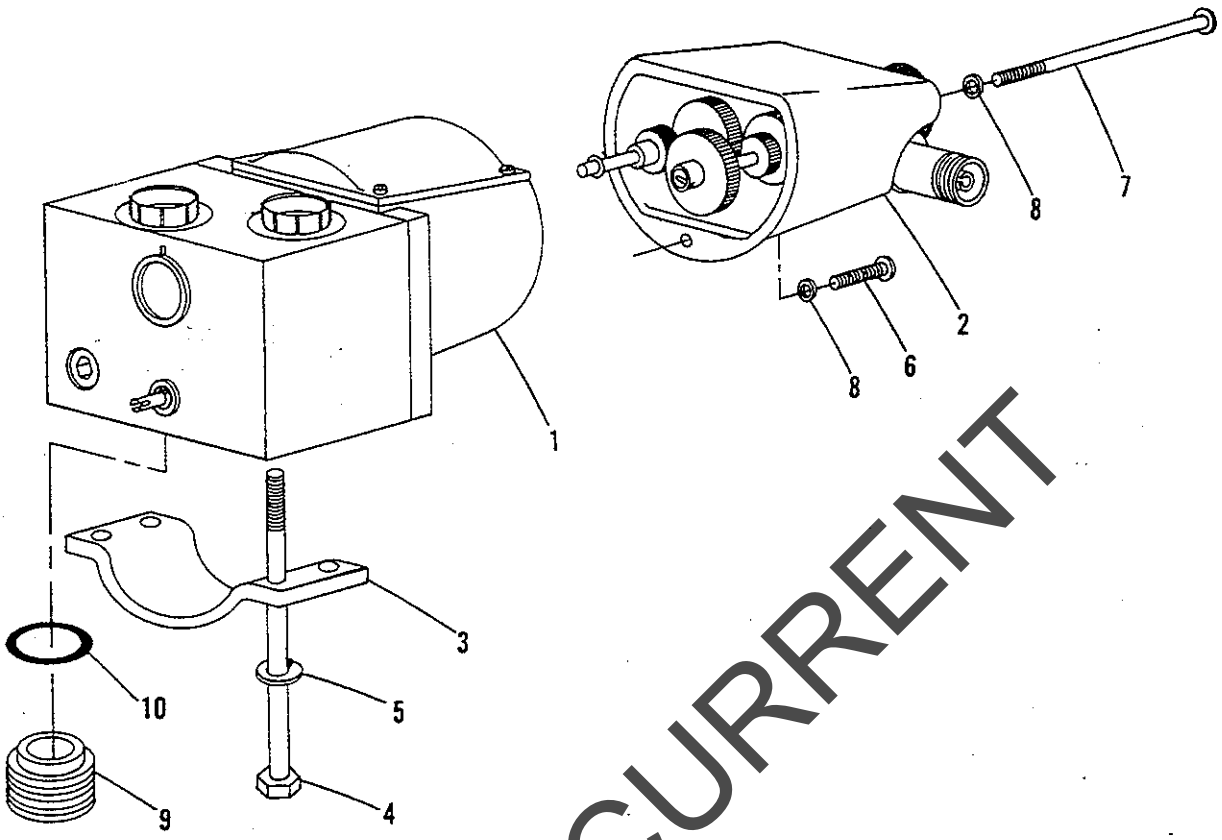
HYDRAULIC SYSTEM W/O MARK II
MANUAL SYSTEM II



HYDRAULIC SYSTEM W/O MARK II
MANUAL SYSTEM II

ITEM	PART NO.	DESCRIPTION	QTY
1	34711	Adapter-Tee	1
2	36802	Hose End	5
3	6335	Clamp-Hose	6
4	16529-32	Hose-Return	1
5	29847	Adapter-90°	1
6	20642	Nut-Hex, ¼-20	2
	20011	Screw-Cap, ¼-20 x 2½	2
7	32485	Valve-Spinner Control	1
8	29788	Adapter	1
9	29769	Adapter-Tee	1
10	22169	Valve-Selector	1
11	*29752	Adapter	1
	16362	Nipple	1
12	71297	Flow Divider	1
13	29764	Adapter-90°	1
14	29838	Adapter-90°	1
15	16521-36	Hose-Return	1
16	29779	Adapter-90°	1
17	16521-24	Hose-Return	1
18	54773	Assembly-Hose	1
19	71473	Assembly-Hose	1
20	22267-4.5	Tube-Hydraulic	1
	34740	Fitting-Tube	2
	34745	Sleeve-Tube	2
21	29850	Adapter-Tee	1
22	29807	Adapter-90°	1
23	29778	Adapter	1
24	46395	Motor-Hydraulic	2
25	29781	Adapter-Tee	1
26	29809	Adapter-Tee	1
27	29773	Adapter-90°	1
28	22266-4.5	Tube-Hydraulic	1
	34739	Fitting-Hydraulic	2
	34744	Sleeve-Hydraulic	2
29	29778	Adapter	1
30	29773	Adapter-90°	1
31	29809	Adapter-Tee	1
32	29779	Adapter-90°	1
33	78948	Valve-Electric Dump	1
34	29827	Adapter-90°	1
35	29807	Adapter-90°	1
36	29850	Adapter-Tee	1
37	29807	Adapter-90°	1
38	29806	Adapter-45°	1

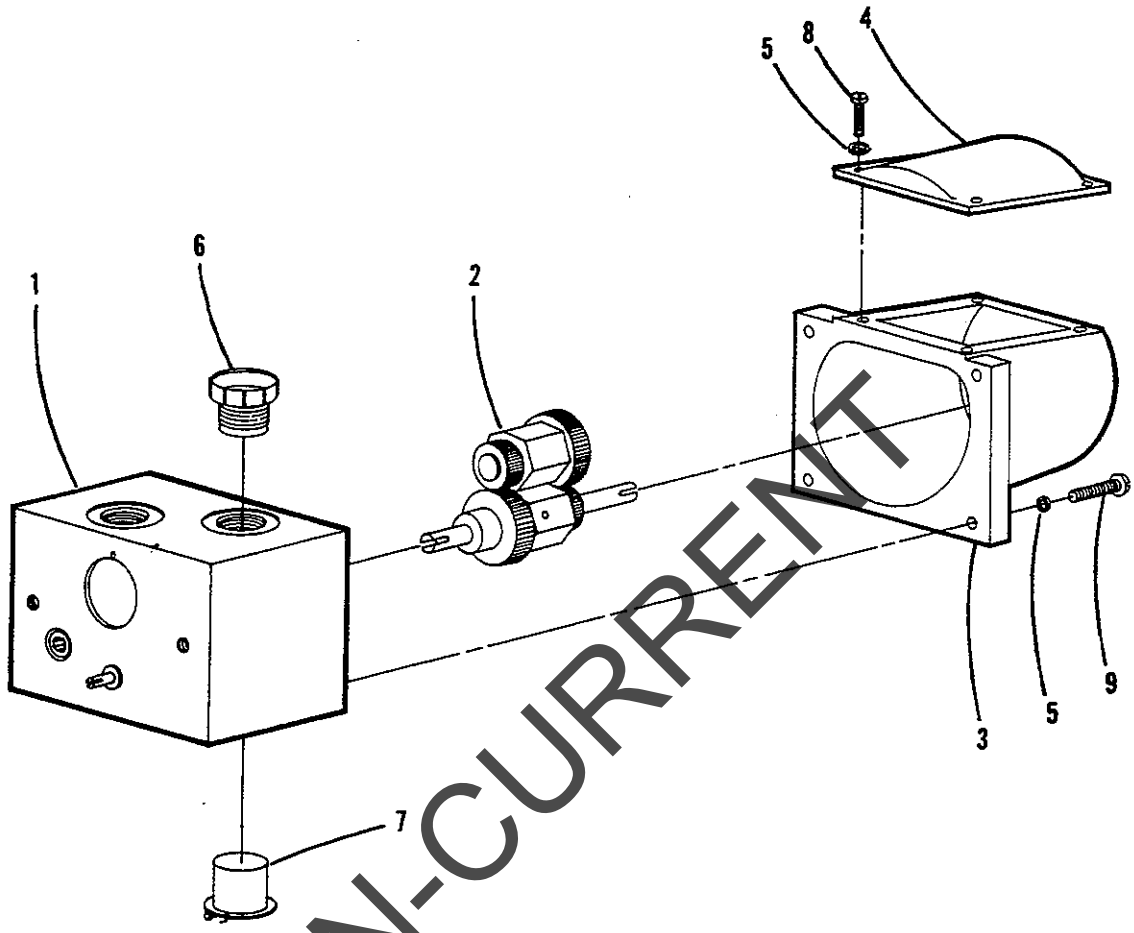
SYNCO-MATIC MARK II SUB ASSEMBLY



ITEM	PART NO.	DESCRIPTION	QTY
	53713	Assembly Group-Valve, 3:1 (2000 PSI)	
	55365	Assembly Group-Valve, 3:1 (1500 PSI)	
1	44405	Assembly Group-Valve Body (1500 PSI)	1
	53714	Assembly Group-Valve Body (2000 PSI)	1
2	55366	Assembly Group-Two Speed, 3:1	1
3	47276	Saddle-Motor (55365 Ass'y)	1
	44407	Saddle-Motor (53713 Ass'y)	1
4	47277	Screw-Cap	4
5	36419	Washer-Lock	4
6	44453	Screw-Machine	1
7	44455	Screw-Machine	2
8	44451	Washer-Lock	3
9	44409	Adapter-Port (installed w/motor)	2
10	29854	O'Ring (installed w/motor)	2
	44486	Kit-Seal, For Mark II Valve	

SYNCO-MATIC MARK II SUB ASSEMBLY

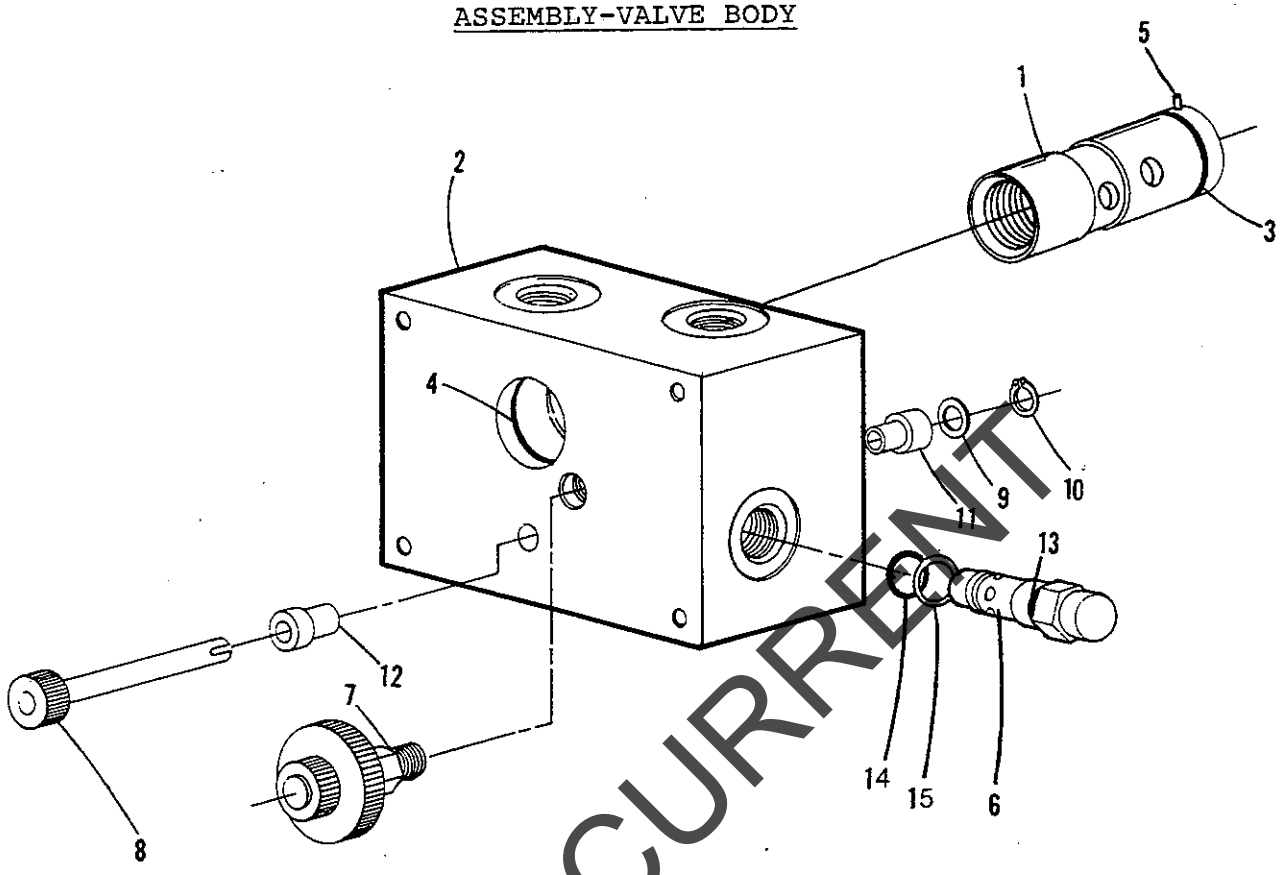
ASSEMBLY GROUP-VALVE BODY



ITEM	PART NO.	DESCRIPTION	QTY
	53714	Assembly Group-Valve Body (2000 PSI)	
	44405	Assembly Group-Valve Body (1500 PSI)	
1	44410	Assembly-Valve Body (1500 PSI)	1
	53715	Assembly-Valve Body (2000 PSI)	1
2	44411	Assembly Group-Idler Arm	1
3	44412	Assembly-Bell Housing	1
4	44413	Assembly-Cap	1
5	44451	Washer-Lock	8
6	8396	Cap-Plastic	2
7	29341	Cap-Plastic	2
8	44452	Screw-Machine	4
9	44453	Screw-Machine	4

SYNCO-MATIC MARK II SUB ASSEMBLY

ASSEMBLY-VALVE BODY



ITEM	PART NO.	DESCRIPTION	QTY
	53715	Assembly-Valve Body (2000 PSI)	
	44410	Assembly-Valve Body (1500 PSI)	
1	44423	Assembly-Spool & Liner	1
2	44424	Valve Body	1
3	29874	O'Ring	1
4	24544	O'Ring	3
5	44457	Pin-Roll	1
6	39287	Cartridge-Relief, 1500 PSI (Incl. Items 13, 14 & 15)	1
	44402	Cartridge-Relief, 2000 PSI (Incl. Items 13, 14 & 15)	1
7	44447	Assembly-Idler Gear w/Shoulder Bolt	1
8	44448	Assembly-Motor Input Shaft	1
9	44449	Shim	1
10	44464	Ring-Snap	1
11	44433	Bushing	1
12	44450	Bushing	1
13	29854	O'Ring	2
14	29876	O'Ring	1
15	29871	Ring-Back Up	1

ALWAYS GIVE PART NAME. NUMBER AND MACHINE SERIAL NUMBER WHEN ORDERING PARTS

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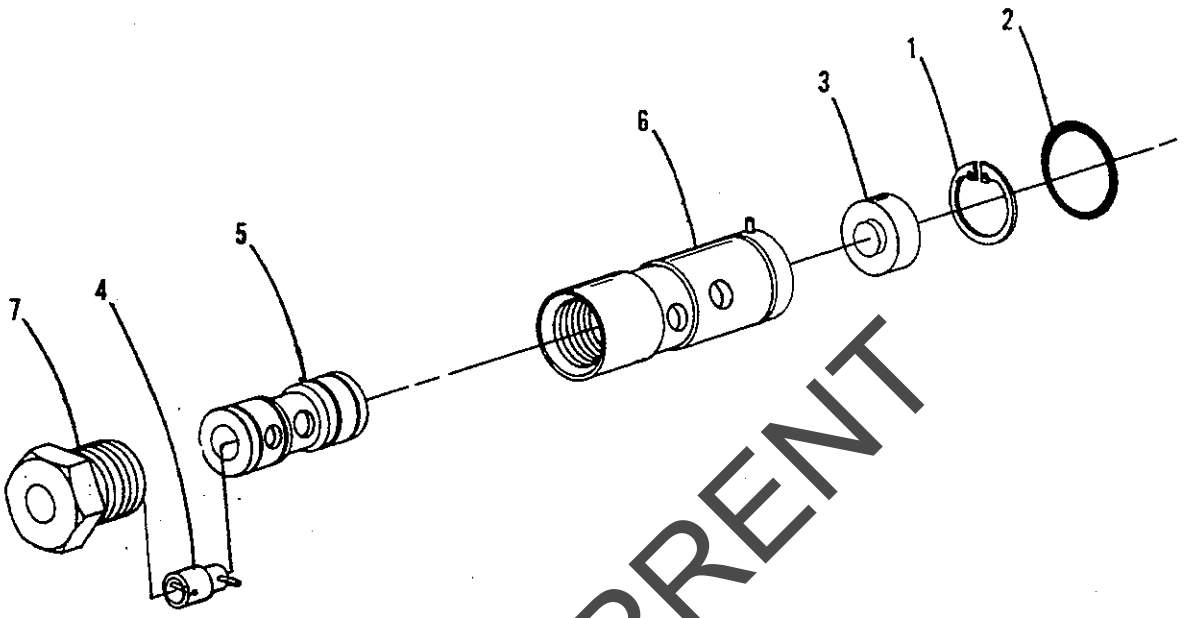
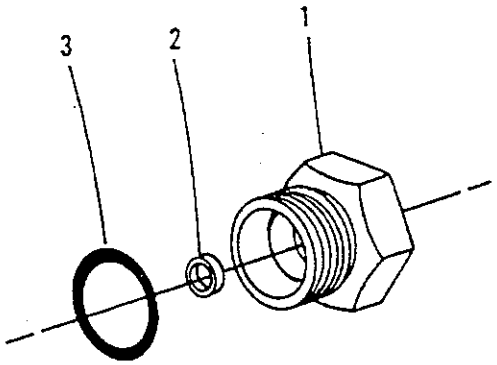


SYNCO-MATIC MARK II SUB ASSEMBLY

ASSEMBLY - SPOOL & LINER

ITEM	PART NO.	DESCRIPTION	QTY.
	44423	Assembly - Spool & Liner	
1	44425	Snap - Ring	1
2	29862	'O' Ring	1
3	N.S.	Disc - Spool End	1
4	44426	Assembly - Shaft - Coupling	1
5	N.S.	Assembly - Spool	1
6	N.S.	Liner - Spool	1
7	44427	Assembly - Plug	1

N.S. - Not Serviced



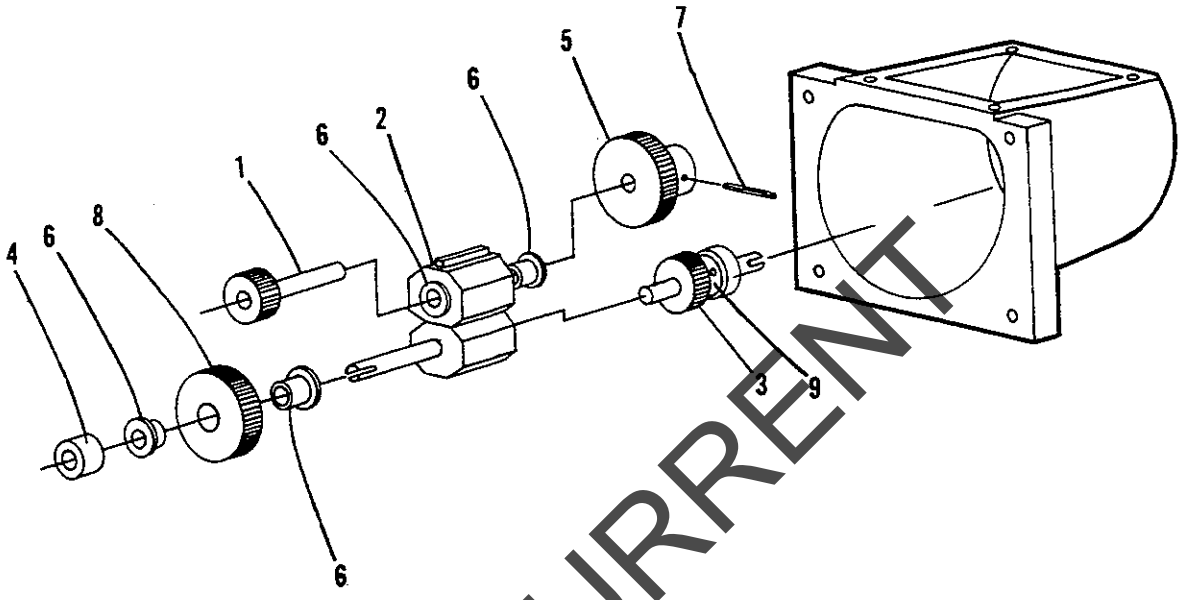
SYNCO-MATIC MARK II SUB ASSEMBLY

ASSEMBLY - PLUG

ITEM	PART NO.	DESCRIPTION	QTY.
	44427	Assembly - Plug	
1	N.S.	Plug - Spool	1
2	29872	Quad-ring	1
3	29855	'O' Ring	1

N.S. - Not Serviced

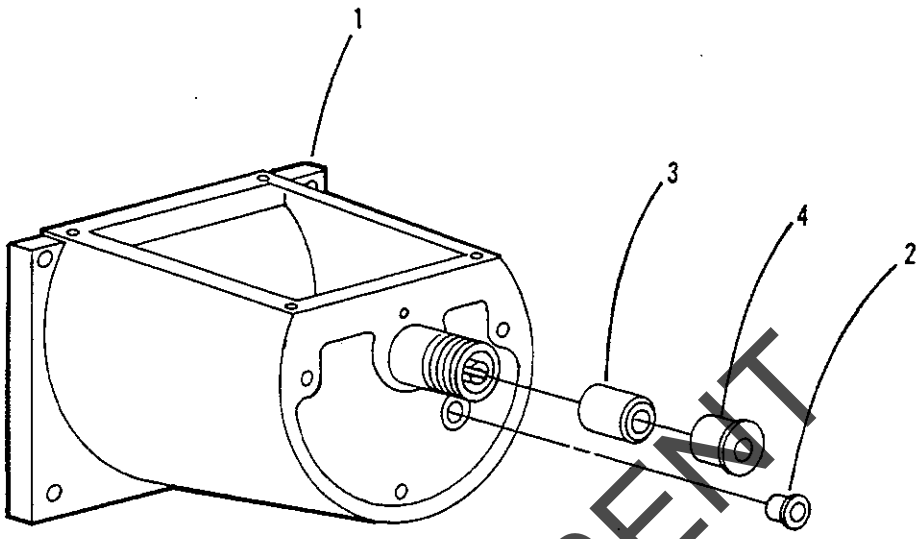
SYNCO - MATIC MARK II SUB ASSEMBLY



ASSEMBLY - GROUP, IDLER ARM

ITEM	PART NO.	DESCRIPTION	QTY.
	44411	Assembly - Group, Idler Arm	
1	44428	Assembly - Gear	1
2	44429	Assembly - Idler Arm	1
3	44430	Assembly - Two Speed Input Shaft	1
4	44431	Spacer	1
5	44432	Gear - 52 Tooth	1
6	44433	Bushing	4
7	44461	Pin - Roll	1
8	51244	Gear - Resolve	1
9	*44435	Bearing	2

* - 1 each included in assemblies 44429 and 44430



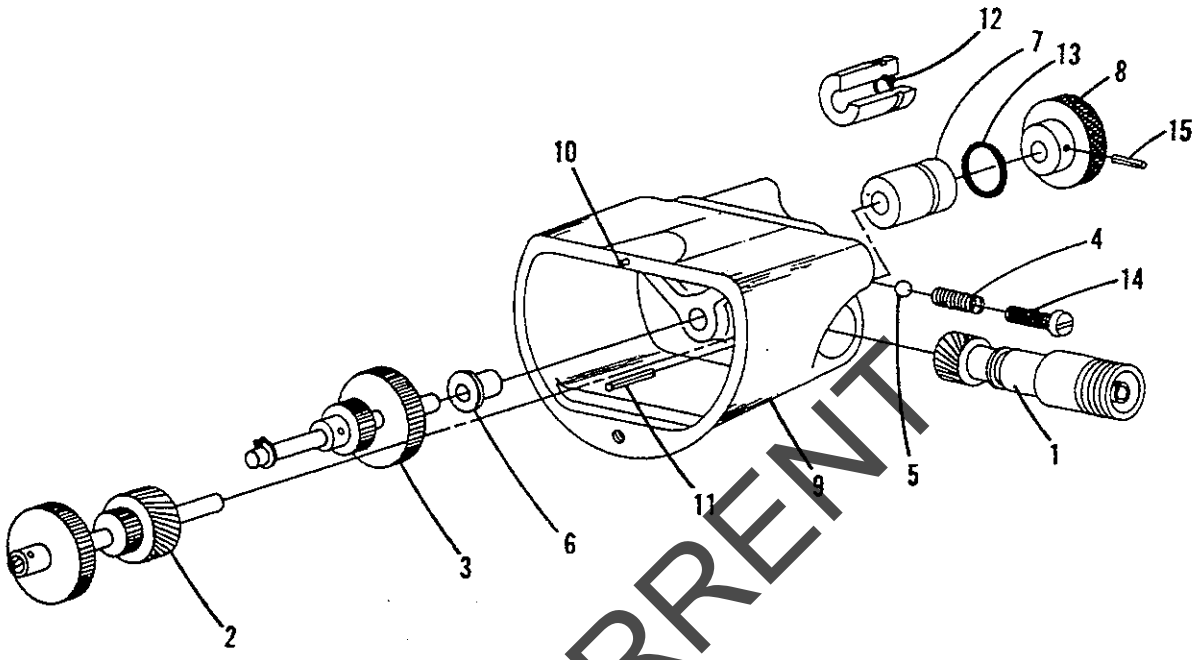
SYNCRO-MATIC MARK II SUB ASSEMBLY

ASSEMBLY - BELL HOUSING

ITEM	PART NO.	DESCRIPTION	QTY.
	44412	Assembly - Bell Housing	
1	N.S.	Bell Housing	1
2	44419	Bushing	1
3	44436	Bushing	1
4	44437	Bushing	1

N.S. - Not Serviced

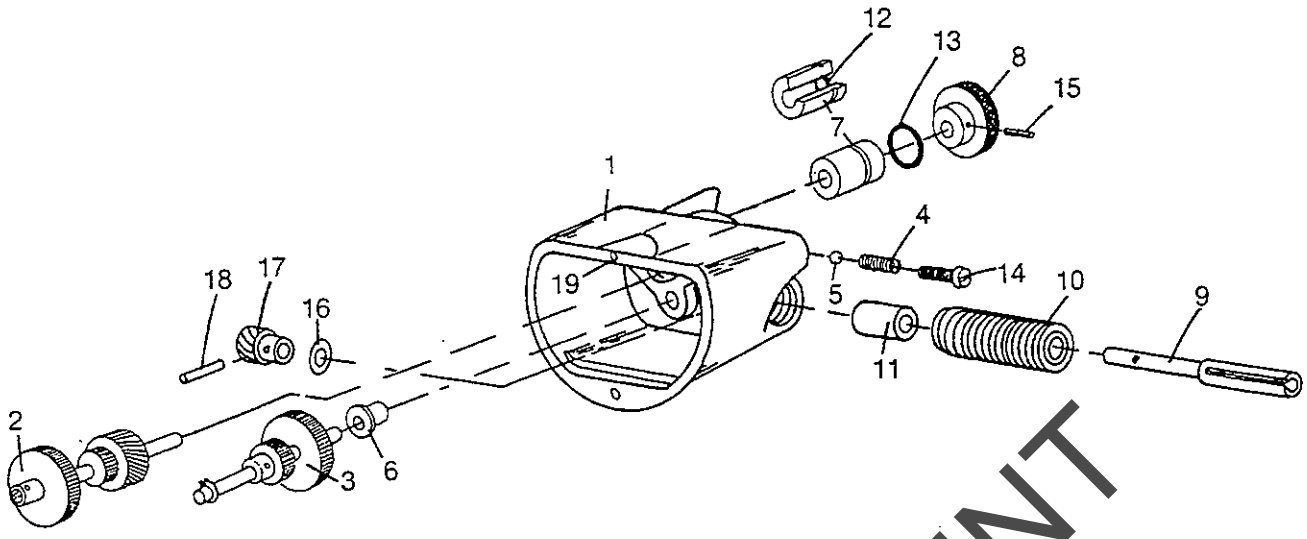
SYNCO - MATIC MARK II SUB ASSEMBLY



ASSEMBLY - SHIFTABLE TWO SPEED

ITEM	PART NO.	DESCRIPTION	QTY.
1	55366	Assembly - Shiftable Two Speed, 3:1	
1	44414	Assembly - Drive Shaft	1
2	55367	Assembly - Driven Shaft, 3:1	1
3	55368	Assembly - Idler Shaft, 3:1	1
4	44417	Spring	1
5	44418	Ball	1
6	44419	Bushing	1
7	44420	Bushing - Knob	1
8	44421	Knob	1
9	44422	Housing - Shiftable Two Speed	1
10	44460	Pin - Roll	1
11	44461	Pin - Roll	1
12	29872	Quad Ring	1
13	29873	"O" Ring	1
14	44498	Machine Screw	1
15	44463	Pin - Roll	1

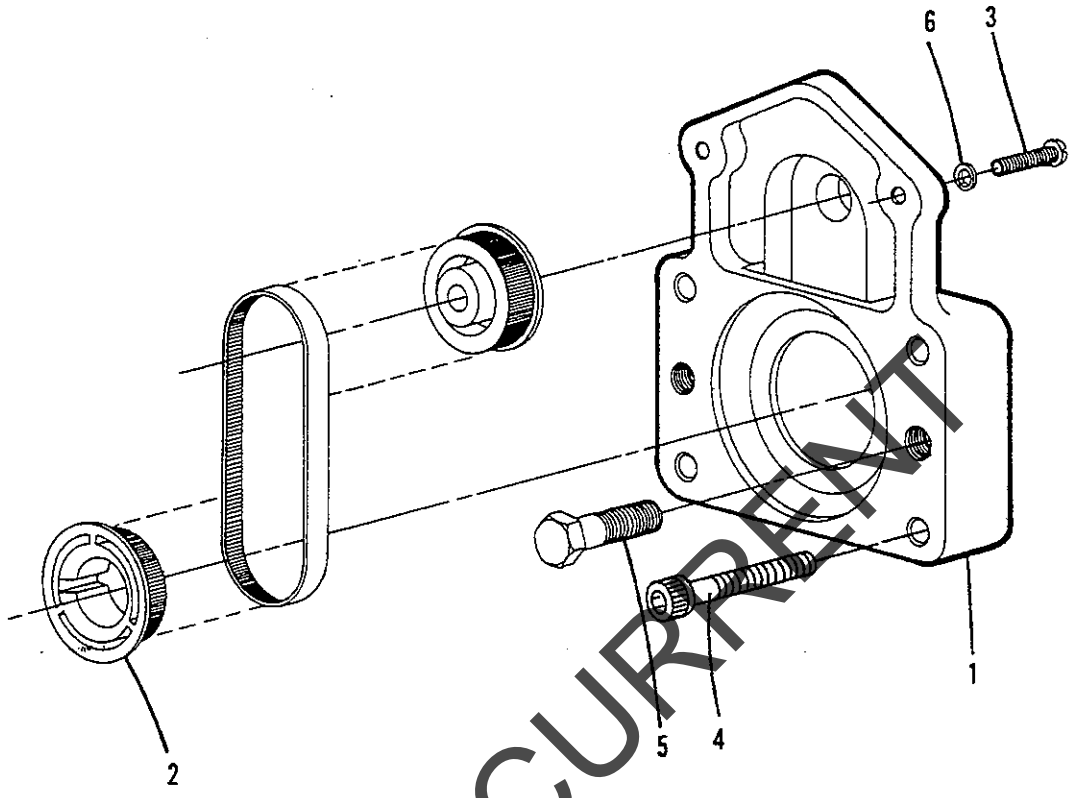
SYNCO-MATIC MARK II SUB ASSEMBLY



ASSEMBLY - SHIFTABLE TWO SPEED, NEW STYLE

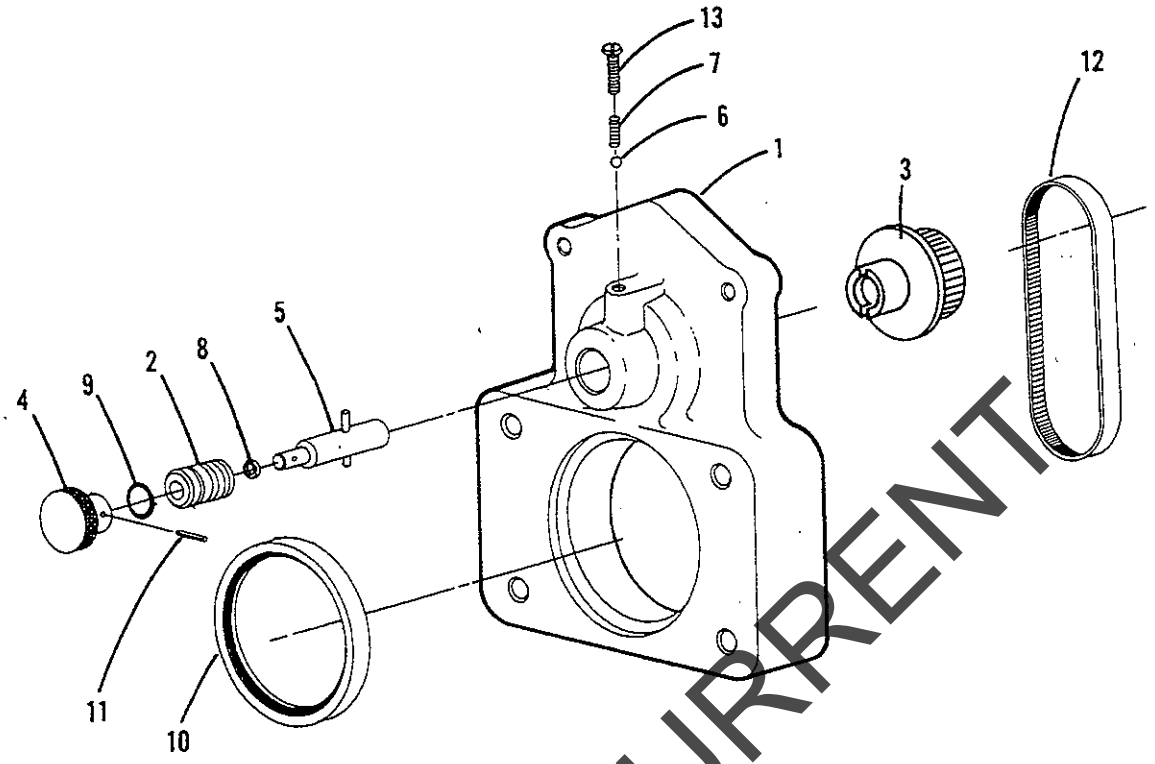
ITEM	PART NO.	DESCRIPTION	QTY
	72963	Assembly - Shiftable Two Speed, 3:1	
1	72967	Housing - Shiftable Two Speed	1
2	55367	Assembly - Driven Shaft, 3:1	1
3	55368	Assembly - Idler Shaft, 3:1	1
4	44417	Spring	1
5	44418	Ball	1
6	44419	Bushing	1
7	44420	Bushing - Knob	1
8	44421	Knob	1
9	51210	Shaft - Input	1
10	72965	Bushing - Threaded	1
11	72966	Bushing - Bronze	1
12	29872	Ring - Quad	1
13	29873	Ring - "O"	1
14	44498	Screw - Machine	1
15	44463	Pin - Roll	1
16	51218	Washer - Flat	1
17	51209	Gear - Helix, Drive	1
18	44461	Pin - Roll	1
19	44460	Pin - Roll	1

SYNCO - MATIC MARK II SUB ASSEMBLY



GROUP - DRIVE, COG-BELT

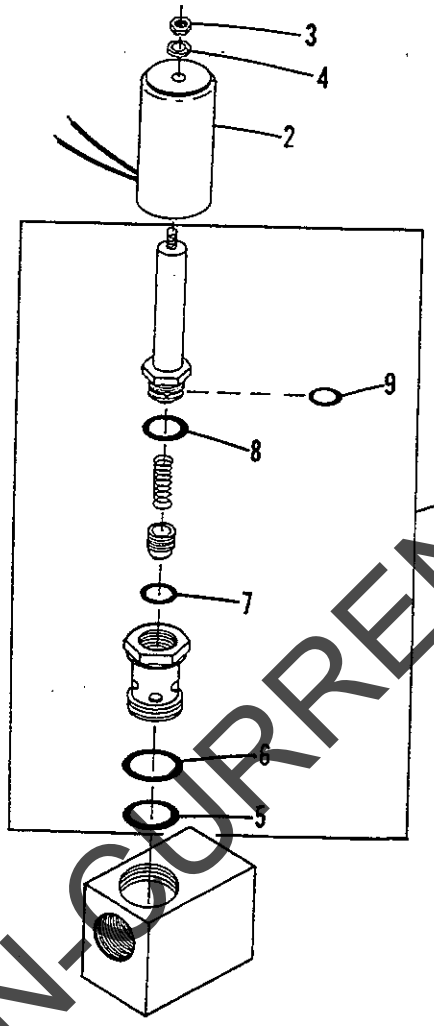
ITEM	PART NO.	DESCRIPTION	QTY.
	43503	Group - Drive, Cog-belt	
1	44438	Assembly - Adapter	1
2	44440	Pulley - Timing, Drive	1
3	44454	Machine Screw	2
4	44456	Socket Head Capscrew	4
5	44442	Capscrew - Special	2
6	44451	Lockwasher	2



SYNCO - MATIC MARK II SUB ASSEMBLY

ASSEMBLY - ADAPTER

ITEM	PART NO.	DESCRIPTION	QTY.
	44438	Assembly - Adapter	
1	44443	Adapter	1
2	44444	Bushing - Clutch Detent	1
3	44441	Pulley - Timing, Driven	1
4	44421	Knob	1
5	44446	Assembly - Clutch Shaft	1
6	44418	Ball	1
7	44417	Spring	1
8	29872	Quad-ring	1
9	29875	'O' Ring	1
10	44445	Seal	1
11	44463	Roll Pin	1
12	44439	Belt - Timing	1
13	44498	Machine Screw	1

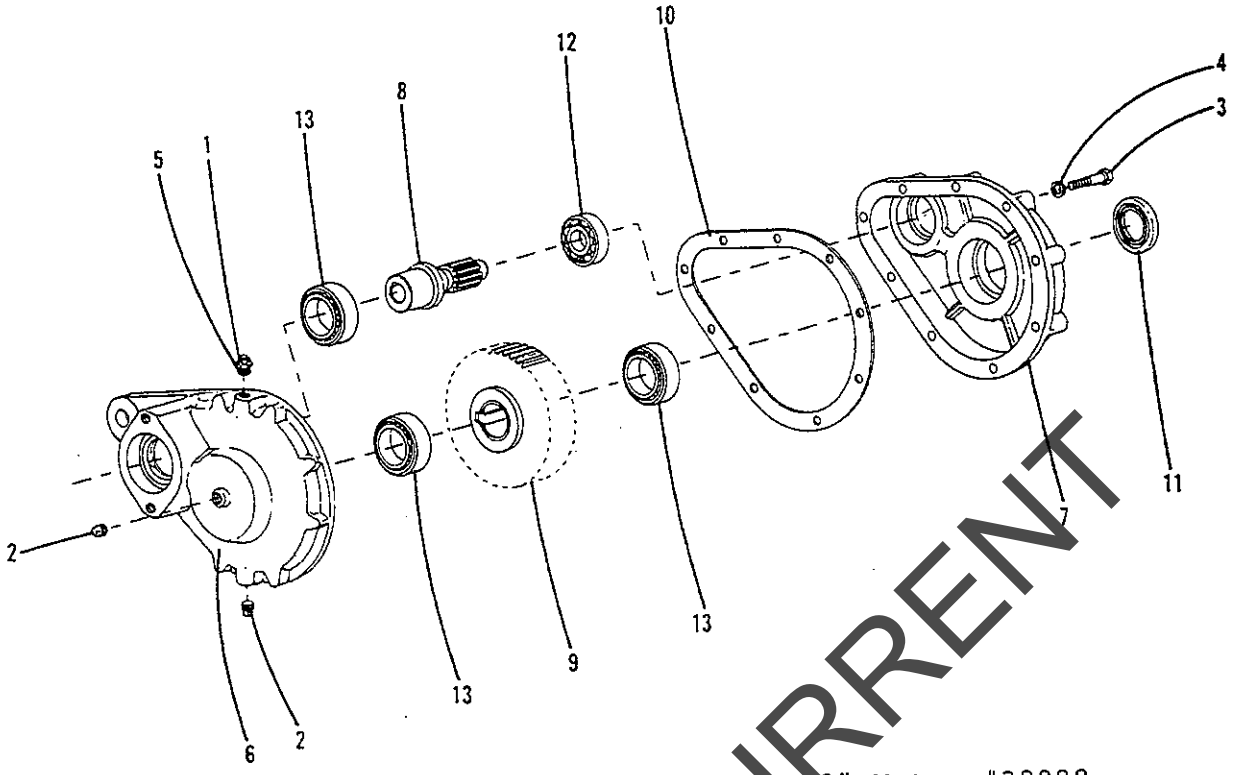


DUMP VALVE - SOLENOID

ITEM	PART NO.	DESCRIPTION	QTY.
	33712	Dump Valve - Solenoid	
1	NSS	Assembly - Cartridge	1
2	33718	Coil	1
3	NSS	Nut - Hex	1
4	NSS	Washer - Lock	1
5	29892	O-Ring	1
6	29893	O-Ring	1
7	29891	O-Ring	1
8	30648	O-Ring	1
9	29894	O-Ring	1
	33714	Kit - O-Ring (Includes Items 5-9)	1

NSS- Not Sold Separately

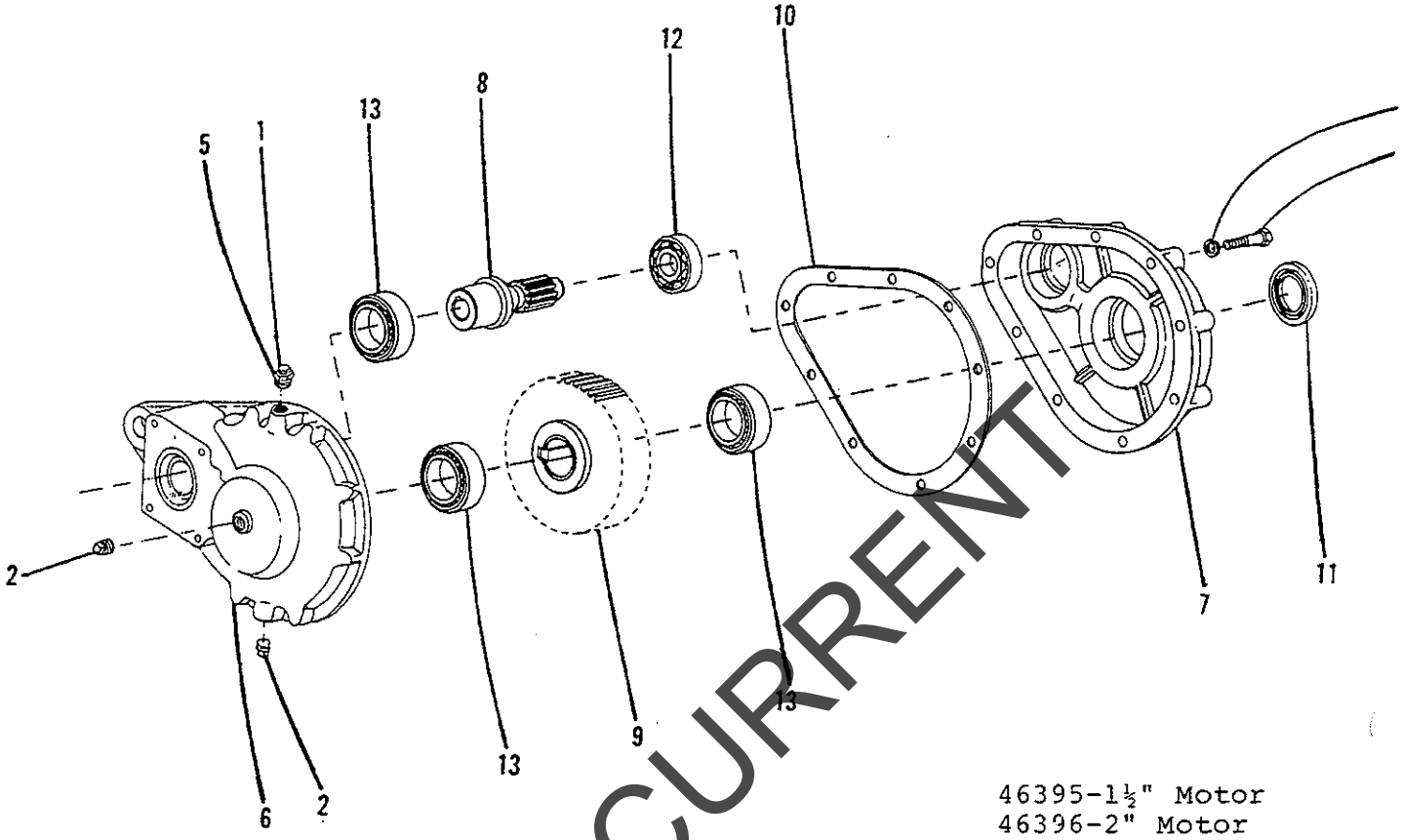
GEAR CASE ASSEMBLY (W/O MARK II)



2" Motor #38898

ITEM	PART NO.	DESCRIPTION	QTY
	36671	Gear Case Assembly	1
1	2564	Cap-Breather	1
2	6031	Pipe Plug	2
3	20040	Screw-Cap, 5/16 NC x 2"	9
4	20711	Washer-Lock, 5/16	9
5	27465	Bushing-Pipe, 1/8" x 3/8"	1
6	37001	Housing-Outboard	1
7	37002	Housing-Inboard	1
8	37003	Gear-Pinion	1
9	37009	Gear	1
10	37005	Gasket	1
11	37006	Seal-Oil	1
12	37007	Bearing	1
13	37008	Bearing	3

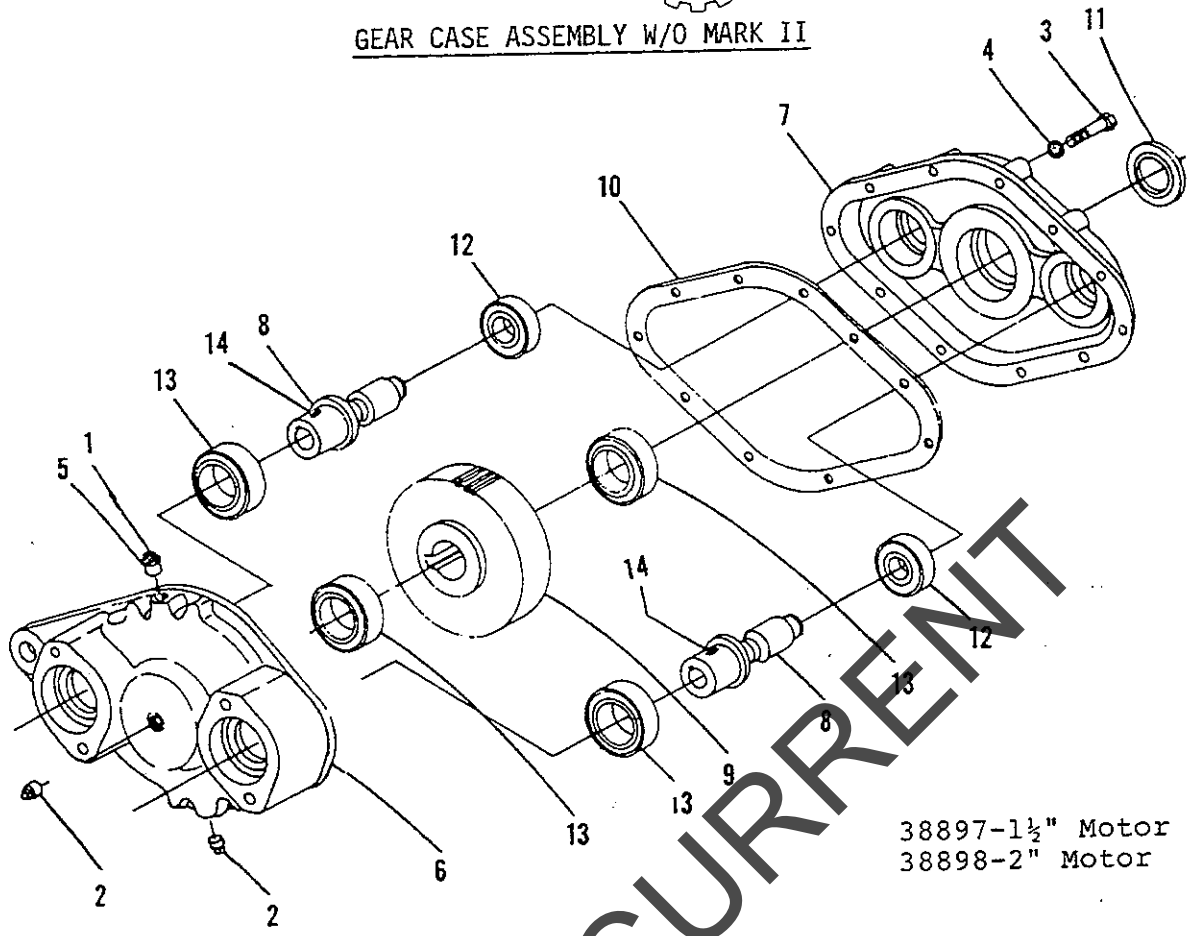
ASSEMBLY GEAR CASE, (W/MARK II)



46395-1½" Motor
46396-2" Motor

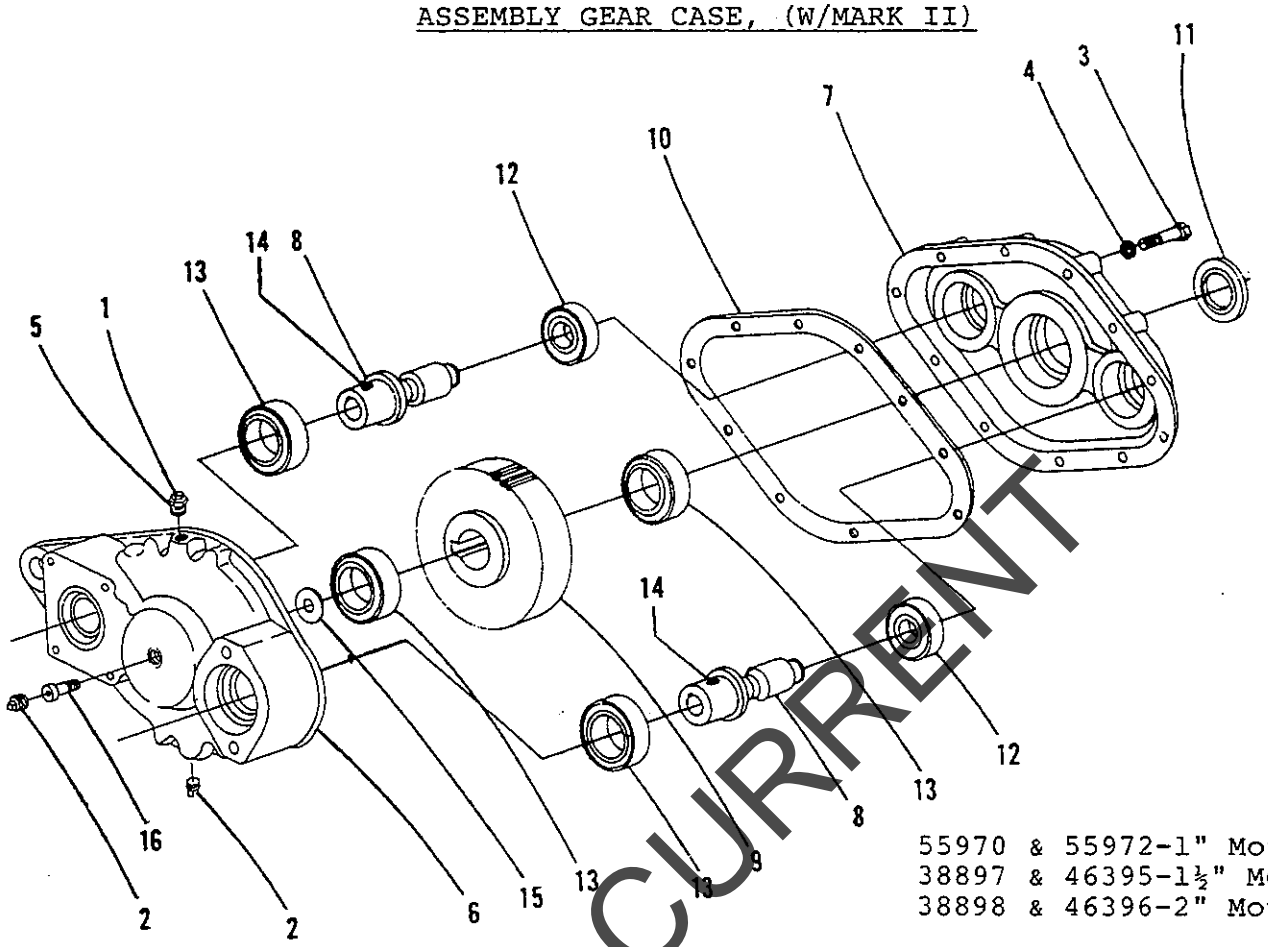
ITEM	PART NO.	DESCRIPTION	QTY
	43501	Assembly-Gear Case	1
1	2564	Cap-Breather	1
2	6031	Plug-Pipe	2
3	20040	Screw-Cap, 5/16 NC x 2	9
4	20711	Washer-Lock, 5/16	9
5	27465	Bushing-Pipe, 1/8" x 3/8"	1
6	44403	Housing-Outboard	1
7	37002	Housing-Inboard	1
8	37003	Gear-Pinion	1
9	37009	Gear	1
10	37005	Gasket	1
11	37006	Seal-Oil	1
12	37007	Bearing	1
13	37008	Bearing	3

GEAR CASE ASSEMBLY W/O MARK II



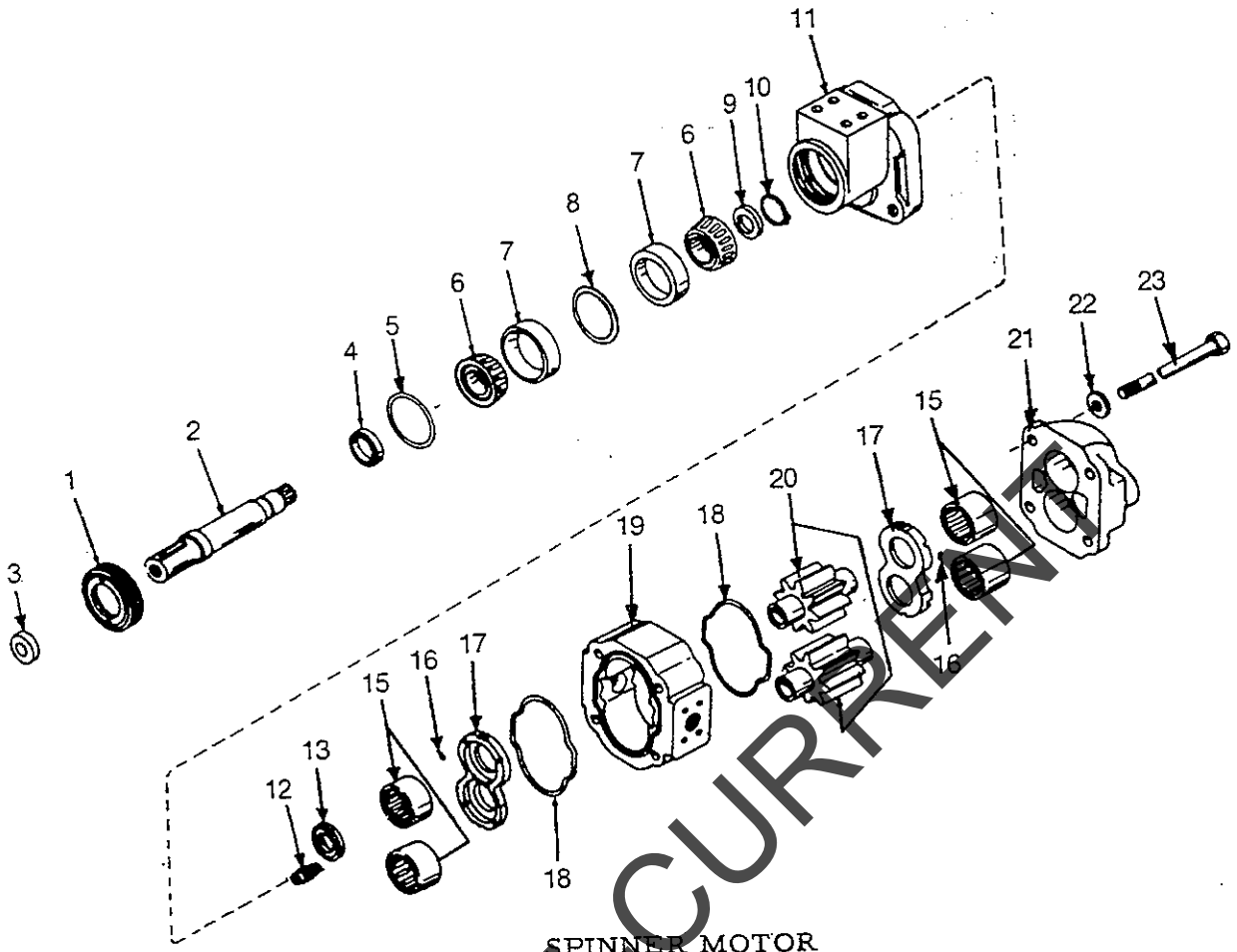
ITEM	PART NO.	DESCRIPTION	QTY
	37985	Assembly-Gear Case	1
1	2564	Cap-Breather	2
2	6031	Pipe-Plug	10
3	20040	Screw-Cap, 5/16 NC x 2	10
4	20711	Washer-Lock, 5/16	1
5	27465	Bushing-Pipe, 1/8 x 7/8	1
6	38983	Housing-Outboard	1
7	38982	Housing-Inboard	2
8	37003	Gear-Pinion	1
9	38981	Gear	1
10	38978	Gasket	1
11	37006	Seal-Oil	2
12	37007	Bearing	4
13	37008	Bearing	1
14	20431	Screw-Nylock Set	

ASSEMBLY GEAR CASE, (W/MARK II)



55970 & 55972-1" Motors
38897 & 46395-1½" Motors
38898 & 46396-2" Motors

ITEM	PART NO.	DESCRIPTION	QTY
	55971	Assembly-Gear Case	
1	2564	Cap-Breather	1
2	6031	Plug-Pipe	2
3	20040	Screw-Cap, 5/16 NC x 2"	10
4	20711	Washer-Lock, 5/16"	10
5	27465	Bushing-Pipe, 1/8" x 7/8"	9
6	55974	Housing-Outboard	1
7	38982	Housing-Inboard	1
8	37003	Gear-Pinion	2
9	38981	Gear	1
10	38978	Gasket	1
11	37006	Seal-Oil	1
12	37007	Bearing	2
13	37008	Bearing	4
14	20431	Screw-Nylock Set, 5/16" NC x 3/4"	1
15	38979	Washer	2
16	38980	Screw-Allen Head	1



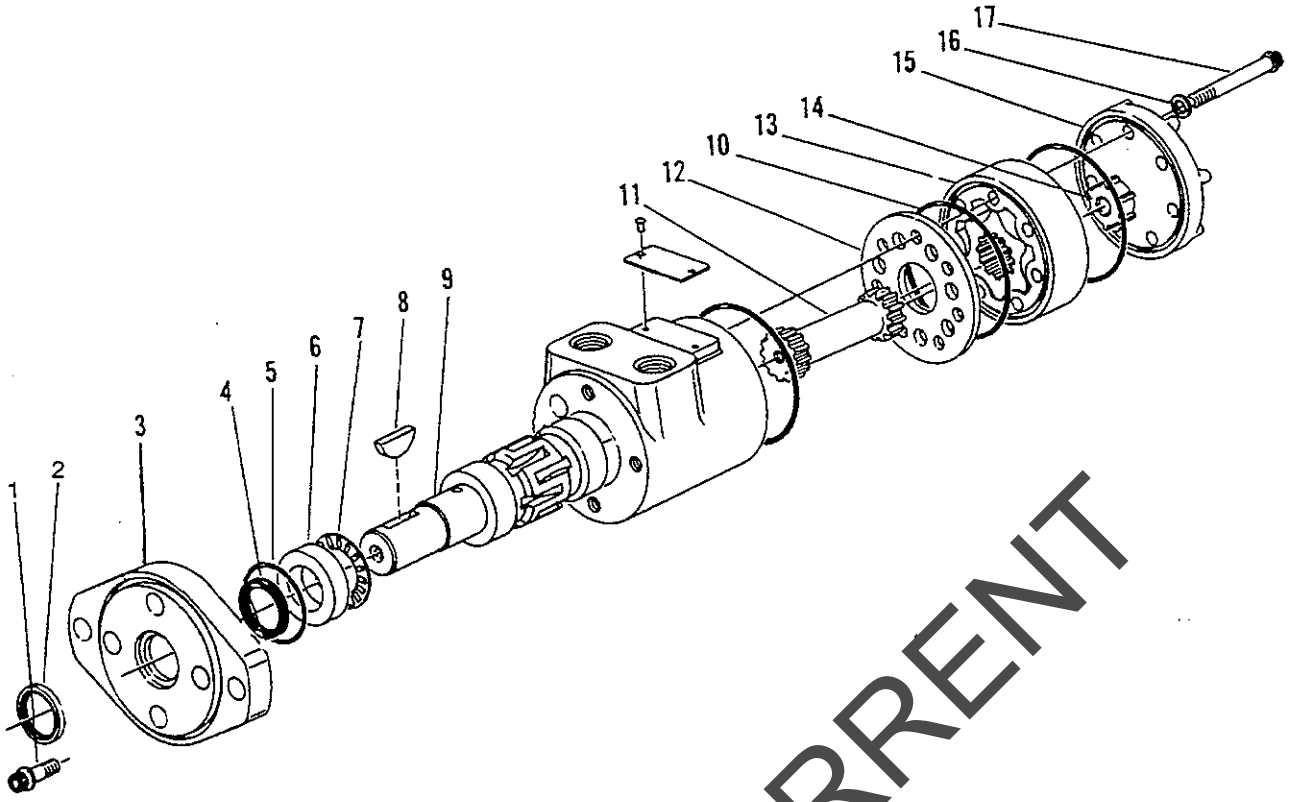
SPINNER MOTOR

ITEM	PART NO.	DESCRIPTION	QTY.
	23800	Assembly - Motor	
1 *	33777	Retainer Ring	1
2	28485	Shaft	1
3 * **	33809	Seal - Excluder	1
4 * **	71980	Seal	1
5 * **	28494	"O" Ring	1
6 *	41014	Bearing Cone	2
7	41013	Bearing Cup	2
8	28454	Spacer	1
9 *	28486	Spacer (Kit)	1
10	28499	Snap Ring	1
11	28490	Shaft End Plate	1
12	58797	Plug	2
13 *	28495	Bushing	1
14			
15	23806	Bearings	4

ITEM	PART NO.	DESCRIPTION	QTY
16 *	23819	Pocket Seals (Makes 12 Seals)	1
17	23818	Plate	2
18 *	23820	Gasket	2
19	28498	Housing	1
20	23822	Gear Set	1
21	23812	Port End Cover	1
22		Washer	4
23	23833	Capscrew	4

23940 Tool - Seal Installation 1
(Required for installation of Item 4

* 72547 Seal Kit
** 72548 Seal Kit



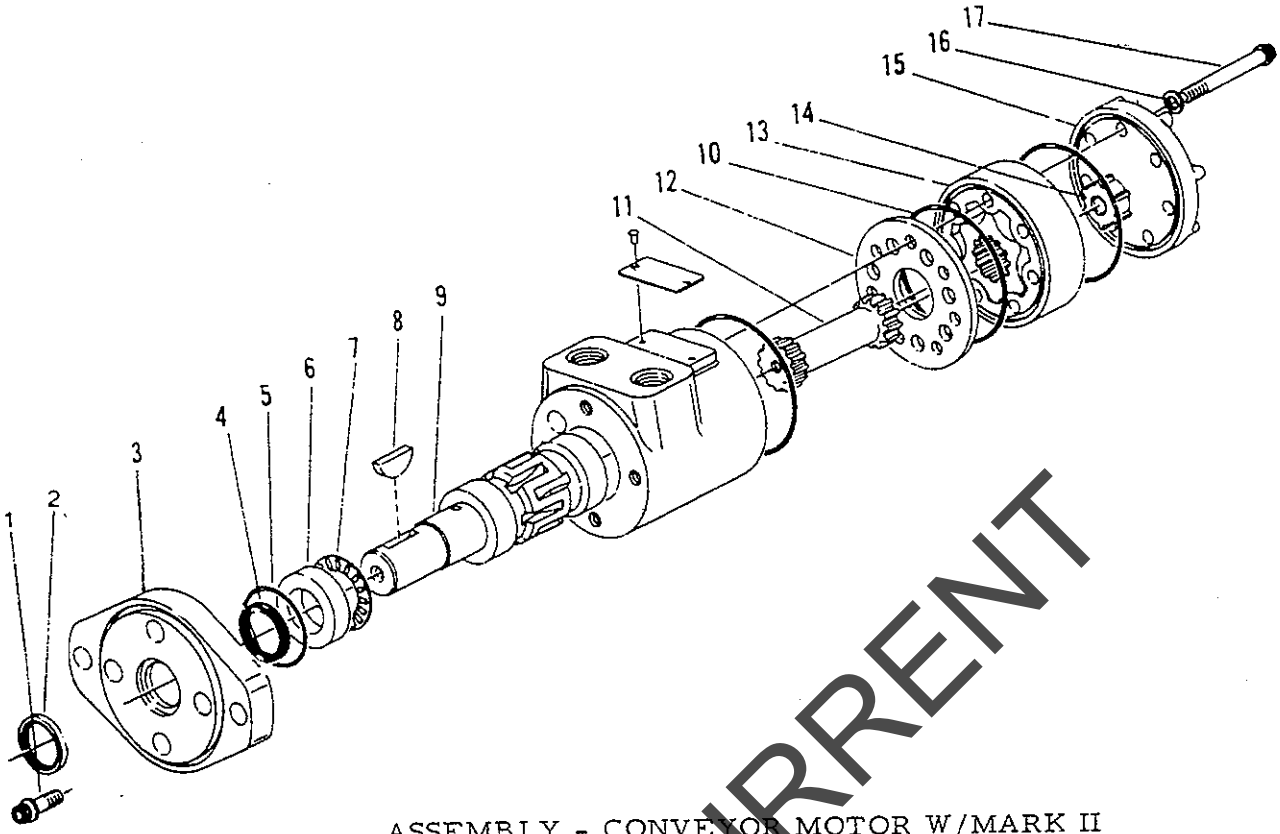
ASSEMBLY CONVEYOR MOTOR

ITEM	PART NO.	DESCRIPTION	QTY.
	46395	Motor - Hydraulic 1 1/2"	
	46396	Motor - Hydraulic 2"	
1	30665	Screw - Cap	4
2	37382	Seal	1
3	46397	Flange - Mounting	1
4	37378	Seal	1
5	37379	Seal - "O" Ring	1
6	37385	Race - Bearing	1
7	37401	Bearing - Thrust Needle	1
8	3065	Key - Woodruff	1
9	37386	Shaft - Output, Keyed	1
10	37380	Seal - "O" Ring	3
11	16946	Drive	1
12	37388	Plate - Spacer	1
13	37395	Gerotor- 2"	1
	37394	Gerotor - 1 1/2"	1
14	37399	Spacer - 2"	1
	37398	Spacer - 1 1/2"	1
15	37400	Cap - End	1
16	37381	Washer - Seal	7

ASSEMBLY CONVEYOR MOTOR CONT'D

17	16938	Screw - Cap - (use on 43494)	7
	16937	Screw - Cap - (use on 43493)	7
*18	22068	Seal - "O" Ring	1
	37352	Kit - Seal (Includes Items # 2, 4, 5, 10, &16)	

* NOT SHOWN



ASSEMBLY - CONVEYOR MOTOR W/MARK II

ITEM	PART NO.	DESCRIPTION	QTY.
	38897	Motor - Hydraulic 1-1/2"	
	46395	Motor - Hydraulic, Modified 1-1/2"	
1	30665	Screw - Cap	4
2	37382	Seal	1
3	46397	Flange - Mounting (Used on 46395)	1
	55220	Flange - Mounting (Used on 38897)	1
4	37378	Seal	1
5	37379	Seal - "O" Ring	1
6	37385	Race - Bearing	1
7	37401	Bearing - Thrust Needle	1
8	3065	Key - Woodruff	1
9	37386	Shaft - Output, Keyed	1
10	37380	Seal - "O" Ring	3
11	16946	Drive	1
12	37388	Plate - Spacer	1
13	37394	Gerotor - 1-1/2"	1
14	37398	Spacer	1
15	37400	Cap - End	1
16	37381	Washer - Seal	7
17	16937	Screw - Cap	7
*18	22068	Seal - "O" Ring	1
	37352	Kit - Seal (Includes Items #2, 4, 5, 10,& 16)	*Not Shown

ALWAYS GIVE PART NAME. NUMBER AND MACHINE SERIAL NUMBER WHEN ORDERING PARTS

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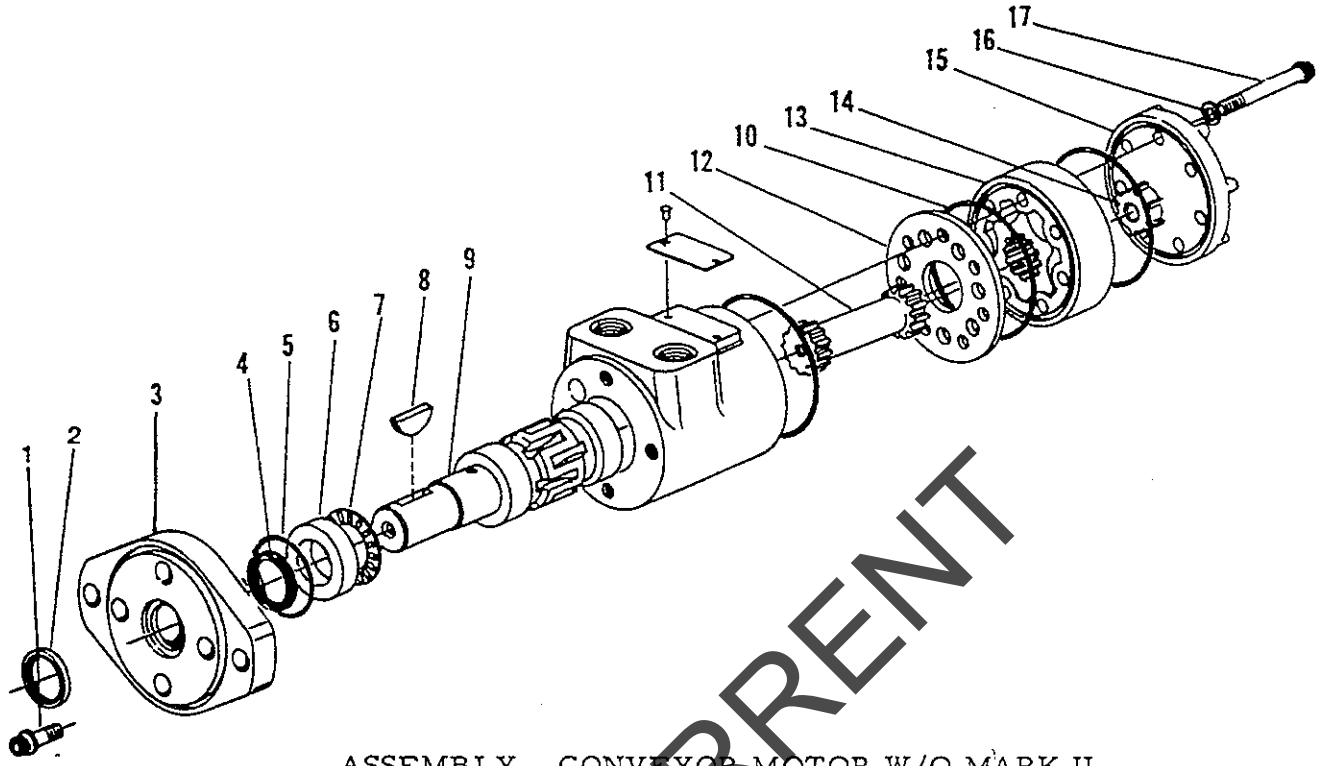

ASSEMBLY - CONVEYOR MOTOR W/O MARK II

ITEM	PART NO.	DESCRIPTION	QTY
	38898	Motor - Hydraulic 2"	
1	30665	Screw - Cap	4
2	37382	Seal	1
3	55220	Flange - Mounting	1
4	37378	Seal	1
5	37379	Seal - "O" Ring	1
6	37385	Race - Bearing	1
7	37401	Bearing - Thrust Needle	1
8	3065	Key - Woodruff	1
9	37386	Shaft - Output, Keyed	1
10	37380	Seal - "O" Ring	3
11	16946	Drive	1
12	37388	Plate - Spacer	1
13	37395	Gerotor	1
14	37399	Spacer	1
15	37400	Cap - End	1
16	37381	Washer - Seal	7
17	16938	Screw - Cap	7
*18	22068	Seal - "O" Ring	1
	37352	Kit - Seal (Includes Items #2, 4, 5, 10 & 16)	

* Not Shown

ALWAYS GIVE PART NAME. NUMBER AND MACHINE SERIAL NUMBER WHEN ORDERING PARTS

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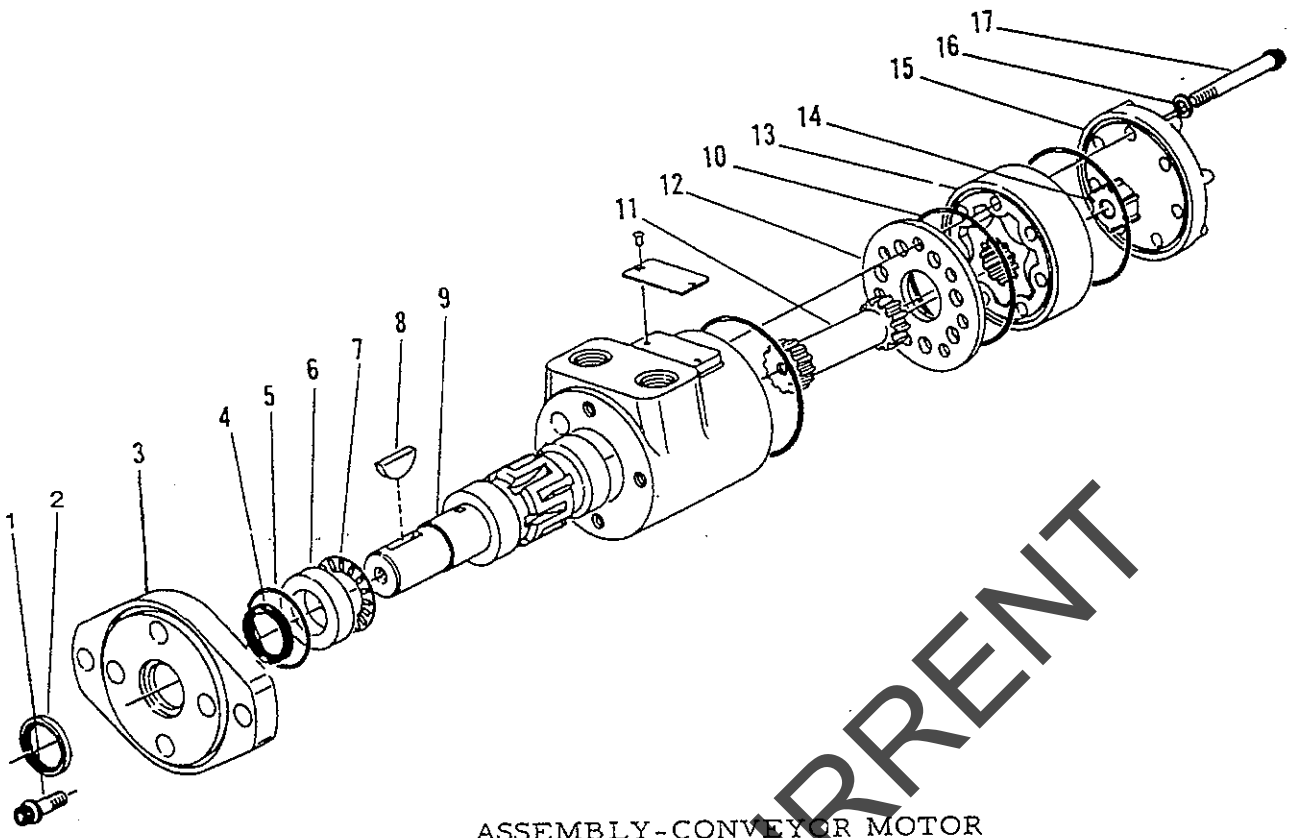
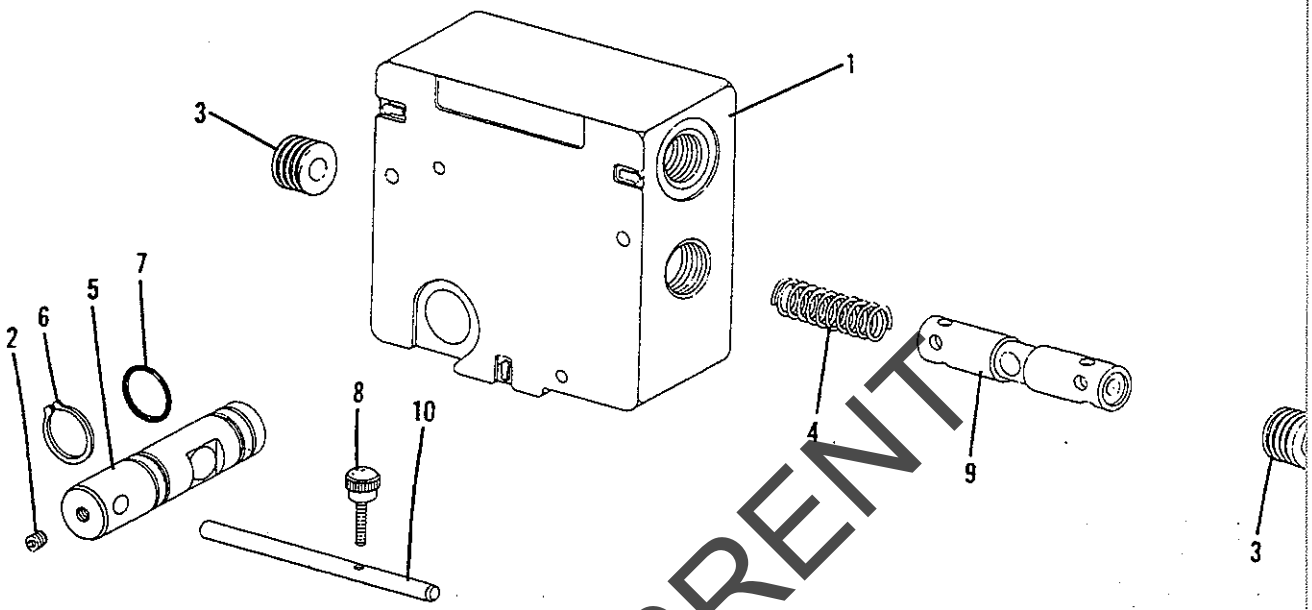


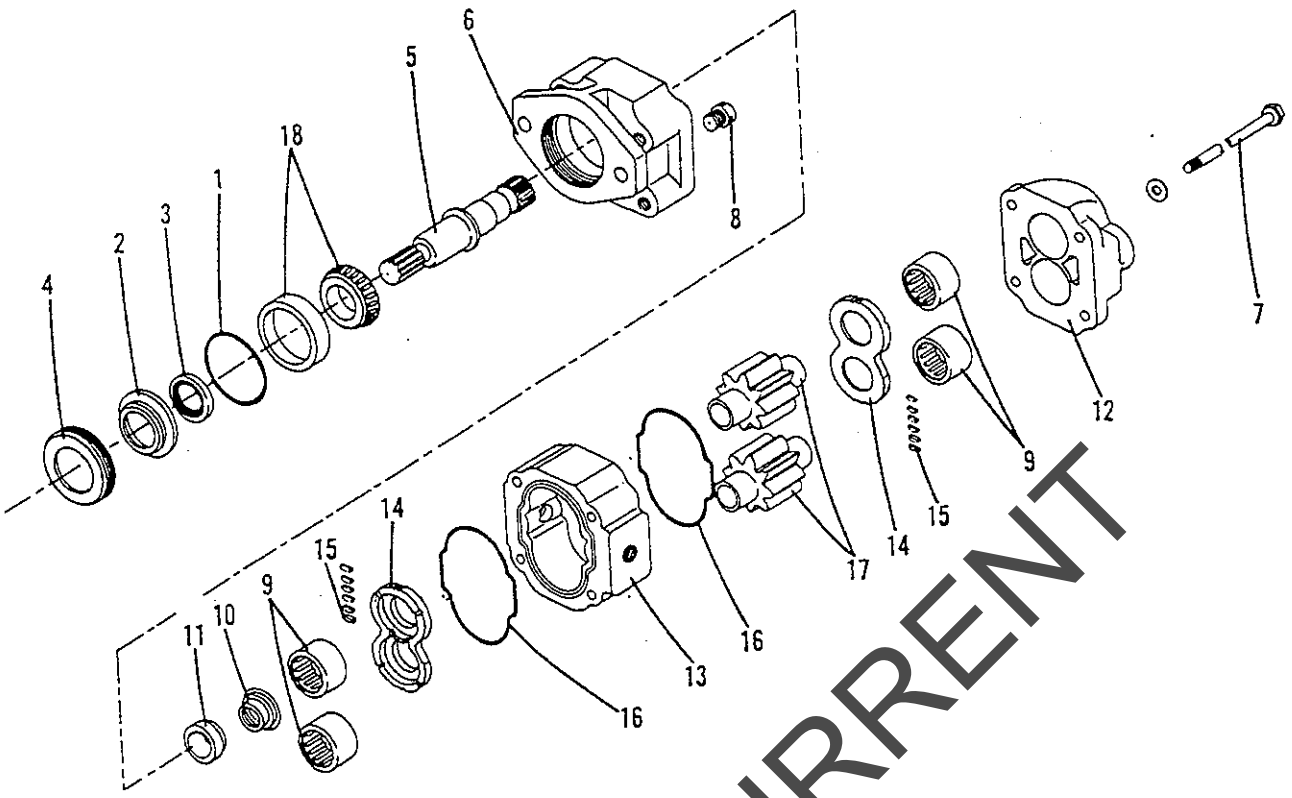
ASSEMBLY-CONVEYOR MOTOR

ITEM	PART NO.	DESCRIPTION	QTY.
	55970	Motor - Hydraulic 1"	
	55972	Motor - Hydraulic, Modified 1"	
1	30665	Screw - Cap	4
2	37382	Seal	1
3	46397	Flange - Mounting (Used on 55972)	1
	55220	Flange - Mounting (Used on 55970)	1
4	37378	Seal	1
5	37379	Seal - "O" Ring	1
6	37385	Race - Bearing	1
7	37401	Bearing - Thrust Needle	1
8	3065	Key - Woodruff	1
9	37386	Shaft - Output, Keyed	1
10	37380	Seal - "O" Ring	3
11	47062	Drive	1
12	37388	Plate - Spacer	1
13	47063	Gerotor - 1"	1
14	47064	Spacer	1
15	37400	Cap - End	1
16	37381	Washer - Seal	7
17	47065	Screw - Cap	7



SPINNER CONTROL VALVE

ITEM	PART NO.	DESCRIPTION	QTY.
	32485	Valve - Hydraulic	
1	------	Body - Adjustable Divider	1
2	20735	Screw - Set, 1/4 - 20 NC x 1/4	1
3	24555	Plug	2
4	24556	Spring	1
5	24557	Spool - Rotary	1
6	24559	Snap Ring	2
7	24563	"O" Ring	2
8	24566	Screw - Thumb	1
9	24574	Spool	1
10	24558	Handle	1
	28474	Kit - Seal (Includes Items # 6 & 7)	1
	34878	Washer - Seal (#FC 106)	2



ASSEMBLY - PUMP DIRECT MOUNT

ITEM	PART NO.	DESCRIPTION	QTY.
1	11760	"O" Ring	1
2	**11761	Seal - Double Lip	1
3	**11762	Seal - Double Lip	1
4	11763	Retainer Ring	1
5	11764	Drive Shaft	1
6	13149	Shaft End Cover	1
7	20187	Capscrew for 1-1/4" pump	4
	20188	Capscrew for 1-1/2" pump	4
	20189	Capscrew for 1-3/4" pump	4
	20190	Capscrew for 2" pump	4
	20191	Capscrew for 2-1/4" pump	4
	20192	Capscrew for 2-1/2" pump	4
8	23805	Check Assembly	2
9	23806	Roller Bearing	4
10	23807	Spring	1
11	23808	Shaft Bushing	1
12	23812	Port End Cover	1
13	23813	Housing - Gear, 1-1/4"	1
	23814	Housing - Gear, 1-1/2"	1
	30039	Housing - Gear, 1-3/4"	1

PUMP ASSEMBLY - CONT'D

ITEM	PART NO.	DESCRIPTION	QTY.
13 cont'd	23815	Housing - Gear, 2"	1
	23816	Housing - Gear, 2-1/4"	1
	23817	Housing - Gear, 2-1/2"	1
14	23818	Thrust Plate	2
15	**23819	Pocket Seal (Make 12 Seals)	1
16	**23820	Gasket	2
17	*	Gear - Drive & Driven	1
18	28491	Bearing - Tapered Roller	1

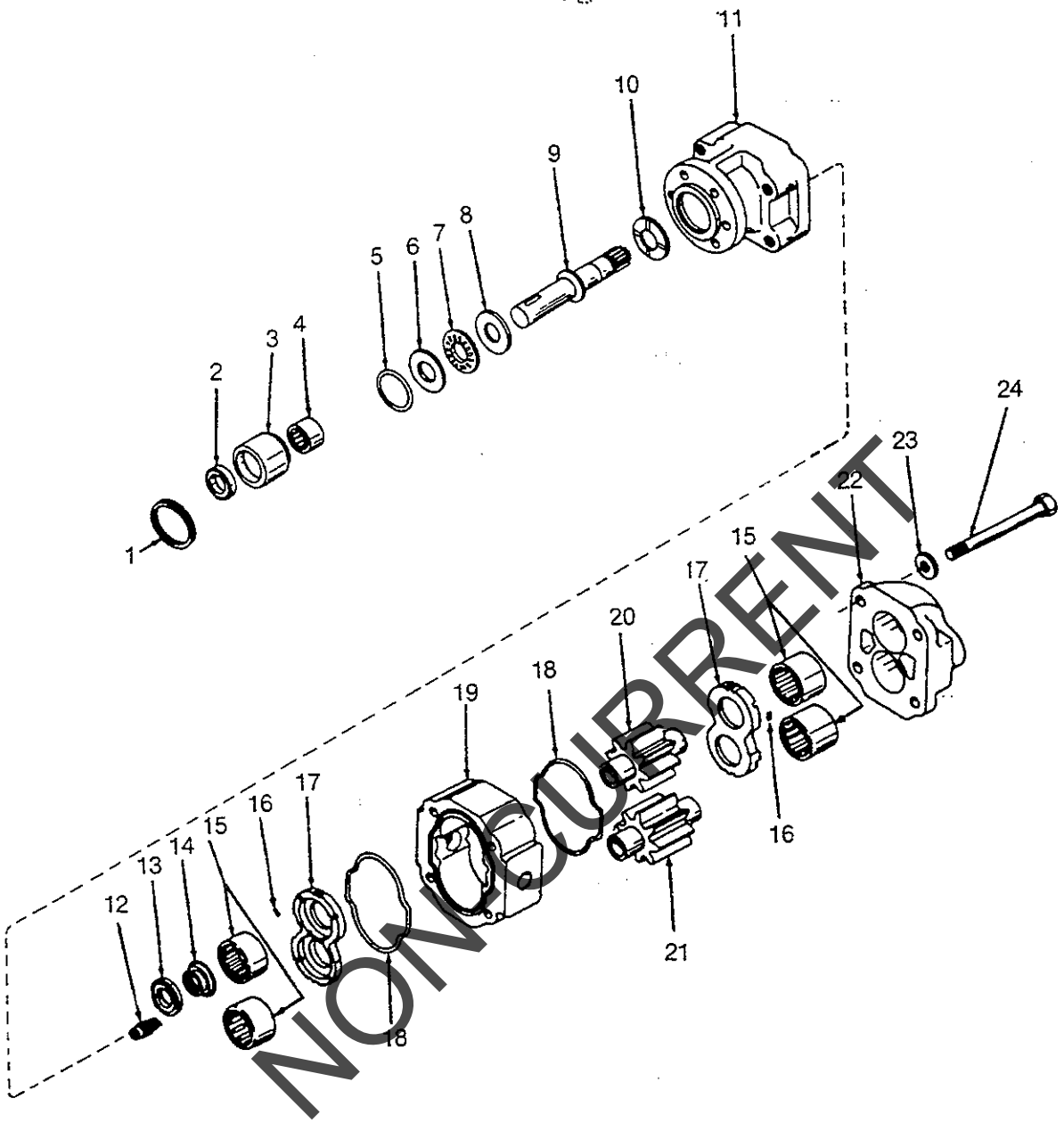
* Item 17 comes only as a Matched Set:

23822	Gear Set 1-1/4"	1
23823	Gear Set 1-1/2"	1
30040	Gear Set 1-3/4"	1
23824	Gear Set 2"	1
23825	Gear Set 2-1/4"	1
23826	Gear Set 2-1/2"	1

** Seal Kit 13048

COMPLETE PUMP ASSEMBLY

31230	1-1/4" Gear Pump
31231	1-1/2" Gear Pump
30168	1-3/4" Gear Pump
31232	2" Gear Pump
36847	2-1/4" Gear Pump
31233	2-1/2" Gear Pump



PUMP ASSEMBLY

ITEM	PART NO.	DESCRIPTION	QTY.
1	**22630	Snap Ring	1
2	**23804	Seal - Double Lip	1
3	23811	Bearing Sleeve	1
4	23803	Roller Bearing	1
5	**23802	"O" Ring	1
6	23809	Thrust Bearing Race	1
7	**23810	Thrust Bearing	1
8	**23809	Thrust Bearing Race	1

ALWAYS GIVE PART NAME. NUMBER AND MACHINE SERIAL NUMBER WHEN ORDERING PARTS

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PUMP ASSEMBLY - CONT'D

ITEM	PART NO.	DESCRIPTION	QTY.
9	23821	Drive Shaft	1
10	23827	Thrust Washer	1
11	23801	Shaft End Cover	1
12	23805	Check Assembly	2
13	**23808	Shaft Bushing	1
14	23807	Spring	1
15	23806	Roller Bearing	4
16	**23819	Pocket Seal (Make 12 Seals)	1
17	23818	Thrust Plate	2
18	**23820	Gasket	2
19	23813	Housing - Gear 1-1/4"	1
	23814	Housing - Gear 1-1/2"	1
	30039	Housing - Gear 1-3/4"	1
	23815	Housing - Gear 2"	1
	23816	Housing - Gear 2-1/4"	1
	23817	Housing - Gear 2-1/2"	1
20	*	Gear - Drive	1
21	*	Gear - Driven	1
22	23812	Port End Cover	1
23		Washer	4
24	20187	Capscrew for 1-1/4" Pump	4
	20188	Capscrew for 1-1/2" Pump	4
	20189	Capscrew for 1-3/4" Pump	4
	20190	Capscrew for 2" Pump	4
	20191	Capscrew for 2-1/4" Pump	4
	20192	Capscrew for 2-1/2" Pump	4

* Items 20 and 21 come only as a Matched Set:

23822	Gear Set 1-1/4"	1
23823	Gear Set 1-1/2"	1
30040	Gear Set 1-3/4"	1
23824	Gear Set 2"	1
23825	Gear Set 2-1/4"	1
23826	Gear Set 2-1/2"	1

** Seal Kit 27490 Shaft and Seal Kit 27491 (Includes 27490 and Items 4 & 9)

COMPLETE PUMP ASSEMBLY

22393	1-1/4" Gear Pump
22394	1-1/2" Gear Pump
22395	1-3/4" Gear Pump
22396	2" Gear Pump
22397	2-1/4" Gear Pump
22398	2-1/2" Gear Pump

ALWAYS GIVE PART NAME. NUMBER AND MACHINE SERIAL NUMBER WHEN ORDERING PARTS

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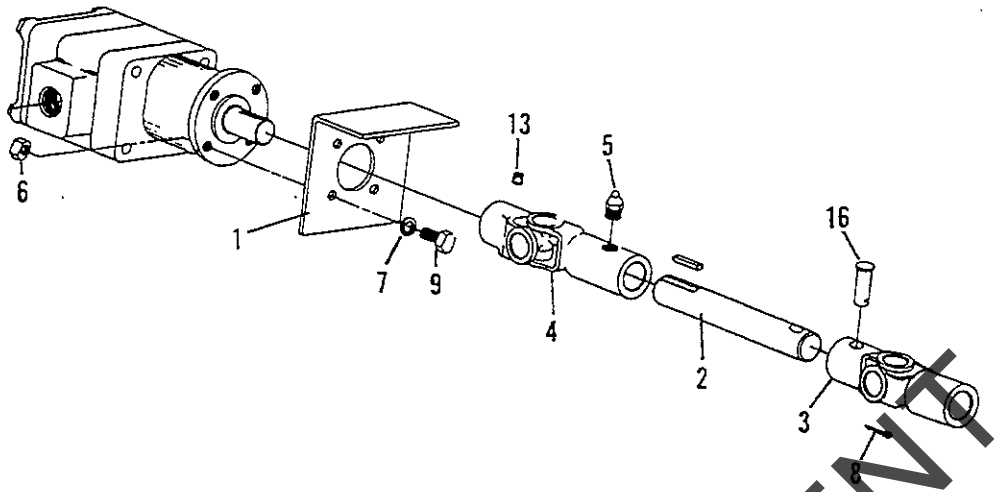
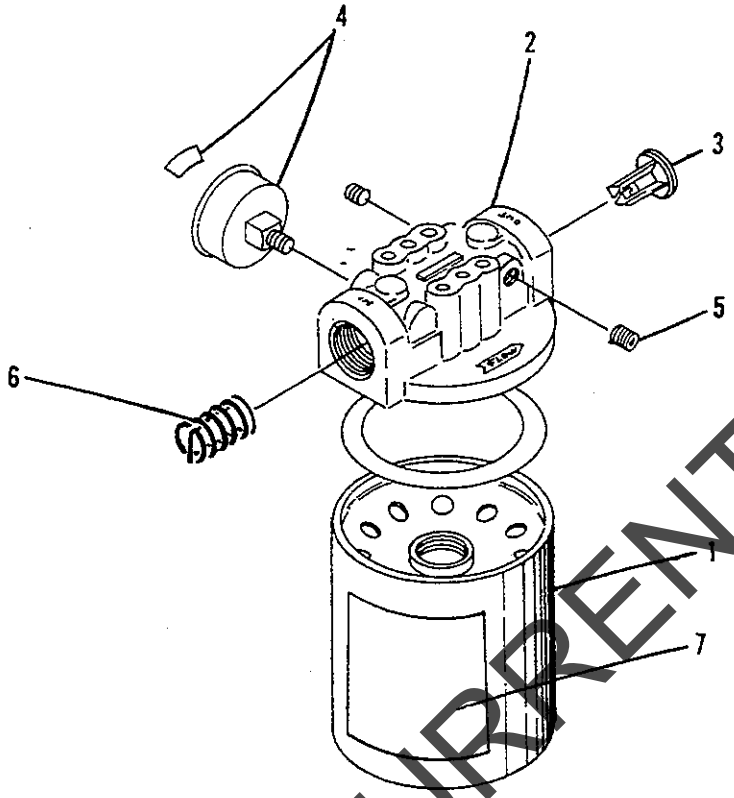


ASSEMBLY - PUMP MOUNTING KIT

ITEM	PART NO.	DESCRIPTION	QTY.
1	13850	Weldment - Bracket, Pump	1
2	17932	Shaft - Drive	1
3	7210	U-Joint	1
4	5649	U-Joint	1
	11756	Group - Hardware, Pump (Consists of items 5 - 16	1
5	6069	Zerk - Grease	1
6	20644	Nut - Hex	4
7	20712	Washer - Lock	4
8	20817	Pin - Cotter	1
9	20069	Screw - Cap	4
10	*20129	Screw - Cap	4
11	*2211	Key - Square	1
12	*2776	Key - Square	1
13	20748	Screw - Set	2
14	*20646	Nut - Hex	4
15	*20714	Washer - Lock	4
16	6122	Pin - Shear	1

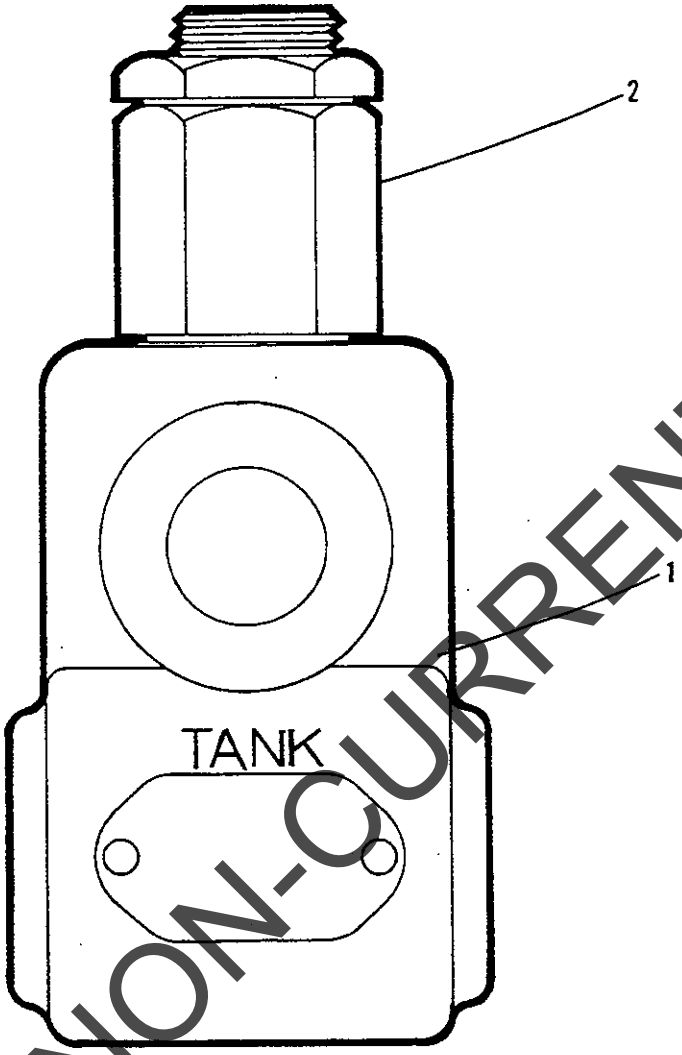
* - Not Shown



FILTER - HYDRAULIC, WITH INDICATOR

ITEM	PART NO.	DESCRIPTION	QTY.
	39845	Filter - Hydraulic with Indicator	
1	43530	Filter - Element Kit	1
2	N.S.	Head Casting	1
3	43533	Relief Valve Poppet	1
4	43534	Indicator with Decal	1
5	6029	Pipe - Plug, 1/8"	1
6	43492	Relief Valve Spring	1
7	39379	Decal	

N.S. - Not Serviced

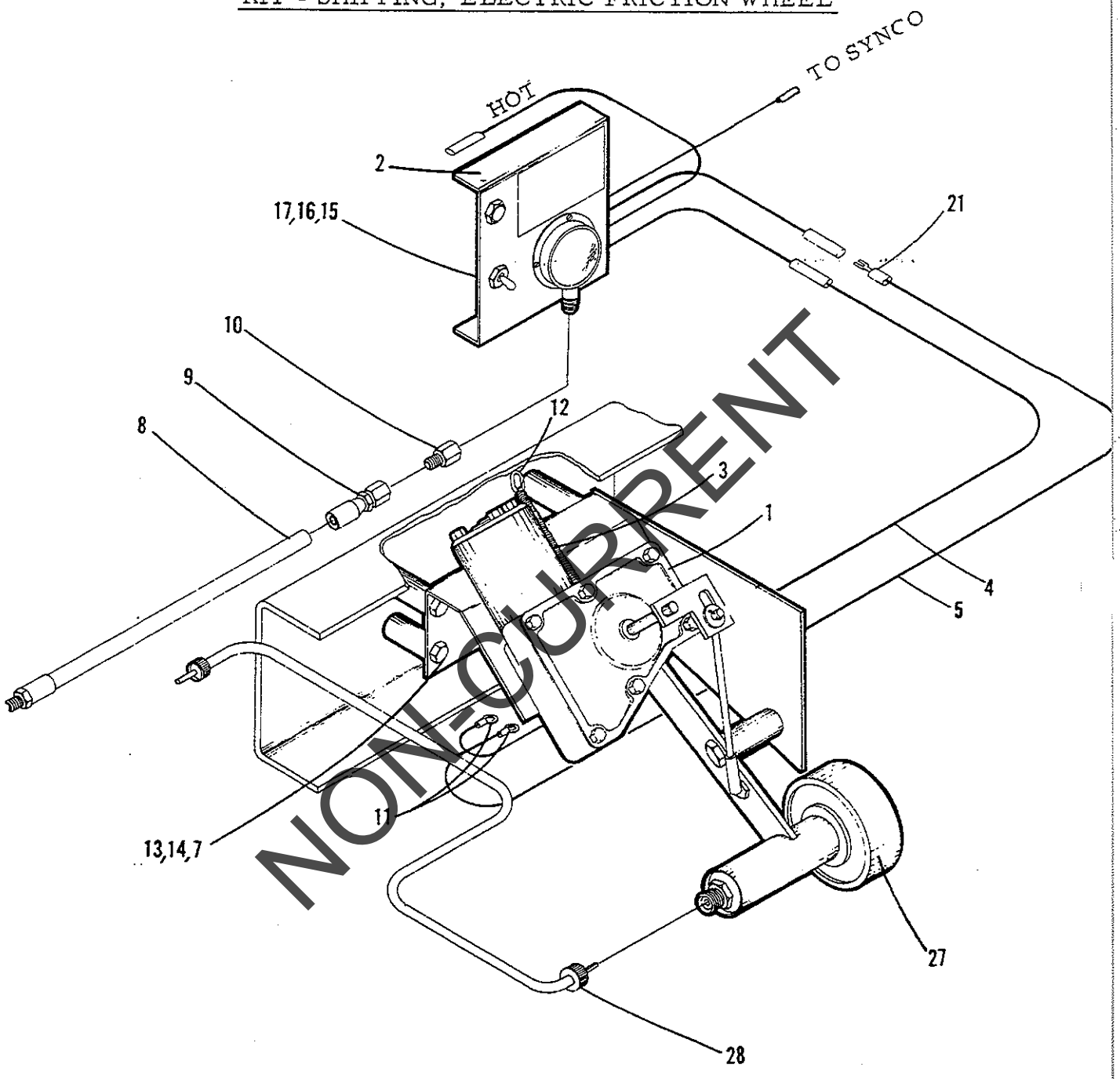


ASSEMBLY - RELIEF VALVE, ADJUSTABLE

ITEM	PART NO.	DESCRIPTION	QTY.
	37447	Assembly - Relief Valve, Adjustable	
1	43487	Housing - Relief Valve	N.S.S.
2	43488	Cartridge - Relief Valve	1

N.S.S. - Not Serviced Separately

KIT - SHIPPING, ELECTRIC FRICTION WHEEL



KIT - SHIPPING, ELECTRIC FRICTION WHEEL

ITEM	PART NO.	DESCRIPTION	QTY.
		Kit - Shipping, Electric Friction Wheel For:	
	46173	10' Unit	
	46174	11' Unit	
	46175	12' Unit	
	46176	13' Unit	
	46177	14' Unit	
	44985	15' Unit	
	44986	16' Unit	
1	16594	Assembly - Friction Wheel	1
2	43553	Assembly - Friction Wheel Control Panel	1
3	8783	Spring	1
4	21589-144	Wire - Electric 14 Ga. Pink	1
5	21583-144	Wire - Electric 14 Ga. Brown	1
6	*43484	Shield - Friction Wheel	1
7	31906	Spacer	4
8		Assembly - Hose For:	
	31582	10' Unit	1
	31583	11' Unit	1
	31584	12' Unit	1
	31585	13' Unit	1
	31586	14' Unit	1
	31587	15' Unit	1
	56114	16' Unit	1
9	56466	Fitting - Hose End	1
10	34718	Adapter - Connector	1
11	6536	Terminal - Ring	2
12	55962	Bolt - Eye	1
13	20081	Screw - Cap	4
14	20644	Nut - Hex	4
15	20569	Screw - Round Head	2
16	20641	Nut - Hex	2
17	20709	Washer - Lock	2
18	*6325	Grommet - Rubber	1
19	*1386	Tie - Plastic	4
20	*21909-10	Chain - Twisted	1
21	6486	Terminal - Fast On	2
22	*20817	Pin - Cotter	1
23	*12374	Connector - Tap	1
24	*20257	Screw - Machine	3
25	*20259	Nut - Hex	3
26	*20643	Nut - Hex	2

* - Not Shown

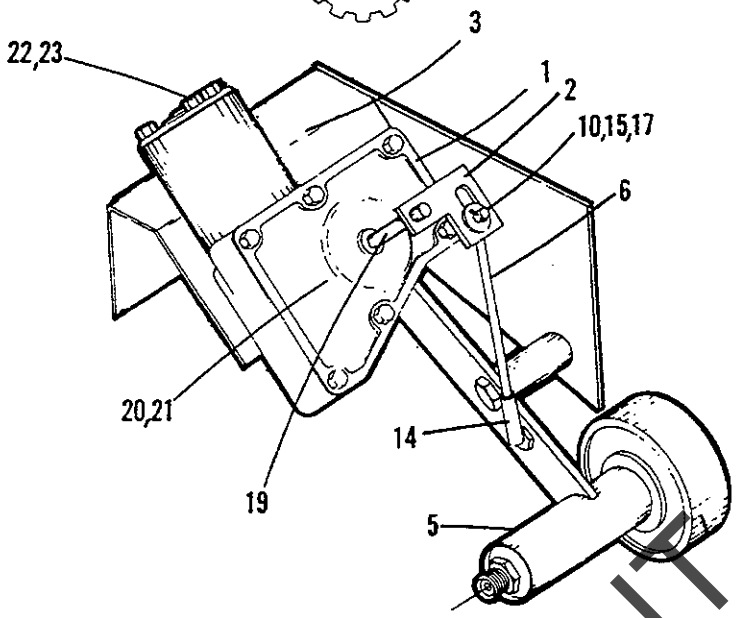
KIT - SHIPPING, ELECTRIC FRICTION WHEEL CONT'D

ITEM	PART NO.	DESCRIPTION	QTY.
27	8719	Friction Wheel 2-1/2" Diameter	1
	8720	Friction Wheel 3" Diameter	1
	8721	Friction Wheel 3-1/2" Diameter	1
	10038	Friction Wheel 4" Diameter	1
	11416	Friction Wheel 5" Diameter	1
	32442	Friction Wheel 6" Diameter	1
28	33947	Speedometer Cable 120"	1
	33948	Speedometer Cable 132"	1
	33949	Speedometer Cable 144"	1
	33950	Speedometer Cable 156"	1
	33951	Speedometer Cable 168"	1
	33952	Speedometer Cable 180"	1
	53974	Speedometer Cable 192"	1
29	*31939	Friction Wheel Adapter (1.5:1)	1
30	*7919	Friction Wheel Adapter (2:1)	1

* - Not Shown

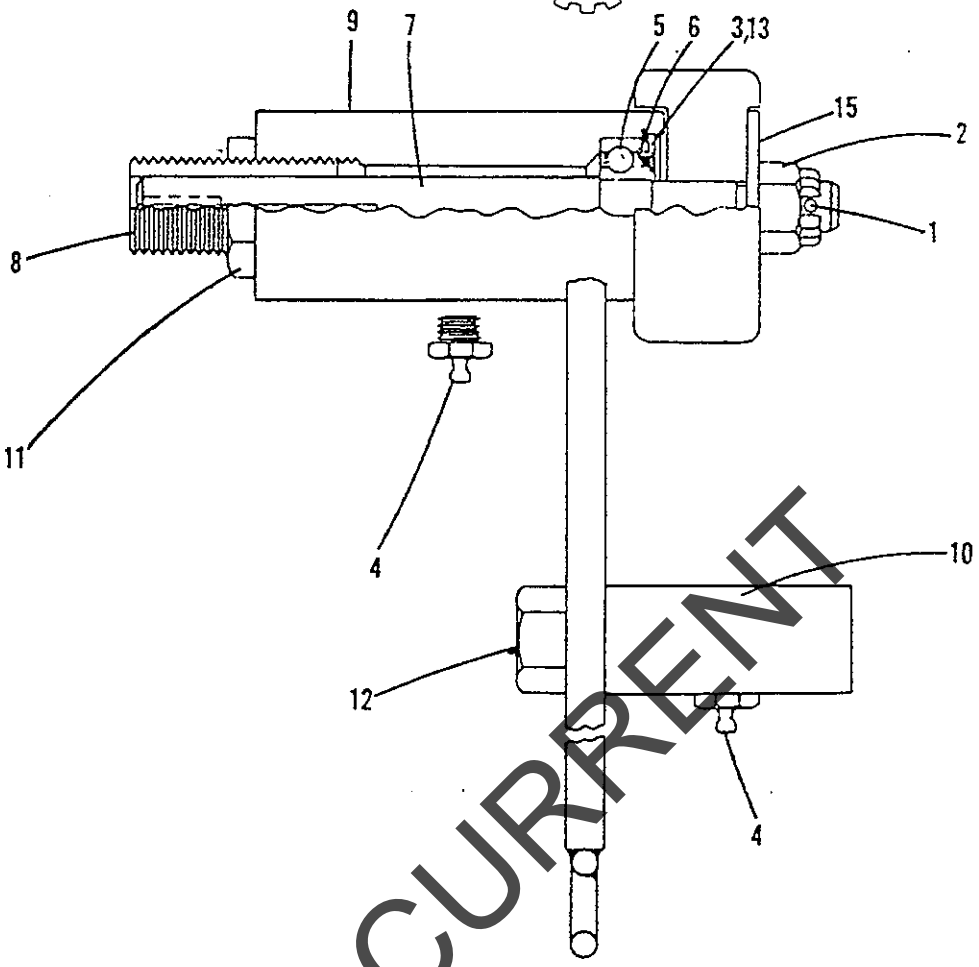
Core Only for Above Speedometer Cables For:

38329	120" Cable	1
38330	132" Cable	1
38331	144" Cable	1
38332	156" Cable	1
38333	168" Cable	1
38334	180" Cable	1
32811	192" Cable	1



ASSEMBLY - ELECTRIC FRICTION WHEEL

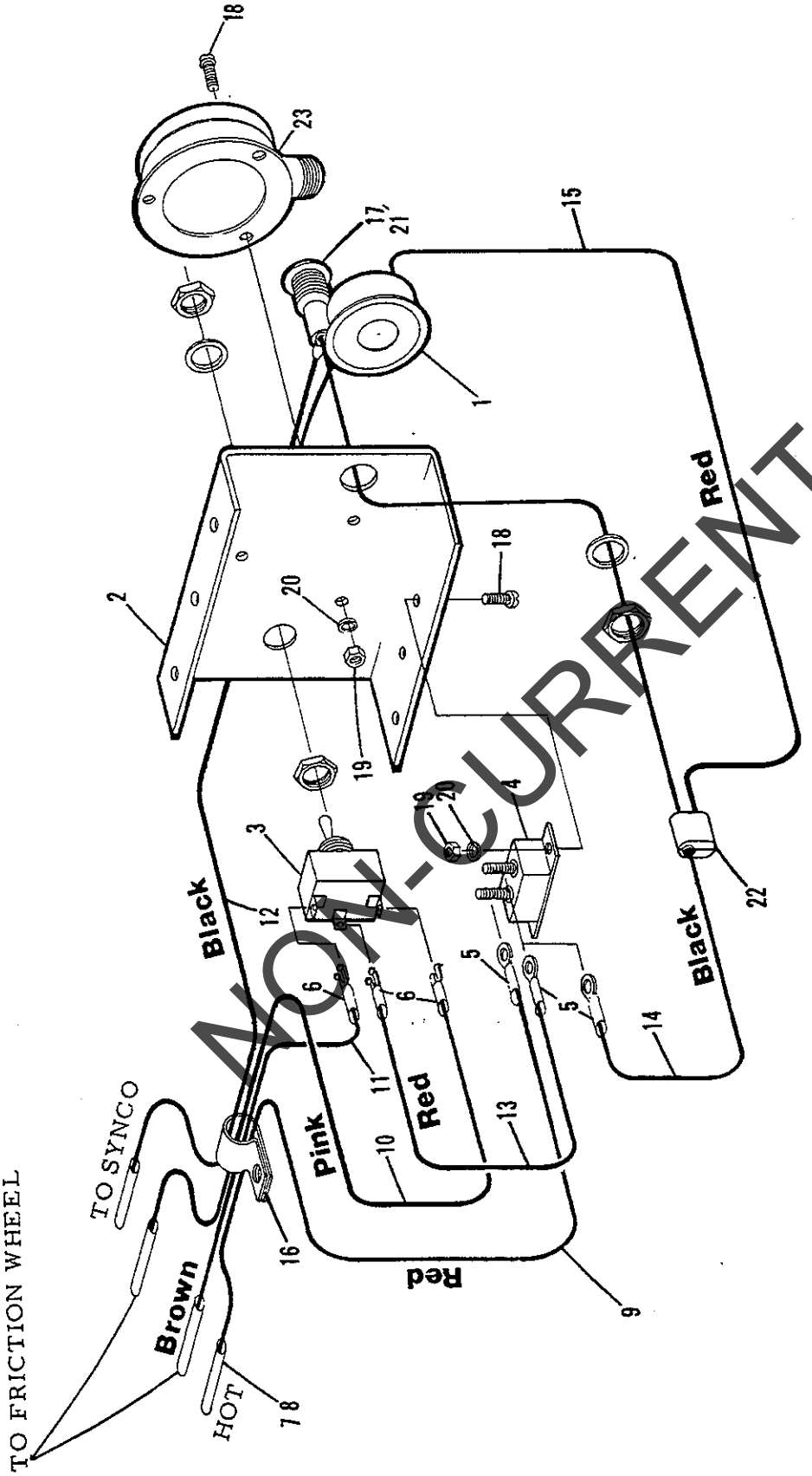
ITEM	PART NO.	DECRIPTION	QTY.
	16594	Assembly - Electric Friction Wheel	
1	2033	Assembly - Electric Actuator	1
2	55964	Link - Bell Crank	1
3	16596	Weldment - Mounting Bracket	1
4	*20875	Nut - Castelated	1
5	14376	Assembly - Friction Wheel	1
6	8776	Rod - Control	1
7	*20128	Screw - Cap	3
8	*20646	Nut - Hex	3
9	*20714	Washer - Lock	3
10	20812	Pin - Cotter	1
11	*20817	Pin - Cotter	1
12	*20694	Washer - Flat	2
13	*21394	Washer - Flat	1
14	40504	Assembly - Ball Joint	1
15	20986	Pin - Roll	1
16	*26974	Gasket	1
17	20691	Washer - Flat	2
18			
19	34870	Assembly - Collar	1
20	31553	Gasket	1
21	57643	Assembly - Shift Cover	1
22	40635	Motor - Electric	1
23	31237	Gasket	1
24	*34993	Bearing w/Snap Ring	1
25	*31559	Switch Assembly	1
26	*31560	Pin Contact	2
	* - Not Shown	NOTE: Items 18-26 are Service Parts for Item #1.	



ASSEMBLY - FRICTION WHEEL

ITEM	PART NO.	DESCRIPTION	QTY.
	14376	Assembly - Friction Wheel (Does not include Items 1, 2, 3 & 15)	
1	20817	Pin - Cotter	1
2	20875	Nut - Castelated	1
3	20694	Washer - Flat	2
4	6072	Zerk - Grease	2
5	8723	Bearing - Ball	1
6	8724	Ring - Snap	1
7	8725	Shaft	1
8	8726	Bushing - Threaded	1
9	8727	Weldment - Housing	1
10	8732	Tube - Spacer	1
11	31167	Nut - Special	1
12	20128	Screw - Cap	1
13	20261	Washer - Flat	2
14	*20428	Pin - Roll	1
15	21394	Washer - Flat	1

* - Not Shown

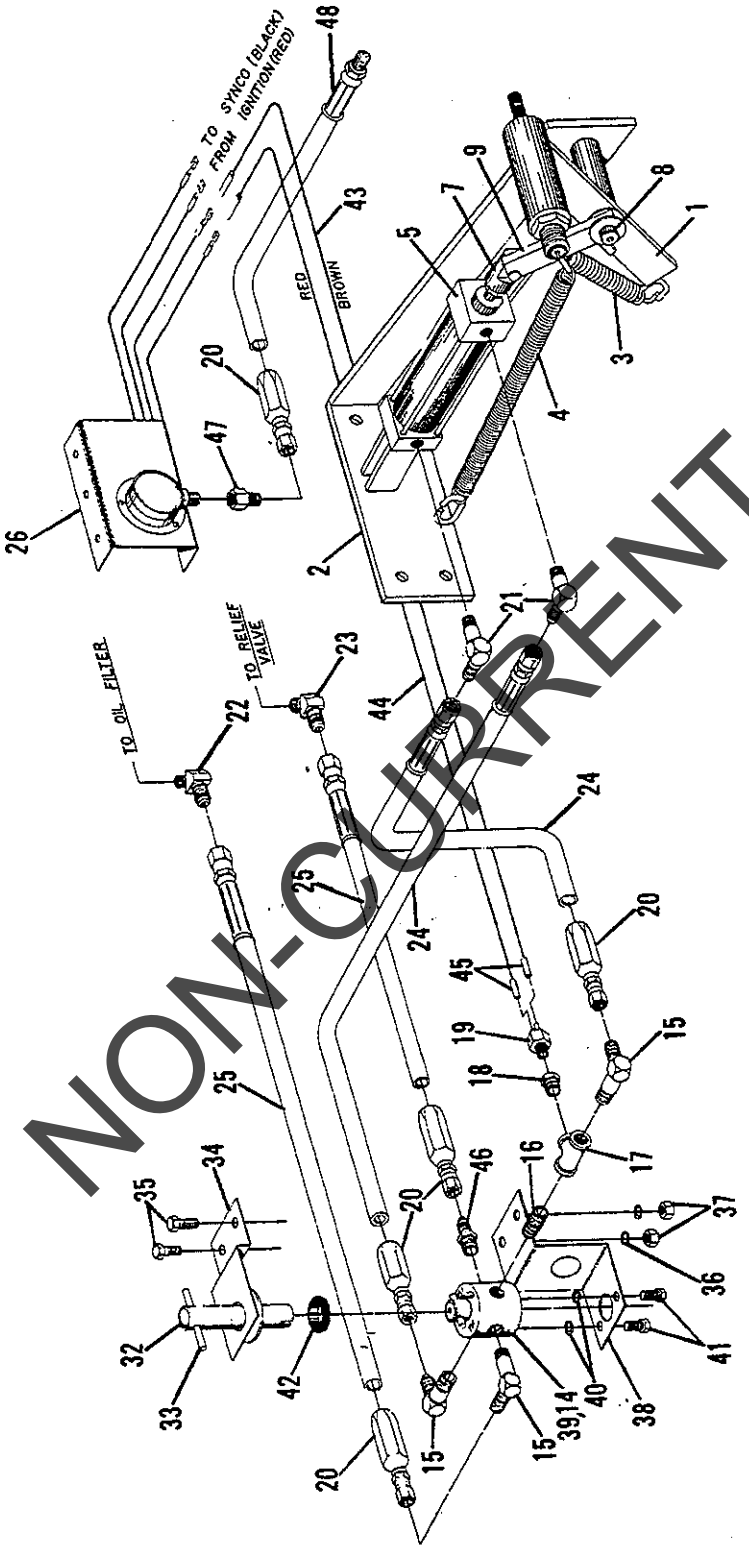


ASSEMBLY GROUP - INSTRUMENT PANEL

ASSEMBLY GROUP - INSTRUMENT PANEL

ITEM	PART NO.	DESCRIPTION	QTY.
	43553	Assembly Group - Instrument Panel	
1	43491	Assembly - Buzzer	1
2	31911	Panel - Instrument	1
3	31681	Switch	1
4	21635	Circuit Breaker - 15 AMP	1
5	6536	Terminal - Ring	3
6	6485	Terminal - Flanged Spade	3
7	6486	Terminal - Fast On	4
8	6487	Connector - Fast On	4
9	21582-12	Wire - Electric 14 Ga. Red x 12	1
10	21589-12	Wire - Electric 14 Ga. Pink x 12	1
11	21583-12	Wire - Electric 14 Ga. Brown x 12	1
12	21580-12	Wire - Electric 14 Ga. Black x 12	1
13	21582-5	Wire - Electric 14 Ga. Red x 5	1
14	21580-5	Wire - Electric 14 Ga. Black x 5	1
15	21961-3	Wire - Electric 16 Ga. Red x 3	1
16	44584	Clamp	1
17	44527	Terminal - Fast On	2
18	20257	Machine Screw	6
19	20259	Nut - Hex	6
20	31561	Washer - Lock	6
21	44523	Light - Indicator	1
	44524	Lens - Red	1
	44526	Lamp	1
22	44529	Connector - Tap	2
23	58571	Guage - Pressure	1

KIT - SHIPPING, HYDRAULIC FRICTION WHEEL



KIT - SHIPPING, HYDRAULIC FRICTION WHEEL

ITEM	PART NO.	DESCRIPTION	QTY.
		Kit - Shipping, Hydraulic Friction Wheel For:	
	59953	10' Unit	
	59954	11' Unit	
	59955	12' Unit	
	59956	13' Unit	
	59957	14' Unit	
	59958	15' Unit	
	59959	16' Unit	
-	54908	Assembly - Hydraulic Friction Wheel (Incl. Items 1-8)	1
1	54915	Assembly - Friction Wheel	1
2	54910	Weldment - Bracket	1
3	31575	Spring - Extension	1
4	44304	Spring - Return	1
5	31577	Actuator - Hydraulic	1
6	*20694	Washer - Flat	2
7	31578	Rod - Eye	1
8	31579	Screw - Shoulder	1
9	54919	Weldment - Pivot Bar	1
10	* 6323	Pin - Clevis	1
11	*21037	Pin - Clevis	1
12	*20817	Pin - Cotter	1
13	*20821	Pin - Cotter	2
14	54924	Valve - Hydraulic	1
15	34732	Adapter	3
16	16378	Nipple - Close	1
17	16516	Tee - Pipe	1
18	6065	Bushing	1
19	37037	Switch - Pressure	1
20	56466	Hose End	5
21	34734	Adapter	2
22	34735	Adapter	1
23	34704	Adapter	1
24	56112	Assembly - Hose	2
25	56113	Assembly - Hose	2
26	54925	Assembly - Control Panel	1
27	* 8735	Shield - Friction Wheel	1
28	*31906	Spacer - Pipe	4
29	*20081	Capscrew	4
30	*20644	Nut - Hex	4
31	*20712	Washer - Lock	4
32	54930	Weldment - Handle	1
33	20941	Pin - Roll	1
34	54932	Retainer - Handle	1
35	20034	Capscrew	2

* - Not Shown

ALWAYS GIVE PART NAME. NUMBER AND MACHINE SERIAL NUMBER WHEN ORDERING PARTS

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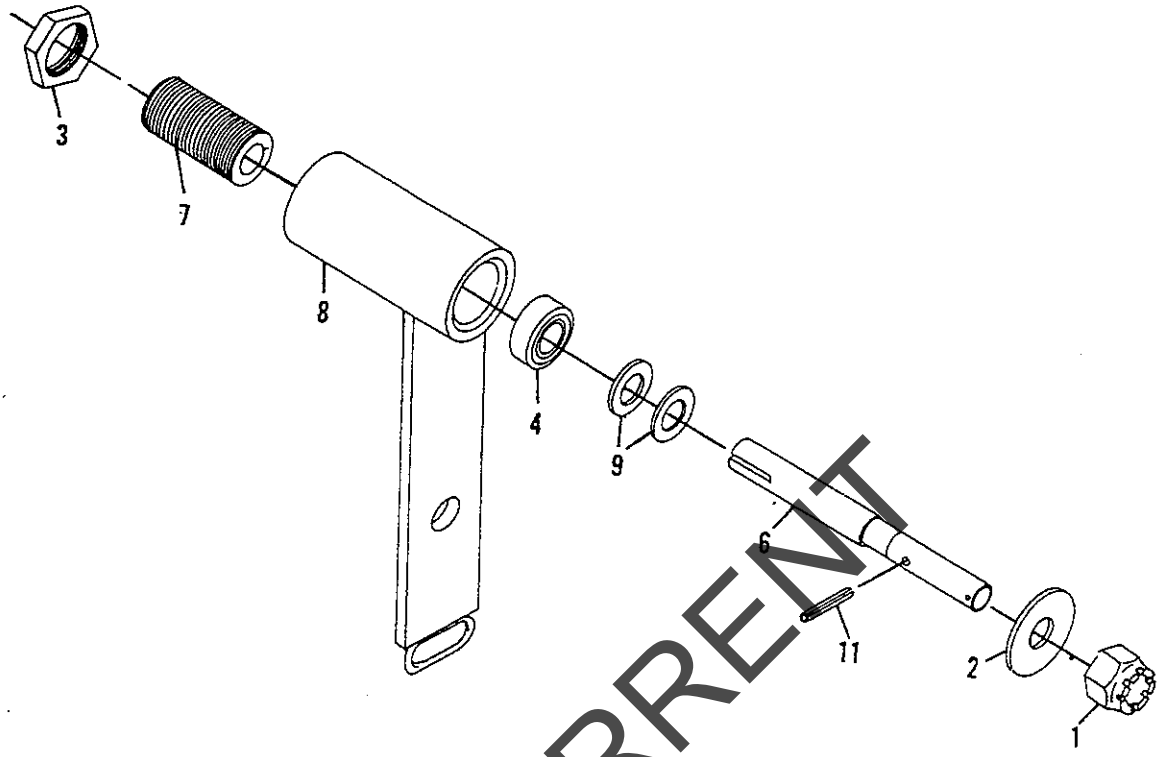
KIT - SHIPPING, HYDRAULIC FRICTION WHEEL CONT'D

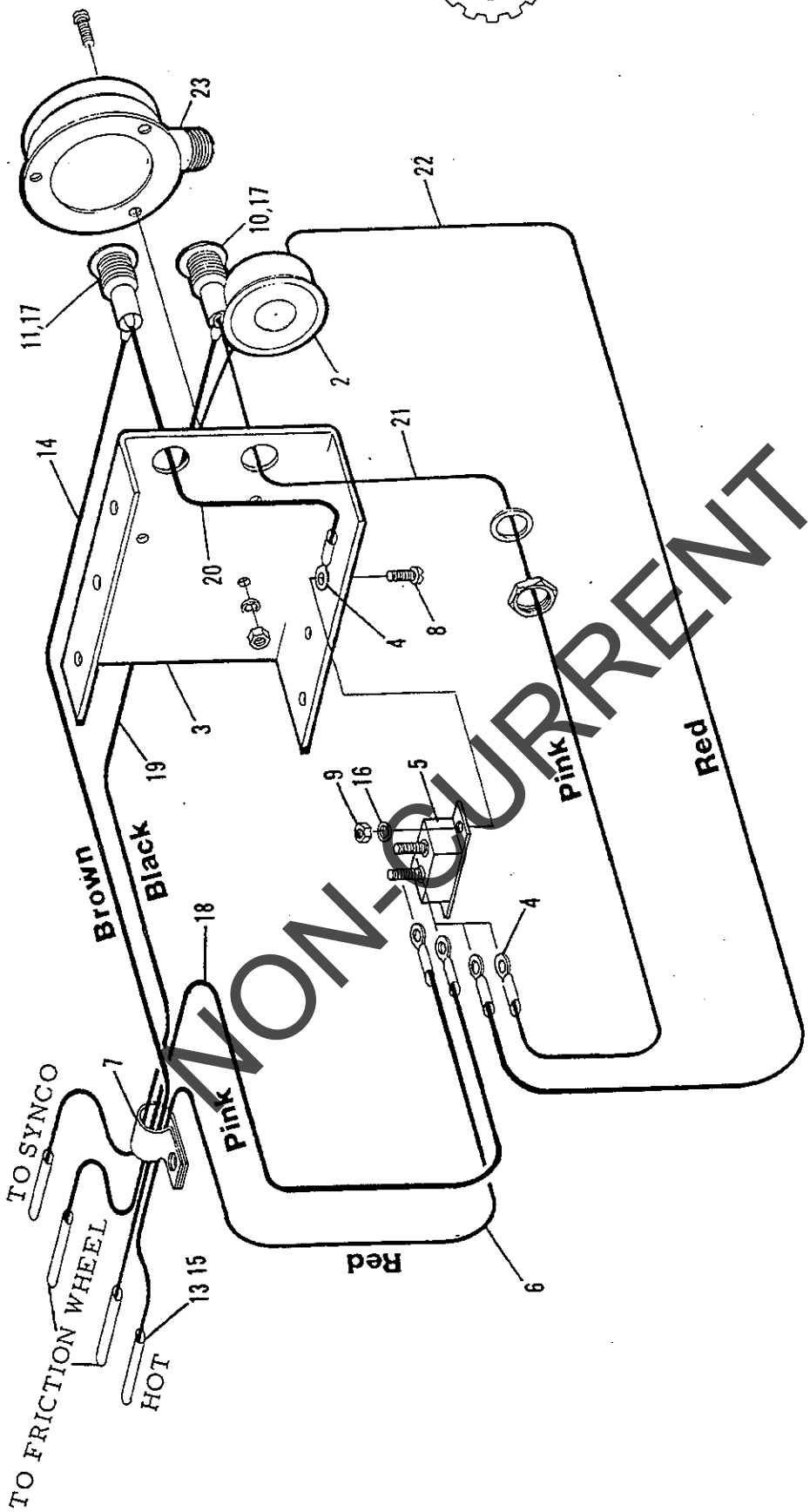
ITEM	PART NO.	DESCRIPTION	QTY.
36	20711	Washer - Lock	2
37	20643	Nut - Hex	2
38	54933	Bracket - Valve	1
39	20939	Pin - Roll	1
40	20710	Washer - Lock	2
41	20031	Capscrew	2
42	24812	Grommet	1
43	21583-144	Wire - Electric 14 Ga. Brown	1
44	21582-144	Wire - Electric 14 Ga. Red	1
45	39293	Connector - Plug	2
46	29765	Adapter	1
47	34718	Adapter	1
48		Assembly - Hose For:	
	31582	10' Unit	1
	31583	11' Unit	1
	31584	12' Unit	1
	31585	13' Unit	1
	31586	14' Unit	1
	31587	15' Unit	1
	56114	16' Unit	1
49	29870	O-ring (Repair Item for Item 14)	2
50	22805	Snap Ring (Repair Item for Item 14)	2



ASSEMBLY - FRICTION WHEEL

ITEM	PART NO.	DESCRIPTION	QTY.
	54915	Assembly - Friction Wheel (Does not include Items 1 & 2)	
1	20875	Nut - Castelated	1
2	21394	Washer - Flat	1
3	31167	Nut - Special	1
4	8723	Bearing - Ball	1
5	8724	Ring - Snap	1
6	8725	Shaft	1
7	8726	Bushing - Threaded	1
8	54916	Weldment - Housing	1
9	20261	Washer - Flat	2
10	*6072	Zerk - Grease	1
11	20428	Pin - Roll	1

* - Not Shown



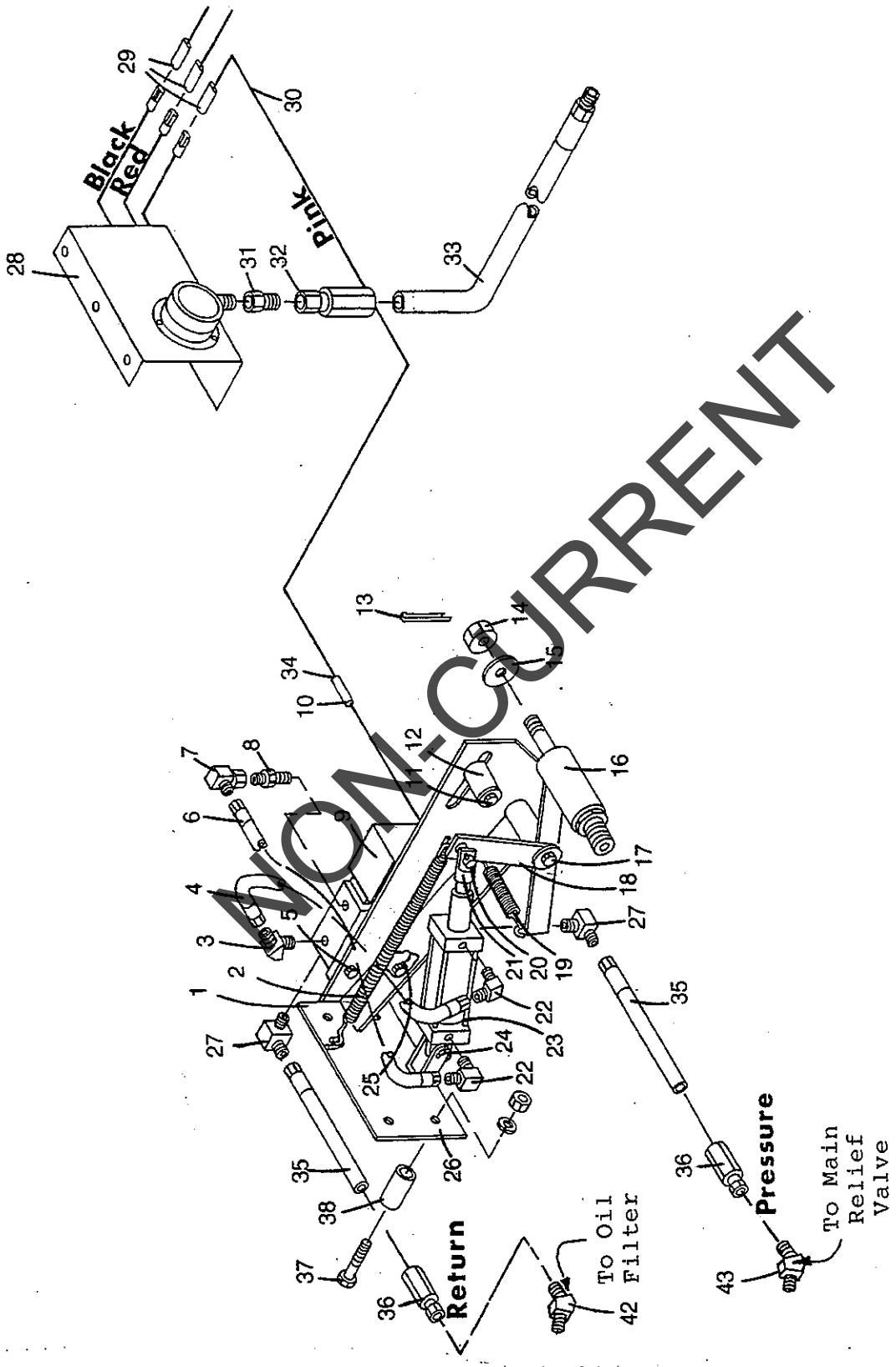
ASSEMBLY GROUP - INSTRUMENT PANEL

ASSEMBLY GROUP - INSTRUMENT PANEL

ITEM	PART NO.	DESCRIPTION	QTY.
	54925	Assembly Group - Instrument Panel	
1	*54927	Decal	1
2	43491	Assembly - Buzzer	1
3	53966	Panel - Instrument	1
4	6536	Terminal - Ring	5
5	21635	Circuit Breaker	1
6	21582-12	Wire - Electric 14 Ga. Red x 12	1
7	44584	Clamp	1
8	20257	Screw - Machine	6
9	20259	Nut - Hex	6
10	44523	Light - Indicator	1
	44524	Lens - Red	1
	44526	Lamp	1
11	44523	Light - Indicator	1
	44525	Lens - Amber	1
	44526	Lamp	1
12	*44529	Connector - Tap	1
13	6486	Terminal	4
14	21583-12	Wire - Electric 14 Ga. Brown x 12	1
15	6487	Connector	4
16	31561	Washer - Lock	6
17	44527	Terminal - Fast On	4
18	21589-12	Wire - Electric 14 Ga. Pink x 12	1
19	21580-12	Wire - Electric 14 Ga. Black x 12	1
20	21583-5	Wire - Electric 14 Ga. Brown x 5	1
21	21589-5	Wire - Electric 14 Ga. Pink x 5	1
22	21961-3	Wire - Electric 16 Ga. Red x 3	1
23	58571	Gauge - Pressure	1

* - Not Shown

KIT-SHIPPING, ELECTRIC/HYDRAULIC FRICTION WHEEL



KIT-SHIPPING, ELECTRIC/HYDRAULIC FRICTION WHEEL

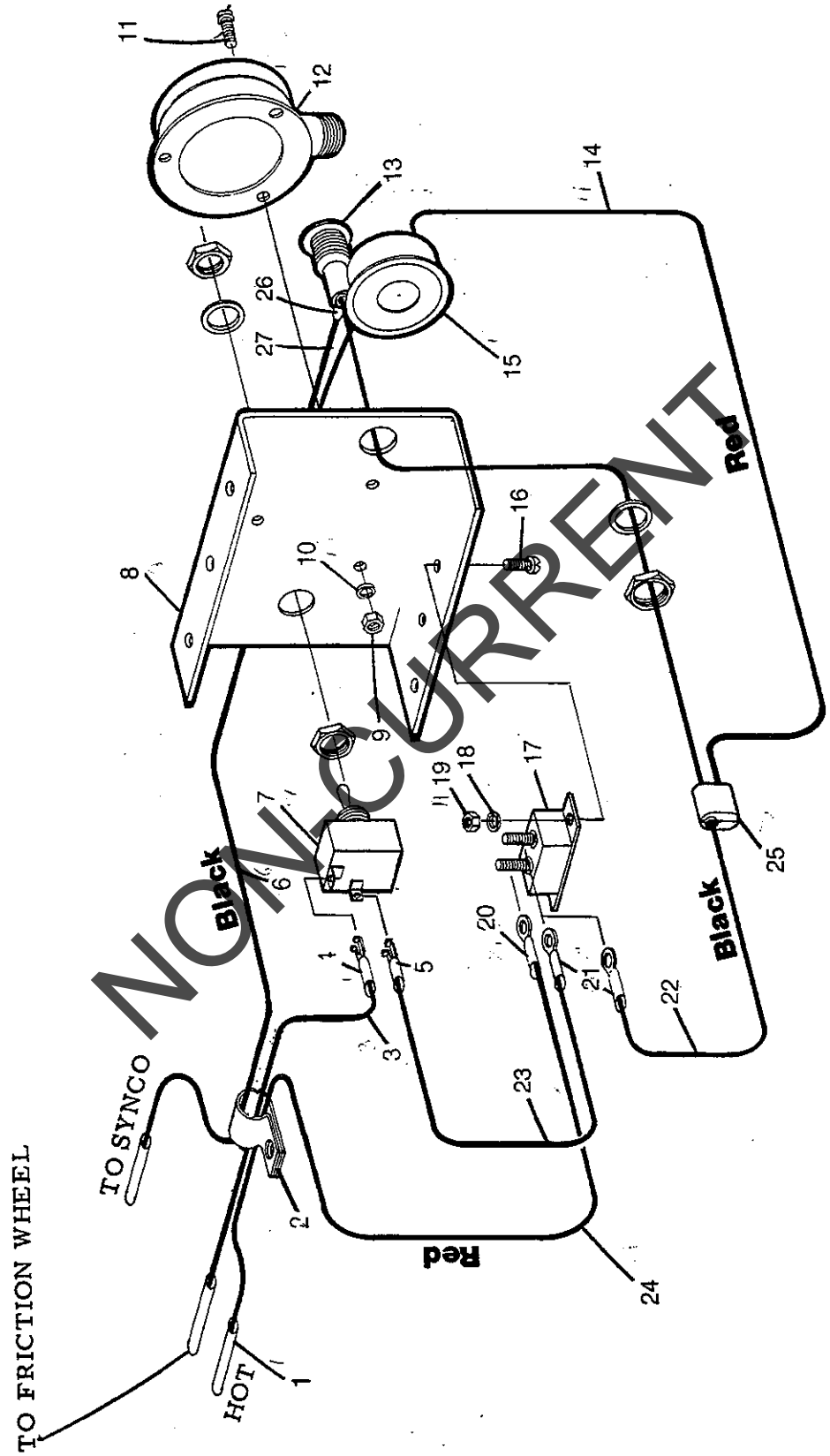
ITEM	PART NO.	DESCRIPTION	QTY
		Kit-Shipping, Electric/Hydraulic Friction Wheel for:	
	72679	10' Unit	
	72680	11' Unit	
	72681	12' Unit	
	72682	13' Unit	
	72683	14' Unit	
	72684	15' Unit	
	72685	16' Unit	
1	72687	Assembly-Friction Wheel	1
2	44304	Spring-Return	1
3	34813	Adapter-Elbow	1
4	58963	Assembly-Hose	1
5	20010	Screw-Cap, ¼ x 2¼	2
	20710	Washer-Lock, ¼	2
	20642	Nut-Hex, ¼	2
	72694	Bar-Retainer	1
6	58962	Assembly-Hose	1
7	34816	Adapter-Elbow	1
8	29824	Adapter-Connector	1
9	39370	Valve-Solenoid 39371 Coil Only	1
10	6549	Connector-Butt	1
11	20078	Screw-Cap, 3/8 x 3-3/4	1
	20693	Washer-Flat, 3/8	3
	20712	Washer-Lock, 3/8	1
	20644	Nut-Hex, 3/8	1
12	72695	Spacer-Brake	1
	16529-3	Hose-Brake	1
13	20817	Pin-Cotter	1
14	20875	Nut-Castelated, ½	1
15	21394	Washer-Flat	1
16	54915	Assembly-Friction Wheel	1
17	31579	Screw-Shoulder	1
	20695	Washer-Flat	2
18	72696	Weldment-Pivot Bar	1
	6073	Zerk-Drive	1
19	31575	Spring-Extension	1
20	20822	Cotter	1
	20693	Washer-Flat	1
21	31578	Eye-Rod	1
22	34812	Adapter-Elbow	2
23	31577	Cylinder-Hydraulic	1
24	21037	Pin-Clevis	1
	20822	Pin-Cotter	1
25	12079	Terminal-Ring	1
26	72689	Weldment-Mounting Bracket	1
27	29830	Adapter-Elbow	2
28	72698	Assembly-Control Panel	1
29	6486	Terminal-Fast On	3
30	21589-144	Wire-Pink	1
31	34718	Adapter-Connector	1
32	56466	End-Hose, Reuseable	1

KIT-SHIPPING, ELECTRIC/HYDRAULIC FRICTION WHEEL-CONT'D

ITEM	PART NO.	DESCRIPTION	QTY
33	31582	Assembly-Hose, 10' Unit	1
	31583	Assembly-Hose, 11' Unit	1
	31584	Assembly-Hose, 12' Unit	1
	31585	Assembly-Hose, 13' Unit	1
	31586	Assembly-Hose, 14' Unit	1
	31587	Assembly-Hose, 15' Unit	1
	56614	Assembly-Hose, 16' Unit	1
34	12374	Connector-Splicer	2
35	58961	Assembly-Hose	2
36	56466	End-Hose, Reuseable	4
37	20081	Screw-Cap, 3/8 x 4½	4
	20712	Washer-Lock, 3/8	4
	20644	Nut-Hex, 3/8	4
38	31906	Spacer-Pipe	1
39	21582-24	Wire-Red	1
40	* 8735	Shield-Friction Wheel	1
41	*43484	Shield-Heat	1
42	34735	Adapter-45°	1
43	34704	Adapter-45°	

*-Not Shown

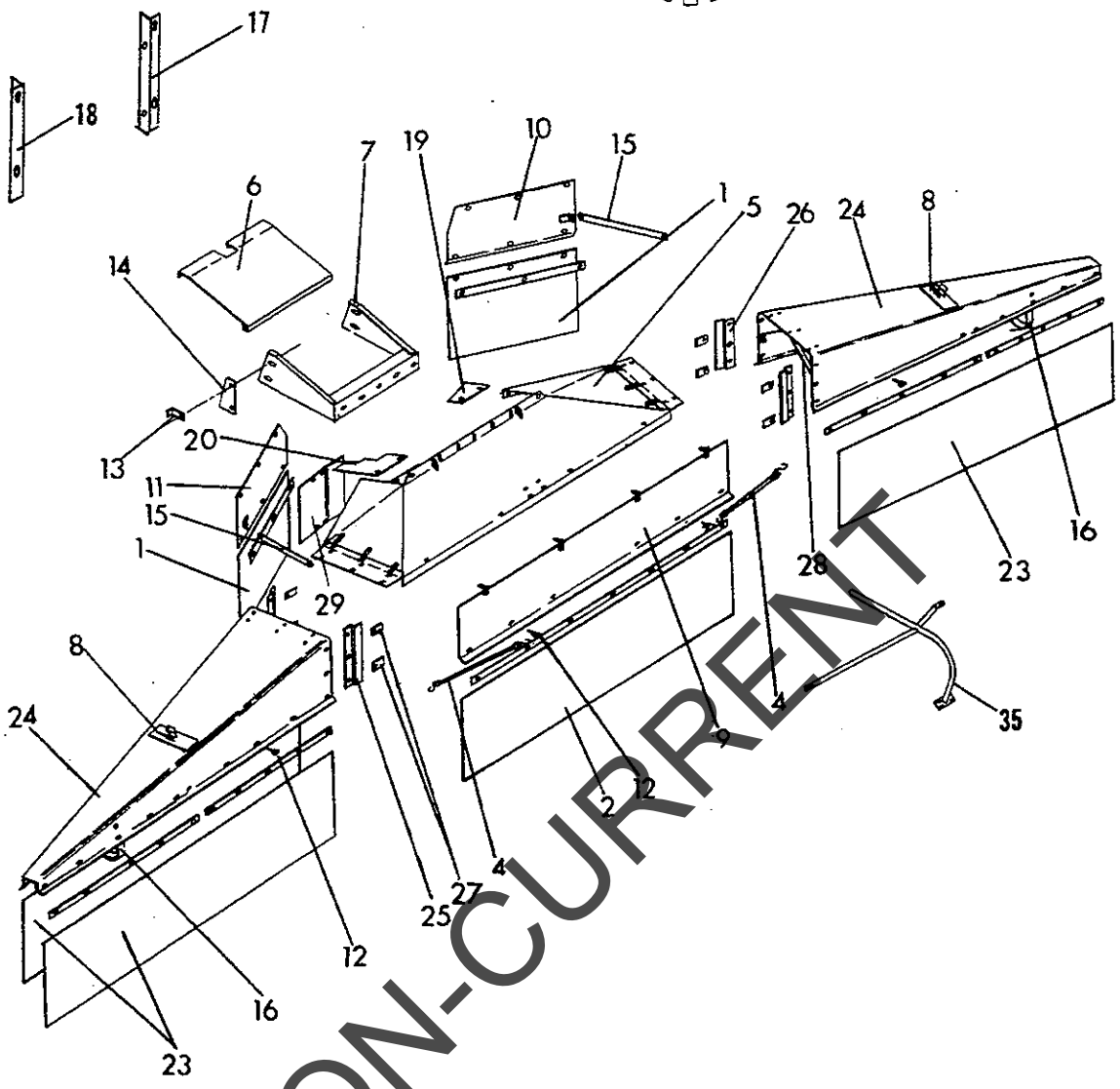
ASSEMBLY-CONTROL PANEL, ELECTRIC/HYDRAULIC FRICTION WHEEL



ASSEMBLY-CONTROL PANEL, ELECTRIC/HYDRAULIC FRICTION WHEEL

ITEM	PART NO.	DESCRIPTION	QTY
1	72698	Assembly-Control Panel	
	6486	Terminal-Fast On	3
	6487	Terminal-Fast On	3
2	44584	Clamp	1
	20257	Screw-Machine	1
	31561	Washer-Lock	1
	20259	Nut-Hex	1
3	21589-12	Wire-Pink	1
4	6485	Terminal-Flanged Spade	1
5	6485	Terminal-Flanged Spade	1
6	21580-12	Wire-Black	1
7	21681	Switch-Toggle	1
8	31911	Panel-Control	1
9	20259	Nut-Hex	3
10	31561	Washer-Lock	3
11	20257	Screw-Machine	3
12	58571	Gauge	1
13	44523	Light-Indicator	1
	44526	Lamp	1
	44524	Lens-Red	1
14	21582-5	Wire-Red	1
15	43491	Buzzer	1
16	20257	Screw-Machine	2
17	21635	Breaker-Circuit, 15 Amp	1
18	31561	Washer-Lock	2
19	20259	Nut-Hex	2
20	6536	Terminal-Ring	1
21	6536	Terminal-Ring	2
22	21580-5	Wire-Black	1
23	21582-5	Wire-Red	1
24	21582-12	Wire-Red	1
25	44529	Connector-Tap	2
26	44527	Terminal-Fast On	2
27	21960-3	Wire-Black	1
28	*36996	Plate-On/Off	1

*-Not Shown



GROUP - P250 HOOD

ITEM	PART NO.	DESCRIPTION	QTY.
	31961	Group - P250 Hood	
1	3494	Belt - Rear Platform Drop	2
2	3495	Belt - Rear Flap	1
3	3496	Belt - Front Center	1
4	6280	Hook - Tension, Rubber	2
5	15383	Weldment - Center Section	1
6	15384	Weldment - Door	1
7	15385	Weldment - Door Extension	1
8	15386	Weldment - Wing Rest	2

GROUP - P250 HOOD CONT'D

ITEM	PART NO.	DESCRIPTION	QTY.
9	15387	Weldment - Rear Flap	1
10	15388	Weldment - Drop R. H.	1
11	15389	Weldment - Drop L. H.	1
12	15418	Weldment - Tie Down Belt	4
13	15419	Ear - Bolting	2
14	15420	Panel - Extension	2
15	15421	Bar - Brace, Hood Drop	2
16	15423	Skid - Wing	2
17	15424	Angle - Mount R. H.	1
18	15425	Angle - Mount L. H.	1
19	15426	Plate - Filler Gear Case	1
20	15427	Plate - Filler Bearing	1
21			1
22			1
23	15430	Belting - Wing Tips	2
24	15431	Hood - Fiberglass	2
25	15432	Lip - Guide, Rear	2
26	15433	Lip - Guide, Front	2
27	15434	Tab - Guide	4
28	15439	Bar - Brace, Wing Tip	2
29	15449	Plate - Filler	1
30	18509	Retainer - Belt, Short	2
31	18542	Retainer - Belt, Long	1
32	18545	Retainer - Belt, Middle	2
33	18546	Retainer - Belt, Outer	2
34	21423	Washer - Flat, Special	64
35	15441	Hood Storage Support	1

OPTIONAL WEAR STRIPS (NOT SHOWN)

	15650	Kit - Wear Strip
		Composed of the Following:
	15467	Plate - Wear 4
	21423	Washer - Flat Special Mounting Hardware 24

INSTALLATION

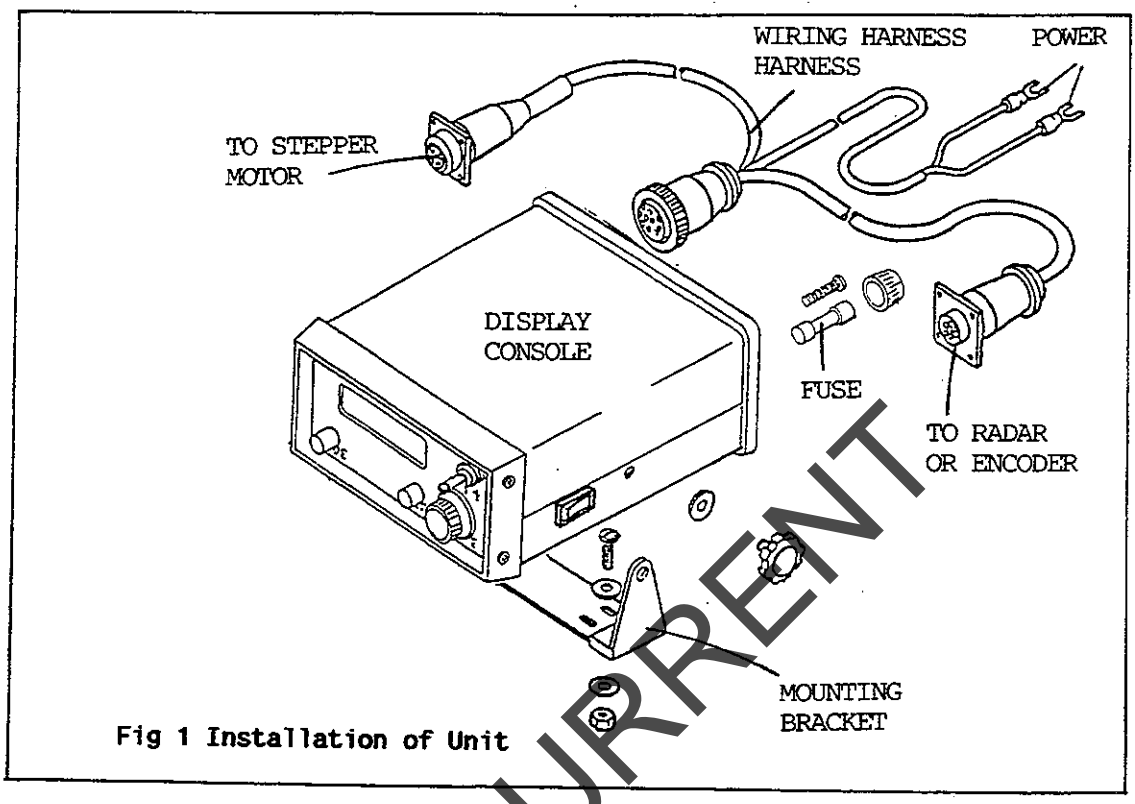


Fig 1 Installation of Unit

PROCESSOR INSTALLATION

Mount the processor inside the truck cab on or under the dash, or in some other location where it is accessible to the operator without obstructing or diverting his normal driving view. The mounting bracket may be attached to the processor with the bracket on top or bottom as required. Make certain there is enough room behind the processor to permit easy access to the control cable connection.

The processor should be out of direct sunlight, or else a shade should be provided. Mount as far away from any two way radio's as possible.

The front display has a liquid crystal and has a temperature rating of -4 degrees F. In cold weather it may go blank until it warms up. If temperature is over 120 degrees F the liquid crystal turns black. It will return to normal after it cools down.

Make sure there is no interference between the processor and the shifting lever or any other vehicle controls.

Drill a hole in the floor or fire wall to run the cable from the processor back to the Mark III unit on the conveyor gear box. and also to the Radar unit if required.

INSTALLATION - Continued

WARNING: All holes which provide entrance to the truck cab are to be grommetted, plugged and sealed to prevent entry of engine fumes, dust, dirt or water.

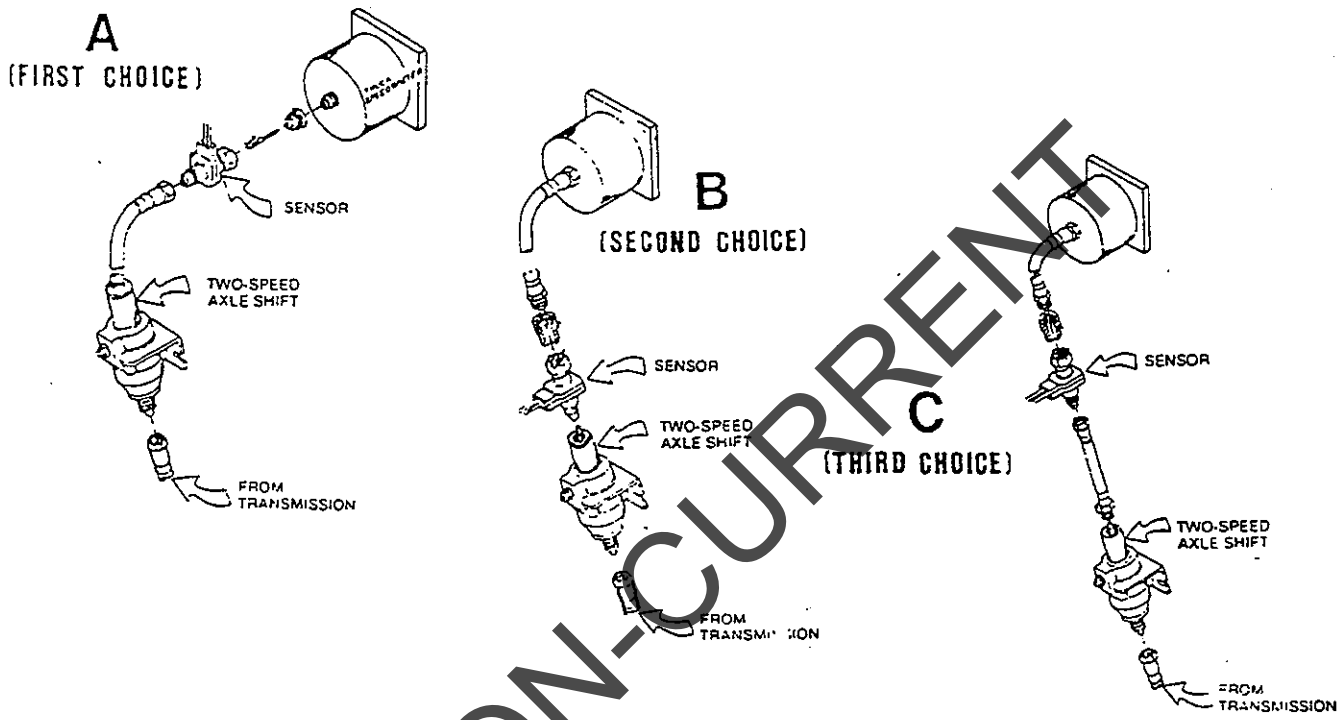


Fig 2 Encoder Installation

ENCODER INSTALLATION

The encoder mounts in the speedometer cable. If possible, the encoder should be mounted to the speedometer, and the speedometer cable attached to the encoder. If the truck has a two speed axle shift the encoder must be mounted between the two speed axle shift and the speedometer. See Fig 2.

NOTE: The encoder must be mounted above the lubricant level in the transmission. If the encoder fills with lubricant, it will stop working.

INSTALLATION - Continued

CAUTION: If, at any time, an arc welder is used on the vehicle or anything connected to the vehicle, disconnect power cable from processor box. Failure to do so can result in damage electronic components, in which case, the warranty will be null and void.

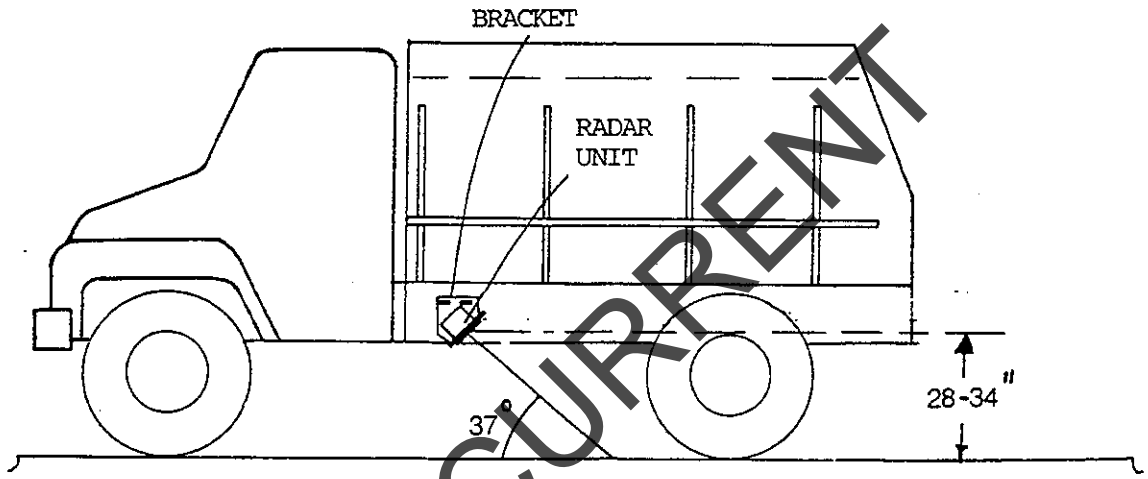


Fig 3 Radar Installation

RADAR INSTALLATION

Mount the radar unit on the bracket provided. Bolt the bracket to the truck frame so the radar unit is at 37 degrees to horizontal. It must also be between 28 and 34 inches from the ground. The unit can point either to the front or rear of the truck.

CABLE ROUTING

Route the cables where they will be protected from pinching, rubbing, or hot exhaust systems. Avoid sharp edges or moving parts. Use sufficient tie wraps to fasten cables securely. A pinched or cut cable can make the entire system inoperative.

INSTALLATION - Continued

Retrofit To Spreader With Mark II

The Mark III uses the same gear box and valve body as the Mark II. The new system does away with the friction wheel by using either a revolving shaft encoder attached to the vehicles speedometer or a ground speed radar detector.

1.) Remove the two speed from the Mark II. Remove the cap assembly from the bell housing.

2.) Remove bushing P/N 44437 from bell housing input protrusion (See Page 20).

3.) Install drive coupler (73337) to the electrical input drive unit. Put silicone on rim of bell housing to seal unit. Fit stepmotor in place set control console to manual mph position and turn on conveyor switch. (See step 8 on page 12.) The stepper motor should be turning now, and this should rotate the idler assy. As the allen bolts are tightened be sure that the idler assembly continues to rotate freely.

4.) Install the new two wire cap (72832) on top of the bell housing.

5.) Remove the friction wheel assembly. If you are removing a hydraulic friction wheel, cap or plug the hydraulic lines to prevent leakage. If you are removing an electric unit, tape up bare wire ends to prevent shorts.

6.) Leave the existing pressure gauge in place for trouble shooting purposes. If desired you can remove the existing control panel and remount the gauge in another location.

7.) Refer to Installation Procedures to install and connect the rest of the Mark III System.

GENERAL DESCRIPTION

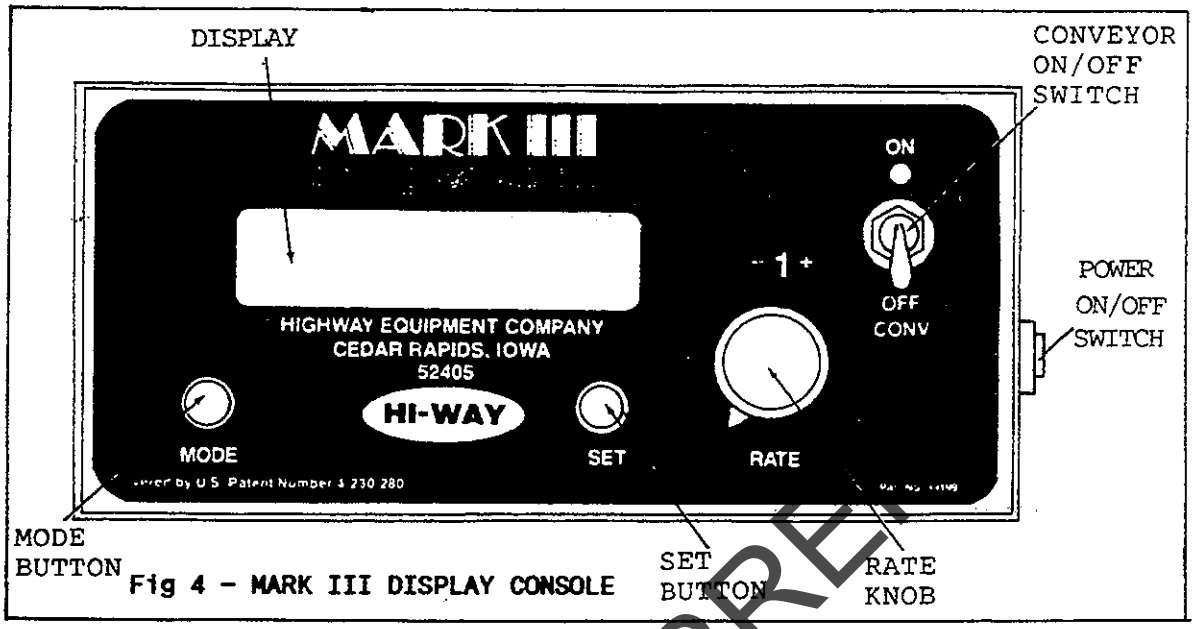


Fig 4 - MARK III DISPLAY CONSOLE

The Mark III is designed for granular dry spreaders. The unit uses a gear box and conveyor speed control to provide a system for variable application rates of material for truck mounted spreaders. The system uses either a revolving shaft encoder attached to the vehicles speedometer or a radar detector to sense the vehicle ground speed. The unit instantaneously senses vehicle ground speed and adjusts the application rate accordingly.

An in cab mounted LCD display console shows truck speed in miles per hour, number of acres spread, distance traveled in feet and yields in pounds per acre of fertilizer or tons per acre of lime with rate control for increase or decrease.

Power On/Off Switch: When in the "on" position, power is provided to the entire control system. When in the "off" position, power is removed from the entire control system.

Conveyor On/Off Switch: This switch is used to start and stop the motion of the conveyor.

Application Rate Knob: With this knob the operator can change the application rate on the go. Turning the knob clockwise increases and counter clockwise decreases application rate in two percent increments.

MODE Button: Pressing the "MODE" button takes you into the programming MODE. This is where you will set your spreading variables. When in the program MODE, pushing the "MODE" button will change the MODE, and also operate the cursor. See fig. 5 . The cursor is a line under a digit on the display. It moves from right to left, one digit at a time, as you push the "MODE" button. When the cursor has shifted all the way to the last digit, pushing the "MODE" button will then change the display to the next mode. See Fig 6 For a listing of all MODES in order.

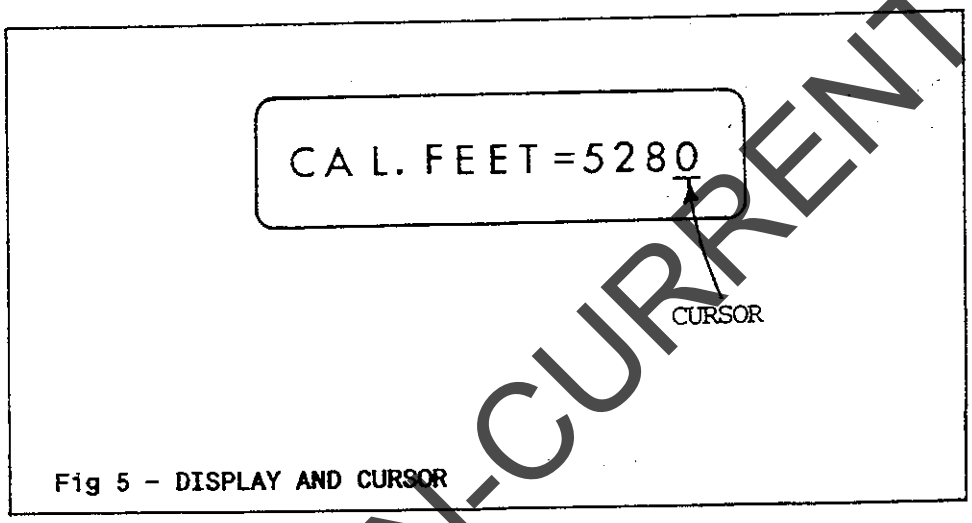


Fig 5 - DISPLAY AND CURSOR

SET Button: When the unit is first turned on, depressing the SET button will take you directly into the SPREADING mode.

The SET button is also used during the programming process. Pushing the SET button advances the number above the cursor digit. Pushing the SET button will also cycle the unit between the "FERTILIZER" or "LIME" MODE.

The following information is designed to take you step by step through programming the Mark III unit. DO NOT PANIC. If a mistake is made, turn the power switch off then back on again. Now push the "MODE" button until the display is back where you want it. There are several things you will need to know when entering your program. See illustration below and Fig 6, Operational Flow Chart.

PROGRAM QUICK CHECK LIST

Use the Program Quick Check List below to make a written record of the program you are going to use for a referance.

FERTILIZER	LIME
Spreader Control	Spreader Control
Fertilizer Mode	Lime Mode
Feedgate=___.___	Feedgate=___.___"
Mat'l=___.___ Lb.	Mat'l= ___.___ Lb.
Spread Width=_____	Spread Width= ____
Yield=_____ Lb/A	Yield= _____ Ton/A
Man. Spd.= ___.___ MPH	Man. Spd.= ___.____
Manual XX.X MPH	Manual XX.X MPH
Cal. Feet=_____	Cal. Feet= _____
Conv. Rate=___	Conv. Rate= ____

****CAUTIONS****

* Whenever the radar angle to the ground is changed, the control box should be recalibrated by following the calibration procedure exactly.

* Increasing the "Cal. Feet" will decrease the conveyor speed, and therefore, decrease the yield.

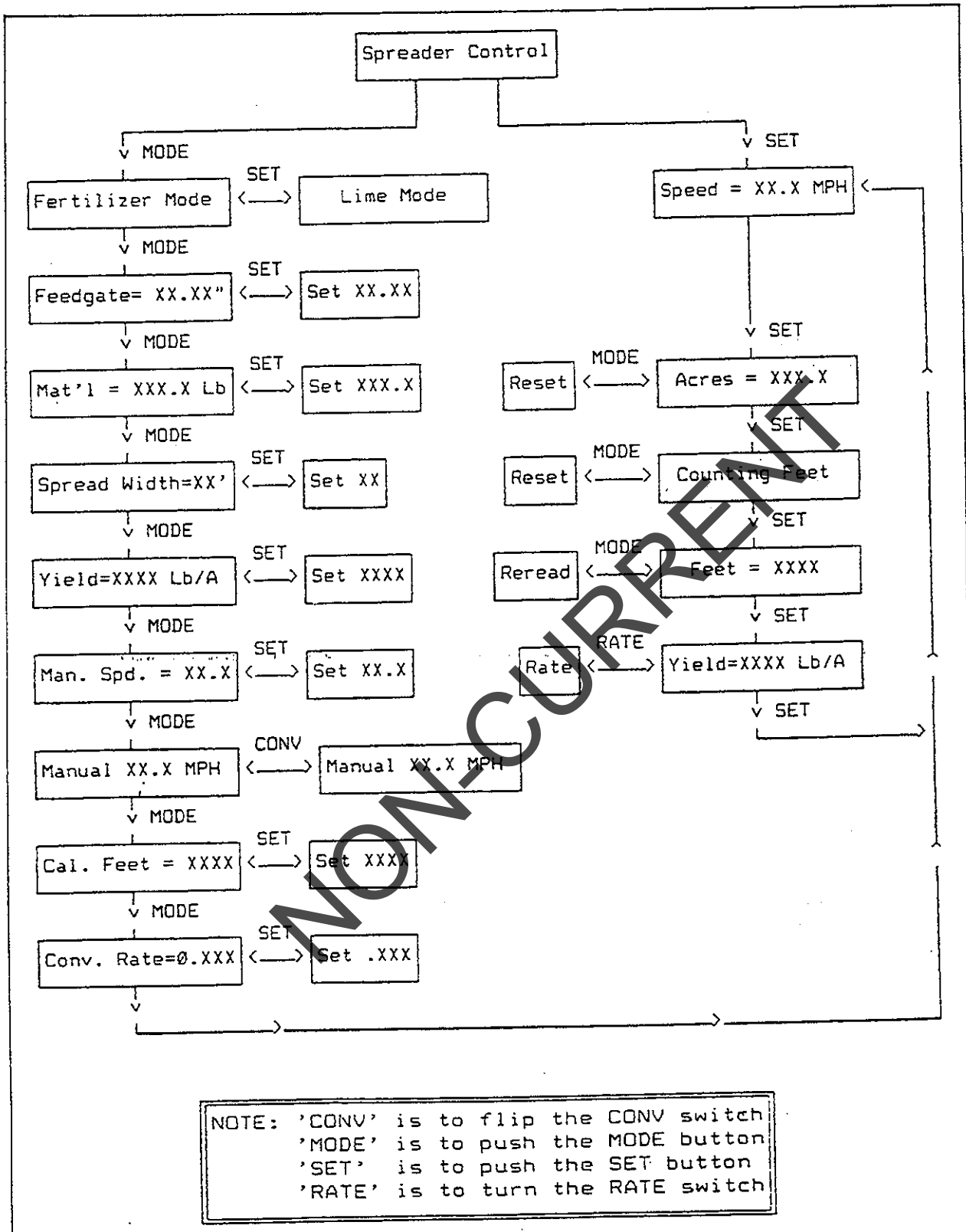


Fig 6 - Operational Flow Chart

CALIBRATION INSTRUCTIONS

The unit must be calibrated before it can be used to spread accurately. If this is the first time the unit has been used with this particular truck or spreader please follow the calibration procedure shown next.

Calibration Procedure

Display

Step 1 : Turn power switch on

SPREADER CONTROL

Step 2 : Push "MODE" button repeatedly until display reads Cal. Feet

CAL. FEET= XXXX

CURSOR

Step 3 : Use the "SET" button to set calibration feet to 5280. Set the R.H. digit to zero then use mode button to move cursor to the next digit. Program it to "8", then the next digit to "2" and the last to "5".

CAL. FEET= 5280

Step 4 : Push MODE 4 more times to see the speedometer

SPEED= X.X MPH

Step 5 : Push SET

ACRES= X X X.X

Step 6 : Push SET

COUNTING FEET

Step 7 : Now drive the truck over a measured one mile course.

When you reach the start of the measured mile, press the "MODE" button to clear the odometer to zero. The display will read Feet = XXXX. After a one second time delay the display will return to showing the message "Counting Feet".

FEET= X X X X

COUNTING FEET

At the end of the measured mile, press the "SET" button to display the message "Feet = XXXX".

FEET 5387

EXAMPLE

This is the number of feet that the encoder or radar thinks you have driven. The program in the spreader control will use this number to compensate for calibration errors in the speedometer encoder or radar. Make a note of this number, as you will need it in the next step.

Calibration Procedure - Continued

When using a radar unit calibrate by running over terrain that is similar to that which you will be spreading on. Calibrating on a smooth surface such as an asphalt highway and then spreading on rough farm ground may result in incorrect spreading.

It is not necessary to have the conveyor switch on when calibrating the unit.

Repeat the procedure 3 times and use the average of the 3 results.

Step 8 : Turn the power switch off and back on. Again press the "MODE" button repeatedly until the message Cal. Feet 5280 appears.

Replace 5280 with the number that you recorded in step 7

Display

CAL FEET=5280

CAL FEET=5387

Step 9 : Drive over the measured mile again as you did in step 7.

This time the odometer should read within 25 feet of 5280. If it does not you may have made an error, or your travel sensor may not be accurate.

If you have a speedometer cable driven encoder, check to be sure that the speedometer cable is not binding.

If you are using radar, recheck the proper mounting instructions for the radar you are using.

FEET 5287

EXAMPLE

IMPORTANT: If you decide to repeat the calibration exercise, be sure to start over at step 1 of these instructions.

Step 10: Turn the power switch off, then on and push the "SET" button to go into the spreading mode.

PROGRAMMING PROCEDURE

Step 1 : Turn the power switch on. The message on the display will read spreader control.

SPREADER CONTROL

Step 2 : Enter the PROGRAMMING mode by pressing the "MODE" button. The message that appears will say either "Fertilizer Mode", or "Lime Mode". Pressing the "SET" button changes from one mode to the other.

LIME MODE

Step 3 : Press the "MODE" button again to change the display to show Feedgate XX.XX. PROGRAM the feed gate opening, in inches, that you will use while spreading. Pressing the"SET" button will change the number above the cursor. Pressing the "MODE" button will move the cursor to the left. Charts on pages 13 & 14 provide information on recommended gate settings for both fertilizer & lime.

FEEDGATE=XX.XX

NOTE: Be sure the feed gate is actually set to the value entered in the program at this step

Step 4 : After all the digits of the feedgate opening have been programmed, pushing the "MODE" button again changes the display to "Mat'l = XXX.X Lb." This is the density in pounds per cubic feet of the material to be spread. Enter in the same manner as you entered the feed gate opening.

MAT'L =XXX.X LB.

Step 5 : After the digits of the material weight have been programmed, pushing the "MODE" button again changes the display to "Spread Width = XX". Enter the desired spread width.

SPREAD WIDTH=XX'

Step 6 : After the digits of the spread width have been entered, pushing the "Mode" button again changes the display to "Yield = XXXX lb/A" if you are in the fertilizer mode or "Yield = X.XXX Ton/A" if you are in the lime mode. Enter the desired yield.

YIELD=XXXX LB/A

PROGRAMMING PROCEDURE - Continued

Step 7 : After the digits of the yield have been entered, pushing the "MODE" button again changes the display to "Man. Spd. = XX.X".

MAN. SPD. = XX.X MPH

This is a feature that can be used for pit dumping or it can be used for spreading if your radar or ground speed encoder fails.

Enter the desired manual speed. Immediately after you enter the last digit of the manual speed, the spreader control will calculate the corresponding conveyor speed. If the conveyor drag shaft speed would be greater than 40 RPM, the spreader control will beep and return you to the beginning of the manual speed setting operation. You must then enter a slower manual speed so that conveyor shaft speed will be 40 RPM or less.

Step 8 : Pushing the "MODE" button again will display the "Man. Speed = XX.X MPH" message to check the manual speed. The conveyor toggle switch turns the conveyor on and off. This mode will be skipped over if the manual speed is set to XX.X MPH or if the conveyor toggle switch is already in the "on" position when you try to enter the mode.

MANUAL XX.X MPH

Step 9 : Pushing the "MODE" button again will display the message "Cal. Feet = XXXX". You will enter a constant here, which will be determined when you calibrate the unit. If the unit has not been previously calibrated, enter the number 5280 here.

CAL. FEET = XXXX

Step 10: Pushing the "MODE" button again will display the message "Conv. Rate = 0.XXX".

CONV. RATE=0.237

The Theoretical values to use are as follows:

Spread Fertilizer with L-2020 straight belt use .237
Spread Fertilizer with L-2020 chain use .192
Spread Fertilizer with L-3020 use .256
Spread Lime with L-2020 straight belt use .192
Spread Lime with L-2020 Chain usse .156
Spread Lime with L-3020 use .207

Step 11: Pushing the "MODE" button one last time will automatically put you into the spreading mode.

SPREADING MODE

Once you have entered the "spreading mode" you cannot reenter the "PROGRAM" mode". This is to prevent you from changing any of the variables if you accidentally press the wrong button while spreading. If you have just set the variables for either "Fertilizer Mode" or "Lime Mode" and would now like to set the variables for the other mode, you must turn the power switch off and then on again, then press the "MODE" button.

To enter the "spreading mode" from the "SPREADER CONTROL" message, press the "SET " button.

The first message to appear after entering the spreading mode will be "Speed = X.X MPH", this is a speedometer to show your truck speed in miles per hour.

Pressing the "SET" button again produces the "Acres = 000.0" message, which shows the number of acres that you have spread. It can be cleared to zero at any time when this message is displayed by pressing the "MODE" button.

Pressing the "SET" button once more displays "Counting Feet". Pressing the mode button when the display shows "Counting Feet" clears the feet count to zero. This is an odometer which was used in an earlier step to calibrate your speedometer cable driven ENCODER, or RADAR travel sensor. After calibrating, this odometer will accurately measure your distance traveled in feet. When you read the odometer by pressing the "SET" button and displaying the "Feet = XXXX" message, the odometer does not stop, but continues to count the number of feet you have traveled. Pressing the "MODE" button will reread the odometer and display the current distance traveled since last clearing the odometer.

Pressing the "SET" button again shows the "Yield = X.XX" message. This message displays either pounds per acre, or tons per acre, depending on whether you are in the Fertilizer mode or the Lime mode.

Turning the "RATE" knob changes the yield. When you are spreading in lime mode with very small yields, (less than 0.10 Ton/A) the yield display may not change with every click of the switch, however, the actual spreading rate will be correct.

Any time that the "RATE" knob is turned, the display changes to the "Yield = 0.00" message to show the rate that is currently being spread, no matter what other message had previously been shown.

One more push of the "SET" button returns you to the speedometer.

The Conveyor toggle switch is used to start and stop the motion of the conveyor.

If you exceed the speed at which the Spreader Control can accurately operate, you will see a message telling you to "Slow Down!!!" and also the beeper beeps. The slow down message tells you that the conveyor reached 40 Conveyor Shaft R.P.M. Which means you are applying fertilizer at a lower rate per acre than the programmed value. As you drive faster the conveyor will stay at 40 R.P.M. When you slow down again so that the Spreader Control can again spread accurately, the display will return to the previous message, and the beeper will stop.

The encoder will provide a signal to the spreader control up to 60 M.P.H. The Magnavox radar speed sensor is good to 25 M.P.H. An improper sensor cannot be sensed by the spreader control - no warning can be displayed by the spreader control.

To exit the "spreading mode", and reenter the "setup mode", turn the power switch off and back on again, then press the "MODE" button.

$$CRPM = \frac{(Y)(SW)(MPH)}{(495(G)(MN)(CFR.)}$$

$$\text{EXAMPLE} - \frac{(350)(60)(MPH)}{(495)(68)(3)(.237)} = 14.9$$

Y= Yield (in pounds per acre)
SW= Swath width
MPH= Miles per hour
MW= Material weight (pounds per cubic foot)
G= Gate opening (inches)
CFR= Conveyor rate

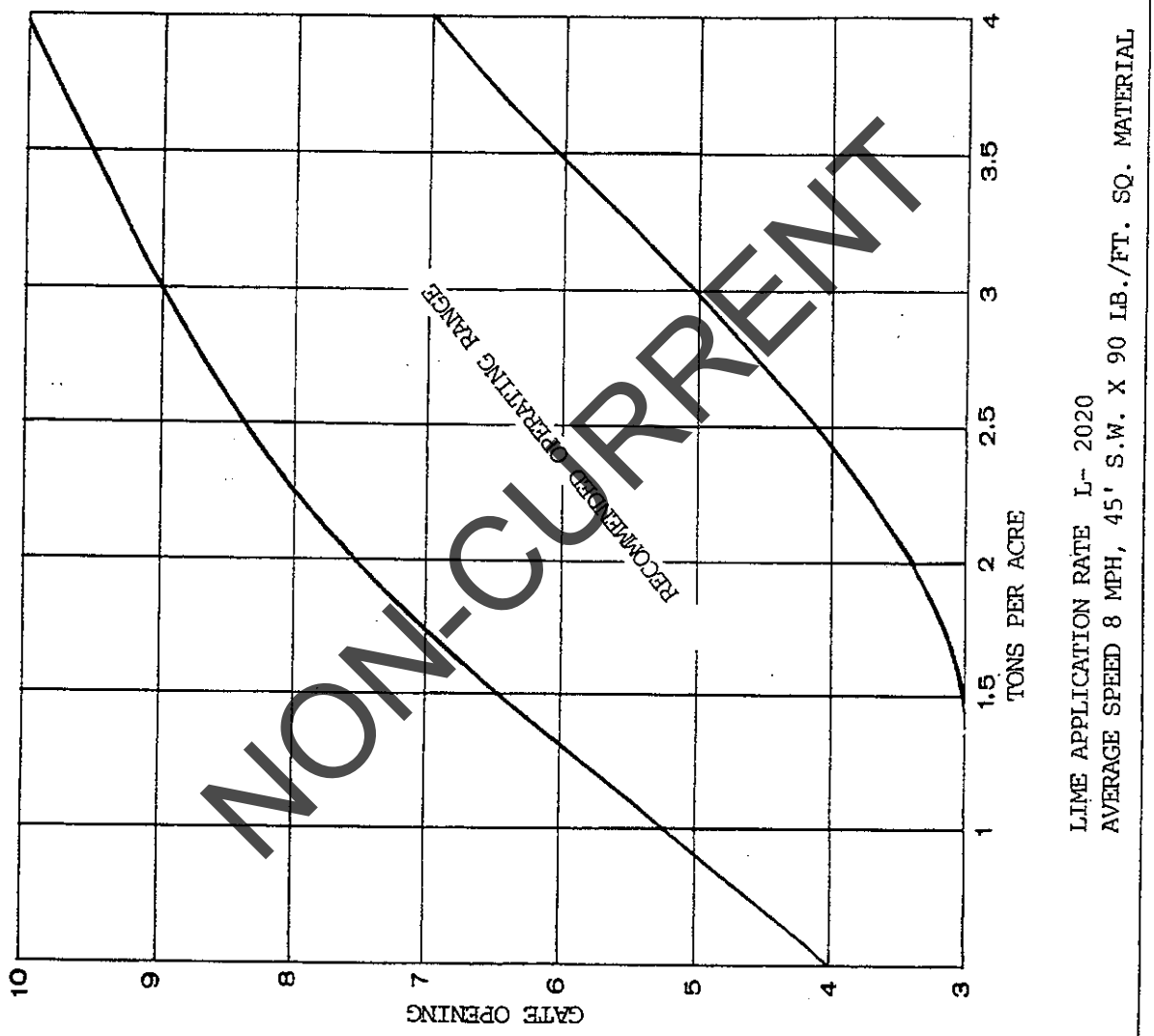


Fig 8 MARK III CHART - LIME

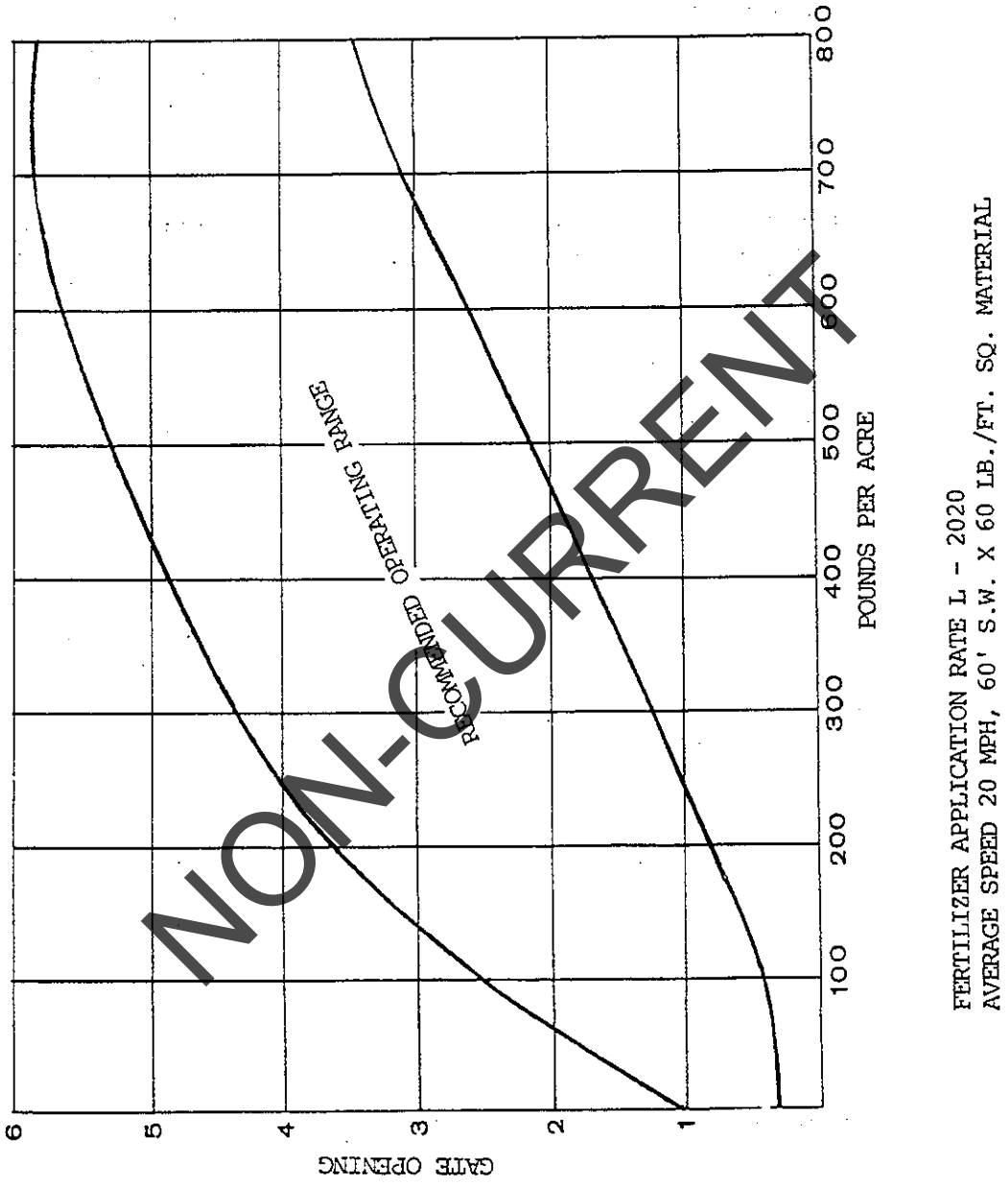


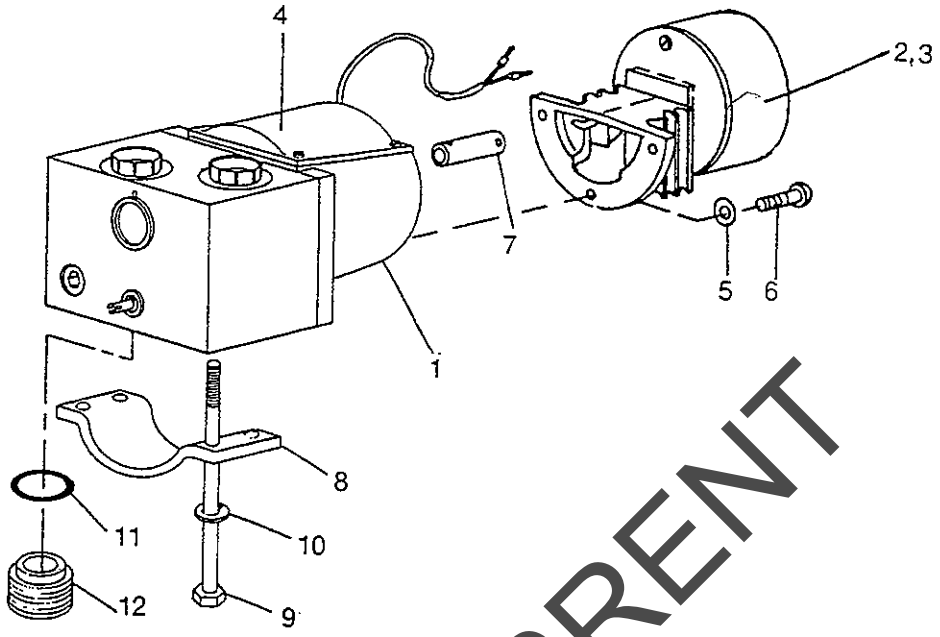
Fig 7 MRK III CHART - FERTILIZER

MARK III TROUBLESHOOTING

SYMPTOM	REASON
Power switch turned on. Display Blank	1. Blown Fuse 2. Power leads not connected. 3. Dead Vehicle Battery. 4. Unit to cold-below -4 degrees F.
Power switch turned on, pushing "SET" displays "MAN SPD = XX.X M.P.H." or beeps and stays at "spreader control"	1. Incomplete program 2. Check program values to be within limits.
Program skips from MAN SPD = XX.X M.P.H. to CAL FEET = XXXX	1. Conveyor switch must be "OFF" to enter manual XX.X M.P.H.
Program will not advance beyond display "MAN SPD = XX.X M.P.H."	1. Program required more than 40 CRPM. Program lower MPH,or larger gate 2. Incomplete Program
Display reads "SLOW DOWN" and beeper sounds steadily	1. Driving too fast
Display beeps intermittently	1. PTO not engaged 2. Defective or undersized hydraulic system components 3. Function knob in manual
Display fails to show reading in "Speed = X.X MPH with vehicle moving.	1. Speedometer cable disengaged or broken. 2. Encoder or radar cable improperly connected. 3. Faulty encoder or Radar.

SYMPTOM	REASON
Application Rate/Acre incorrect	1. Insure actual gate opening matches program setting. 2. Check entire program for accurate values 3. Check for proper "CAL FEET = XXXX" 4. Insure "YIELD =XXXX LB/A in spread mode matches "YIELD = XXXX LB/A" in program adjust with rate knob. 5. Adjust "CONV. RATE = X.XXXX" 6. Faulty encoder or radar
During programming display returns to "SPREADER CONTROL"	1. Incomplete program
Problem completing program	1. Turn power switch OFF then back on and start the program over.
Program in Operation (Run) mode but conveyor does not move when machine moves	1. PTO not engaged 2. Conveyor switch in OFF position 3. Program has improper values 4. Stepper motor unplugged
Display beeper sounds steady but no warning on display	1. Stepper motor stopped at out of sync position 2. Bad cap assembly
Conveyor starts to run when PTO is engaged	There is a built in brake in the stepper motor that must be engaged, before PTO is engaged, as follows: 1. Turn on main power switch 2. Push SET button once 3. Turn on conveyor switch, drive vehicle 10 feet then turn OFF conveyor switch.

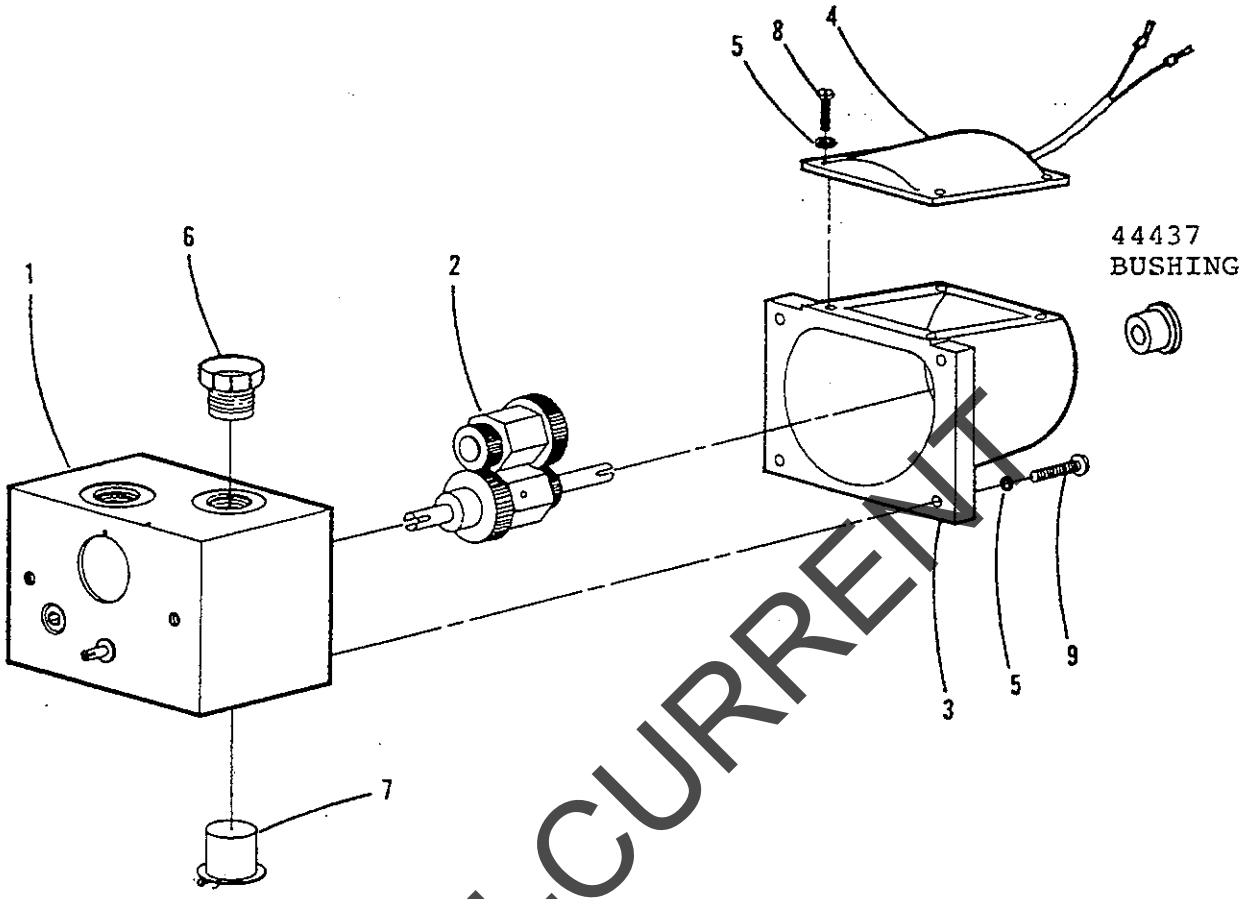
GROUP - MARK III VALVE ASS'Y



ITEM	PART NO.	DESCRIPTION	QTY
	72818	Group - Mark III Valve Ass'y	
1.	73338	Assembly Group - Valve Body	1
2.	72807	Assembly - Input Drive Electrical *	1
3.	72831	Ass'y - Input Drive Electrical	1
4.	72832	Ass'y - Cap, 2 wire	1
5.	20724	Washer - Seal	3
6.	44453	Screw - Machine	3
7.	73337	Ass'y - Coupler Drive	1
8.	47276	Saddle - Motor	1
9.	47277	Screw - Cap, 5/6 X 3 1/2	4
10.	36419	Washer - Lock, 5/6	4
11.	44409	Adapter - Port	2
12.	29854	"O" Ring	2

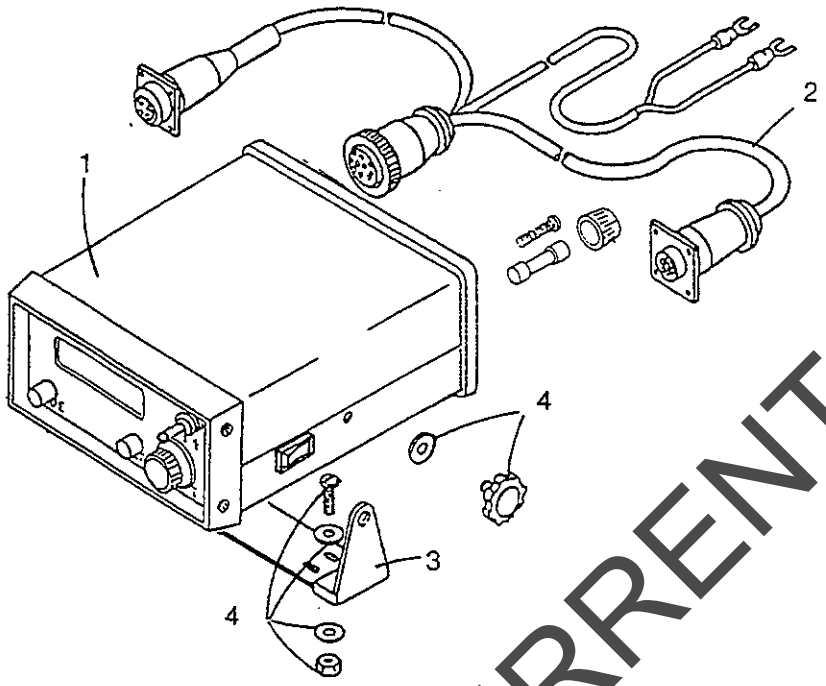
*Includes Items 3,4,5,6,7.

ASSEMBLY GROUP-VALVE BODY



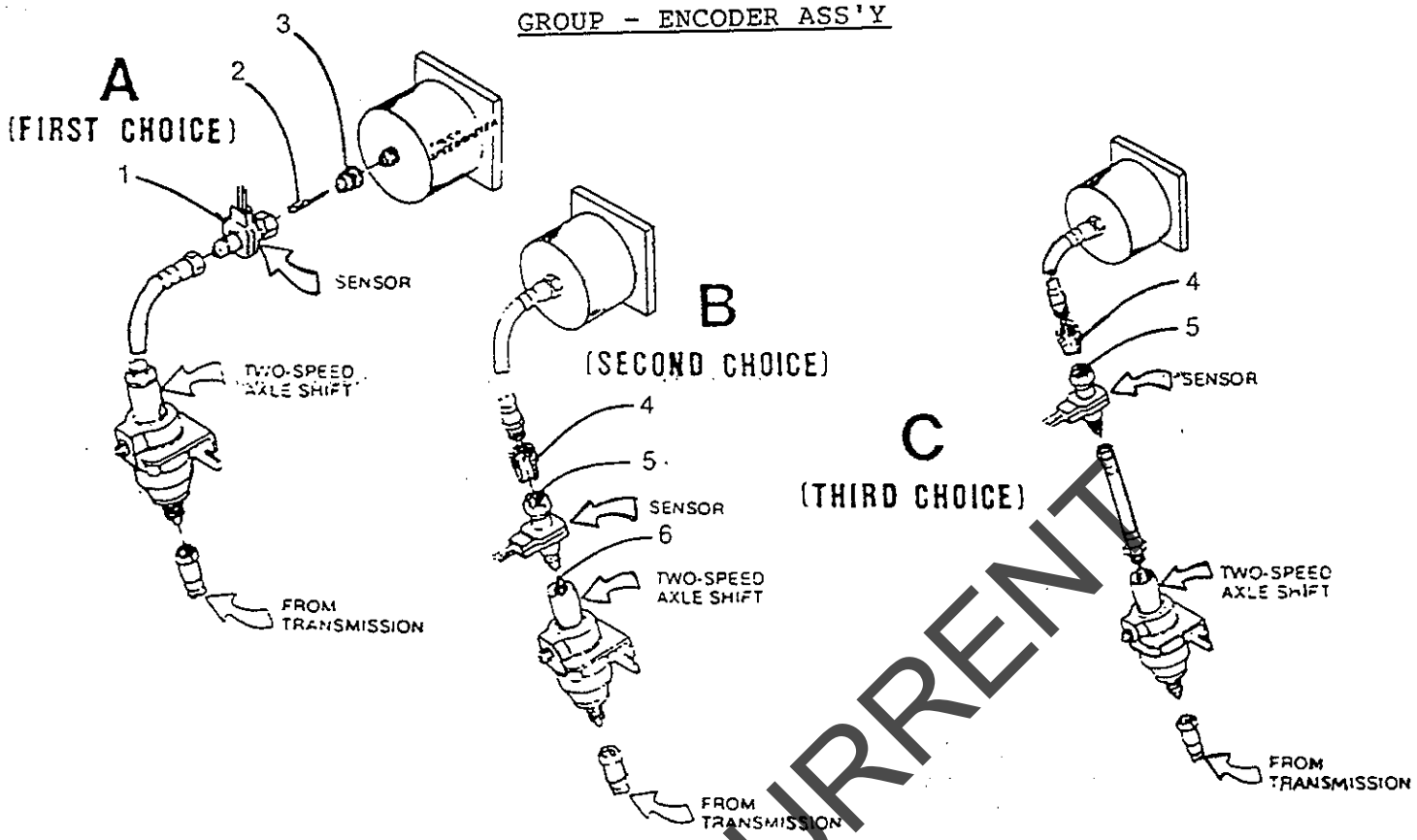
ITEM	PART NO.	DESCRIPTION	QTY
	73338	Assembly Group-Valve Body	
1	44410	Assembly-Valve Body	1
2	44411	Assembly Group-Idler Arm	1
3	44412	Assembly-Bell Housing	1
4	73832	Assembly-Cap	1
5	44451	Washer-Lock	8
6	8396	Cap-Plastic	2
7	29341	Cap-Plastic	2
8	44452	Screw-Machine	4
9	44453	Screw-Machine	4

ASS'Y - CONTROL BOX, MARK III



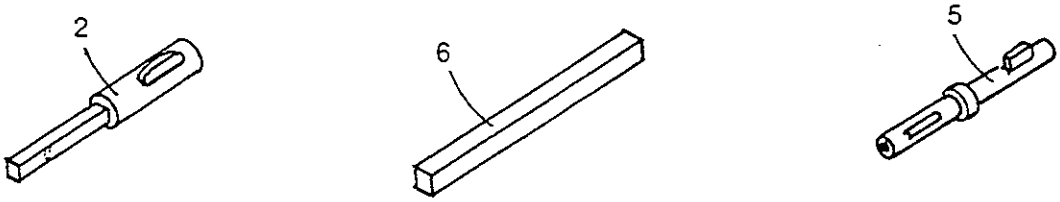
ITEM	PART NO.	DESCRIPTION	QTY.
	72829	Ass'y - Control Box Group	
	74535	Ass'y - Control Box Group- Metric	
1.	72802	Ass'y - Control Box	1
		Decal	1
		Fuse - 4 Amp 3AGC	1
2.	72803	Wiring Harness - Processor	1
3.	72805	Bracket - Control Box	1
4.	72806	Group - Hardware	

GROUP - ENCODER ASS'Y

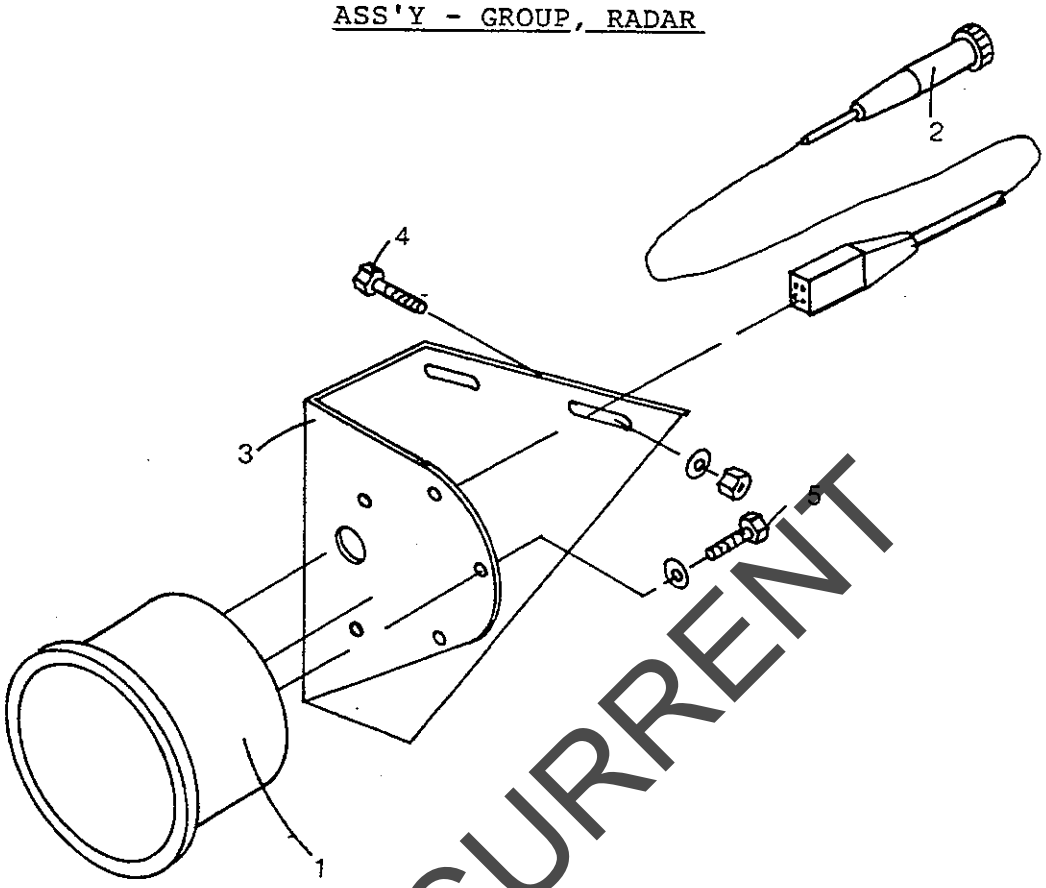


ITEM	PART NO.	DESCRIPTION	QTY.
	72808	Group - Encoder	
1.	72809	Ass'y - Encoder	1
2.	72810	Tip - Drive	1
3.	72811	Adapter - Speedometer	1
4.	73334	Adapter - Long	1
5.	73335	Tip	1
6.	73336	Tip - Drive	1

Note: Sensor must be mounted above the lubricant level in the transmission. If sensor fills with lubricant it will stop working.



ASS'Y - GROUP, RADAR



ITEM	PART NO.	DESCRIPTION	QTY.
	72812	Ass'y - Group, Radar	
1.	72813	Radar Unit	1
2.	72814	Harness - Wiring, Radar	1
3.	72833	Bracket - Mounting	1
4.	20034	Screw - Cap, 5/6 X 3/4	6
	20711	Washer - Lock, 5/6	2
5.	20124	Screw - Cap, 1/2 X 1 1/2	2
	20714	Washer - Lock, 1/2	2
	20646	Nut - Hex, 1/2	2