
10SERIES™

INSTALLATION, OPERATION, PARTS LIST, AND MAINTENANCE MANUAL



THE GORMAN-RUPP COMPANY • MANSFIELD, OHIO
GORMAN-RUPP OF CANADA LIMITED • ST. THOMAS, ONTARIO, CANADA

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INTRODUCTION

This Installation, Operation, and Maintenance Manual is designed to help you achieve the best performance and longest life from your Gorman-Rupp pump.

This pump is a 10 Series, semi-open impeller, self-priming centrifugal model with a suction check valve. The pump is powered by a Ford F268D diesel engine, and mounted on a 2-wheel trailer meeting D.O.T. specifications. The unit is designed for handling liquids which contain specified entrained solids. The pump is constructed primarily of gray iron with ductile iron impeller and steel wearing parts.

If there are any questions regarding the pump or trailer application which are not covered in this manual or in other literature accompanying this unit, please contact your Gorman-Rupp distributor, or write:

The Gorman-Rupp Company or Gorman-Rupp of Canada Limited
P.O. Box 1217 70 Burwell Road
Mansfield, Ohio 44901 St. Thomas, Ontario N5P 3R7

For information or technical assistance on the engine, contact the engine manufacturer's local dealer or representative.

The following are used to alert maintenance personnel to procedures which require special attention, to those which could damage equipment, and to those which could be dangerous to personnel:

NOTE

Instructions to aid in installation, operation, and maintenance or which clarify a procedure.

CAUTION

Instructions which must be followed to avoid causing damage to the product or other equipment incidental to the installation. These instructions describe the requirements and the possible damage which could result from failure to follow the procedures.

WARNING

These instructions must be followed to avoid causing injury or death to personnel, and describe the procedure required and the injury which could result from failure to follow the procedure.

WARNINGS

WARNINGS - SECTION A

THESE WARNINGS APPLY TO 10 SERIES ENGINE DRIVEN PUMPS. REFER TO THE MANUAL ACCOMPANYING THE ENGINE BEFORE ATTEMPTING TO BEGIN OPERATION.

WARNING

```

////////////////////////////////////
//
// Before attempting to open or service the pump:
//
// 1. Familiarize yourself with this manual.
// 2. Switch off the engine ignition and remove the key
//    to ensure that the pump will remain inoperative.
// 3. Allow the pump to cool if overheated.
// 4. Vent the pump slowly and cautiously.
// 5. Close the suction and discharge valves.
// 6. Check the temperature before opening any covers,
//    plates, or plugs.
// 7. Drain the pump.
//
////////////////////////////////////

```

WARNING

```

////////////////////////////////////
//
// This pump is designed to pump liquids containing speci-
// fied entrained solids.. Do not attempt to pump
// volatile, flammable, or corrosive liquids which may dam-
// age the pump or endanger personnel as a result of pump
// failure.
//
////////////////////////////////////

```

WARNING

```

////////////////////////////////////
//
// When lifting the entire unit, connect chains with
// spreader bars to the trailer lifting eyes. Use lifting
// and moving equipment in good repair and with adequate
// capacity to prevent injuries to personnel or damage to
// equipment. The lifting eyes are designed to support on-
// ly the weight of the unit. Remove suction and discharge
// hoses before lifting.
//
////////////////////////////////////

```

WARNING

```

////////////////////////////////////
//
// After the trailer has been positioned, make certain that
// the pump and all piping or hose connections are secure
// before operation.
//
////////////////////////////////////

```

WARNINGS

WARNING

```

////////////////////////////////////
//
// Do not operate the pump against a closed discharge valve //
// for long periods of time. This could bring the liquid //
// to a boil, build pressure, and cause the pump to rupture //
// or explode. //
// //
////////////////////////////////////

```

WARNING

```

////////////////////////////////////
//
// Do not remove plates, covers, gauges, pipe plugs, or //
// fittings from an overheated pump. Vapor pressure within //
// the pump can cause parts being disengaged to be ejected //
// with great force. Allow the pump to cool before servic- //
// ing. //
// //
////////////////////////////////////

```

WARNING

```

////////////////////////////////////
//
// Do not operate an internal combustion engine in an ex- //
// plosive atmosphere. When operating internal combustion //
// engines in an enclosed area, make certain that exhaust //
// fumes are piped to the outside. These fumes contain //
// carbon monoxide, a deadly gas that is colorless, //
// tasteless, and odorless. //
// //
////////////////////////////////////

```

WARNING

```

////////////////////////////////////
//
// Fuel used by internal combustion engines presents an ex- //
// tremely explosion and fire hazard. Make certain that all //
// fuel lines are securely connected and free of leaks. //
// Never refuel a hot or running engine. Avoid overfilling //
// the fuel tank. Always use the correct type of fuel. //
// //
////////////////////////////////////

```

WARNING

```

////////////////////////////////////
//
// Never tamper with the governor to gain more power. The //
// governor establishes safe operating limits that should //
// not be exceeded. The maximum continuous operating speed //
// is 2150 RPM. //
// //
////////////////////////////////////

```


WARNINGS

WARNING

```

////////////////////////////////////
//
// Read all instructions pertaining to the function and op- //
// eration of the trailer (Section F) before attempting to //
// hitch or move it. Failure to comply could result in //
// equipment damage or vehicle accident. //
// //
////////////////////////////////////

```

WARNING

```

////////////////////////////////////
//
// The approximate trailer tongue weight is 330 lbs.. Be //
// sure the tow vehicle hitch is rated for this capacity //
// and fitted with the proper sized ball. //
// //
////////////////////////////////////

```

WARNING

```

////////////////////////////////////
//
// Do not attempt to operate the pump unless the trailer is //
// level. Be sure the trailer leveling stands are posi- //
// tioned on a solid surface, and the wheels are chocked. //
// //
////////////////////////////////////

```


INSTALLATION - SECTION B

Since pump installations are seldom identical, this section offers only general recommendations and practices required to inspect, position, and arrange the pump and piping.

Most of the information pertains to a standard **static lift application** where the pump is positioned above the free level of liquid to be pumped.

If installed in a **flooded suction application** where the liquid is supplied to the pump under pressure, some of the information such as mounting, line configuration, and priming must be tailored to the specific application. Since the pressure supplied to the pump is critical to performance and safety, **be sure** to limit the incoming pressure to 50% of the maximum pressure developed by the pump.

For further assistance, contact your Gorman-Rupp distributor or the Gorman-Rupp Company.

Pump Dimensions

See Figure 1 for the approximate physical dimensions of this pump and trailer.

OUTLINE DRAWING

POWERED BY
FORD F268D ENGINE

18.00 CLEARANCE REQ'D FOR
[457,2] REMOVAL OF BACK COVER PLATE

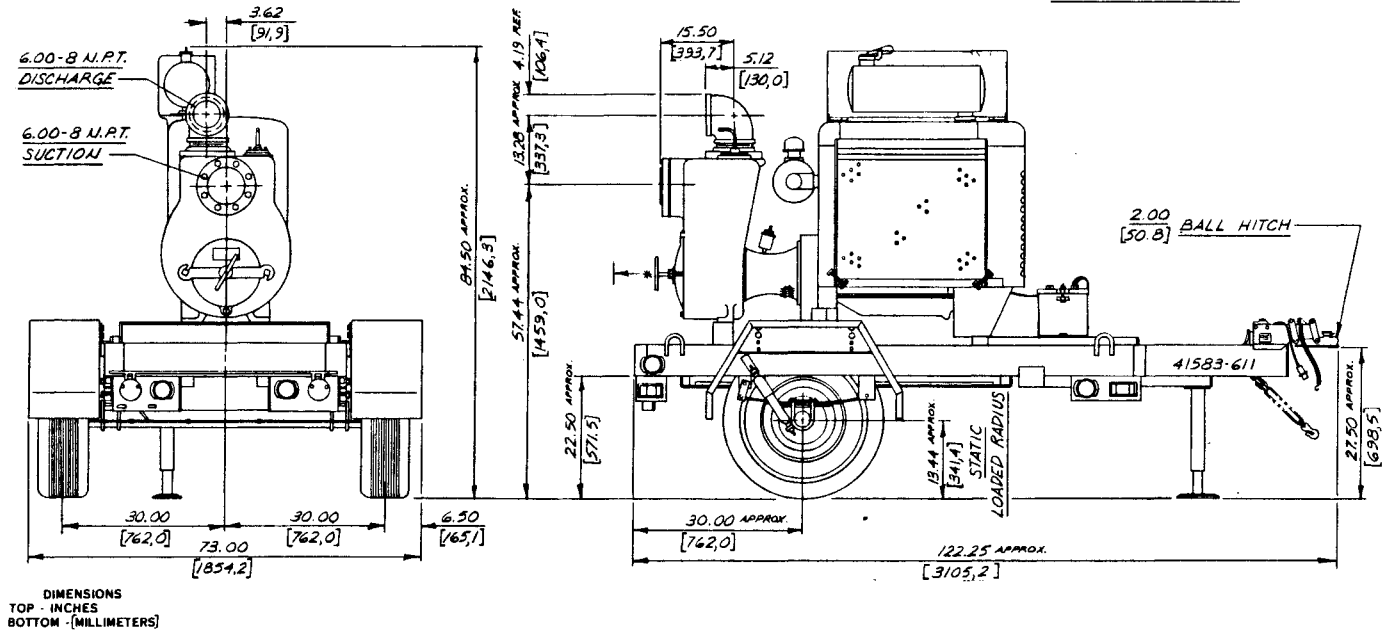


Figure 1. Pump Model 16C2-F268D-HT

WARNING

//////////////////////////////////////
 //
 // Read all instructions pertaining to the function and op- //
 // eration of the trailer (Section F) before attempting to //
 // hitch or move it. Failure to comply could result in //
 // equipment damage or vehicle accident. //
 //
 //////////////////////////////////////

PREINSTALLATION INSPECTION

The pump assembly was inspected and tested before shipment from the factory. Before installation, inspect the pump for damage which may have occurred during shipment. Check as follows:

INSTALLATION

- a. Inspect the pump and trailer for cracks, dents, damaged threads, and other obvious damage.
- b. Check for and tighten loose bolts, nuts, capscrews, and other attaching hardware. Since gaskets tend to shrink after drying, check for and tighten loose nuts and capscrews securing mating surfaces.
- c. Carefully read all tags, decals, and markings on the pump assembly, and follow the instructions indicated.
- d. Check all lubricant levels and lubricate as necessary. Refer to LUBRICATION in the MAINTENANCE AND REPAIR section of this manual and perform duties as instructed.
- e. If the pump and engine have been stored for more than 12 months, some of the components or lubricants may have exceeded their maximum shelf life. These **must be inspected or replaced** to ensure maximum pump service.

If the maximum shelf life has been exceeded, or if anything appears to be abnormal, contact your Gorman-Rupp distributor or the factory to determine the repair or updating policy. **Do not** put the pump into service until appropriate action has been taken.

POSITIONING PUMP

Lifting

To lift the complete unit, attach lifting equipment to the lifting eyes provided on the trailer. The lifting eyes are intended to support only the weight of the pump, engine, and trailer. Customer installed equipment such as suction and discharge hoses **must** be removed before attempting to lift.

Use lifting equipment with a capacity of at least 16,500 pounds. The combined weight of the pump, engine, and trailer is approximately 3,300 pounds, not including weight of accessories. It is strongly recommended that a spreader bar be used to ensure proper chain positioning and load balance.

CAUTION

The pump assembly can be seriously damaged if the cables or chains used to lift and move the unit are improperly wrapped around the pump.

INSTALLATION

WARNING

```

////////////////////////////////////
//
// Use lifting and moving equipment in good repair and with //
// adequate capacity to prevent injuries to personnel or //
// damage to equipment. The bail is intended for use in //
// lifting the pump assembly only. Suction and discharge //
// hoses and piping MUST be removed from the pump when //
// lifting the pump by the bail. //
// //
////////////////////////////////////

```

Mounting

Locate the pump in an accessible place as close as practical to the liquid being pumped. Level mounting is essential for proper operation. Position trailer leveling stands on solid surface and adjust height as required. Secure wheels with chocks.

WARNING

```

////////////////////////////////////
//
// Do not attempt to operate the pump unless the trailer is //
// level. Be sure the trailer leveling stands are posi- //
// tioned on a solid surface, and the wheels are chocked. //
// //
////////////////////////////////////

```

SUCTION AND DISCHARGE PIPING

Materials

Either pipe or hose may be used for suction and discharge lines; however, the materials must be compatible with the liquid being pumped. If hose is used in suction lines, it must be the rigid-wall, reinforced type to prevent collapse under suction. Using piping couplings in suction lines is not recommended.

Line Configuration

Keep suction and discharge lines as straight as possible to minimize friction losses. Make minimum use of elbows and fittings, which substantially increase friction loss. If elbows are necessary, use the long-radius type to minimize friction loss.

INSTALLATION

Connections to Pump

Before tightening a connecting flange, align it exactly with the pump port. Never pull a pipe line into place by tightening the flange bolts and/or couplings.

Lines near the pump must be independently supported to avoid strain on the pump which could cause excessive vibration, decreased bearing life, and increased shaft and seal wear. If hose-type lines are used, they should have adequate support to secure them when filled with liquid and under pressure.

Gauges

Most pumps are drilled and tapped for installing discharge pressure and vacuum suction gauges. If these gauges are desired for pumps that are not tapped, drill and tap the suction and discharge lines not less than 18 inches from the suction and discharge ports and install the lines. Installation closer to the pump may result in erratic readings.

SUCTION LINES

To avoid air pockets which could affect pump priming, the suction line must be as short and direct as possible. When operation involves a suction lift, the line must always slope upward to the pump from the source of the liquid being pumped; if the line slopes down to the pump at any point along the suction run, air pockets will be created.

Fittings

Suction lines should be the same size as the pump inlet. If reducers are used in suction lines, they should be the eccentric type, and should be installed with the flat part of the reducers uppermost to avoid creating air pockets. Valves are not normally used in suction lines, but if a valve is used, install it with the stem horizontal to avoid air pockets.

Strainers

If a strainer is furnished with the pump, be certain to use it; any spherical solids which pass through a strainer furnished with the pump will also pass through the pump itself.

If a strainer is not furnished with the pump, but is installed by the pump user, make certain that the total area of the openings in the strainer is at least three or four times the cross section of the suction line, and that the openings will not permit passage of solids larger than the solids handling capability of the pump.

This pump is designed to handle up to 3.00 inch diameter spherical solids.

Sealing

Since even a slight leak will affect priming, head, and capacity, especially when operating with a high suction lift, all connections in the suction line should be sealed with pipe dope to ensure an airtight seal. Follow the sealant manufacturer's recommendations when selecting and applying the pipe dope. The pipe dope should be compatible with the liquid being pumped.

Suction Lines In Sumps

If a single suction line is installed in a sump, it should be positioned away from the wall of the sump at a distance equal to one and one-half times the diameter of the suction line.

If there is a liquid flow from an open pipe into the sump, the flow should be kept away from the suction inlet because the inflow will carry air down into the sump, and air entering the suction line will reduce pump efficiency.

If it is necessary to position inflow close to the suction inlet, install a baffle between the inflow and the suction inlet at a distance one and one-half times the diameter of the suction pipe. The baffle will allow entrained air to escape from the liquid before it is drawn into the suction inlet.

If two suction lines are installed in a single sump, the flow paths may interact, reducing the efficiency of one or both pumps. To avoid this, position the suction inlets so that they are separated by a distance equal to at least three times the diameter of the suction pipe.

Suction Line Positioning

The depth of submergence of the suction line is critical to efficient pump operation. Figure 2 shows recommended minimum submergence vs. velocity.

NOTE

The pipe submergence required may be reduced by installing a standard pipe increaser fitting at the end of the suction line. The larger opening size will reduce the inlet velocity. Calculate the required submergence using the following formula based on the increased opening size (area or diameter).

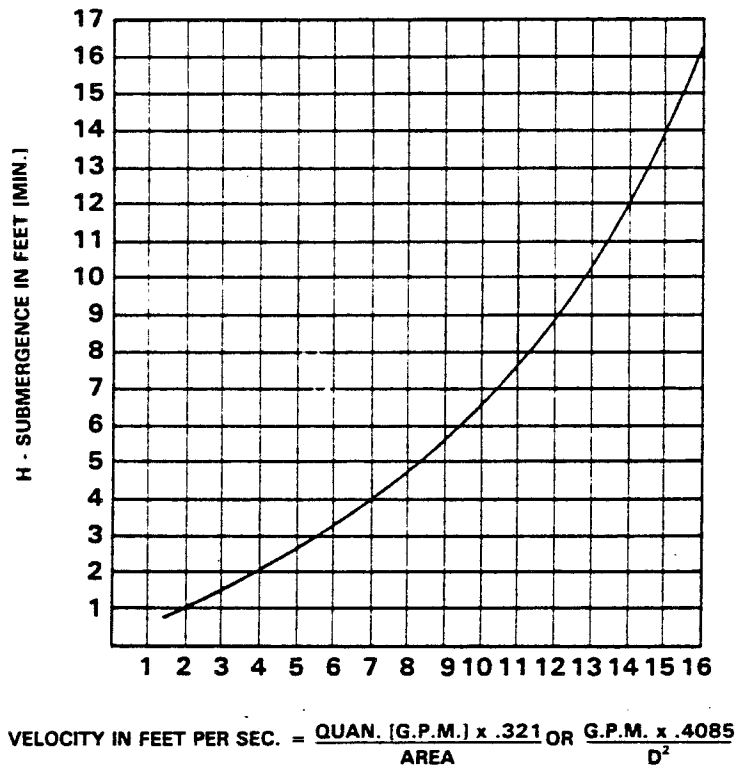


Figure 2. Recommended Minimum Suction Line Submergence Vs. Velocity

DISCHARGE LINES

Siphoning

Do not terminate the discharge line at a level lower than that of the liquid being pumped unless a siphon breaker is used in the line. Otherwise, a siphoning action causing damage to the pump could result.

Valves

A check valve in the discharge line is normally recommended, but it is not necessary in low discharge head applications.

If a throttling valve is desired in the discharge line, use a valve as large as the largest pipe to minimize friction losses. Never install a throttling valve in a suction line.

With high discharge heads, it is recommended that a throttling valve and a system check valve be installed in the discharge line to protect the pump from excessive shock pressure and reverse rotation when it is stopped.

INSTALLATION

Bypass Lines

If it is necessary to permit the escape of air to atmosphere during initial priming or in the repriming cycle, install a bypass line between the pump and the discharge check valve. The bypass line should be sized so that it does not affect pump discharge capacity.

Either a Gorman-Rupp automatic air release valve - which will automatically open to allow the pump to prime, and automatically close when priming is accomplished - or a hand-operated shutoff valve should be installed in the bypass line.

NOTE

The bypass line may clog frequently, particularly if the valve remains closed. If this condition occurs, either use a larger bypass line or leave the shutoff valve open during the pumping operation.

Do not terminate the discharge line at a level lower than that of the liquid being pumped unless a siphon breaker is used in the line. Otherwise, a siphoning action could result, causing damage to the pump.

ALIGNMENT

The alignment of the pump and the engine is critical for trouble free mechanical operation. See Section E, **Securing Pump And Drive Assembly To Engine** for detailed information.

OPERATION

OPERATION - SECTION C**WARNING**

```

////////////////////////////////////
//
// This pump is designed to pump liquids containing speci- //
// fied entrained solids.. Do not attempt to pump //
// volatile, flammable, or corrosive liquids which may dam- //
// age the pump or endanger personnel as a result of pump //
// failure. //
// //
////////////////////////////////////

```

WARNING

```

////////////////////////////////////
//
// Never tamper with the governor to gain more power. The //
// governor establishes safe operating limits that should //
// not be exceeded. The maximum continuous operating speed //
// is 2150 RPM. //
// //
////////////////////////////////////

```

PRIMING

Position the trailer and install the piping as described in INSTALLATION. Make sure that the piping connections are tight, and that the pump is securely mounted. Check that the pump is properly lubricated (see LUBRICATION in MAINTENANCE AND REPAIR).

This pump is self-priming, but the pump should never be operated unless there is liquid in the casing.

CAUTION

Never operate a self-priming pump unless there is liquid in the casing. The pump will not prime when dry. Extended operation of a dry pump will destroy the seal assembly.

Add liquid to the pump casing when:

1. The pump is being put into service for the first time.
2. The pump has not been used for a considerable length of time.
3. The liquid in the pump casing has evaporated.

Once the pump casing has been filled, the pump will prime and reprime as necessary.

OPERATION

WARNING

```

////////////////////////////////////
//
// After filling the pump casing, reinstall and tighten the //
// fill plug. Do not attempt to operate the pump unless //
// all connecting piping is securely installed. Otherwise, //
// liquid in the pump forced out under pressure could cause //
// injury to personnel. //
// //
////////////////////////////////////

```

To fill the pump, remove the pump casing fill cover or fill plug at the top of the casing and add clean liquid until the pump is filled. Replace the fill cover or fill plug before operating the pump.

STARTING

Consult the operations manual furnished with the engine.

NOTE

This pump is equipped with a safety shut down device to terminate engine operation if pump discharge pressure falls below 30 psi. During engine start up, the button on the discharge pressure gauge must be depressed to over-ride this safety feature.

OPERATION

Lines With a Bypass

Either a Gorman-Rupp automatic air release valve or a hand operated shutoff valve may be installed in a bypass line.

If a Gorman-Rupp automatic air release valve has been installed, close the throttling valve in the discharge line. The Gorman-Rupp valve will automatically open to allow the pump to prime, and automatically close when priming has been accomplished. After the pump has been primed, and liquid is flowing steadily from the bypass line, open the discharge throttling valve.

If a hand operated shutoff valve has been installed, close the throttling valve in the discharge line, and open the bypass shutoff valve so that the pump will not have to prime against the weight of the liquid in the discharge line. When the pump has been primed, and liquid is flowing steadily from the bypass line, close the bypass shutoff valve and open the discharge throttling valve.

OPERATION

Lines Without a Bypass

Open all valves in the discharge line and start the power source. Priming is indicated by a positive reading on the discharge pressure gauge or by a quieter operation. The pump may not prime immediately because the suction line must first fill with liquid. If the pump fails to prime within five minutes, stop it and check the suction line for leaks.

After the pump has been primed, partially close the discharge line throttling valve in order to fill the line slowly and guard against excessive shock pressure which could damage pipe ends, gaskets, sprinkler heads, and any other fixtures connected to the line. When the discharge line is completely filled, adjust the throttling valve to the required flow rate.

Leakage

No leakage should be visible at pump mating surfaces, or at pump connections or fittings. Keep all line connections and fittings tight to maintain maximum pump efficiency.

Liquid Temperature And Overheating

The maximum liquid temperature for this pump is 110°F. Do not apply it at a higher operating temperature.

Overheating can occur if operated with the valves in the suction or discharge lines closed. Operating against closed valves could bring the liquid to a boil, build pressure, and cause the pump to rupture or explode. If overheating occurs, stop the pump and allow it to cool before servicing it. Refill the pump casing with cool liquid.

WARNING

```

////////////////////////////////////
//                               //
// Do not remove plates, covers, gauges, pipe plugs, or //
// fittings from an overheated pump. Vapor pressure within //
// the pump can cause parts being disengaged to be ejected //
// with great force. Allow the pump to cool before servic- //
// ing.                               //
//                               //
////////////////////////////////////

```

Strainer Check

If a suction strainer has been shipped with the pump or installed by the user, check the strainer regularly, and clean it as necessary. The strainer should also be checked if pump flow rate begins to drop. If a vacuum suction gauge has been installed, monitor and record the readings regularly to detect strainer blockage.

OPERATION

Pump Vacuum Check

With the pump inoperative, install a vacuum gauge in the system, using pipe dope on the threads. Block the suction line and start the pump. At operating speed the pump should pull a vacuum of 20 inches or more of mercury. If it does not, check for air leaks in the seal, gasket, or discharge valve.

Open the suction line, and read the vacuum gauge with the pump primed and at operation speed. Shut off the pump. The vacuum gauge reading will immediately drop proportionate to static suction lift, and should then stabilize. If the vacuum reading falls off rapidly after stabilization, an air leak exists. Before checking for the source of the leak, check the point of installation of the vacuum gauge.

STOPPING

Never halt the flow of liquid suddenly. If the liquid being pumped is stopped abruptly, damaging shock waves can be transmitted to the pump and piping system. Close all connecting valves slowly. If the pump is driven by an engine, reduce the throttle speed slowly and allow the engine to idle briefly before stopping.

CAUTION

If application involves a high discharge head, gradually close the discharge throttling valve before stopping the pump.

After stopping the pump, remove the engine ignition key or take other action to ensure that the pump will remain inoperative.

Cold Weather Preservation

In below freezing conditions, drain the pump to prevent damage from freezing. Also, clean out any solids by flushing with a hose. Operate the pump for approximately one minute; this will remove any remaining liquid that could freeze the pump rotating parts.

If the pump will be idle for more than a few hours, or if it has been pumping liquids containing a large amount of solids, drain the pump, and flush it thoroughly with clean water. To prevent large solids from clogging the drain port and preventing the pump from completely draining, insert a rod or stiff wire in the drain port, and agitate the liquid during the draining process. Clean out any remaining solids by flushing with a hose.

OPERATION

BEARING TEMPERATURE CHECK

Bearings normally run at higher than ambient temperatures because of heat generated by friction. Temperatures up to 160°F are considered normal for bearings, and they can operate safely to at least 180°F.

Checking bearing temperatures by hand is inaccurate. Bearing temperatures can be measured accurately by placing a contact-type thermometer against the housing. Record this temperature for future reference.

A sudden increase in bearing temperatures is a warning that the bearings are at the point of failing to operate properly. Make certain that the bearing lubricant is of the proper viscosity and at the correct level (see LUBRICATION in MAINTENANCE AND REPAIR). Bearing overheating can also be caused by shaft misalignment and/or excessive vibration.

When pumps are first started, the bearings may seem to run at temperatures above normal. Continued operation should bring the temperatures down to normal levels.

PUMP TROUBLESHOOTING - SECTION D

WARNING

```

////////////////////////////////////
//
// Before attempting to open or service the pump:
//
// 1. Familiarize yourself with this manual.
// 2. Switch off the engine ignition and remove the key
//    to ensure that the pump will remain inoperative.
// 3. Allow the pump to cool if overheated.
// 4. Vent the pump slowly and cautiously.
// 5. Close the suction and discharge valves.
// 6. Check the temperature before opening any covers,
//    plates, or plugs.
// 7. Drain the pump.
//
////////////////////////////////////
    
```

NOTE

Troubleshooting the trailer assembly is covered in Section F.

TROUBLE	POSSIBLE CAUSE	PROBABLE REMEDY
PUMP FAILS TO PRIME	Air leak in suction line. Lining of suction hose collapsed. Leaking or worn seal or pump gasket. Suction lift or discharge head too high. Strainer clogged. Suction check valve or foot valve clogged or binding.	Correct leak. Replace suction hose. Check pump vacuum. Replace leaking or worn seal or gasket. Check piping installation and install bypass line if needed. See INSTALLATION. Check strainer and clean if necessary. Clean valve.
PUMP STOPS OR FAILS TO DELIVER RATED FLOW OR PRESSURE	Air leak in suction line. Suction intake not submerged at proper level or sump too small.	Correct leak. Check installation and correct as needed. Check submergence chart (Section B).

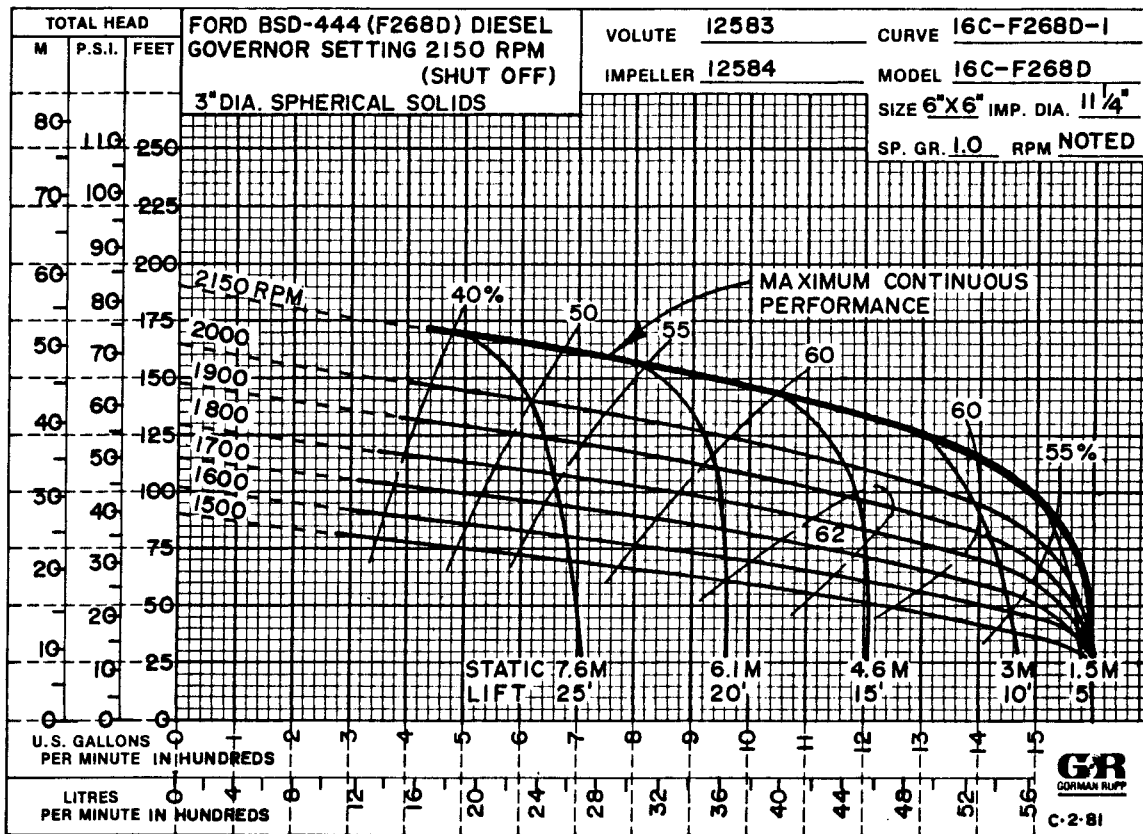
TROUBLE	POSSIBLE CAUSE	PROBABLE REMEDY
PUMP STOPS OR FAILS TO DELIVER RATED FLOW OR PRES-SURE(cont.)	<p>Lining of suction hose collapsed.</p> <p>Impeller or other wearing parts worn or damaged.</p> <p>Impeller clogged.</p> <p>Suction lift or discharge head too high.</p> <p>Strainer clogged.</p> <p>Pump speed too slow.</p> <p>Leaking or worn seal or pump gasket.</p>	<p>Replace suction hose.</p> <p>Replace worn or damaged parts. Check that impeller is properly centered and rotates freely.</p> <p>Free impeller of debris.</p> <p>Check piping installation and install bypass line if needed. See INSTALLATION.</p> <p>Check strainer and clean if necessary.</p> <p>Check engine output; consult engine operation manual.</p> <p>Check pump vacuum. Replace leaking or worn seal or gasket.</p>
PUMP REQUIRES TOO MUCH POWER	<p>Pump speed too high.</p> <p>Discharge head too low.</p> <p>Liquid solution too thick.</p> <p>Bearing(s) frozen.</p>	<p>Check engine output.</p> <p>Adjust discharge valve.</p> <p>Dilute if possible.</p> <p>Disassemble pump and check bearing(s).</p>
PUMP CLOGS FREQUENTLY	<p>Discharge flow too slow.</p> <p>Suction check valve or foot valve clogged or binding.</p> <p>Liquid solution too thick.</p>	<p>Open discharge valve fully to increase flow rate, and run engine at maximum governed speed.</p> <p>Clean valve.</p> <p>Dilute if possible.</p>

TROUBLE	POSSIBLE CAUSE	PROBABLE REMEDY
EXCESSIVE NOISE	<p>Cavitation in pump.</p> <p>Pumping entrained air.</p> <p>Pump or drive not securely mounted.</p> <p>Impeller clogged or damaged.</p>	<p>Reduce suction lift and/or friction losses in suction line. Record vacuum and pressure gauge readings and consult local representative or factory.</p> <p>Locate and eliminate source of air bubble.</p> <p>Secure mounting hardware.</p> <p>Clean out debris; replace damaged parts.</p>
BEARINGS RUN TOO HOT	<p>Bearing temperature is high, but within limits.</p> <p>Low or incorrect lubricant.</p> <p>Suction and discharge lines not properly supported.</p> <p>Drive misaligned.</p>	<p>Check bearing temperature regularly to monitor any increase.</p> <p>Check for proper type and level of lubricant.</p> <p>Check piping installation for proper support.</p> <p>Align drive properly.</p>

PUMP MAINTENANCE AND REPAIR - SECTION E

(Trailer assembly maintenance and repair is covered in Section F.)

MAINTENANCE AND REPAIR OF THE WEARING PARTS OF THE PUMP WILL MAINTAIN PEAK OPERATING PERFORMANCE.



*STANDARD PERFORMANCE FOR PUMP MODEL 16C2-F268D-HT

*Based on 70°F clear water at sea level with minimum suction lift. Since pump installations are seldom identical, your performance may be different due to such factors as viscosity, specific gravity, elevation, temperature, and impeller trim.

If your pump serial number is followed by an "N", your pump is NOT a standard production model. Contact the Gorman-Rupp Company to verify performance or part numbers.

CAUTION

Pump speed and operating condition points must be within the continuous performance range shown on the curve.

SECTIONAL DRAWING

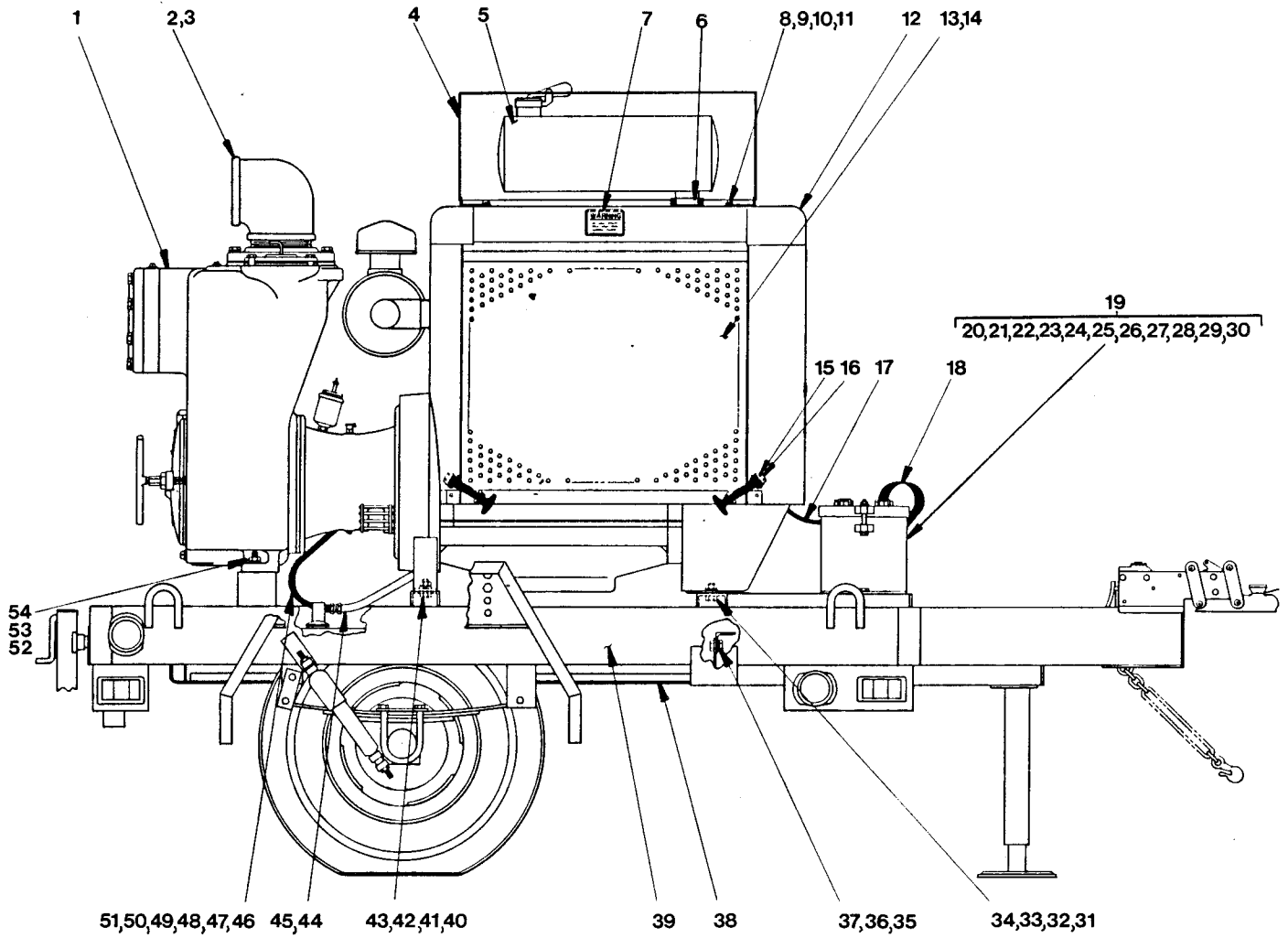


Figure 1. Model 16C2-F268D-HT Pump Assembly

PARTS LIST
Pump Model 16C2-F268D-HT
 (From S/N 797357 up)

ITEM NO.	PART NAME	PART NUMBER	MATL CODE	QTY	ITEM NO.	PART NAME	PART NUMBER	MATL CODE	QTY
1	PUMP END ASSY	16C2	-----	1	35	HEX HD CAPSCREW	B00604	15991	10
2	PIPE ELBOW	R00096	11990	1	36	HEX NUT	D00006	15991	10
3	PIPE NIPPLE	T00096	15070	1	37	LOCKWASHER	J00006	15991	10
4	MUFFLER GUARD ASSY	42331-022	-----	1	38	FUEL TANK & GUARD	46711-041	-----	1
5	*MUFFLER	29334-122	-----	1	39	TRAILER ASSY	41583-611	-----	1
6	MUFFLER CLAMP	29334-260	-----	1		(SEE SECTION F)			
7	WARNING DECAL	38816-132	-----	2	40	HEX HD CAPSCREW	B01007	15991	2
8	HEX HD CAPSCREW	B00504	15991	2	41	HEX NUT	D00010	15991	2
9	NUT RETAINER	21768-703	15991	2	42	LOCKWASHER	J00010	15991	2
10	LOCKWASHER	J00005	15991	2	43	FLAT WASHER	K00010	15991	2
11	FLAT WASHER	K00005	15991	2	44	*FUEL HOSE ASSY	46341-747	-----	1
12	FORD F268D ENGINE	29218-101	-----	1	45	ELBOW	25812-804	-----	1
13	SIDE PANEL ASSY	42142-060	24150	1	46	*FUEL LINE	11308-A	-----	1
14	SIDE PANEL ASSY	42142-061	24150	1	47	*FUEL RETURN ASSY	14294	24030	1
15	POP RIVET	21122-022	-----	12	48	MALE CONNECTOR	26523-402	-----	1
16	HOOD FASTENER	29338-043	-----	4	49	REDUCER ELBOW	Q00402	11990	1
17	*CABLE ASSY	6926-AA	24040	1	50	HOSE CLAMP	S00855	-----	1
18	*GRD CABLE ASSY	5795-AC	24040	1	51	HOSE CLAMP	S01788	-----	1
19	BATTERY BOX ASSY	GRP40-04	-----	1	52	HEX HD CAPSCREW	B01009	15991	2
20	-BATTERY BOX CVR	4896-X	24000	1	53	HEX NUT	D00010	15991	2
21	*-CABLE ASSY	5795-CR	24040	1	54	LOCKWASHER	J00010	15991	2
22	-BATTERY TAG	6588-S	00000	1		NOT SHOWN:			
23	-BATTERY BOX	10478	24000	1		STRAINER	7823-A	24000	1
24	-HEX HD CAPSCREW	B00604	15991	1		POP RIVET	21122-023	-----	8
25	-HEX HD CAPSCREW	B00605	15991	1		CONNECTOR	S01670	-----	2
26	-HEX HD CAPSCREW	B00624	15991	2		CONNECTOR	S00468	-----	1
27	-HEX NUT	D00006	15991	4		SERVICE TEE	US00004	11990	1
28	-LOCKWASHER	J00006	15991	4		HOSE	31411-044	19360	1
29	-FLAT WASHER	K00006	15991	6		PRESSURE GAUGE	S01445	-----	1
30	*-BATTERY	S00978	-----	2		GROMMET	S00807	-----	1
31	HEX HD CAPSCREW	B01006	15991	2		WIRE ASSY	5795-DY	-----	1
32	HEX NUT	D00010	15991	2		ELBOW 90	S00698	-----	1
33	LOCKWASHER	J00010	15991	2		STAR WASHER	BL00005	-----	2
34	FLAT WASHER	K00010	15991	2					

*INDICATES PARTS RECOMMENDED FOR STOCK

Above Serial Numbers Do Not Apply To Pumps Made In Canada.

CANADIAN SERIAL NO AND UP

SECTIONAL DRAWING

SEAL AREA DETAIL

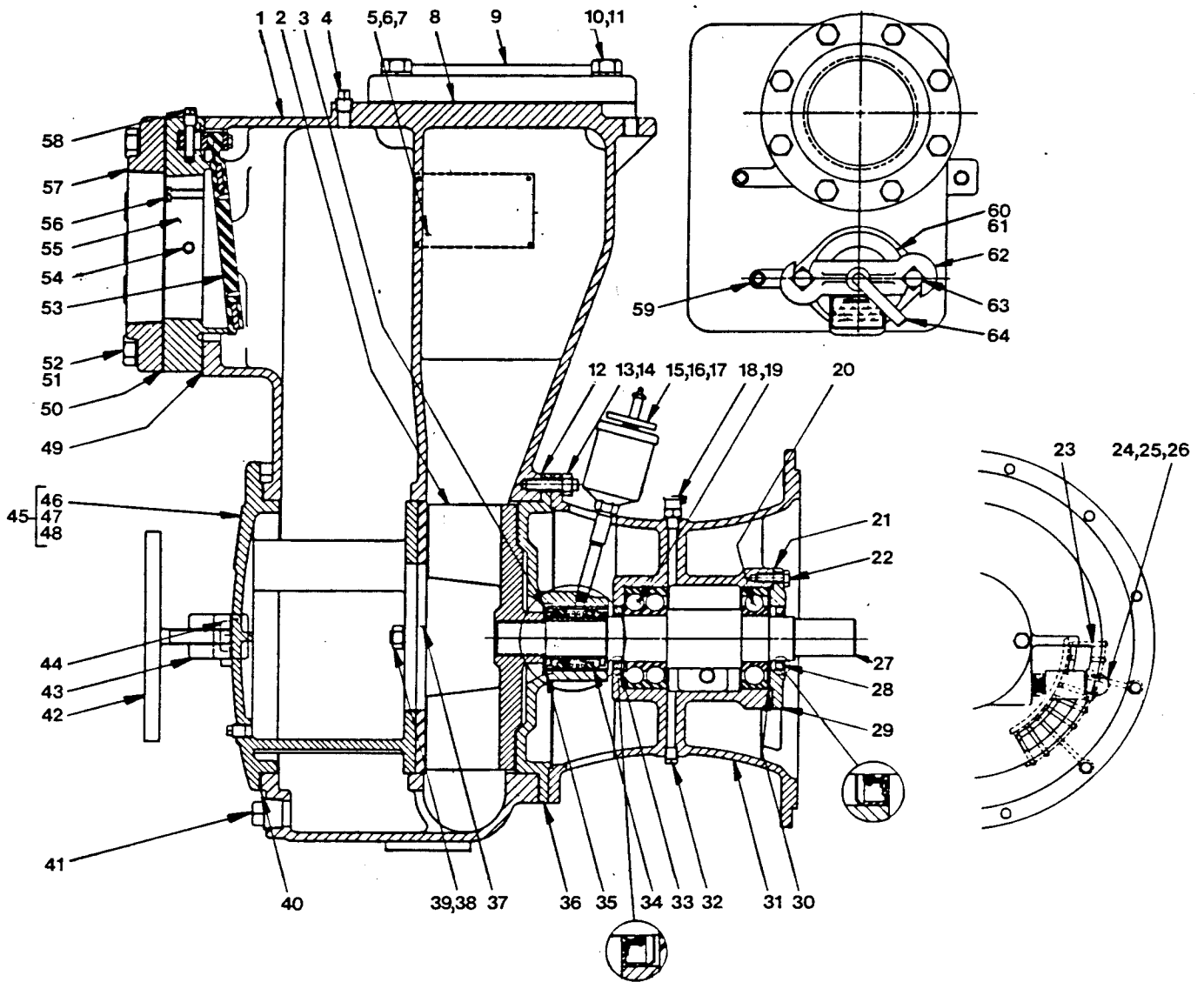
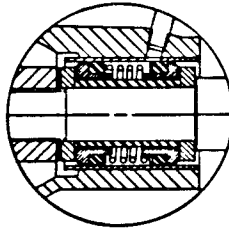


Figure 2. Pump End Assy 16C2-F268D-HT

PARTS LIST
Pump End Assy 16C2-F268D-HT

ITEM NO.	PART NAME	PART NUMBER	MATL CODE	QTY	ITEM NO.	PART NAME	PART NUMBER	MATL CODE	QTY
1	PUMP CASING	12583	10010	1	33	*OIL SEAL	25258-622	-----	1
2	*IMPELLER	12584	11000	1	34	*SEAL LINER	7408	14010	REF
3	*SEAL ASSY	GS01500	-----	1	35	*IMP SHIM SET	5091	17090	REF
4	PIPE PLUG	P00004	11990	1	36	*SEAL PLATE	11895-A	10010	1
5	NAME PLATE	2613-D	13990	1	37	*WEAR PLATE ASSY	2545	15990	1
6	DRIVE SCREW	BM#04-03	15990	4	38	HEX NUT	D00008	15991	2
7	WARNING DECAL	38816-096	-----	1	39	LOCKWASHER	J00008	15991	2
8	*DISCH FLANGE GSKT	1679-G	18000	1	40	*COVER GSKT	7668-G	20000	1
9	DISCHARGE FLANGE	1758	10010	1	41	CASING DRAIN PLUG	P00016	11990	1
10	HEX HD CAPSCREW	B01208	15991	8	42	CVR CLAMP SCREW	2536	24000	1
11	LOCKWASHER	J00012	15991	8	43	CVR CLAMP BAR	12586	11000	1
12	*CASING GSKT SET	34-G	18000	1	44	MACHINE BOLT	A01010	15991	2
13	STUD	C00809	15991	8	45	*COVER ASSY	42111-935	-----	1
14	HEX NUT	D00008	15991	8	46	-COVER	NOT AVAILABLE		1
15	*SEAL GREASE CUP	S01509	-----	1	47	-WARNING PLATE	2613-EV	13990	1
16	PIPE COUPLING	AE00004	11990	1	48	-CVR DRAIN PLUG	P00004	11990	1
17	HVY PIPE NIPPLE	THA00412	15070	1	49	*CHECK VALVE SEAT GSKT	11402-G	21020	1
18	*OIL HOLE CVR	26717-068	-----	1	50	*SUCTION FLANGE GSKT	1679-G	18000	1
19	*BALL BEARING	23421-461	-----	1	51	HEX HD CAPSCREW	B01214	15991	8
20	*BALL BEARING	S01077	-----	1	52	LOCKWASHER	J00012	15991	8
21	*BRG CAP GSKT	5413-G	18000	1	53	*CHECK VALVE ASSY	46411-064	-----	1
22	HEX HD CAPSCREW	B00604	15991	4	54	PIPE PLUG	P00004	11990	1
23	INTERMEDIATE GUARD	SEE FIG. 3		REF	55	*CHECK VALVE SEAT	11402-C	10010	1
24	*OIL LEVEL SIGHT GAUGE	S01471	-----	1	56	RD HD MACH SCREW	X00506	14990	2
25	CLOSE NIPPLE	T00012	15070	1	57	SUCTION FLANGE	1758	10010	1
26	PIPE COUPLING	AE00012	11990	1	58	CHECK VALVE PIN	11645	17010	1
27	*IMPELLER SHAFT	38514-807	-----	REF	59	PIPE PLUG	P00004	11990	1
28	*OIL SEAL	25258-622	-----	1	60	FILL COVER ASSY	42111-344	-----	1
29	*BEARING CAP	4185-A	10010	1	61	*FILL COVER GSKT	50-G	19210	1
30	*WAVY WASHER	23963-327	-----	1	62	COVER CLAMP BAR	38111-004	-----	1
31	INTERMEDIATE	38263-614	-----	REF	63	MACHINE BOLT	A01014	15991	2
32	INTERM DRAIN PLUG	P00006	11990	1	64	COVER CLAMP SCREW	31912-009	-----	1

*INDICATES PARTS RECOMMENDED FOR STOCK

SECTIONAL DRAWING

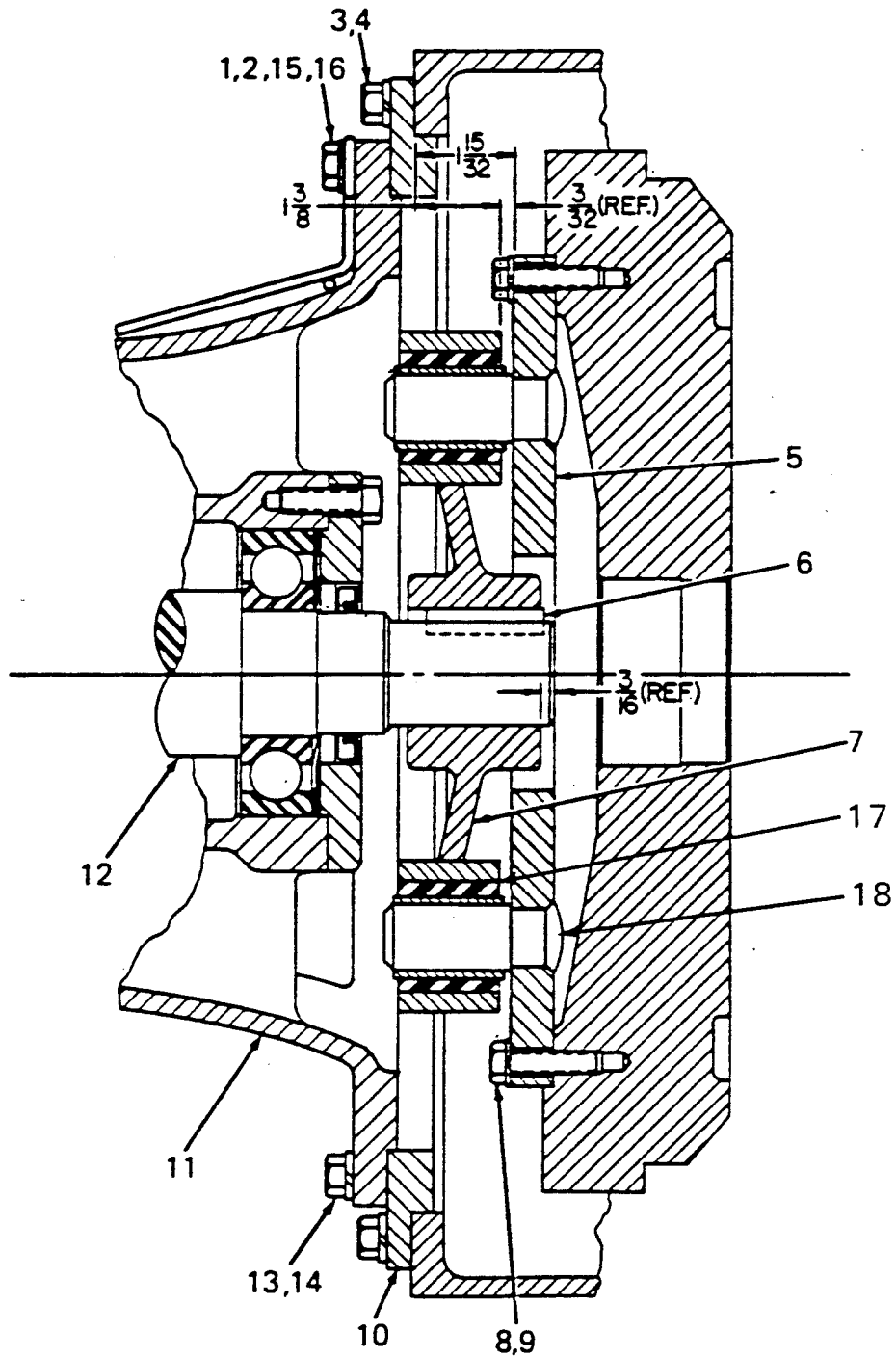


Figure 3. Drive Assembly For 16C2-F268D-HT

PARTS LIST
Drive Assembly For 16C2-F268D-HT

ITEM NO.	PART NAME	PART NUMBER	MATL CODE	QTY
1	HEX HD CAPSCREW	B00606	15991	4
2	LOCKWASHER	J00006	15991	4
3	HEX HD CAPSCREW	B00604	15991	12
4	LOCKWASHER	J00006	15991	12
5	DRIVE PLATE ASSEMBLY	44131-004	24150	1
6	KEY	N00607	15990	1
7	DRIVE ARM ASSEMBLY	13817-C	-----	1
8	HEX HD CAPSCREW	B00606	15991	8
9	LOCKWASHER	J00006	15991	8
10	* ADAPTOR RING	3093	15020	1
11	INTERMEDIATE	38263-614	10010	1
12	IMPELLER SHAFT	38514-807	16040	1
13	HEX HD CAPSCREW	B00605	15991	8
14	LOCKWASHER	J00006	15991	8
15	INTERMEDIATE GUARD	42381-031	24150	1
16	INTERMEDIATE GUARD	42381-032	24150	1
17	* DYNA-FLEX JOINT	S02110	-----	2
18	* DRIVE PIN	13819	15030	2

*INDICATES PARTS RECOMMENDED FOR STOCK

PUMP AND SEAL DISASSEMBLY AND REASSEMBLY

This pump requires little service due to its rugged, minimum-maintenance design. However, if it becomes necessary to inspect or replace the wearing parts, follow these instructions which are keyed to the sectional views (see Figures 1, 2 and 3) and the accompanying parts lists.

Most service functions may be performed by draining the pump and removing the back cover assembly. If major repair is required, the piping and/or engine must be disconnected.

Before attempting to service the pump, take precautions to ensure that the engine will remain inoperative. Close all connecting valves.

WARNING

```

////////////////////////////////////
//                               //
// Before attempting to open or service the pump: //
//                               //
// 1. Familiarize yourself with this manual. //
// 2. Switch off the engine ignition and remove the key //
// to ensure that the pump will remain inoperative. //
// 3. Allow the pump to cool if overheated. //
// 4. Vent the pump slowly and cautiously. //
// 5. Close the suction and discharge valves. //
// 6. Check the temperature before opening any covers, //
// plates, or plugs. //
// 7. Drain the pump. //
//                               //
////////////////////////////////////

```

WARNING

```

////////////////////////////////////
//                               //
// When lifting the entire unit, connect chains with //
// spreader bars to the trailer lifting eyes. Use lifting //
// and moving equipment in good repair and with adequate //
// capacity to prevent injuries to personnel or damage to //
// equipment. The lifting eyes are designed to support on- //
// ly the weight of the unit. Remove suction and discharge //
// hoses before lifting. //
//                               //
////////////////////////////////////

```

Back Cover Removal

(Figure 2)

The impeller, wear plate, check valve, and seal assembly can be serviced after the back cover assembly (45) has been removed.

Before removing the assembly, remove the casing drain plug (41) and drain the pump. Clean and reinstall the drain plug.

Loosen the cover clamp screw (42) and clamp bar (43) securing the back cover. Pull the back cover and assembled wear plate (37) from the pump casing (1).

Suction Check Valve Removal

(Figure 2)

After the back cover assembly has been removed, reach through the opening and hold the check valve assembly (53) in place while removing the check valve pin (58). Slide the assembly out of the suction port and remove it.

NOTE

If the check valve assembly or any components require replacement, the complete assembly must be replaced. Individual parts are not sold separately.

The check valve assembly may also be serviced by removing the suction flange (57). Remove the hardware (51 and 52) securing the suction flange to the pump casing, and pull the flange and assembled check valve from the suction port. Remove the check valve pin (58), and remove the check valve.

Inspect the suction flange gasket (50) for wear or damage, and replace as required.

Impeller Removal

(Figure 2)

Turn the cross arm on the automatic lubricating grease cup (15) clockwise until it rests against the cover (see Figure 5). This will prevent the grease from escaping when the impeller is removed.

To loosen the impeller (2), tap the vanes in a counterclockwise direction (when facing impeller) with a block of wood or a soft-faced mallet. Unscrew the impeller and replace it if cracked or badly worn. Use caution when removing the impeller; tension on the seal spring will be released as the impeller is unscrewed.

Slide the impeller adjusting shims (35) from the impeller shaft. For ease of reassembly, tag and tie the shims, or measure and record their thickness.

Seal Disassembly

(Figure 2)

Carefully remove the stationary and rotating seal elements, packing rings, seal spring, and the shaft sleeve, using a stiff wire with a hooked end if necessary.

Inspect the seal liner (34) for wear or grooves which could cause leakage or damage to the seal packing rings. The seal liner is a press fit in the seal

plate (36), and does not normally require replacement. If replacement is necessary, the seal plate must be removed. (See **Pump Disassembly**).

If no further disassembly is required, see **Seal Reassembly**.

Pump Disassembly

(Figure 2)

To service the seal plate, intermediate, bearings, or drive assembly, the pump end must be removed from the trailer. See Figure 1, and remove the hardware (52, 53, and 54) securing the pump casing to the trailer.

Remove the hex nuts (14) securing the pump casing (1) to the intermediate, and remove the pump casing. If shims have been used under the mounting feet to level the pump casing, tag and tie these shims. Remove the grease cup and piping (15, 16, and 17) from the seal plate (36). Remove the seal plate and gasket (12).

Separating Intermediate And Drive Assembly From Engine

(Figure 3)

If necessary to separate the intermediate and drive assemblies from the engine, support the intermediate using a hoist and sling, and remove the hardware (3 and 4) securing the intermediate (1) and adaptor (10) to the engine bellhousing. Separate the assemblies by pulling the intermediate straight away from the engine.

As the assemblies are separated, the drive pins (18) will disengage from the drive arm assembly (7). The drive arm assembly and the impeller shaft key (6) are a tight press fit on the shaft (12), and will remain on the shaft.

It is not necessary to remove the drive plate assembly (5) from the engine flywheel unless the drive pins are bent or worn and must be replaced. To remove the drive plate assembly, remove the hardware (8 and 9) securing the assembly to the engine flywheel, and remove the drive plate.

The drive pins are secured into the drive plate by a tight press fit and peening. To remove the pins, drill through from the peened end and drive the pins out using a drift pin.

Use a bearing puller to remove the drive arm assembly from the impeller shaft. Remove the shaft key.

Inspect the dyna flex joints (17), and replace them if worn. The dyna flex joints are a press fit in the drive arm.

Impeller Shaft And Bearing Disassembly

(Figure 2)

When the pump is properly operated and maintained, the intermediate should not require disassembly. Disassemble the shaft and bearings **only** when there is evidence of wear or damage.

CAUTION

Shaft and bearing disassembly in the field is not recommended. These operations should be performed only in a properly-equipped shop by qualified personnel.

Drain the bearing lubricant by removing the intermediate drain plug (32). Clean and reinstall the drain plug.

Remove the hardware (22) securing the bearing cap (29) to the intermediate (31), and remove the bearing cap, gasket (21), outboard oil seal (28), and wavy washer (30).

Place a block of wood against the impeller end of the shaft (27), and drive the shaft and assembled bearings out of the intermediate. Remove the inboard oil seal (33) from the intermediate. The inboard bearing should come free with the shaft. If it does not, press it out of the intermediate bore with an arbor (or hydraulic) press.

Use a bearing puller to remove the inboard and outboard bearings (19 and 20) from the impeller shaft.

Impeller Shaft And Bearing Reassembly

(Figure 2)

Clean the bore of the intermediate, all component parts, and the impeller shaft with a soft cloth soaked in cleaning solvent. Inspect the parts for wear, and replace as necessary.

WARNING

```

////////////////////////////////////
//
// Most cleaning solvents are toxic and flammable. Use //
// them only in a well-ventilated area free from excessive //
// heat, sparks, and flame. Read and follow all prec- //
// autions printed on solvent containers. //
// //
////////////////////////////////////

```

Inspect the shaft for damaged threads, distortion, or nicks and scratches. Dress small nicks and burrs with a fine file or honing stone. Replace the impeller shaft if severely damaged.

To prevent contamination, wash the bearings separately in **fresh** cleaning solvent. Dry the bearings with filtered compressed air and coat with light oil for ease of reassembly.

Rotate the bearings by hand to check for roughness or binding. If rotation is rough, replace the bearings.

CAUTION

Bearings must be kept free of all dirt and foreign material. Failure to do so will greatly shorten bearing life. DO NOT spin dry bearings. This may scratch the balls or races and cause premature bearing failure.

The bearing tolerances provide a light press fit onto the impeller shaft, and snug push fit into the pedestal. If the bearings slip on and off easily, the shaft is worn and must be replaced. The pedestal must be replaced if the bearings do not fit snugly.

Dip the bearings in clean oil and then position them on the shaft with the loading grooves facing toward the impeller. Using an arbor press, press against the inner races until the bearings seat squarely against the shaft shoulders.

CAUTION

When installing the bearings onto the shaft, NEVER press or hit against the outer race, balls, or ball cage. Press ONLY on the inner race.

Slide the shaft and assembled bearings into the intermediate bore until the inboard bearing (19) bottoms against the bore shoulder.

CAUTION

When installing the shaft and bearings into the bearing bore, push against the outer race. NEVER hit the balls or ball cage.

Install the wavy washer.

Install the bearing cap gasket (21) and secure the bearing cap (29) to the intermediate.

Install the outboard and inboard oil seals (28 and 33) with the lips positioned as shown in Figure 2.

Lubricate the bearings as indicated in **LUBRICATION** at the end of Section E.

Securing Intermediate And Drive Assembly To Engine

(Figure 3)

Secure the drive plate assembly to the engine flywheel. If the drive pins were removed from the drive plate assembly, install new pins by pressing them into the drive plate and peening the ends.

Install the impeller shaft key and press the drive arm assembly on the impeller shaft.

CAUTION

Make certain that the drive plate and drive arm assemblies are mounted in accordance with the dimensions shown in Figure 3. If the drive assembly is not properly positioned on the impeller shaft, a preload condition can occur and cause premature bearing failure.

Align the drive arm assembly so that the drive pins will engage the dyna flex joints, and secure the intermediate and intermediate guards to the engine bellhousing.

Pump Reassembly

(Figure 2)

Before securing the seal plate to the intermediate, inspect the bore of the seal liner (34) for wear or grooves which might cause leakage or damage to the seal packing rings. If the seal liner must be replaced, position the seal plate (36) on the bed of an arbor (or hydraulic) press and use a new sleeve to force the old one out. After the new liner is properly installed, a 1/4 inch diameter hole must be drilled through it to permit the flow of lubricant to the seal assembly. **Be careful** to center the drill in the threaded grease pipe hole and not damage the threads. Deburr the hole from the inside of the seal liner after drilling.

Slide the seal plate onto the shaft until fully seated against the pedestal. Align the threaded seal lubricant hole with pedestal opening and temporarily secure the seal plate using two capscrews and nuts (1/2 UNC X 1 1/2 inch long, not supplied). Proceed to install the seal and impeller. See **Seal Reassembly and Impeller Reassembly And Adjustment**.

After the seal and impeller have been properly installed, remove the two capscrews temporarily holding the seal plate and install the same thickness of casing gaskets (12) as previously removed. Secure the seal plate and pump casing to the pedestal using nuts (14).

NOTE

The front impeller clearance must be adjusted after pump casing and back cover are fully reassembled by adding or subtracting pump casing gaskets (12). Do not secure the pump casing to the base until this operation is done.

Seal Reassembly

(Figure 2 and 4)

Clean the seal cavity and shaft with a cloth soaked in fresh cleaning solvent.

WARNING

```

////////////////////////////////////
//                               //
// Most cleaning solvents are toxic and flammable. Use //
// them only in a well-ventilated area free from excessive //
// heat, sparks, and flame. Read and follow all prec- //
// autions printed on solvent containers.                //
//                                                       //
////////////////////////////////////

```

The seal is not normally reused because wear patterns on the finished faces cannot be realigned during reassembly. This could result in premature failure. If necessary to reuse an old seal in an emergency, **carefully** wash all metallic parts in fresh cleaning solvent and allow to dry thoroughly.

Handle the seal parts with extreme care to prevent damage. Be careful not to contaminate precision finished faces; even fingerprints on the faces can shorten seal life. If necessary, clean the faces with a non-oil based solvent and a clean lint free tissue. Wipe **lightly** in a concentric pattern to avoid scratching the faces.

Inspect the seal components for wear, scoring, grooves, and other damage that might cause leakage. Clean and polish the seal spacer sleeve, or replace it if there are nicks or cuts on either end. If any components are worn, replace the complete seal; **never mix old and new seal parts.**

If a replacement seal is being used, remove it from the container and inspect the precision finished faces to ensure that they are free of any foreign matter.

To ease installation of the seal, lubricate the packing rings and seal liner with water or a very **small** amount of oil, and apply a drop of light lubricating oil on the finished faces. Assemble the seal as follows, (see Figure 4).

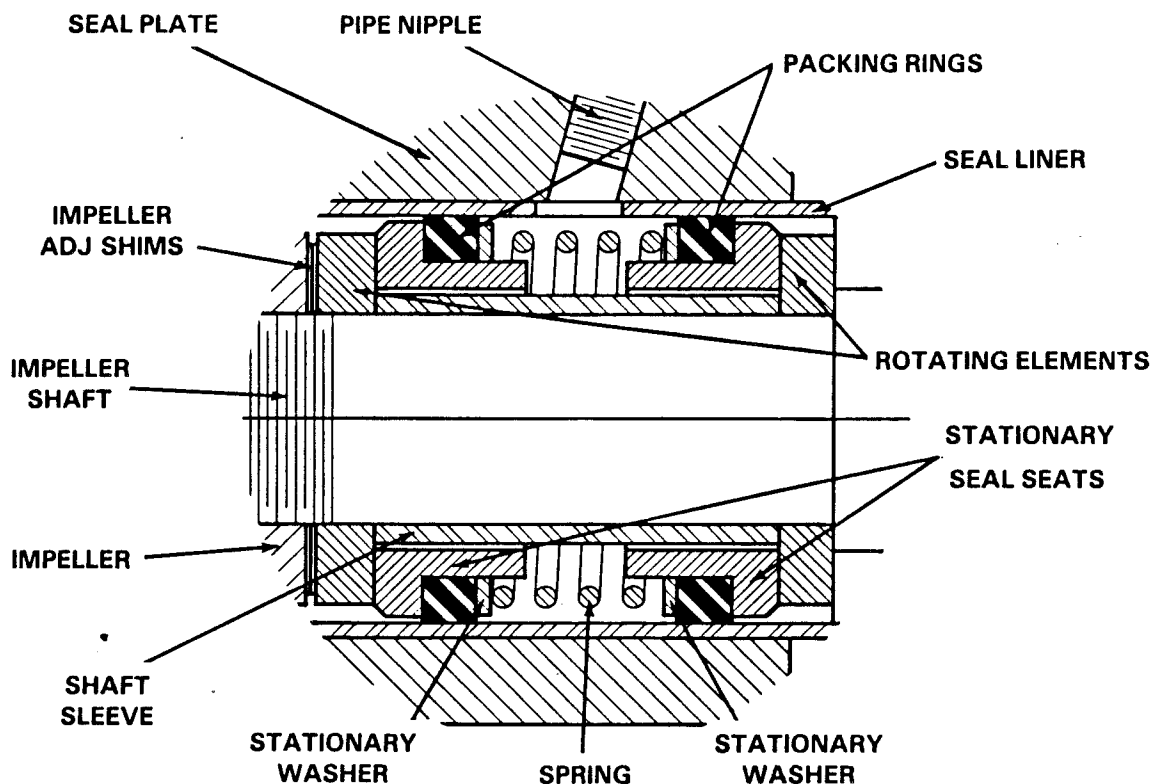


Figure 4. GS01500 Seal Assembly

CAUTION

This seal is not designed for operation at temperatures above 110°F. Do not use at higher operating temperatures.

Inspect the seal plate, the seal liner, and the impeller shaft for burrs or sharp corners, and remove any that exist. Replace the seal liner (34) if wear or grooves exist which could cause leakage or damage to the seal packing rings.

NOTE

The seal plate must be removed to install a new seal liner. See **Pump Reassembly** for specific instructions on seal liner installation.

Install the inboard rotating element with the chamfered side facing the shaft shoulder.

Subassemble the stationary seal seats, packing rings, stationary washers and spring onto the shaft sleeve. Apply a drop of light oil on the precision finished faces of the stationary seats; **never use grease**. Slide the entire subas-

sembly into the lubricated seal liner until it bottoms against the inboard rotating element.

Install the outboard rotating element with the chamfered side facing the impeller.

Reinstall the automatic grease cup and piping (15, 16, and 17).

Lubricate the seal as indicated in LUBRICATION, after the impeller has been installed.

Impeller Reassembly And Adjustment

(Figure 2)

Inspect the impeller, and replace it if cracked or badly worn.

Slide the same number of impeller adjusting shims (35) as previously removed on to the shaft and screw the impeller on until tight.

A clearance of .020 to .040 inch between the impeller and the seal plate is necessary for maximum pump efficiency. Measure this clearance, and add or remove impeller shims until it is reached.

NOTE

If the pump has been completely disassembled, install a new pump casing gasket set and secure the pump casing to the intermediate at this time.

A clearance of .010 to .020 inch between the impeller and the wear plate is also recommended for maximum pump efficiency. This clearance must be set after installing the back cover, by adding or removing gaskets in the pump casing gasket set until the impeller binds against the wear plate when the shaft is turned. After the impeller binds, add .015 inch of gaskets.

NOTE

An alternate method of adjusting this clearance is to reach through the discharge port with a feeler gauge and measure the gap. Add or subtract pump casing gaskets accordingly.

Suction Check Valve Installation

Inspect the check valve assembly, and replace it if badly worn.

NOTE

The check valve assembly must be replaced as a complete unit. Individual parts are not sold separately.

Reach through the back cover opening with the assembled check valve and position the check valve adaptor into the mounting slot in the suction flange. Align the adaptor with the flange hole and secure the assembly with the check valve pin (58).

NOTE

If the suction or discharge flange was removed, replace the respective gaskets and apply "Permatex Aviation #3 Form-A-Gasket" or equivalent to the mating surfaces.

Back Cover Installation

(Figure 2)

Inspect the wear plate (37) and replace it if badly worn or grooved. To remove the wear plate, disengage the hardware (38 and 39).

Clean any scale or debris from the back cover shoulder and pump casing which might prevent a good seal. Replace the back cover gasket (40) and slide the back cover assembly into the pump casing. Be sure the wear plate does not bind against the pump casing.

NOTE

To ease future disassembly, apply a film of grease or 'Never-Seez' on the back cover shoulder, or any surface which contacts the pump casing. This action will reduce rust and scale build-up.

Secure the back cover assembly by installing the clamp bar and tightening the cover clamp screw. **Do not** over tighten the clamp screw; it should be just tight enough to ensure a good seal at the back cover shoulder.

Final Pump Reassembly

(Figure 1)

Be sure the pump is secured to the trailer and engine.

Install the suction and discharge lines, and open all valves. Make certain that all piping connections are tight, properly supported and secure.

Be sure the pump end and engine have been properly lubricated, see LUBRICATION.

Fill the pump casing with clean liquid. Reinstall the fill cover plate and tighten it.

Refer to OPERATION, Section C, and start the pump.

LUBRICATION

Seal Assembly

Fill the grease cup through the grease fitting with a good grade of No. 2 lithium base grease until grease escapes from the relief hole. Turn the grease cup arm counterclockwise until it is at the top of the stem; this will release the spring to apply grease to the seal (see Figure 5).

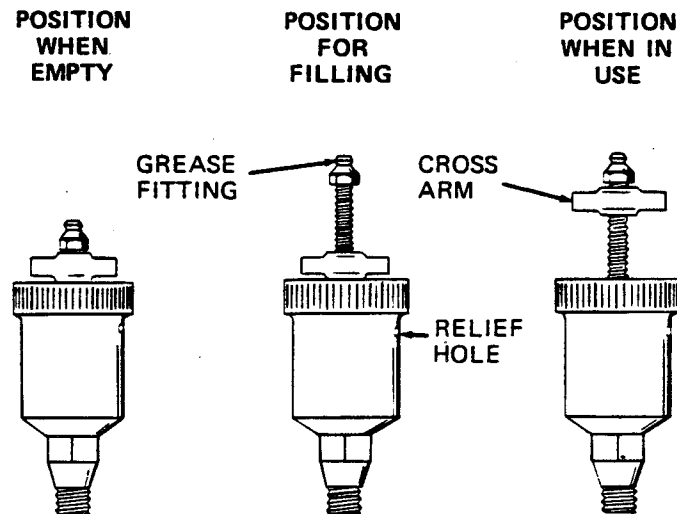


Figure 5. Automatic Lubricating Grease Cup

Bearings

The bearing housing was fully lubricated when shipped from the factory. Check the oil level regularly through the sight gauge (24, Figure 2) and maintain it at the mid-point of the gauge. When lubrication is required, add S.A.E. #30 non-detergent oil through the oil hole cover (18, Figure 2).

NOTE

The white reflector in the sight gauge must be positioned horizontally to provide proper drainage.

Under normal operating conditions, drain and refill the bearing housing once each year with clean oil. **Do not** over lubricate. Excessive oil could cause preloading and over-heating of the bearings.

For cold weather operation, consult the factory or a lubricant supplier for the recommended grade of oil.

Engine

Refer to the engine manufacturer's recommendations.

TRAILER OPERATION, MAINTENANCE, AND REPAIR

TRAILER OPERATION, MAINTENANCE AND REPAIR

This section contains information necessary for operation, maintenance and repair of the trailer assembly. Follow all operating and safety precautions to ensure safe and proper operation of the trailer. Regular maintenance and repair of the trailer, as any other piece of machinery, will ensure long life and safe, trouble-free operation.

Drawings and parts lists for the trailer assembly and subassemblies are included at the end of this section.

NOTE

The brake actuator, axle and wheel brake assemblies are proprietary items purchased by Gorman-Rupp for use on the trailer. Complete replacement kits for these proprietary items are available from the factory. Gorman-Rupp does not, however, stock or furnish individual repair parts for these assemblies.

Drawings and parts lists for the axle assembly are included at the end of this section. The brakes are covered separately in the attached vendor data. Repair parts for these assemblies may be ordered directly from the original vendors listed at the end of this section.

WARNING

Read this entire section before hitching the trailer to the towing vehicle and attempting to tow it. Failure to follow proper operating and safety precautions described in this section could result in equipment damage and/or personal injury.

WARNING

Do not attempt to operate the pump unless the trailer is level. Be sure the trailer leveling stands are positioned on a solid surface, and the wheels are chocked.

TRAILER OPERATION, MAINTENANCE, AND REPAIR

TRAILER SPECIFICATIONS

ITEM	SPECIFICATION
Gross vehicle weight.	3,300 lbs.
Tongue weight.	330 lbs.
Maximum capacity for customer installed accessories.	1,000 lbs. in addition to weight of pump and engine. Do not overload.
Maximum recommended towing speed.	45 mph.
Tire size/inflation	Noted on tires.
Wheel bolt torque.	90 - 95 ft. lbs.
Hitch connection.	2 inch ball type.
Electrical system.	12 volt.
Braking system.	Self-contained hydraulic surge type. (Use SAE j1702 or j1703 motor vehicle brake fluid in actuator master cylinder as required.)

PRE-OPERATION INSPECTION

The trailer was inspected and tested before being shipped from the factory; however, the following items should be inspected and checked before hitching or moving the trailer.

- a. Inspect trailer for scratched paint, dents, broken lights or other obvious damage.
- b. Check brake fluid level in actuator master cylinder and inspect complete hydraulic system for leaks.
- c. Be sure capacity and hitch size of tow vehicle is compatible with trailer.
- d. Be sure electrical connector on tow vehicle mates with trailer connector and all lights function properly.

TRAILER OPERATION, MAINTENANCE, AND REPAIR

- e. Check trailer and tow vehicle tire inflation (noted on tires).
- f. Check trailer wheel bolts for proper torque (90-95 ft. lbs.).

See Periodic Service under TRAILER MAINTENANCE AND REPAIR in this section for further information.

OPERATION

Brake System

The trailer is equipped with a self-contained, surge-type hydraulic brake system which functions independent of the tow vehicle brake or electrical systems.

The trailer brakes are automatically engaged when the tow vehicle slows down and the weight of the trailer pushes against the actuator mounted on the tongue. The actuator forces brake fluid to the wheel cylinders, applying the brakes. The faster the deceleration of the tow vehicle, the greater the braking effort on the trailer.

The actuator master cylinder was filled and the brakes were tested at the factory; however, periodic adjustment may be required. The complete brake system should be inspected and serviced on a regular schedule. (See **TRAILER MAINTENANCE AND REPAIR** in this section). Failure to observe normal maintenance procedures may result in ineffective operation or complete failure of the brake system.

Hitching Trailer To Vehicle

The following instructions are keyed to Figures 1 and 3.

TRAILER OPERATION, MAINTENANCE, AND REPAIR

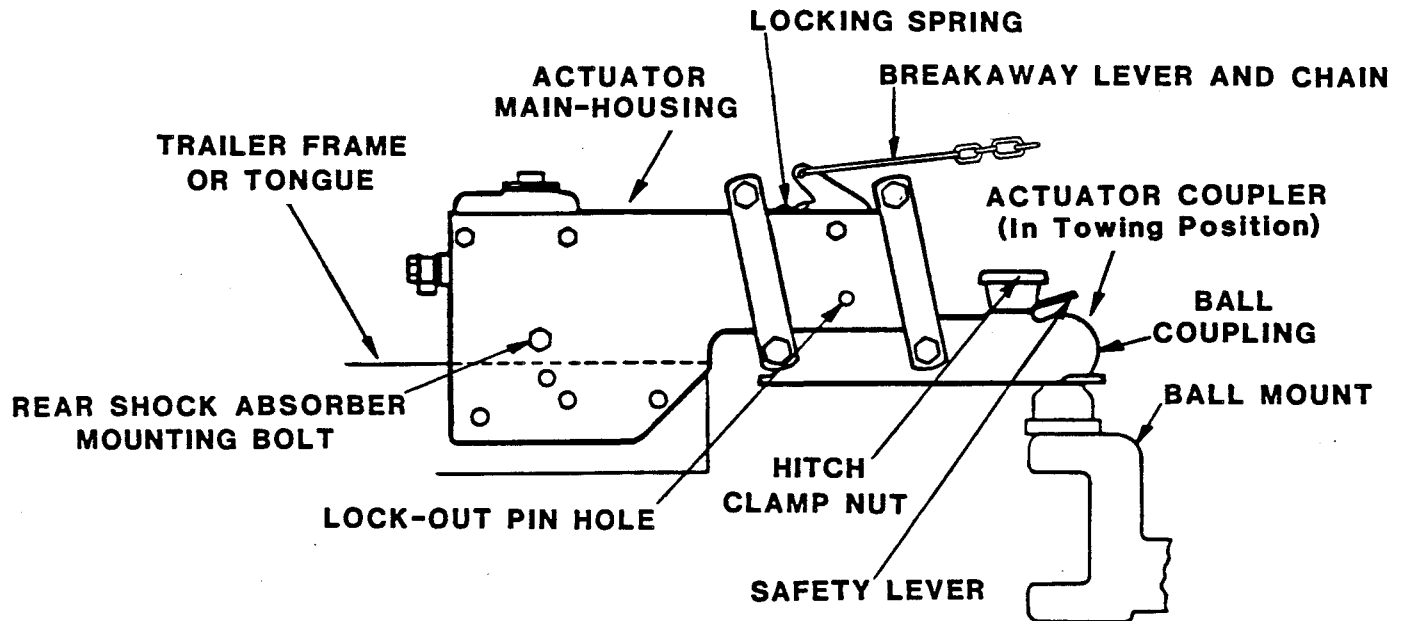


Figure 1.

Remove the lock-out pin assembly (38, Figure 3) from the brake actuator and insert it into the storage clip. Check that the breakaway lever on the brake actuator is fully released (pointing all the way back toward the rear of the trailer) and that the locking spring is not engaging any teeth in the breakaway lever. Check the actuator for free movement through its full range of travel (do not mistake brake shock absorber resistance for binding).

Use the front trailer jack (10, Figure 3) to raise the trailer tongue high enough to permit alignment of the tow vehicle hitch with the ball coupling.

NOTE

Lubricate the hitch ball with a small amount of bearing grease before hitching the trailer to the tow vehicle.

Lower the trailer tongue until the hitch ball is **fully seated in the ball coupling**. Turn the hitch clamp nut until the hitch ball is secure and the safety lever locks in one of the notches in the nut.

Fully retract the front trailer jack and rotate it 90° and secure it with the locking pin.

Plug the 4-way connector on the trailer wiring harness into the mating connector on the tow vehicle. Check the brake lights, turn signals, tail and clearance lights. (See Figures 2 and 5 for the electrical wiring harness and connections.)

Cross the safety chains (16, Figure 3) under the trailer tongue so the chains will cradle the tongue in the event of a breakaway. Attach the safety chains to the tow vehicle with sufficient slack to permit full turns.

Fasten the emergency breakaway chain securely to the tow vehicle in a manner and position that will permit normal operation of the tow vehicle and trailer, but

TRAILER OPERATION, MAINTENANCE, AND REPAIR

assure application of the trailer brakes if the two vehicles accidentally separate.

CAUTION

Always check to ensure that the breakaway lever is fully released and the breakaway chain does not pull taut during towing. Accidental application of the lever will cause the trailer brakes to drag, heat up, and possibly burn out.

Fully retract the rear trailer jack (12, Figure 3) and rotate it 90° and secure it with the locking pin.

Towing

The maximum recommended towing speed is 45 mph.

The brakes should release when the trailer is pulled from a dead stop. Because a slight drag may not be noticeable to the driver, perform the following test periodically to ensure the brakes are releasing properly.

1. Tap each brake drum with a hammer while the actuator is fully compressed.
2. Fully extend the actuator mechanism and tap on the brake drums again. The drums should ring clearly when the brakes are released.

The trailer should not push the tow vehicle or jackknife during stops. Investigate **any** erratic brake performance **immediately**.

Do not attempt tighter turns than the vehicle combination is capable of making.

CAUTION

Tight turns and jackknifing while backing can damage the actuator or other equipment.

Backing

The brake actuator is designed to permit backing when on a level surface. Limited braking occurs during backing but should not interfere with maneuvering the trailer under normal conditions. Back slowly and steadily to avoid jamming. Do not lurch.

When backing up hill or on loose gravel, the brake actuator can be temporarily immobilized by removing the lock-out pin assembly (38, Figure 3) from the stor-

TRAILER OPERATION, MAINTENANCE, AND REPAIR

age clip and inserting it into the lock-out hole in the actuator. This will prevent the tow vehicle from compressing the master brake cylinder.

CAUTION

If the lock-out pin is used to immobilize the actuator during backing, be sure to remove the pin and check that the mechanism is operating freely before resuming normal operation.

Parking

The hydraulic system is not designed to be used as a parking brake. When parking, set and lower the front and rear trailer jacks and chock the wheels.

WARNING

```

////////////////////////////////////
//                               //
// Do not attempt to operate the pump unless the trailer is //
// level. Be sure the trailer leveling stands are posi- //
// tioned on a solid surface, and the wheels are chocked. //
//                               //
////////////////////////////////////
    
```

PERIODIC SERVICE

Trailer Troubleshooting

TROUBLE	POSSIBLE CAUSE	PROBABLE REMEDY
BRAKES GRAB- BING OR LOCK- ING	Grease on lining.	Replace seals and lining.
	Loose parts.	Check for broken springs, loose rivets and bolts.
	Rust on brake drums from non-use.	Normal use will remove rust.

TRAILER OPERATION, MAINTENANCE, AND REPAIR

TROUBLE	POSSIBLE CAUSE	PROBABLE REMEDY
NOISY BRAKES	Poor bearing adjustment. Loose parts. Lining worn to rivets. Bent backing plate. Grease on lining. Brake release.	Adjust bearings. Check for worn or damaged bearings and replace if necessary. Check for broken springs, loose rivets and bolts. Install new linings. Replace if necessary. Replace seals and lining. Eliminate or minimize through adjustment.
INOPERATIVE STOP LIGHTS OR TURN SIGNALS	Defective light bulb. Incorrectly wired. Blown fuse on tow vehicle.	Replace bulb. Check wiring harness drawing and rewire. Replace fuse.
WEAK BRAKES	Actuator master cylinder low on fluid. Improper adjustment. Air in lines. Grease on lining. Excessive trailer load. Bent backing plate.	Add brake fluid. Adjust brakes to compensate for wear. Bleed brakes. Replace seals and lining. Reduce load to within limits. Replace if necessary.
INTERMITTENT OR SURGING BRAKES	Loose wheel bearings. Drums out of round.	Adjust bearings and replace if defective. Resurface drums if over .015 inch out of round.
BRAKES DRAGGING OR OVER HEATING	Improper adjustment. Bent backing plate. Breakaway lever engaged. Weak or broken shoe return springs. Rusted brake assembly.	Adjust brakes to compensate for wear. Replace if necessary. Release lever. Replace if necessary. Clean and lubricate.

 TRAILER OPERATION, MAINTENANCE, AND REPAIR

Trailer Periodic Service Table

COMPONENT	SERVICE REQUIRED	FREQUENCY
WHEEL BOLTS	Torque to 90-95 ft. lbs.	At delivery/After first 100 miles/Monthly or every 2,500 miles thereafter.
TIRE INFLATION	Check pressure - inflate as required.	At delivery/Monthly or every 2,500 miles thereafter.
BRAKE ACTUATOR MASTER CYLINDER	Check level - add brake fluid. Bleed system if necessary.	At delivery/As required.
BRAKES	Check function - adjust brakes.	As required.
WHEEL BEARINGS	Inspect - Repack.	Every 20,000 miles/After 4 months or more of non-use.

Refer to the specific instructions on the following pages for further information.

Wheel Bolt Adjustment

Under normal operating conditions, the wheel bolts will seat in within the first 100 miles, resulting in a drop in torque. Each bolt should be checked at that time and retorqued to 90-95 ft. lbs. Recheck the bolt torque every month or 2,500 miles, whichever comes first.

When reinstalling the wheel after service, install each bolt and torque to no more than 20 ft. lbs. each. Continue torquing the bolts in an opposite and alternating sequence, increasing the torque each time around by 20-25 ft. lbs. until each is torqued to 90-95 ft. lbs.

Tire Inflation

The tire size and recommended maximum inflation pressure is noted on the tires.

Always use a quality tire pressure gauge when checking inflation pressures. Simply looking at the tires to check inflation pressures is not enough, especially with radial tires. Underinflated radial tires may **appear** properly inflated.

Be sure to reinstall the valve caps after checking the air pressure. This will prevent contamination of the valve core by dirt or moisture which could cause a leak.

Brake Actuator Master Cylinder

The brake actuator master cylinder was filled and the brake lines were pressurized before the trailer left the factory.

If necessary to add brake fluid, remove the master cylinder plug and add clean SAE j1702 or j1703 motor vehicle brake fluid. Clean and replace the fill plug.

CAUTION

Use of improper brake fluid will void all brake system warranties.
--

Keep the system protected from dirt and moisture during storage. Inspect and test the complete system after long periods of idleness. Look for rust inside the master cylinder reservoir and around the mouth of the cylinder bore. Replace cloudy, dirty, or watery brake fluid.

Bleeding Brakes

Use of a pressure bleeder to bleed the brake system is preferable, but the brakes may be bled manually by pumping the actuator coupler back and forth through its full range of travel. Manual bleeding requires a two-man team.

To simplify manual bleeding, remove the rear shock absorber mounting bolt (see Figure 1) to eliminate shock absorber resistance to the compression and extension strokes. Leave the bolt out until the brakes have been fully adjusted.

Check that the breakaway lever is fully released (pointing all the way back toward the rear of the trailer).

Bleed one wheel cylinder at a time. Connect a tube or hose to the wheel cylinder bleeder screw. Place the free end of the hose in a glass jar containing clean brake fluid.

Remove the master cylinder fill plug and make sure the cylinder is full. The first operator should open the bleeder screw while the second operator compresses the actuator coupler. The first operator then closes the bleeder screw **before** the coupler is pulled forward. Repeat this procedure until no bubbles appear in the jar of brake fluid. Close the bleeder screw, remove the hose and repeat the complete procedure on the other wheel cylinder.

Make sure to keep the master cylinder full to prevent air from being reintroduced to the system. All air must be removed from the system or the brakes will not work properly.

TRAILER OPERATION, MAINTENANCE, AND REPAIR

When bleeding is complete, install the fill plug, apply pressure and check the system for leaks.

If no further adjustments are necessary, align the shock absorber and reinstall the mounting bolt.

Brake Adjustment

Position the trailer on a solid, level surface and jack up the wheels just high enough to rotate freely. **Be sure** to rest the trailer frame securely on blocks or jack stands to ensure personal safety.

With the brake drums cool, the breakaway lever fully released, and the brake actuator in the towing position, remove the shock absorber rear mounting bolt (see bleeding instructions above) and proceed as follows:

1. Compress the actuator several times to center the shoes in the brake drum.
2. Return the actuator to the fully-extended towing position.
3. While turning the wheel by hand, use a brake adjusting tool or screwdriver to turn the brake adjusting screw (located at the bottom of the drum and accessible through the backplate) until there is enough drag on the wheel to make it difficult to turn. Back off the adjusting screw until the wheel turns freely.
4. Repeat the procedure for the other wheel.
5. Be sure to replace the shock absorber rear mounting bolt after both brakes are adjusted.

Wheel Bearing Adjustment And Lubrication

These instructions are keyed to Figure 4 and the accompanying parts list at the end of this section.

The wheel bearings were adjusted and fully packed before the trailer left the factory. The bearings should be inspected and repacked every 20,000 miles or if the trailer has been idle for 4 months or longer.

Position the trailer on a solid, level surface and jack one wheel off the ground just far enough to allow free rotation and perform the following checks. **Be sure** to rest the axle securely on a block or jack stand to ensure personal safety.

1. Check the wheel end play by pushing and pulling on each wheel several times. Excess wheel play indicates loose adjustment or defective bearing(s).
2. Spin each wheel by hand to check for freedom of rotation. Drag or difficult rotation can indicate improper bearing or brake adjustment.

TRAILER OPERATION, MAINTENANCE, AND REPAIR

- 3. While rotating each wheel, listen for any unusual noise. If there is any unusual noise, further examination will likely show a defective bearing.

Perform the following steps if repacking, replacement or adjustment of bearings is indicated.

Disassembly

Remove the wheel bolts (2) and wheel (1).

Remove the dust cap (9) and cotter pin (12). (If repacking or replacement of wheel bearings is not required, see **Adjustment**, Page F-12.) Remove the spindle nut (10), and spindle washer (11).

Loosen the outer cup and bearing (6 and 7) by shaking the hub slightly. In most cases this will loosen the outer bearing so that it can be removed by hand.

Remove the entire hub and drum (3). This assembly contains the inner cup and bearing (4 and 5) and the grease seal (8).

NOTE

Pay particular attention to the position of the inner cup and bearing and the grease seal. You will need to remember this during reassembly.

Remove the inner cup and bearing and grease seal from the hub by inserting a brass drift pin or piece of wood through the small end of the hub and tapping gently until the bearing and seal loosen.

Use a soft cloth soaked in solvent to clean all dirt and grease from the inside of the hub and spindle.

WARNING

```

////////////////////////////////////
//
// Most cleaning solvents are toxic and flammable. Use //
// them only in a well-ventilated area free from excessive //
// heat, sparks, and flame. Read and follow all prec- //
// autions printed on solvent containers. //
// //
////////////////////////////////////

```

Cleaning And Inspection

Prior to relubrication, used bearings must be thoroughly cleaned.

Do not immerse the grease seals in solvent. Merely wipe them clean with a cloth.

Immerse the cups and bearings in solvent and rotate then bearings by hand. When the bearings appear clean, remove the bearings and cups and allow the bearings to drain free of solvent. Solvent on bearings may dilute and harm the lubricant effectiveness.

TRAILER OPERATION, MAINTENANCE, AND REPAIR

CAUTION

Bearings must be kept free of all dirt and foreign material. Failure to do so will greatly shorten bearing life. **DO NOT** spin dry bearings. This may scratch the balls or races and cause premature bearing failure.

Carefully inspect the bearing cups (races) and bearing cones for pitting, scratches, spalling, wear, discoloration, or other damage. Rotate the bearings by hand to check for roughness or binding. If rotation is rough or any physical damage is observed, replace the entire bearing assembly. **Never replace a bearing cone without replacing its mating cup.**

Inspect the grease seals and replace them if cracked or brittle.

Repacking

Bearings should be repacked with the **minimum** amount of the lightest bodied lubricant that will keep the bearing surfaces separated. Bearings can overheat if too much, too little or too heavy a lubricant is applied. The lubricant must allow the bearings to function under high temperatures caused by loads and brake heat and still return to its original consistency, with little or no oil separation, when cool. With this in mind, Sunoco 802 or Sunoco Prestige 742 EP lubricant, or their equivalent, is recommended.

If possible, use a bearing packer to repack the bearing cones. If a bearing packer is not available, the bearings may be lubricated by hand by pressing grease into and around each and every roller. Additional grease within the hub is not required.

Reassembly

Install the inner bearing and cup in the hub and replace the grease seal by tapping gently with a wooden block. Make sure the seal is installed **exactly** as it was before disassembly.

Replace the hub on the spindle taking extreme care not to damage the spindle thread or the grease seal. **This must be done very carefully.**

Replace the outer bearing and cup, washer and spindle nut.

Adjustment

Slowly rotate the hub in either direction while tightening the spindle nut to 50 ft. lbs. torque, or until there is a slight bind. When this occurs, back the adjusting nut off to the nearest locking hole in the castellation. This should allow the wheel to rotate freely without excessive end play.

TRAILER OPERATION, MAINTENANCE, AND REPAIR

NOTE

The total amount of internal running clearance between the roller and the raceway of the bearings should be between .002 and .008 inch. Since this clearance can only be measured accurately with the use of special instruments, the common method of measuring end play is by pushing inward and pulling outward on the hubs several times. A very **slight** end play should be felt.

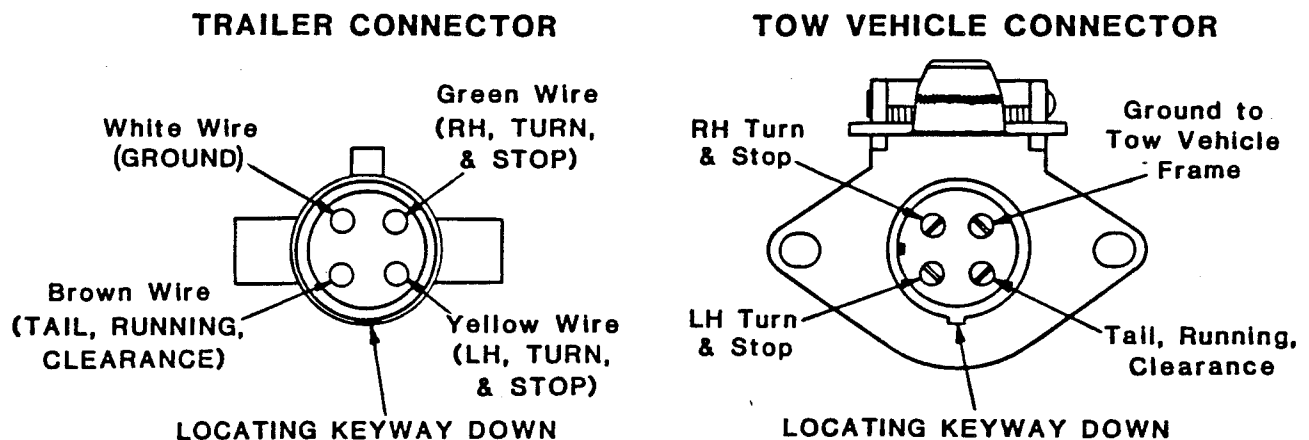
Install the cotter pin, bend it to a lock position and install the dust cap.

Reinstall the wheels and wheel bolts (see **Wheel Bolt Torque**, this section).

ELECTRICAL SYSTEM

A schematic of the trailer wiring harness is included at the end of this section. The only part sold separately from the complete wiring harness is the 4-way connector. This is a 2-part connector, with one part attached to the wiring harness and the other part shipped loose to be attached to the tow vehicle electrical system.

Pay particular attention to wire color location shown in the detail of the trailer connector. Be sure to connect the correct wires from the tow vehicle electrical system to the proper contacts in the tow vehicle connector indicated in parenthesis under the wire color. (See Figure 2 below.)



NOTE

The ground wire from the tow vehicle connector to the frame is not supplied with the wiring harness or the connector.

TRAILER OPERATION, MAINTENANCE, AND REPAIR

TRAILER DRAWINGS AND PARTS LISTS**Original Equipment Manufacturers**

The brake actuator, axle and wheel brake assemblies are proprietary items purchased by Gorman-Rupp for use on the trailer. Complete replacement kits for these proprietary items are available from the factory. Gorman-Rupp does not, however, stock or furnish individual repair parts for these assemblies.

Drawings and parts lists for the axle assembly are included at the end of this section. The wheel brakes and towing brake actuator are covered separately in the attached vendor data. Repair parts for these assemblies may be ordered directly from the following Original Equipment Manufacturers.

1. 29310-305 Coupler With Actuator
 - a. O.E.M. Model TA6 - Manufactured by:
Toledo Stamping And Manufacturing Company
P.O. Box 596
Toledo, Ohio 43693
Phone - (419) 382-3407
2. 29311-101 Axle Assembly
 - a. O.E.M. Model 5SF0 - Manufactured by:
Dalton-Walther Corporation
Fayette/Franklin Division
Fayette, Ohio 43521
Phone - (419) 237-2511
3. 12" X 2" Hydraulic Brake Assemblies
 - a. O.E.M. Free-Backing Type - Manufactured by:
Dico
200 S. W. 16th St.
Des Moines, Iowa 50305
Phone - (515) 224-7286

ASSEMBLY DRAWING

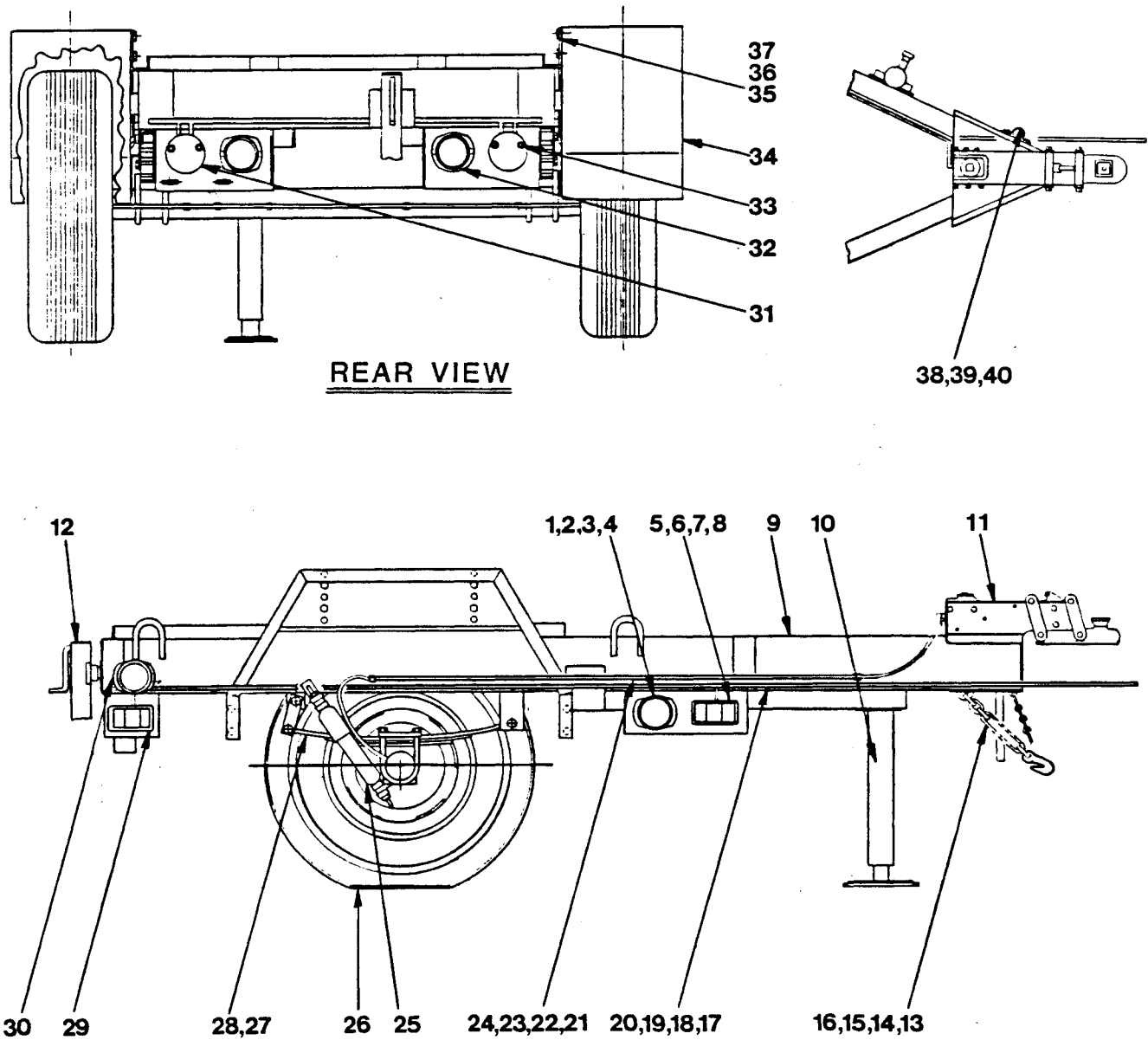


Figure 3. 41583-611 Trailer Assembly

TRAILER OPERATION, MAINTENANCE, AND REPAIR

PARTS LIST

41583-611 Trailer Assembly

ITEM NO.	PART NAME	PART NUMBER	MATL CODE	QTY
1	REFLECTOR - AMBER	29338-405	-----	4
2	HEX HD CAPSCREW	B00403	15991	12
3	LOCKWASHER	J00004	15991	12
4	HEX NUT	D00004	15991	12
5	CLEARANCE LAMP	29338-903	-----	2
6	RD HD MACHINE SCREW	X#10-03	15991	16
7	T TYPE LOCKWASHER	AK#00010	15991	16
8	FLAT WASHER	K#00010	15991	16
9	TRAILER SUB-ASSEMBLY	41583-612	24150	1
10	-FRONT TRAILER JACK	29313-145	-----	1
11	-COUPLER W/ACTUATOR	29310-305	-----	1
12	-REAR TRAILER JACK	29313-147	-----	1
13	U-BOLT	5495	15990	2
14	LOCKWASHER	J00006	15991	4
15	HEX NUT	D00006	15991	4
16	SAFETY CHAIN ASSY	41158-008	24150	2
17	WIRING HARNESS	47381-015	-----	1
18	CABLE CLAMP	27111-315	-----	8
19	PAN HD TAPSCREW	CC#00008-01 1/2	15991	8
20	T TYPE LOCKWASHER	AK#00010	15991	8
21	BRAKE LINE ASSY	29313-501	-----	1
22	CABLE CLAMP	27111-321	-----	7
23	PAN HD TAPSCREW	CC#00008-01 1/2	15991	7
24	T TYPE LOCKWASHER	AK#00008	15991	7
25	SHOCK ABSORBER	29337-501	-----	2
26	TIRE	29330-703	-----	2
27	AXLE KIT	29311-101	-----	1
28	SHACKLE PARTS KIT	29311-901	-----	2
	-SHACKLE PLATE	NOT AVAILABLE		4
	-SHACKLE BOLT	NOT AVAILABLE		6
	-SHACKLE NUT	NOT AVAILABLE		6
29	REAR MARKER LAMP	29338-902	-----	2
30	PAN HD TAPSCREW	CC00402	15990	4
31	TAIL AND DIRECTION LIGHT	29338-952	-----	1
32	REFLECTOR - RED	29338-404	-----	4
33	TAIL AND DIRECTION LIGHT	29338-942	-----	1
34	FENDER ASSY	42172-001	24150	2
35	HEX HD CAPSCREW	B00806	15991	8
36	LOCKWASHER	J00008	15991	8
37	HEX NUT	D00008	15991	8
38	LOCK OUT PIN ASSY	41152-004	24030	1
39	CLIP	38116-015	15990	1
40	PAN HD TAPSCREW	CC00402	15990	2

ASSEMBLY DRAWING

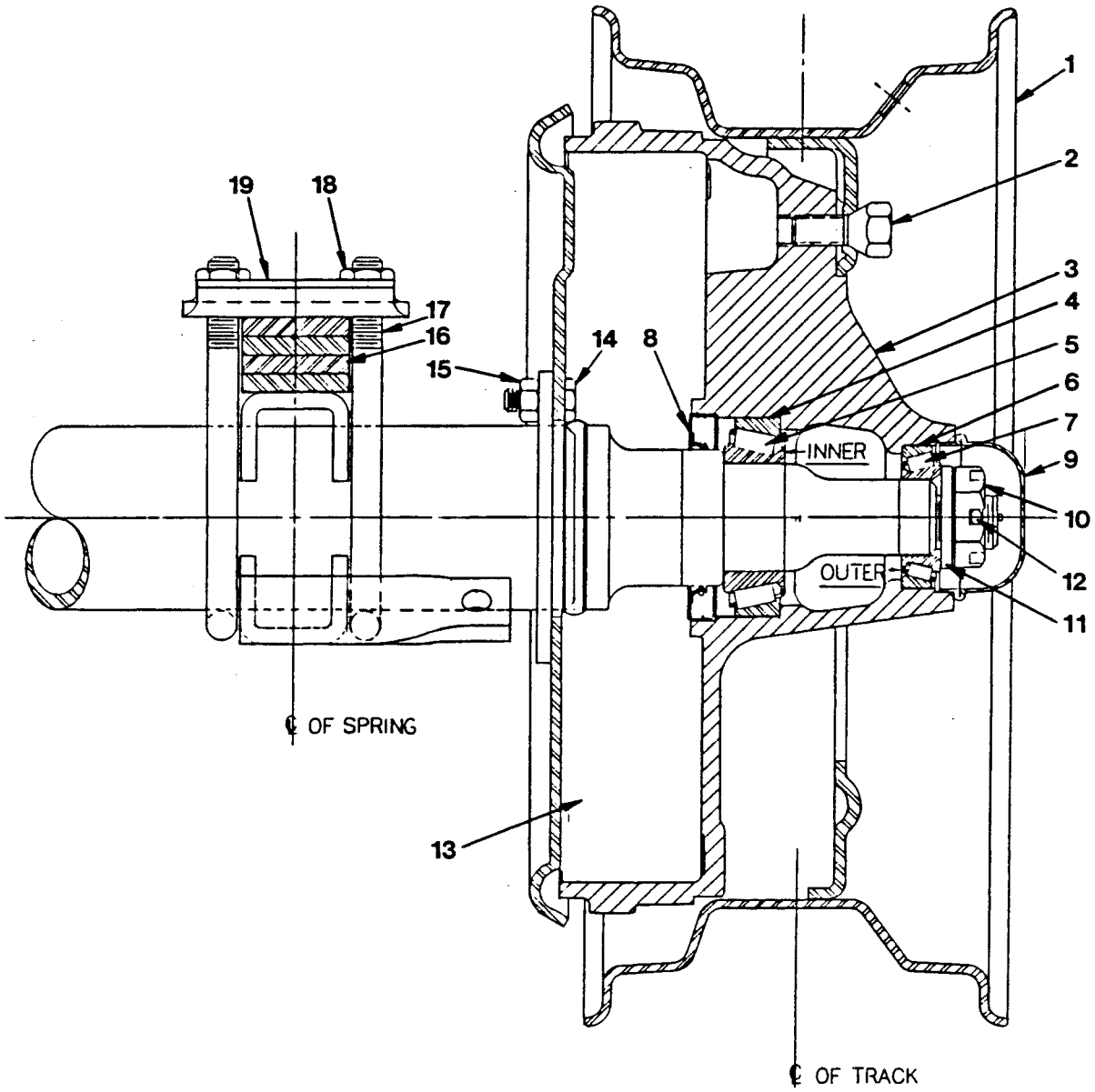


Figure 4. 29311-101 Axle Assembly

TRAILER OPERATION, MAINTENANCE, AND REPAIR

PARTS LIST
29311-101 Axle Assembly

ITEM NO.	PART NAME	PART NUMBER	MATL CODE	QTY
1	15 X 6 US WHEEL	79-001075		2
2	WHEEL MOUNTING BOLT	08-900108		8
3	HUB AND DRUM (US-12)	11-9230-50		2
	Each Hub and Drum Contains:			
4	-INNER CUP (25520)	08-201859		1
5	-INNER BEARING (25580)	08-202736		1
6	-OUTER CUP (LM67010)	08-201923		1
7	-OUTER BEARING (LM67048)	08-202737		1
8	-GREASE SEAL	08-900106		1
9	GREASE CAP	79-000196		2
10	SPINDLE NUT	08-202734		2
11	SPINDLE WASHER	79-000053		2
12	SPINDLE COTTER PIN	08-201996		2
13	DICO HYDRAULIC BRAKE ASSY, RH	79-000840		1
	DICO HYDRAULIC BRAKE ASSY, LH	79-000841		1
14	BRAKE MOUNTING BOLT	08-202729		5
15	BRAKE MOUNTING BOLT NUT	08-201789		5
16	E2200-26" EYED SPRING	79-009976		2
17	U-BOLT	79-000229		4
18	U-BOLT NUT	08-202259		8
19	SPRING CLAMP	79-000267		2

Note: Numbers shown above are the Original Equipment Manufacturer's part numbers.

See Page F-14 for O.E.M. address.

ASSEMBLY DRAWING

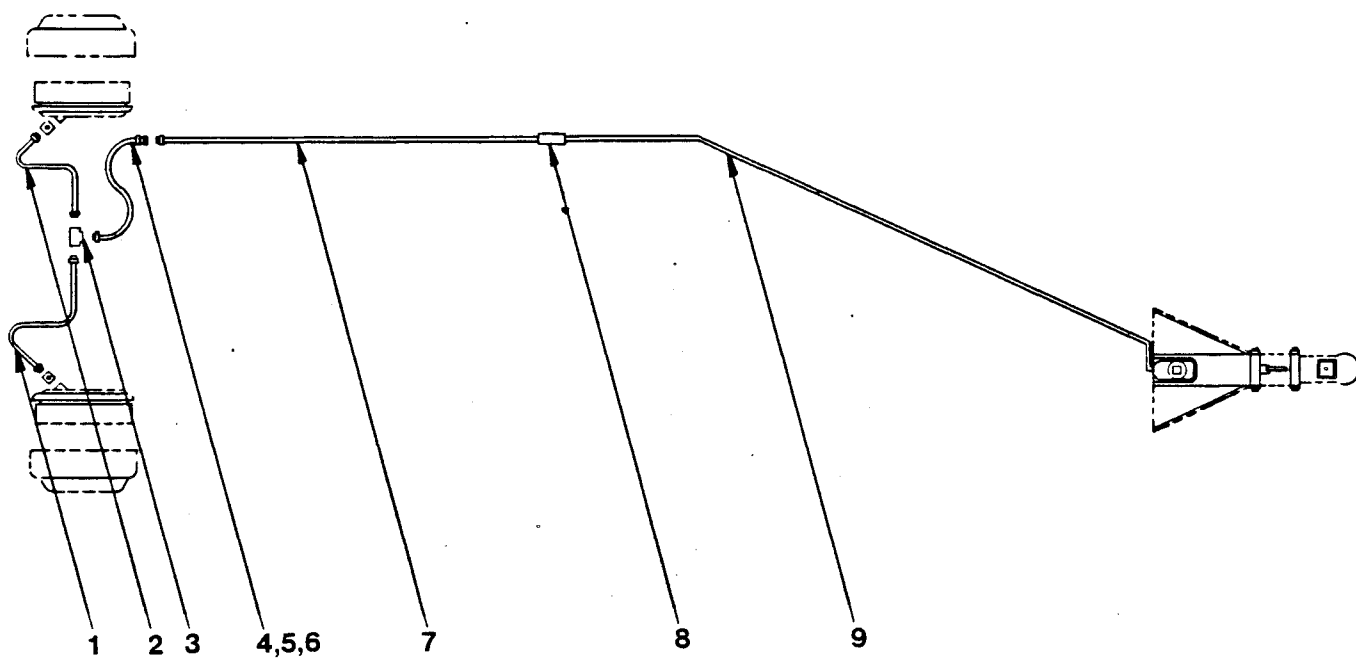


Figure 5. 29313-501 Brake Line Assembly

TRAILER OPERATION, MAINTENANCE, AND REPAIR

PARTS LIST

29313-501 Brake Line Assembly

ITEM NO.	PART NAME	PART NUMBER	MATL CODE	QTY
1	TUBING	29313-502	-----	1
2	TUBING	29313-504	-----	1
3	TEE	29313-507	-----	1
4	HOSE - MALE AND FEMALE	29313-510	-----	1
5	BRACKET	29313-508	-----	1
6	CLIP	29313-509	-----	1
7	TUBING	29313-503	-----	1
8	TUBE UNION	29313-506	-----	1
9	TUBING	29313-505	-----	1

TRAILER OPERATION, MAINTENANCE, AND REPAIR

ASSEMBLY DRAWING

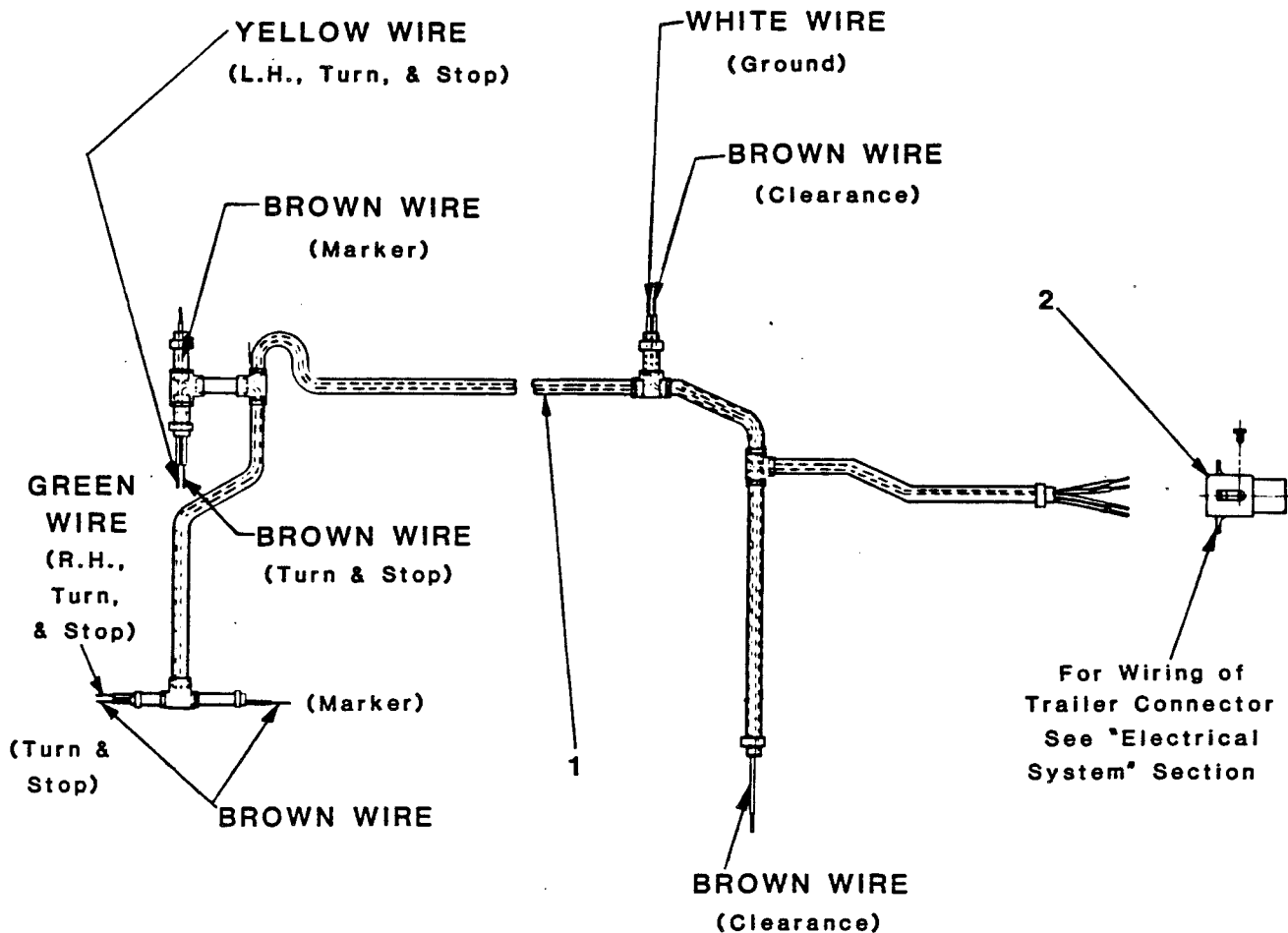


Figure 6. 47381-015 Wiring Harness

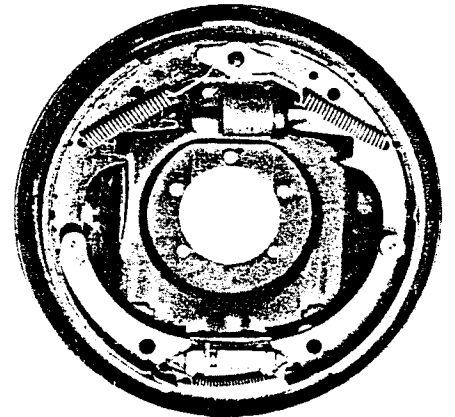
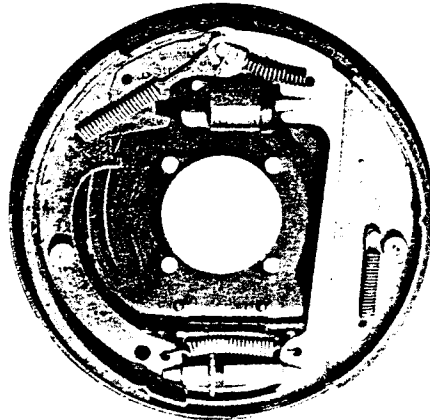
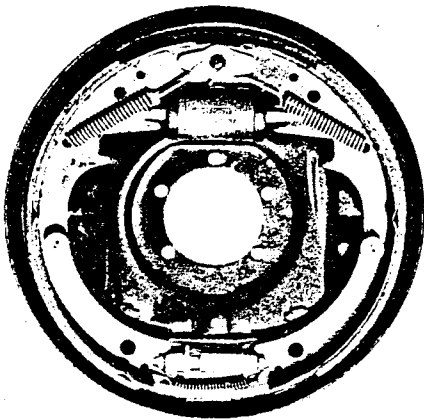
PARTS LIST

ITEM NO.	PART NAME	PART NUMBER	MATL CODE	QTY
1	WIRING HARNESS	47315-015	-----	1
2	** 4-WAY CONNECTOR ASSEMBLY	27235-021	-----	1

** Assembly includes trailer and vehicle connectors.
Individual components are not sold separately.

**INSTALLATION INSTRUCTION
AND SERVICE MANUAL**

DICO
12" x 2"
BRAKES
FREE BACKING
UNI-SERVO
DUO-SERVO



MFGD. BY

DICO

DES MOINES, IOWA

INSTRUCTIONS FOR 12" SURG-O-MATIC BRAKES

BRAKE INSTALLATION

1. Brake Mounting Flange

To assure correct brake action, the mounting flange must be square and concentric with the axle spindle. A flange that is not properly installed will contribute to rapid lining wear and improper brake action.

The 12" DICO brake is designed to interchange with existing equipment mounting on flanges with (5) holes on 3-7/8" B. C. and a 3-1/4" register diameter. Several manufacturers offer complete axles with flanges attached, or you may choose to install flanges yourself.

Use a flange welding fixture to properly position the flange for welding. Bolt the flange to the welding fixture securely with all bolts.

Install the fixture (and flange) onto the spindle and tighten spindle nut. If flange is being installed on a round axle, rotate to secure "wheel cylinder up" location when the axle is installed.

It is best not to make a continuous weld around the flange. First, tack weld on all four sides between the bolts. Follow this with a full weld up each side of the axle. It is usually not advisable or necessary to weld across the top and bottom of the axle. The bottom of the axle is its most highly stressed area and a weld at this point will weaken the axle. Allow the axle, spindle, and flange to cool before removing welding fixture.

2. Installing Brakes

Place the brake against spindle flange. In mounting the brake, be sure the hydraulic wheel cylinder is at the top. Brakes are also marked as "RIGHTS" and "LEFTS". The brake designated as "LEFT" travels on the driver's side of the road.

3. Installing Brake Drum

When the brakes have been correctly assembled to the axle flanges, the hub and drum assemblies may be mounted on the axle spindle.

Pack the inside bearing with suitable wheel bearing grease. Force grease through and around the rollers. Place the bearing in the hub and install the grease seal flush with the end of the hub using an arbor press or soft mallet. Remove excess grease.

To avoid injury to bearing seal, lubricate seal seat prior to putting on the brake drum. Grease pack and install the outer bearing on spindle. Place flat washer and spindle nut on spindle. Turn drum as you tighten nut. When a pronounced drag is felt in the bearings, back off nut one complete slot and install cotter pin and dust cap.

Caution: Do not pack hub full of grease. Excessive grease may leak into brake drums causing brake failure.

Wheels may now be mounted on the trailers.

4. Adjusting Brakes

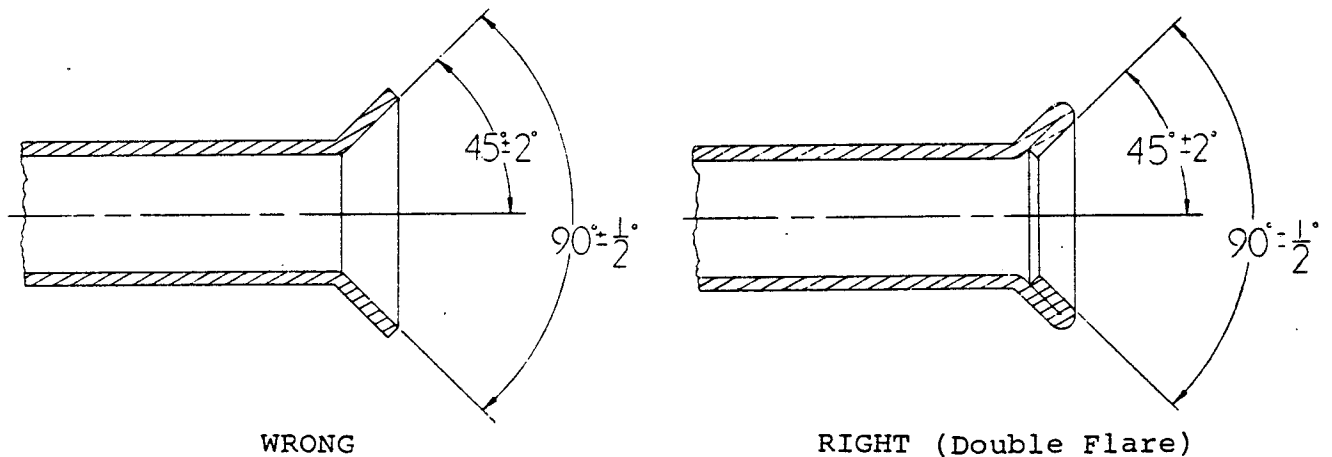
Before removing the jacks, adjust the brakes.

The brake adjustment nut is located behind a slot at the bottom of the backing plate. Tighten until you cannot rotate wheel by hand, then back off the adjustment 10 to 12 notches.

ALWAYS ROTATE DRUM IN DIRECTION OF FORWARD ROTATION ONLY.

5. Hydraulic lines

Use care in forming tubing to avoid sharp bends or kinks. Be sure and use a "Double Flaring" type of tool on steel tubing to assure tight leakproof connections. Anchor all hydraulic lines at two foot intervals to prevent chafing and vibration. Be sure and use hydraulic rubber hose at points of flexing. Anchor hose ends to avoid stress on tubing.



6. Bleeding the System

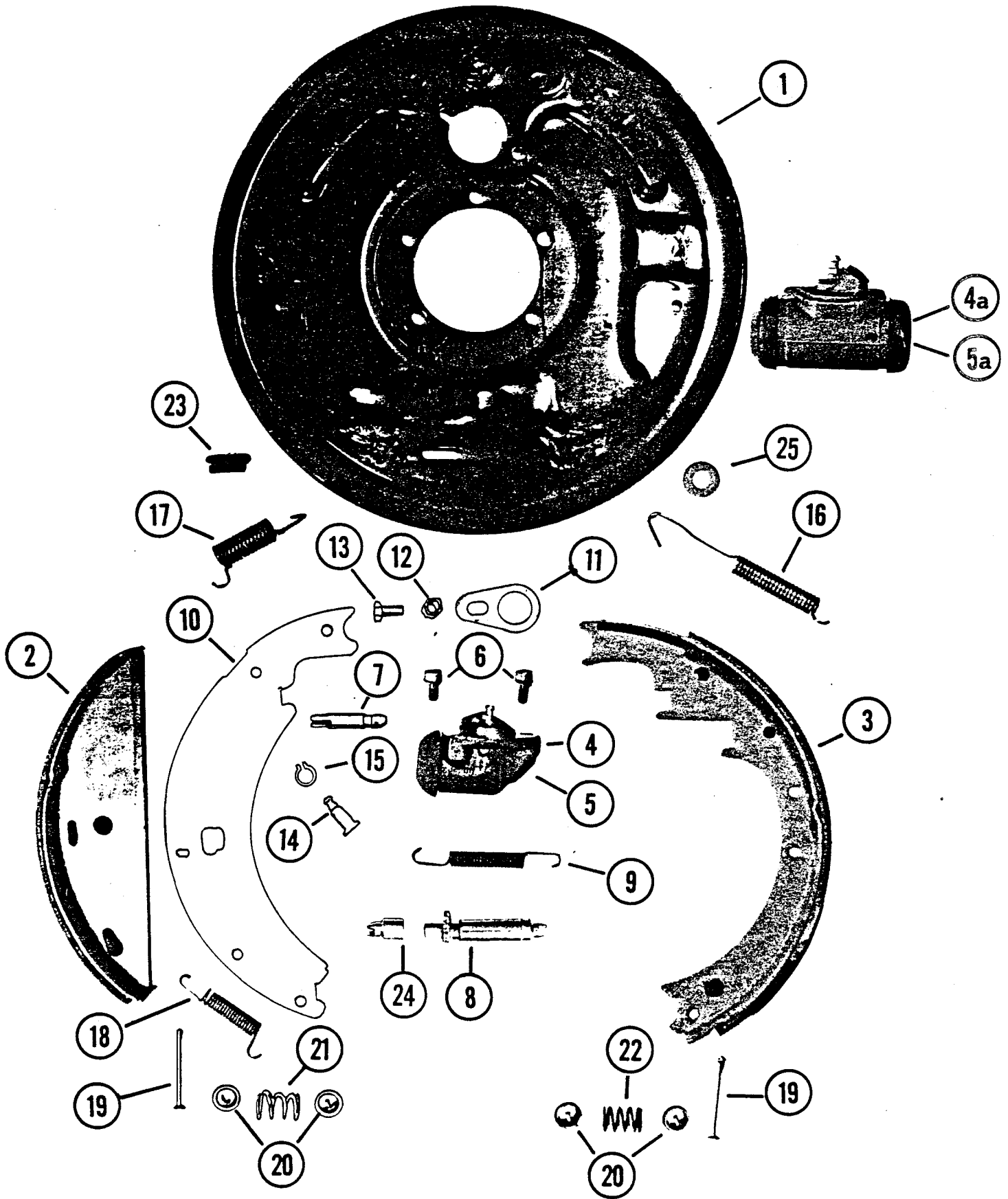
The first requisite for safe, sure hydraulic braking is the use of quality brake fluid. Use only DOT-3 heavy duty fluid.

If pressure bleeding equipment is available, follow the manufacturer's instruction in bleeding the system.

If system must be bled manually, proceed as follows: Fill master cylinder with fluid. Install bleeder hose on first wheel cylinder to be bled, (if Tandem axle trailers, bleed rear axle first). Have loose end of hose submerged in brake fluid in glass container to observe bubbling.

By loosening the bleeder screw located in the wheel cylinder one turn, the system is open to the atmosphere through the passage drilled in the screw. Pump actuator with long steady strokes. The bleeding operation is completed when bubbles no longer rise to the surface of the fluid. Be sure and close bleeder screw securely.

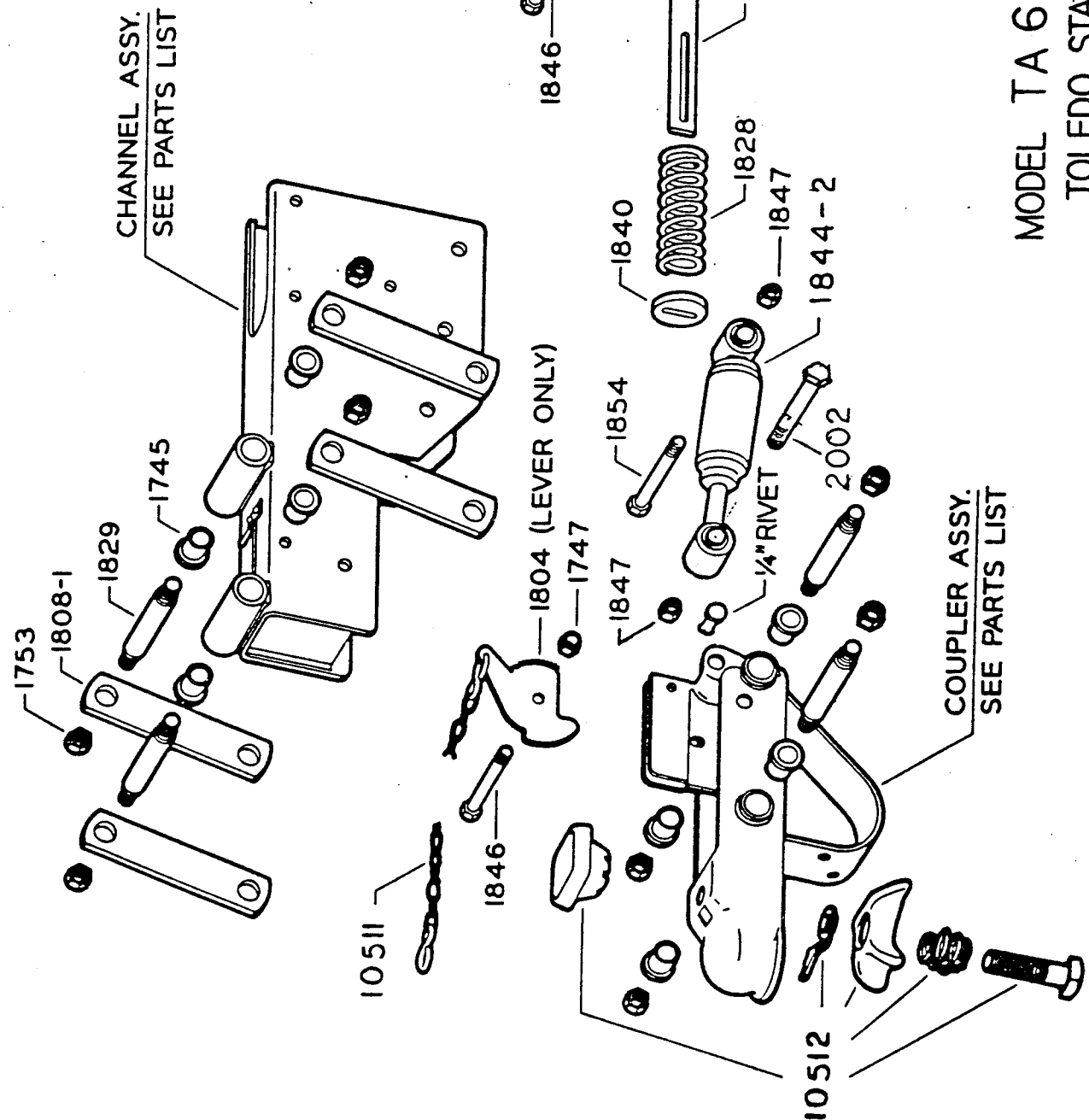
Repeat bleeding operation at each wheel cylinder. During the bleeding process, replenish the brake fluid, so the level does not fall below the 1/2 full level in the master cylinder reservoir. After bleeding is completed, make sure master cylinder reservoir is filled and filler cap securely in place.



12" X 2" BRAKE PARTS LIST

Ref. No.	Part No.	Description	No. Used Per Assembly		
			Free Backing	Duo-Servo	Uni-Servo
1	18496	Back Plate Assembly	1	1	1
2	18497	Front Shoe Assembly	1		
2	23492	Front Shoe Assembly		1	1
3	18503	Rear Shoe Assembly	1	1	1
4	9776	Wheel Cylinder Assembly-Right	1		1
4 A	17185	Wheel Cylinder Assembly-Right		1	
5	9777	Wheel Cylinder Assembly-Left	1		1
5 A	17186	Wheel Cylinder Assembly-Left		1	
6	23457	Screw & Lockwasher	2	2	2
7	9783	Push Rod	1	2	1
8	23323	Adjusting Screw Assembly	1	1	1
9	18506	Spring-Adjusting Screw (maroon)	1	1	1
10	18502	Shoe Lever	1		
11	17917	Travel Link	1		
12	17406	Locknut	1		
13	7949	Hex Cap Screw	1		
14	12560	Pin Front Shoe	1		
15	7778	Retaining Ring	1		
16	9786	Spring- Shoe (orange)	1	2	2
17	9785	Spring - Lever (red)	1		
18	6814	Spring - Shoe (orange)	1		
19	18508	Pin-Shoe Hold Down	2	2	2
20	9789	Cup-Shoe Hold Down	4	4	4
21	9790	Spring-Hold Down (yellow)	1		
22	9791	Spring-Hold Down (black)	1	2	2
23	9254	Cover Plate-Adjusting Hole	1	1	1
24	18836	Socket	1	1	1
25	18950	Washer	1		
26	10961	Shoe Guide Plate		1	1
27	9797	Plug Plastic	2	2	2
	15845	Wheel Cylinder Repair Kit	1/2	1	1/2
*	17194	Parking Strut		1	1
*	9792	Parking Lever-R		1	1
*	9793	Parking Lever-L		1	1
*	9794	Spring Washer		1	1
*	9795	Retainer		1	1
*	16090	Spring-Parking Strut		1	1
*	7820	Washer		2	2

* Used On Model With Parking Brake



MODEL TA 6 BRAKE ACTUATOR
 TOLEDO STAMPING & MFG. CO.

PARTS LIST
HYDRO-ACT MODEL TA6 ACTUATOR

<u>Part No.</u>	<u>Description</u>
CHANNEL ASSEMBLIES	
10601-1	A-Frame Mount
10602	2-1/2 inch Saddle Mount
10603	3-inch Saddle Mount
COUPLER ASSEMBLIES	
Fulton, 2-inch Ball (Hydro-Act Standard)	
10605-1	Less Skid Bar, Less Clamping Mechanism
10605-2	With Skid Bar, Less Clamping Mechanism
10612	Bulldog, 2-inch Ball
10512	Fulton Coupler Clamping Mechanism, Complete
10614	Master Cylinder Ass'y, * Complete with Fittings
1745	Nylon Bearing
1747	3/8-24 Nut, Self-Locking
1753	1/2-20 Nut, Self-Locking
1804	Breakaway Lever
1808-1	Link
1828	Push Rod Spring
1829	Shaft
1840	Push Rod Washer
1841	Spacer
1844-2	Shock Absorber
1846	3/8-24 x 4 Hex Hd Bolt
1847	7/16-20 Nut, Self-Locking
1854	7/16-20 x 4 Hex Hd Bolt
2002	7/16-20 x 2 Hex Hd Bolt
10607	Push Rod Ass'y
10511	Breakaway Chain with S-hooks

*Master cylinder repair kits not stocked by Toledo Stamping.
Check with your local brake service or automotive parts
dealer. Ask for FC 11300 or equivalent.

HYDRO-ACT DIVISION
TOLEDO STAMPING & MANUFACTURING COMPANY
P. O. BOX 596 - TOLEDO, OHIO 43693
PHONE (419) 382-3407

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International: +1-419-755-1352**

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