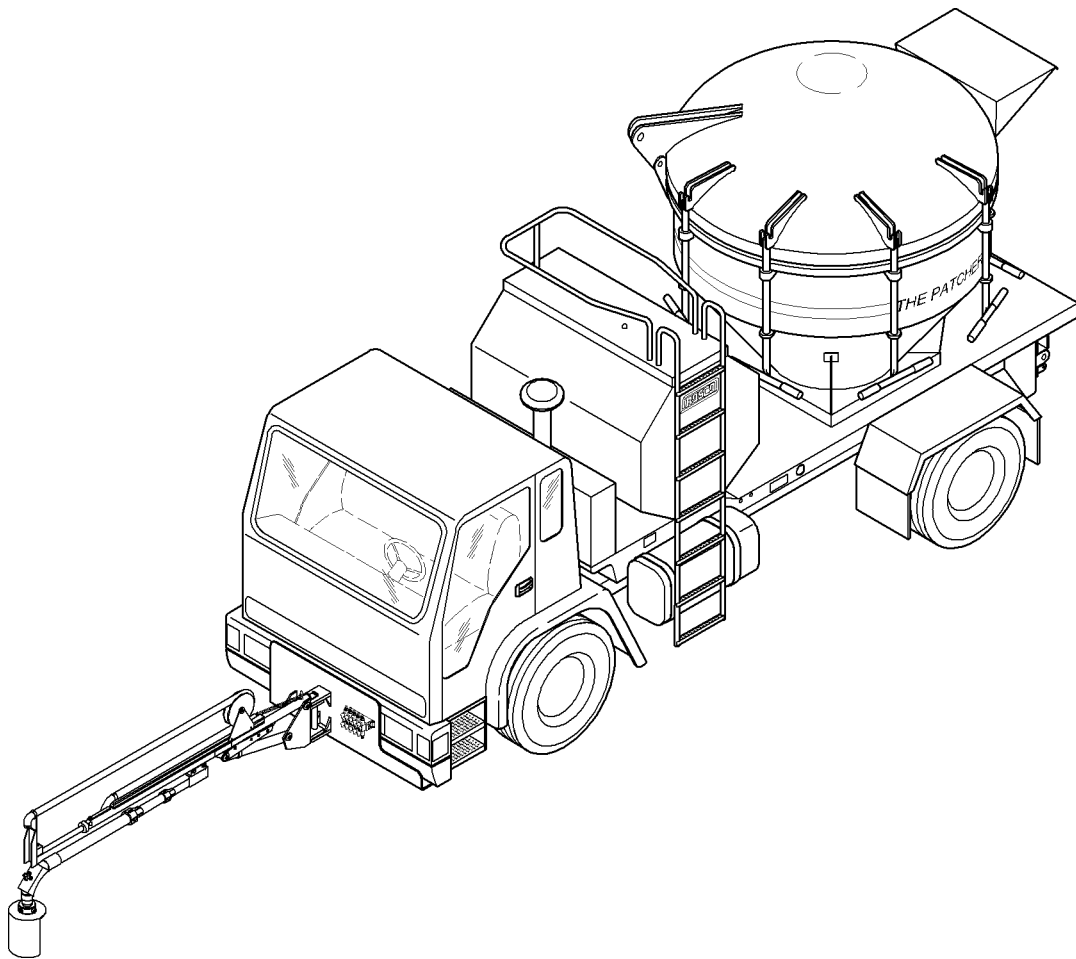


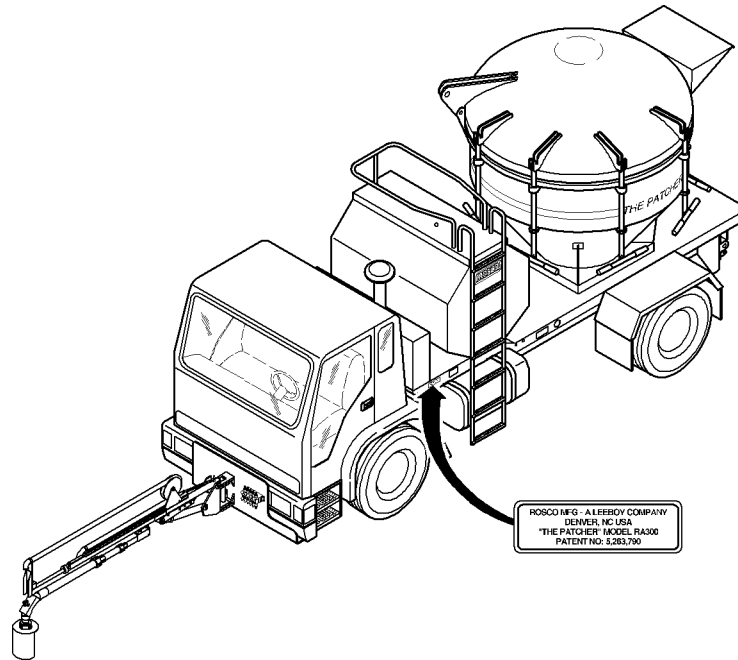


OPERATIONS, SERVICE AND PARTS MANUAL



RA-300 PATCHER
for GMC Truck
Manual No. 37679-06
For Units with Serial No. 49276 and higher
Revised 11-31-07

USERS' REFERENCE GUIDE



DELIVERY DATE _____

UNIT SERIAL NUMBER _____

ENGINE TYPE _____

ENGINE NUMBER _____

DEALER'S NAME AND ADDRESS

PHONE NUMBER _____

EQUIPMENT HOURS _____

SERVICE MANAGER _____

**LIMITED WARRANTY
POLICY AND PROCEDURES
EFFECTIVE FOR UNITS SHIPPED AFTER JANUARY 1, 2008**

A. WARRANTY

1. For warranty repairs on machines with less than fifty (50) hours in service, a FACTORY-TRAINED SERVICE REPRESENTATIVE will be reimbursed at a rate of \$1.50/mile, and three (3) hours at shop rate.
2. If a defect in material or workmanship is found and the authorized Dealer is notified during the warranty period, VT LeeBoy will repair or replace any part or component of the unit or part that fails to conform to the warranty during the warranty period.
3. The warranty date will begin upon online registration of the unit by the Dealer and will expire after twelve (12) months have passed. The unit must be registered by the Dealer within ten (10) days of being sold.
4. Manufacturers' Warranties:
For LeeBoy Dealers: Engines are warranted by their manufacturers and may have warranty coverage that differs from that of VT LeeBoy.
For Rosco Dealers: Engines and truck chassis are warranted by their manufacturers and may have warranty coverage that differs from that of VT LeeBoy.
5. Replacement parts furnished by VT LeeBoy are covered for the remainder of the warranty period applicable to the unit or component in which such parts are installed.
6. VT LeeBoy has the right to repair any component or part before replacing it with a new one.
7. All new replacement parts purchased by a VT LeeBoy Dealer will carry a six-month warranty.

B. LIMITATIONS

VT LeeBoy has no obligation under this warranty for:

1. Any defects caused by misuse, misapplication, negligence, accident or failure to maintain or use in accordance with the most current operating instructions.
2. Unauthorized alterations.
3. Defects or failures caused by any replacement parts or attachments not manufactured by or approved by VT LeeBoy.
4. Failure to conduct normal maintenance and operating service including, without limitation, providing lubricants, coolant, fuel, tune-ups, inspections or adjustments.
5. Unreasonable delay, as established by VT LeeBoy, in making the applicable units or parts available upon notification of a service notice ordered by same.

6. Warranty Responsibility:

For LeeBoy Dealers: The warranty responsibility on all engines rests with the respective manufacturer.

For Rosco Dealers: The warranty responsibility on all engines and/or truck chassis rests with the respective manufacturer.

7. Warranty and Parts Support:

For LeeBoy Dealers: VT LeeBoy may have support agreements with some engine manufacturers for warranty and parts support.

For Rosco Dealers: VT LeeBoy may have support agreements with some engine and/or truck chassis manufacturers for warranty and parts support.

C. ITEMS NOT COVERED

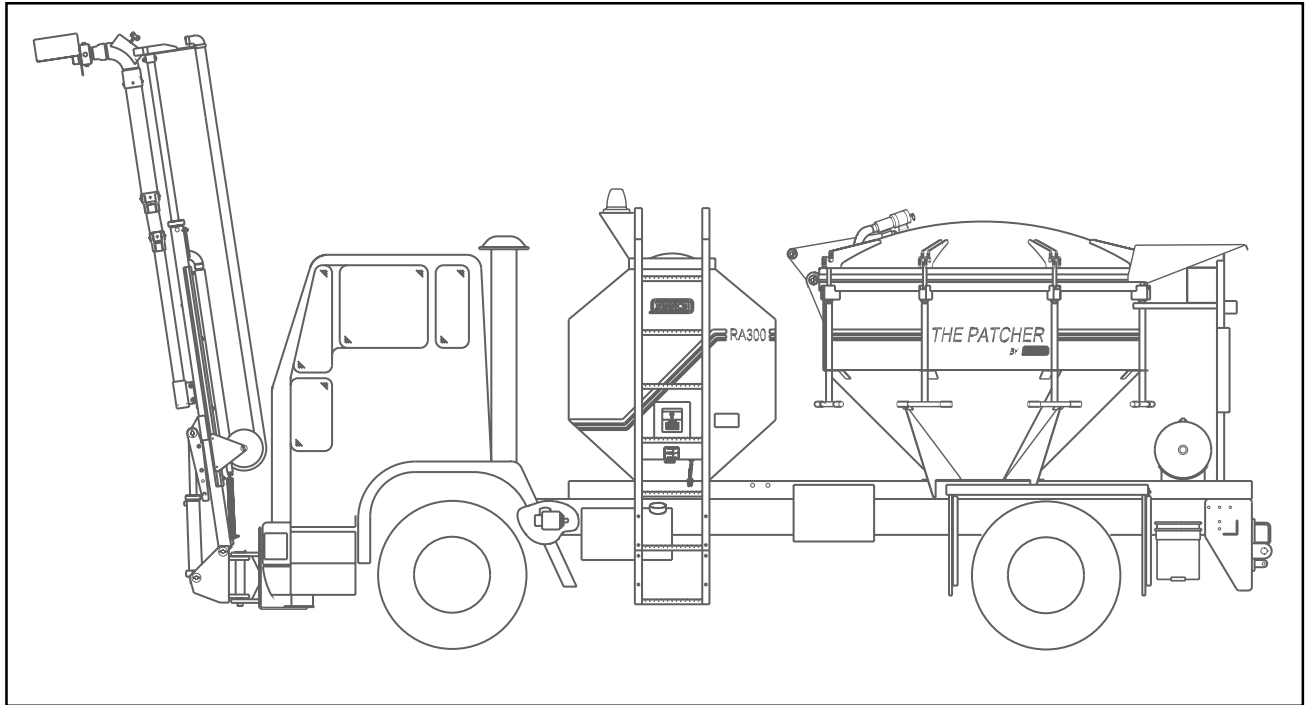
VT LeeBoy is not responsible for the following:

1. Costs related to travel time, mileage or overtime other than as covered under the Warranty Section, Item 1, of this document.
2. Costs related to transporting the product to and from the place at which warranty work is performed.
3. Air freight charges related to transporting repair parts to the place at which warranty work is performed.
4. All used units or used parts of any kind.
5. Repairs due to normal wear and tear or brought about by abuse or lack of maintenance of the equipment, except for premature failures, conveyor chains, poly-track pads, and track rails.
6. Attachments not manufactured or installed by VT LeeBoy.
7. Liability for incidental or consequential damages of any type including, but not limited to, lost profits or expenses of acquiring replacement equipment.
8. Miscellaneous charges.

D. OTHER WARRANTIES

THE FOREGOING WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHER EXPRESSED, STATUTORY AND IMPLIED WARRANTIES APPLICABLE TO UNITS, ENGINES, OR PARTS WITHOUT LIMITATION, ALL IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR USE OR PURPOSE. IN NO EVENT, WHETHER AS A RESULT OF BREACH OF CONTRACT OR WARRANTY OR ALLEGED NEGLIGENCE OR LIABILITY WITHOUT FAULT, SHALL VT LEEBOY BE LIABLE FOR SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES INCLUDING, WITHOUT LIMITATION, LOSS OF PROFIT OR REVENUE, COST OF CAPITAL, COST OF SUBSTITUTED EQUIPMENT, FACILITIES OR SERVICES, DOWNTIME COSTS, LABOR COSTS OR CLAIMS OF CUSTOMERS, PURCHASERS OR LESSEES FOR SUCH DAMAGES.

**RA-300 PATCHER for GMC
OPERATIONS, SERVICE AND PARTS MANUAL**

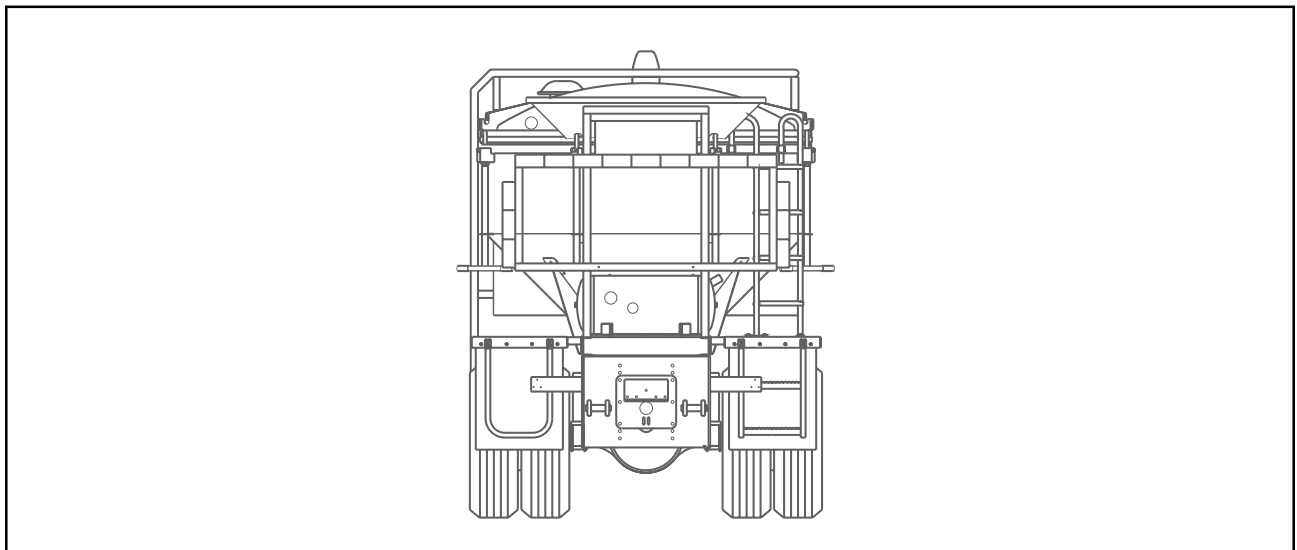


SIDE VIEW

This manual should be used with all related supplemental books, engine and transmission manuals, and parts books. Related Service Bulletins should be reviewed to provide information regarding some of the recent changes.

If any questions arise concerning this publication or others, contact your local ROSCO Distributor for the latest available information.

Contents of this manual are based on information in effect at the time of publication and are subject to change without notice.



REAR VIEW

RA-300 PATCHER for GMC



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RA-300 PATCHER for GMC



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Section 1

INTRODUCTION & SAFETY



FORWARD

LeeBoy's ROSCO RA-300 Patcher is a truck-mounted asphalt spray patcher, designed to provide an alternative to conventional methods of pothole patching. One person controls all patching functions from the cab. The rear Arrow Board directs traffic movement, allowing the operator to remain in the vehicle while continuing to work in low traffic or high traffic areas. The hydraulic Patch-on-the-Go system allows for patching on the move, with no auxiliary power. The spray injection process lets the operator repair large numbers of problem areas in a single day, anywhere asphalt patching is needed: potholes, highway cracks, bridge approaches, eroded areas, parking lots and many other applications.

The optional Jet Flush system dampens the aggregate to enhance adhesion between the aggregate and emulsion. Also available, is the Auxiliary Engine system that provides an alternate hydraulic pumping system for those operators who choose not to use the truck transmission mounted PTO. Completing the option package is a choice between an LED Arrow Board, or 48" x 96" Arrow Board, to provide more visibility on job sites.

This manual contains the correct operation and routine maintenance procedures needed by the owner/operator for the safe and efficient use of the ROSCO RA-300 Patcher. In order to maximize the performance and efficiency of the machine, it is VERY IMPORTANT that the owner/operator and maintenance personnel read this manual thoroughly before operating or servicing the machine.

Always keep this manual in a convenient place for instant reference and NEVER attempt to make repairs or adjustments that you do not fully understand. If you require additional information or service, contact your authorized ROSCO Dealer. Always give your dealer the Serial Number of your machine when ordering parts or when requesting service or other information.

The technical information found in this manual was correct at the time it was approved for publication. However, due to a continuous program of research and development, some procedures, specifications and parts may be altered in a constant effort to update and improve our products.

ROSCO Manufacturing Company reserves the right to make design or specification changes without prior notification and to make improvements without incurring an obligation to add them to any machine in existence. Please contact your local authorized ROSCO Dealer if you require further assistance.

RECEIVING THE RA-300 PATCHER

CAUTION: Always set the park brake before leaving the machine. Check park brake before placing machine back in service.



The RA-300 Patcher was inspected thoroughly at the factory. However, road hazards or vandalism may occur during transport, and result in damage. Inspect the machine as outlined below and perform necessary repairs before placing the machine in service.

1. Check engine oil level as shown in the manufacturer's manual.
2. Check fuel tank, cooling system, engine oil, and hydraulic reservoir for proper levels and contaminants. If contaminants are suspected, flush and fill the system.
3. Read this manual and understand the contents.
4. Check all hydraulic functions and repair or adjust as necessary. Have any repairs or adjustments performed by a qualified mechanic, or consult your local dealer.
5. Check for missing parts. If parts are missing or the machine is damaged, contact the local dealer.
6. Check the park brake to make sure it is operating properly.
7. Check the seat belt to make sure it is operating properly.

OVERVIEW OF THE MANUAL

GENERAL INFORMATION

This manual contains Safety information, Specifications, Operation procedures, Maintenance and Troubleshooting guidelines, and an Illustrated Parts List for the RA-300 Patcher.

INTRODUCTION AND SAFETY


Important Safety precautions related to specific areas of the machine and workplace are included to insure your safety, the safety of those around you, and the correct operation of the machine.

SPECIFICATIONS

Refer to **Specifications**, Section 2 in this manual, for all major system specifications and detailed information on this machine's components and controls.


OPERATION

Refer to **Operation**, Section 3 in this manual, for information needed to operate the machine safely. The operator of this equipment should READ, UNDERSTAND, and FOLLOW all instructions and ALL Safety precautions found in Section 1 of this manual, as well as all Cautions and Warnings provided throughout all sections of this manual.

CAUTION:  **Do not attempt to operate the RA-300 Patcher unless fully trained in the machine's operation. Only authorized personnel should operate this machine. All instructions provided in this manual and on the machine's operation and warning decals must be followed to prevent damage to the equipment and/or injury to operating personnel.**

MAINTENANCE AND TROUBLESHOOTING

Refer to **Maintenance**, Section 4 of this manual, for all maintenance and repair procedures, as well as charts and tables containing important machine-specific information.

CAUTION:  **All maintenance instructions provided in this manual should be followed to insure the safety of the personnel performing the maintenance and to prevent damage to the machine.**

Section 1

INTRODUCTION & SAFETY

PRECAUTIONARY INSTRUCTIONS

This manual provides important information to familiarize you with safe operating and maintenance procedures. Even though you may be familiar with similar equipment, you **MUST** read and understand this manual before operating this unit.

Safety is everyone's business and is one of your primary concerns. Knowing the guidelines covered in the following paragraphs and throughout Section 1 will help provide for your safety, the safety of those around you, and the machine's proper operation.

LOOK FOR THESE SYMBOLS WHICH POINT OUT ITEMS OF EXTREME IMPORTANCE TO YOU AND YOUR COWORKERS. READ AND UNDERSTAND THE WARNINGS. HEED AND FOLLOW THE INSTRUCTIONS.

Note the use of the words **DANGER**, **WARNING**, **CAUTION** and **ATTENTION** with the message. The appropriate word for each message has been selected using the following guidelines:

DANGER: An immediate and specific hazard which **WILL** result in severe personal injury or death if the proper precautions are not taken.



WARNING: A specific hazard or unsafe practice which **COULD** result in severe personal injury or death if proper precautions are not taken.



CAUTION: Unsafe practices which **COULD** result in personal injury if proper practices are not taken, or as a reminder of good safety practices.



ATTENTION: Equipment on the machine could be damaged through improper performance of an operation, maintenance or repair procedure.



MATERIAL SAFETY DATA SHEETS

In addition, some machines use or contain hazardous chemicals which may require a specific Material Safety Data Sheet (MSDS). If such information is necessary for the safe operation of this machine, those MSDSs are included on the following pages.

SAFETY DECALS

KNOW and UNDERSTAND the content and position of each safety decal.

KEEP the safety decals and signs CLEAN and legible.

REPLACE safety decals and signs that are missing or have become illegible. When replacing or painting machine parts, REPLACE safety decals as necessary. See **Decal Installation** in Section 4, **Maintenance**.

OBTAIN replacement decals or signs from your dealer. Refer to the **Illustrated Parts List** in this manual for a list of part numbers.

The illustrations on this page will aid you in determining the proper location of decals. If you need more explicit instructions for their placement, contact your dealer.

NOTE: It is the responsibility of the owner and operator to make sure that all decals are readable and located on the machine as designated by the manufacturer.

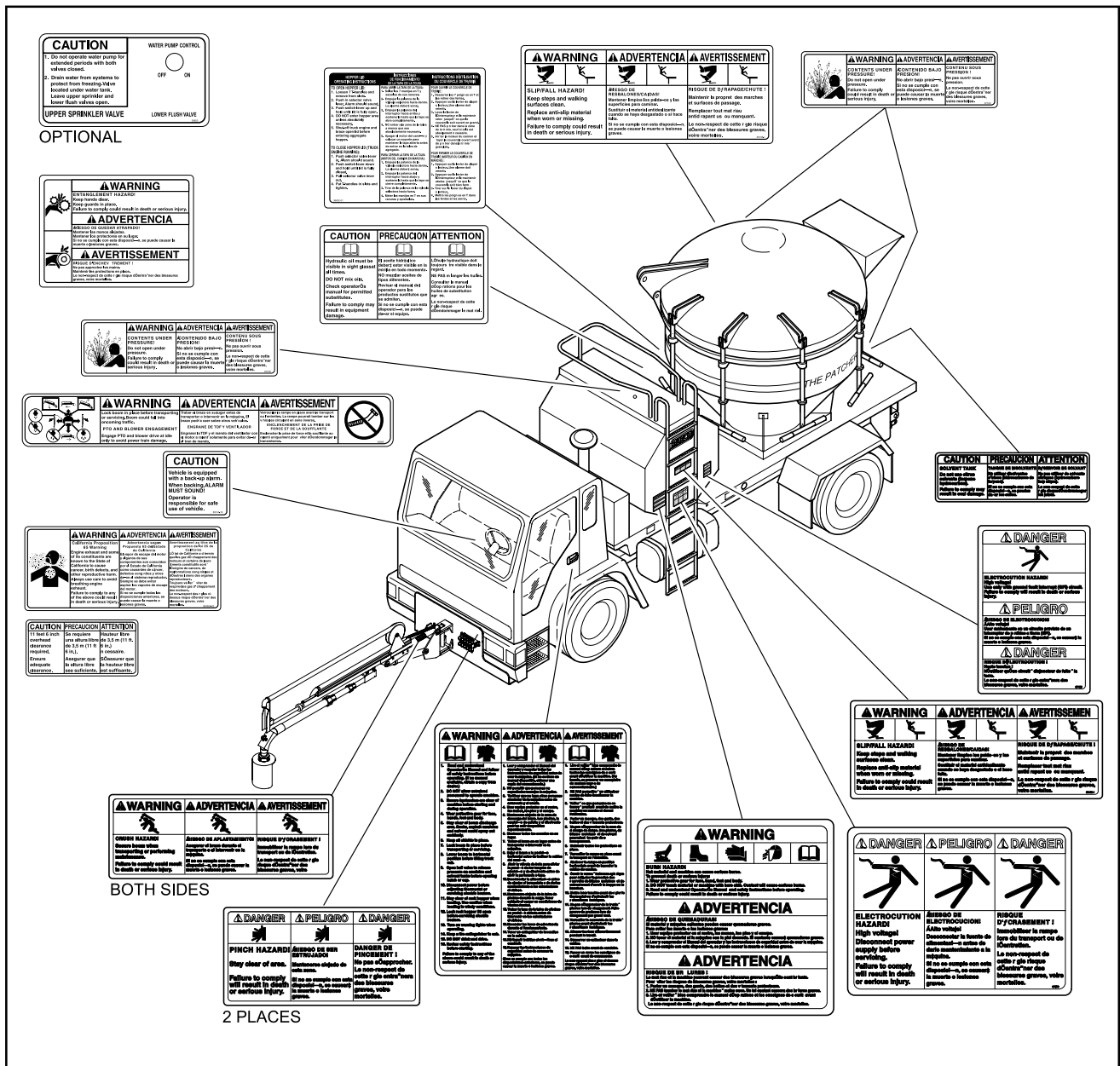


FIGURE 1-1. DECALS and DECAL LOCATIONS

Section 1

INTRODUCTION & SAFETY



SAFETY

PRE-START INSPECTION

INSPECT machine. Have any malfunctioning, broken or missing parts corrected or replaced before using the machine.

READ and UNDERSTAND the operator's manual as well as all decals pertaining to instructions and safety.

Have a FIRST AID KIT available. Know how to use it.

Have a charged FIRE EXTINGUISHER within reach.

Have the correct type for your situation:

TYPE A: Wood, paper, textile, rubbish.

TYPE B: Flammable liquid.

TYPE C: Electrical equipment.

CHECK hydraulic hoses daily for wear and leaks. Replace if damaged.

CHECK engine, transmission, and hydraulic oil levels. Fill to the correct level as necessary.

USE the correct hydraulic fluid grade for the operating season.

FILL the fuel tank with the engine off. NEVER fill fuel tank near an open flame, or when smoking.

CHECK for frayed or worn electrical wires and loose or corroded connections.

CHECK tires for wear, cuts, and damage. CHECK air pressure.

INSPECT wheels for loose, damaged, or missing hardware. TIGHTEN as necessary. Refer to the Torque Specification charts in Section 4.

CHECK pedals and levers for freedom of movement.

MAKE SURE operator's compartment, steps and hand holds are free of grease and debris.

CHECK steps and supports for damage. Repair as necessary.

CHECK protective devices, cab, ROPS, canopy, shields, and seat belt for wear or damage.

MAKE SURE all lights, reflectors and other protective devices are clean and operate correctly.

CHECK that all safety decals and signs are in place and readable. These are as important as any other equipment on the machine.

OPERATING SAFETY

WEAR OSHA required safety equipment when operating the machine.

WEAR appropriate ear protection when exposed to loud noise.

DO NOT wear loose fitting clothing, rings or wrist watches that could catch on moving parts.

ADJUST the seat and FASTEN the seat belt before starting the machine.

ALWAYS make sure no person or object is in your line of travel BEFORE starting.

DO NOT allow riders on the machine unless they are seated in appropriate seats.

KNOW and UNDERSTAND the job site traffic flow patterns. Work SLOWLY in tight areas and when turning.

DRIVE at speeds compatible with road, weather, and job site conditions.

AVOID steep hills, rough terrain, and sharp turns if possible.

ALWAYS look BEFORE changing your direction of travel.

DO NOT run engine in a closed building for long periods of time.

DO NOT start engine by shorting across starter terminals. Machine will start in gear if normal circuitry is bypassed.

NEVER start engine while standing on the ground. Start engine only from operator's seat, with all controls in neutral.

DO NOT leave the engine running without operator present.

USE recommended hand holds and steps with at least three points of support when getting on and off the machine. Face the machine and NEVER jump off or dismount while the machine is moving.

HOT MATERIAL PRECAUTIONS

WEAR protective gear for face, hands, feet and body when working with hot material.

ALLOW the machine to cool before repairing or servicing working components.

IF hot asphalt touches the skin, flush area immediately with cold water. Do not apply ice directly to affected area. Do not attempt to remove asphalt cement with products containing solvents or ammonia. Natural separation will occur in about 48 - 72 hours. Get medical attention immediately!

FIRE AND EXPLOSION PRECAUTIONS

KEEP machine and asphalt material away from sparks, incandescent material and open flames. Fumes are flammable.

RELEASE pressure in asphalt tank and flush tank with vent valve before checking or filling the tank. Lids and covers can open with explosive force causing death or serious injury.

DO NOT mix different asphalt materials in the tank. Hot asphalt can vaporize material with a lower flash point temperature and cause an explosion.

DO NOT exceed asphalt flash temperature. Hot fumes can explode. See **Heating the Asphalt** in Section 3 for information and guidelines.

DO NOT smoke around the machine. Fuel, emulsion and their fumes can explode when exposed to flame or heat.

CLEAN asphalt and oil accumulations from surfaces that can get hot. Fire can occur in accumulated asphalt or oils and get out of hand quickly.

STOPPING SAFETY

ALWAYS park the machine on solid, level ground. If this is not possible, always park at a right angle to the slope.

ALWAYS engage park brake.

USE proper flags, barriers and warning devices especially when parking in areas of traffic.

GENERAL MAINTENANCE SAFETY

NEVER work on the machine with the engine running.

DO NOT change the engine governor settings.

DO NOT work under the machine unless the machine is supported by approved jacks and jack stands.

ALWAYS replace damaged or lost decals.

REINSTALL safety devices, guards or shields after servicing or adjusting the machine.

CLEAN the service area. KEEP tools and parts off the floor. BE SURE electrical outlets and tools are properly grounded. USE adequate light for the job.

BATTERY SAFETY

DISCONNECT battery cables when working on the electrical system or when welding on the unit.

IF battery needs a charge, be sure battery charger is off when making connections.

BE SURE the correct battery polarity is observed [negative (-) to negative (-) and positive (+) to positive (+)], when connecting a battery charger or jumper cable.

DO NOT tip batteries more than 45 degrees. Electrolyte solution is caustic and explosive.

TIRE SAFETY

DO NOT change tires unless the machine is supported by approved jacks and jack stands.

DO NOT inflate tires beyond the maximum recommended pressure.

DO NOT hammer on rims with steel hammers. Use rubber, lead, plastic or brass faced mallets.

DO NOT mount a tire without the proper equipment and experience.

HANDLING FLUIDS SAFELY

NEVER fill the fuel tank with the engine running.

DO NOT smoke while refueling the machine.

DO NOT fill fuel tank to capacity. Allow room for expansion.

DO NOT use hands to find hydraulic leaks. High-pressure fluid can penetrate the skin, causing severe injury.

TRANSPORT

FOLLOW all local regulations regarding transporting equipment on public roads and highways.

KNOW and USE all required signal devices, including tail lights, slow moving vehicle signs, and warning beacons. Provide an escort when necessary.

BE SURE the lights and reflectors are clean, in good repair and can be seen clearly by all overtaking and oncoming traffic.

Refer to Section 3, **Operation**, for more detailed instructions.

STORAGE

STORE the machine in an area away from human activity.

BE SURE the unit is stored in an area that is firm, level and free of debris.

STORE the machine inside a building, or cover it with a weather-proof tarpaulin and support the wheels securely.

Refer to Section 4, **Maintenance**, for more detailed instructions.

Section 1 INTRODUCTION & SAFETY



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Section 2

SPECIFICATIONS



GENERAL INFORMATION

The descriptions and specifications provided in this section are applicable to the ROSCO RA-300 Patcher. This section contains a description of how the major components operate. It also includes specifications for the major system components. Included in this section are machine weights, dimensions, performance, and major system specifications for the RA-300 Patcher.

ENGINE

The RA-300 Patcher is a truck-mounted asphalt spray patcher. Refer to the engine manufacturer's manual, provided with the truck, for specifics related to engine components.

HYDRAULIC SYSTEM

The Hydraulic System provides power and control of Patcher functions. The system consists of:

- A. Two (2) hydraulic pumps with minimum of 10 GPM per section, driven from truck PTO
- B. Five (5) solenoid valves
- C. Five (5) hydraulic cylinders
- D. One (1) solenoid relief valve
- E. One (1) double selector valve
- F. Hydraulic oil reservoir tank and filter
- G. Electric controls in the truck cab

The hydraulic pump is PTO-driven off the truck transmission. The rear pump produces power to move the front discharge boom (to position and place patching materials), to power the rockslide gate feeder (to interject aggregate into the material delivery line), and to raise and lower the aggregate tank lid (in order to load aggregate). Five (5) electric solenoid valves with switches in the truck cab control the discharge boom and slide gate hydraulic functions.

The front pump powers the blower. A proportional valve controls the blower speed. Maximum speed is reached at an engine speed of 1000 rpm.

AGGREGATE DELIVERY SYSTEM

The Aggregate Delivery System provides storage of aggregate and its delivery to the mixing nozzle mounted at the front of the boom. The system consists of:

- A. Aggregate hopper with 5 cubic yard capacity
- B. Slide gate feeder
- C. High volume, low pressure, positive displacement blower driven by truck PTO, capable of 850 CFM @ 2,850 RPM
- D. Muffler
- E. Delivery hose
- F. Telescoping discharge boom with emulsion hose take-up reel
- G. +/- Gate set control

Appropriate sized, relatively clean aggregate is loaded into the aggregate hopper (see **Material Selection** in Section 3). The blower pressurizes the hopper and then the slide gate feeder introduces the aggregate into the pressurized delivery hose. The high volume air produced by the blower first passes through the muffler and then propels the rock through the feeder and out the delivery hose on the boom.

ASPHALT DELIVERY SYSTEM

The Asphalt Delivery System provides storage of liquid asphalt and its delivery to the mixing nozzle on the boom. The system consists of:

- A. Insulated storage tank
- B. Two (2) 4500 watt, 240 volt thermostatically controlled immersion heating elements
- C. Insulated delivery line capable of maintaining 60 PSI
- D. Remote operation from truck cab
- E. Mixing nozzle
- F. Flush system with 30 gallon capacity

Liquid asphalt is loaded into the storage tank, which in turn is pressurized. This emulsion is forced down the delivery line, through the asphalt valve and out to the mixing nozzle on the boom. At the mixing nozzle, the asphalt is forced through spray nozzles to coat the passing aggregate. The flush tank is filled with solvent (diesel fuel or other suitable solvent). By changing the position of the three-way valve located on the driver's side (under the asphalt tank), solvent can be forced through the delivery lines to clean out the asphalt delivery system.

SPECIFICATIONS

Tables 2-1 through 2-8 list major system specifications for the RA-300 Patcher. Additional maintenance tables are shown in Section 4, **Maintenance**.

TABLE 2-1. MACHINE DIMENSIONS

ITEM	SPECIFICATION
Weight	17,900 lbs (8,119 kg)
Length (with boom up)	26' 2" (8 m)
Length (with boom extended)	40' 9" (12.42m)
Height (with boom up)	11' 1" (3.38 m)
Height (with boom extended)	10' 0" (3.05 m)
Machine Width	8' 0" (2.44 m)
Turning Radius	23' 6" (7.16 m)

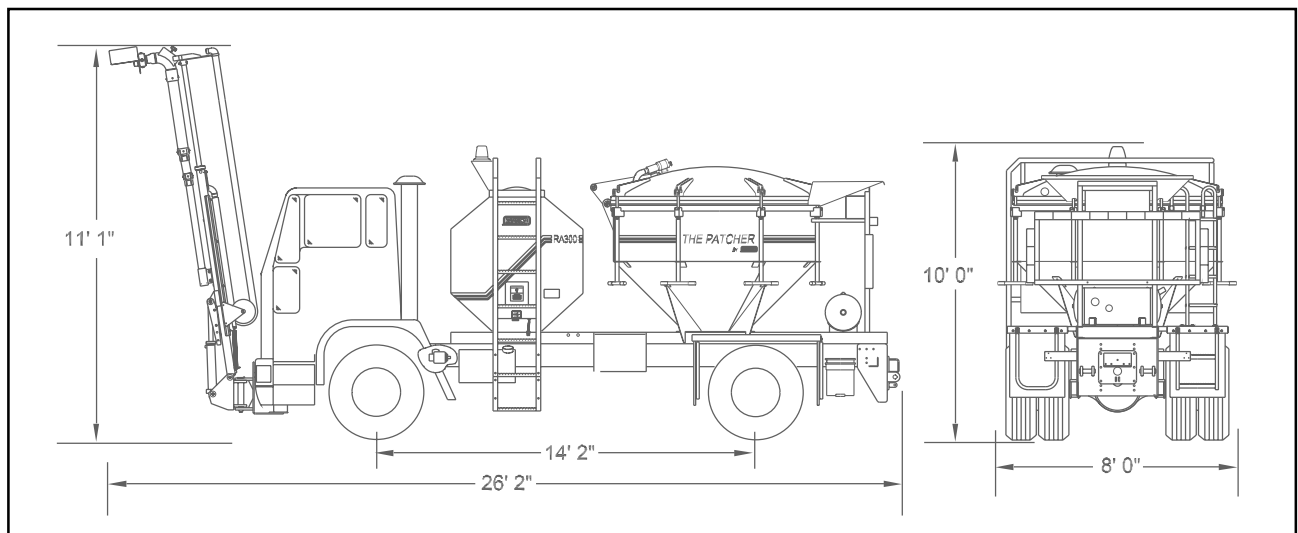


FIGURE 2-1. OUTLINE DIMENSIONAL DRAWING WITH BOOM UP

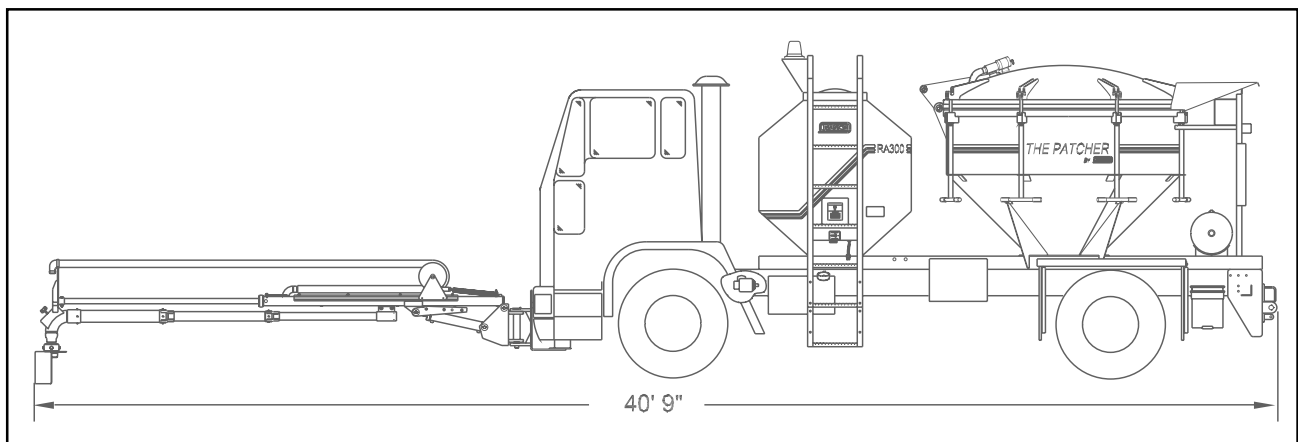


FIGURE 2-2. OUTLINE DIMENSIONAL DRAWING WITH BOOM EXTENDED

Section 2 SPECIFICATIONS



TABLE 2-2. CHASSIS REQUIREMENTS

ITEM	SPECIFICATION
Cab Forward	33,000 GVW (14,970 kg)
Front Axle	12,000 lbs (5,443 kg)
Rear Axle	21,000 lbs (9,525 kg)
Rear Spring Rating	23,000 lbs (10,433 kg)
Air Brakes	13.2 CFM (0.374 m) compressor minimum
Truck Engine	210 HP (157 kw)
Truck Wheelbase	14' 2" (4.32 m)

TABLE 2-3. HYDRAULIC SYSTEM SPECIFICATIONS

ITEM	SPECIFICATION
Prince Pump (dual)	10 to 16 GPM (38 to 61 liters) each at 1000 RPM
Prince Pump (Auxiliary Engine)	10 GPM (38 liters) each at 1500 RPM
Hydraulic Reservoir	20 gallons (76 liters)
Hydraulic Return Filter	10-Micron Spin-On Cartridge (P/N 38327-01)
Hydraulic Charge Filter	7-Micron Spin-On Cartridge (P/N 72543)
Hydraulic Strainer	In-Tank (P/N 33148)

TABLE 2-4. AIR SYSTEM SPECIFICATIONS

ITEM	SPECIFICATION
Blower Manufacturer	Tuthill
Displacement	0.323 cu. ft./rev. (9.15 l/rev.)
Blower Volume	881 CFM @ 1 PSI (24.9 m @ 6.9 kPa)
Maximum Speed	2850 RPM
Maximum Pressure Rise	7 PSI (48.3 kPa)
Maximum Temperature Rise	200° F (93.3° C)
Drive System	Hydraulic Motor
Air Cleaner	Dry Type Replaceable Element (P/N 36531-1)

TABLE 2-5. ASPHALT EMULSION SYSTEM SPECIFICATIONS

ITEM	SPECIFICATION
Nominal Tank Capacity	400 gallons (1,514 l)
Tank Insulation	4 inches (102 mm) Styrofoam
Tank Skin	16 gauge steel
Fill Opening	12 inches (305 mm)
Heating Elements	Two 4500 watt, 240 volt
Temperature Control	Dial Thermometer 50° to 500° F (10° to 260° C)

TABLE 2-6. AGGREGATE SYSTEM SPECIFICATIONS

ITEM	SPECIFICATION
Type	Pressurized Hopper
Hopper Capacity	5 cubic yards or 8,079 lbs (3.8 cu. m or 3665 kg)
Delivery System	Gravity, slide gate feed into air stream
Aggregate Feed Hopper	Slide Gate
Control	On/Off switch in truck cab

TABLE 2-7. DISCHARGE HOSE, NOZZLE & BOOM SPECIFICATIONS

ITEM	SPECIFICATION
Hose Type	Abrasion Resistant
Hose Diameter	3 inches ID (76 mm)
Hose Length	22 feet (6.71 m)
Hose Reinforcement	Wire Helix
Emulsion Supply Hoses	0.5 inch (13 mm) High Temp
Nozzle Construction	Welded Steel
Control	Remote valves operated from truck cab
Boom Type	3-Stage Telescoping
Working Radius	13' 6" (4.12 m)
Boom Suspension	Hydraulic Cylinders

TABLE 2-8. CLEANOUT SYSTEM SPECIFICATIONS

ITEM	SPECIFICATION
Type	Air Pressurized Solvent
Solvent Type	Diesel Fuel
Cleanout Tank Capacity	30 gallons (114 l)

Section 2 SPECIFICATIONS



NOTES:

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GENERAL INFORMATION


This section provides the Operating instructions for the RA-300 Patcher. Before starting or operating the machine, it is important to READ, UNDERSTAND, and FOLLOW all Operating instructions, Danger, Warning, and Caution messages in this section, as well as all Safety information contained in Section 1 of this manual.

DANGER:  Failure to observe the Operating instructions, Danger, Warning, and Caution messages in this manual can cause serious injury or death. Only authorized personnel, who are fully trained in the machine operation, can operate the RA-300 Patcher.

This machine should be kept in good mechanical condition at all times.

WARNING:  Do not operate a machine needing repair. Put an information tag on the instrument panel that says **DO NOT OPERATE**. Remove the key from the ignition switch. Repair all damage at once. Minor damage can result in major system failures.

OPERATING CONTROLS, INDICATORS, AND GAUGES

WARNING:  Do not start or operate the RA-300 Patcher before reading, understanding and following all information given in this section and shown on the machine. The operator must read and understand the function of all controls, indicators, and gauges before starting the engine. Serious injury or death can result if these procedures are not followed.

Operating controls for the RA-300 Patcher are shown in Figures 3-1 and described in Table 3-1. Additional controls are shown in Figure 3-2 and described in Table 3-2.

Section 3 OPERATION

TABLE 3-1. JOYSTICK CONTROLLER

FIGURE	ITEM	CONTROL NAME	TYPE	FUNCTION
3-1	1	Joystick		Controls rock flow, emulsion flow, and telescoping and side-to-side motion of boom.
3-1	2	Boom Up/Down Switch	Rocker Switch (on the joystick)	Controls the up and down movement of the boom with brief toggles.
3-1	3	Rock On/Off Switch	Rocker Switch (on the joystick)	Opens and closes Rock Gate to start and stop rock flow.
3-1	4	Rock Flow +/- Switch	Rocker Switch	Controls rock flow with brief toggles.
3-1	5	Emulsion On/Off Switch	Rocker Switch (on the joystick)	Turns emulsion flow on and off.
3-1	6	Blower On/Off Switch	Rocker Switch	Turns blower on and off.
3-1	7	Air Speed Mode Switch	Rocker Switch	Controls the mode of operation of the blower.
3-1	8	Beacon On/Off Switch	Rocker Switch	Turns beacon light on and off.

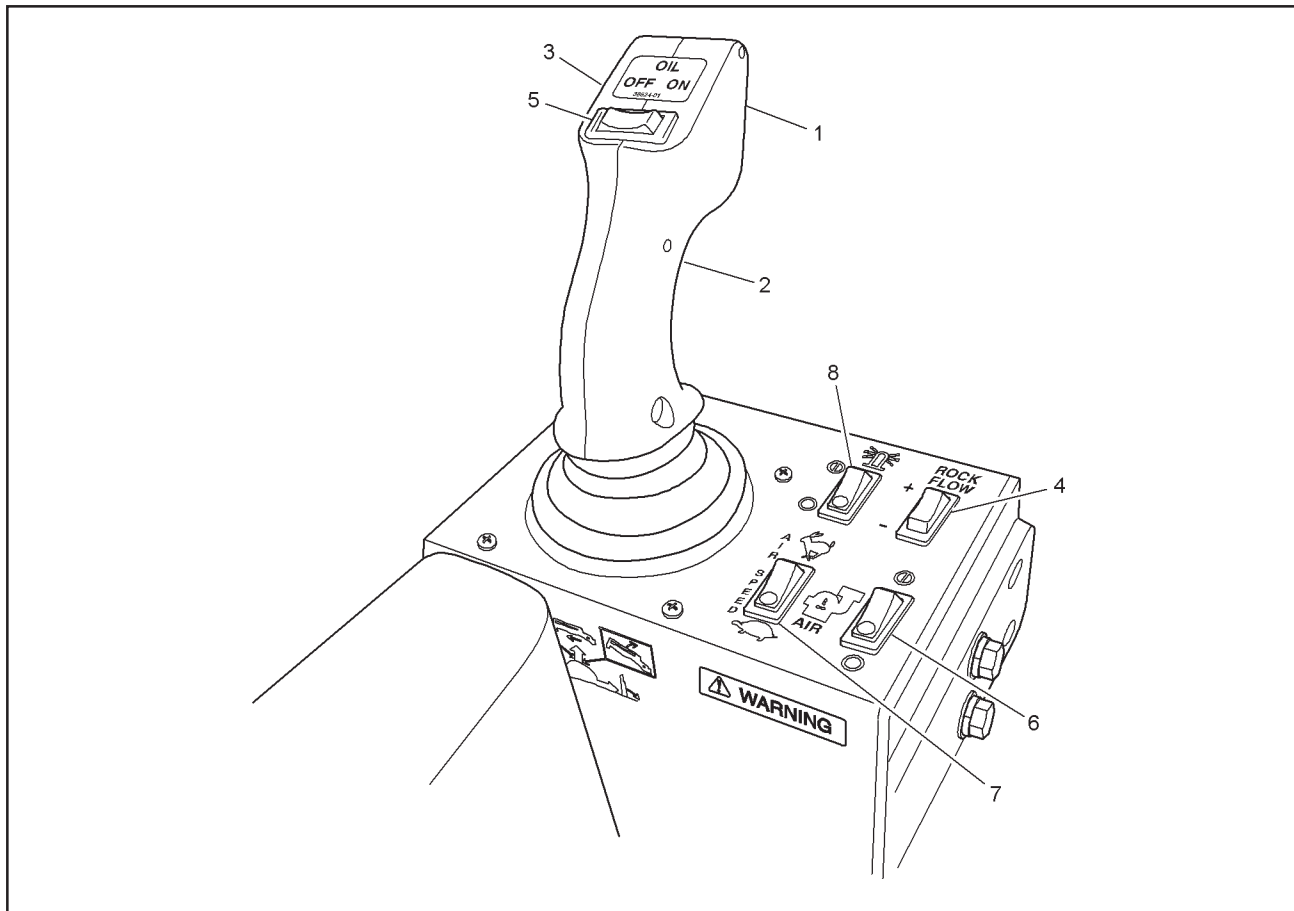


FIGURE 3-1. JOYSTICK CONTROLLER

TABLE 3-2. GAUGE PANEL

FIGURE	ITEM	CONTROL NAME	TYPE	FUNCTION
3-2	1	Hydraulic Warning Light	Red Warning Light	Indicates that the hydraulic system is overheating. Shut down the PTO and resolve the heating problem.
3-2	2	Hour Meter		Displays total machine work hours.
3-2	3	Rock Gate Indicator	Red Indicator Light	Indicates that the Rock Gate is open.
3-2	4	Air Pressure Gauge		Displays PSI of air system.
3-2	5	PTO Light	Red Indicator Light	Indicates that the hydraulic drive is engaged.
3-2	6	Air Speed Selector	Knob	Controls the air speed of the blower.

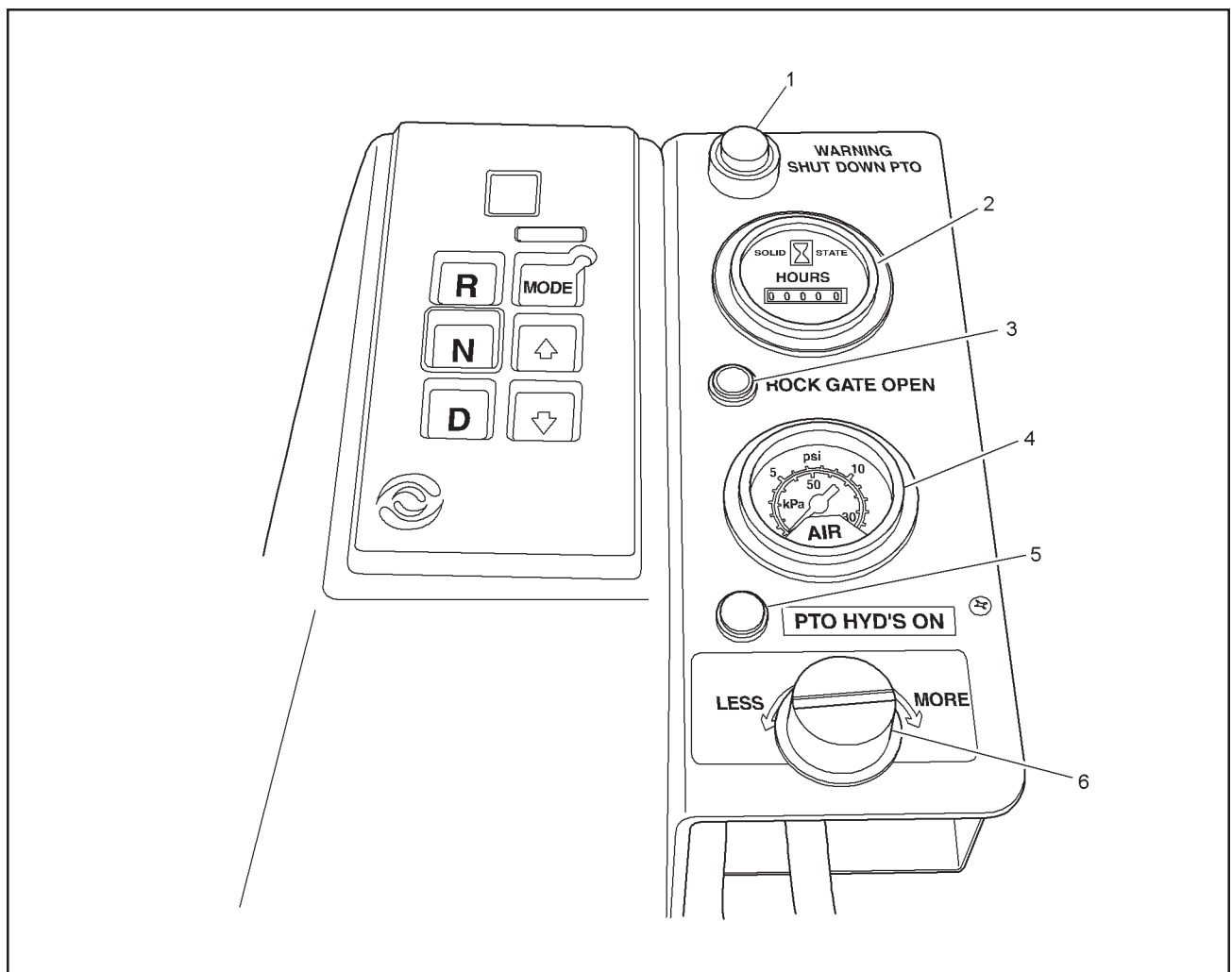


FIGURE 3-2. GAUGE PANEL

Section 3 OPERATION

TABLE 3-3. TRANSMISSION PANEL

FIGURE	ITEM	CONTROL NAME	TYPE	FUNCTION
3-3	1	Mode Select	Push Button	Engages the hydraulic pump.
3-3	2	PTO Light	Red Indicator Light	Indicates that the hydraulic drive is engaged.

Refer to Allison Transmission owner's manual for a description of all other functions.

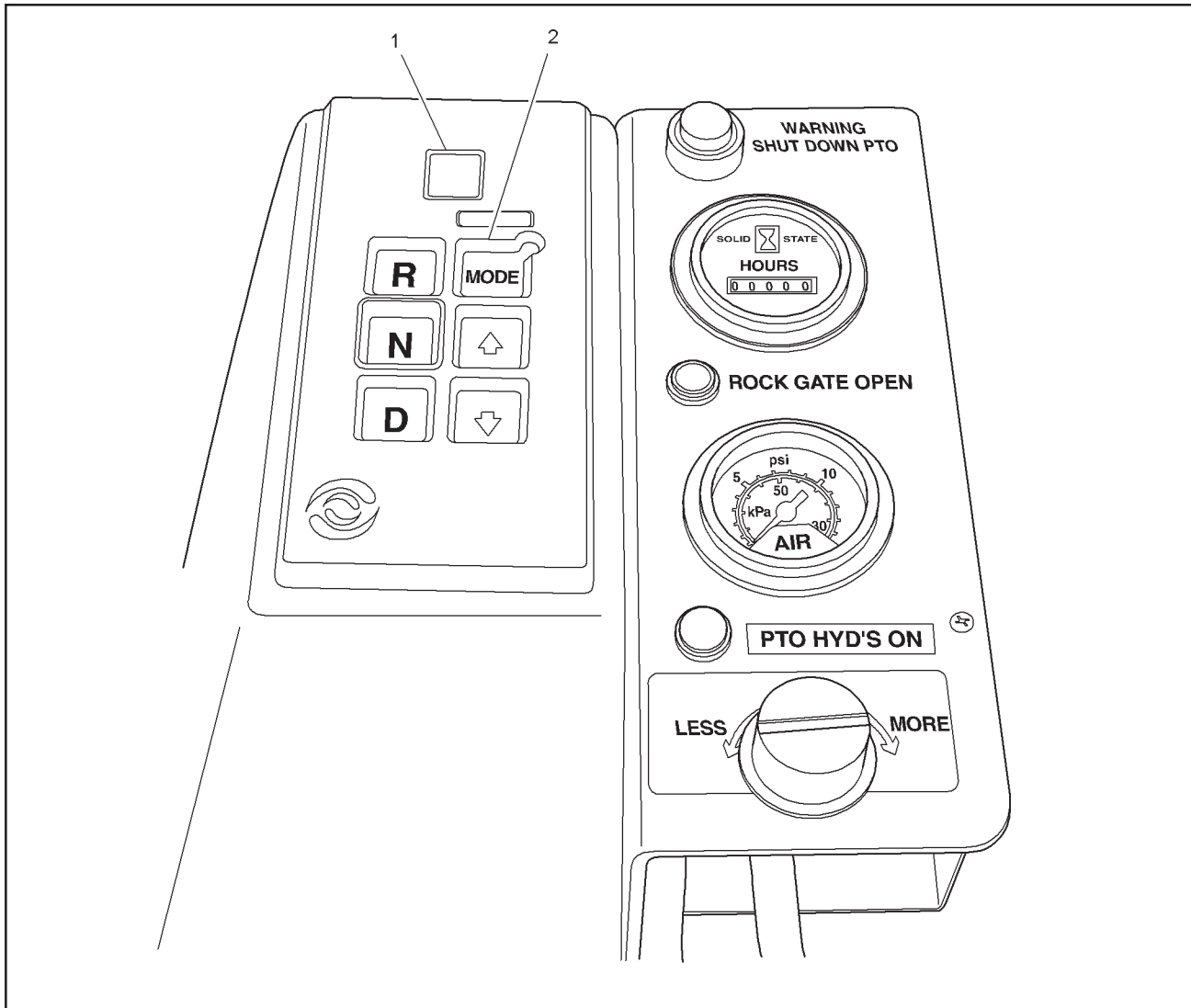


FIGURE 3-3. TRANSMISSION PANEL

TABLE 3-4. ARROWBOARD CONTROL PANEL

FIGURE	ITEM	CONTROL NAME	TYPE	FUNCTION
3-4	1	Power	On/Off Touchpads	Turns the arrowboard on and off.
3-4	2	Select Mode	Touchpad Button	Used to scroll through selectable sequences.
3-4	3	Enter	Touchpad Button	Used to set the sequence as displayed at "Select Mode".
3-4	4	Toggle Display	Touchpad Button	Toggles between Bulb Brightness and Battery Level modes.

For detailed instructions and schematics, refer to the Trafcon Operations Manual at the back of this manual.

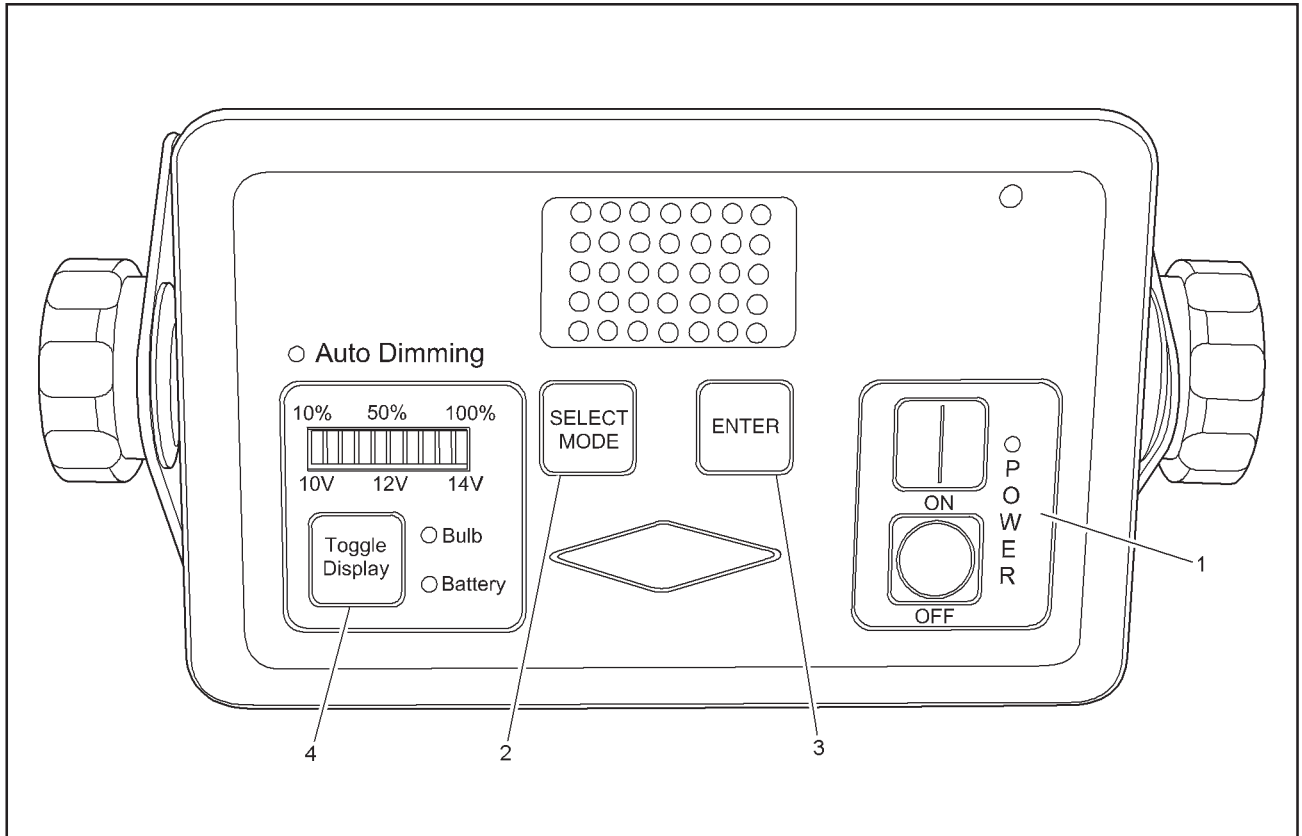


FIGURE 3-4. ARROWBOARD CONTROL PANEL

Section 3

OPERATION



PRELIMINARY PROCEDURES

Before starting or operating the machine, it is important to READ, UNDERSTAND, and FOLLOW all Operating instructions, Danger, Warning, and Caution messages in this manual as well as all Safety information contained in Section 1 of this manual.

Recommended fluid types and required quantities are listed in **Specifications**, Section 2 of this manual.

BREAK-IN PROCEDURES

NOTE: Make every effort to become familiar with the feel and sound of the machine.

1. Observe engine operation carefully.
2. Check the engine oil and coolant frequently.
3. Operate engine at normal loads.
4. Check indicators and gauges frequently during operation.
5. Avoid excessive engine idling.
6. Perform 10 hour or daily service.
7. Watch for fluid leaks and repair immediately.
8. Perform service intervals as indicated in Maintenance, Section 4 of this manual.
9. Check engine manufacturer's manual for additional information on engine break-in.

PRE-START INSPECTION

INSPECT machine. Have any malfunctioning, broken or missing parts repaired or replaced before using the Patcher.

CHECK hydraulic hoses daily for wear and leaks. Replace if damaged.

CHECK that all the instruction and safety labels are in place and readable. These are as important as any other equipment on the machine.

READ and FOLLOW all instruction decals.

WEAR OSHA required safety equipment when operating the machine.

CHECK engine, and hydraulic oil levels. Fill to the correct level as necessary.

FILL the fuel tank with the engine off. NEVER fill fuel tank near an open flame or when smoking.

CHECK for frayed or worn electrical wires and loose or corroded connections.

CHECK tires for wear and damage. Remove any debris lodged between the tires. Maintain tire pressure at recommended levels.

CHECK controls for freedom of movement.

CHECK supports for damage. Repair as necessary.

ENGINE OPERATION

Before starting the engine:

1. Check the fuel level. Fill fuel tank daily to avoid condensation.
2. Check the fuel lines and tank for leaks.
3. Check the engine oil level.

ATTENTION: Failure to maintain correct engine oil level is the greatest single cause of engine failures.

4. Check the hydraulic oil level.

Refer to engine manufacturer's manual for instructions when starting engine for the first time. Follow engine manufacturer's recommendations for fuel and oil.

MATERIAL SELECTION

AGGREGATE SELECTION

General Guidelines

The RA-300 Patcher is designed to use a variety of aggregate types, but certain sizes and shapes will produce the most durable patch. The following guidelines should be considered when choosing aggregate:

1. Use clean aggregate. Dirty aggregate or excessive fines will retard curing of the patch, shorten the life of the patch, and limit adhesion of the emulsion to the aggregate. Use a 200-grade sieve to test your aggregate for excessive fines. No more than 3% should pass through.
2. The largest aggregate particles should not exceed twice the size of the smallest particle.
3. For most patching applications, including potholes, cracks and thin overlays, aggregate of 1/4 or 5/16-inch (6.35 or 7.94 mm) grades are recommended. For larger areas and deeper repairs, aggregate up to 1/2-inch (12.7 mm) grade may be used.
4. Smaller sized aggregate is recommended to help limit loose rock damage to vehicles.
5. Finer grade material is recommended for patching, as it will have fewer voids. Coarse grades may be used under special conditions such as base stabilization.
6. The aggregate shape is also important. Angular particles with rough surface texture, such as crushed aggregate, will produce an interlocking effect and relatively low absorption. This commonly produces the best patch.

Electrical Charge of Aggregates

The Asphalt Emulsion Manufacturers Association manual states:

1. Anionic emulsions (with a negative (-) charge on the asphalt droplets) perform best with aggregates having positive (+) surface charges, such as limestone and dolomite.
2. Cationic emulsions (with a positive (+) charge on the asphalt droplets) perform best with aggregates having negative (-) surface charges, such as siliceous or granite aggregates.

NOTE: Consider the availability of suitable liquid asphalts, and their electrical charge, before selecting aggregate.

LIQUID ASPHALT SELECTION

General Guidelines

Recommendations for liquid asphalt are given below. Laboratory evaluations are strongly recommended to determine the compatibility of given asphalt grades with an aggregate. For more information on Liquid Asphalt selection, obtain a copy of the following manual:

“A Basic Asphalt Emulsion Manual”

Manual Series No. 19 (MS-19)

from

The Asphalt Institute

Research Park Drive, P.O. Box 14052

Lexington, Ky, USA 40512-4052

Telephone: (606) 288-4960 Fax: (606) 288-4999

The selection of liquid asphalt is generally dependent on the following considerations:

1. Availability of various types of aggregate.
2. Availability of various liquid asphalt grades.
3. Climate conditions anticipated during application.
4. Traffic conditions during application.

The liquid asphalt most commonly used in the RA-300 Patcher is a rapid-set grade of emulsified asphalt. The rapid-set cationic CRS-2 or the anionic RS-2 emulsions are designed to react quickly with aggregate, forming a fast curing patch that can support traffic immediately after completion of the repair work. It is for this reason that most recommendations and directions found in this section will be directed at emulsified asphalts.

In certain climates, rapid-set emulsions may set up too quickly. Moderate-set emulsions are then recommended (MS-2 & CMS-2). It is important to note that some emulsion manufacturers have grades or mixtures that do not conform to industry standards. These materials are often tailored to local geographic conditions and may provide superior performance to the standard grades.

Section 3

OPERATION

Classifications & Grades of Liquid Asphalt

There are a number of considerations when choosing liquid asphalts. The best results can be obtained by trying several different types of asphalt and aggregates. The following classifications and grades of liquid asphalts can be applied using the air patching method:

Emulsified Asphalt

Asphalt product made fluid by emulsifying asphalt cements with water and an emulsifier. On exposure to the atmosphere, the water evaporates, leaving the asphalt cement to perform its function. The current primary uses of emulsified asphalts are surface treatments, fog seal, prime coat, cold mix patching, road mix, and tack coats.

Standard Grades of Emulsified Asphalt:

1. Anionic (negative (-) charge): RS-1, RS-2, MS-1, HFMS-1, MS-2, HFMS-2, MS-2h, HFMS-2h, HFMS-2s, SS-1, SS-1h
2. Cationic (positive (+) charge): CRS-1, CRS-2, CMS-2, CMS-2h, CSS-1, CSS-1

ATTENTION: Do not mix emulsion types, especially anionic with cationic.



Cutback Asphalt

Asphalt products made by blending asphalt cement with gasoline or naphtha for rapid cure grades, with kerosene for medium cure grades, or with non-volatile liquids such as fuel oil for slow curing grades. Upon exposure to the atmosphere, the diluents evaporate, leaving the asphalt cement to perform its function. Cold mix patching and road mix are the main uses of cutback asphalt.

WARNING: Do not use cutback asphalts in the RA-300 Patcher. These asphalt solutions are highly flammable and become explosive when pressurized.



Asphalt Cements

Basic asphalt refined from petroleum by fractional distillation. Hot mixes and surface treatments are the most common uses.

ATTENTION: Do not use asphalt cements in the RA-300 Patcher. The RA-300 Patcher is not capable of heating liquid asphalts to a high enough temperature. Highly viscous asphalts or asphalts that must be heated higher than 200° F to become thin enough to pump cannot be used in the RA-300 Patcher. These asphalts will cause problems by plugging hoses or piping and will be extremely difficult to remove. Consult the factory for clean out suggestions if such materials have been loaded into the RA-300.



LIQUID ASPHALT STORAGE & HANDLING

General Guidelines

The Asphalt Institute has published a leaflet entitled "Storing and Handling Emulsified Asphalt" (CL-21). Portions of the guidelines contained in the leaflet are listed below.

Storing Emulsified Asphalt

Store emulsified asphalts at 50° F to 185° F (10° C to 85° C), depending on the grade of emulsion and its intended use.

Use hot water as the heating medium for storage tanks with heating coils. Low pressure or waste steam may also be used, providing the temperature on the coil surface is controlled and limited to not more than 185° F (85° C).

Store emulsified asphalts at the temperature specified for the particular grade. High viscosity rapid-set spray grades are stored at 125° F to 185° F (52° C to 85° C) since they are usually applied in this temperature range.

ATTENTION: Do not heat emulsified asphalt above 185° F (85° C). Elevated temperatures evaporate the water, increasing viscosity, and producing an asphalt layer in the tank. The material can no longer be used, and it will be difficult to empty the tank.



ATTENTION: Do not allow emulsified asphalt to freeze. Freezing breaks the emulsion, separating the asphalt from the water. The result will be two layers in the tank, neither suited for the intended use, and the tank will be difficult to clean.



DO NOT allow the temperature of the heating surface to exceed 205° F (96° C). This will cause premature breakdown of the asphalt on the heating surface.

DO NOT use forced air to agitate emulsified asphalts. This action may cause the emulsion to break down.

Storage Facilities for Emulsified Asphalt

NOTE: These guidelines apply only to emulsified asphalts. Do not use cutback asphalts or asphalt cements with the RA-300 Patcher. Consult the supplier or manufacturer to determine the proper storage facilities for these asphalt materials.

Use insulated storage tanks to protect the asphalt from freezing and to provide the best utilization of heat.

A skin of asphalt can form on the surface of emulsions when they are exposed to air. For this reason, use tall vertical tanks. They will expose the least amount of the emulsion surface area to the air. Most fixed storage tanks are vertical, but horizontal tanks are often used for short-term field storage. Skinning can be reduced in horizontal tanks by keeping them full. This minimizes the area exposed to air.

Side-entering propellers located about three feet up from the tank bottom may be utilized to prevent surface skin formation. Large diameter, slow-turning propellers are best and should be used to roll the material over. Avoid over mixing.

Tanks may be circulated from top to bottom with a pump. Avoid over pumping.

In tanks not equipped with propellers or a circulating system, a very light film of kerosene or oil on the surface of the asphalt can reduce skin formation.

Cathodic protection should be provided to avoid possible corrosion of tank walls and heating coils.

HANDLING LIQUID ASPHALT

Use pumps with proper internal clearances for handling asphalt. Pumps with tight internal clearances can bind and seize.

Warm pumps to about 150° F (65° C) to ease start up. Use a mild heating method to apply heat to the pump packing or casing to free a seized pump. Do not use open flames to warm pumps.

Fill the pump with No. 1 or No. 2 fuel oil when it will be out of service, even for a short period of time, to ensure a free start up.

Flush out pump and circulating system lines and leave drain plugs open during periods when the equipment is not in service.

Protect pumps, valves, and lines from freezing in winter. Drain pumps or fill them with antifreeze according to the pump manufacturer's recommendation.

Haul liquid asphalt materials in truck transports equipped with baffle (surge) plates to prevent sloshing.

Pump with the suction line placed at the bottom of the storage tank to minimize contamination from skinning that may have formed.

Place inlet pipes and return lines at the bottom of storage tanks to prevent foaming.

Avoid repeated pumping and recycling since the viscosity may drop and air may become entrained, causing the emulsion to be unstable.

Mix emulsions by circulation prior to application if they have been in prolonged storage.

Remember that emulsions with the same grade designation can be very different chemically and in performance.

Guard against mixing different classes, types, and grades of emulsified asphalt in storage tanks, transports, and distributors. Because it is hard to visually determine the difference between various emulsified asphalts, always make a trial blend of the newly delivered emulsion with the stored emulsion before pumping off. Check the trial blend for compatibility.

Use warm water for diluting emulsified asphalts and always add the water slowly to the emulsion (not the emulsion to the water).

Check the compatibility of the water with the emulsion by testing in a flask before diluting grades of emulsified asphalt.

Section 3

OPERATION

OPERATOR CONTROLS

Your unit is equipped with a Joystick Controller mounted on a pedestal on the driver's right side. The rocker switches on the joystick control rock flow, emulsion flow, and up/down movement of the boom. The rocker switches on the pedestal control the blower, rock flow, and the beacon. These, along with other controls and indicators, are described below.

The relay panel for the Joystick Controller is located behind the passenger seat in the truck. Be sure there is a secure connection between the controller and the relay panel.

JOYSTICK CONTROLLER

By moving the Joystick (Figure 3-1, item 1) left-and-right or forward-and-back, the operator controls the side-to-side motion, and the telescoping of the boom. The Boom Up/Down switch (Figure 3-1, item 2) raises and lowers the boom by repeated brief toggles in the desired direction.

ROCK FLOW

Rock flow is controlled with two switches. The first control is the Rock On/Off switch (Figure 3-1, item 3) located on the joystick. Press and hold the switch UP to open the Rock Gate and start the rock flow. Press the switch DOWN and hold it to stop the flow and close the Rock Gate. A red light (Figure 3-2, item 3) indicates that the Rock Gate is open.

The second control is the Rock Flow +/- switch (Figure 3-1, item 4), which regulates the amount of rock flow only when the gate is open. This switch is a momentary switch. Increase or decrease the amount of rock by pressing the switch briefly in the desired direction and then releasing.

NOTE: It will take about four seconds to notice the change in increase or decrease.

When first setting the rock flow, close the gate by pressing DOWN and holding the Rock On/Off switch (Figure 3-1, item 3). Press the Rock Flow +/- switch (Figure 3-1, item 4) toward minus (-) to stop rock flow.

Open the rock gate by pressing UP and holding the Rock On/Off switch. Press the Rock Flow +/- switch toward plus (+) in small increments until the desired rock flow is reached.

EMULSION FLOW

Emulsion flow is controlled in two ways. The Emulsion On/Off switch (Figure 3-1, item 5) located on top of the joystick starts and stops the emulsion flow.

The Vernier cable, near the floor at the operator's right, regulates the emulsion flow.

Use the switch to turn the emulsion on and off. Regulate the emulsion flow by pressing the center knob and moving the cable in and out. After optimum flow is achieved, release the center knob and turn the large knob to fine-tune the flow. To stop the flow, hold the Emulsion On/Off switch to the left.

BLOWER

To start the blower, push the Blower On/Off switch (Figure 3-1, item 6) to the "I" position. The blower is at maximum capacity with engine RPM at 1000. The blower output will not increase above 1000 RPM. The PTO will disengage at 1300 RPM. To stop the blower, push the Blower On/Off switch to the "O" position.

The Air Speed Mode switch (Figure 3-1, item 7) controls the mode of operation of the blower. The turtle indicates the Patching Mode and the rabbit indicates the Blowout Mode. Regulate the speed of the blower by rotating the Air Speed Selector knob (Figure 3-2, item 6) on the Gauge Panel. Maximum blower speed is obtained in Blowout Mode.

BEACON

The amber rotating beacons above the emulsion tank and at the base of the arrowboard are activated by pushing the Beacon On/Off switch (Figure 3-1, item 8) to the "I" position. Push the switch to the "O" position to turn off the beacons.

HYDRAULIC MODE

The hydraulic pump must be engaged to run all hydraulic functions of the RA-300 Patcher. To start the pump, push the Mode Select button (Figure 3-3, item 1) on the Transmission Panel. A red light will appear on the Transmission Panel (Figure 3-3, item 2) and the Gauge Panel (Figure 3-2, item 5). Push the Mode Select button again to stop hydraulic functions.

The Hydraulic Warning light (Figure 3-2, item 1) indicates the hydraulic system is overheating. The PTO should be shut down until the problem is solved.

ARROWBOARD

Use the arrowboard to alert and redirect surrounding traffic during patching operations. The operator can select from four light configurations, depending on the demands of the job site and traffic patterns. Choose the appropriate light sequence by using Select Mode and Enter (Figure 3-5, items 2 and 3) on the Arrowboard Control Panel.

PREPARING THE MACHINE FOR PATCHING

FILLING THE SYSTEM

Aggregate Hopper

Fill the Aggregate Hopper with relatively clean aggregate. Aggregate that is too large or contains excessive fines (dust) will negatively affect the patching process. Refer to **Material Selection** earlier in this section for more information on selecting aggregate.

Use the following instructions for operating the Aggregate Hopper lid. These instructions can also be found on the decal attached to the Selector Valve housing at the right rear side of the Aggregate Hopper (see Figure 3-5).

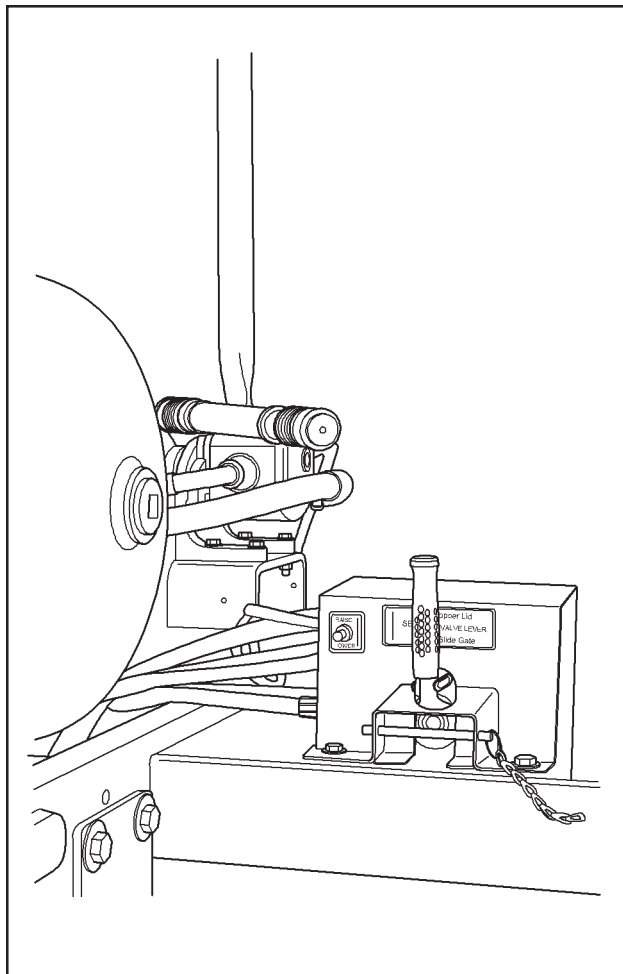


FIGURE 3-5. AGGREGATE HOPPER LID CONTROLS

To open the hopper lid (truck engine must be running):

1. Loosen the seven T-handles and remove from slots.
2. Push Selector Valve lever in. Alarm should sound.
3. Push the Raise/Lower switch up and hold until lid is fully open.
4. Shut off truck engine and brace lid open before entering the Aggregate Hopper.

To close hopper lid (truck engine must be running):

1. Push Selector Valve lever in. Alarm should sound
2. Push the Raise/Lower switch down and hold until lid is fully closed.
3. Pull Selector Valve lever out.
4. Put T-handles in slots and tighten.

Emulsion Tank

ATTENTION: The Emulsion Tank must be cleaned thoroughly before switching types of emulsion or liquid asphalt.



Close the left hand Air Regulator valve and open the Emulsion Tank Vent Valve to relieve tank pressure.

CAUTION: The Emulsion Tank Air Regulator valve (the left hand valve) is located between the Emulsion Tank and the Aggregate Hopper. Close the valve before opening the Emulsion Tank Vent Valve to relieve tank pressure prior to filling. Failure to do so can lead to loss of truck brake pressure.

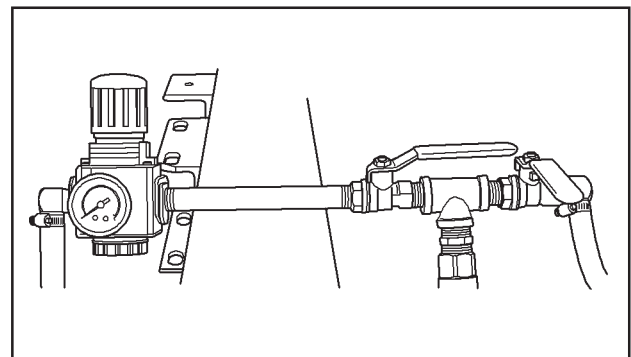


FIGURE 3-6. AIR REGULATOR VALVES

Section 3 OPERATION

DANGER: The Vent Valve lever on top of the Emulsion Tank must be opened and all pressure relieved before opening or filling the tank. Pressure gauge near the Emulsion Tank Vent Valve must read 0 (zero) PSI.

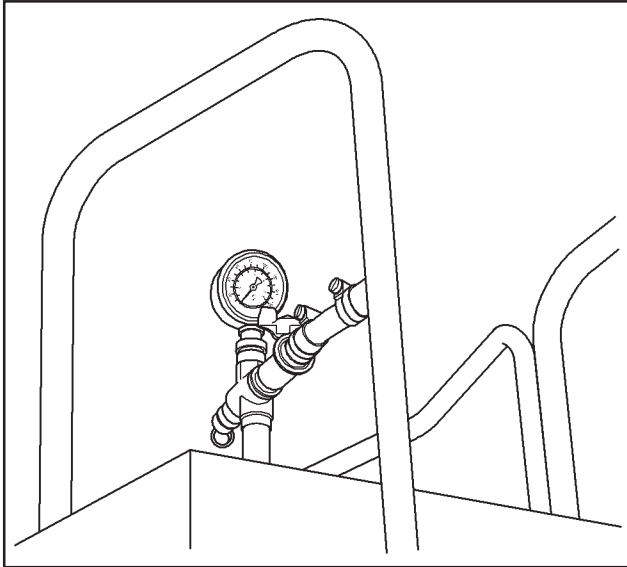


FIGURE 3-7. EMULSION TANK VENT VALVE

Fill the Emulsion Tank to the desired level with high quality liquid asphalt. Refer to **Material Selection** earlier in this section for more information on selecting emulsions or other liquid asphalts.

NOTE: Do not overfill. Leave 4 to 5 inches of space for material to expand when heated. For best results, fill the Emulsion Tank daily. This will reduce sludge build-up on the inside of the tank.

Solvent Tank

Close the right hand Air Regulator valve and open the Emulsion Tank Vent Valve to relieve tank pressure.

CAUTION: The Solvent Tank Air Regulator valve (the right hand valve) is located between the Emulsion Tank and the Aggregate Hopper. Close the valve before opening the Solvent Tank Vent Valve to relieve tank pressure prior to filling. Failure to do so can lead to loss of truck brake pressure.



DANGER: The Vent Valve lever on top of the Solvent Tank must be opened and all pressure relieved before opening or filling the tank. Pressure gauge near the Solvent Tank Vent Valve must read 0 (zero) PSI.



NOTE: The Solvent Tank Vent Valve lever must be closed, as shown below, to pressurize the Solvent Tank. This interferes with the tank fill cap, so it cannot be opened when the tank is pressurized. Open the Vent Valve lever to relieve pressure before opening the tank or filling the tank.

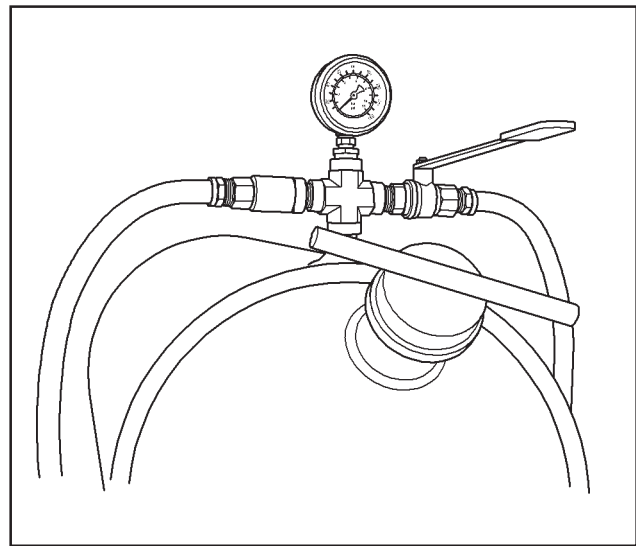


FIGURE 3-8. SOLVENT TANK VENT VALVE

Fill the Solvent Tank, located at the rear of the Aggregate Hopper, with solvent. Keep the Solvent Tank full so that the lines can be cleaned at any time.

CAUTION: After flushing the system, close the Air Regulator valves and move the Solvent Tank lever to the open position to relieve tank pressure. Some solvents are flammable and could explode or ignite if the tank is punctured while pressurized.



Be sure Vent Valves on the Emulsion Tank and the Solvent Tank, and the Air Regulator valves are set back to their normal open positions. Also, open both asphalt supply valves at the discharge nozzle.

Pressurize the Emulsion Tank and Solvent Tank by opening the Air Regulator valves. The gauge should read 60 PSI when tanks are fully pressurized.

HEATING THE ASPHALT

The RA-300 Patcher is equipped to heat liquid asphalt by using ordinary 120 volt AC household current. The temperature of the asphalt can then be maintained in the field using heat generated from the engine's cooling system.

Spraying Temperatures

The highest temperature used for spraying should be that at which no fogging occurs when the asphalt material leaves the discharge nozzle.

Refer to Table 3-4 and determine the proper application temperature for the grade of asphalt being used. Set the thermostat control to this temperature before continuing.

WARNING: Do not exceed recommended asphalt spraying temperatures. Serious personal injury may result.



TABLE 3-5. ASPHALT SPRAYING TEMPERATURES

EMULSIFIED ASPHALTS		
Type & Grade	Fahrenheit	Celsius
RS-1	70° to 140°	21° to 60°
RS-2	125° to 185°	52° to 85°
MS-1	70° to 160°	21° to 71°
MS-2	70° to 160°	21° to 71°
MS-2h	70° to 160°	21° to 71°
HFMS-1	70° to 160°	21° to 71°
HFMS-2	70° to 160°	21° to 71°
HFMS-2h	70° to 160°	21° to 71°
SS-1	70° to 160°	21° to 71°
SS-1h	70° to 160°	21° to 71°
CRS-1	125° to 180°	52° to 82°
CRS-2	125° to 180°	52° to 82°
CMS-2	70° to 160°	21° to 71°
CMS-2h	70° to 160°	21° to 71°
CSS-1	70° to 160°	21° to 71°
CSS-1h	70° to 160°	21° to 71°

Electric Heating System

The material in the Emulsion Tank is heated by two electric AC elements immersed in the engine system coolant, one at either side of the tank.

The temperature control is located under a panel on the driver's side of the Emulsion Tank under an access door (see Figure 3-9).

To set the temperature control, use a small screwdriver to move the control pointer to the desired temperature. The temperature control indicates degrees Fahrenheit on a standard unit.

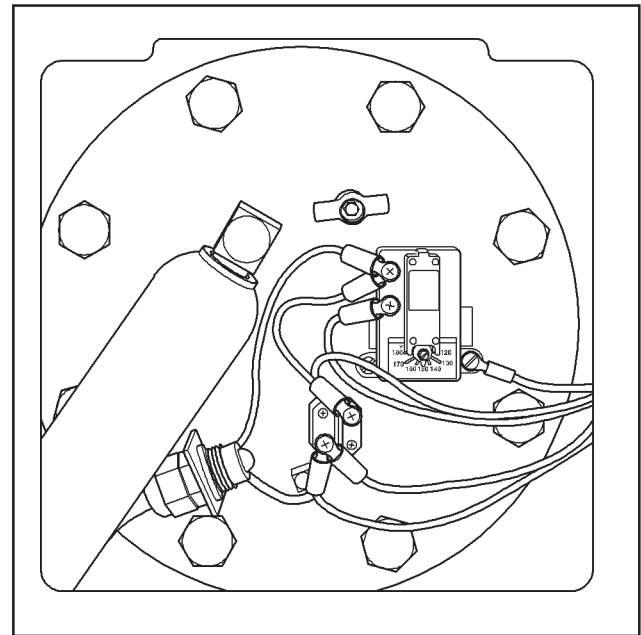


FIGURE 3-9. ELECTRIC HEATING TEMPERATURE CONTROLS

An element indicator light, located on the side of the Emulsion Tank, will come on during the heating cycle, and extinguish when the set temperature is reached. The electrical plug can be connected to a standard 120 volt minimum 20 amp AC outlet.

DANGER: When using the electrical heating system, use a plug protected by a Ground Fault Interrupt (GFI) circuit.



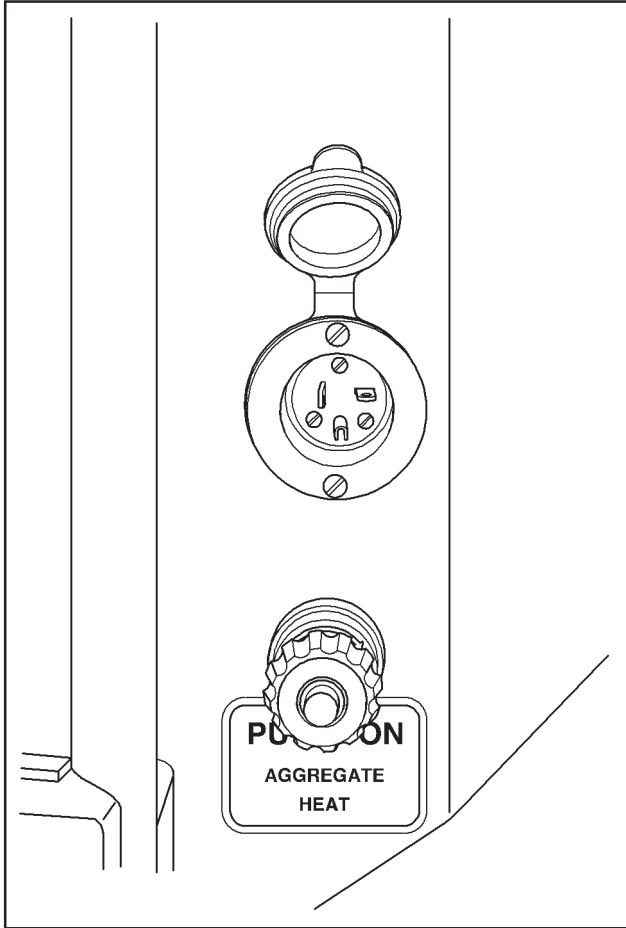


FIGURE 3-10. HEATING ELEMENT INDICATOR LIGHT AND OUTLET

Normally, the heater elements are adequate for heating the asphalt. In cold weather, the asphalt will warm more quickly if the machine is parked inside a warm building. Refer to **Patching In Cold Climate**, later in this section, for more information.

ADJUSTING THE ROCK GATE

A micro switch controls the traveling distance of the Rock Gate cylinder, which in turn, controls the maximum opening of the Rock Gate. Depending on the size of aggregate being used, this micro switch can be moved forward or back in the mounting bracket (Figure 3-11).

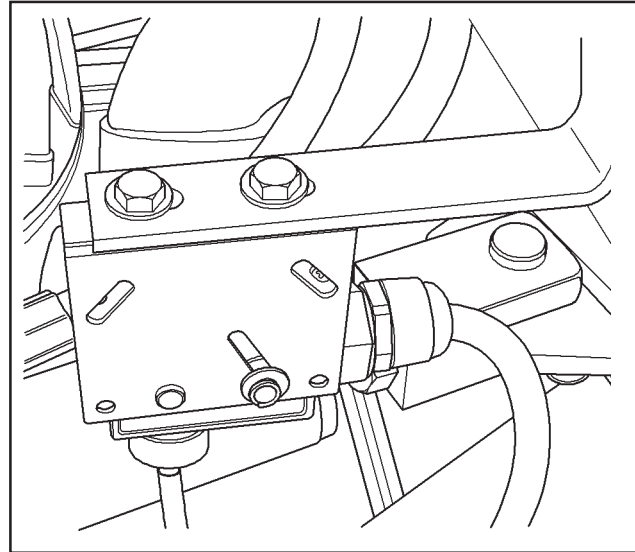


FIGURE 3-11. ROCK GATE CYLINDER AND MICRO SWITCH

This sets the Rock Gate opening to the desired flow based on aggregate size. The gate will return to the same position when it is opened with the Rock On/Off switch (Figure 3-1, item 3) during future operations.

After the gate is opened with the Rock On/Off switch, control of the rock flow is managed with the Rock Flow +/- switch (Figure 3-1, item 4).

PATCHING INSTRUCTIONS

THEORY OF OPERATION

The RA-300 Patcher provides an alternative to conventional methods of pothole patching. By understanding its operation, owners and operators can ensure successful asphalt patching for potholes, highway cracks, bridge approaches, eroded areas, parking lots and many other applications.

Four Basic Steps of Patching with the RA-300 Patcher

Clean

The telescoping discharge boom is placed over the pothole or patch area. Dust, dirt, water and debris are removed with high velocity air provided by the blower.

Tack

Liquid asphalt is blown into the clean hole, lining the sides, filling cracks and fissures, and providing “glue” for the patch material. All edges are sealed to produce a seamless patch.

Fill and Compact

Aggregate is coated with liquid asphalt in the mixing chamber and simultaneously blown at high velocity into the hole, compacting the patch from the bottom up. This action provides a dense and durable patch.

NOTE: Do not crown the mix. This will result in a hump that will not compact out.

Dust Coat

A protective “dust coat” of aggregate is applied to the patch area. This completes the process and traffic can immediately drive over the patch without damage to it or to passing vehicles.

GENERAL PREPARATION

Empty the solvent from the emulsion line at the beginning of each day.

ATTENTION: This should be done as close to the job site as possible to prevent set-up of new asphalt in the nozzle.



Move the 3-way Valve on the Emulsion Tank to EMULSION (Figure 3-12) and the Blower On/Off switch (Figure 3-1, item 6) to “O”. Place the waste catch bucket under the nozzle and be sure that both asphalt supply valves at the discharge nozzle are open.

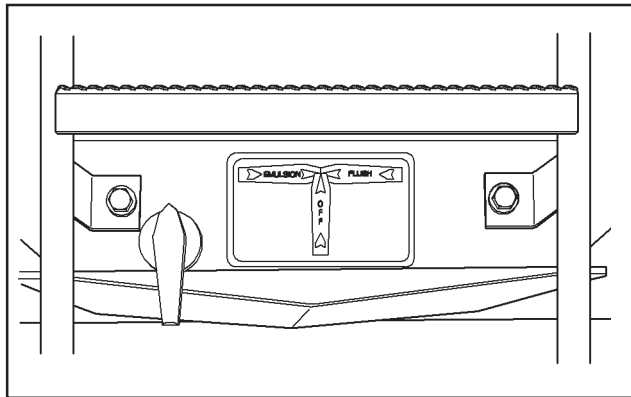


FIGURE 3-12. 3-WAY VALVE

Turn the Emulsion On/Off switch (Figure 3-1, item 5) ON. When all solvent is removed and liquid asphalt begins to flow from the nozzle, press the Emulsion On/Off switch OFF to stop the flow.

Cover the waste catch bucket and store it in the bracket on driver's side of the truck. If you must travel to the job site, cap the discharge nozzle, move the boom to the travel position, and lock the boom in the upright position, using the clevis pins at the boom cylinder and the boom pivot (see Figure 3-13).

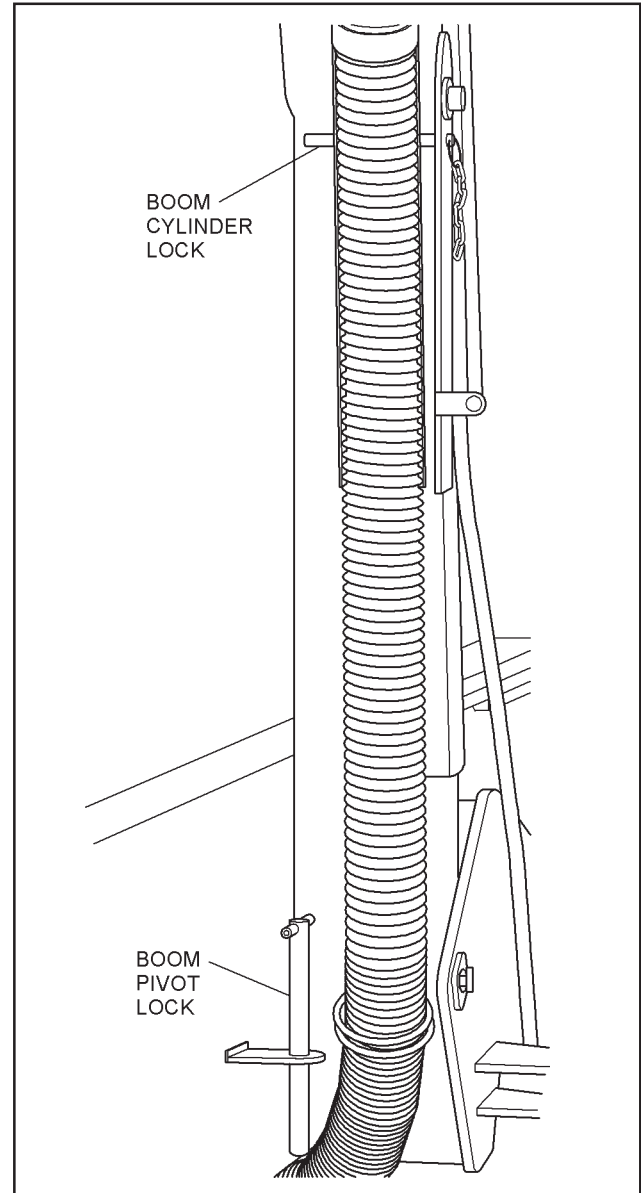


FIGURE 3-13. BOOM TRAVEL LOCK PINS

PREPARING TO PATCH

1. Position the truck behind the pothole or patch area.
2. Turn on the beacon (Figure 3-1, item 8) and the lighted arrowboard to warn traffic.
3. Set the truck emergency brake and put truck transmission in neutral.

Section 3 OPERATION

- Engage the PTO. Engage the hydraulic drive by pressing the Mode Select button (Figure 3-3, item 1) on the Transmission Panel. The PTO Lights on the Gauge Panel (Figure 3-2, item 5) and the Transmission Panel (Figure 3-3, item 2) will light up when it is engaged.

NOTE: You may need to put the transmission in drive with the brakes locked to stop the spinning of the gears before engaging the PTO. Put the transmission back in neutral before the PTO is engaged.

- Unlock the boom travel lock (Figure 3-13) and lower the discharge boom. Using the Boom Up/Down switch (Figure 3-1, item 2) and the Joystick, bring the discharge boom and nozzle down so that the nozzle is directly over the pothole at 12 to 14 inches (30.5 to 35.5 cm). Remove the nozzle cap. Check that both asphalt supply valves at the discharge nozzle are open.

ATTENTION: To avoid damage to the truck, lower the boom before swinging the boom in either direction.



- Set the engine RPM at 1000. Be sure the transmission is in neutral and the emergency brake is set. Raise the RPM to the desired level and lock it by pressing the Auto Cruise button on the left side of the truck's dash panel.

CLEANING OUT THE HOLE

- Start the blower by pressing the Blower On/Off switch (Figure 3-1, item 6) to the "1" position. Move the Air Speed Mode switch (Figure 3-1, item 7) to the Blowout position ("rabbit"). Engage the PTO as instructed in step 4, above.
- Clean out the hole using the Joystick to move the nozzle around the entire pothole and an area 4 to 6 inches (10.2 to 15.2 cm) surrounding the pothole edge.
- Try to remove all freestanding water from the hole. If there is water in the hole, extra emulsion is needed to ensure the oil is not diluted.

TACK COATING THE HOLE

- Raise the discharge nozzle to a patching height of 24 to 48 inches (61 to 122 cm) above the hole by pushing the Boom Up/Down switch (Figure 3-1, item 2) in the UP direction. Move the Air Speed Mode switch (Figure 3-1, item 7) to the Patch position ("turtle") and adjust the speed with the Air Speed Selector knob (Figure 3-2, item 6).
- Turn the Emulsion On/Off switch (Figure 3-1, item 5) ON. Regulate the emulsion flow using the knob on the Vernier cable, located at the operator's right, near the floor. While holding the center button down, push and pull the cable to adjust the flow. Release the center button and fine-tune the flow by turning the knob. Begin spraying the edges, sides and bottom of the pothole using the Joystick.
- The liquid asphalt should be carried out of the nozzle in a mist. If excessive dribbling occurs, try one or more of the following:
 - Slightly increase the truck engine speed (blower speed) for more airflow.
 - Check that both asphalt supply valves at the discharge nozzle are completely open.
 - Slightly close the Emulsion On/Off switch (Figure 3-1, item 5), or in some cases, open it more. Dribbling may occur because of too much asphalt spray or not enough asphalt spray to properly mix with the air stream.
 - Clean the emulsion spray nozzles (inside the discharge nozzle). Clean the nozzles by flushing with solvent, applying hot air to their exterior, or using a pick to unplug them. You can also close one nozzle, which will build pressure on the other side and force the material out. Repeat for the other side.
 - Replace the emulsion spray nozzles.
 - Increase air pressure at the Air Regulator valves (see Figure 3-6). This increases discharge pressure in the emulsion tank and at the spray nozzles.

NOTE: Air pressure is set at 65 PSI at the factory.

- Increase the liquid asphalt material temperature.

NOTE: The Blower speed and Emulsion Tank pressure should be set as low as possible, but yet high enough to produce good asphalt spray coverage.

FILLING THE HOLE

1. After the hole is tacked, push the Rock On/Off switch (Figure 3-1, item 3) UP to open the Rock Gate and start the aggregate delivery. Do this while the Emulsion On/Off switch (Figure 3-1, item 5) is ON so that liquid asphalt coats the aggregate as it emerges from the nozzle.

NOTE: There is a delay of three to four seconds in aggregate flow to the nozzle, so the Rock On/Off switch (Figure 3-1, item 3) should be activated in advance of need.

NOTE: Aggregate may become clogged at the Rock Gate or along the walls of the hopper. If this occurs, loosen the aggregate with the intermittent Vibrator switch, located in the center console at the driver's right side.

2. Adjust the rock flow with the Rock Flow +/- switch (Figure 3-1, item 4). Refer to **Operator Controls** in this section, for more information on adjusting rock flow.
3. To insure an even patch, move the nozzle around the damaged area while repairing the pothole. A proper asphalt/aggregate mixture can be maintained by brief toggles to the Emulsion On/Off switch (Figure 3-1, item 5).
4. Using the Vernier cable and the Emulsion On/Off switch (Figure 3-1, item 5), adjust the flow so that only a slight covering of asphalt is applied to the aggregate.

NOTE: The normal tendency is to apply too much asphalt, which causes slowed curing rates and is a waste of materials. The final appearance should be a darkly mottled or heavily speckled patch, but not quite entirely black.

5. The patch is compacted by the force of the material's impact as it is applied. Refer to **Theory Of Operation** in this section, for more information. No other compaction is necessary, however, compaction won't hurt this type of patch. Compaction will provide a more finished appearance, and should be done after applying a dust coat to the patch.

DUST COATING THE PATCH

1. Turn the Emulsion On/Off switch (Figure 3-1, item 5) OFF.
2. Elevate the discharge nozzle slightly, and lightly cover the patch with dry aggregate. The dust coat helps prevent the tires of passing vehicles from picking up asphalt.
3. Push the Rock On/Off switch (Figure 3-1, item 3) OFF (down) to stop the flow of aggregate.
4. Raise the discharge boom to travel position or near vertical position.

NOTE: Some dribbling from the nozzle occurs which may get on the truck cab. Cap the discharge nozzle if traveling a long distance or traveling at highway speeds.

5. Slow the truck engine speed and/or depress the clutch and turn off the PTO by pressing the Mode Select button (Figure 3-3, item 1) and pushing the Blower On/Off switch (Figure 3-1, item 6) to "O".
6. Drive the Patcher slowly at low engine RPM to the next hole.

SPECIAL TIPS

Each operator develops certain techniques that work for his/her individual needs. The following suggestions may be helpful in establishing your technique.

1. Fill large shallow holes from the furthest point out and work towards the machine in semi-circular arcs.
2. Fill large deep holes by filling the deepest point of the hole first and then working outwards, building a slight ledge or shelf upon which to build successive layers.
3. If you find the surface of the patch is uneven, try one of the following solutions to correct the problem:
 - a. Raise the boom a little higher.
 - b. Increase the air speed (Figure 3-2, item 6).
 - c. Slightly decrease the rock flow.
4. If you encounter excessive rock bounce, reduce blower speed and/or raise the discharge nozzle away from the surface of the patch. More asphalt may also be needed to help the material stick together and to the patch.

Section 3 OPERATION

5. Poor aggregate coating may be caused by several things: the rate of the aggregate flow may be too fast (near or above 150 lbs/min); the emulsion pressure may be set too high; the aggregate is too large; the aggregate is damp and does not coat well.

To correct these problems: slow the aggregate flow and keep the nozzle moving; reduce the emulsion air pressure at the Air Regulator valves; use smaller aggregate; do not store the aggregate overnight in the hopper where it can collect condensation.

6. Do not overfill the pothole. The natural tendency is to fill the pothole slightly above level to allow for traffic compaction. This is not necessary. The pothole should be filled flush to the existing road surface. Extra fill will create a rough spot in the road surface.

PATCHING IN COLD CLIMATE

The RA-300 Patcher is designed for normal operation at temperatures of 40° F (4° C) or higher. The machine can be used successfully at colder temperatures with special considerations to the following items:

Freezing Aggregate

The operator may need to park the machine inside a warm building to prevent the aggregate from freezing.

Emulsion Types

Special emulsions may be needed for operation below freezing.

Patch Quality

Patches made below freezing are subject to conditions that lower the quality of the patch. Some conditions include ice in the pothole, freezing of the emulsion before it breaks, cooling of the emulsion, and operator experience.

The RA-300 has made patches at temperatures as low as -15° F (-26° C). The life of these patches, on average, is less than those made at 40° F (4° C) and above, but compares well to other patching techniques.

RA-300 PATCH-ON-THE-GO

Some customers want to use the RA-300 Patcher to patch long cracks up the pavement while creeping ahead slowly. This requires a hydraulic system that acts independently of the truck engine RPM. To accomplish this, the hydraulic system is powered one of two ways:

1. Hydraulic Patch-On-The-Go is the result of a modified hydraulic system that allows the air blower to operate at a high RPM when the truck engine is at low RPM. A large hydraulic pump and modified PTO were incorporated which gives enough air flow to blow out the patch when the truck engine is at low RPM. An electrically controlled hydraulic flow control valve (Figure 3-2, item 6) holds the blower speed constant and independent of the truck engine RPM.
2. The optional Auxiliary Engine is a separate engine that powers the hydraulic system independently of the truck engine. The patching procedure is the same as the standard machine with the added ability to control the auxiliary engine RPM during blow-out of the hole.

To operate the Patch-On-The-Go, use the Air Speed Selector knob (Figure 3-2, item 6) to set the air for optimum movement of the aggregate being used. Once set, this is not changed until a different size rock is used. To get more air to blow out the hole, move the Air Speed Mode switch (Figure 3-1, item 7) to the Blowout position (“rabbit”). For coating the inside of the hole and patching, move the switch back to the Patch position (“turtle”).

Because the pump on the machine is so large, it would produce too much hydraulic flow and hydraulic heat at higher engine RPMs. The PTO disengages at 1300 RPM and will reengage at 900 RPM. Therefore, all patching should be done at engine speeds around 1100 RPM.

HYDRAULIC PATCH-ON-THE-GO (POG)

General Information

This feature allows for patching cracks and/or shoulders while the machine is moving. The same steps outlined in **Patching Instructions** should be followed to obtain a good and long lasting patch. The Patch-On-The-Go system is designed to operate when the truck is idling. The PTO will disengage at engine RPM above 1300.

Preparing To Patch

1. Place Air Speed Mode switch (Figure 3-1, item 7) in the Patch position (“turtle”).
2. Place Blower On/Off switch (Figure 3-1, item 6) in “1” position. This provides power for the blower operation.
3. Set the air speed of the blower by adjusting the Air Speed Selector knob (Figure 3-2, item 6).

Patching-On-The-Go

1. Blow out the patch area by moving the Air Speed Mode switch (Figure 3-1, item 7) to the Blowout position (“rabbit”). This provides maximum airflow to clean excessive material and/or moisture from the area.
2. Reverse your direction and change the Air Speed Mode switch to the Patch position (“turtle”) and apply your emulsion to the area.
3. Move forward and spray the area with a mixture of aggregate and emulsion to fill the patch area.
4. Reverse your direction and apply a cover coat of aggregate. This should complete your patching application.

NOTE: See previous pages for more detail on these four steps.

AUXILIARY ENGINE PATCH-ON-THE-GO

Starting the Auxiliary Engine

1. Turn the key clockwise on the engine control panel.
2. Make sure that the engine speed control is turned all the way to the left.
3. Turn the key to the “1” position and pilot light will come on.
4. Push key in and turn further clockwise against spring pressure.
 - a. Position 2: no function
 - b. Position 3: start
5. Turn the key to the “start” position and begin the crank cycle.

6. The engine should begin to turn over and should run on its own. Pilot light will go out.

NOTE: The engine is equipped with a self-priming fuel pump. It may need to crank several times to fill the fuel lines.

7. Once the engine begins to run, move the knob (potentiometer) to increase the speed of the engine.

Determining Engine Speed for Patching

1. Set engine RPM to approximately 1500 (potentiometer knob in 9 o'clock position).
2. Adjust the Rock On/Off switch and/or the engine RPM to get the desired rate of rock flow. Take note of the knob position. Watch the air pressure gauge. It should be 2 to 4 PSI. Above 4 PSI will plug the rock hose. Do not go over 5 PSI.
3. Return the engine to idle.

Patching with the Auxiliary Engine

NOTE: Refer to Patching Instructions earlier in this section for a more detailed explanation of the patching procedure.

1. To blow water and loose material from the hole, increase engine RPM to approximately 2000 (potentiometer knob in 12 o'clock position). Be sure Rock On/Off switch is OFF and Blower On/Off switch is in the “1” position.
2. After the hole is cleaned out, move potentiometer knob to the position determined in step 2 of **Determining Engine Speed for Patching.**
3. Lower the engine RPM and proceed with tack coating and filling the hole.
4. Dust coat the patch with dry rock. When this is completed, return the potentiometer knob to the idle position.
5. Move to the next hole and repeat process.

Section 3

OPERATION


CLEANING THE SYSTEM

When stopping the patching operation for any extended period of time (10 to 20 minutes), it is advisable to clean out the asphalt delivery system.

CLEANING THE ASPHALT LINES

1. Turn the 3-way Valve (Figure 3-12) on the Emulsion Tank to the Flush position.
2. Position the waste catch bucket below the discharge boom nozzle.
3. Turn the Emulsion On/Off switch (Figure 3-1, item 5) ON to start the solvent circulating through the system.
4. Turn the Emulsion On/Off switch OFF when solvent begins to spray from the nozzle instead of liquid asphalt.
5. Close both asphalt supply valves on the discharge nozzle.
6. Reopen one nozzle and then the other to assure that solvent flows from each nozzle and each one is clean.
7. Cap the discharge nozzle.
8. Cover the waste catch bucket and store it in the holder on the left side of the truck.
9. Dispose of waste asphalt/emulsion properly at the end of each workday.

NOTE: In some cases waste material can be added back into the Emulsion Tank.


DANGER:  The Vent Valve lever on top of the solvent tank must be opened and all pressure relieved before opening or filling the tank. The pressure gauge near the Vent Valve must read 0 (zero) PSI.

CLEANING THE AGGREGATE HOPPER

1. Be sure the Rock Gate is closed before starting to clean the hopper.
2. Remove the cover on the bottom of the Aggregate Hopper and clean out all accumulated fines and rock.
3. Replace the door.
4. Use a high-pressure water system to flush the hopper and gate opening.
5. When water flushing is complete, turn on the blower to remove any water and debris from the system.

COMBATING POOR VISIBILITY

Increasingly, asphalt maintenance equipment is being used during less than ideal light conditions such as fog, smog and at night. Using the equipment during these and similar conditions presents safety hazards to workers, bystanders and passing traffic. People can be injured or killed by the equipment, passing traffic, driving into ditches, holes, other obstructions, or down embankments.


WARNING:  When operating the machine under restricted light conditions, equip the unit with special lighting. This will help prevent serious injury and death, and prevent damage to the machine and property.

To help combat these hazards, the Patcher must be equipped with front and rear lighting options, back-up lights, and shielded rotating beacons. The shielding prevents eyestrain for the operator, which can hamper vision.


Use reflective tape on the sides of all machines that may be used at night. Be sure all personnel wear reflective vests. Use impact barriers (movable or stationary) to protect the workers from traffic and to direct the traffic flow away from road hazards.

TOWING AND TRANSPORT


PREPARING THE MACHINE FOR TRAILER TRANSPORT

WARNING:  When transporting the Patcher on a trailer, use a trailer that is large and heavy enough to handle the Patcher in all driving situations.

1. Clean the machine using a pressure washer. Remove all loose gravel, mud or debris from wheels and frame.
2. Empty the Aggregate Hopper, Emulsion Tank, and Solvent Tank.

ATTENTION:  Use a step-trailer to transport the RA-300 Patcher. Use the raised deck to support the lowered boom. Do not transport the Patcher with the boom raised. The combined height of the trailer and Patcher with raised boom exceeds restrictions.

3. Make sure the combined height of the truck, trailer and loaded Patcher meet height restrictions for the local area, including bridges, overpasses, and overhead obstructions.
4. Park the transfer vehicle or trailer on a level surface with transmission in park and engine off.
5. Engage the transfer vehicle's emergency brake and use wheel chocks in both directions.
6. Use a ramp or loading dock. Make sure the ramp weight capacity will support the machine and has a low angle of rise to the trailer bed.

WARNING:  **Be sure loading dock and trailer are the same height. Do not bounce the Patcher or force the Patcher to climb over edge. This could cause the Patcher to slide off or damage the machine.**

7. Load the machine on the trailer bed by driving straight on, centered on the trailer. The Patcher centerline must be over the centerline of the trailer.

NOTE: **The Patcher should be positioned to insure even distribution of load between trailer axles and trailer hitch.**

8. Block Patcher tires to prevent Patcher from moving forward or backward.
9. Lower the boom and secure it to the raised deck of the step-trailer.
10. Place transmission in park.
11. Place ignition switch in the OFF position and remove the key.
12. Secure the Patcher to the trailer using chains rated in excess of Patcher weight.
13. Cover the exhaust opening with heavy gauge plastic to prevent dust and moisture from entering the engine.

NOTE: **Remove the plastic cover from the exhaust before operating the machine.**

Section 3 OPERATION



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GENERAL INFORMATION

This section gives the necessary procedures for routine and general maintenance on the RA-300 Patcher. Before starting any Maintenance program on the machine, it is important to READ, UNDERSTAND, and FOLLOW all Maintenance instructions, Danger, Warning, and Caution messages in this section, as well as all Safety information contained in Section 1 of this manual.

DANGER:  Failure to observe the Maintenance instructions, Danger, Warning, and Caution messages in this manual can cause serious injury or death.

NOTE: By following a careful service and maintenance program for your machine, you will insure many years of trouble free operation.

PROPERLY MAINTAINED EQUIPMENT IS SAFE EQUIPMENT! The user of this product is responsible for inspecting the machine daily, and for having parts replaced or repaired when continued use would cause damage or excessive wear to other parts. General daily inspection of the machine should include inspection for missing guards, loose bolts, fluid leaks, worn or damaged hoses and debris or dirt accumulations which could cause a potential service or safety problem.

ROUTINE MAINTENANCE

GENERAL INFORMATION

Maintenance must be a planned program that includes periodic machine inspection and lubrication procedures.

The maintenance program must be done based on the machine's "Operating Hours" recorded on the hour meter, or on a "Periodic Schedule" which is done at daily, weekly, monthly or yearly intervals.


ATTENTION:  When performing any routine maintenance such as 50, 100, 250, 500, or 1000 hours, always include previous routine maintenance hours to the higher hourly schedule.

Table 4-1, Maintenance Interval Chart, lists recommended maintenance procedures and time intervals between machine maintenance inspections and lubrication procedures. Tables 4-2 through 4-5 list recommended torque values for fittings and fasteners commonly used on this machine.

MACHINE LUBRICATION

Proper lubrication is necessary to maintain the machine at top efficiency. Refer to the lubrication information in Table 4-1, Maintenance Interval Chart. All lubrication points are shown in Figure 4-1.

Section 4 MAINTENANCE



TABLE 4-1. MAINTENANCE INTERVAL CHART *

8 HOURS or DAILY		
Air Blower Oil Level	Check	AEON Blower Lubricant (P/N 90600)
Air Blower Filter Element	Check	P/N 36531-1
Hydraulic Oil	Check	Citgo A/W All-Temp VG32
Hydraulic Filters		
Return Filter	Check	P/N 72543
Charge Filter	Check	P/N 37680
Discharge Hose	Check	P/N 36353
50 HOURS or WEEKLY		
Hose Fittings	Check	Tighten as necessary
FIRST 100 HOURS		
Hydraulic Oil	Replace	Citgo A/W All-Temp VG32
Hydraulic Filters		
Return	Replace	P/N 72543
Charge	Replace	P/N 37680
Hydraulic Strainer	Clean	P/N 33148 In-Tank
100 HOURS or MONTHLY		
Air Blower Filter Element	Replace	P/N 36531-1 Dry Type
Air Blower Drive Shaft **	Lubricate	No. 2 Non-Corrosive Grease
Discharge Hose	Adjust/Rotate	P/N 36353
Boom Pivot Point Grease Zerks	Lubricate	Multi-Service Grease
Hydraulic Lift Cyl., each end (item 1)		
Hydraulic Swing Cyl., each end (item 2)		
Main Pivot Point (item 3)		
Hose Retractor Wheel (item 4)		
Boom Cylinder End, each side (item 5)		
500 HOURS or SEMI-ANNUALLY		
Air Blower Oil	Replace	AEON Blower Lubricant (P/N 90600)
Air Blower Filter Element	Replace	P/N 36531-1
Air Blower Bearings **	Lubricate	No. 2 Non-Corrosive Grease
Hydraulic Oil	Replace	Citgo A/W All-Temp VG32
Hydraulic Filters		
Return	Replace	P/N 72543
Charge	Replace	P/N 37680
Hydraulic Strainer	Replace	P/N 33148 In-Tank
Discharge Hose	Replace	P/N 36353

* Refer to truck manufacturer's manual for additional information.

** Refer to Figure 4-8, and air blower manuals at end of this section.

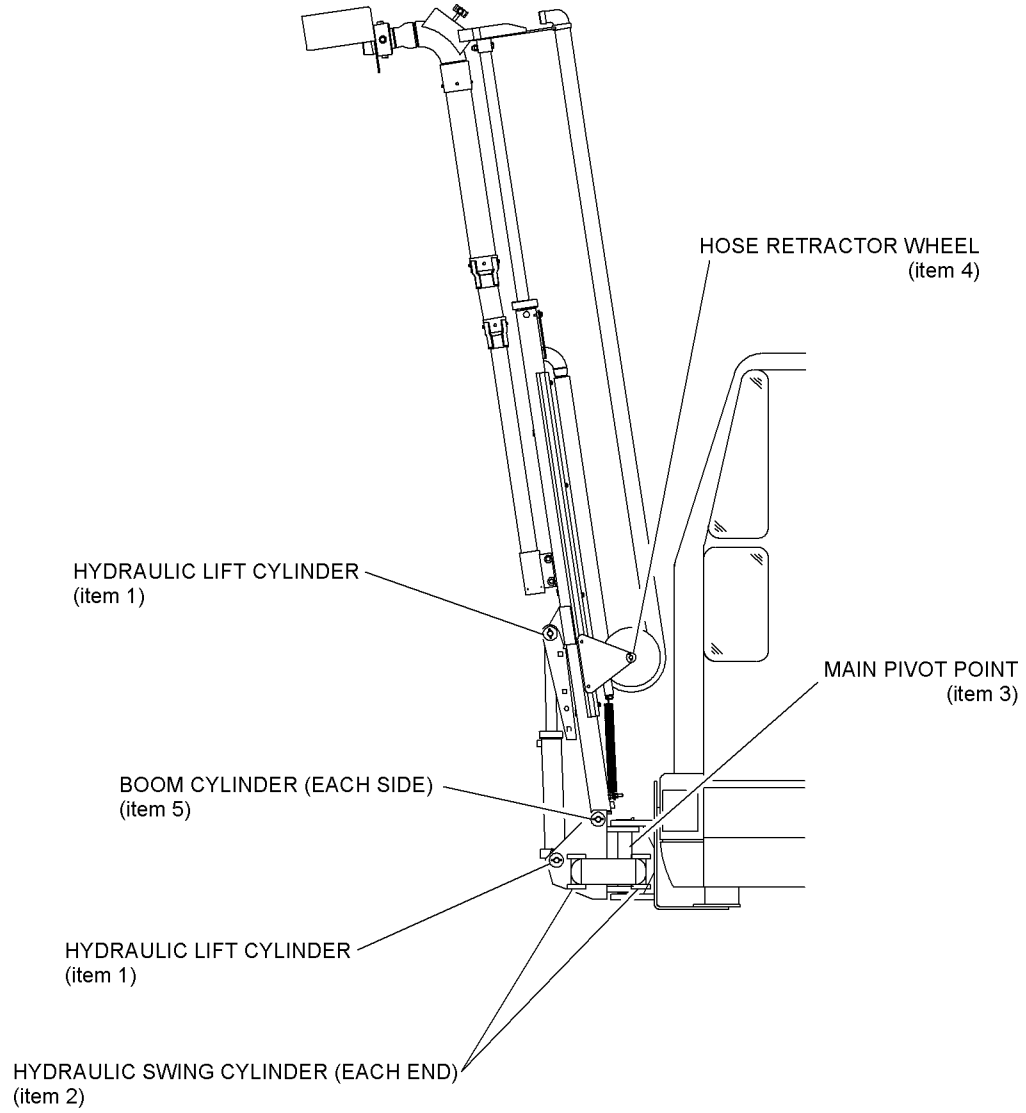


FIGURE 4-1. LUBRICATION POINTS

Section 4 MAINTENANCE



TIGHTENING FLARE TYPE TUBE FITTINGS

1. Check the flare and flare seat for defects that might cause leakage.
2. Align tube with fitting before tightening.
3. Lubricate connection and hand tighten swivel nut until snug.
4. To prevent twisting the tube(s), use two wrenches. Place one wrench on the connector body and with the second, tighten the swivel nut to the torque shown in Table 4-2.

TABLE 4-2. TORQUE SPECIFICATIONS FOR HYDRAULIC FITTINGS - FLARE TYPE TUBE

Tube Size OD	Nut Size Across Flats	Torque Value		Recommended Turns to Tighten (After Finger Tightening)	
		(N•m)	(lb-ft)	(Flats)	(Turns)
(in)	(in)				
3/16	7/16	8	6	1	1/6
1/4	9/16	12	9	1	1/6
5/16	5/8	16	12	1	1/6
3/8	11/16	24	18	1	1/6
1/2	7/8	46	34	1	1/6
5/8	1	62	46	1	1/6
3/4	1 1/4	102	75	3/4	1/8
7/8	1 3/8	122	90	3/4	1/8

TIGHTENING O-RING FITTINGS

1. Inspect O-ring and seat for dirt or obvious defects.
2. On angle fittings, back the lock nut off until washer bottoms out at top of groove.
3. Hand tighten fitting until back-up washer or washer face (if straight fitting) bottoms on face and O-ring is seated.
4. Position angle fittings by unscrewing no more than one turn.
5. Tighten straight fittings to torque shown in Table 4-3.
6. Tighten while holding body of fitting with a wrench.

TABLE 4-3. TORQUE SPECIFICATIONS FOR HYDRAULIC FITTINGS - O-RING TYPE

Tube Size OD	Nut Size Across Flats	Torque Value		Recommended Turns to Tighten (After Finger Tightening)	
		(N•m)	(lb-ft)	(Flats)	(Turns)
3/8	1/2	8	6	2	1/3
7/16	9/16	12	9	2	1/3
1/2	5/8	16	12	2	1/3
9/16	11/16	24	18	2	1/3
3/4	7/8	46	34	2	1/3
7/8	1	62	46	1 1/2	1/4
1 1/16	1 1/4	102	75	1	1/6
1 3/16	1 3/8	122	90	1	1/6
1 5/16	1 1/2	142	105	3/4	1/8
1 5/8	1 7/8	190	140	3/4	1/8
1 7/8	2 1/8	217	160	1/2	1/12

Section 4 MAINTENANCE

The following table gives the correct torque values for standard fasteners and is intended as a guide for average applications involving typical stresses and machined surfaces. Values are based on physical limitations of clean, plated and lubricated hardware. Check tightness of bolts periodically, using this table as a guide. When using locking fastener, increase torque values by 5%.

CAUTION: Always replace original equipment with hardware of equal grade. When an individual torque value is specified, it should be followed instead of values given in this table.



TABLE 4-4. TORQUE SPECIFICATIONS FOR STANDARD INCH FASTENERS

SIZE	THREAD	CAPSCREWS: SAE GRADE 5				CAPSCREWS: SAE GRADE 8			
		TORQUE FT. LB.		TORQUE N•m		TORQUE FT. LB.		TORQUE N•m	
		Dry	Lubed	Dry	Lubed	Dry	Lubed	Dry	Lubed
1/4	20 UNC	8	6	11	9	12	9	16	12
	28 UNF	10	7	13	10	14	10	19	14
5/16	18 UNC	17	13	24	18	25	18	33	25
	24 UNF	19	14	26	20	27	20	37	28
3/8	16 UNC	31	23	42	31	44	33	59	44
	24 UNF	35	26	47	36	49	37	67	50
7/16	14 UNC	49	37	67	50	70	52	95	71
	20 UNF	55	41	75	56	78	58	105	79
1/2	13 UNC	75	57	100	77	105	80	145	110
	20 UNF	85	64	115	86	120	90	165	120
9/16	12 UNC	110	82	145	110	155	115	210	155
	18 UNF	120	91	165	125	170	130	230	175
5/8	11 UNC	150	115	205	155	210	160	285	215
	18 UNF	170	130	230	175	240	180	325	245
3/4	10 UNC	265	200	360	270	375	280	510	380
	16 UNF	295	225	405	300	420	315	570	425
7/8	9 UNC	430	320	580	435	605	455	820	615
	14 UNF	475	355	640	480	670	500	905	680
1	8 UNC	645	485	875	655	910	680	1230	925
	14 UNF	720	540	980	735	1020	765	1380	1040
1-1/8	7 UNC	795	595	1080	805	1290	965	1750	1310
	12 UNF	890	670	1210	905	1440	1080	1960	1470
1-1/4	7 UNC	1120	840	1520	1140	1820	1360	2460	1850
	12 UNF	1240	930	1680	1260	2010	1500	2730	2050
1-3/8	6 UNC	1470	1100	1990	1490	2380	1780	3230	2420
	12 UNF	1670	1250	2270	1700	2710	2040	3680	2760
1-1/2	6 UNC	1950	1460	2640	1980	3160	2370	4290	3210
	12 UNF	2190	1650	2970	2230	3560	2670	4820	3620

N•m = Newton meter
FT. LBS = Foot Pound

The following table gives the correct torque values for standard fasteners and is intended as a guide for average applications involving typical stresses and machined surfaces. Values are based on physical limitations of clean, plated and lubricated hardware. Check tightness of bolts periodically, using this table as a guide. When using locking fastener, increase torque values by 5%.

CAUTION: Always replace original equipment with hardware of equal grade. When an individual torque value is specified, it should be followed instead of values given in this table.



TABLE 4-5. TORQUE SPECIFICATIONS FOR METRIC FASTENERS

NOMINAL SIZE & PITCH	CLASS 8.8 (GRADE 5 EQUIVALENT)				CLASS 10.9 (GRADE 8 EQUIVALENT)			
	TORQUE FT. LB.		TORQUE N•m		TORQUE FT. LB.		TORQUE N•m	
	Dry	Lubed	Dry	Lubed	Dry	Lubed	Dry	Lubed
M4 x 0.7	2.27	1.70	3.07	2.30	2.27	2.31	4.17	3.13
M5 x 0.8	4.58	3.43	6.20	4.65	6.22	4.67	8.43	6.33
M6 x 1	7.75	5.83	10.5	7.9	10.60	7.97	14.3	10.8
M8 x 1.25	18.89	14.17	25.6	19.2	18.95	19.26	34.8	26.1
M10 x 1.25	39.11	29.52	53.0	40.1	53.87	40.59	73.0	55.0
M12 x 1.75	64.94	48.71	88.0	66.0	88.56	66.42	120.0	90.0
M14 x 2	103.32	77.49	140.0	105.0	140.22	107.01	190.0	145.0
M16 x 2	162.36	121.77	220.0	165.0	221.40	166.05	300.0	225.0
M20 x 2.5	317.34	236.16	430.0	320.0	428.04	321.03	580.0	435.0
M24 x 3	516.12	409.59	740.0	555.0	754.38	557.19	1010.0	755.0
M27 x 3	797.04	597.78	1080.0	810.0	1084.86	811.80	1470.0	1100.0
M30 x 3.5	1084.86	811.80	1470.0	1100.0	1476.00	1107.00	2000.0	1500.0

N•m = Newton meter
FT. LBS = Foot Pound

Section 4 MAINTENANCE

MAINTENANCE SCHEDULE

GENERAL INFORMATION

Preventive maintenance on the RA-300 Patcher will provide years of trouble-free operation. Adjustments can be performed in the field with ordinary hand tools.

Engine preventive maintenance is not covered in this manual. Refer to the truck manufacturer's manual for engine service information.

NOTE: When changing oil and cleaning the machine, do so only in an area designed to contain the oil and chemicals involved in any maintenance requirement. Discard these by-products in accordance with environmental regulations.

CAUTION: Do not substitute fasteners of any kind unless the fasteners are equal in size and grade to original equipment. See Tables 4-4 and 4-5 for torque specifications.



ATTENTION: When performing routine maintenance such as 50, 100, 250, 500, or 1000 hours, always include previous routine maintenance hours to the higher hourly schedule.



PREPARING THE MACHINE FOR MAINTENANCE

When performing maintenance, perform the following steps before leaving the operator's seat, unless the maintenance procedure instructs otherwise.

1. Park the machine on a flat even surface.
2. Place transmission in park.
3. Set the emergency brake.
4. Place ignition key in the OFF position.

WARNING: If maintenance must be performed with engine running, do not leave machine unattended.



CHECKS AND ADJUSTMENTS

1. Check for loose, damaged, missing or corroded parts. Repair or replace as required.
2. Check for damaged, loose, or missing decals. Replace decals as required.

CHECKING OIL LINES AND FITTINGS

1. Refer to **Preparing The Machine For Maintenance** and park the machine.
2. Check the machine for indications of oil leakage around oil lines, hoses, and fittings.
3. Refer to Tables 4-2 and 4-3 for torque specifications, and tighten fittings as necessary.
4. Replace hoses and fittings as needed.

TRUCK MAINTENANCE

Perform all service functions on the vehicle as defined in the truck owner's manual. This will include but is not limited to:

1. Check fuel level. Add as required.
2. Check engine oil level. Add as required.
3. Check coolant level. Add as required.
4. Check transmission fluid and brake fluid levels. Add as required.
5. Check all belts and hoses. Replace as needed.
6. Check the tire inflation pressure.
7. Clean all lights and lenses.

Consult the truck manufacturer's manual for detailed instructions. A copy of this manual was provided with the Patcher at the time of its delivery from the dealership.

ALLISON TRANSMISSION


The following is a guideline for programming the Diagnostic Data Reader (DDR):

1. Check ECU program groups and insure that "Mode" selection is available. (LeeBoy uses Group 70.) This package number may change for different groups. If the group used does not support the "Mode" selection, a toggle switch will need to be installed to activate the #118 wire to use the overspeed options in the transmission.
2. PTO Enable - Maximum Speeds:

Engine speed for engagement	900 RPM
Engine speed for operation	1300 RPM
Output speed for engagement	900 RPM
Output speed for operation	1300 RPM
3. When using "Mode" selection (group 70), check to insure that wire #112 is enabled.

HYDRAULIC SYSTEM

The RA-300 Patcher's hydraulic system consists of a truck-mounted hydraulic gear pump, five hydraulic cylinders, hydraulic reservoir, filter, and a five-station valve block with solenoid-operated valves.


WARNING:  **Do not service the machine while it is in motion or while the engine is running. If the engine must be running to service a component, place transmission in neutral, apply park brake, block wheels, and use extreme caution.**

HYDRAULIC FLUID

Your machine was factory filled with Citgo All-Weather All-Temp VG32 hydraulic oil, a multi-grade anti-wear oil for use in equipment where wide temperature ranges are encountered. Its features include excellent pour point depression, high viscosity index, and resistance to oxidation, foaming and corrosion, as well as protection against pump component wear. It is highly recommended for use in mobile and other hydraulic equipment in heavy-duty all-weather service. It meets the FMC Hi-Performance, Hydraulic Oil Grade 22-32 requirements.


Citgo A/W All-Temp VG32 has a pour point of -35° F (-37° C) and a maximum hydraulic reservoir temperature of 160° F (72° C). It will loose one half its life for every 20° F rise in the ambient temperature. Oil life above 200° F (94° C) is in excess of 1000 hours. However, hydraulic oil maintenance intervals listed in the maintenance section should be followed.

Contact your authorized dealer for more details on hydraulic oils, or if you are considering an alternative oil due to availability or climate.

ATTENTION:  **The use of other hydraulic oils could result in substandard performance or failure of the machine's hydraulic components.**

HYDRAULIC OIL REQUIREMENTS

1. Be sure hydraulic oil selection is compatible with your hydraulic system.
2. Be sure to use mineral base hydraulic oil.
3. Be sure hydraulic oil selection assistance is from a reputable supplier.

ATTENTION:  **Do not mix manufacturers or grade weights when adding hydraulic oil. Substandard performance or hydraulic component failure can occur.**

Hydraulic oil must provide anti-wear properties that meet or exceed those found in the API (American Petroleum Institute) classification SD, SE or CC crank case oil.

Hydraulic oil viscosity must not fall below 70 SUS (13 cs) in the reservoir under the most adverse conditions. The best viscosity rating is 80 to 300 SUS (17 cs to 65 cs). The viscosity rating at the lowest expected start-up temperature should not exceed 10,000 SUS (2,158 cs).

Hydraulic oil must have rust and oxidation inhibitors that will maintain chemical stability. When changing the hydraulic oil and refilling with oil other than the specific factory fill oil, the hydraulic system must be completely drained. Be sure to purge or drain all hoses, cylinders, valves, motors and pumps of hydraulic oil. All hydraulic oil filters must also be changed at this time.

Section 4

MAINTENANCE

HYDRAULIC SYSTEM CHECKS

1. Before each day's use, inspect the machine for hydraulic leaks. Check weekly to make sure that all hose fittings are secure and tight.

DANGER:



Never use your hand to locate hydraulic leaks. Hydraulic fluid under pressure will pierce the skin and is dangerous. Use a piece of wood or cardboard to locate leaks. If hydraulic oil has pierced the skin, get immediate medical attention.

DANGER:



Always wear eye protection when inspecting for leaks in the hydraulic system.

2. If leaking fluid is found, it is probably on the pressure side of the hydraulic system. Find and repair the leaking component before starting the machine.
3. Leaks on the suction side of the hydraulic system are more difficult to find. This condition is serious since air or dirt introduced into the hydraulic system causes rapid component wear and eventual failure. Some symptoms of suction leakage are:
 - a. Foaming of hydraulic oil.
 - b. Sluggish hydraulic system operation.
 - c. Unusual noise in hydraulic pump or motor.

If a suction side leak is suspected, verify that all reservoir connectors and fittings are properly tightened. If the problem persists, replace the defective hose assembly or fitting.

WARNING:



Never attempt to repair hydraulic hoses with tape, clamps, or cements. The hydraulic system operates under extremely high pressure. Temporary repairs will fail, creating a hazardous condition.

4. Inspect the machine during operation for hydraulic leaks that may only be noticeable while the unit is running.

CHECKING HYDRAULIC OIL LEVEL

Check the level of hydraulic oil prior to each day's operation. Hydraulic oil should be visible in the sight gauge. If not, fill the tank until oil is visible in the sight gauge.

1. Refer to **Preparing The Machine For Maintenance** and park machine.
2. Make sure all cylinders are retracted.
3. Wait ten minutes for oil to drain after engine has been shut down.
4. Check hydraulic tank sight gauge. The hydraulic oil level should be in the upper half of the sight gauge but never above the upper fill line.
5. Add Citgo A/W All-Temp VG32 hydraulic oil as needed.

ATTENTION: Use extreme caution when removing the filler cap to prevent any foreign matter from entering the hydraulic reservoir.



6. Clean the fill cap strainer each time hydraulic oil is added or changed.

CHECKING AND CLEANING HYDRAULIC RESERVOIR FILLER CAP

WARNING:



Wear eye protection and chemical resistant gloves when using solvent for cleaning purposes. Some solvent can cause skin irritation and eye damage.

WARNING:





Wear eye protection when using compressed air for drying or cleaning components. Never point the nozzle at another individual. Use a safety reduction valve to reduce air pressure to a safe level. Compressed air can cause serious personal injury if misused.

1. Remove filler cap and inspect for damage. Check cap for dirt and clogging.
2. Use solvent to clean cap thoroughly. Dry with compressed air.
3. Check filler cap to insure free air flow. Replace as necessary.
4. Install cap.

CHANGING HYDRAULIC FILTERS

1. Refer to **Preparing The Machine For Maintenance** and park machine.
2. Allow the engine to cool completely.
3. Locate the hydraulic filters by removing the panel behind the driver's seat.
4. Thoroughly clean the filter and filter head with a lint free cloth.
5. Remove the hydraulic reservoir filler cap.
6. Turn the filter bowl counterclockwise to remove. Clean the mounting surface with a lint free cloth and remove any loose filter seals in the filter-head mounting surface.
7. Drain and remove the filter element from the filter bowl.
8. Using solvent, thoroughly clean the bowl. Dry using compressed air.

WARNING:  **Wear eye protection and chemical resistant gloves when using solvent for cleaning purposes. Some solvent can cause skin irritation and eye damage.**

WARNING:  **Wear eye protection when using compressed air for drying or cleaning components. Never point the nozzle at another individual. Use a safety reduction valve to reduce air pressure to a safe level. Compressed air can cause serious personal injury if misused.**

9. Lightly lubricate the filter bowl seal with clean hydraulic oil.
10. Place element into bowl.
11. Install bowl on filter head and turn clockwise until the seal contacts the mounting surface. Tighten the filter 1/2 to 3/4 additional turn. Tighten filter bowl to 45 ft. lbs. (60.8 Nm) torque.
12. Check hydraulic level in reservoir and fill with Citgo A/W All-Temp VG32 as necessary.
13. Start engine and check for leaks. Tighten or replace filter as necessary.

DRAINING, FLUSHING, AND FILLING HYDRAULIC OIL RESERVOIR

Condensation that may build up in the hydraulic system is capable of clogging the filter elements. This can lead to insufficient hydraulic fluid at the pump and will degrade performance. Clogged filter elements can damage the hydraulic pump and other system components.

Drain and replace hydraulic oil and filter after the first 100 hours of service, and after every 500 hours of service or seasonally, whichever comes first. The suction strainer should be removed and cleaned at the 500 hour interval or whenever the hydraulic oil is changed.

1. Refer to **Preparing The Machine For Maintenance** and park machine.
2. Remove reservoir filler cap.
3. Remove drain plug and drain the hydraulic oil into a suitable container. Dispose of oil properly.
4. Flush hydraulic reservoir completely.
5. Install drain plug.
6. Replace the suction filter.
7. Replace high-pressure filter.
8. Fill hydraulic oil reservoir to proper level.
9. Install filler cap.
10. Start engine and operate hydraulic control levers several times. Check hydraulic oil sight gauge and fill as necessary.

PUMPS AND MOTORS

The hydraulic pump and motor generally require no regularly scheduled maintenance. Frequent inspection for leaks will indicate the need for service of these components.

Section 4 MAINTENANCE

VALVE BLOCK

The valve block is the most complex component of the system. It contains a flow modulating valve, relief valve, pressure compensated flow control valves, needle valves, and the 12V DC directional solenoid valves. See Figures 4-2 through 4-5 and Table 4-6.

The relief valve on the front manifold should be set at 1500 PSI for normal operation, but can be set as high as 2500 PSI to free a stuck slide gate.

ATTENTION: Reset the pressure to 1500 PSI to prevent damage to valve and manifold components.

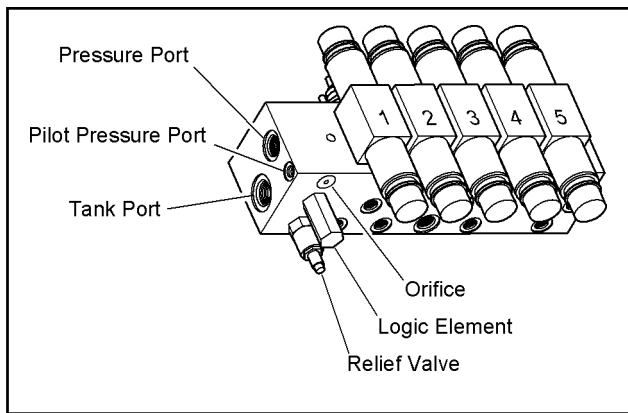


FIGURE 4-2. HYDRAULIC MANIFOLD - VIEW 1

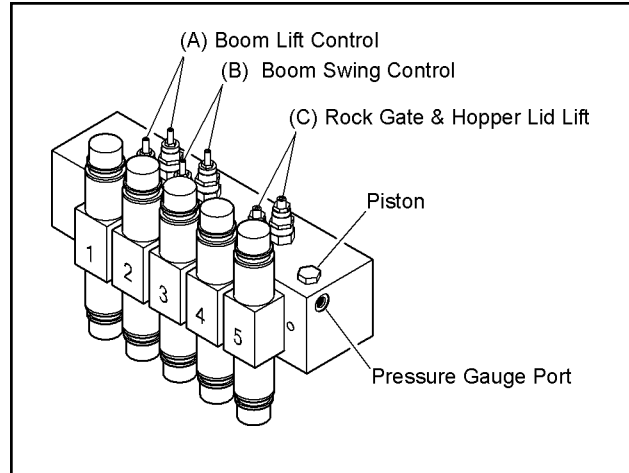


FIGURE 4-3. HYDRAULIC MANIFOLD - VIEW 2

NOTE: To adjust flow, loosen jam nuts at A, B, or C with a 1/2 inch wrench. Turn top of flow control with a 1/8 inch allen wrench. Tighten jam nut when finished.

TABLE 4-6. HYDRAULIC MANIFOLD VALVE FUNCTIONS

ITEM	CONTROL	VALVE FUNCTION	WIRE COLOR
1	Discharge Boom Lift	Top - Up Bottom - Down	Yellow Yellow/Red
2	Discharge Boom Swing	Top - Right Bottom - Left	Red/Blue Pink
3	Discharge Boom Telescope	Top - Out Bottom - In	Green Green/Yellow
4	Rock Gate & Hopper Lid Lift	Top - Open Bottom - Close	Purple Purple/White
5	Rock Gate	Top - Decrease Bottom - Increase	White/Black Brown

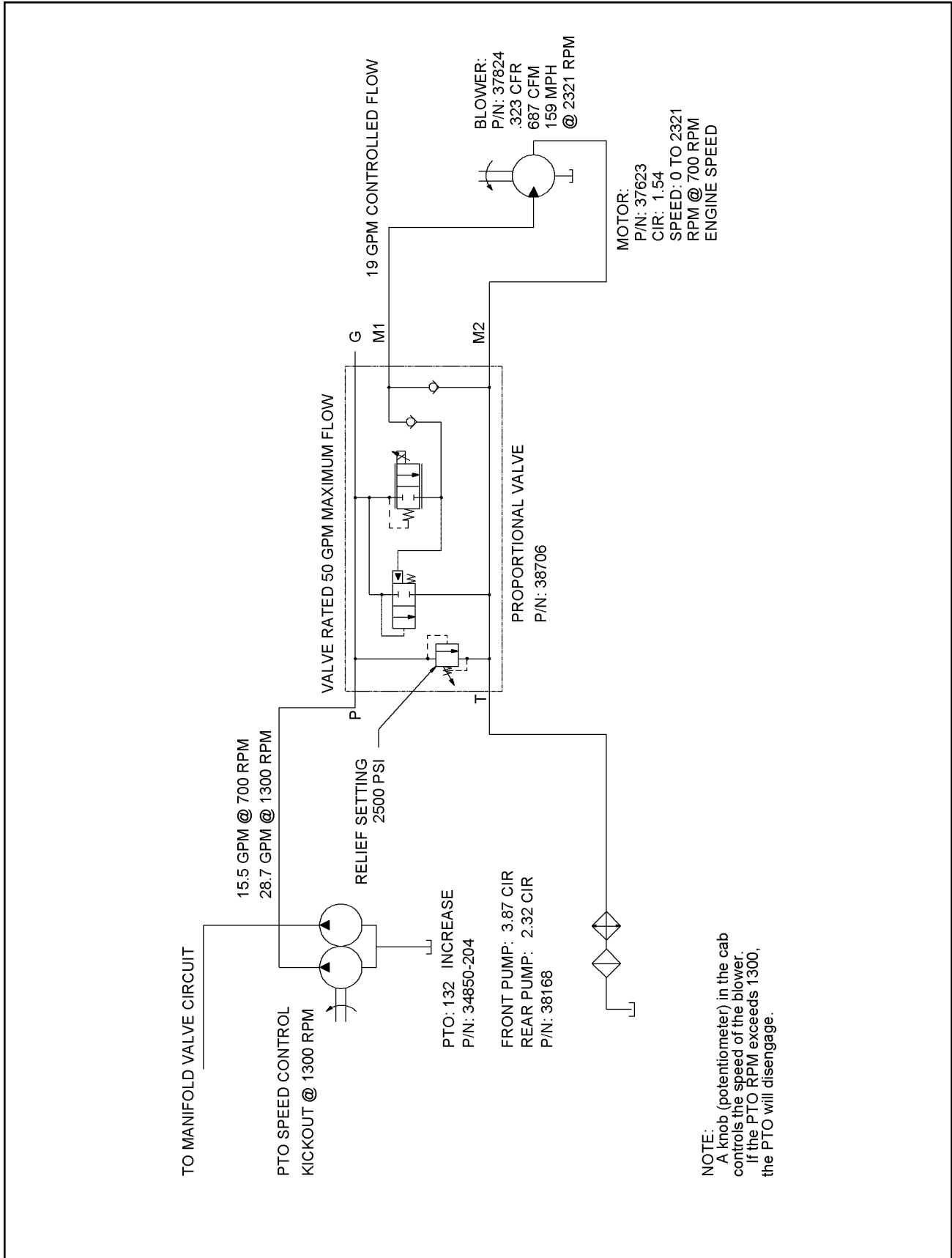


FIGURE 4-4. HYDRAULIC MANIFOLD SCHEMATIC - VIEW 1

Section 4 MAINTENANCE

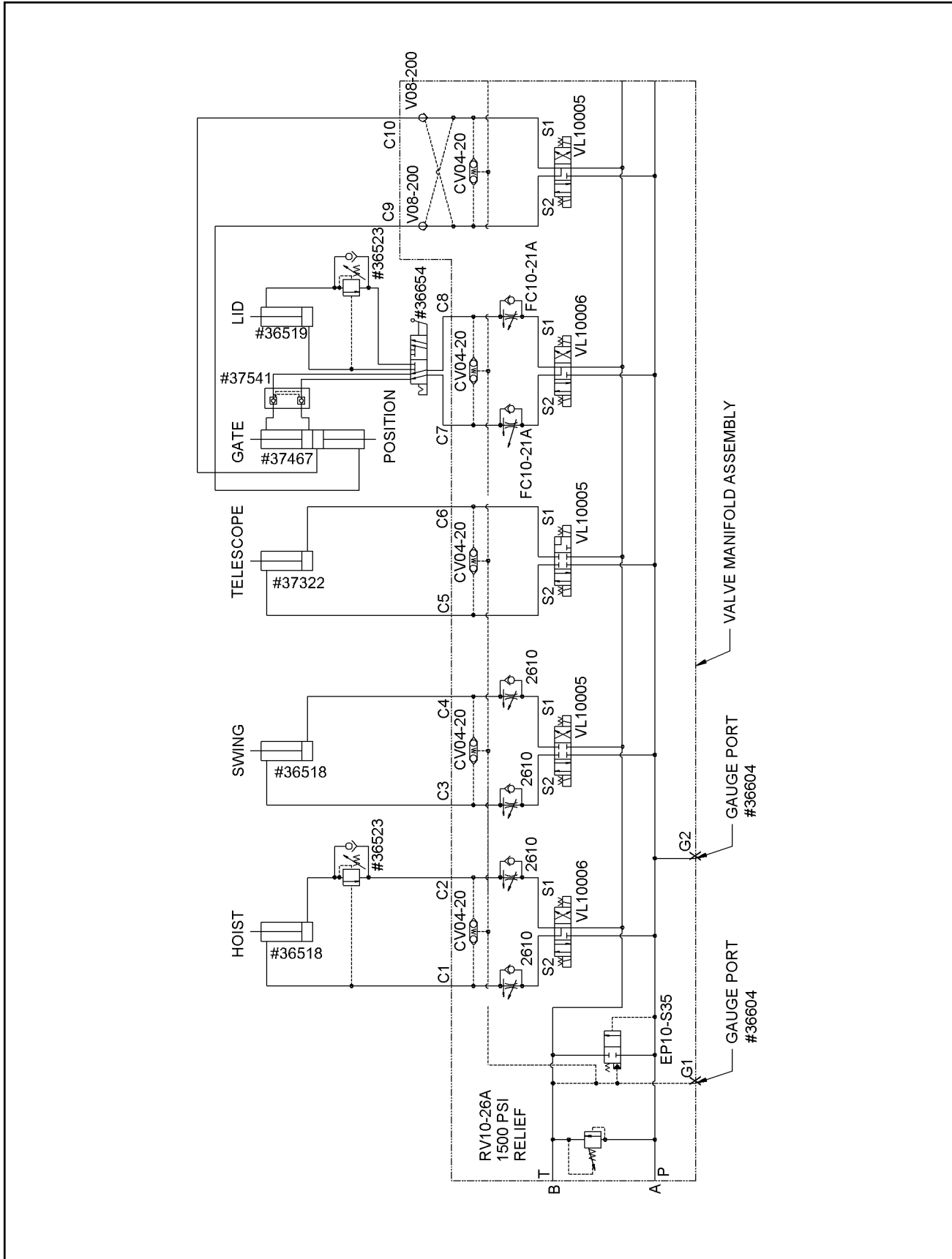


FIGURE 4-5. HYDRAULIC MANIFOLD SCHEMATIC - VIEW 2

TESTING THE HYDRAULIC PATCH-ON-THE-GO

1. Check the relief valve setting on the Proportional valve. The setting should be 2450 to 2500 PSI.
2. Check the relief valve setting on the front manifold valve. The setting should be 1450 to 1550 PSI.
3. Adjust maximum blower speed. The truck engine should be running at 1050 to 1150 RPM. The Air Speed Mode switch should be in Blowout position ("turtle"). Adjust the Maximum Flow screw on the amplifier (see Figure 4-6) to the Proportional valve so that the blower runs at 2800 to 2850 RPM. No adjustment on the Minimum Flow screw is required.
4. Overspeed should be set at 1300 RPM maximum (disengage) and 900 RPM maximum (engage).

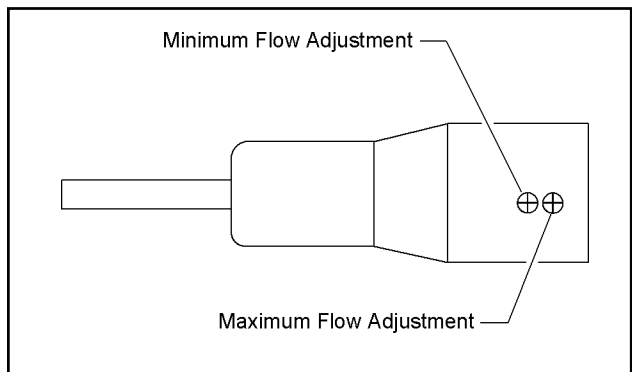


FIGURE 4-6. PROPORTIONAL VALVE

TESTING THE PROPORTIONAL VALVE & CONTROL

Testing The Control Panel Connections

1. Unplug the harness at the Proportional valve (see Figure 4-7).
2. With key switch OFF, place Air Speed Mode switch in the Blowout position ("turtle").

3. Put an ohmmeter, set at 10K or more, on the harness, in the following manner:
 - a. One lead on the brown pin and one on the gray pin. The meter should read approximately 10,000 ohms.
 - b. One lead on the orange/yellow pin and one on the gray pin. The meter should read approximately 0 (zero) ohms.
 - c. One lead on the brown pin and one on the orange/yellow pin. The meter should read approximately 10,000 ohms.
4. With key switch OFF, place Air Speed Mode switch in the Patch position ("rabbit").
 - a. One lead on the brown pin and one on the gray pin. The meter should read approximately 10,000 ohms.
 - b. One lead on the orange/yellow pin and one on the gray pin. The meter should vary from 0 (zero) to 10,000 ohms when the Air Speed Selector knob is rotated.
 - c. One lead on the brown pin and one on the orange/yellow pin. The meter should vary from 0 (zero) to 10,000 ohms when the Air Speed Selector knob is rotated.

Testing The Amplifier Card

1. Unplug the card from the harness. Connect the red wire on the card to the white wire on the harness. Connect the black wire on the card to the black wire on the harness.
2. Place a jumper between the white and green wires on the Amplifier Card.

NOTE: This will supply full power to the Proportional valve when the engine is running at 1000 RPM, with the PTO engaged, and the Blower On/Off switch at "I" (ON).

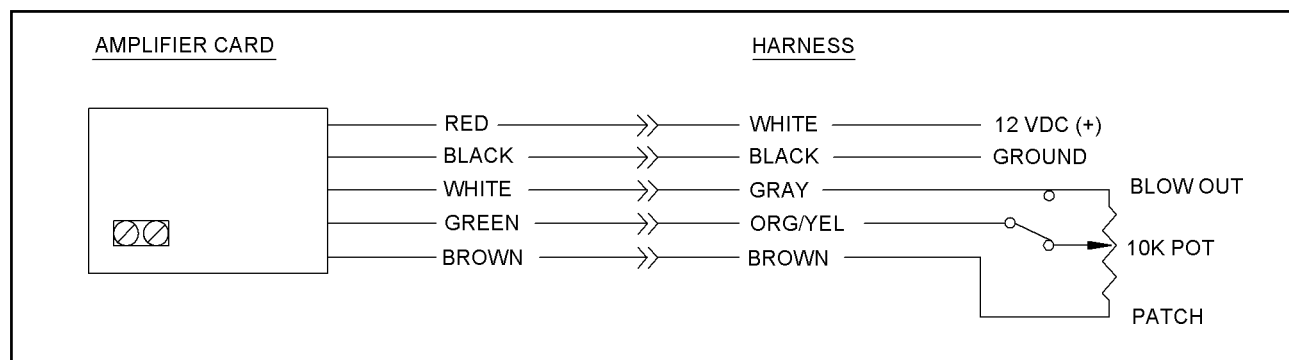


FIGURE 4-7. PROPORTIONAL VALVE CIRCUIT

Section 4 MAINTENANCE

- To vary the blower speed, adjust the Maximum Flow screw on the amplifier (see Figure 4-6). No adjustment on the Minimum Flow screw is required.

ATTENTION: Do not overspeed the blower. Maximum RPM is 2850. Internal bearing damage can occur.



- You can also check the Amplifier Card using a voltmeter attached to the white and brown wires on the Amplifier Card. When the blower and key switch are ON, you should read approximately 5V DC.

NOTE: Harness wire colors may vary among models, but Amplifier Card wires will not vary.

ASPHALT DELIVERY SYSTEM

AGGREGATE SYSTEM

The Aggregate Hopper and Rock Gate, located at the rear of the Patcher, were designed and constructed specifically for use on this product. The Rock Gate is the only wear item (in addition to the discharge hose), and may need to be replaced after 2000 hours of use. Refer to the **Illustrated Parts List** (IPL) in the back of this manual for replacement part numbers.

Aggregate Hose Care

The aggregate hose runs from the boom to the Aggregate Hopper at the rear of the truck. To prolong the life of the aggregate hose, rotate the hose at least every 100 hours.

AIR BLOWER

The RA-300 Patcher is equipped with a medium-pressure air blower. Figure 4-8 illustrates maintenance and lubrication points on the blower. Refer to the blower manufacturer's manual for more detail.

Filter

Check the Air Blower filter prior to each day's use of the Patcher. Clean or replace when restriction indicator (if equipped) shows red or when visual inspection indicates the need. Use genuine LeeBoy replacement parts when changing this filter element.

Oil

To check the oil level of the Air Blower, remove Oil Overflow Plug and the Breather from the gear cover on the back of the air blower. Add oil to the gear case until oil drips out of the Oil Overflow Plug hole. Refer to Section 2, **Specifications**, for system capacities.

ATTENTION: Do not overfill the air blower gear case. This will cause the gears to overheat and may damage the unit.



Change the oil in the air blower after every 500 hours of operation. To change oil in the air blower:

- Remove the Oil Drain Plug.
- Drain the used oil through the drain port and replace the plug.
- Remove the Oil Level Plug and the Breather. Pour fresh oil into the vent hole as required until oil drips out of the Oil Level Plug hole.
- Refer to Section 2, **Specifications**, for system capacities.

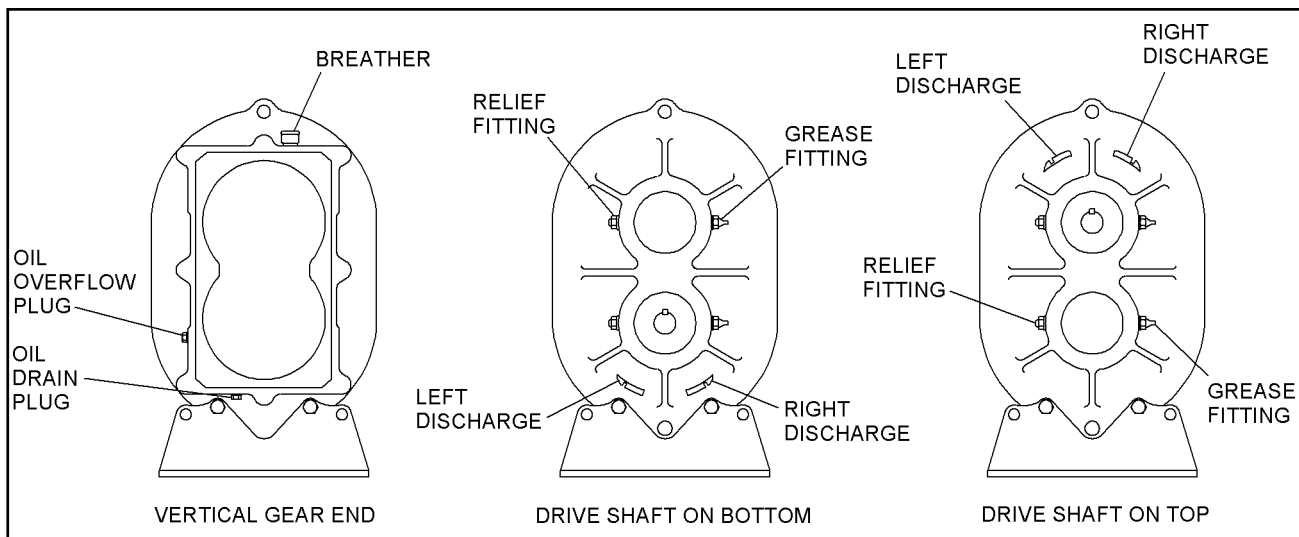


FIGURE 4-8. AIR BLOWER LUBRICATION

Bearings

Grease the bearings on the drive end of the air blower after the first 100 hours of operation, then every 500 hours. Lubricate the bearings through the Grease Fittings. The old grease will be forced out of the Relief Fittings.

ATTENTION: Keep the Relief Fittings open at all times to prevent damage to seals.



ATTENTION: If your machine is being used during unusual conditions, such as extended work days, extreme temperatures, or elevated RPMs, you may need to grease the bearings more often.



Coupler

Check blower coupler for excessive wear or looseness every 40 hours or weekly.

CAUTION: To prevent the PTO from engaging, always shut off truck engine before inspecting blower drive components. Serious injury can result from moving hydraulic components.



EMULSION TANK

When filling the Emulsion Tank, allow 4 to 5 inches of space for the material to expand when it is heated.

DANGER: Open the vent valve to relieve all pressure in tank before opening hatch. Serious injury will result from a pressurized explosion.



DANGER: Do not smoke while filling the emulsion tank. Asphalt material and fumes are flammable, and can explode.



If sludge builds up in the bottom of the Emulsion Tank, remove the drain plug and flush the tank with steam or cleaning fluid/solvent. Because of the wide variety of liquid asphalts that can be used in the RA-300, consult the asphalt supplier for the proper solvent for each type of asphalt used.

ATTENTION: Clean the tank in the above manner if the Patcher will be out of service for an extended period of time.



BROKEN ASPHALT EMULSION

Asphalt emulsion is considered “broken” when it separates into the components of asphalt and water. The mixture will not flow, and forms layers in the tank.

There is usually a watery layer on the top, and a gooey mess of asphalt below. A crust will sometimes form over the top of the mixture consisting of a hard black surface with lumps in it. No amount of stirring will recombine the components. It must be removed and properly disposed of.

CAUSES OF BREAKING

Temperature extremes, mixing grades of emulsion, or improper handling of the emulsion are the most common factors that cause asphalt emulsion to break.

Temperature Extremes

If the emulsion is allowed to freeze or is heated over 185° F (85° C) the material can break.

Mixing Grades

Mixing anionic and cationic grades of emulsions can also cause the asphalt emulsion to break.

Improper Handling

The way the mixture is handled can cause breaking. Remember, do not over-agitate the emulsion. Do not allow the water to evaporate off of the emulsion, and do not blow air through the emulsion.

NOTE: Always remove emulsion from the tank if the unit will not be used for a long period of time. This will prevent the material from breaking or setting up during storage.

REMOVING BROKEN ASPHALT

Follow the patching instructions as outlined in Section 3, **Operation**, to prevent the asphalt from breaking. If, however, it becomes necessary to remove broken asphalt from the tank, use the following steps. Allow plenty of time for this process, as it will take one to two days to complete.

CAUTION: The following suggestions are for removing broken asphalt emulsion only. If you are unsure of the Emulsion Tank contents, or if the tank contains asphalt cement or cutback asphalt, contact an expert for clean out advice.




Section 4

MAINTENANCE

Add enough water to cover the heating elements. Heat the material to 150° F (65° C). Hold the emulsion at this temperature for four (4) to eight (8) hours. The heat makes the emulsion more fluid and makes it easier to drain the material from the machine.

Connect a five (5) foot piece of 1-inch (25.4 mm) diameter hose with a 212° F (100° C) rating to the drain valve on the Emulsion Tank. The hose must be equipped with a 1-inch (25.4 mm) male hose barb fitting (P#70036) held on with a #20 worm hose clamp (P#33167) on one end. Connect this end to the Emulsion Tank drain valve.


Estimate the number of barrels needed to hold the material and have more than enough on hand. This is important because once the draining process has begun, it must be carried out to completion to prevent the material from becoming even more difficult to remove.

WARNING:  **Wear protective gear for face, hands, body, and feet when handling hot material. If hot material touches the skin, flush the area with cool water and get medical attention.**

Pressurize the tank to 65 PSI. Open the drain valve very slowly while making sure the hose stays in the barrel. Blow the material out through the hose into the barrels and watch for leaks.

If the emulsion will not pump out, heat the material to 180° F (82° C) and repeat the procedure.

Once the tank is empty, close the drain valve, remove the hose, and replug the hole. Refer to **Cleaning The System** in Section 3. If the tank cannot be satisfactorily cleaned using the outlined method, call the supplier of the emulsion for suggestions on removing the material.


DANGER:  **Do not use flammable liquids to dissolve the asphalt emulsion. These materials can explode, ignite, or cause asphyxiation.**

STORAGE

PREPARING FOR LONG TERM STORAGE

A stored machine requires as much periodic maintenance as a machine at work. Stored units must receive periodic scheduled maintenance.

1. Refer to the truck manufacturer's manual and perform all recommended instructions.
2. Clean the machine. Paint chipped or rusty areas to prevent rusting.
3. Inspect the machine thoroughly and repair worn or damaged parts.
4. Retract all hydraulic cylinders, as far as possible.
5. Coat with grease or rust inhibitor all exposed cylinder rods, seals, and o-rings to prevent cracking.

ATTENTION:  **Some rust inhibitors can destroy painted surfaces. Do not spray rust inhibitor on painted surfaces.**

6. Lubricate all grease points. Make sure all grease cavities are filled with grease. See Table 4-1, **Maintenance Interval Chart**.
7. Fill bearings with grease at the drive end cavities of the air blower.
8. Top up all fluid levels to minimize condensation forming inside the tanks.
9. Check hydraulic oil sight gauge and fill as necessary.
10. Inspect all air and hydraulic hoses, couplers, fittings and cylinders. Tighten any loose fittings and replace any hoses that are worn.
11. Use tape to seal the inlet, discharge, and all vent openings on the air blower. Do not store the unit piped to the system.
12. Check all safety decals. Replace any decals that are damaged or illegible. Refer to **Decal Installation** in this section.
13. Store machine in a dry, protected area. If stored outside, cover with waterproof material.

PERIODIC MAINTENANCE DURING STORAGE

If a unit will not be used for more than two months, refer to Table 4-1, **Maintenance Interval Chart**, and follow procedures for 100-Hours interval, as well as these preventive maintenance procedures:

1. Keep battery fully charged and check the level of the electrolyte regularly.
2. Check for water in hydraulic fluid. Any machine that is stored for an extended period in a climate that has a wide range of temperatures and/or humidity, will develop condensation on the inside of the tank walls. Check the hydraulic fluid on a regular basis for possible moisture contamination.

ATTENTION: Hydraulic oil that is contaminated, must be drained, the filter elements replaced and the tank refilled with LeeBoy approved fluid. Failure to do this could result in premature failure of the pumps and/or motors.



3. Start and run the engine until it is warm. Cycle all hydraulic and/or hydrostatic functions until all components are warm and the hydraulic fluid is up to operating temperature.
4. After the machine is warmed, grease all pivot points. See Figure 4-1, **Lubrication Points**.
5. Rotate the PTO drive shaft three or four revolutions every two weeks.

REMOVING THE MACHINE FROM STORAGE

1. Follow steps above in **Periodic Maintenance During Storage**.
2. Refer to Table 4-1, **Maintenance Interval Chart**. Check all fluid levels, belt tensions, and bolt torques.
3. Refer to truck manufacturer's manual for additional instructions.
4. Clean grease or rust inhibitor from all exposed cylinder rods, seals, and o-rings.
5. Remove tape from the inlet and discharge openings of the air blower.

DECAL INSTALLATION

1. Be sure that the installation area is clean and dry. Use hot soapy water and dry the area thoroughly before installing decals.
2. Determine the exact position by taking measurements and test fitting before you remove the backing paper.
3. For decals with no top protection paper, determine the decal location and remove the smallest portion of the split backing paper.
4. Align the decal over the specified area and carefully press the small portion with the exposed adhesive backing into place.
5. Peel back the remaining paper and carefully smooth the remaining portion of the decal in place.
6. Small air pockets can be pierced with a pin and smoothed out using the piece of decal backing paper.
7. If the decal has a protective top paper, use hot soapy water on the surface to which the decal is being applied. Leave wet. After determining the location, remove the backing paper and soak the decal in clean soapy water before application. This will help prevent air bubbles in the finished decal.
8. Smooth the decal into place with a sponge and check for air bubbles. Small air pockets may be pierced with a pin and smoothed out. When the decal is completely smoothed out, carefully remove the top paper.

Section 4 MAINTENANCE



TROUBLESHOOTING

GENERAL INFORMATION

The troubleshooting charts below identify the most common symptoms of failure. Use these charts to help identify the failed component.

For specific engine and hydraulic problems not covered here, see the engine or hydraulic manufacturer's manual.

ATTENTION: Do not attempt to service or repair major components such as the engine, hydrostatic pump or motor unless authorized to do so by your LeeBoy dealer. **ANY UNAUTHORIZED REPAIR WILL VOID THE WARRANTY.**



TROUBLESHOOTING CHARTS

AGGREGATE SYSTEM PROBLEMS

SYMPTOM	CAUSE	REMEDY
No aggregate flow. (Be sure there is aggregate in the hopper.)	Delivery hose plugged. (Check air pressure gauge. Above 5 PSI indicates a problem.) The machine may have been driven with the aggregate tank slide gate open, allowing rock into the hose. Be sure Rock On/Off switch is OFF when traveling.	Open at coupling on boom and clean out. Disconnect hose at Rock Gate, remove from hangers, and clean out. Increase engine RPM while monitoring blower pressure. Do not exceed 7 PSI.
	Valve not activated to open Rock Gate.	Activate valve.
	Insufficient air volume.	Check blower RPM. Should be 1200 to 1800. Check & clean blower air filter.
	Slide gate jammed or frozen closed.	Check for air leaks in discharge piping and at aggregate hopper lid, slide gate, and hoses. If frozen, use heat to thaw. If jam is caused by limestone buildup, spray with high-pressure water to clean. Increase relief pressure to 2000 PSI, open gate, and cycle several times. Then reset relief pressure to 1500 PSI.
	Rock frozen in hopper.	Warm/thaw. (Park unit in a heated building.)
	Cap still on discharge nozzle.	Remove cap.
	Build up of fines on inside walls of hose.	Use clean aggregate. Use rubber hammer to tap on outside of hose to loosen build up.

TROUBLESHOOTING CHARTS


AGGREGATE SYSTEM PROBLEMS (Continued)

SYMPTOM	CAUSE	REMEDY
Poor or uneven aggregate flow.	<p>Aggregate is wet and/or bridging.</p> <p>Delivery hose is clogged.</p> <p>Insufficient air volume.</p>	<p>Run vibrator.</p> <p>Use clean, dry rock.</p> <p>Swing the boom side to side rapidly. This will cause material to slide down hopper walls.</p> <p>Remove and clean hose. Flush nozzle.</p> <p>Flush delivery system with water (optional).</p> <p>Check blower RPM. Should be 1400-1800.</p> <p>Check & clean blower air filter.</p> <p>Check for air leaks in discharge piping and at aggregate hopper lid, slide gate and hoses.</p>
Dusty delivery of aggregate.	<p>Dry, dusty material.</p> <p>Excessive fines in aggregate.</p>	<p>Dampen rock in hopper.</p> <p>Replace with new aggregate material.</p>
Aggregate lid settles.	<p>Pressure setting on counter-balance valve set too low.</p> <p>Hydraulic cylinder seals are leaking.</p> <p>Counter-balance valve and/or seals are bad.</p>	<p>Lower or raise lid so rear edge is open 4 to 6 inches. Loosen jam nut and turn adjusting screw in until lid no longer settles. Turn an additional 1-1/2 turns.</p> <p>Replace seals.</p> <p>Replace valve and/or seals.</p>

Section 4 MAINTENANCE


TROUBLESHOOTING CHARTS

EMULSION SYSTEM PROBLEMS

SYMPTOM	CAUSE	REMEDY
<p>No emulsion at nozzle.</p>	<p>3-way valve on asphalt tank in OFF or FLUSH position.</p> <p>Low air pressure.</p> <p>Line, valve or nozzles clogged.</p> <p>Separated emulsion.</p> <p>Low tank level.</p> <p>Valves on discharge nozzle or in cab closed.</p> <p>Asphalt cement or cut back asphalt has been used by mistake.</p>	<p>Select ASPHALT position.</p> <p>Check air lines, valves and gauges.</p> <p>Check and clean or replace.</p> <p>Drain tank and fill with good emulsion.</p> <p>Fill tank.</p> <p>WARNING:  Relieve all pressure before opening load hatch.</p> <p>Open valves.</p> <p>Consult the LeeBoy service dept. or an authorized dealer for clean out procedure.</p>
<p>Poor or uneven emulsion flow.</p>	<p>Separated emulsion.</p> <p>Low air pressure.</p> <p>Emulsion is too cool.</p> <p>Outside temperature is too cool for type of material being used.</p> <p>Nozzles plugged or too large.</p>	<p>Drain and replace with new material.</p> <p>Check air lines, valves, and gauges.</p> <p>Heat to proper spray temperature for material.</p> <p>Consult local supplier for recommendations.</p> <p>Unplug or use smaller nozzles.</p>

TROUBLESHOOTING CHARTS

SOLVENT SYSTEM PROBLEMS

SYMPTOM	CAUSE	REMEDY
<p>No solvent for cleanout.</p>	<p>No solvent in tank.</p> <p>3-way selector valve on asphalt tank is in wrong position.</p> <p>No air pressure to solvent tank.</p> <p>Valves on nozzle or in cab closed.</p>	<p>Fill tank with solvent.</p> <p>WARNING:  Relieve all pressure before removing cap.</p> <p>Select FLUSH position.</p> <p>Open air valve.</p> <p>Fix pinched airline.</p> <p>Set regulator to 60 psi.</p> <p>Open valves.</p>

Section 4 MAINTENANCE



TROUBLESHOOTING CHARTS

HYDRAULIC SYSTEM PROBLEMS

SYMPTOM	CAUSE	REMEDY
Hydraulic system overheats.	<p>Low hydraulic fluid level.</p> <p>Engine RPM is too high.</p> <p>Running hydraulic system when ridding for long distances.</p> <p>Hydraulic oil cooler plugged with debris.</p> <p>Relief valve set too low.</p> <p>Flow modulating valve defective.</p> <p>Worn or defective pump.</p> <p>Defective electric fans.</p>	<p>Fill reservoir to proper level in sight gauge.</p> <p>Slow engine rpm to 1400 rpm.</p> <p>Shut off PTO for hydraulics when not needed.</p> <p>Clean oil cooler fins.</p> <p>Set relief valve to 1500 psi.</p> <p>Replace valve.</p> <p>Replace pump.</p> <p>Check / replace fuse.</p>
No movement of boom, hopper lid or slide gate.	<p>PTO not engaged.</p> <p>No or low hydraulic oil pressure.</p> <p>Electrical or hydraulic failure.</p> <p>Boom flow controls out of adjustment.</p> <p>Blown fuse, tripped circuit breaker or bad electrical connection.</p>	<p>Engage PTO that drives hydraulic pump.</p> <p>Check oil level in reservoir. Check that inlet oil valve is open.</p> <p>Adjust relief pressure on valve block.</p> <p>Activate manual override on valve block to determine if problem is electrical or hydraulic. If problem is electrical, you will be able to control functions with manual overrides.</p> <p>Adjust flow controls.</p> <p>Check fuse, reset circuit breaker.</p> <p>Check control panel power line at battery.</p> <p>Check electrical connections at solenoid valve.</p>
Poor or uneven cylinder action.	<p>Low hydraulic fluid level.</p> <p>Boom flow controls out of adjustment.</p> <p>Relief valve set too low.</p>	<p>Check level. Check that oil inlet valve is open.</p> <p>Adjust (applies to Lift and Side Shift only).</p> <p>Adjust relief valve.</p>

TROUBLESHOOTING CHARTS

HYDRAULIC SYSTEM PROBLEMS (Continued)


SYMPTOM	CAUSE	REMEDY
Discharge boom settles.	<p>Pressure setting on counter-balance valve is set too low.</p> <p>Hydraulic cylinder seals are leaking.</p> <p>Counter-balance valve and/or seals are bad.</p>	<p>Extend boom fully. Loosen jam nut and turn adjusting screw in until boom no longer settles.</p> <p>Replace seals.</p> <p>Replace valve and/or seals.</p>
Hydraulic cylinders on boom not operating properly.	<p>Loss of hydraulic power. Check by watching the pressure gauge on top of the valve while manually activating the valve by pushing on the solenoid valve end. If no pressure shows, the problem is hydraulic. Main cause would be contamination of the main relief valve or flow control.</p> <p>Loss of electric power. Check voltage when controls are activated. Lack of power could be caused by loose/bad connections, or by a bad micro-switch in the joystick handle.</p>	<p>Clean the cartridge component on the valve. Check hydraulic filter and replace if necessary.</p> <p>Check all connections. Replace any bad connections. Replace micro-switch if necessary.</p>

Section 4 MAINTENANCE



TROUBLESHOOTING CHARTS

GENERAL SYSTEM PROBLEMS

SYMPTOM	CAUSE	REMEDY
Low, or no air from blower.	Valve not activated. Plugged air cleaner. Plugged discharge hose or piping.	Activate valve. Clean or replace element. Clean out hose or piping.
PTO will not engage.	Truck not in neutral or clutch not fully depressed. Blown fuse. PTO solenoid bad.	Be sure truck is in neutral or clutch is fully engaged. Inspect and replace. Replace solenoid.
Control panel is inoperative.	Tripped circuit breakers or blown fuse. Loose wire.	Reset or replace. Check all wiring.
120-volt AC heat system not working.	Tripped circuit breakers or blown fuse. Thermostat not set to desired temperature. Faulty wiring. Electric element(s) burned out.	Reset or replace. Reset temperature or thermostat Check wiring with volt/ohmmeter WARNING: Use extreme caution when checking 120-volt AC circuits.  Test for continuity with 120-volt power disconnected. Be sure circuit breaker is rated properly for this use. Replace element(s).
Truck coolant system not heating emulsion to a high enough temperature.	Asphalt temperatures needed are above 180° F (82° C). Faulty truck engine thermostat. Pinched or plugged circulation hose.	Coolant heating system was not intended to heat asphalts / emulsions above 180° F (82° C). Replace with 195° F (91° C) or higher thermostat. Inspect, clean or replace.

NOTES:

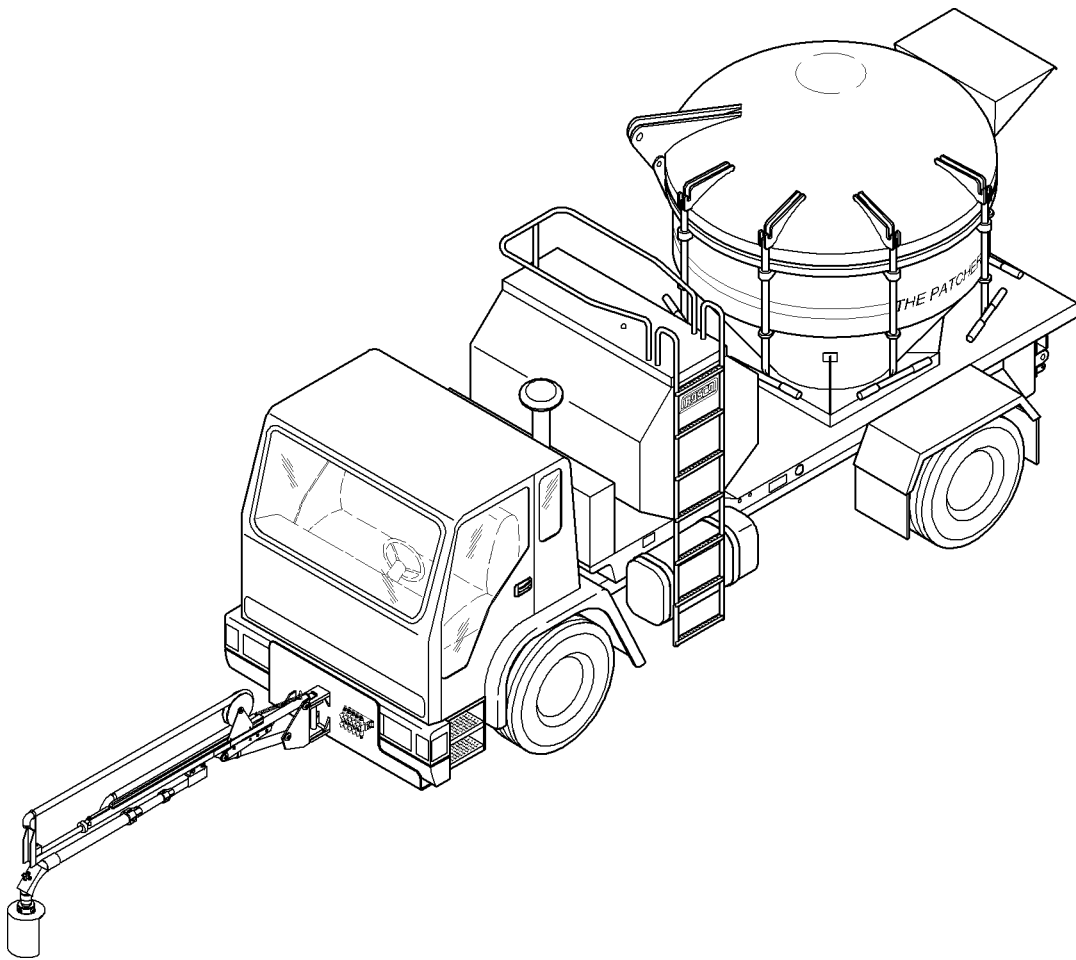
Section 4 MAINTENANCE



NOTES:



ILLUSTRATED PARTS LIST



RA-300 PATCHER
for GMC Truck
Manual No. 37679-06
For Units with Serial No. 49276 and higher
Revised 11-31-07

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INTRODUCTION

This Illustrated Parts List (IPL) is intended for use in identifying and requisitioning replacement parts.

ILLUSTRATED PARTS LIST

HOW TO USE THE IPL

In column 1, FIG refers to the corresponding illustration, and ITEM refers to the item number for the referenced illustration.

Parts with a dash preceding the ITEM number are not illustrated.

In column 2, PART NUMBER refers to the associated FIG or ITEM in column 1.

In column 3, NOMENCLATURE refers to the description of the associated PART NUMBER. Bullets preceding the description are explained in **General System Of Assembly Order**, in following paragraphs.

In the case of sub-assemblies, parts are captioned ATTACHING PARTS and are listed immediately following the attached part(s). The -----*----- symbol follows the last item of the attached parts group.

In column 4, UNITS PER ASSY refers to the quantity required to assemble the item illustrated in the associated FIG. Unit of measure may be EACH, FT, LBS or other.

In the case of sub-assemblies, the quantities listed for the attaching parts are the quantity required to attach one item.

NHA notations at item descriptions refer to Next Higher Assembly.

On the associated illustrations, numbers in parentheses next to the item number, refer to the quantities used at that assembly location.

EXPLANATION OF PART NUMBERS

If standard parts (those with AN, MS, NAF, NAS prefixes) are used, the standard part number is listed in the PART NUMBER column.

If a company other than LeeBoy is referred to as the original manufacturer, these parts may carry the original manufacturer's part number or a LeeBoy part number. These manufacturers are identified by an appropriate vendor code following the nomenclature. If the part number is a LeeBoy part number, the original manufacturer's part number is given after his vendor code. Vendor codes are in accordance with the current issue of Cataloguing Handbook, "Commercial and Government Entity" (H4-1 and H4-2) and are preceded by the capital letter "V".

When a vendor code cannot be obtained from the H4-1 and H4-2 Cataloguing Handbook, the manufacturer's full name and address are included in the parts list. Government standard parts such as AN, MS, NAF and NAS parts are not identified with a vendor code.

GENERAL SYSTEM OF ASSEMBLY ORDER

The indenture system used in the Illustrated Parts List shows relationship of parts and assemblies to the next higher assembly or installation as follows:

1 2 3 4 5 6 7

Installation

- Detail parts for installation
- Assembly
- Attaching parts for assembly
- *-----
- Detail parts for assembly
- Sub-assembly
- Attaching parts for sub-assembly
- *-----
- Detail parts for sub-assembly
- Sub-sub-assembly
- Attaching parts for sub-sub-assembly
- *-----
- Detail parts for sub-sub-assembly

ALPHABETICAL INDEX

An Alphabetical Index is provided as a supplement at the end of the Illustrated Parts List.

EQUIPMENT DESIGNATOR INDEX

If equipment designators are used in place of part numbers at any place in the IPL, an Equipment Designator Index is provided, listing all equipment designators listed in the Illustrated Parts List.

ILLUSTRATED PARTS LIST

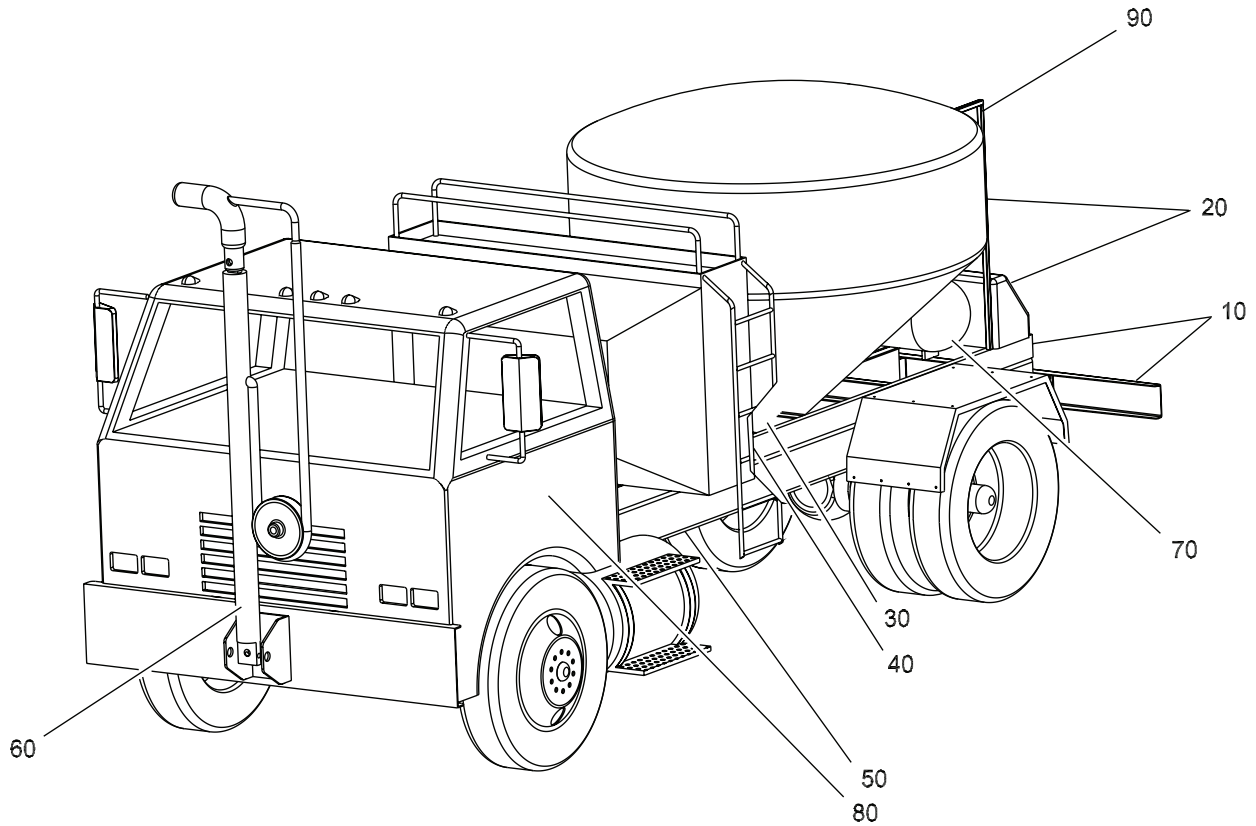


FIGURE 1. TOP ASSEMBLY

FIGURE 1. TOP ASSEMBLY

FIG ITEM	PART NUMBER	NOMENCLATURE 1 2 3 4 5 6 7	UNITS PER ASSY
1	28026	TOP ASSEMBLY	
10	24321	FRAME ASSEMBLY (See Figure 2 for Breakdown)	1
20	TBD	AGGREGATE SYSTEM (See Figures 3 thru 7 for Breakdown)	1
30	24326	PRESSURIZED AIR GROUP (See Figure 8 for Breakdown)	1
40	TBD	EMULSION TANK GRPS (See Fig 9 thru 12 for Breakdown)	1
50	24323	BLOWER & DISCHARGE BOOM (See Fig 13 for Breakdown)	1
60	28142	HYDRAULIC SYSTEM (See Figures 14 thru 16 for Breakdown)	1
70	24327	SOLVENT TANK GROUP (See Figure 17 for Breakdown)	1
80	28645	IN-CAB CONTROLS (See Figure 18 for Breakdown)	1
90	TBD	LIGHTING PACKAGES (See Figure 19 for Breakdown)	1

ILLUSTRATED PARTS LIST

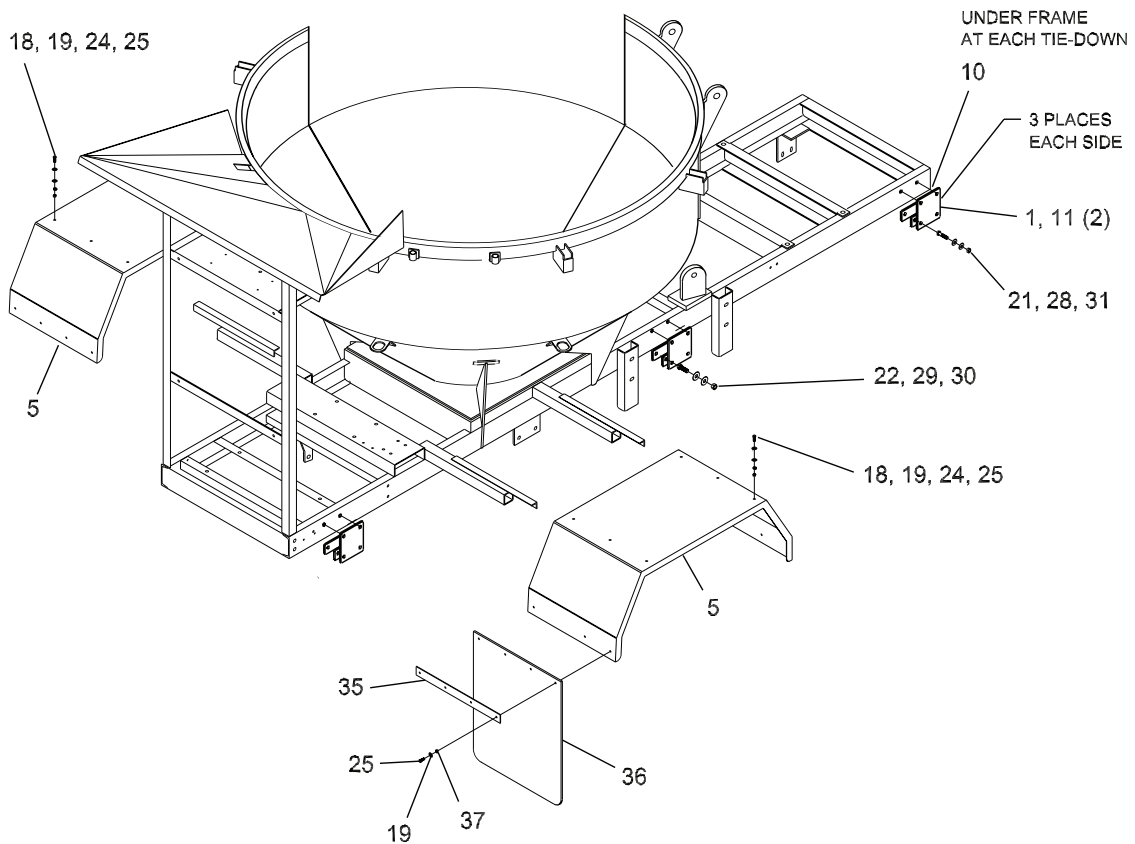
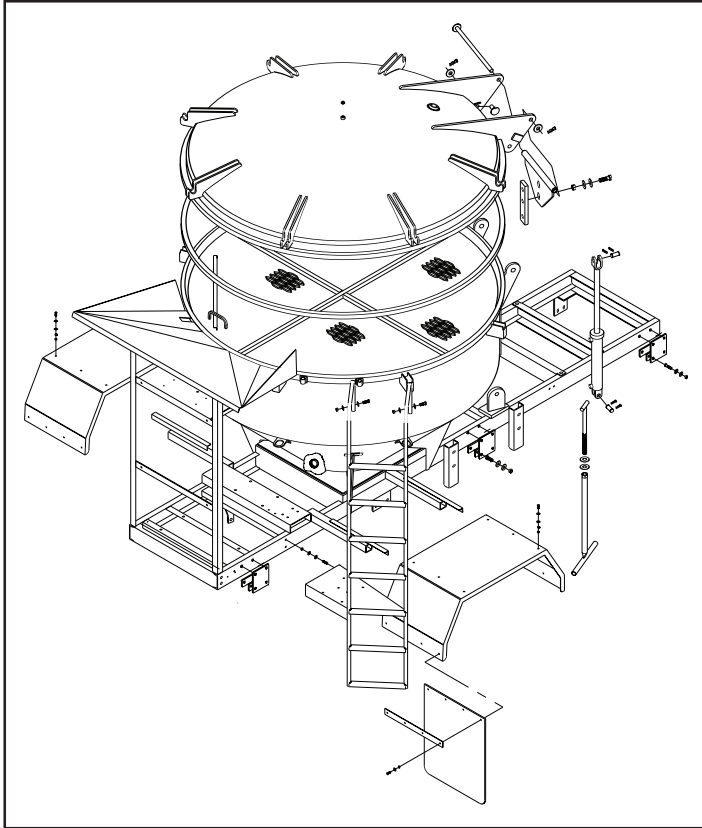


FIGURE 2. FRAME ASSEMBLY (PAGE 1 OF 2)

FIGURE 2. FRAME ASSEMBLY (PAGE 1 OF 2)

FIG ITEM	PART NUMBER	NOMENCLATURE 1 2 3 4 5 6 7	UNITS PER ASSY
2	24321	FRAME ASSEMBLY (See Fig 1 for NHA)	1
1	29266	TIE DOWN,MACK	6
5	22181	FENDER,SINGLE AXLE,STL	2
10	24590	BAR,.375X3.00X6.50	8
11	985781	BAR,TIE DOWN SPACER	12
18	80037	NUT,HEX,.312-18	12
19	80141	WASHER,FLAT,USS,.313	32
21	80144	WASHER,FLAT,USS,.500	12
22	80146	WASHER,FLAT,USS,.625	30
24	80161	WASHER,LOCK,.312	12
25	80208	CSHH,.312-18X1.00,GR5	20
28	80354	NUT,FLEXLOC,.500-13,FULL,LT	6
29	80356	NUT,FLEXLOC,.625-11,FULL,LT	12
30	80983	CSHH,.625-11X2.00,GR8	10
31	81036	CSHH,.500-13X2.25,GR8	6
35	13960	MOUNT BAR,MUD FLAP	2
36	27737	MUD FLAP,24X24	2
37	80351	NUT,FLEXLOC,.312-18,FULL,LT	8
	25872	BUMPER,REAR ASSEMBLY	1
-1	23555	BUMPER,REAR	1
-2	25871	BRACKET,BUMPER,SHORT MOUNT	2
-3	80144	WASHER,FLAT,USS,.500	8
-4	80186	CSHH,.500-13X1.75,GR5	8
-5	80354	NUT,FLEXLOC,.500-13,FULL,LT	8

- ITEM NOT ILLUSTRATED

ILLUSTRATED PARTS LIST

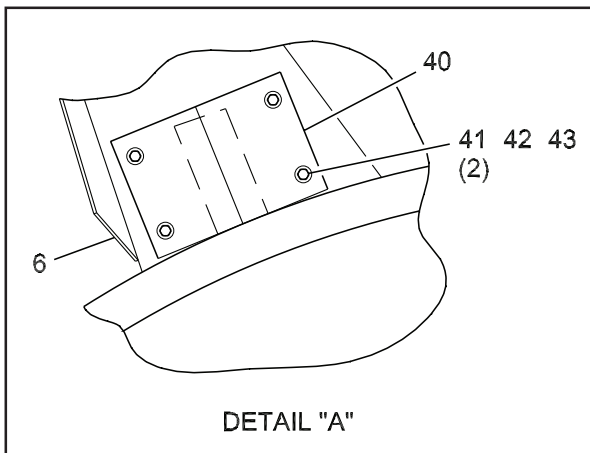
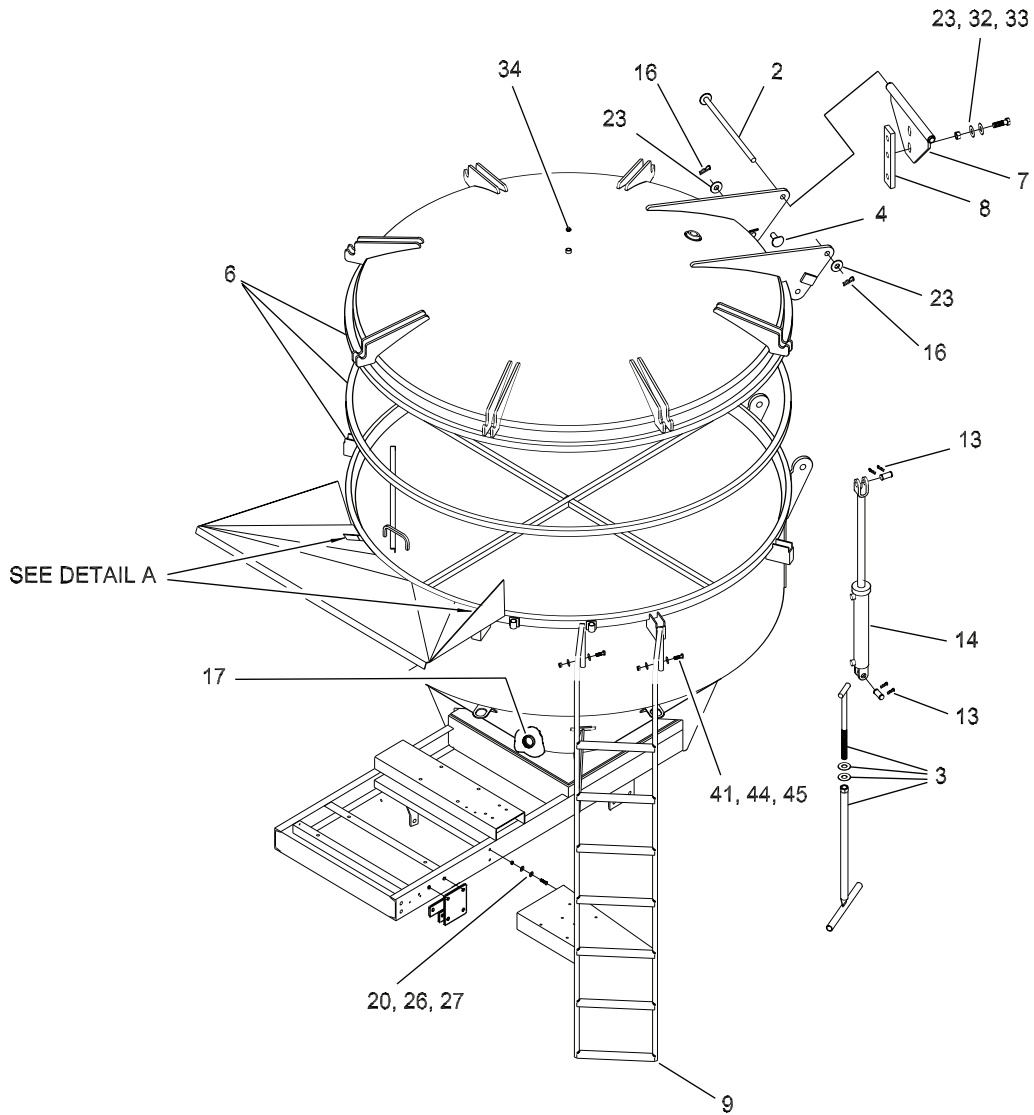


FIGURE 2. FRAME ASSEMBLY (PAGE 2 OF 2)

FIGURE 2. FRAME ASSEMBLY (PAGE 2 OF 2)

FIG ITEM	PART NUMBER	NOMENCLATURE 1 2 3 4 5 6 7	UNITS PER ASSY
2	24321	FRAME ASSEMBLY (See Figure 1 for NHA)	1
2	20457	PIN,PIVOT LID LIFT	1
3	20458	T BOLT ASSEMBLY,LID LOCK	7
4	REF	PIN,LID PIVOT,W/M	2
6	989182	FRAME,HOPPER & LID	1
7	24101	HINGE PLATE W/M	1
8	24103	BAR,LID LIFT	1
9	25354	LADDER,REAR,W/M,HEAVY	1
13	36129-02	PIN,CLEVIS,1.00 OD	2
14	36519	CYL,HYD,3.00X14.00X1.50 ROD	1
-15	640210-1	SEAL KIT,HYD CYL,3.00X1.50	A/R
16	36544	PIN,COTTER, .177,7GA	1
17	70444	PIPE,PLUG,2.00,SQ HEAD	1
20	80142	WASHER,FLAT,USS,.375	8
23	80149	WASHER,FLAT,USS,1.000	3
26	80226	CSHH,.375-16X1.50,GR5	4
27	80352	NUT,FLEXLOC,.375-16,FULL,LT	4
32	81075	NUT,STOVERS 1.00-8, GR C	2
33	81080	CSHH,1.000-8X3.00,GR8	2
34	99537	PIPE,PLUG,08MP,SQ HEAD	1
-38	24591	BRAKE VALVE RELOCATION	0
40	24732	COVER,CHUTE,T-BOLT	4
41	80140	WASHER,FLAT,USS,.250	20
42	80185	CSHH,.250-20X1.00,GR5	8
43	80350	NUT,FLEXLOC,.250-20,FULL,LT	8
44	80036	NUT,HEX,.250-20	2
45	80197	CSHH,.250-20X2.25,GR5	2

- ITEM NOT ILLUSTRATED

ILLUSTRATED PARTS LIST



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FIGURE 3. AGGREGATE SYSTEM

FIG ITEM	PART NUMBER	NOMENCLATURE 1 2 3 4 5 6 7	UNITS PER ASSY
-3	TBD	AGGREGATE SYSTEM (See Figure 1 for NHA)	1
-1	989182	AGGREGATE TANK (See Fig 4 for Breakdown)	1
-2	25799	VIBRATOR GROUP (See Fig 5 for Breakdown)	1
-3	24188	OPTIONAL JET FLUSH SYSTEM (See Fig 6 for Breakdown)	1

- ITEM NOT ILLUSTRATED

ILLUSTRATED PARTS LIST

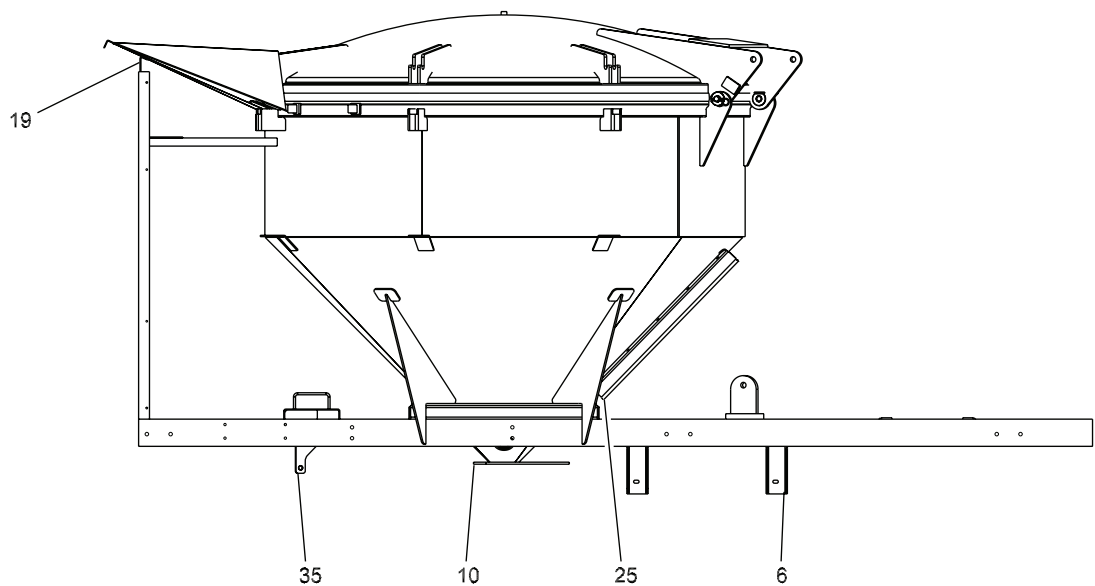
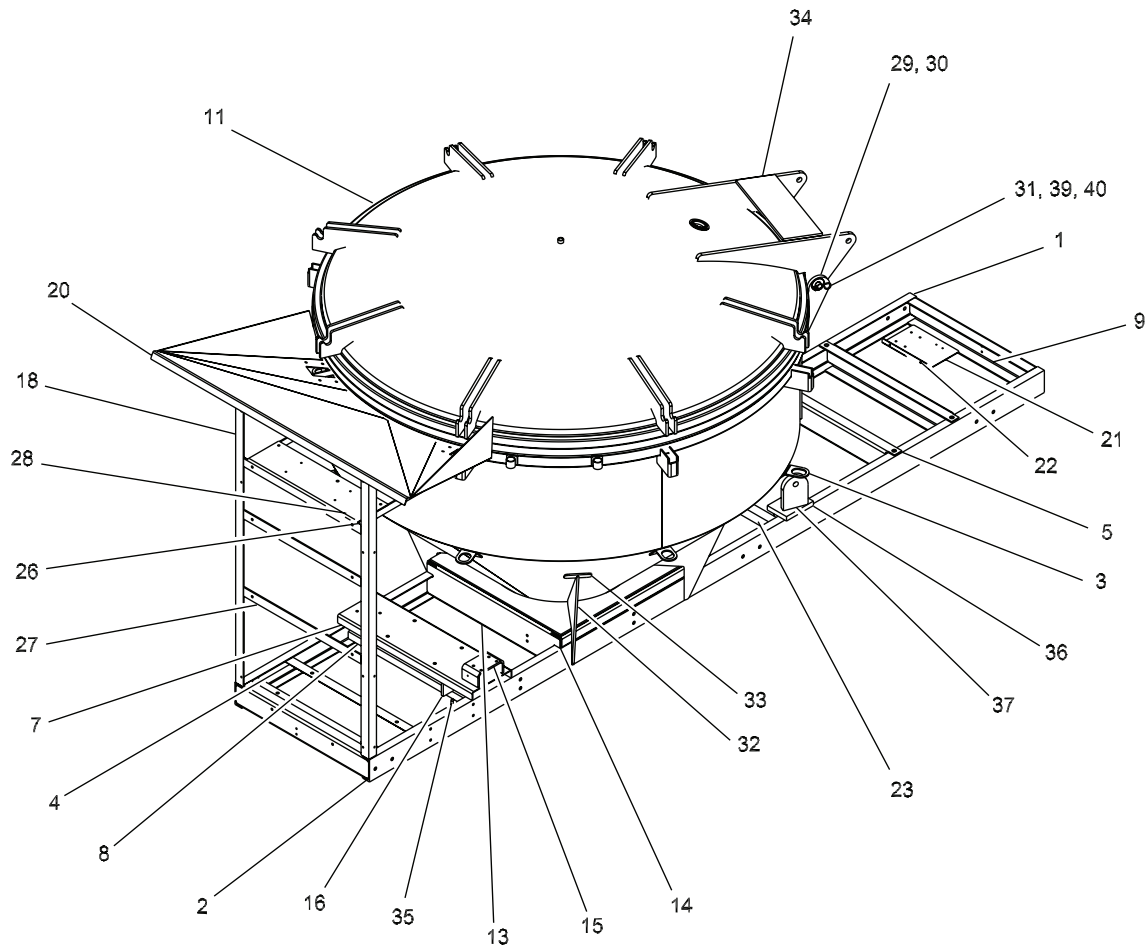
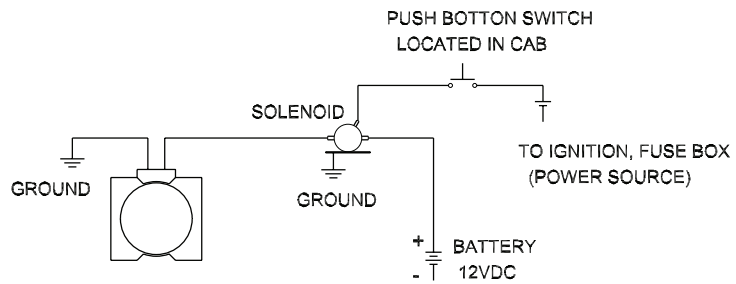
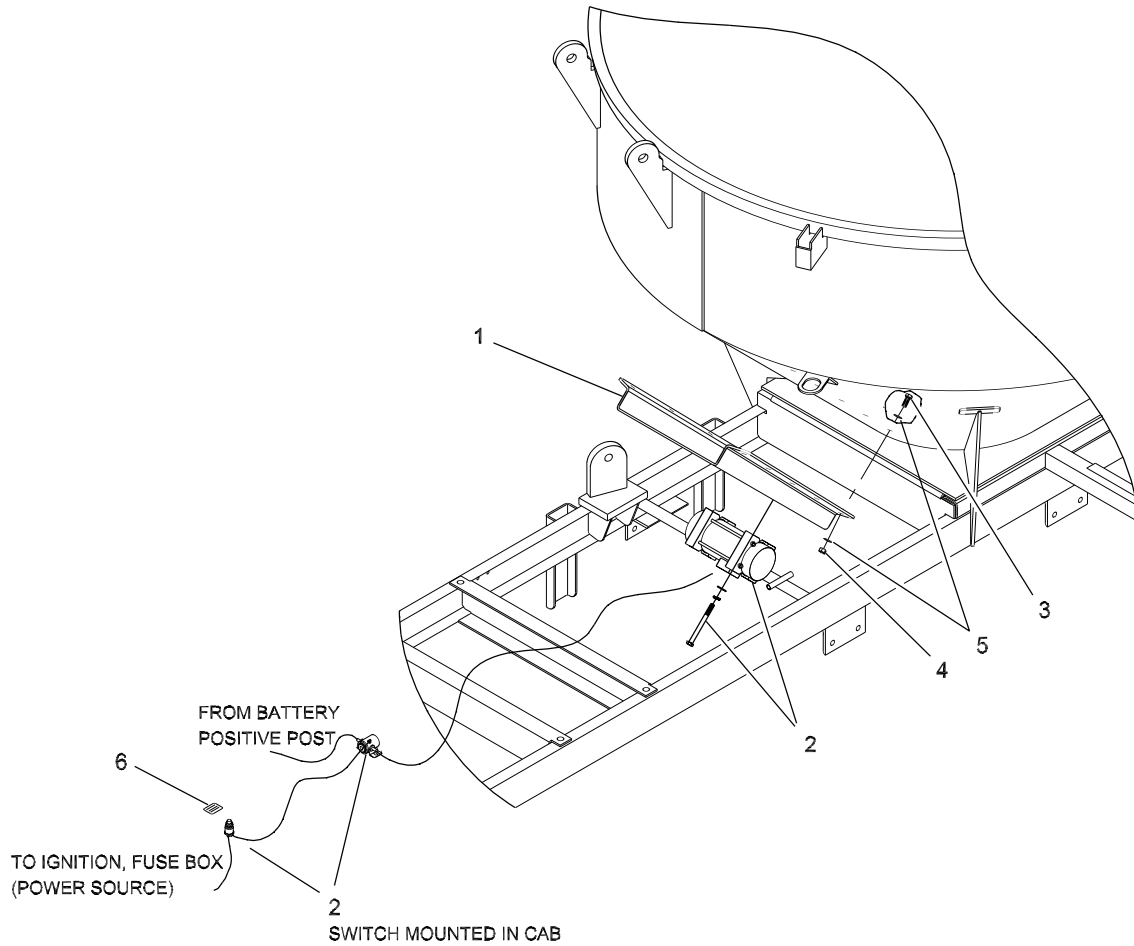


FIGURE 4. AGGREGATE TANK

FIGURE 4. AGGREGATE TANK

FIG ITEM	PART NUMBER	NOMENCLATURE 1 2 3 4 5 6 7	UNITS PER ASSY
4	989182	AGGREGATE TANK (See Figure 3 for NHA)	1
1	24078	CHANNEL,LEFT	1
2	24079	CHANNEL,RIGHT	1
3	27569	HOPPER & CONE,W/M	1
4	20502	SUPPORT,SOLVENT TANK	2
5	24074	CROSSMEMBER,EMULSION TANK	2
6	24072	BRKT,HYD TANK	2
7	25550	BASE,BLOWER	1
8	24081	CHANNEL,MNT,ROCK GATE ANCHOR	1
9	24073	CROSSMEMBER,FRT/RR	2
10	24337	PLATE,MOUNTING GATE	1
11	20448	HOPPER LID,W/M	1
13	24075	CROSSMEMBER,ROCK TANK	2
14	24077	TUBE,SQ,2.50X.250X24.38	2
15	25227	MNT,PUMP BRKT	1
16	25225	GUSSET,GATE CYL	1
18	24088	ANGLE,2.00X2.00X.250X63.88	2
19	24090	SUPPORT,CHUTE/LIGHT	1
20	21367	SHIELD,ROCK	1
21	25649	BASE,SOLENOIDS	1
22	81042	NUT,WELD,.250-20	2
23	24076	MOUNT,ANGLE,BLOWER VALVE	1
24	99644	PIPE,NIPPLE,06X4.00	1
25	25800	MOUNT,VIBRATOR,DC1600,BOLT ON	1
26	20427-1	BAR,.250X1.50X25.00	2
27	20428	SUPPORT,BAR,HORIZONTAL	2
28	24089	SHELF,LIGHT	1
29	20648	HINGE,LOWER HOPPER LID	2
30	20796	PIVOT,PIN LID,W/M	2
31	80149	WASHER,FLAT,USS,1.00	2
32	24336	GUSSET,HOPPER	4
33	20438	PAD,GUSSET	4
34	989239	HINGE ASSY,HOPPER LID,W/M	1
35	24082	ANCHOR,CYL,ROCK GATE	1
36	20509	PLATE,CYL ANCHOR	1
37	24085	ANCHOR,LID CYL	1
38	24086	GUSSET,ANCHOR BASE	2
39	36544	PIN,COTTER,.177 DIA	2
40	35406	BUSHING,1.003 ID X 1.253 OD X.750	2
-41	29489	FENDER SUPPORT,W/M	4

- ITEM NOT ILLUSTRATED



WIRING DETAIL

FIGURE 5. VIBRATOR GROUP

FIGURE 5. VIBRATOR GROUP

FIG ITEM	PART NUMBER	NOMENCLATURE 1 2 3 4 5 6 7	UNITS PER ASSY
5	25799	VIBRATOR GROUP (See Figure 3 for NHA)	1
1	25800	MOUNT,VIBRATOR DC1600,BOLT-ON	1
2	37985	VIBRATOR,DC1600 W/SWITCH KIT	1
3	80186	CSHH,.500-13X1.75,GR5	10
4	80354	NUT,FLEXLOC,.500-13,FULL,LT	10
5	81141	WASHER,SAE,HARDENED,.500	20
6	37730	DECAL,VIBRATOR,RA300	1

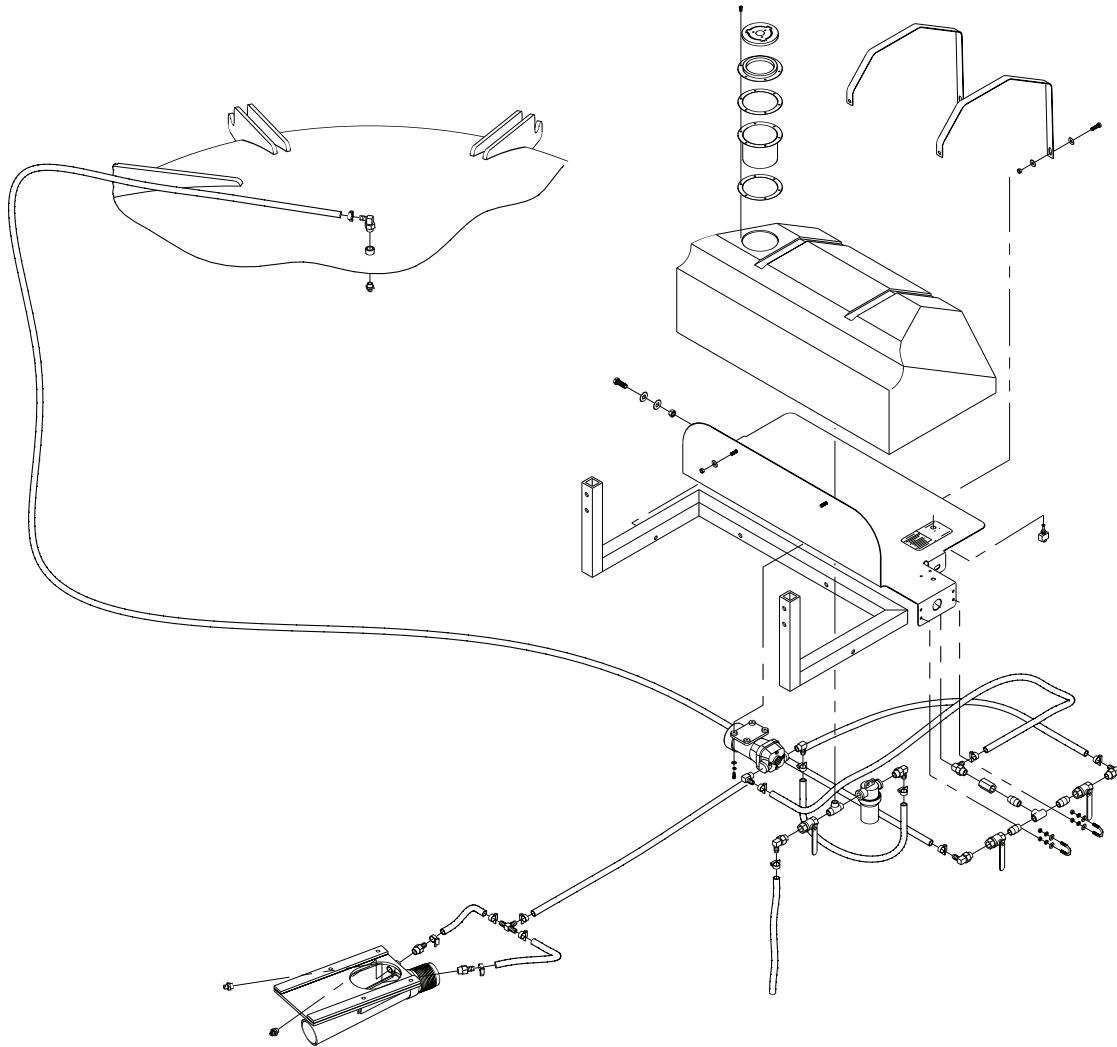


FIGURE 6. OPTIONAL JET FLUSH SYSTEM (1 OF 3)

FIGURE 6. OPTIONAL JET FLUSH SYSTEM (1 OF 3)

FIG ITEM	PART NUMBER	NOMENCLATURE 1 2 3 4 5 6 7	UNITS PER ASSY
6	24188	OPTIONAL JET FLUSH SYSTEM (See Figure 3 for NHA)	1
-1	851391	SWITCH,TOGGLE,SPST,2-POS	1
-2	24189	MOUNT,WATER TANK,W/M	1
-3	32874	VALVE,BALL,.500 (BRASS)	3
-4	33164	CLAMP,HOSE,# 10	13
-5	33598	TIE WRAP,.188X15.50	25
-6	35077	U-BOLT,.250-20,1.00IW,1.75IL	2
-7	35771	FITT,TEE 08HB,POLY	1
-8	36151	FILLER,TANK,4 IN	1
-9	36926	STRAINER ASSY	1
-10	36174	FITT,STR 06MP-08HB,BLK POLY	2
-11	36730	PUMP,WATER,DIAPHRAM	1
-12	36809	PORT KIT,08 BARB X 90,EPDM	1
-13	36846	FITT,TEE 08MP,NYLON	1
-14	36848	VALVE,CHECK,.500 FPT,1 PSI	1
-15	36849	NOZZLE,FULLJET,06 MP,BRASS	2
-16	36850	NOZZLE,FULLJET,08 MP,BRASS	1
-17	36853	DECAL,WATER FLUSH SYSTEM	1
-18	37315	FITT,STR 08MP-08MP,BRASS	3
-19	37318	FITT,TEE 08FP-08FP-08FP,BRASS	1
-20	54960	STRAP,DELUXE WATER TANK	2
-21	6352	HOSE,08,PUSH-ON,250	35
-22	70319	FITT,90 08MP-08HB,POLY	6
-23	71621	CSHH,.375-16X2.75,GR5	2
-24	80891	MACH SCR,PH,#10-32X1.00	4
-25	72670	TANK ASSY,WATER,35GAL,DELUXE	1
-26	80036	NUT,HEX,.250-20	4
-27	80140	WASHER,FLAT,USS,.250	4
-28	80141	WASHER,FLAT,USS,.313	6
-29	80142	WASHER,FLAT,USS,.375	4
-30	80160	WASHER,LOCK,.250	4
-31	80206	CSHH,.312-18X1.25,GR5	2
-32	80351	NUT,FLEXLOC,.312-18,FULL,LT	4
-33	80352	NUT,FLEXLOC,.375-16,FULL,LT	2
-34	80995	WASHER,FLAT,USS,#10	4
-35	871071601	WASHER,LOCK,#10	4
-36	988229	SUPPORT-WATER TANK,W/M	1

- ITEM NOT ILLUSTRATED

ILLUSTRATED PARTS LIST

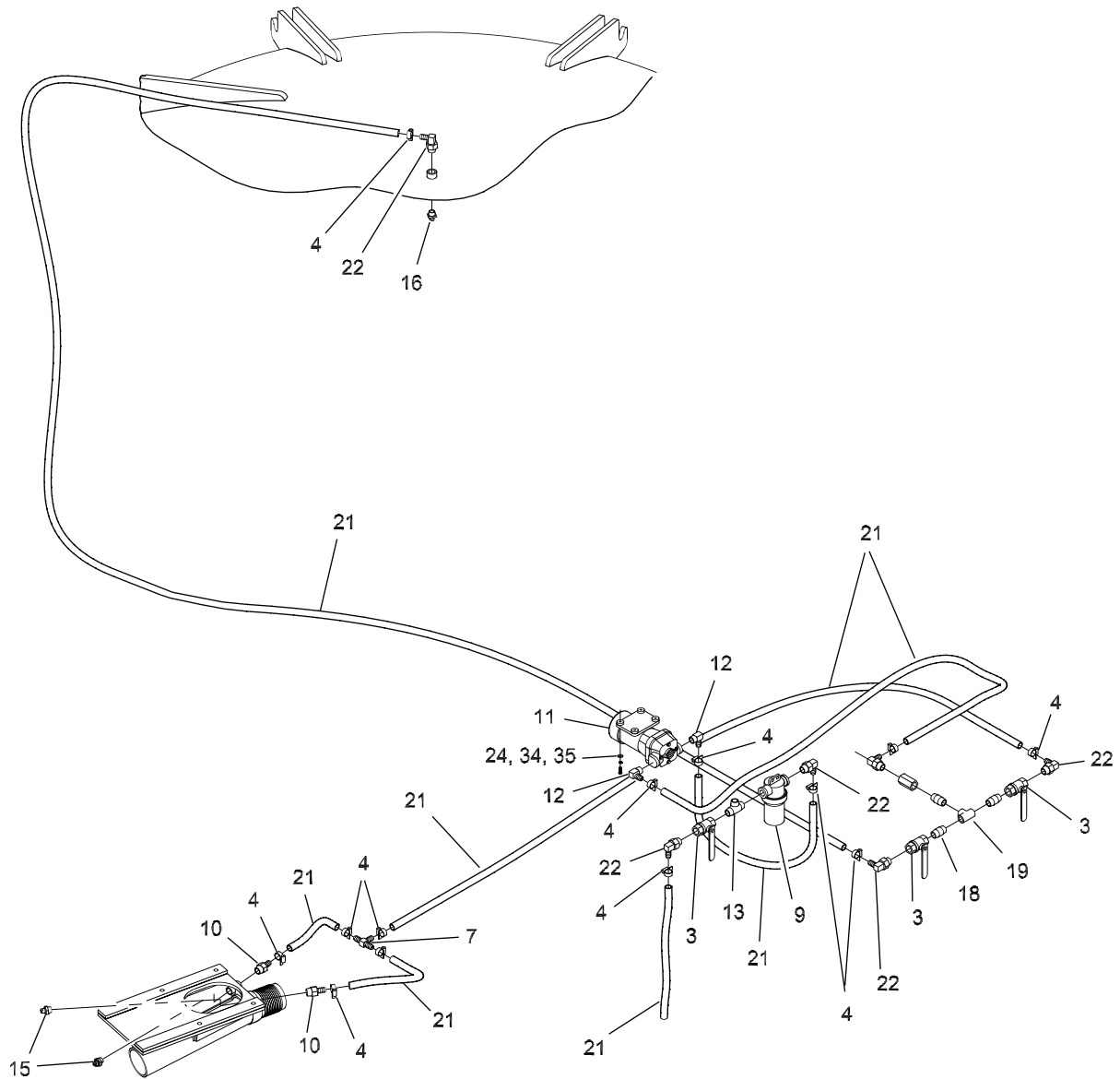


FIGURE 6. OPTIONAL JET FLUSH SYSTEM (2 OF 3)

FIGURE 6. OPTIONAL JET FLUSH SYSTEM (2 OF 3)

FIG ITEM	PART NUMBER	NOMENCLATURE 1 2 3 4 5 6 7	UNITS PER ASSY
6	24188	OPTIONAL JET FLUSH SYSTEM (See Figure 3 for NHA)	1
3	32874	VALVE,BALL,.500 (BRASS)	3
4	33164	CLAMP,HOSE,# 10	13
-5	33598	TIE WRAP,.188X15.50	25
7	35771	FITT,TEE 08HB,POLY	1
9	36926	STRAINER ASSY	1
10	36174	FITT,STR 06MP-08HB,BLK POLY	2
11	36730	PUMP,WATER,DIAPHRAM	1
12	36809	PORT KIT,08 BARB X 90,EPDM	1
13	36846	FITT,TEE 08MP,NYLON	1
15	36849	NOZZLE,FULLJET,06 MP,BRASS	2
16	36850	NOZZLE,FULLJET,08 MP,BRASS	1
18	37315	FITT,STR 08MP-08MP,BRASS	3
19	37318	FITT,TEE 08FP-08FP-08FP,BRASS	1
21	6352	HOSE,08,PUSH-ON,250	35
22	70319	FITT,90 08MP-08HB,POLY	6
24	80891	MACH SCR,PH,#10-32X1.00	4
34	80995	WASHER,FLAT,USS,#10	4
35	871071601	WASHER,LOCK,#10	4

- ITEM NOT ILLUSTRATED

ILLUSTRATED PARTS LIST

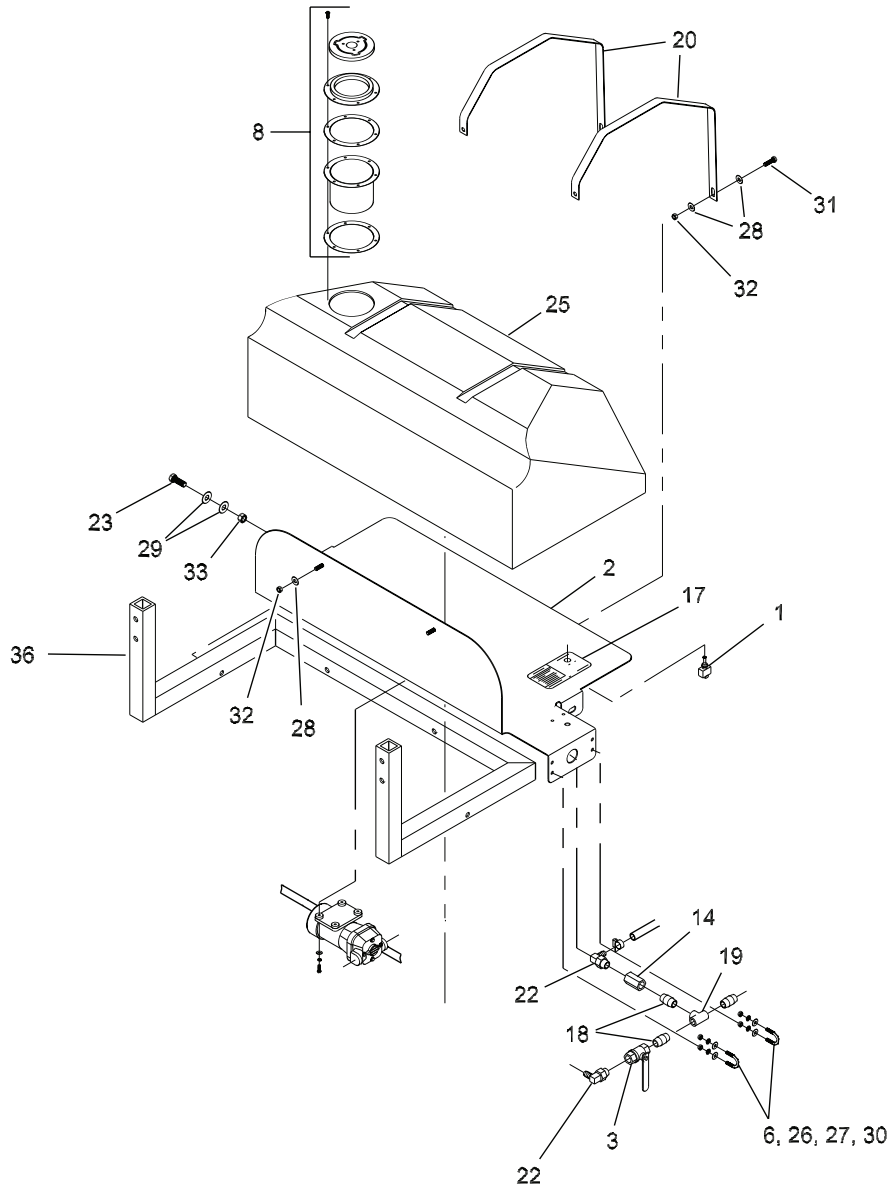


FIGURE 6. OPTIONAL JET FLUSH SYSTEM (3 OF 3)

FIGURE 6. OPTIONAL JET FLUSH SYSTEM (3 OF 3)

FIG ITEM	PART NUMBER	NOMENCLATURE 1 2 3 4 5 6 7	UNITS PER ASSY
6	24188	OPTIONAL JET FLUSH SYSTEM (See Figure 3 for NHA)	1
1	851391	SWITCH,TOGGLE,SPST,2-POS	1
2	24189	MOUNT,WATER TANK,W/M	1
3	32874	VALVE,BALL,.500 (BRASS)	3
-5	33598	TIE WRAP,.188X15.50	25
6	35077	U-BOLT,.250-20,1.00IW,1.75IL	2
8	36151	FILLER,TANK,4 IN	1
14	36848	VALVE,CHECK,.500 FPT,1 PSI	1
17	36853	DECAL,WATER FLUSH SYSTEM	1
18	37315	FITT,STR 08MP-08MP,BRASS	3
19	37318	FITT,TEE 08FP-08FP-08FP,BRASS	1
20	54960	STRAP,DELUXE WATER TANK	2
22	70319	FITT,90 08MP-08HB,POLY	6
23	71621	CSHH,.375-16X2.75,GR5	2
25	72670	TANK ASSY,WATER,35GAL,DELUXE	1
26	80036	NUT,HEX,.250-20	4
27	80140	WASHER,FLAT,USS,.250	4
28	80141	WASHER,FLAT,USS,.313	6
29	80142	WASHER,FLAT,USS,.375	4
30	80160	WASHER,LOCK,.250	4
31	80206	CSHH,.312-18X1.25,GR5	2
32	80351	NUT,FLEXLOC,.312-18,FULL,LT	4
33	80352	NUT,FLEXLOC,.375-16,FULL,LT	2
36	988229	SUPPORT-WATER TANK,W/M	1

- ITEM NOT ILLUSTRATED

ILLUSTRATED PARTS LIST

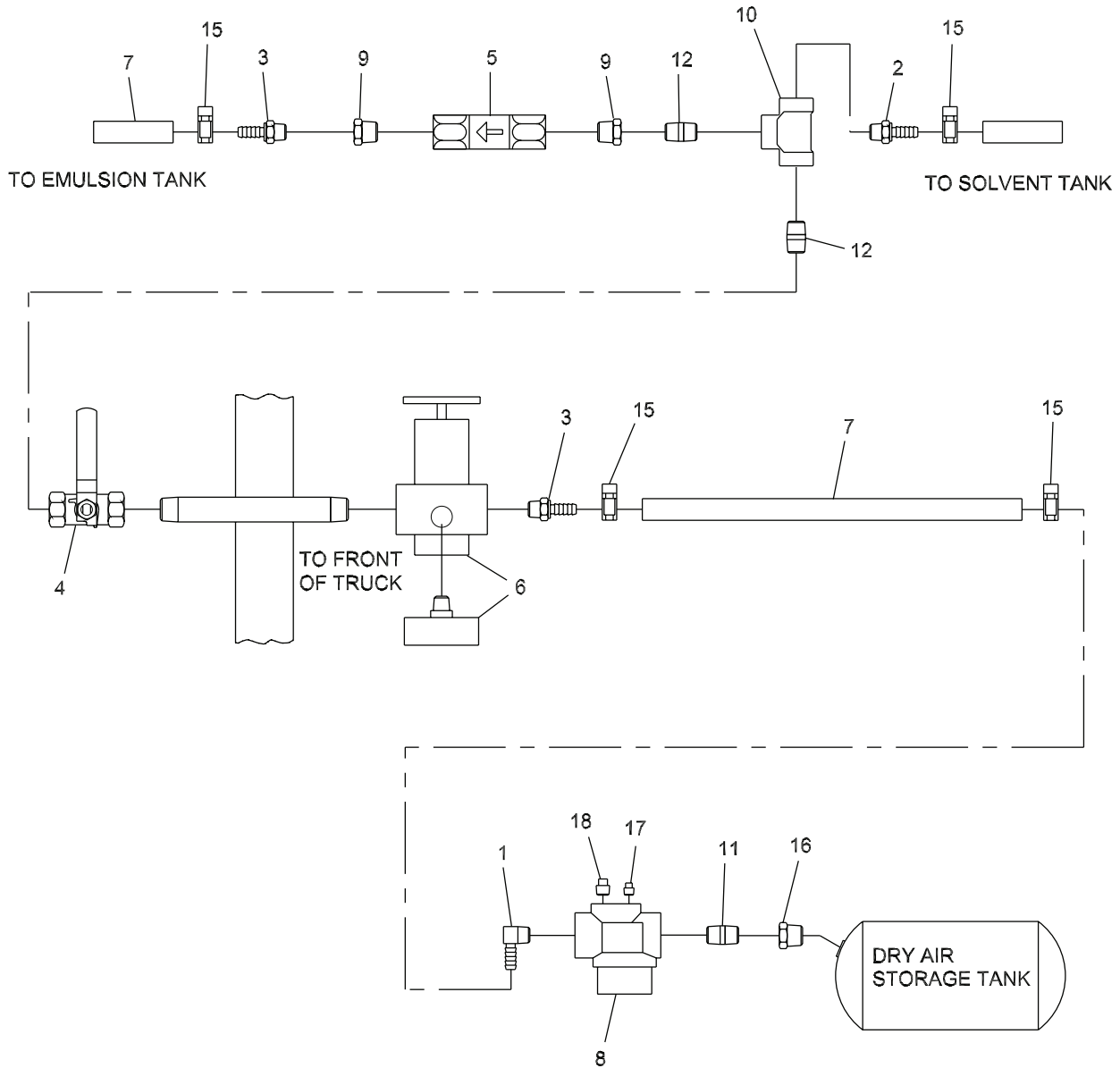


FIGURE 7. PRESSURIZED AIR GROUP

FIGURE 7. PRESSURIZED AIR GROUP

FIG ITEM	PART NUMBER	NOMENCLATURE 1 2 3 4 5 6 7	UNITS PER ASSY
7	24326	PRESSURIZED AIR GROUP (See Figure 1 for NHA)	1
1	31971	FITT,90 04MP-04HB,CRIMPED	1
2	31959	FITT,STR 06MP-06HB,PUSH-ON	1
3	33280	FITT,STR 06MP-04HB,PUSH-ON	2
4	480160	VALVE,BALL,.375	1
5	36871	VALVE,CHECK,.500 FPT,5 PSI	1
6	35435	AIR PRESS REGULATOR 5-125 PSIG	1
7	5347	HOSE,04,PUSH-ON,LOW PRESSURE	21
8	6534	VLV,PRESS PROTECTION,65-45	1
9	99450	PIPE,BUSH,08MP-06FP,MI	2
10	99568	PIPE,TEE,06FP,MI	1
11	99591	PIPE,NIPPLE,.250XCLOSE	1
12	99638	PIPE,NIPPLE,.375XCLOSE	2
*-13	36481	TUBING,AIR BRAKE,BLK,08	3
*-14	37611	FITT,STR 08NT-08NT,BRASS	2
15	33277	CLAMP,HOSE,# 04	4
16	99980	PIPE,BUSH,08MP-04FP,STL	1
17	99534	PIPE,PLUG,.125,SQ HEAD	1
18	99535	PIPE,PLUG,.250,SQ HEAD,MI	1

* Items 13 and 14 are to be used when relocating a truck air storage tank.

- ITEM NOT ILLUSTRATED

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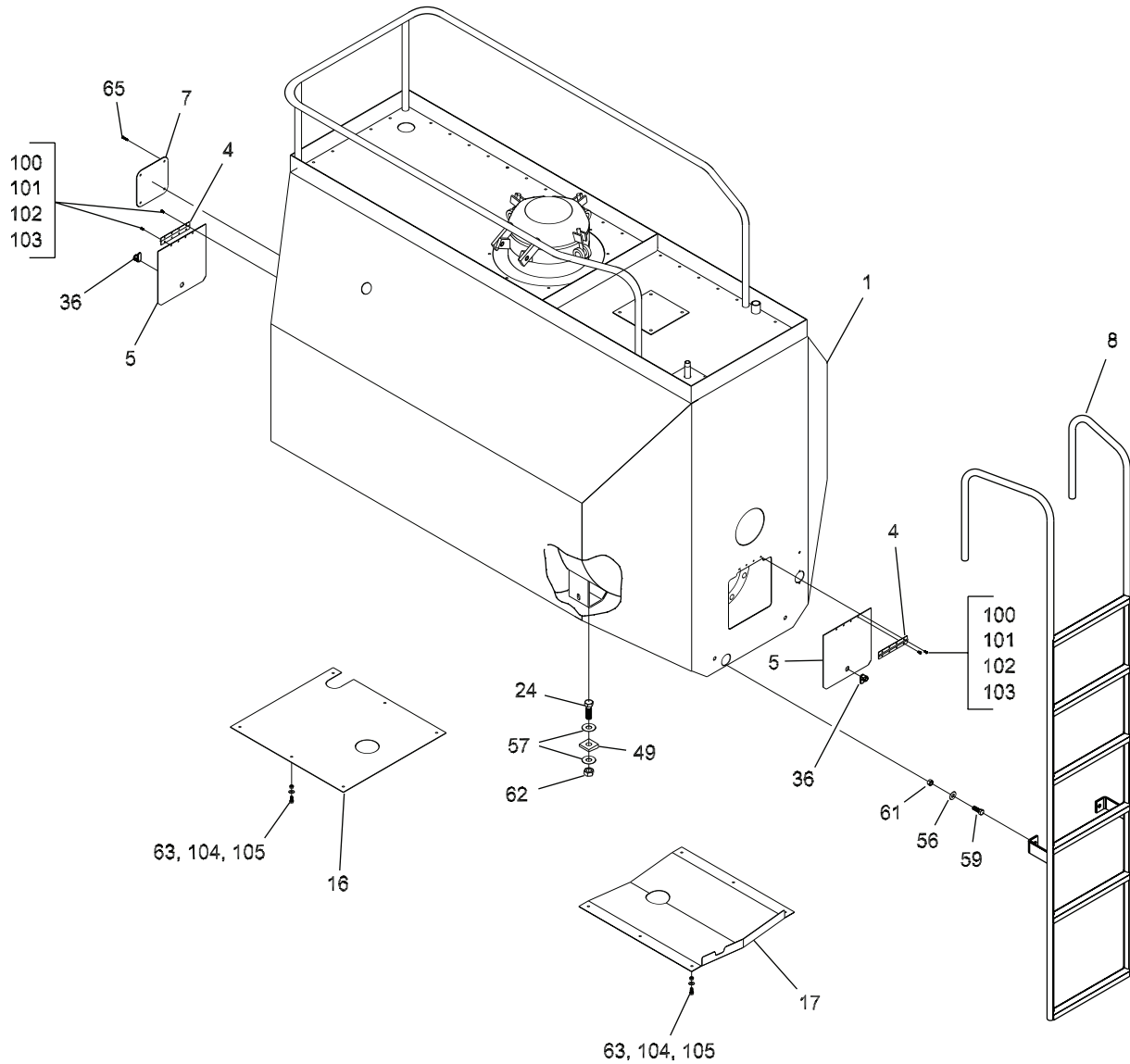
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FIGURE 8. EMULSION TANK GROUPS

FIG ITEM	PART NUMBER	NOMENCLATURE 1 2 3 4 5 6 7	UNITS PER ASSY
8	TBD	EMULSION TANK GROUPS (See Figure 1 for NHA)	1
-1	28637	EMULSION TANK (See Fig 9 for Breakdown)	1
-2	28639	EMULSION TANK INSULATE (See Fig 10 for Breakdown)	1
-3	20993	EMULSION TANK ELECTRICAL HEATER (See Fig 11)	1

- ITEM NOT ILLUSTRATED

ILLUSTRATED PARTS LIST

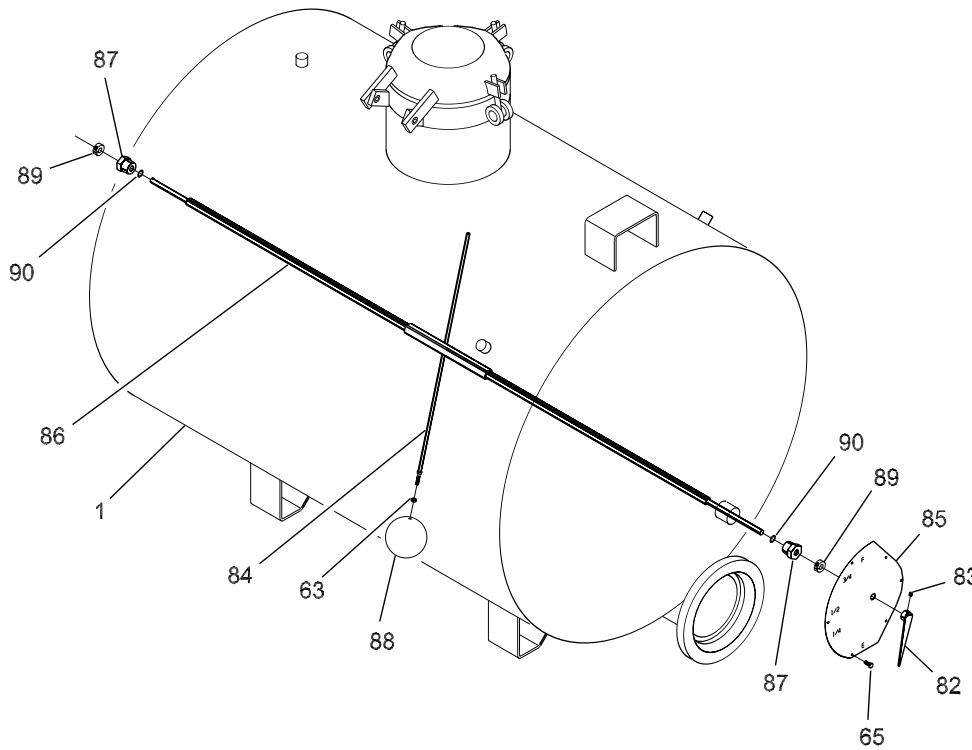


TANK SHELL DETAIL

FIGURE 9. EMULSION TANK (1 OF 4)

FIGURE 9. EMULSION TANK (1 OF 4)

FIG ITEM	PART NUMBER	NOMENCLATURE 1 2 3 4 5 6 7	UNITS PER ASSY
9	28637	EMULSION TANK (See Figure 8 for NHA)	1
1	28639	EMULSION TANK INSULATE GRP (See Fig 10 for Breakdown)	1
4	20963	HINGE,CONTROL BOX	2
5	20974	SERVICE DOOR	2
7	23729	COVER,POTENTIOMETER	1
8	24170	LADDER,SIDE,WELDMENT	1
16	24384	COVER,DRAIN	1
17	24743	COVER,SELECTION VALVE	1
24	33137	CSHH,.750-10X2.50,GR5	4
36	35812	LOCK,WITH OFFSET CAM	2
49	37670	WASHER,SQ,BEVEL,.750	4
56	80144	WASHER,FLAT,USS,.500	2
57	80147	WASHER,FLAT,USS,.750	8
59	80248	CSHH,.500-13X1.00,GR5	2
61	80354	NUT,FLEXLOC,.500-13,FULL,LT	2
62	80357	NUT,FLEXLOC,.750-10,FULL,LT	4
63	80036	NUT,HEX,.250-20	13
65	81160	SCR,SLFDRL,HH,#10X1.00,#3PT	10
100	80926	MACH SCR,PH,#8-32X.75	16
101	80793	NUT,HEX,#8-32	16
102	80995	WASHER,FLAT,USS,#10	16
103	871071601	WASHER,LOCK,#10	16
104	80192	CSHH,.250-20X.75,GR5	12
105	80140	WASHER,FLAT,USS,.250	12



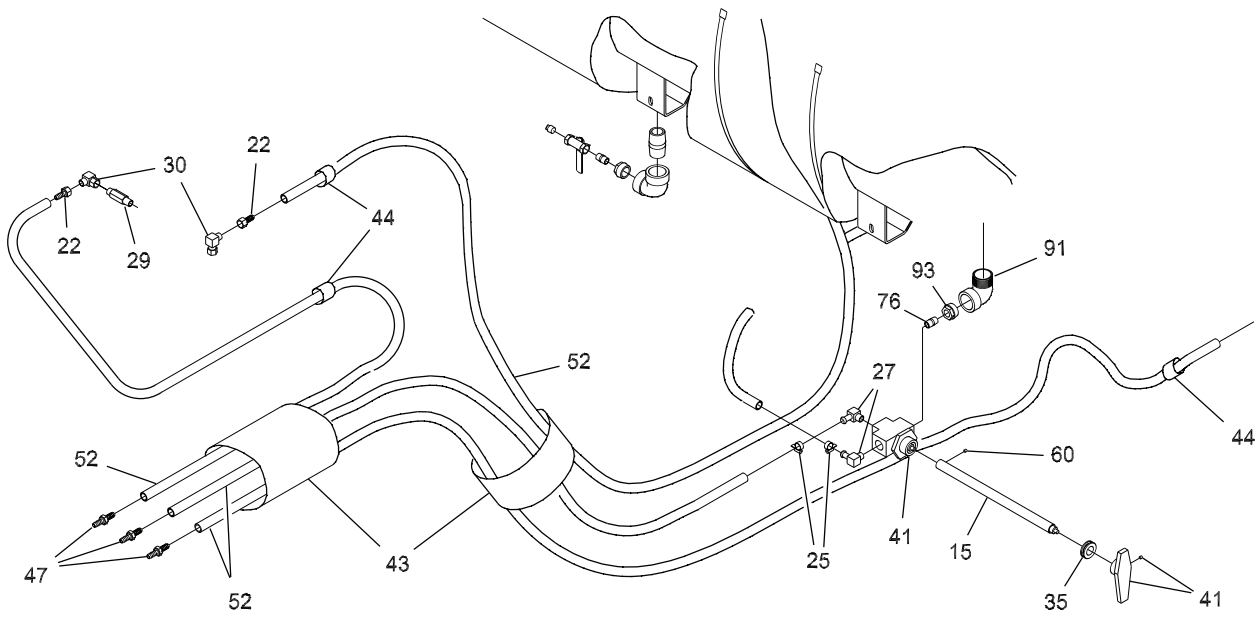
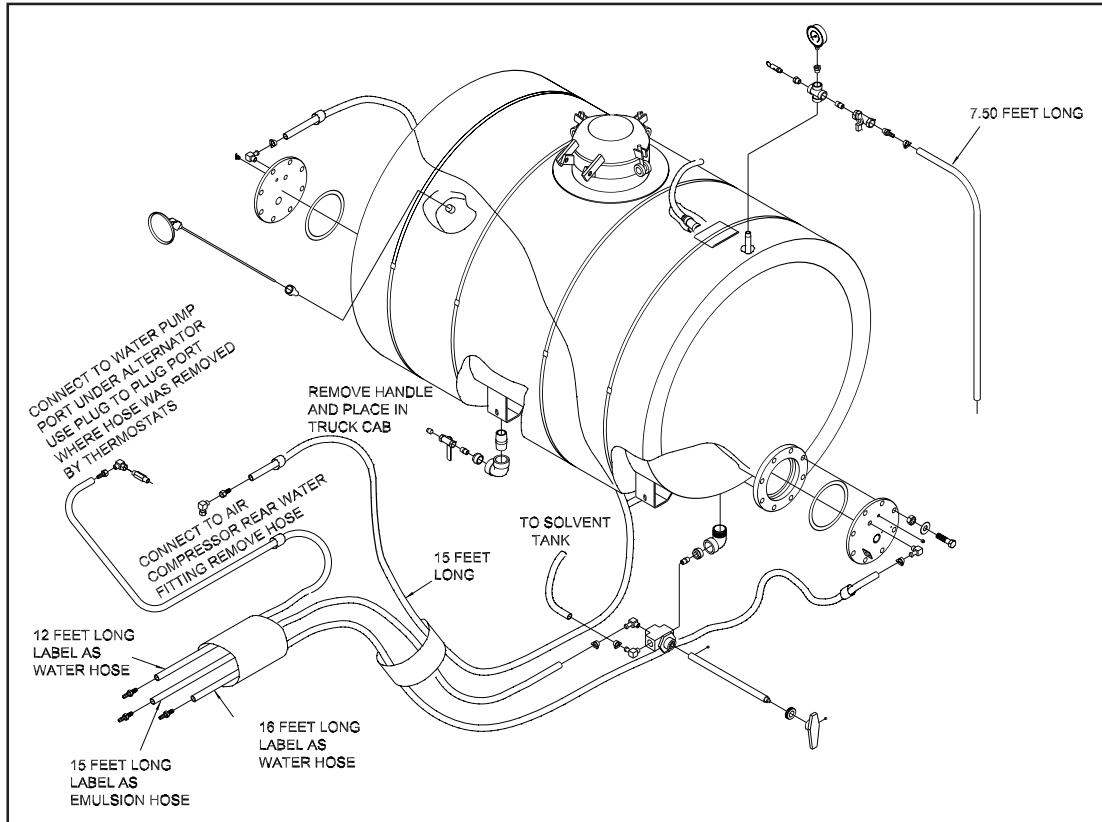
FLOAT DETAIL

FIGURE 9. EMULSION TANK (2 OF 4)

FIGURE 9. EMULSION TANK (2 OF 4)

FIG ITEM	PART NUMBER	NOMENCLATURE 1 2 3 4 5 6 7	UNITS PER ASSY
9	28637	EMULSION TANK (See Figure 8 for NHA)	1
1	28639	EMULSION TANK INSULATE GRP (See Fig 10 for Breakdown)	1
63	80036	NUT,HEX,.250-20	13
65	81160	SCR,SLFDRL,HH,#10X1.00,#3PT	10
82	8119	POINTER ASSY	1
83	80392	SET SCREW,.250-20X.500	1
84	28641	FLOAT ROD W/M,RA300,GALLONS	1
85	28640	PLATE,CONTENTS,GALLONS,RA300	1
86	23730	FLOAT ROD W/M,RA300	1
87	29093	NUT,FLOAT ROD PIVOT,.188 SEAL	2
88	35845	FLOAT,4.00 SPHERICAL SS304	1
89	37505	COLLAR,SHAFT,SPLT,.50IDX1.12OD	2
90	39084	O-RING,#310,.18X.50ID,VITON	2

ILLUSTRATED PARTS LIST



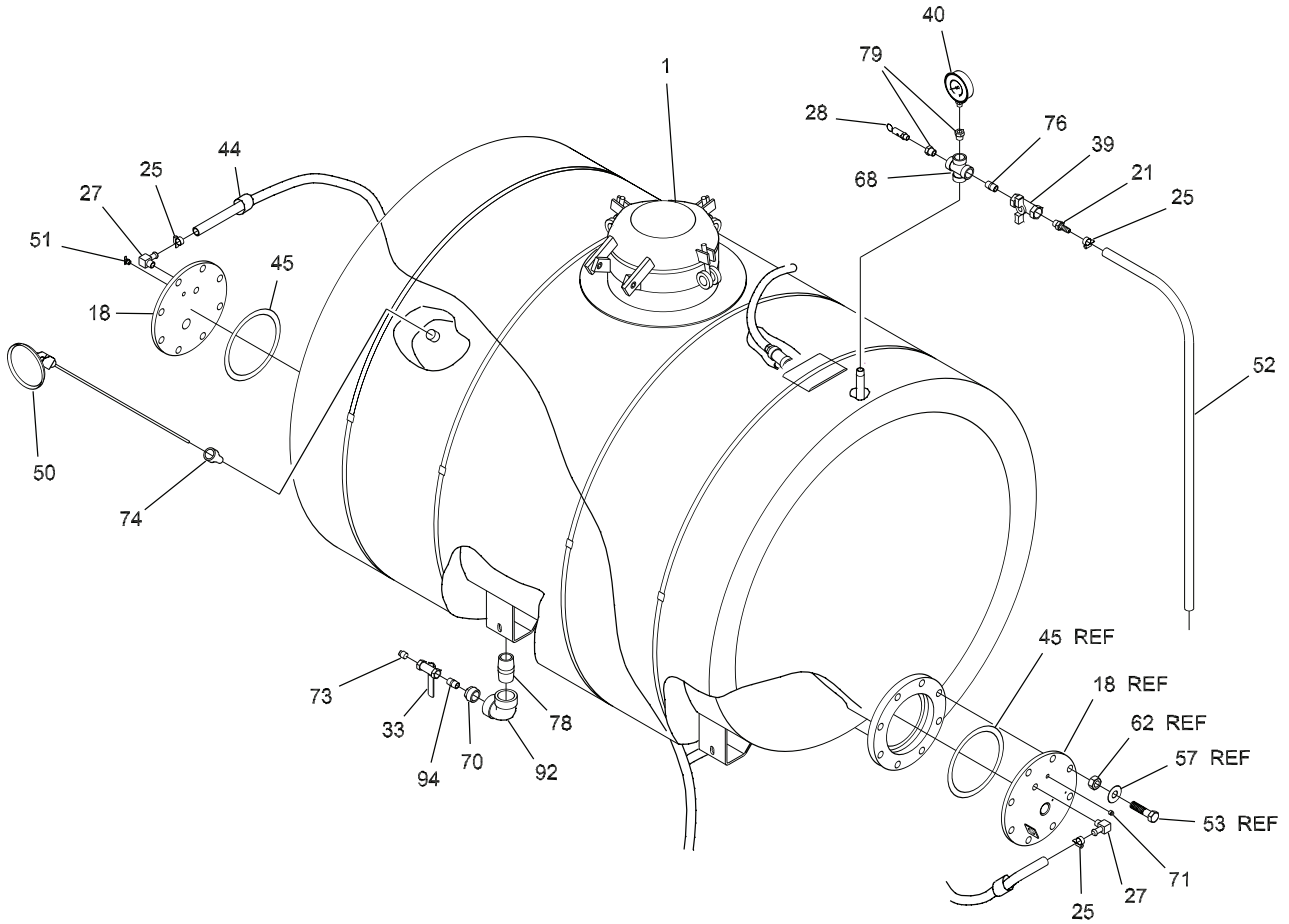
HOSE ROUTING DETAIL

FIGURE 9. EMULSION TANK (3 OF 4)

FIGURE 9. EMULSION TANK (3 OF 4)

FIG ITEM	PART NUMBER	NOMENCLATURE 1 2 3 4 5 6 7	UNITS PER ASSY
9	28637	EMULSION TANK (See Figure 8 for NHA)	1
15	24382	HANDLE EXTENTION	1
22	31109	FITT,STR 08FJX-08HB,PUSH-ON	2
25	33163	CLAMP,HOSE,# 08	5
27	33328	FITT,90 08MP-08HB,CRIMPED	4
29	37737	FITT,STR 08MJ-08MB,X-LONG	1
30	33900	FITT,90 08MJ-08FJX	2
35	35465-05	GROMMET,INSULATION,1.00ID	1
41	36662	VALVE,BALL,.500 NPT,3-WAY	1
43	36664	INSULATION,TUBE,1.62IDx.38WALL	20
44	36665	INSULATION,TUBE,1.12IDx.38WALL	15
47	37003	FITT,STR 08HB-08HB	3
52	6352	HOSE,08,PUSH-ON,250	66
60	80300	SET S,HSKT,KCUP,.250-20X.25	1

ILLUSTRATED PARTS LIST



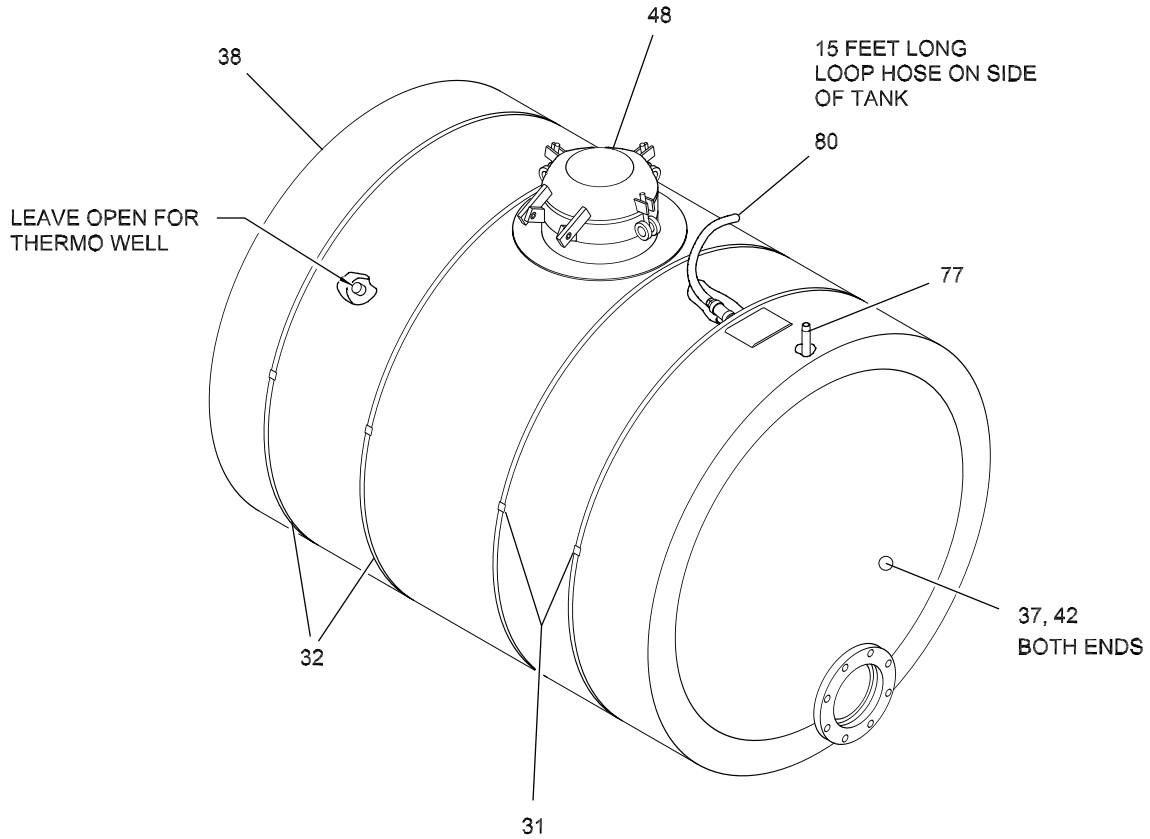
HOSE ROUTING DETAIL

FIGURE 9. EMULSION TANK (4 OF 4)

FIGURE 9. EMULSION TANK (4 OF 4)

FIG ITEM	PART NUMBER	NOMENCLATURE 1 2 3 4 5 6 7	UNITS PER ASSY
9	28637	EMULSION TANK (See Figure 8 for NHA)	1
1	28639	EMULSION TANK INSULATE GRP (See Fig 10 for Breakdown)	1
18	24490	FLANGE W/M,WATER TUBE (Part of Tank Insulate Group)	REF
21	31046	FITT,STR 08MP-08HB,PUSH-ON	1
25	33163	CLAMP,HOSE,# 08	5
27	33328	FITT,90 08MP-08HB,CRIMPED	4
28	33750	VALVE,AIR SAFETY,125PSI,04 NPT	1
33	280210	VALVE,BALL,1.00	1
-38	36553	FITT,CAP 08FJ	1
39	36622	VALVE,BALL,.500 NPT,T HANDLE	1
40	36656	GAUGE,PRESS,0-160 PSI,2.50	1
44	36665	INSULATION,TUBE,1.12IDX.38WALL	15
45	36684	GASKET,FLANGE,6.00,NON-ASB (Part of Tank Insulate Grp)	REF
50	5470	THERM,DIAL,5.0 FACE,500 F	1
51	910150	VALVE,DRAIN COCK,.250 NPT	2
52	6352	HOSE,08,PUSH-ON,250	66
53	71646	CSHH,.750-10X3.00,GR5 (Part of Tank Insulate Group)	REF
-54	81177	MACH SCR,PH,#8-32X.25	2
57	80147	WASHER,FLAT,USS,.750 (Part of Tank Insulate Group)	REF
62	80357	NUT,FLEXLOC,.750-10,FULL,LT (Part of Tank Insulate Grp)	REF
68	99498	PIPE,CROSS,.500,MI	1
70	99247	PIPE,BUSH,2.00MP-16FP,MI	1
71	99535	PIPE,PLUG,.250,SQ HEAD,MI	2
73	99539	PIPE,PLUG,16MP,SQ HEAD,MI	1
74	99551	PIPE,RED,08FP-04FP-MI	1
76	99596	PIPE,NIPPLE,.500XCLOSE	2
78	99436	PIPE,NIPPLE,2.00X5.00	1
79	99980	PIPE,BUSH,08MP-04FP,STL	2
92	99271	ELBOW,PIPE,90,2.00,MI	1
93	99440	PIPE,BUSH,2.00MP-08FP,MI	1
94	99606	PIPE,NIPPLE,1.00XCLOSE	1
-96	80162	WASHER,LOCK,.375	4
-97	80219	CSHH,.375-16X.75,GR5	4

- ITEM NOT ILLUSTRATED



TANK INSULATE DETAIL

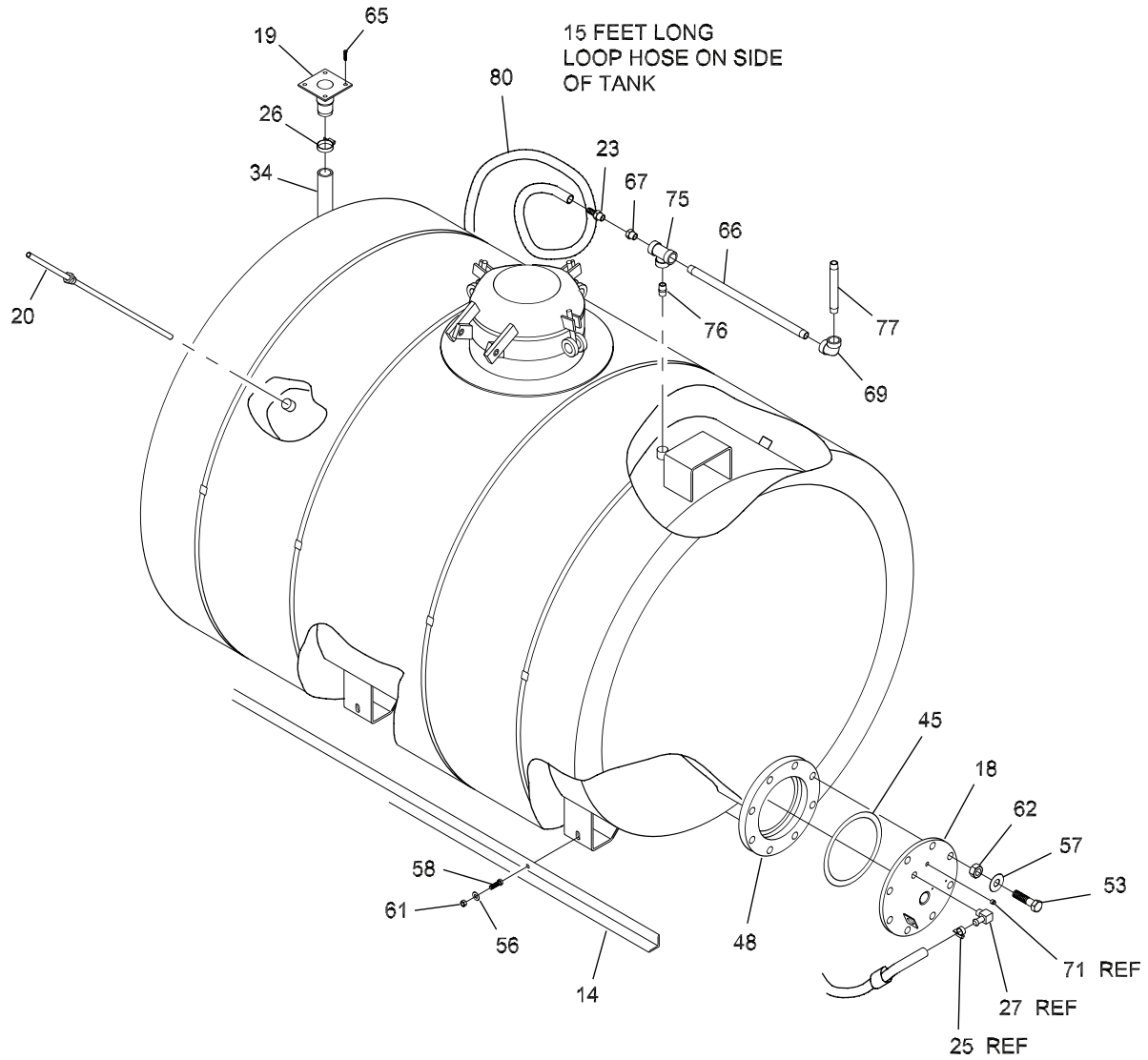
FIGURE 10. EMULSION TANK INSULATE GROUP (1 OF 2)

FIGURE 10. EMULSION TANK INSULATE GROUP (1 OF 2)

FIG ITEM	PART NUMBER	NOMENCLATURE 1 2 3 4 5 6 7	UNITS PER ASSY
10	28639	EMULSION TANK INSULATE GRP (See Figure 9 for NHA)	1
-1	12677-4	WASHER,INS,SQ,.94DIAX4.00	2
-2	20952	BAFFLE,EMULSION TANK	4
-3	20953-01	BAR,.375X2.00X70.00(99052)	1
-6	20991	COVER, ACCESS HOLE	1
-9	28642	PLATE,SKIN ENDS,LS,EMUL TANK	1
-10	28643	PLATE,SKIN ENDS,RS,EMUL TANK	1
-11	28339	PLATE,FR SIDE,EMUL TANK SKIN	2
-13	24379	PLATFORM WELDMENT	1
31	34069	BUCKLE,BAND-IT,.625,SS	4
32	34070	BAND,BAND-IT,.625,SS	50
37	35954	ADHESIVE,AEROSOL,SPRAY CAN	1
38	36527	INSULATION,THERMAL-CEL,4.00	4
42	36663	INSULATION,R11,W/VAPOR BARRIER	14
48	37738	TANK W/M,EMUL,400GAL	1
77	99670	PIPE,NIPPLE,.500X7.00	1
80	38579	HOSE,.06,LOW PRESS PUSH ON	15
-81	1708-25	WASHER,INSULATION,3"OD	1

- ITEM NOT ILLUSTRATED

ILLUSTRATED PARTS LIST



TANK INSULATE DETAIL

FIGURE 10. EMULSION TANK INSULATE GROUP (2 OF 2)

FIGURE 10. EMULSION TANK INSULATE GROUP (2 OF 2)

FIG ITEM	PART NUMBER	NOMENCLATURE 1 2 3 4 5 6 7	UNITS PER ASSY
10	28639	EMULSION TANK INSULATE GRP (See Figure 9 for NHA)	1
14	24381	ANGLE,EMULSION TANK	2
18	24490	FLANGE W/M,WATER TUBE	2
19	24509	OVERFLOW DRAIN W/M	1
20	26981	THERMO WELL,.08X30.25,W/ENDSLUG	1
23	31959	FITT,STR 06MP-06HB,PUSH-ON	1
25	33163	CLAMP,HOSE,# 08 (Part of Emulsion Tank, See Figure 9)	REF
26	33169	CLAMP,HOSE,# 28	1
27	33328	FITT,90 08MP-08HB,CRIMPED (Part of Emulsion Tank)	REF
31	34069	BUCKLE,BAND-IT,.625,SS	4
32	34070	BAND,BAND-IT,.625,SS	50
34	34501	HOSE,24,HYD SUCTION	7.2
45	36684	GASKET,FLANGE,6.00,NON-ASB	2
48	37738	TANK W/M,EMUL,400GAL	1
53	71646	CSHH,.750-10X3.00,GR5	16
56	80144	WASHER,FLAT,USS,.500	4
57	80147	WASHER,FLAT,USS,.750	16
58	80185	CSHH,.250-20X1.00,GR5	4
61	80354	NUT,FLEXLOC,.500-13,FULL,LT	4
62	80357	NUT,FLEXLOC,.750-10,FULL,LT	16
65	81160	SCR,SLFDRL,HH,#10X1.00,#3PT	192
66	853210683	PIPE,TBE,08X18.00	1
67	99450	PIPE,BUSH,08MP-06FP,MI	1
69	99512	ELBOW,PIPE,90,.500,MI	1
71	99535	PIPE,PLUG,.250,SQ HEAD,MI (Part of Emulsion Tank)	REF
75	99569	PIPE,TEE,08FP,MI	1
76	99596	PIPE,NIPPLE,.500XCLOSE	1
77	99670	PIPE,NIPPLE,.500X7.00	1
80	38579	HOSE,06,LOW PRESS PUSH ON	15

ILLUSTRATED PARTS LIST

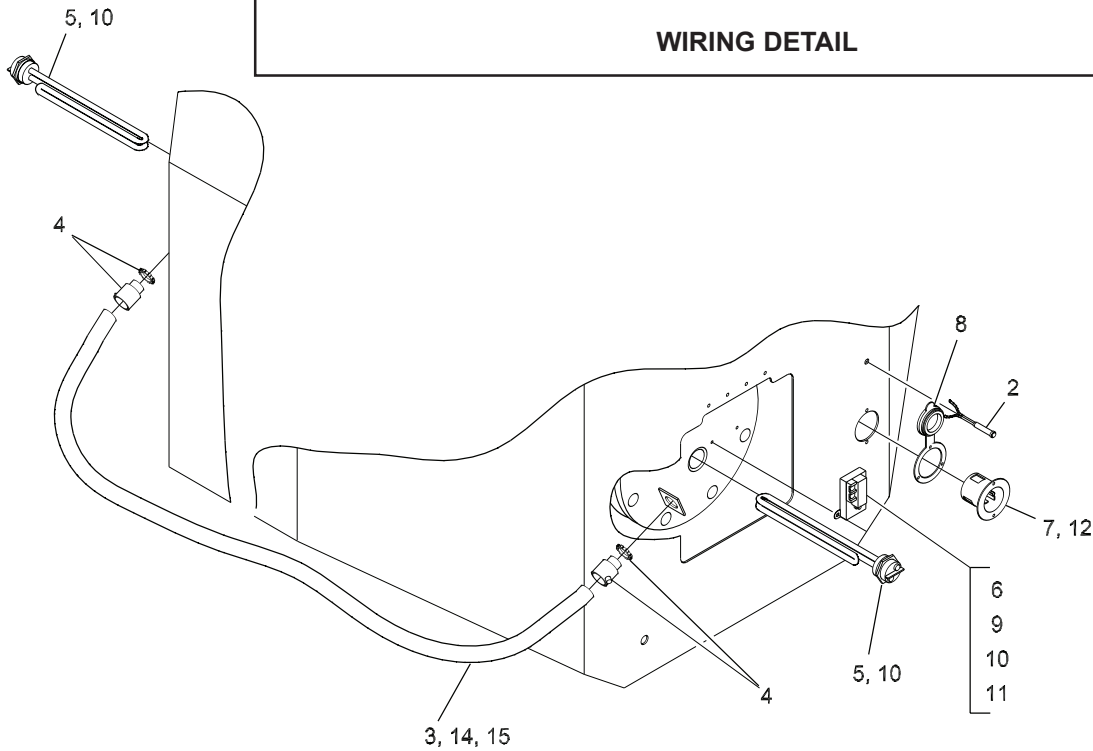
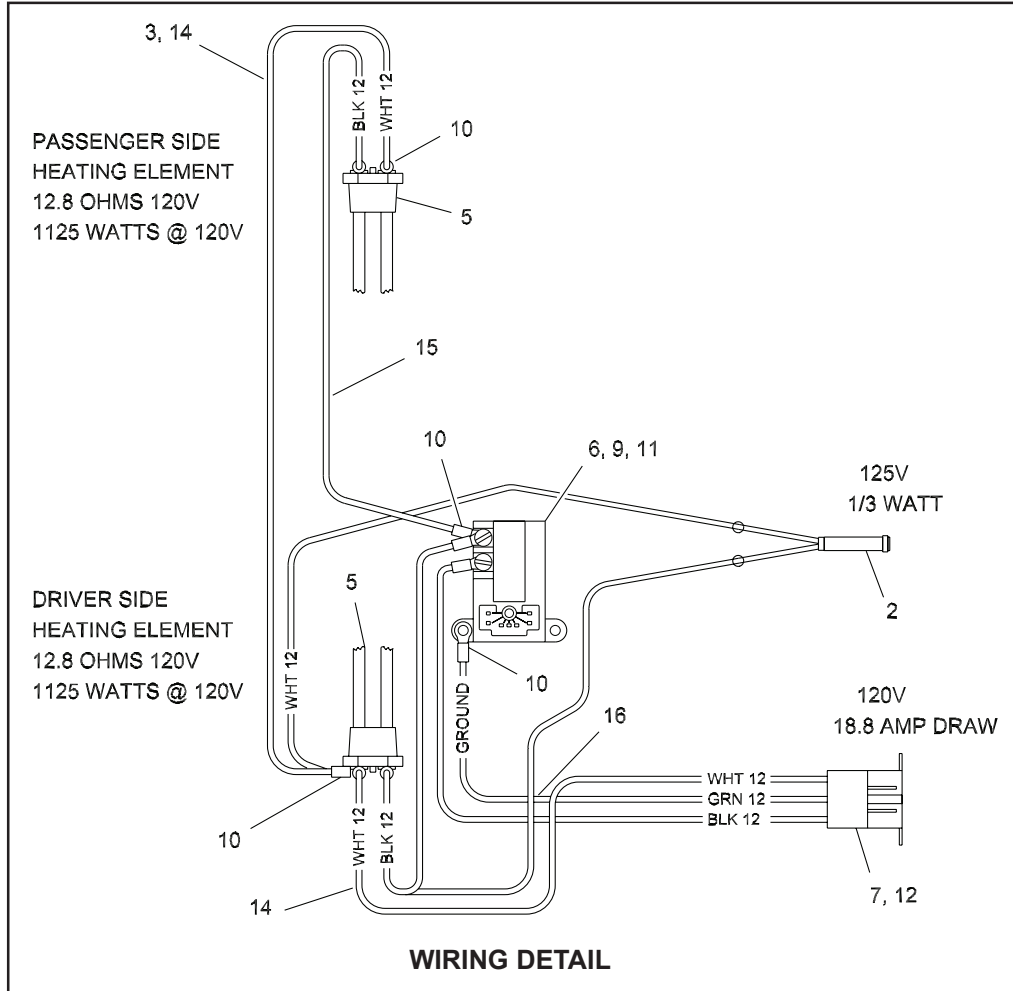


FIGURE 11. EMULSION TANK ELECTRICAL HEATER

FIGURE 11. EMULSION TANK ELECTRICAL HEATER

FIG ITEM	PART NUMBER	NOMENCLATURE 1 2 3 4 5 6 7	UNITS PER ASSY
11	20993	EMULSION TANK HEATER (See Figure 8 for NHA)	1
2	34167	LIGHT, GREEN INDICATOR	1
3	34729	CONDUIT, METAL FLEX, .50 ID	9
4	34732	CONNECTOR, STR, FLEX CONDUIT, .50	2
5	36681	ELEMENT, HEATER, 240V 4500W	2
6	36682	THERMOSTAT, ELEC, 110-170 DEG F	1
7	37591	RCPT, ELEC, MALE, 20A, 125V, FLG IN	1
8	37721	CAP, WEATHER SEAL	1
9	80496	MACH SCR, PH, #10-32X.25, PHIL	2
10	851390204	TERM, RING, 16-14 GA, #10 STUD	11
11	871071601	WASHER, LOCK, #10	2
12	81150	SCR, SLFTPG, PH, #10X.500, AB	2
13	37728	PLUG, ELEC, FEMALE, 20A, 125V	1
14	90738-03	WIRE, 12GA, WHT, 600V	15
15	90738-02	WIRE, 12GA, BLACK, 600V	15
16	90738-04	WIRE, 12GA, GREEN, 600V	2

ILLUSTRATED PARTS LIST

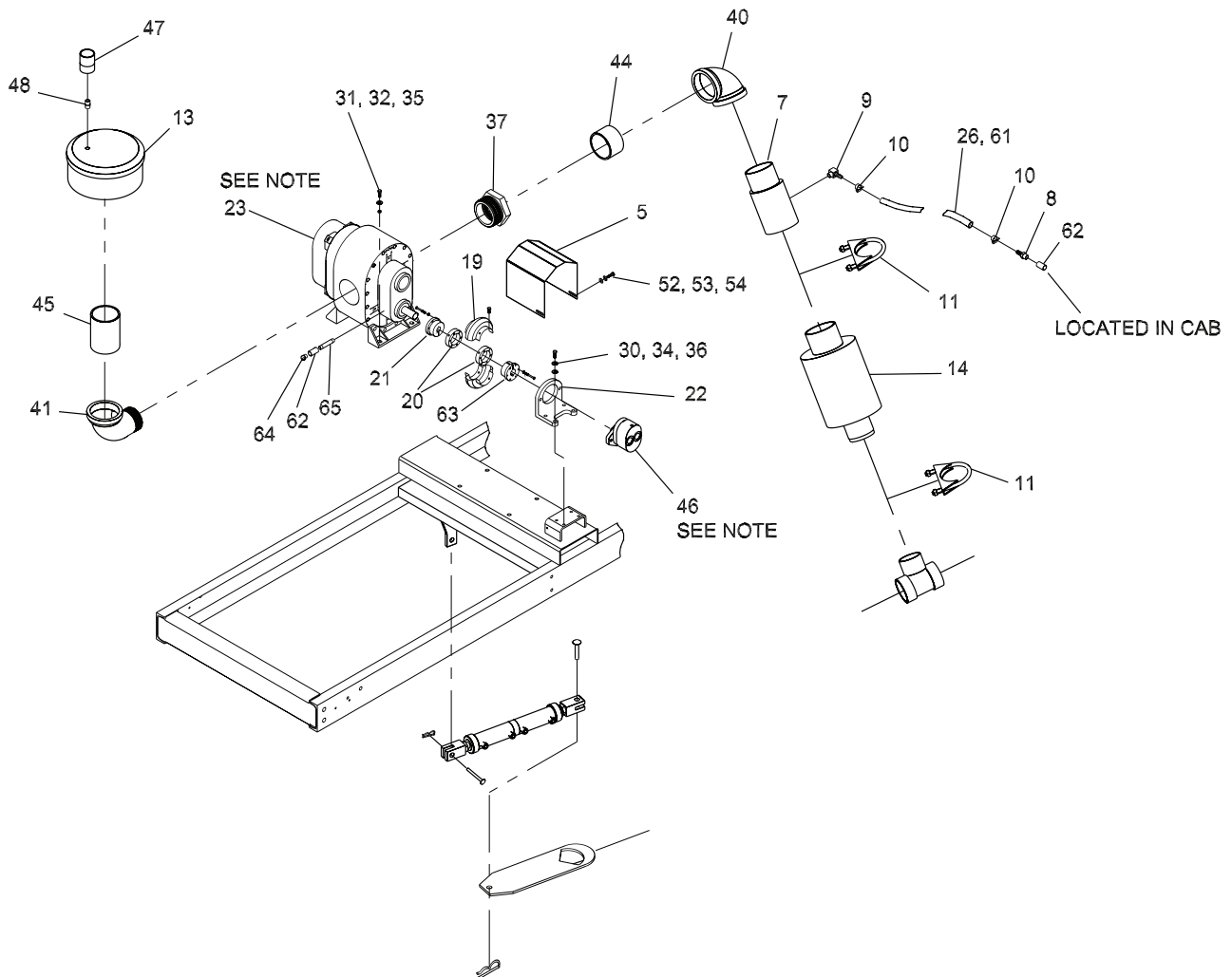
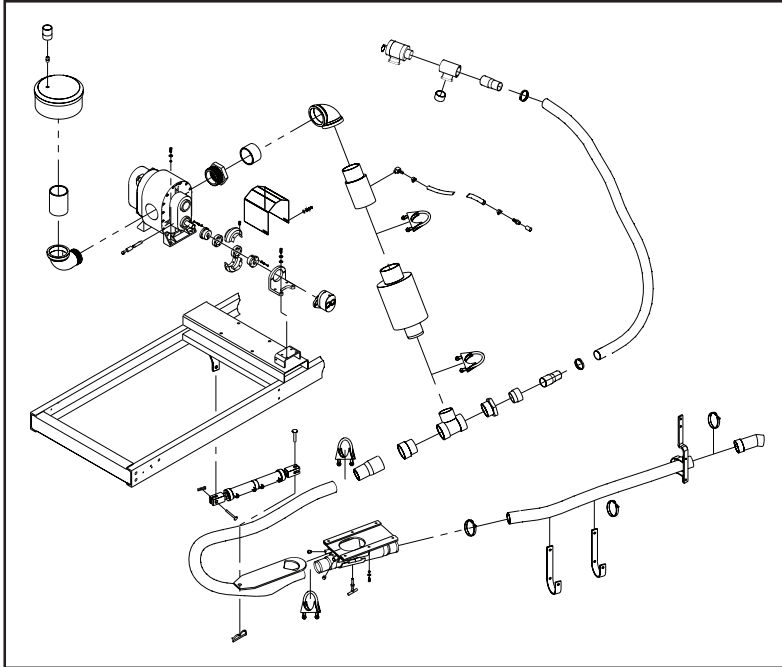
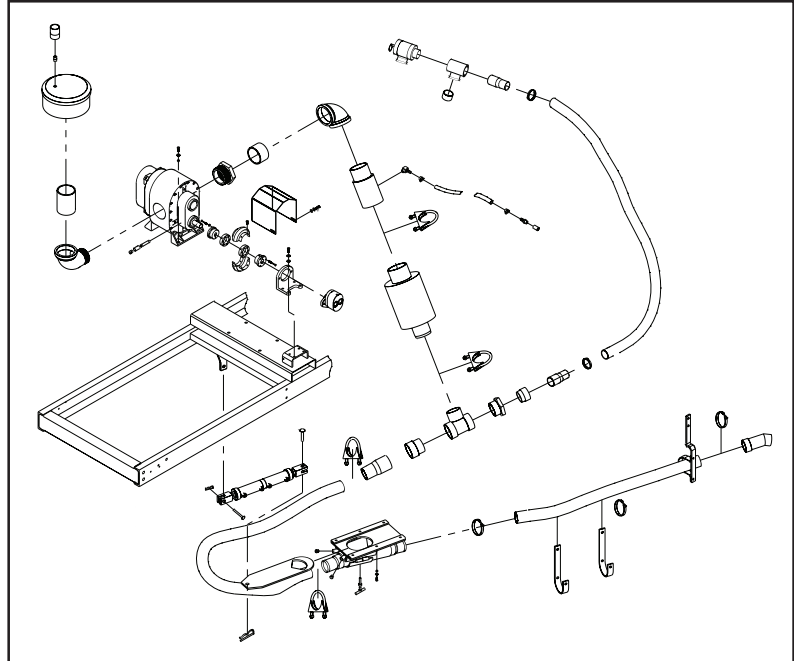


FIGURE 12. BLOWER AND DISCHARGE BOOM (1 OF 6)

FIGURE 12. BLOWER AND DISCHARGE BOOM (1 OF 6)

FIG ITEM	PART NUMBER	NOMENCLATURE 1 2 3 4 5 6 7	UNITS PER ASSY
12	25551	BLOWER GROUP (See Figure 1 for NHA)	1
5	25226	SHIELD,COUPLING	1
7	24330	MUFFLER COUPLER W/M	1
8	33343	FITT,STR 02MP-04HB,PUSH-ON	1
9	31971	FITT,90 04MP-04HB,CRIMPED	1
10	33277	CLAMP,HOSE,# 04	2
11	34040	CLAMP,MUFFLER 4.00	2
13	36531	FILTER ELEMENT,INTAKE/SILENCER	1
14	36534	MUFFLER,4" ID INLET/OUTLET	1
19	37272	ELEMENT,FLEX COUPLING	1
20	37273	HUB,FLEX COUPLING	2
21	34219	BUSHING,1.125 IDX1.871OD,1.312	1
22	37626	MOUNT,FOOT (SAE "A")	1
23	985670	BLOWER,POS DISPL,323C,TUTHILL	1
26	5347	HOSE,04,PUSH-ON,LOW PRESSURE	25
30	80142	WASHER,FLAT,USS,.375	8
31	80144	WASHER,FLAT,USS,.500	4
32	80186	CSHH,.500-13X1.75,GR5	4
34	80352	NUT,FLEXLOC,.375-16,FULL,LT	8
35	80354	NUT,FLEXLOC,.500-13,FULL,LT	4
36	81048	CSHH,.375-16X3.00,GR8	4
37	90108	PIPE,BUSH,4.00MP-3.00FP,MI	1
40	99273	ELBOW,PIPE,90,3.00,MI	1
41	99287	ELBOW,PIPE,90,4.00 STREET,MI	1
44	99793	PIPE,NIPPLE,3.00XCLOSE	1
45	99814	PIPE,NIPPLE,4.00X4.00	1
46	38637	MOTOR,HYD,GEAR,1.30 CIR,"A"	1
47	853521158	INDICATOR,AIR FILTER SERVICE	1
48	99610	PIPE,NIPPLE,.125XCLOSE	1
52	80160	WASHER,LOCK,.250	2
53	80192	CSHH,.250-20X.75,GR5	2
54	80140	WASHER,FLAT,USS,.250	2
61	35465-10	GROMMET,INS,.50IDX1.00X.063	1
62	99489	PIPE,COUPLING,.125	2
63	37876	BUSHING,.625 IDX1.871 OD,W/KEY	1
64	34516	CLAMP,HOSE,#52	1
65	33683	FITT,LUBE,45,02MP	1

ILLUSTRATED PARTS LIST



LOCATED ON TOP OF TANK

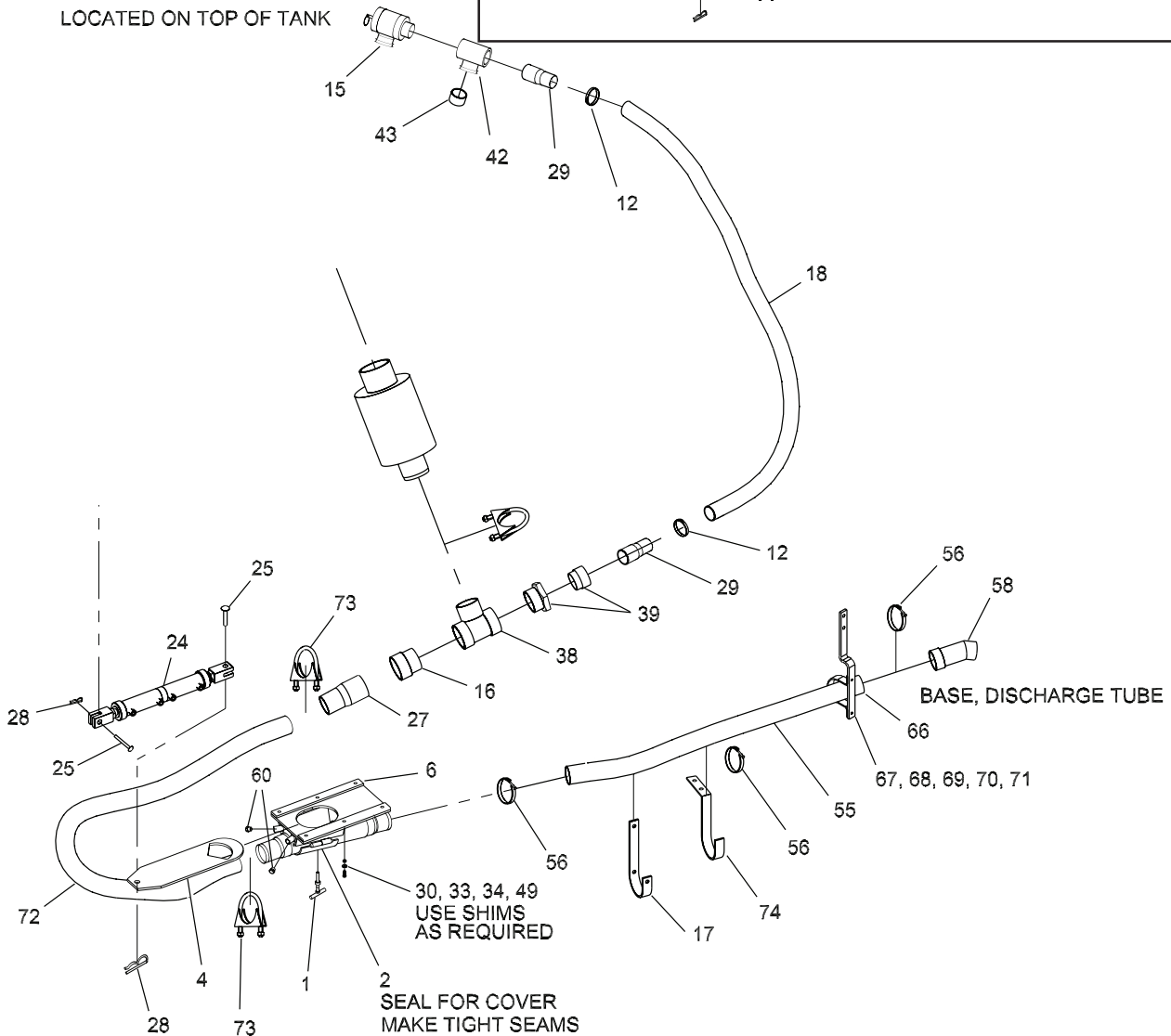


FIGURE 12. BLOWER AND DISCHARGE BOOM (2 OF 6)

FIGURE 12. BLOWER AND DISCHARGE BOOM (2 OF 6)

FIG ITEM	PART NUMBER	NOMENCLATURE 1 2 3 4 5 6 7	UNITS PER ASSY
12	25551	BLOWER GROUP (See Figure 1 for NHA)	1
1	25587	T-HANDLE W/M	1
2	38043	RUBBER STRIP,SPONGE,.18X.75	2
4	24651	SLIDE GATE	1
6	988412	SLIDE GATE HOUSING,W/M	1
12	985627	CLAMP,HOSE,2.00ID,SPIRAL LOCK	2
15	36536	VLV,RELIEF,8 PSI,2.00 NPT	1
16	36617	PIPE,ADPTR,3.00MSOCX3.00FP,PVC	1
17	24522	HOOK,HOSE,4.00 LONG	1
18	985626	HOSE,2.00 ID,POLY CONVOLUTED	11
24	37650	CYL,HYD,2.00X4.00X1.00 ROD	1
25	37662	PIN,CLEVIS,.750X2.00	2
27	5700	PIPE,NIPPLE,KING,3.00NPT	1
28	5928	PIN,COTTER,.148,#9	2
29	6063	PIPE,NIPPLE,KING,2.00	2
30	80142	WASHER,FLAT,USS,.375	8
33	80230	CSHH,.375-16X2.00,GR5	4
34	80352	NUT,FLEXLOC,.375-16,FULL,LT	8
38	91374	PIPE,TEE,3.00 SOC,PVC	1
39	91377	PIPE,BUSH,3.00MSOCX2.00FP,PVC	1
42	99333	PIPE,TEE,2.00FP,MI	1
43	99434	PIPE,NIPPLE,2.00XCLOSE	1
49	25825	SHIM,SLIDE GATE,16 GAUGE	2
55	985583	HOSE,3.00 ID,POLY CONVOLUTED	23
56	985594	CLAMP,HOSE,3.50ID,SPIRAL LOCK	3
58	24549	CONNECTOR PIPE,W/M	1
60	99536	PIPE,PLUG,.375,SQ HEAD	2
66	99612	PIPE,NIPPLE,.125X2.00	1
67	28391	BRACKET,HOSE SUPPORT	1
68	28006	SUPPORT,HOSE	1
69	80037	NUT,HEX,.312-15	4
70	80161	WASHER,SPLIT LOCK,.312	4
71	80209	CSHH,.312-18X1.50,GR5	4
72	36876	HOSE,SUCTION,3.00,WIRE HELIX	5
73	161250	CLAMP,MUFFLER,3.00	2

ILLUSTRATED PARTS LIST

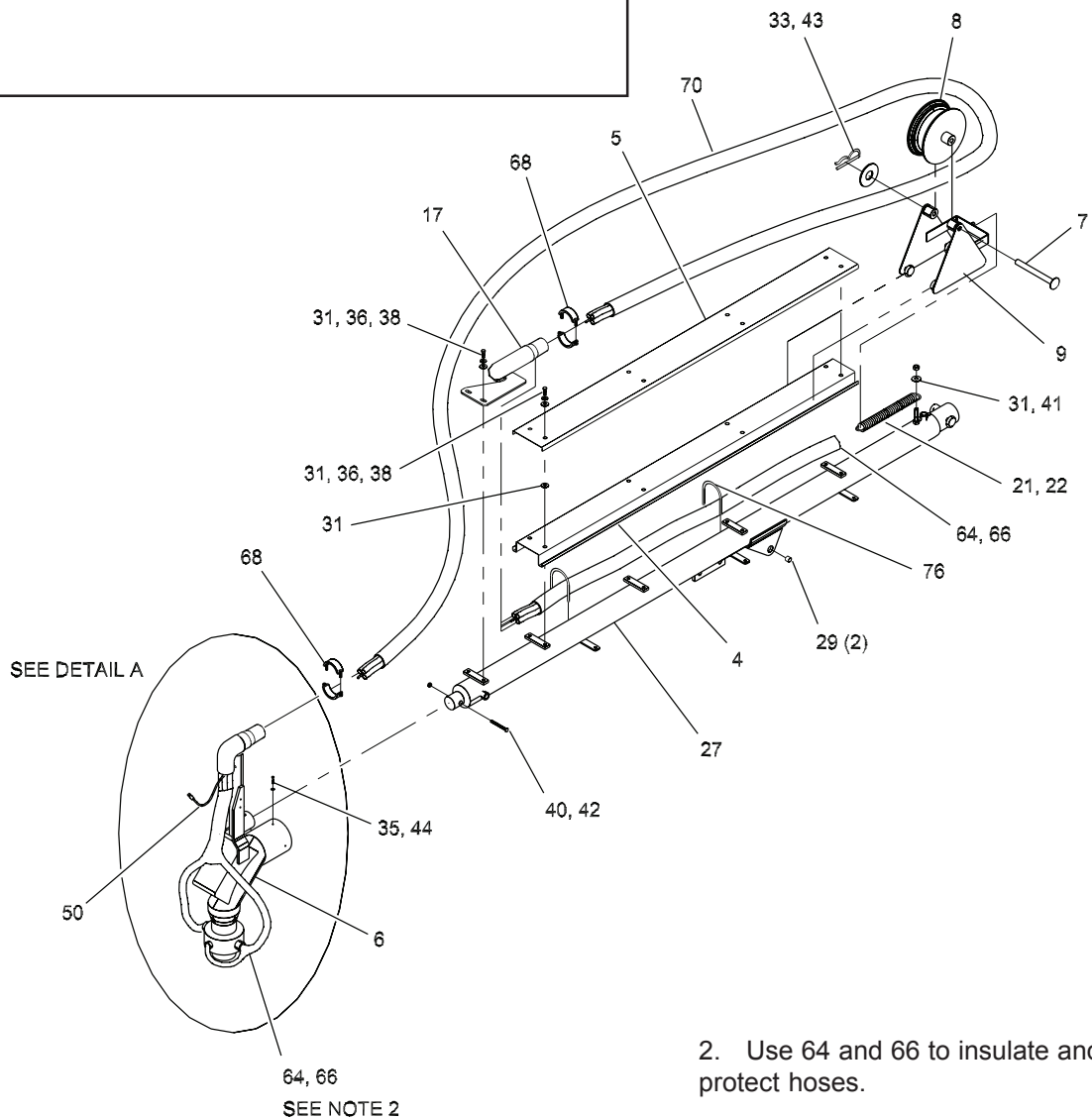
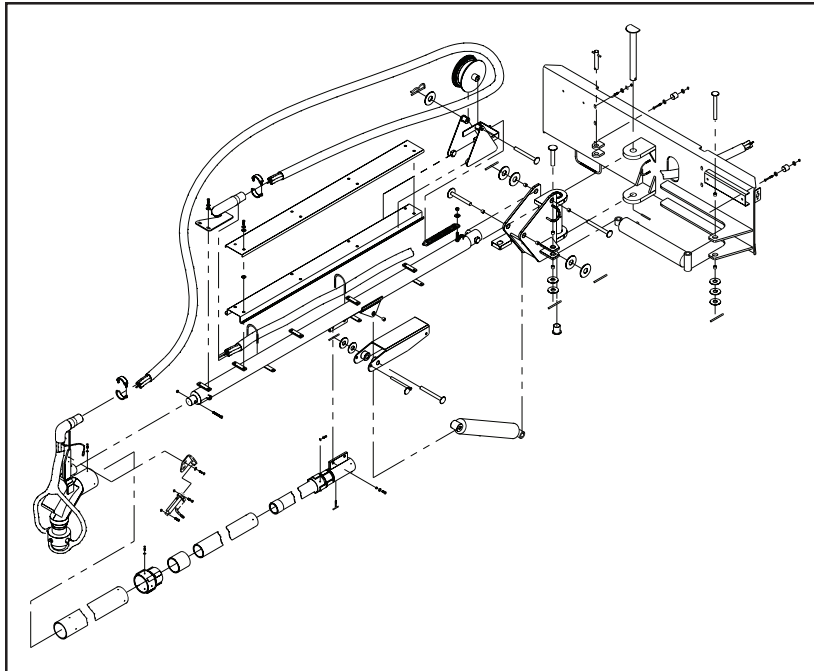
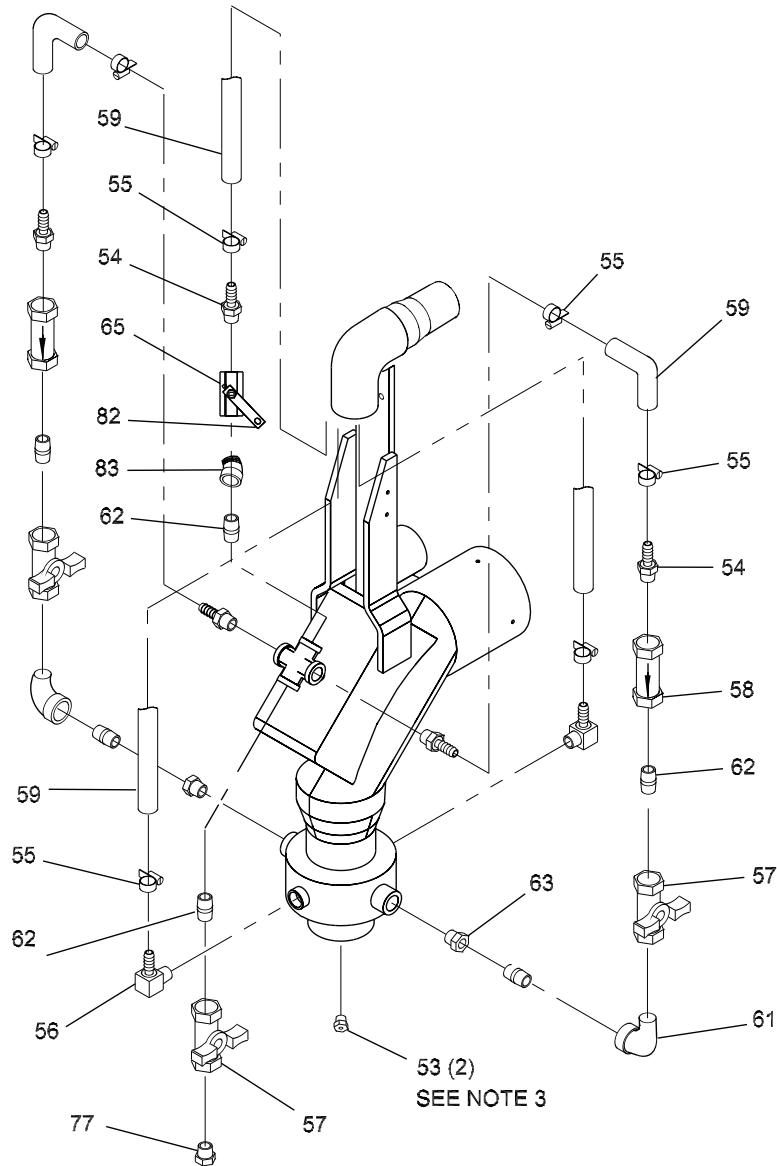


FIGURE 12. BLOWER AND DISCHARGE BOOM (3 OF 6)

FIGURE 12. BLOWER AND DISCHARGE BOOM (3 OF 6)

FIG ITEM	PART NUMBER	NOMENCLATURE 1 2 3 4 5 6 7	UNITS PER ASSY
12	24323	DISCHARGE BOOM GROUP (See Fig 1 for NHA)	1
4	20825	TRACK BOTTOM,HOSE RETRACTOR	1
5	20826	TRACK TOP,HOSE RETRACTOR	1
6	20831	NOZZLE W/M	1
7	20860	PIN W/M,HOSE RETRACTOR	1
8	20862	RETRACTOR WHEEL W/M	1
9	20865	SUPPORT W/M,RETRACTOR WHEEL	1
17	20857	RETAINER,HOSE W/M	1
21	36538	SPR,.99 DIA X 15.25	1
22	36539	SPR,1.375 DIA X 16.25	1
27	37322	CYL,HYD,3.00X72.00X2.00 ROD	1
29	930041	BUSHING,1.25ODX1.00IDX.50	10
31	80142	WASHER,FLAT,USS,.375	18
33	80146	WASHER,FLAT,USS,.625	1
35	80160	WASHER,LOCK,.250	12
36	80162	WASHER,LOCK,.375	10
38	80224	CSHH,.375-16X1.25,GR5	10
40	80289	CSHH,.625-11X3.50,GR 5	1
41	80354	NUT,FLEXLOC,.500-13,FULL,LT	10
42	80356	NUT,FLEXLOC,.625-11,FULL,LT	1
43	80389	PIN,COTTER,.125X1.00	1
44	80423	CSHH,.250-20X.50,GR5	12
50	24419	HARNESS,BOOM,ACTUATOR/LIGHTS	1
64	984360	HOSE,GUARD,SIZE 32	15
66	36664	INSULATION,TUBE,1.62IDx.38WALL	15
68	33332	CLAMP,HOSE,# 33,KNOX	2
70	36353	HOSE,WATER,SUCT/DISCH,2.00 ID	12
76	37720	CLAMP,MUFFLER,2-1/4"	2

ILLUSTRATED PARTS LIST



DETAIL A

3. Two additional spray nozzles are sent along, in the cab of the truck.

FIGURE 12. BLOWER AND DISCHARGE BOOM (4 OF 6)

FIGURE 12. BLOWER AND DISCHARGE BOOM (4 OF 6)

FIG ITEM	PART NUMBER	NOMENCLATURE 1 2 3 4 5 6 7	UNITS PER ASSY
12	24323	DISCHARGE BOOM GROUP (See Figure 1 for NHA)	1
53	24594-078	NOZZLE,EMULSION SPRAY,.078	4
54	31046	FITT,STR 08MP-08HB,PUSH-ON	5
55	33163	CLAMP,HOSE,# 08	7
56	33328	FITT,90 08MP-08HB,CRIMPED	2
57	36622	VALVE,BALL,.500 NPT,T HANDLE	3
58	36871	VALVE,CHECK,.500 FPT,5 PSI	2
59	6352	HOSE,08,PUSH-ON,250	45
61	99526	ELBOW,PIPE,90,.500 STREET,MI	2
62	99596	PIPE,NIPPLE,.500XCLOSE	6
63	99985	PIPE,BUSH,12MP-08FP,STL	2
65	36220	VALVE,BALL,.500 NPT	1
77	99537	PIPE,PLUG,08MP,SQ HEAD	1
82	24679	LEVER,3-WAY 08 NPT VALVE	1
83	99519	PIPE,ELBOW,45,.500 STREET,MI	1
-84	38642	SLEEVE,ABRASIVE,NOZZLE,RA300	1

- ITEM NOT ILLUSTRATED

ILLUSTRATED PARTS LIST

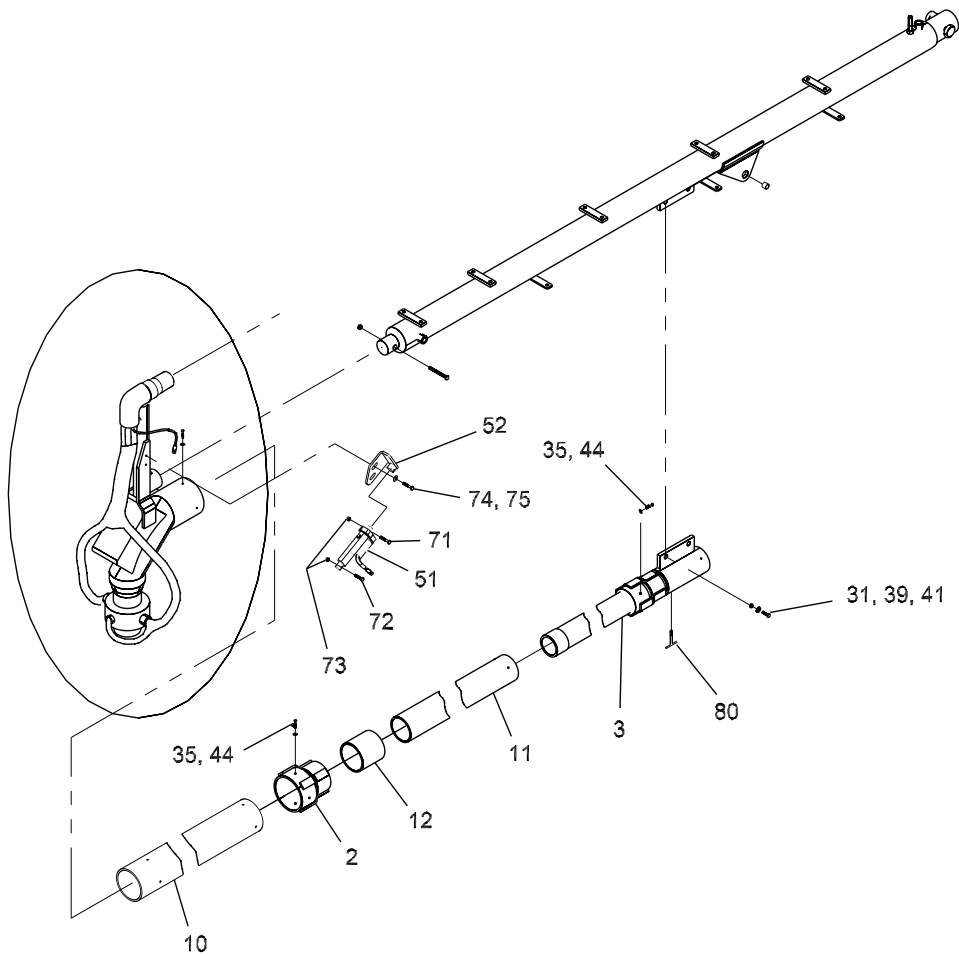


FIGURE 12. BLOWER AND DISCHARGE BOOM (5 OF 6)

FIGURE 12. BLOWER AND DISCHARGE BOOM (5 OF 6)

FIG ITEM	PART NUMBER	NOMENCLATURE 1 2 3 4 5 6 7	UNITS PER ASSY
12	24323	DISCHARGE BOOM GROUP (See Fig 1 for NHA)	1
2	20798	REDUCER W/M,4 PVCX3 PVC	1
3	20823	BASE,DISCHARGE TUBE	1
10	986474	PIPE,4.00X35.50,SCH 40,ABS	1
11	986475	PIPE,3.00X40.75,SCH 40,ABS	1
12	986477	PIPE,COUPLING,3.00SOC,MODIFIED	1
31	80142	WASHER,FLAT,USS,.375	18
35	80160	WASHER,LOCK,.250	12
39	80261	CSHH,.500-13X2.50,GR5	2
41	80354	NUT,FLEXLOC,.500-13,FULL,LT	10
44	80423	CSHH,.250-20X.50,GR5	12
51	23252	ACTUATOR,EMULSION/THROTTLE	1
52	24778	MOUNT,ACTUATOR,RA300	1
71	80194	CSHH,.250-20X1.50,GR5	1
72	80187	CSHH,.250-20X1.25,GR5	1
73	80350	NUT,FLEXLOC,.250-20,FULL,LT	2
74	80141	WASHER,FLAT,USS,.313	2
75	80208	CSHH,.312-18X1.00,GR5	2
80	21553	T-HANDLE W/M,.375-16X1.00	2

FIGURE 12. BLOWER AND DISCHARGE BOOM (6 OF 6)

FIG ITEM	PART NUMBER	NOMENCLATURE 1 2 3 4 5 6 7	UNITS PER ASSY
12	24323	DISCHARGE BOOM GROUP (See Fig 1 for NHA)	1
1	20491	PIN,PIVOT W/M	1
13	20874	PIN,CYLINDER W/M 1.00OD	3
14	22201	CYLINDER PIN W/M,1.00 X 5.94	1
15	24057	BOOM PIVOT W/M,RA300T	1
16	24059	FRONT BUMPER W/M	1
18	24303	LIFT CYL LOCK W/M	1
19	32833	BUSHING,1.503ID,1.754OD,1.5	2
20	36518	CYL,HYD,3.00X16.00X1.50 ROD	2
-20A	36518-02	KIT,SEAL,HYD CYL,3.00BX1.50RBM	A/R
21	36538	SPR,.99 DIA X 15.25	1
-23	80346	ROLL PIN,.250X1.75	5
24	36613	BEARING,THRUST 1.50 ID X.0781	1
25	36614	WASHER,THRUST,1.50IDX.062	2
26	37134	PIN,QUICK REL,1.00X3.50X11.00	1
29	930041	BUSHING,1.25ODX1.00IDX.50	10
32	80144	WASHER,FLAT,USS,.500	3
34	80149	WASHER,FLAT,USS,1.000	5
41	80354	NUT,FLEXLOC,.500-13,FULL,LT	10
45	851118-1	ROLL PIN,.375X2.00	1
-46	99190-01	TUBE,RND,1.50X.500X1.438 LG	1
-47	R48-1	WASHER,1.031X1.50X.062THICK	2
-48	R48-2	WASHER,FLAT,1.50X1.031X.075	2
-49	R48-3	WASHER,1.031X1.50X.125THICK	2
64	984360	HOSE,GUARD,SIZE 32	15
66	36664	INSULATION,TUBE,1.62IDx.38WALL	15
69	20872	PIN,CYLINDER W/M 1.00 OD	1
78	81140	CSHH,.500-13X1.75,GR8	4
79	81183	CSHH,.500-13X3.25,GR8	3
81	37117	PIN,QUICK RELEASE,.50 X 6.00	1
85	988496	BRKT,BUMPER	2
86	988502	ADAPTOR,FRT BUMPER	1
87	988502-01	ADAPTOR,FRT BUMPER,MODIFIED	1

- ITEM NOT ILLUSTRATED

ILLUSTRATED PARTS LIST

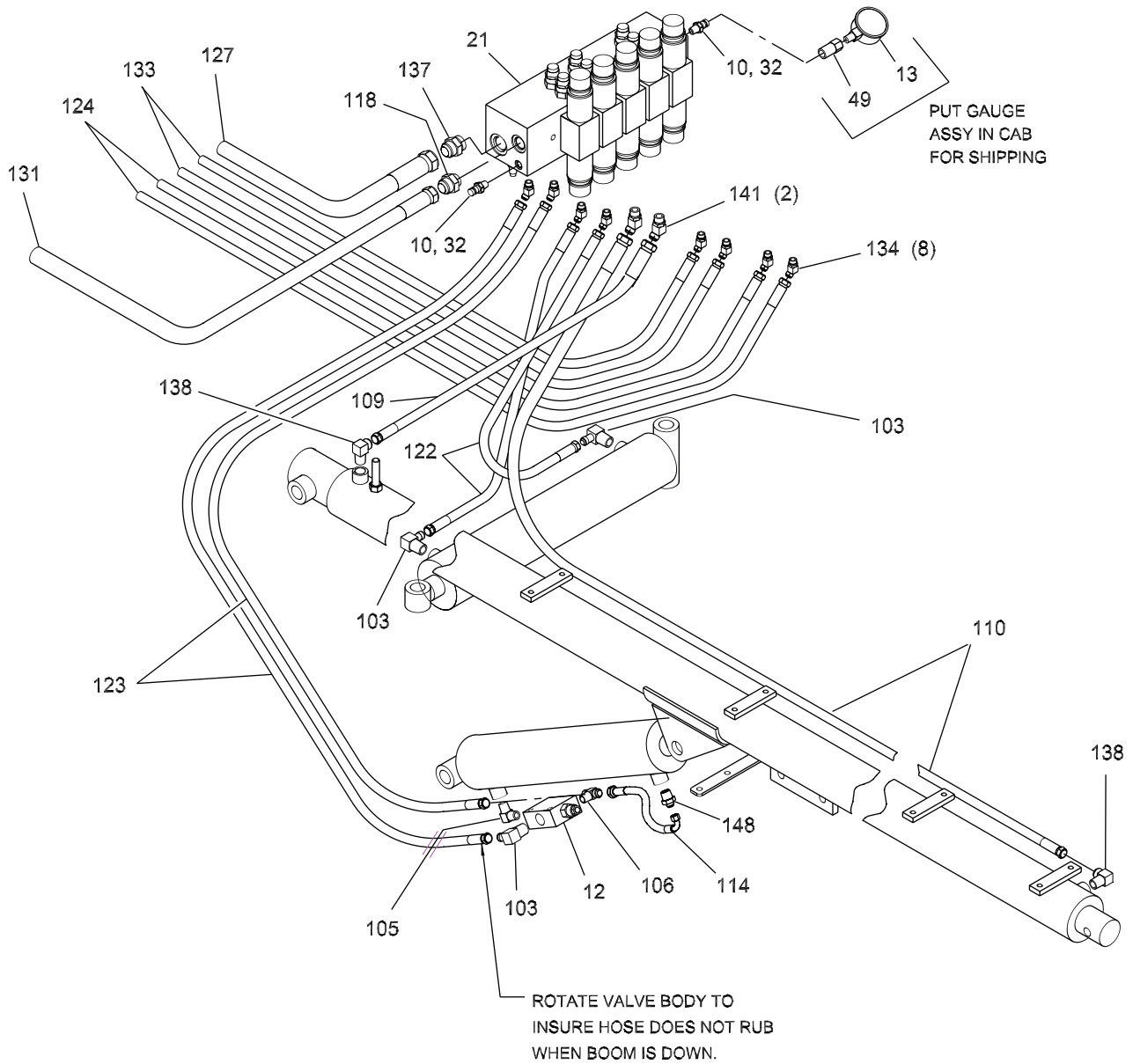


FIGURE 13. HYDRAULIC SYSTEM (1 OF 3)

FIGURE 13. HYDRAULIC SYSTEM (1 OF 3)

FIG ITEM	PART NUMBER	NOMENCLATURE 1 2 3 4 5 6 7	UNITS PER ASSY
13	28142	HYDRAULIC SYSTEM (See Figure 1 for NHA)	1
-2	34850-135	PTO DRIVE,129%,SAE"B",ENG	1
-4	38051	DIODE,1 AMP,200V,PLASTIC	10
10	72370	FITT,TEST 04MB-02PD	1
12	36523	VALVE,COUNTER BALANCE	2
13	36604	GAUGE,PRESS,0-2000 PSI, 2.50	1
-20	38855	KIT,RA300,HYD HOSE/FITT,POG (See Fig 14 for Breakdown)	1
		(Items 103 thru 148 are included in Item 20)	
103	34536	•FITT,90 06MJ-08MP	5
105	36634	•FITT,90 08MP-08MP	2
106	36637	•FITT,TEE 06MJ-06MJ-04MP	2
109	37533-057	•HOSE,08,08FJ-08FJ,3000	1
110	37533-138	•HOSE,08,08FJ-08FJ,3000	1
118	71882	•FITT,STR 12MJ-10MB	1
122	72550-026	•HOSE,06,06FJX-06FJX,3000	4
123	72550-062	•HOSE,06,06FJX-06FJX,3000	2
124	38932-286	•HOSE,06,06FJ-NONE,3000	2
127	72600-178	•HOSE,12,12FJX-12RJ45,1250	1
131	72595-152	•HOSE,12,12FJX-12FJX,3000	1
133	72599-310	•HOSE,06,06FJX-08FJX,3000	2
134	72614	•FITT,45 06MJ-06MB	8
137	853180160	•FITT,STR 12MJ-12MB	4
138	X161	•FITT,90 08MJ-08MP	2
141	X274	•FITT,45 08MJ-08MB	2
148	34082	•FITT,STR 06MJ-08MP	1
21	37647	VLV,HYD,MAN,DO3,5 SOL,12V (See Fig 15 for Breakdown)	1
32	72372	FITT,PLUG 02PD,DUST	1
33	80350	NUT,FLEXLOC,..250-20,FULL,LT	8
49	72691	FITT,TEST 04FP-02PD COUPLER	1

- ITEM NOT ILLUSTRATED

ILLUSTRATED PARTS LIST

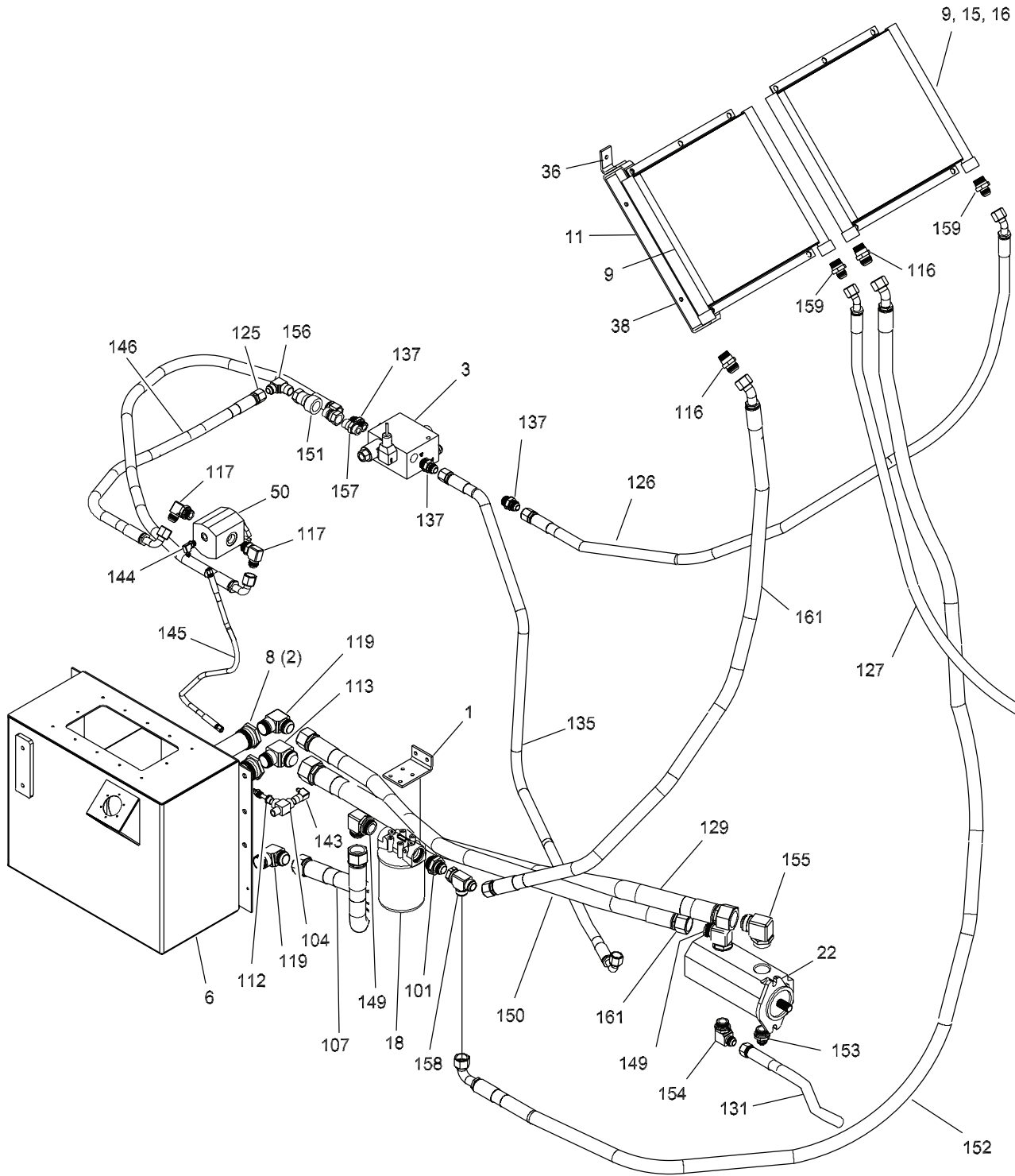


FIGURE 13. HYDRAULIC SYSTEM (2 OF 3)

FIGURE 13. HYDRAULIC SYSTEM (2 OF 3)

FIG ITEM	PART NUMBER	NOMENCLATURE 1 2 3 4 5 6 7	UNITS PER ASSY
13	28142	HYDRAULIC SYSTEM (See Figure 1 for NHA)	1
1	25646	SUPPORT,FILTER,(FOR 72543)	1
3	38706	VLV,HYD,PROP,MANIFOLD,12V	1
6	24360	TANK ASSY,HYD,20GAL	1
8	33148	STRAINER,SUCT,2NPT,25GPM,100ME	1
9	35735	COOLER,HYD OIL	2
11	24847	MOUNT,OIL COOLER	4
15	36997	FAN,ELEC,12VDC,1940 CFM	2
16	36998	GROMMET,ELEC FAN	8
18	72543	FILTER ASSY,HYD RETURN	1
-18A	72543-02	•FILTER HEAD (Part of item 18)	REF
-18B	6442	•FILTER ELEMENT (Part of item 18)	REF
-18C	72543-01	•GAUGE,RET LINE FILTER INDICATOR (Part of item 18)	REF

- ITEM NOT ILLUSTRATED

ILLUSTRATED PARTS LIST



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FIGURE 13. HYDRAULIC SYSTEM (2 OF 3) (Continued)

FIG ITEM	PART NUMBER	NOMENCLATURE 1 2 3 4 5 6 7	UNITS PER ASSY
13	28142	HYDRAULIC SYSTEM (See Figure 1 for NHA)	1
-20	38855	KIT,RA300,HYD HOSE/FITT,POG (See Fig 14 for Breakdown) (Items 101 thru 161 are included in Item 20)	1
101	36180	•FITT,STR 16MJ-20MB	1
104	36305	•PIPE,TEE,08MP-08FP-08FP,STL	1
107	37807-024	•HOSE,20,20FJX-20FJX,200	1
112	33356	•PIPE,BUSH,08MP-06FP,BRASS	1
113	37632	•FITT,90 24MJ-20MP	1
116	6345	•FITT,STR 16MJ-16MP	2
117	71775	•FITT,90 12MJ-12MB	2
119	33890	•FITT,90 20MJ-20MP	2
125	72558-054	•HOSE,12,12FJX-12RJ90,1250	1
126	72600-190	•HOSE,12,12FJX-12RJ45,1250	1
127	72600-178	•HOSE,12,12FJX-12RJ45,1250	1
129	72575-090	•HOSE,24,24FJX-24FJX,150	1
131	72595-152	•HOSE,12,12FJX-12FJX,3000	1
135	38062-190	•HOSE,12,12FJX-12RJ90,3000	1
137	853180160	•FITT,STR 12MJ-12MB	4
143	35808	•FITT,90 04MJ-08MP	1
144	35562	•FITT,90 04MJ-06MB	1
145	72416-091	•HOSE,04,04FJX-04FJX,3000	1
146	38062-032	•HOSE,12,12FJX-12RJ90,3000	1
149	33493	•FITT,90 20MJ-20MB	2
150	38930-090	•HOSE,20,20FJS-NONE,200	1
151	853182304	•FITT,QD -12 FP,SET, 4000PSI	1
152	38809-105	•HOSE,16,16FJX90-16FJX45,1000	1
153	31149	•FITT,STR 12MJ-16MB	1
154	71771	•FITT,90 12MJ-16MB	1
155	72668	•FITT,90 24MJ-24MB	1
156	34072	•FITT,90 12MJ-12MP	1
157	72400	•FITT,STR 12MP-12MB	1
158	34111	•FITT,TEE 16MJ-16FJX-16MJ	1
159	34306	•FITT,STR 12MJ-16MP	2
161	38929	•FITT,HES,20FJ-20HB,FLD CRMP	1
22	38168	PUMP,HYD,DUAL,3.8/2.3CIR,RH	1
36	28261	BAR,OIL COOLER MOUNT CLIP	4
38	81082	SCREW,SELF TAP,BTN HD.,.312X100	4
38	99462	PIPE,BUSH,1.25MP-16FP,MI	1
50	38637	MOTOR,HYD,GEAR,1.30 CIR,SAE A	REF

- ITEM NOT ILLUSTRATED

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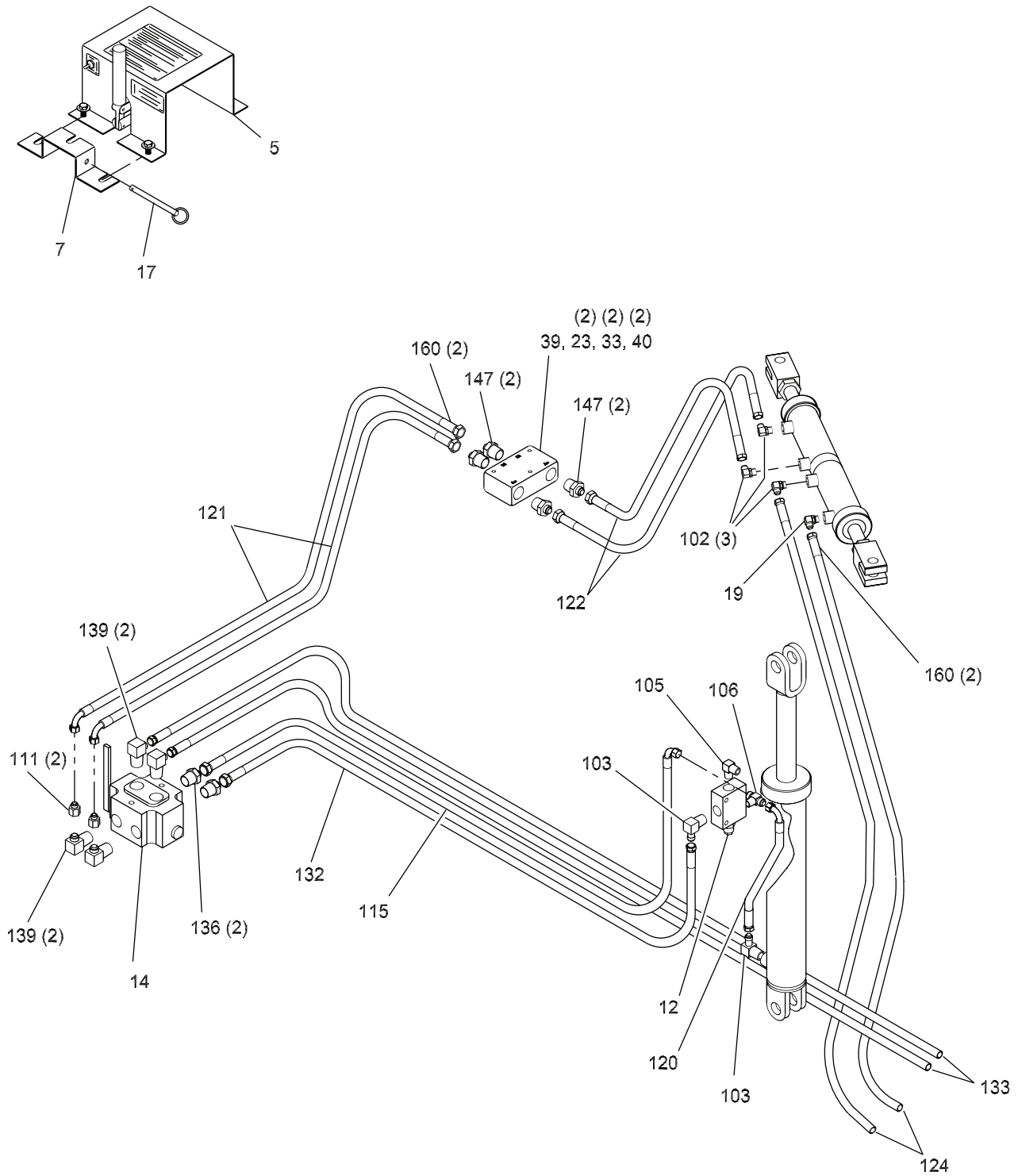


FIGURE 13. HYDRAULIC SYSTEM (3 OF 3)

FIGURE 13. HYDRAULIC SYSTEM (3 OF 3)

FIG ITEM	PART NUMBER	NOMENCLATURE 1 2 3 4 5 6 7	UNITS PER ASSY
13	28142	HYDRAULIC SYSTEM (See Figure 1 for NHA)	1
5	24087	COVER,SELECTOR VALVE	1
7	22605	VALVE STOP	1
12	36523	VALVE,COUNTER BALANCE	2
14	36654	VLV,HYD,SELECT,2 POS,12 NPT PT	1
17	37095	PIN,QUICK RELEASE, .375X4.00	1
19	37540	FITT,90 06MJ-06MB, .037 ORF	1
-20	38855	KIT,RA300,HYD HOSE/FITT,POG (See Fig 14 for Breakdown)	1
		(Items 102 thru 160 are included in Item 20)	
102	33892	•FITT,90 06MJ-06MB	3
103	34536	•FITT,90 06MJ-08MP	5
105	36634	•FITT,90 08MP-08MP	2
106	36637	•FITT,TEE 06MJ-06MJ-04MP	2
111	37631	•FITT,STR 06MJ-08FJ	2
115	37635-126	•HOSE,06,08FJS-06FJ90,180 OFF	1
120	72549-011.5	•HOSE,06,06FJX-06RJ90,3000	1
121	38933-163	•HOSE,06,06FJX90-NONE,3000	2
122	72550-026	•HOSE,06,06FJX-06FJX,3000	4
124	38932-286	•HOSE,06,06FJ-NONE,3000	2
132	72599-126	•HOSE,06,06FJX-08FJX,3000	1
133	72599-310	•HOSE,06,06FJX-08FJX,3000	2
136	853180103	•FITT,STR 08MJ-12MP	2
139	X180	•FITT,90 08MJ-12MP	4
147	X217	•FITT,STR 06MJ-06MB	4
160	38928	•FITT,HES,06FJ-06HB,FLD CRMP	4
23	80140	WASHER,FLAT,USS, .250	12
33	80350	NUT,FLEXLOC, .250-20,FULL,LT	8
39	38063	VALVE,CHECK,PO,06FB,30G,3000	1
40	80449	CSHH, .250-20X2.75,GR5	2

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FIGURE 14. HYDRAULIC HOSE KIT (PAGE 1 OF 2)

FIG ITEM	PART NUMBER	NOMENCLATURE 1 2 3 4 5 6 7	UNITS PER ASSY
14	38855	KIT,RA300,HYD HOSE/FITT,POG (See Figure 13 for NHA)	1
-101	36180	FITT,STR 16MJ-20MB	1
-102	33892	FITT,90 06MJ-06MB	3
-103	34536	FITT,90 06MJ-08MP	5
-104	36305	PIPE,TEE,08MP-08FP-08FP,STL	1
-105	36634	FITT,90 08MP-08MP	2
-106	36637	FITT,TEE 06MJ-06MJ-04MP	2
-107	37807-024	HOSE,20,20FJX-20FJX,200	1
-108	38931-068	HOSE,16,16FJ-16FJX45,1250	1
-109	37533-057	HOSE,08,08FJ-08FJ,3000	1
-110	37533-138	HOSE,08,08FJ-08FJ,3000	1
-111	37631	FITT,STR 06MJ-08FJ	2
-112	33356	PIPE,BUSH,08MP-06FP,BRASS	1
-113	37632	FITT,90 24MJ-20MP	1
-114	72549-014	HOSE,06,06FJX-06RJ90,3000	1
-115	37635-126	HOSE,06,08FJS-06FJ90,180 OFF	1
-116	6345	FITT,STR 16MJ-16MP	2
-117	71775	FITT,90 12MJ-12MB	2
-118	71882	FITT,STR 12MJ-10MB	1
-119	33890	FITT,90 20MJ-20MP	2
-120	72549-011.5	HOSE,06,06FJX-06RJ90,3000	1
-121	38933-163	HOSE,06,06FJX90-NONE,3000	2
-122	72550-026	HOSE,06,06FJX-06FJX,3000	4
-123	72550-062	HOSE,06,06FJX-06FJX,3000	2
-124	38932-286	HOSE,06,06FJ-NONE,3000	2
-125	72558-054	HOSE,12,12FJX-12RJ90,1250	1
-126	72600-190	HOSE,12,12FJX-12RJ45,1250	1
-127	72600-178	HOSE,12,12FJX-12RJ45,1250	1
-129	72575-090	HOSE,24,24FJX-24FJX,150	1
-131	72595-152	HOSE,12,12FJX-12FJX,3000	1
-132	72599-126	HOSE,06,06FJX-08FJX,3000	1
-133	72599-310	HOSE,06,06FJX-08FJX,3000	2
-134	72614	FITT,45 06MJ-06MB	8
-135	38062-190	HOSE,12,12FJX-12RJ90,3000	1

- ITEM NOT ILLUSTRATED

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FIGURE 14. HYDRAULIC HOSE KIT (PAGE 2 OF 2)

FIG ITEM	PART NUMBER	NOMENCLATURE 1 2 3 4 5 6 7	UNITS PER ASSY
14	38855	KIT,RA300,HYD HOSE/FITT,POG	1
-136	853180103	FITT,STR 08MJ-12MP	2
-137	853180160	FITT,STR 12MJ-12MB	4
-138	X161	FITT,90 08MJ-08MP	2
-139	X180	FITT,90 08MJ-12MP	4
-141	X274	FITT,45 08MJ-08MB	2
-143	35808	FITT,90 04MJ-08MP	1
-144	35562	FITT,90 04MJ-06MB	1
-145	72416-091	HOSE,04,04FJX-04FJX,3000	1
-146	38062-032	HOSE,12,12FJX-12RJ90,3000	1
-147	X217	FITT,STR 06MJ-06MB	4
-148	34082	FITT,STR 06MJ-08MP	1
-149	33493	FITT,90 20MJ-20MB	2
-150	38930-090	HOSE,20,20FJS-NONE,200	1
-151	853182304	FITT,QD -12 FP,SET, 4000PSI	1
-152	38809-105	HOSE,16,16FJX90-16FJX45,1000	1
-153	31149	FITT,STR 12MJ-16MB	1
-154	71771	FITT,90 12MJ-16MB	1
-155	72668	FITT,90 24MJ-24MB	1
-156	34072	FITT,90 12MJ-12MP	1
-157	72400	FITT,STR 12MP-12MB	1
-158	34111	FITT,TEE 16MJ-16FJX-16MJ	1
-159	34306	FITT,STR 12MJ-16MP	2
-160	38928	FITT,HES,06FJ-06HB,FLD CRMP	4
-161	38929	FITT,HES,20FJ-20HB,FLD CRMP	1

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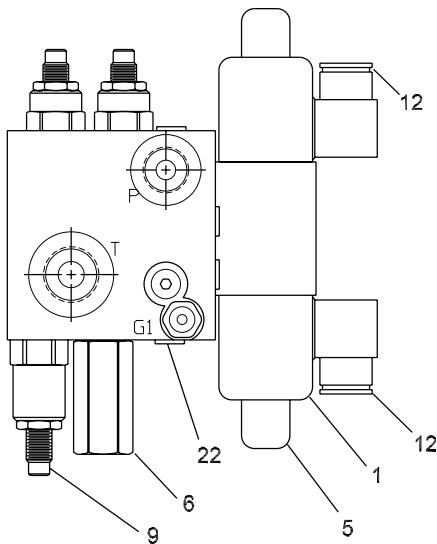
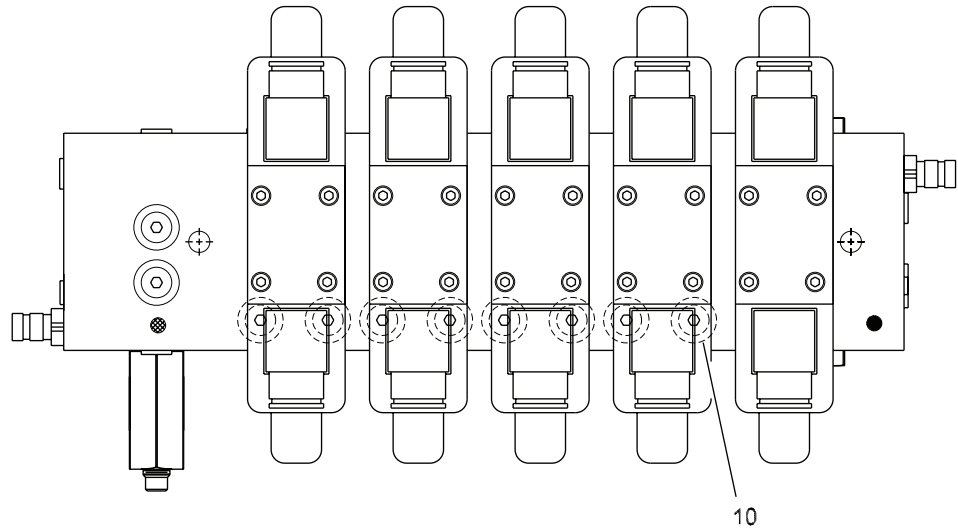
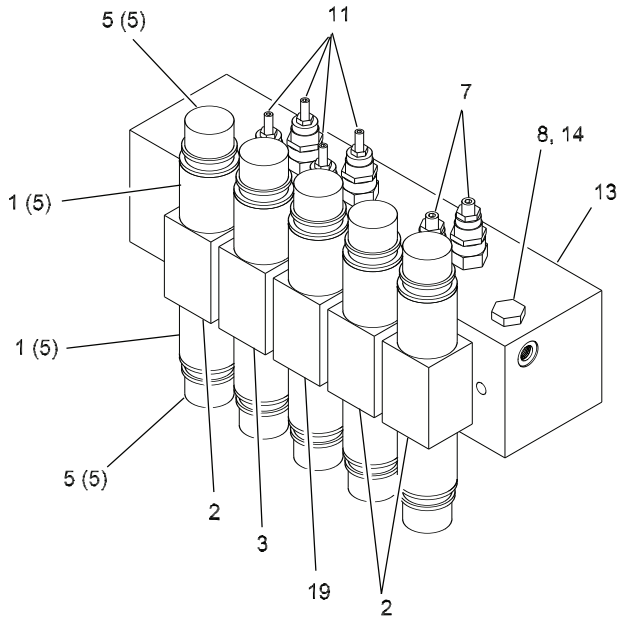


FIGURE 15. VALVE, HYDRAULIC MANIFOLD

FIGURE 15. VALVE, HYDRAULIC MANIFOLD

FIG ITEM	PART NUMBER	NOMENCLATURE 1 2 3 4 5 6 7	UNITS PER ASSY
15	37647	VALVE, HYDRAULIC MANIFOLD	1
1	37647-01	COIL, SOLENOID 12V, BOSCH DO3 (Part of items 2, 3, 19)	10
2	37647-02	VLV, 4-WAY, OPEN, BOSCH DO3	3
3	37647-03	VLV, 4-WAY, CLOSE, BOSCH DO3	1
-4	37647-04	KIT, SEAL VALVE, BOSCH DO3	5
5	37647-05	CAP, MANUAL OVERRIDE, BOSCH DO3	10
6	37647-06	VLV, LOGIC ELEMENT	1
7	37647-07	VLV, FLOW CONTROL, STD	2
8	37647-08	VLV, CHECK, CYL	2
9	37647-09	VLV, RELIEF	1
10	37647-10	VLV, CHECK, PILOT	10
11	37647-11	VLV, PRESS COMP FLOW	4
12	37647-12	CONNECTOR, DIN	10
13	37647-13	BLOCK, MANIFOLD, 5 VALVE	1
14	37647-14	PISTON, W/SEALS	1
-15	37647-15	VLV, SPOOL, REGEN, DO3 (Part of item 19)	1
-16	37647-16	VLV, SPOOL, MOTOR, DO3 (Part of item 2)	3
-17	37647-17	VLV, NAME PLATE, DO3, MOTOR SPOOL	1
-18	37647-18	VLV, NAME PLATE, DO3, REGEN SPOOL	1
19	37647-19	VLV, 4-WAY, REGEN, DO3, 12VDC	1
-20	37647-23	VLV, SPOOL, CLOSED CTR, DO3 (Part of item 3)	1
-21	37647-20	KIT, SEAL, FLOW CONTROL (part of item 7)	2
22	37647-22	ORIFICE, .020 DIA	1

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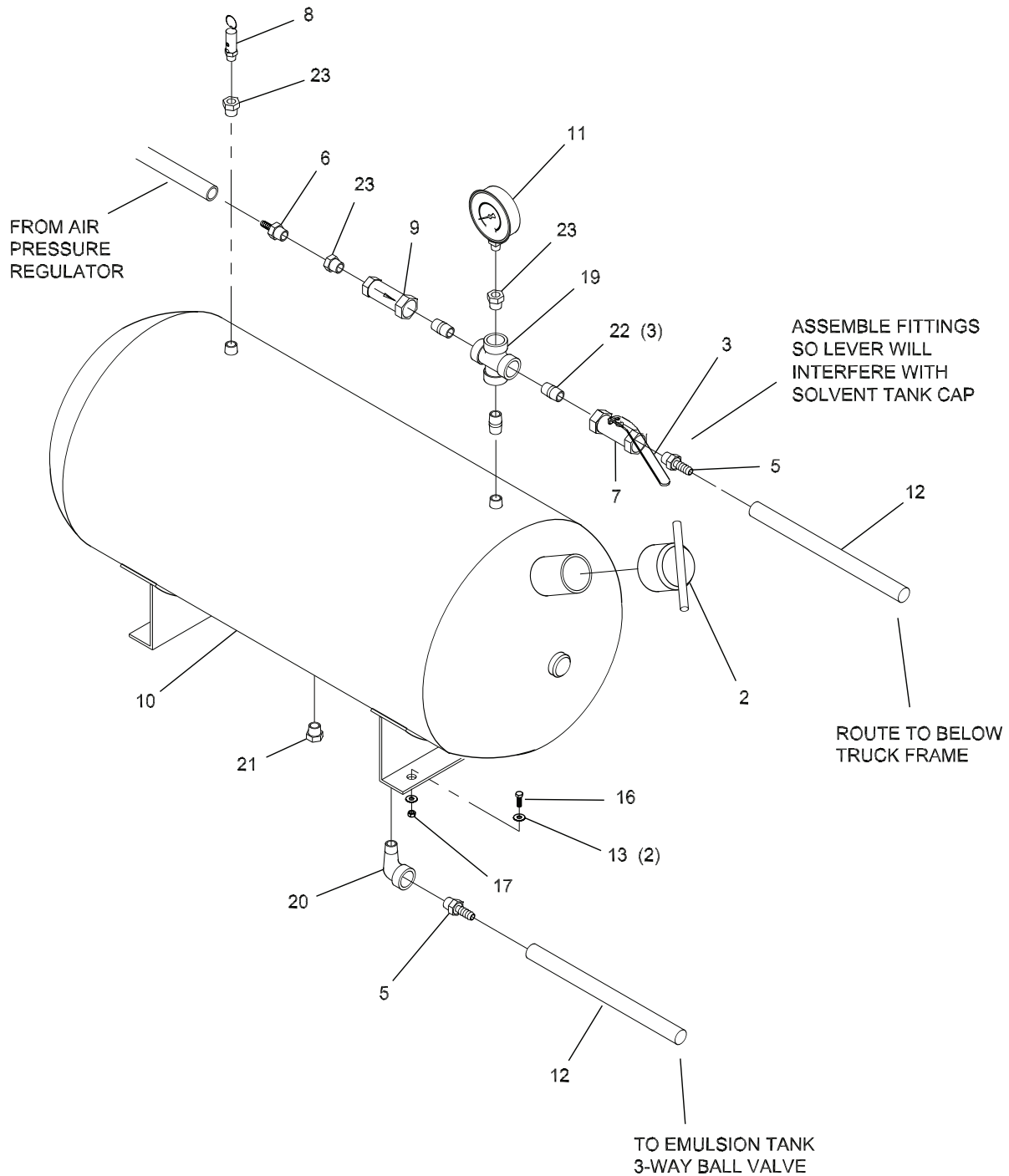


FIGURE 16. SOLVENT TANK GROUP (1 OF 2)

FIGURE 16. SOLVENT TANK GROUP (1 OF 2)

FIG ITEM	PART NUMBER	NOMENCLATURE 1 2 3 4 5 6 7	UNITS PER ASSY
16	24327	SOLVENT TANK GROUP (See Figure 1 for NHA)	1
2	20954	CAP W/M,2.00 NPT	1
3	28895	HANDLE,AIR VALVE	1
5	31046	FITT,STR 08MP-08HB,PUSH-ON	2
6	31167	FITT,STR 04MP-04HB,PUSH-ON	1
-7	32874	VALVE,BALL,.500 (BRASS)	1
8	33750	VALVE,AIR SAFETY,125PSI,04 NPT	1
9	36871	VALVE,CHECK,.500 FPT,5 PSI	1
10	36537	TANK,SOLVENT,30GAL,100PSI	1
11	36656	GAUGE,PRESS,0-160 PSI,2.50	1
12	6352	HOSE,08,PUSH-ON,250	20
13	80142	WASHER,FLAT,USS,.375	8
16	80228	CSHH,.375-16X1.75,GR5	4
17	80352	NUT,FLEXLOC,.375-16,FULL,LT	4
19	99498	PIPE,CROSS,.500,MI	1
20	99526	ELBOW,PIPE,90,.500 STREET,MI	1
21	99537	PIPE,PLUG,08MP,SQ HD,MI	1
22	99596	PIPE,NIPPLE,.500XCLOSE	3
23	99980	PIPE,BUSH,08MP-04FP,STL	3

- ITEM NOT ILLUSTRATED

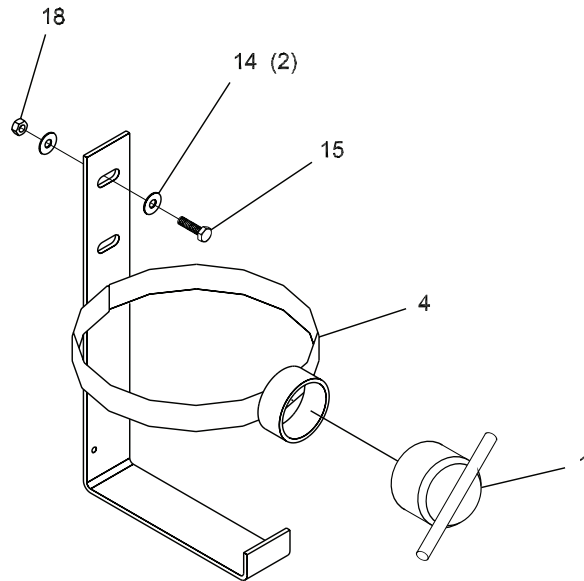


FIGURE 16. SOLVENT TANK GROUP (2 OF 2)

FIGURE 16. SOLVENT TANK GROUP (2 OF 2)

FIG ITEM	PART NUMBER	NOMENCLATURE 1 2 3 4 5 6 7	UNITS PER ASSY
16	24327	SOLVENT TANK GROUP (See Figure 1 for NHA)	1
1	20498	CAP W/M,3.00 NPT	1
4	24388	HOLDER,WASTE SOLVENT PAIL	1
14	80144	WASHER,FLAT,USS,.500	2
15	80186	CSHH,.500-13X1.75,GR5	1
18	80354	NUT,FLEXLOC,.500-13,FULL,LT	1

ILLUSTRATED PARTS LIST

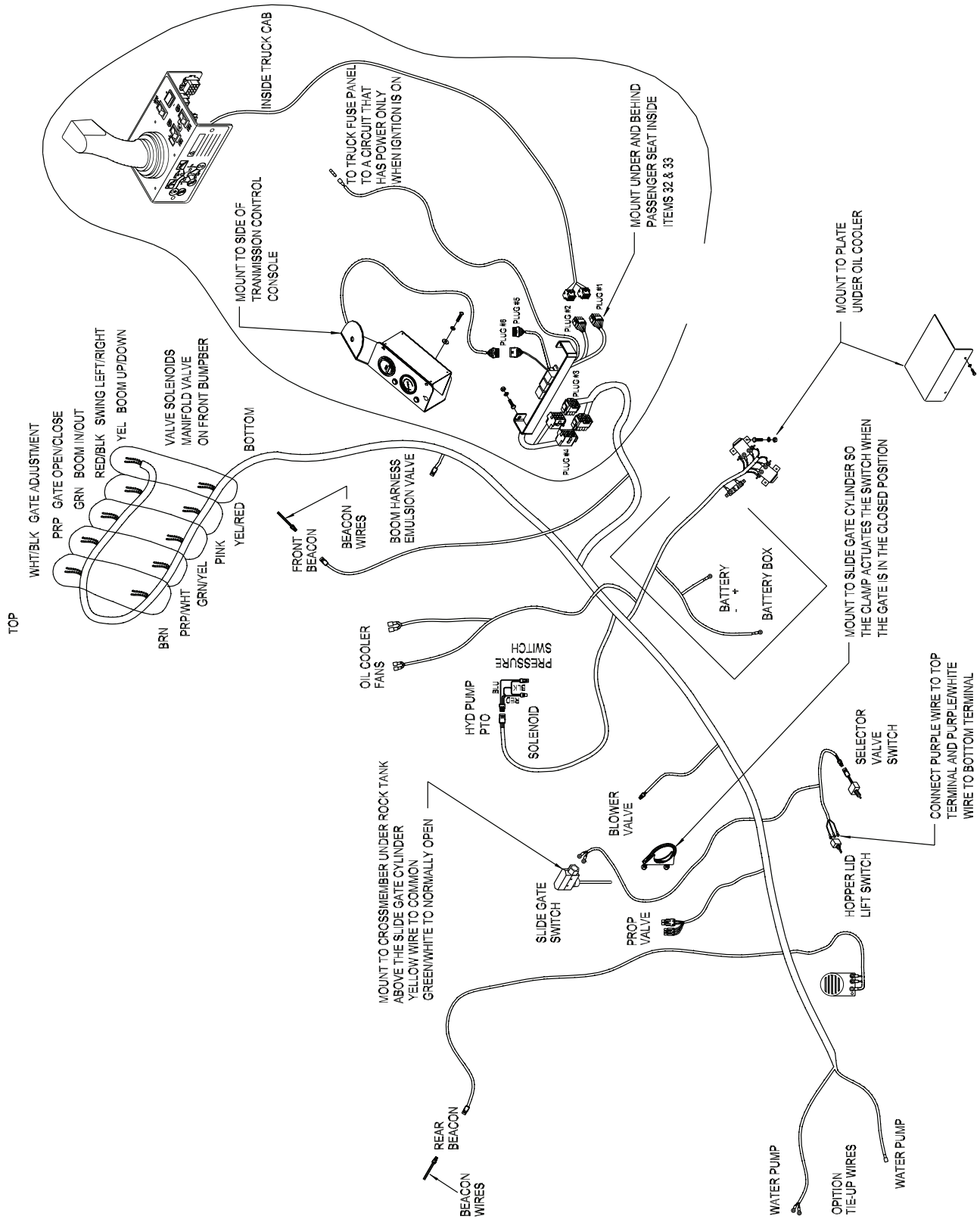


FIGURE 17. IN-CAB CONTROL GROUPS (1 OF 4)

FIGURE 17. IN-CAB CONTROL GROUPS (1 OF 4)

FIG ITEM	PART NUMBER	NOMENCLATURE 1 2 3 4 5 6 7	UNITS PER ASSY
17	28645	CONTROL GROUP (See Figure 1 for NHA)	1
-1	28661	RELAYS & FUSE GRP,POG,GMC	1
-2	28662	HARNESS,MAIN,RA300	1
-3	28663	GAUGE PANEL GRP,GMC,RA300	1
-4	36218	FUSE,30 AMP,ATC	3
-5	35139	CONNECTOR,SEALED,TOWER,2-PIN	2
-6	36165	TERM,SEALED CONN,16-14 GA,FEM	7
-7	34853	CIRCUIT BREAKER,40 AMP	1
-8	36300	CONNECTOR,SEALED,TOWER,3-PIN	1
-9	36623	SEAL,CABLE,14-16 GA,GRAY	7
-10	720290	SOLENOID,12V,CONSTANT DUTY	2
-11	25247	SWITCH,PUSH BTN,ON-MOM OFF,MOD	1
-12	37688	TERM,PUSH-ON,.25,FUSE TAP-IN	1
-13	851392	SWITCH,TOGGLE,3-POS,SPDT,MOM	1
-14	80036	NUT,HEX,.250-20	6
-15	80140	WASHER,FLAT,USS,.250	3
-16	80160	WASHER,LOCK,.250	8
-17	80185	CSHH,.250-20X1.00,GR5	8
-18	80476	WASHER,LOCK,M06	3
-19	80798	MACH SCR,PH,#10-24X1.00	2
-20	80824	NUT,HEX,#10-24	2
-21	81182	MACH SCR,PH,M06X1.0X30,CL8.8	3
-22	851442	SEAL,SWITCH,NUT,.469-32	1
-23	871071601	WASHER,LOCK,#10	2
-24	80142	WASHER,FLAT,USS,.375	2
-25	33312	CLAMP,MUFFLER,.3125X2.5	1
-26	33964	SWITCH,BACKUP ALARM,NEUTRAL	1
-27	25650	COVER,SOLENOIDS	1
-28	37118	FUSE HOLDER,IN LINE,ATC	3
-29	38941	HARNESS,OVERSPEED,ALLISON TRANS	1
-30	36340	FUSE,10 AMP,ATC	1
-31	25682	JOYSTICK CONSOLE GRP,RA300	1
-32	988650	ENCLOSURE,ELECTRICAL-GMC	1
-33	988651	COVER,ACCESS-GMC	1

- ITEM NOT ILLUSTRATED

ILLUSTRATED PARTS LIST

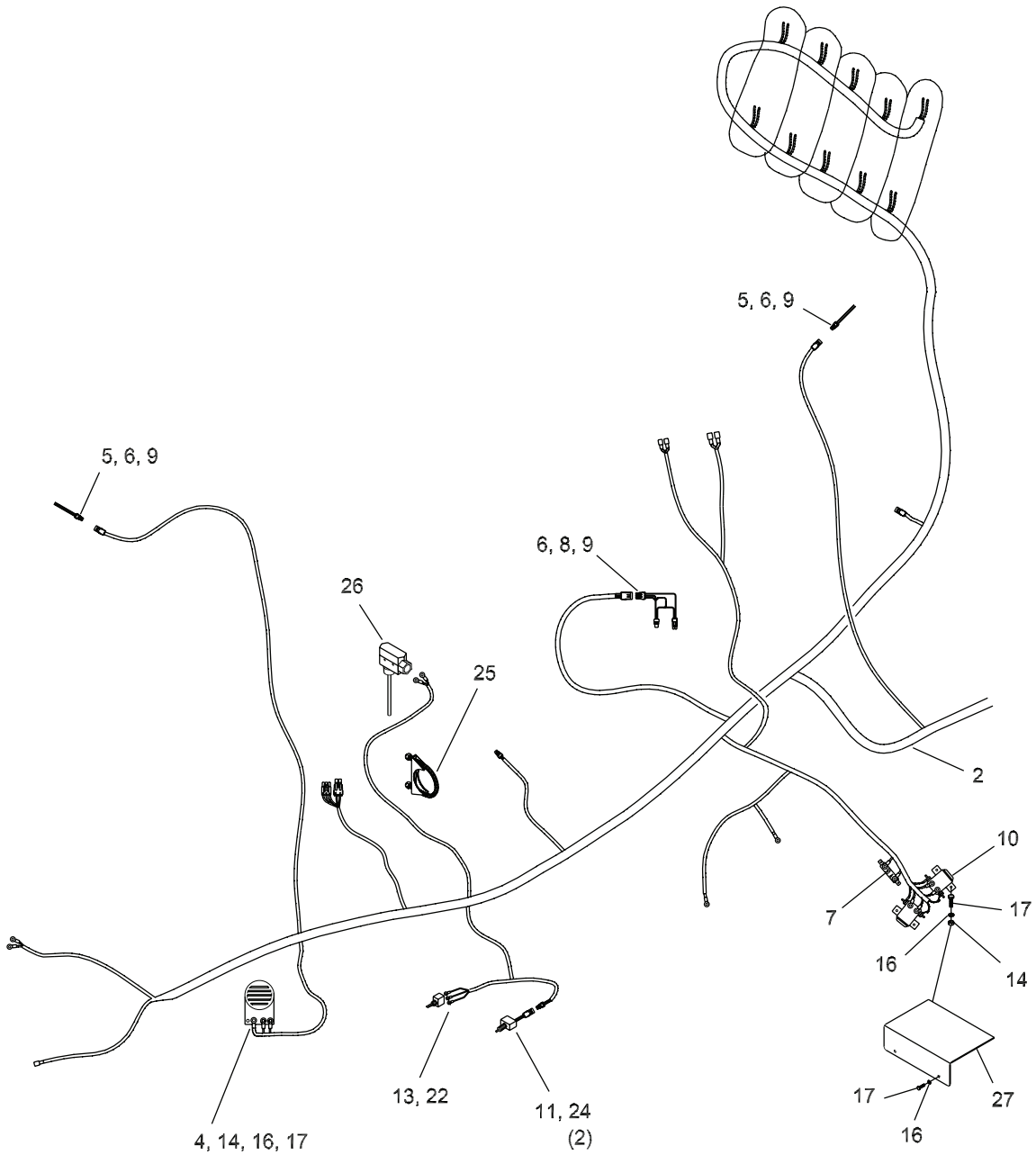


FIGURE 17. IN-CAB CONTROL GROUPS (2 OF 4)

FIGURE 17. IN-CAB CONTROL GROUPS (2 OF 4)

FIG ITEM	PART NUMBER	NOMENCLATURE 1 2 3 4 5 6 7	UNITS PER ASSY
17	28645	CONTROL GROUP (See Figure 1 for NHA)	1
2	28662	HARNESS,MAIN,RA300	1
4	36218	FUSE,30 AMP,ATC	3
5	35139	CONNECTOR,SEALED,TOWER,2-PIN	2
6	36165	TERM,SEALED CONN,16-14 GA,FEM	7
7	34853	CIRCUIT BREAKER,40 AMP	1
8	36300	CONNECTOR,SEALED,TOWER,3-PIN	1
9	36623	SEAL,CABLE,14-16 GA,GRAY	7
10	720290	SOLENOID,12V,CONSTANT DUTY	2
11	25247	SWITCH,PUSH BTN,ON-MOM OFF,MOD	1
13	851392	SWITCH,TOGGLE,3-POS,SPDT,MOM	1
14	80036	NUT,HEX,..250-20	6
16	80160	WASHER,LOCK,..250	8
17	80185	CSHH,..250-20X1.00,GR5	8
22	851442	SEAL,SWITCH,NUT,.469-32	1
24	80142	WASHER,FLAT,USS,..375	2
25	33312	CLAMP,MUFFLER,..3125X2.5	1
26	33964	SWITCH,BACKUP ALARM,NEUTRAL	1
27	25650	COVER,SOLENOIDS	1

ILLUSTRATED PARTS LIST

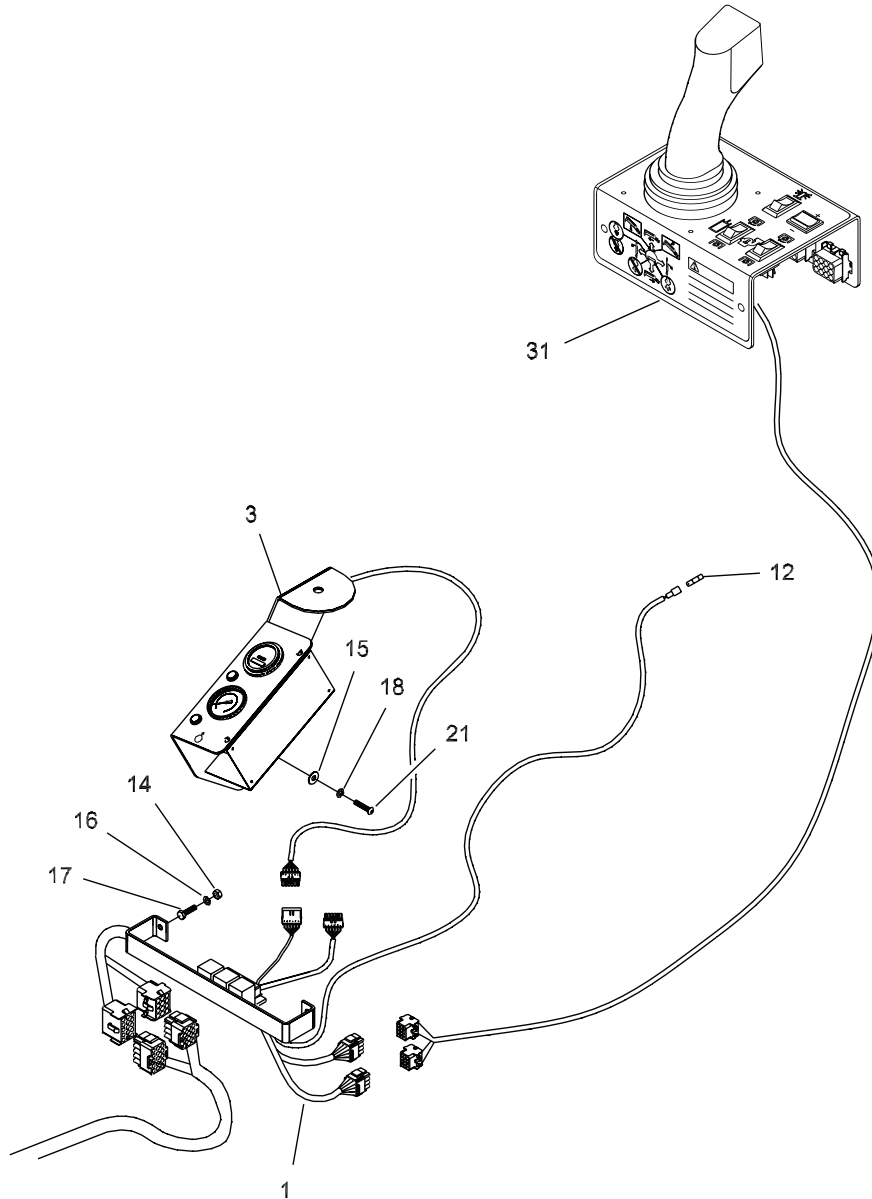


FIGURE 17. IN-CAB CONTROL GROUPS (3 OF 4)

FIGURE 17. IN-CAB CONTROL GROUPS (3 OF 4)

FIG ITEM	PART NUMBER	NOMENCLATURE 1 2 3 4 5 6 7	UNITS PER ASSY
17	28645	CONTROL GROUP (See Figure 1 for NHA)	1
1	28661	RELAYS & FUSE GRP,POG,GMC	1
3	28663	GAUGE PANEL GRP,GMC,RA300	1
12	37688	TERM,PUSH-ON,.25,FUSE TAP-IN	1
14	80036	NUT,HEX,.250-20	6
15	80140	WASHER,FLAT,USS,.250	3
16	80160	WASHER,LOCK,.250	8
17	80185	CSHH,.250-20X1.00,GR5	8
18	80476	WASHER,LOCK,M06	3
-19	80798	MACH SCR,PH,#10-24X1.00	2
-20	80824	NUT,HEX,#10-24	2
21	81182	MACH SCR,PH,M06X1.0X30,CL8.8	3
-23	871071601	WASHER,LOCK,#10	2
-28	37118	FUSE HOLDER,IN LINE,ATC	3
-29	38941	HARNESS,OVERSPEED,ALLISON TRANS	1
-30	36340	FUSE,10 AMP,ATC	1
-31	25682	JOYSTICK CONSOLE GRP,RA300	1
-32	988650	ENCLOSURE,ELECTRICAL-GMC	1
-33	988651	COVER,ACCESS-GMC	1

- ITEM NOT ILLUSTRATED

ILLUSTRATED PARTS LIST

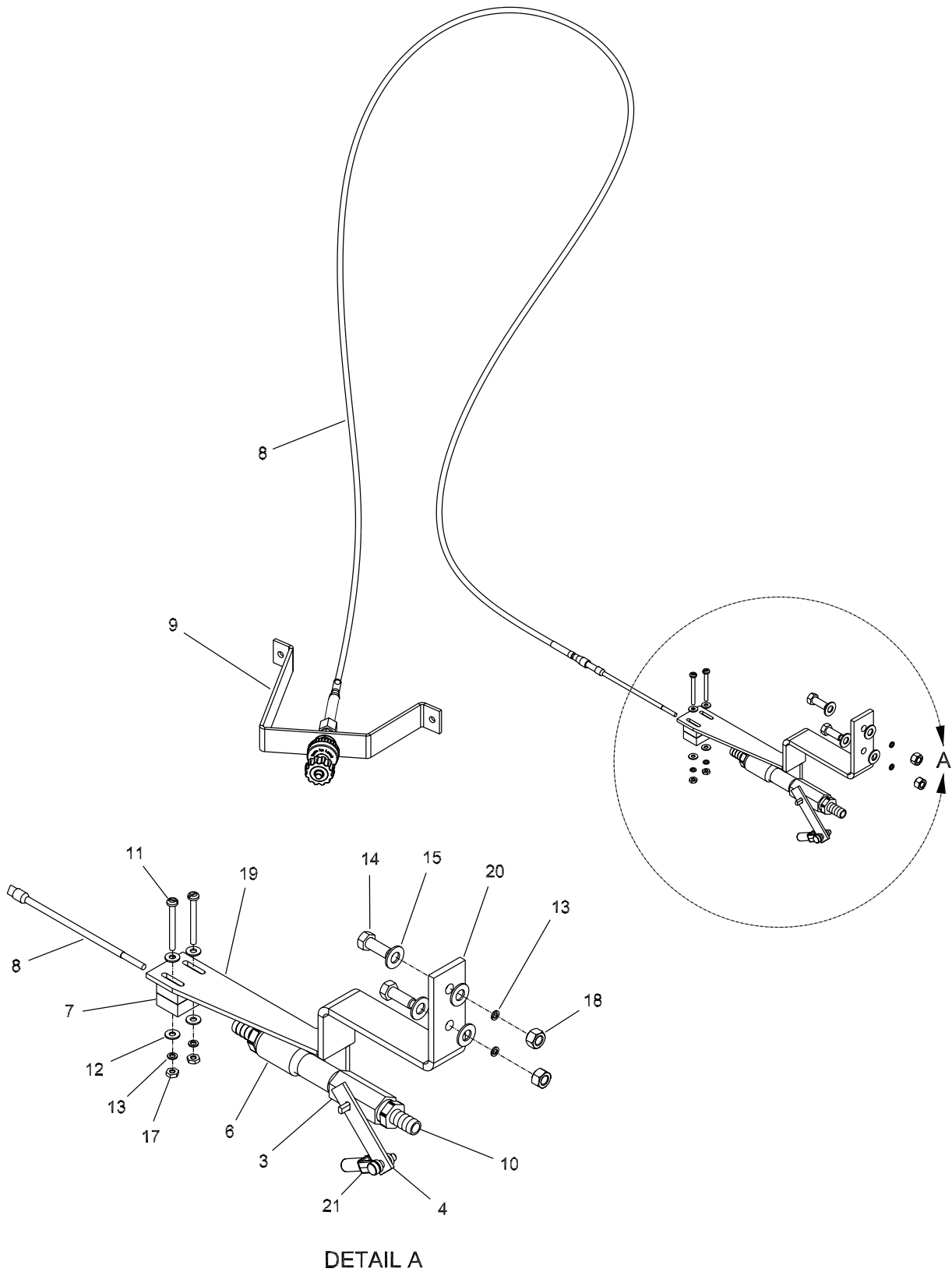


FIGURE 17. IN-CAB CONTROL GROUPS (4 OF 4)

FIGURE 17. IN-CAB CONTROL GROUPS (4 OF 4)

FIG ITEM	PART NUMBER	NOMENCLATURE 1 2 3 4 5 6 7	UNITS PER ASSY
17	988543	EMULSION CABLE (See Figure 1 for NHA)	1
3	36220A	VALVE,BALL,.500 NPT	1
4	25517	LEVER,3-WAY,08NPT,VLV,2.25 C-C	1
6	99492	PIPE,COUPLING,.500	1
7	984531	BAR,CABLE CLAMP	2
8	37845	CABLE,THROTTLE,VERNIER,3"TX126	1
9	29292	BRACKET,CAB EMULSION	1
10	X427	FITT,STR 08MP-08HB,CRIMPED	2
11	80997	MACH SCR,PH,#10-24X2.00	2
12	80995	WASHER,FLAT,USS,#10	4
13	80879	WASHER,LOCK,#10	4
14	80221	CSHH,.375-16X1.00,GR5	2
15	80996	WASHER,FLAT,SAE,.375	4
17	81005	NUT,FLEXLOC,#10-24,FULL,LT	2
18	80038	NUT,HEX,.375-16	2
19	988542	CABLE SUPPORT,W/M	1
20	988541	BAR,CABLE SUPPORT	1
21	37846	CLEVIS,10-32X1.25,W/.250 PIN	1

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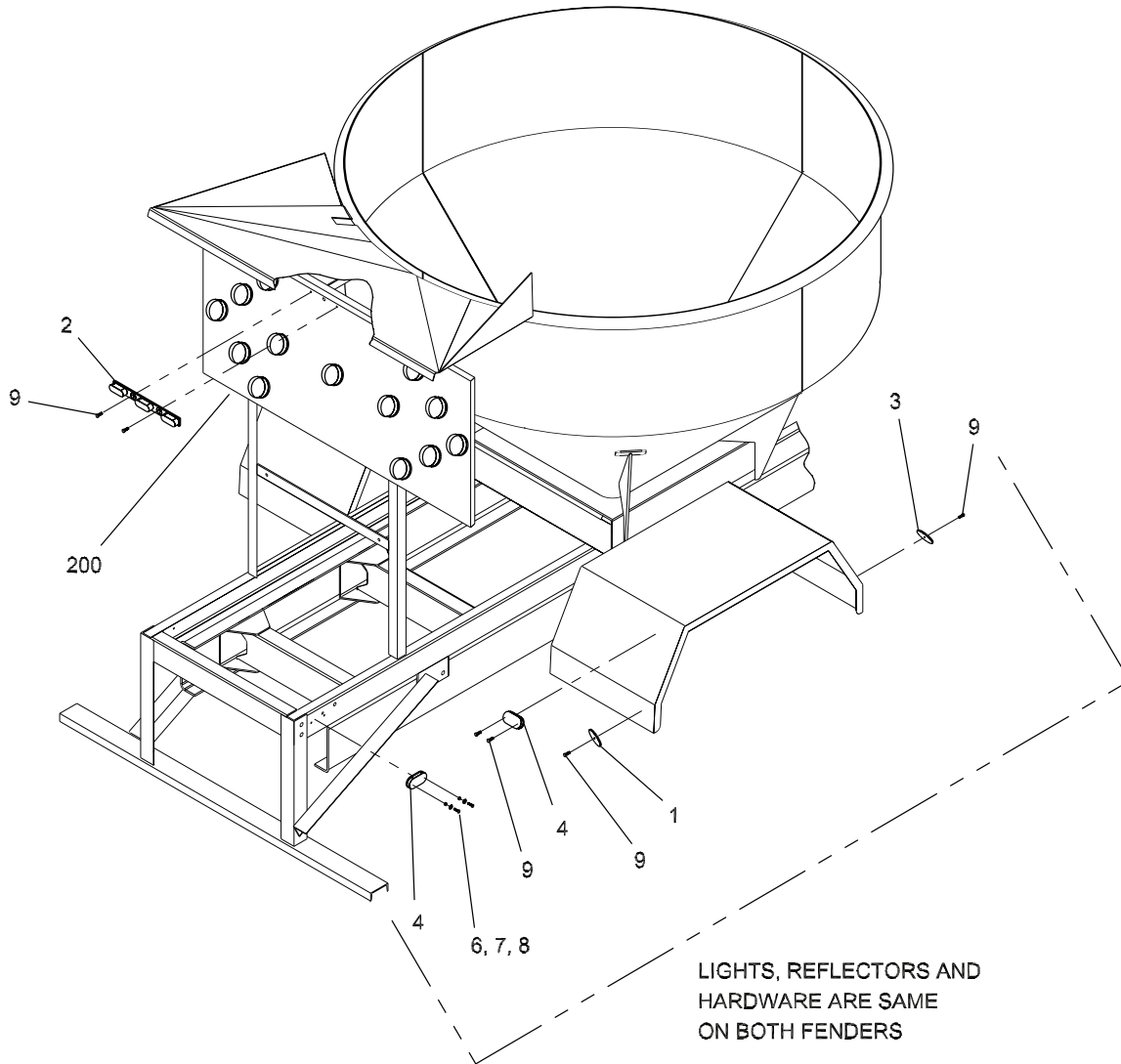


FIGURE 18. LIGHTING PACKAGES

FIGURE 18. LIGHTING PACKAGES

FIG ITEM	PART NUMBER	NOMENCLATURE 1 2 3 4 5 6 7	UNITS PER ASSY
18	24358	LIGHTS AND REFLECTORS (See Figure 1 for NHA)	1
1	5036	REFLECTOR,RED	2
2	35663	LIGHT BAR,RED,3 LIGHT	1
3	5037	REFLECTOR,AMBER	2
4	5096	LIGHT,CLEARANCE,RED W/REFLECT	4
-5	24506	HARNESS,WIRE,LIGHTS,RA300	1
6	80798	MACH SCR,PH,#10-24X1.00	4
7	80995	WASHER,FLAT,USS,#10	4
8	81005	NUT,FLEXLOC,#10-24,FULL,LT	4
9	81160	SCR,SLFDRL,HH,#10X1.00,#3PT	8
-100	37596	BEACON,AMBER,DUAL MIRROR,ROTATING	2
200	38238	ARROW BOARD,30X60,W/40 FT CABLE	1
-300	37686	OPTIONAL ARROW BOARD,LED,30X60,W/40 FT CABLE	1
-400	985623	OPTIONAL ARROW BOARD,48X96	1
		ATTACHING PARTS	
-401	988940	SUPPORT,ARROW BOARD-LH,W/M	2
-402	988941	SUPPORT,ARROW BOARD-RH,W/M	2
-403	36819	ARROW BOARD,48X96,40FT HARNESS	1
-404	985427	MOUNT,STROBE LIGHT,BASE	1
-405	985428	MOUNT,STROBE,LIGHT,HOOD	1
-406	80250	CSHH,.500-13X1.25,GR5	8
-407	80144	WASHER,FLAT,USS,.500	8
-408	80354	NUT,FLEXLOC,.500-13,FULL,LT	8
-409	110-205	CSHH,.375-16X1.00,GR5	9
-410	80142	WASHER,FLAT,USS,.375	9
-411	80352	NUT,FLEXLOC,.375-16,FULL,LT	9
-412	988969	WASHER,SPECIAL-ARROW BOARD	9
		-----*	

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FIGURE 19. MISCELLANEOUS GROUPS

FIG ITEM	PART NUMBER	NOMENCLATURE 1 2 3 4 5 6 7	UNITS PER ASSY
-19	TBD	MISCELLANEOUS GROUPS	1
-1	988473-15	GRP,FLUIDS-RA300 PATCHER	1
-101	91500	•OIL,HYD,ISO68	27
-102	90600	•OIL,GEAR LUBE,90W	1.86
-103	988511	•ANTI-FREEZE,100%-RED	15
-104	988238	•FUEL,DIESEL-OFF ROAD	5
-2	25781	FINAL AND DECAL GROUP	1
-201	984960	•KIT,DECAL,RA300,PRIME	1
-202	986431	•KIT,DECAL,DECORATIVE,RA300	1
-203	35355	•PLATE,SERIAL NUMBER,ROSCO	1
-204	72244	•GRIP,RUBBER,HANDLE,FLEX	14
-205	R135	•GRIP,RUBBER,.625 ID	1
-206	36542	•TIE DOWN,RUBBER,15,W/HOOKS	1
-3	988342	MANUAL-PAK GROUP	1
-301	985234-01	•MANUAL-PAK CASE,10.5X13.5X2.5	1
-302	80192	•CSHH,.250-20X.75,GR5	4
-303	80140	•WASHER,FLAT,USS,.250	8
-304	80350	•NUT,FLEXLOC,.250-20,FULL,LT	4
-305	988634	•DECAL,MANUAL BOXES	1

- ITEM NOT ILLUSTRATED

ILLUSTRATED PARTS LIST



ALPHABETICAL INDEX FOR ALL STANDARD AND OPTIONAL PARTS

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87	988502-01	ADAPTOR,FRT BUMPER,MODIFIED	51
37	35954	ADHESIVE,AEROSOL,SPRAY CAN	35
20	TBD	AGGREGATE SYSTEM	5
1	24321	AGGREGATE TANK	11
6	35435	AIR PRESS REGULATOR 5-125 PSIG	23
35	24082	ANCHOR,CYL,ROCK GATE	13
37	24085	ANCHOR,LID CYL	13
18	24088	ANGLE,2.00X2.00X.250X63.88	13
14	24381	ANGLE,EMULSION TANK	37
103	988511	ANTI-FREEZE,100%-RED	81
200	38238	ARROW BOARD,30X60,W/40 FT CABLE	79
403	36819	ARROW BOARD,48X96,40FT HARNESS	79
B			
2	20952	BAFFLE,EMULSION TANK	35
32	34070	BAND,BAND-IT,.625,SS	35, 37
26	20427-1	BAR,.250X1.50X25.00	13
3	20953-01	BAR,.375X2.00X70.00(99052)	35
10	24590	BAR,.375X3.00X6.50	7
7	984531	BAR,CABLE CLAMP	77
20	988541	BAR,CABLE SUPPORT	77
8	24103	BAR,LID LIFT	9
36	28261	BAR,OIL COOLER MOUNT CLIP	57
11	985781	BAR,TIE DOWN SPACER	7
7	25550	BASE,BLOWER	13
3	20823	BASE,DISCHARGE TUBE	49
21	25649	BASE,SOLENOIDS	13
100	37596	BEACON,AMBER,DUAL MIRROR,ROTATING	79
24	36613	BEARING,THRUST 1.50 ID X.0781	51
13	37647-13	BLOCK,MANIFOLD,5 VALVE	65
50	24323	BLOWER & DISCHARGE BOOM	5
23	985670	BLOWER,POS DISPL,323C,TUTHILL	41
15	24057	BOOM PIVOT W/M,RA300T	51
2	25871	BRACKET,BUMPER,SHORT MOUNT	7
9	29292	BRACKET,CAB EMULSION	77
67	28391	BRACKET,HOSE SUPPORT	43
38	24591	BRAKE VALVE RELOCATION	9
85	988496	BRKT,BUMPER	51

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31	34069	BUCKLE,BAND-IT,.625,SS	35, 37
1	23555	BUMPER,REAR	7
63	37876	BUSHING,.625 IDX1.871 OD,W/KEY	41
40	35406	BUSHING,1.003 ID X 1.253 OD X.750	13
21	34219	BUSHING,1.125 IDX1.871OD,1.312	41
29	930041	BUSHING,1.25ODX1.00IDX.50	45, 51
19	32833	BUSHING,1.503ID,1.754OD,1.5	51
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19	988542	CABLE SUPPORT,W/M	77
8	37845	CABLE,THROTTLE,VERNIER,3"TX126	77
2	20954	CAP W/M,2.00 NPT	67
1	20498	CAP W/M,3.00 NPT	69
5	37647-05	CAP,MANUAL OVERRIDE,BOSCH DO3	65
8	37721	CAP,WEATHER SEAL	39
1	24078	CHANNEL,LEFT	13
8	24081	CHANNEL,MNT,ROCK GATE ANCHOR	13
2	24079	CHANNEL,RIGHT	13
7	34853	CIRCUIT BREAKER,40 AMP	71, 73
10	33277	CLAMP,HOSE,# 04	41
15	33277	CLAMP,HOSE,# 04	23
25	33163	CLAMP,HOSE,# 08	31, 33, 37
55	33163	CLAMP,HOSE,# 08	47
4	33164	CLAMP,HOSE,# 10	17, 19
26	33169	CLAMP,HOSE,# 28	37
68	33332	CLAMP,HOSE,# 33,KNOX	45
64	34516	CLAMP,HOSE,#52	41
12	985627	CLAMP,HOSE,2.00ID,SPIRAL LOCK	43
56	985594	CLAMP,HOSE,3.50ID,SPIRAL LOCK	43
11	34040	CLAMP,MUFFLER 4.00	41
25	33312	CLAMP,MUFFLER,.3125X2.5	71, 73
76	37720	CLAMP,MUFFLER,2-1/4"	45
73	161250	CLAMP,MUFFLER,3.00	43
21	37846	CLEVIS,10-32X1.25,W/.250 PIN	77
1	37647-01	COIL,SOLENOID 12V,BOSCH DO3	65
89	37505	COLLAR,SHAFT,SPLT,.50IDX1.12OD	29
3	34729	CONDUIT,METAL FLEX,.50 ID	39
58	24549	CONNECTOR PIPE,W/M	43
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4	34732	CONNECTOR,STR,FLEX CONDUIT,.50	39
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6	20991	COVER, ACCESS HOLE	35
33	988651	COVER,ACCESS-GMC	71, 75
40	24732	COVER,CHUTE,T-BOLT	9
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7	23729	COVER,POTENTIOMETER	27
17	24743	COVER,SELECTION VALVE	27
5	24087	COVER,SELECTOR VALVE	59
27	25650	COVER,SOLENOIDS	71, 73
5	24074	CROSSMEMBER,EMULSION TANK	13
9	24073	CROSSMEMBER,FRT/RR	13
13	24075	CROSSMEMBER,ROCK TANK	13
44	80423	CSHH,.250-20X.50,GR5	45, 49
104	80192	CSHH,.250-20X.75,GR5	27
302	80192	CSHH,.250-20X.75,GR5	81
53	80192	CSHH,.250-20X.75,GR5	41
17	80185	CSHH,.250-20X1.00,GR5	71, 73, 75
42	80185	CSHH,.250-20X1.00,GR5	9
58	80185	CSHH,.250-20X1.00,GR5	37
72	80187	CSHH,.250-20X1.25,GR5	49
71	80194	CSHH,.250-20X1.50,GR5	49
45	80197	CSHH,.250-20X2.25,GR5	9
40	80449	CSHH,.250-20X2.75,GR5	59
25	80208	CSHH,.312-18X1.00,GR5	7
75	80208	CSHH,.312-18X1.00,GR5	49
31	80206	CSHH,.312-18X1.25,GR5	17, 21
71	80209	CSHH,.312-18X1.50,GR5	43
97	80219	CSHH,.375-16X.75,GR5	33
14	80221	CSHH,.375-16X1.00,GR5	77
409	110-205	CSHH,.375-16X1.00,GR5	79
38	80224	CSHH,.375-16X1.25,GR5	45
26	80226	CSHH,.375-16X1.50,GR5	9
16	80228	CSHH,.375-16X1.75,GR5	67
33	80230	CSHH,.375-16X2.00,GR5	43
23	71621	CSHH,.375-16X2.75,GR5	17, 21
36	81048	CSHH,.375-16X3.00,GR8	41
59	80248	CSHH,.500-13X1.00,GR5	27
406	80250	CSHH,.500-13X1.25,GR5	79

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3	80186	CSHH,.500-13X1.75,GR5	15
32	80186	CSHH,.500-13X1.75,GR5	41
4	80186	CSHH,.500-13X1.75,GR5	7
78	81140	CSHH,.500-13X1.75,GR8	51
31	81036	CSHH,.500-13X2.25,GR8	7
39	80261	CSHH,.500-13X2.50,GR5	49
79	81183	CSHH,.500-13X3.25,GR8	51
30	80983	CSHH,.625-11X2.00,GR8	7
40	80289	CSHH,.625-11X3.50,GR 5	45
24	33137	CSHH,.750-10X2.50,GR5	27
53	71646	CSHH,.750-10X3.00,GR5	33, 37
33	81080	CSHH,1.000-8X3.00,GR8	9
24	37650	CYL,HYD,2.00X4.00X1.00 ROD	43
14	36519	CYL,HYD,3.00X14.00X1.50 ROD	9
20	36518	CYL,HYD,3.00X16.00X1.50 ROD	51
27	37322	CYL,HYD,3.00X72.00X2.00 ROD	45
14	22201	CYLINDER PIN W/M,1.00 X 5.94	51
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305	988634	DECAL,MANUAL BOXES	81
6	37730	DECAL,VIBRATOR,RA300	15
17	36853	DECAL,WATER FLUSH SYSTEM	17, 21
4	38051	DIODE,1 AMP,200V,PLASTIC	53
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20	99526	ELBOW,PIPE,90,.500 STREET,MI	67
61	99526	ELBOW,PIPE,90,.500 STREET,MI	47
69	99512	ELBOW,PIPE,90,.500,MI	37
92	99271	ELBOW,PIPE,90,2.00,MI	33
40	99273	ELBOW,PIPE,90,3.00,MI	41
41	99287	ELBOW,PIPE,90,4.00 STREET,MI	41
19	37272	ELEMENT,FLEX COUPLING	41
5	36681	ELEMENT,HEATER,240V 4500W	39
1	28637	EMULSION TANK	25
3	20993	EMULSION TANK ELECTRICAL HEATER	25
40	TBD	EMULSION TANK GRPS	5
2	28639	EMULSION TANK INSULATE	25
1	28639	EMULSION TANK INSULATE GRP	27, 29, 33
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5	22181	FENDER,SINGLE AXLE,STL	7
8	36151	FILLER,TANK,4 IN	17, 21
18	72543	FILTER ASSY,HYD RETURN	55
18B	6442	FILTER ELEMENT	55
13	36531	FILTER ELEMENT,INTAKE/SILENCER	41
18A	72543-02	FILTER HEAD	55
2	25781	FINAL AND DECAL GROUP	81
134	72614	FITT,45 06MJ-06MB	53, 61
141	X274	FITT,45 08MJ-08MB	53, 63
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143	35808	FITT,90 04MJ-08MP	57, 63
1	31971	FITT,90 04MP-04HB,CRIMPED	23
9	31971	FITT,90 04MP-04HB,CRIMPED	41
102	33892	FITT,90 06MJ-06MB	59, 61
19	37540	FITT,90 06MJ-06MB,.037 ORF	59
103	34536	FITT,90 06MJ-08MP	53, 59, 61
30	33900	FITT,90 08MJ-08FJX	31
138	X161	FITT,90 08MJ-08MP	53, 63
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27	33328	FITT,90 08MP-08HB,CRIMPED	31, 33, 37
56	33328	FITT,90 08MP-08HB,CRIMPED	47
22	70319	FITT,90 08MP-08HB,POLY	17, 19, 21
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154	71771	FITT,90 12MJ-16MB	57, 63
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113	37632	FITT,90 24MJ-20MP	57, 61
155	72668	FITT,90 24MJ-24MB	57, 63
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161	38929	FITT,HES,20FJ-20HB,FLD CRMP	57, 63
65	33683	FITT,LUBE,45,02MP	41
32	72372	FITT,PLUG 02PD,DUST	53
151	853182304	FITT,QD -12 FP,SET, 4000PSI	57, 63
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111	37631	FITT,STR 06MJ-08FJ	59, 61
148	34082	FITT,STR 06MJ-08MP	53, 63
3	33280	FITT,STR 06MP-04HB,PUSH-ON	23
2	31959	FITT,STR 06MP-06HB,PUSH-ON	23
23	31959	FITT,STR 06MP-06HB,PUSH-ON	37
10	36174	FITT,STR 06MP-08HB,BLK POLY	17, 19
22	31109	FITT,STR 08FJX-08HB,PUSH-ON	31
47	37003	FITT,STR 08HB-08HB	31
29	37737	FITT,STR 08MJ-08MB,X-LONG	31
136	853180103	FITT,STR 08MJ-12MP	59, 63
10	X427	FITT,STR 08MP-08HB,CRIMPED	77
21	31046	FITT,STR 08MP-08HB,PUSH-ON	33
5	31046	FITT,STR 08MP-08HB,PUSH-ON	67
54	31046	FITT,STR 08MP-08HB,PUSH-ON	47
18	37315	FITT,STR 08MP-08MP,BRASS	17, 19, 21
14	37611	FITT,STR 08NT-08NT,BRASS	23
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137	853180160	FITT,STR 12MJ-12MB	53, 57, 63
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19	37318	FITT,TEE 08FP-08FP-08FP,BRASS	17, 19, 21
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158	34111	FITT,TEE 16MJ-16FJX-16MJ	57, 63
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10	72370	FITT,TEST 04MB-02PD	53
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84	28641	FLOAT ROD W/M,RA300,GALLONS	29
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10	24321	FRAME ASSEMBLY	5
6	989182	FRAME,HOPPER & LID	9
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45	36684	GASKET,FLANGE,6.00,NON-ASB	33, 37
3	28663	GAUGE PANEL GRP,GMC,RA300	71, 75
11	36656	GAUGE,PRESS,0-160 PSI,2.50	67
40	36656	GAUGE,PRESS,0-160 PSI,2.50	33
13	36604	GAUGE,PRESS,0-2000 PSI, 2.50	53
18C	72543-01	GAUGE,RET LINE FILTER INDICATOR	55
205	R135	GRIP,RUBBER,.625 ID	81
204	72244	GRIP,RUBBER,HANDLE,FLEX	81
16	36998	GROMMET,ELEC FAN	55
61	35465-10	GROMMET,INS,.50IDX1.00X.063	41
35	35465-05	GROMMET,INSULATION,1.00ID	31
1	988473-15	GRP,FLUIDS-RA300 PATCHER	81
38	24086	GUSSET,ANCHOR BASE	13
16	25225	GUSSET,GATE CYL	13
32	24336	GUSSET,HOPPER	13
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15	24382	HANDLE EXTENTION	31
3	28895	HANDLE,AIR VALVE	67
50	24419	HARNESS,BOOM,ACTUATOR/LIGHTS	45
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29	38941	HARNESS,OVERSPEED,ALLISON TRANS	71, 75
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34	989239	HINGE ASSY,HOPPER LID,W/M	13
7	24101	HINGE PLATE W/M	9
4	20963	HINGE,CONTROL BOX	27
29	20648	HINGE,LOWER HOPPER LID	13
4	24388	HOLDER,WASTE SOLVENT PAIL	69
17	24522	HOOK,HOSE,4.00 LONG	43
3	27569	HOPPER & CONE,W/M	13
11	20448	HOPPER LID,W/M	13
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7	5347	HOSE,04,PUSH-ON,LOW PRESSURE	23
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122	72550-026	HOSE,06,06FJX-06FJX,3000	53, 59, 61
123	72550-062	HOSE,06,06FJX-06FJX,3000	53, 61

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110	37533-138	HOSE,08,08FJ-08FJ,3000	53, 61
12	6352	HOSE,08,PUSH-ON,250	67
21	6352	HOSE,08,PUSH-ON,250	17, 19
52	6352	HOSE,08,PUSH-ON,250	31, 33
59	6352	HOSE,08,PUSH-ON,250	47
131	72595-152	HOSE,12,12FJX-12FJX,3000	53, 57, 61
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127	72600-178	HOSE,12,12FJX-12RJ45,1250	53, 57, 61
125	72558-054	HOSE,12,12FJX-12RJ90,1250	57, 61
135	38062-190	HOSE,12,12FJX-12RJ90,3000	57, 61
146	38062-032	HOSE,12,12FJX-12RJ90,3000	57, 63
108	38931-068	HOSE,16,16FJ-16FJX45,1250	61
152	38809-105	HOSE,16,16FJX90-16FJX45,1000	57, 63
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150	38930-090	HOSE,20,20FJS-NONE,200	57, 63
107	37807-024	HOSE,20,20FJX-20FJX,200	57, 61
129	72575-090	HOSE,24,24FJX-24FJX,150	57, 61
34	34501	HOSE,24,HYD SUCTION	37
55	985583	HOSE,3.00 ID,POLY CONVOLUTED	43
64	984360	HOSE,GUARD,SIZE 32	45, 51
72	36876	HOSE,SUCTION,3.00,WIRE HELIX	43
70	36353	HOSE,WATER,SUCT/DISCH,2.00 ID	45
20	37273	HUB,FLEX COUPLING	41
60	27509	HYDRAULIC SYSTEM	5
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80	28645	IN-CAB CONTROLS	5
47	853521158	INDICATOR,AIR FILTER SERVICE	41
42	36663	INSULATION,R11,W/VAPOR BARRIER	35
38	36527	INSULATION,THERMAL-CEL,4.00	35
44	36665	INSULATION,TUBE,1.12IDx.38WALL	31, 33
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66	36664	INSULATION,TUBE,1.62IDx.38WALL	45, 51

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201	984960	KIT,DECAL,RA300,PRIME	81
20	38855	KIT,RA300,HYD HOSE/FITT,POG	53, 57, 59
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21	37647-20	KIT,SEAL,FLOW CONTROL	65
20A	36518-02	KIT,SEAL,HYD CYL,3.00BX1.50RBM	51
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9	25354	LADDER,REAR,W/M,HEAVY	9
8	24170	LADDER,SIDE,WELDMENT	27
82	24679	LEVER,3-WAY 08 NPT VALVE	47
4	25517	LEVER,3-WAY,08NPT,VLV,2.25 C-C	77
18	24303	LIFT CYL LOCK W/M	51
2	35663	LIGHT BAR,RED,3 LIGHT	79
4	5096	LIGHT,CLEARANCE,RED W/REFLECT	79
2	34167	LIGHT,GREEN INDICATOR	39
90	TBD	LIGHTING PACKAGES	5
36	35812	LOCK,WITH OFFSET CAM	27
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19	80798	MACH SCR,PH,#10-24X1.00	71, 75
6	80798	MACH SCR,PH,#10-24X1.00	79
11	80997	MACH SCR,PH,#10-24X2.00	77
9	80496	MACH SCR,PH,#10-32X.25,PHIL	39
24	80891	MACH SCR,PH,#10-32X1.00	17, 19
54	81177	MACH SCR,PH,#8-32X.25	33
100	80926	MACH SCR,PH,#8-32X.75	27
21	81182	MACH SCR,PH,M06X1.0X30,CL8.8	71, 75
301	985234-01	MANUAL-PAK CASE,10.5X13.5X2.5	81
3	988342	MANUAL-PAK GROUP	81
15	25227	MNT,PUMP BRKT	13
46	38637	MOTOR,HYD,GEAR,1.30 CIR,"A"	41
50	38637	MOTOR,HYD,GEAR,1.30 CIR,SAE A	57
35	13960	MOUNT BAR,MUD FLAP	7
52	24778	MOUNT,ACTUATOR,RA300	49
23	24076	MOUNT,ANGLE,BLOWER VALVE	13
22	37626	MOUNT,FOOT (SAE "A")	41
11	24847	MOUNT,OIL COOLER	55
404	985427	MOUNT,STROBE LIGHT,BASE	79

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405	985428	MOUNT,STROBE,LIGHT,HOOD	79
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25	25800	MOUNT,VIBRATOR,DC1600,BOLT ON	13
2	24189	MOUNT,WATER TANK,W/M	17, 21
36	27737	MUD FLAP,24X24	7
7	24330	MUFFLER COUPLER W/M	41
14	36534	MUFFLER,4" ID INLET/OUTLET	41
		N	
6	20831	NOZZLE W/M	45
53	24594-078	NOZZLE,EMULSION SPRAY,.078	47
15	36849	NOZZLE,FULLJET,06 MP,BRASS	17, 19
16	36850	NOZZLE,FULLJET,08 MP,BRASS	17, 19
17	81005	NUT,FLEXLOC,#10-24,FULL,LT	77
8	81005	NUT,FLEXLOC,#10-24,FULL,LT	79
304	80350	NUT,FLEXLOC,.250-20,FULL,LT	81
33	80350	NUT,FLEXLOC,.250-20,FULL,LT	53, 59
43	80350	NUT,FLEXLOC,.250-20,FULL,LT	9
73	80350	NUT,FLEXLOC,.250-20,FULL,LT	49
32	80351	NUT,FLEXLOC,.312-18,FULL,LT	17, 21
37	80351	NUT,FLEXLOC,.312-18,FULL,LT	7
17	80352	NUT,FLEXLOC,.375-16,FULL,LT	67
27	80352	NUT,FLEXLOC,.375-16,FULL,LT	9
33	80352	NUT,FLEXLOC,.375-16,FULL,LT	17, 21
34	80352	NUT,FLEXLOC,.375-16,FULL,LT	41, 43
411	80352	NUT,FLEXLOC,.375-16,FULL,LT	79
18	80354	NUT,FLEXLOC,.500-13,FULL,LT	69
28	80354	NUT,FLEXLOC,.500-13,FULL,LT	7
35	80354	NUT,FLEXLOC,.500-13,FULL,LT	41
4	80354	NUT,FLEXLOC,.500-13,FULL,LT	15
408	80354	NUT,FLEXLOC,.500-13,FULL,LT	79
41	80354	NUT,FLEXLOC,.500-13,FULL,LT	45, 49, 51
5	80354	NUT,FLEXLOC,.500-13,FULL,LT	7
61	80354	NUT,FLEXLOC,.500-13,FULL,LT	27, 37
29	80356	NUT,FLEXLOC,.625-11,FULL,LT	7
42	80356	NUT,FLEXLOC,.625-11,FULL,LT	45
62	80357	NUT,FLEXLOC,.750-10,FULL,LT	27, 33, 37
87	29093	NUT,FLOAT ROD PIVOT,.188 SEAL	29
20	80824	NUT,HEX,#10-24	71, 75
101	80793	NUT,HEX,#8-32	27
14	80036	NUT,HEX,.250-20	71, 73, 75

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ITEM NUMBER	PART NUMBER	NOMENCLATURE	IPL PAGE NUMBER
26	80036	NUT,HEX, .250-20	17, 21
44	80036	NUT,HEX, .250-20	9
63	80036	NUT,HEX, .250-20	27, 29
69	80037	NUT,HEX, .312-15	43
18	80037	NUT,HEX, .312-18	7
18	80038	NUT,HEX, .375-16	77
32	81075	NUT,STOVERS 1.00-8, GR C	9
22	81042	NUT,WELD, .250-20	13
		O	
102	90600	OIL,GEAR LUBE,90W	81
101	91500	OIL,HYD,ISO68	81
400	985623	OPTIONAL ARROW BOARD,48X96	79
300	37686	OPTIONAL ARROW BOARD,LED,30X60,W/40 FT	79
3	24188	OPTIONAL JET FLUSH SYSTEM	11
22	37647-22	ORIFICE, .020 DIA	65
90	39084	O-RING,#310, .18X.50ID,VITON	29
19	24509	OVERFLOW DRAIN W/M	37
		P	
33	20438	PAD,GUSSET	13
7	20860	PIN W/M,HOSE RETRACTOR	45
25	37662	PIN,CLEVIS, .750X2.00	43
13	36129-02	PIN,CLEVIS,1.00 OD	9
43	80389	PIN,COTTER, .125X1.00	45
28	5928	PIN,COTTER, .148,#9	43
39	36544	PIN,COTTER, .177 DIA	13
16	36544	PIN,COTTER, .177,7GA	9
69	20872	PIN,CYLINDER W/M 1.00 OD	51
13	20874	PIN,CYLINDER W/M 1.00OD	51
4	REF	PIN,LID PIVOT,W/M	9
2	20457	PIN,PIVOT LID LIFT	9
1	20491	PIN,PIVOT W/M	51
26	37134	PIN,QUICK REL,1.00X3.50X11.00	51
17	37095	PIN,QUICK RELEASE, .375X4.00	59
81	37117	PIN,QUICK RELEASE, .50 X 6.00	51
11	986475	PIPE,3.00X40.75,SCH 40,ABS	49
10	986474	PIPE,4.00X35.50,SCH 40,ABS	49
16	36617	PIPE,ADPTR,3.00MSOCX3.00FP,PVC	43
16	99980	PIPE,BUSH,08MP-04FP,STL	23
23	99980	PIPE,BUSH,08MP-04FP,STL	67
79	99980	PIPE,BUSH,08MP-04FP,STL	33

ITEM NUMBER	PART NUMBER	NOMENCLATURE	IPL PAGE NUMBER
112	33356	PIPE,BUSH,08MP-06FP,BRASS	57, 61
67	99450	PIPE,BUSH,08MP-06FP,MI	37
9	99450	PIPE,BUSH,08MP-06FP,MI	23
38	99462	PIPE,BUSH,1.25MP-16FP,MI	57
63	99985	PIPE,BUSH,12MP-08FP,STL	47
93	99440	PIPE,BUSH,2.00MP-08FP,MI	33
70	99247	PIPE,BUSH,2.00MP-16FP,MI	33
39	91377	PIPE,BUSH,3.00MSOCX2.00FP,PVC	43
37	90108	PIPE,BUSH,4.00MP-3.00FP,MI	41
62	99489	PIPE,COUPLING,.125	41
6	99492	PIPE,COUPLING,.500	77
12	986477	PIPE,COUPLING,3.00SOC,MODIFIED	49
19	99498	PIPE,CROSS,.500,MI	67
68	99498	PIPE,CROSS,.500,MI	33
83	99519	PIPE,ELBOW,45,.500 STREET,MI	47
66	99612	PIPE,NIPPLE,.125X2.00	43
48	99610	PIPE,NIPPLE,.125XCLOSE	41
11	99591	PIPE,NIPPLE,.250XCLOSE	23
12	99638	PIPE,NIPPLE,.375XCLOSE	23
77	99670	PIPE,NIPPLE,.500X7.00	35, 37
22	99596	PIPE,NIPPLE,.500XCLOSE	67
62	99596	PIPE,NIPPLE,.500XCLOSE	47
76	99596	PIPE,NIPPLE,.500XCLOSE	33, 37
24	99644	PIPE,NIPPLE,06X4.00	13
94	99606	PIPE,NIPPLE,1.00XCLOSE	33
78	99436	PIPE,NIPPLE,2.00X5.00	33
43	99434	PIPE,NIPPLE,2.00XCLOSE	43
44	99793	PIPE,NIPPLE,3.00XCLOSE	41
45	99814	PIPE,NIPPLE,4.00X4.00	41
29	6063	PIPE,NIPPLE,KING,2.00	43
27	5700	PIPE,NIPPLE,KING,3.00NPT	43
17	99534	PIPE,PLUG,.125,SQ HEAD	23
18	99535	PIPE,PLUG,.250,SQ HEAD,MI	23
71	99535	PIPE,PLUG,.250,SQ HEAD,MI	33, 37
60	99536	PIPE,PLUG,.375,SQ HEAD	43
21	99537	PIPE,PLUG,08MP,SQ HD,MI	67
34	99537	PIPE,PLUG,08MP,SQ HEAD	9
77	99537	PIPE,PLUG,08MP,SQ HEAD	47
73	99539	PIPE,PLUG,16MP,SQ HEAD,MI	33
17	70444	PIPE,PLUG,2.00,SQ HEAD	9

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74	99551	PIPE,RED,08FP-04FP-MI	33
66	853210683	PIPE,TBE,08X18.00	37
10	99568	PIPE,TEE,06FP,MI	23
75	99569	PIPE,TEE,08FP,MI	37
104	36305	PIPE,TEE,08MP-08FP-08FP,STL	57, 61
42	99333	PIPE,TEE,2.00FP,MI	43
38	91374	PIPE,TEE,3.00 SOC,PVC	43
14	37647-14	PISTON,W/SEALS	65
30	20796	PIVOT,PIN LID,W/M	13
85	28640	PLATE,CONTENTS,GALLONS,RA300	29
36	20509	PLATE,CYL ANCHOR	13
11	28339	PLATE,FR SIDE,EMUL TANK SKIN	35
10	24337	PLATE,MOUNTING GATE	13
203	35355	PLATE,SERIAL NUMBER,ROSCO	81
9	28642	PLATE,SKIN ENDS,LS,EMUL TANK	35
10	28643	PLATE,SKIN ENDS,RS,EMUL TANK	35
13	24379	PLATFORM WELDMENT	35
13	37728	PLUG,ELEC,FEMALE,20A,125V	39
82	8119	POINTER ASSY	29
12	36809	PORT KIT,08 BARB X 90,EPDM	17, 19
30	24326	PRESSURIZED AIR GROUP	5
2	34850-135	PTO DRIVE,129%,SAE"B",ENG	53
22	38168	PUMP,HYD,DUAL,3.8/2.3CIR,RH	57
11	36730	PUMP,WATER,DIAPHRAM	17, 19
		R	
7	37591	RCPT,ELEC,MALE,20A,125V,FLG IN	39
2	20798	REDUCER W/M,4 PVCX3 PVC	49
3	5037	REFLECTOR,AMBER	79
1	5036	REFLECTOR,RED	79
1	28661	RELAYS & FUSE GRP,POG,GMC	71, 75
17	20857	RETAINER,HOSE W/M	45
8	20862	RETRACTOR WHEEL W/M	45
23	80346	ROLL PIN,.250X1.75	51
45	851118-1	ROLL PIN,.375X2.00	51
2	38043	RUBBER STRIP,SPONGE,.18X.75	43
		S	
65	81160	SCR,SLFDRL,HH,#10X1.00,#3PT	27, 29, 37
9	81160	SCR,SLFDRL,HH,#10X1.00,#3PT	79
12	81150	SCR,SLFTPG,PH,#10X.500,AB	39
38	81082	SCREW,SELF TAP,BTN HD,.312X100	57

ITEM NUMBER	PART NUMBER	NOMENCLATURE	IPL PAGE NUMBER
15	640210-1	SEAL KIT,HYD CYL,3.00X1.50	9
9	36623	SEAL,CABLE,14-16 GA,GRAY	71, 73
22	851442	SEAL,SWITCH,NUT,.469-32	71, 73
5	20974	SERVICE DOOR	27
60	80300	SET S,HSKT,KCUP,.250-20X.25	31
83	80392	SET SCREW,.250-20X.500	29
28	24089	SHELF,LIGHT	13
5	25226	SHIELD,COUPLING	41
20	21367	SHIELD,ROCK	13
49	25825	SHIM,SLIDE GATE,16 GAUGE	43
84	38642	SLEEVE,ABRASIVE,NOZZLE,RA300	47
4	24651	SLIDE GATE	43
6	988412	SLIDE GATE HOUSING,W/M	43
10	720290	SOLENOID,12V,CONSTANT DUTY	71, 73
70	24327	SOLVENT TANK GROUP	5
21	36538	SPR,.99 DIA X 15.25	45, 51
22	36539	SPR,1.375 DIA X 16.25	45
9	36926	STRAINER ASSY	17, 19
8	33148	STRAINER,SUCT,2NPT,25GPM,100ME	55
20	54960	STRAP,DELUXE WATER TANK	17, 21
9	20865	SUPPORT W/M,RETRACTOR WHEEL	45
401	988940	SUPPORT,ARROW BOARD-LH,W/M	79
402	988941	SUPPORT,ARROW BOARD-RH,W/M	79
27	20428	SUPPORT,BAR,HORIZONTAL	13
19	24090	SUPPORT,CHUTE/LIGHT	13
1	25646	SUPPORT,FILTER	55
68	28006	SUPPORT,HOSE	43
4	20502	SUPPORT,SOLVENT TANK	13
36	988229	SUPPORT-WATER TANK,W/M	17, 21
26	33964	SWITCH,BACKUP ALARM,NEUTRAL	71, 73
11	25247	SWITCH,PUSH BTN,ON-MOM OFF,MOD	71, 73
13	851392	SWITCH,TOGGLE,3-POS,SPDT,MOM	71, 73
1	851391	SWITCH,TOGGLE,SPST,2-POS	17, 21
		T	
3	20458	T BOLT ASSEMBLY,LID LOCK	9
6	24360	TANK ASSY,HYD,20GAL	55
25	72670	TANK ASSY,WATER,35GAL,DELUXE	17, 21
48	37738	TANK W/M,EMUL,400GAL	35, 37
10	36537	TANK,SOLVENT,30GAL,100PSI	67
12	37688	TERM,PUSH-ON,.25,FUSE TAP-IN	71, 75

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ITEM NUMBER	PART NUMBER	NOMENCLATURE	IPL PAGE NUMBER
10	851390204	TERM,RING,16-14 GA,#10 STUD	39
6	36165	TERM,SEALED CONN,16-14 GA,FEM	71, 73
1	25587	T-HANDLE W/M	43
80	21553	T-HANDLE W/M,.375-16X1.00	49
50	5470	THERM,DIAL,5.0 FACE,500 F	33
20	26981	THERMO WELL,08X30.25,W/ENDSLUG	37
6	36682	THERMOSTAT,ELEC,110-170 DEG F	39
1	29266	TIE DOWN,MACK	7
206	36542	TIE DOWN,RUBBER,15,W/HOOKS	81
5	33598	TIE WRAP,.188X15.50	17, 19, 21
4	20825	TRACK BOTTOM,HOSE RETRACTOR	45
5	20826	TRACK TOP,HOSE RETRACTOR	45
46	99190-01	TUBE,RND,1.50X.500X1.438 LG	51
14	24077	TUBE,SQ,2.50X.250X24.38	13
13	36481	TUBING,AIR BRAKE,BLK,08	23
		U	
6	35077	U-BOLT,.250-20,1.00IW,1.75IL	17, 21
		V	
7	22605	VALVE STOP	59
28	33750	VALVE,AIR SAFETY,125PSI,04 NPT	33
8	33750	VALVE,AIR SAFETY,125PSI,04 NPT	67
4	480160	VALVE,BALL,.375	23
3	32874	VALVE,BALL,.500 (BRASS)	17, 19, 21
7	32874	VALVE,BALL,.500 (BRASS)	67
3	36220A	VALVE,BALL,.500 NPT	77
65	36220	VALVE,BALL,.500 NPT	47
41	36662	VALVE,BALL,.500 NPT,3-WAY	31
39	36622	VALVE,BALL,.500 NPT,T HANDLE	33
57	36622	VALVE,BALL,.500 NPT,T HANDLE	47
33	280210	VALVE,BALL,1.00	33
14	36848	VALVE,CHECK,.500 FPT,1 PSI	17, 21
5	36871	VALVE,CHECK,.500 FPT,5 PSI	23
58	36871	VALVE,CHECK,.500 FPT,5 PSI	47
9	36871	VALVE,CHECK,.500 FPT,5 PSI	67
39	38063	VALVE,CHECK,PO,06FB,30G,3000	59
12	36523	VALVE,COUNTER BALANCE	53, 59
51	910150	VALVE,DRAIN COCK,.250 NPT	33
2	25799	VIBRATOR GROUP	11
2	37985	VIBRATOR,DC1600 W/SWITCH KIT	15
3	37647-03	VLV,4-WAY,CLOSE,BOSCH DO3	65

ITEM NUMBER	PART NUMBER	NOMENCLATURE	IPL PAGE NUMBER
2	37647-02	VLV,4-WAY,OPEN,BOSCH DO3	65
19	37647-19	VLV,4-WAY,REGEN,DO3,12VDC	65
8	37647-08	VLV,CHECK,CYL	65
10	37647-10	VLV,CHECK,PILOT	65
7	37647-07	VLV,FLOW CONTROL,STD	65
21	37647	VLV,HYD,MAN,DO3,5 SOL,12V	53
3	38706	VLV,HYD,PROP,MANIFOLD,12V	55
14	36654	VLV,HYD,SELECT,2 POS,12 NPT PT	59
6	37647-06	VLV,LOGIC ELEMENT	65
17	37647-17	VLV,NAME PLATE,DO3,MOTOR SPOOL	65
18	37647-18	VLV,NAME PLATE,DO3,REGEN SPOOL	65
11	37647-11	VLV,PRESS COMP FLOW	65
8	6534	VLV,PRESS PROTECTION,65-45	23
9	37647-09	VLV,RELIEF	65
15	36536	VLV,RELIEF,8 PSI,2.00 NPT	43
20	37647-23	VLV,SPOOL,CLOSED CTR,DO3	65
16	37647-16	VLV,SPOOL,MOTOR,DO3	65
15	37647-15	VLV,SPOOL,REGEN,DO3	65
		W	
47	R48-1	WASHER,1.031X1.50X.062THICK	51
49	R48-3	WASHER,1.031X1.50X.125THICK	51
48	R48-2	WASHER,FLAT,1.50X1.031X.075	51
15	80996	WASHER,FLAT,SAE,.375	77
102	80995	WASHER,FLAT,USS,#10	27
12	80995	WASHER,FLAT,USS,#10	77
34	80995	WASHER,FLAT,USS,#10	17, 19
7	80995	WASHER,FLAT,USS,#10	79
105	80140	WASHER,FLAT,USS,.250	27
15	80140	WASHER,FLAT,USS,.250	71, 75
23	80140	WASHER,FLAT,USS,.250	59
27	80140	WASHER,FLAT,USS,.250	17, 21
303	80140	WASHER,FLAT,USS,.250	81
41	80140	WASHER,FLAT,USS,.250	9
54	80140	WASHER,FLAT,USS,.250	41
19	80141	WASHER,FLAT,USS,.313	7
28	80141	WASHER,FLAT,USS,.313	17, 21
74	80141	WASHER,FLAT,USS,.313	49
13	80142	WASHER,FLAT,USS,.375	67
20	80142	WASHER,FLAT,USS,.375	9
24	80142	WASHER,FLAT,USS,.375	71, 73

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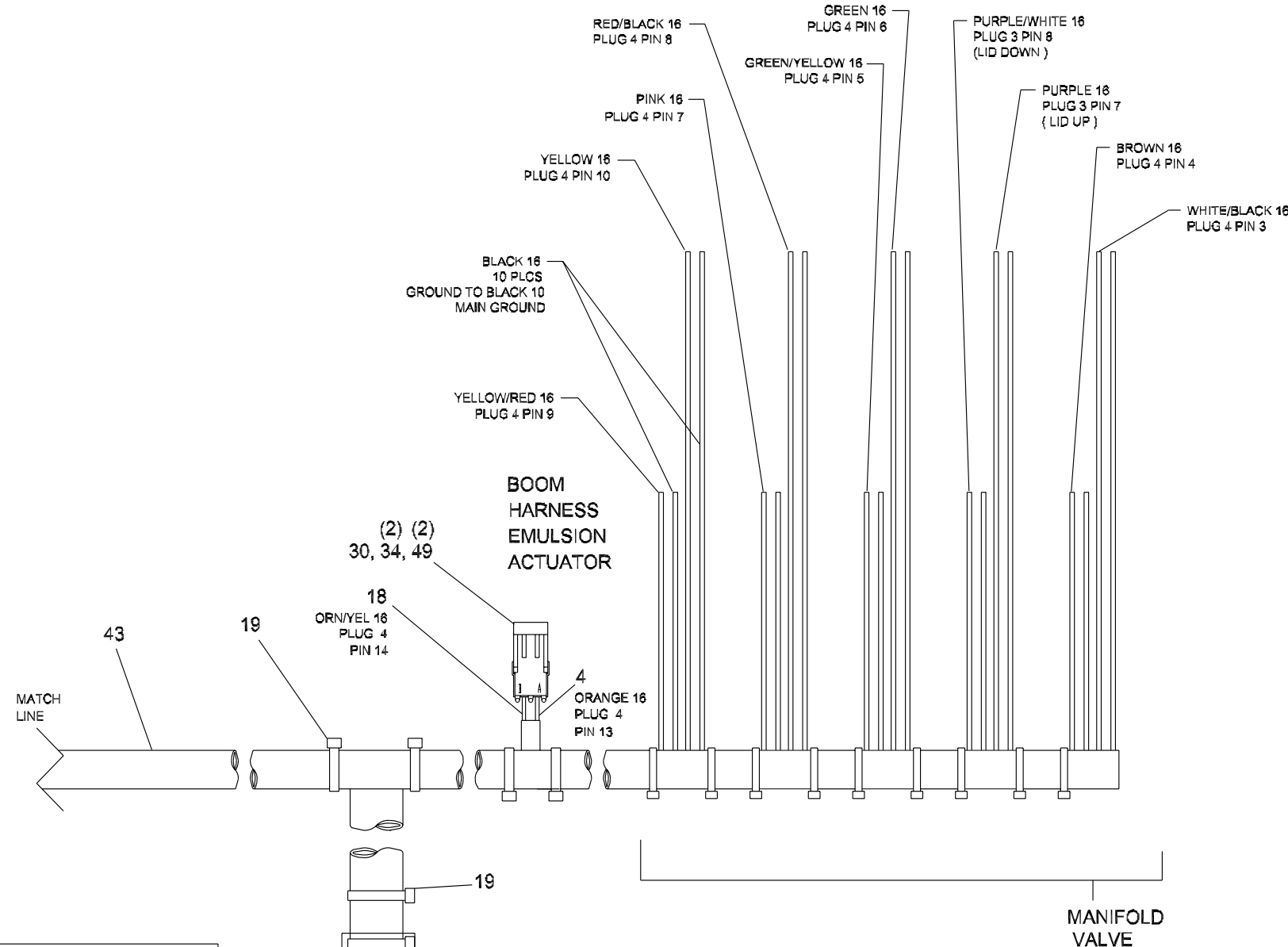
ITEM NUMBER	PART NUMBER	NOMENCLATURE	IPL PAGE NUMBER
29	80142	WASHER,FLAT,USS,.375	17, 21
30	80142	WASHER,FLAT,USS,.375	41, 43
31	80142	WASHER,FLAT,USS,.375	45, 49
410	80142	WASHER,FLAT,USS,.375	79
14	80144	WASHER,FLAT,USS,.500	69
21	80144	WASHER,FLAT,USS,.500	7
3	80144	WASHER,FLAT,USS,.500	7
31	80144	WASHER,FLAT,USS,.500	41
32	80144	WASHER,FLAT,USS,.500	51
407	80144	WASHER,FLAT,USS,.500	79
56	80144	WASHER,FLAT,USS,.500	27, 37
22	80146	WASHER,FLAT,USS,.625	7
33	80146	WASHER,FLAT,USS,.625	45
57	80147	WASHER,FLAT,USS,.750	27, 33, 37
31	80149	WASHER,FLAT,USS,1.00	13
23	80149	WASHER,FLAT,USS,1.000	9
34	80149	WASHER,FLAT,USS,1.000	51
1	12677-4	WASHER,INS,SQ,.94DIAX4.00	35
81	1708-25	WASHER,INSULATION,3"OD	35
103	871071601	WASHER,LOCK,#10	27
11	871071601	WASHER,LOCK,#10	39
13	80879	WASHER,LOCK,#10	77
23	871071601	WASHER,LOCK,#10	71, 75
35	871071601	WASHER,LOCK,#10	17, 19
16	80160	WASHER,LOCK,.250	71, 73, 75
30	80160	WASHER,LOCK,.250	17, 21
35	80160	WASHER,LOCK,.250	45, 49
52	80160	WASHER,LOCK,.250	41
24	80161	WASHER,LOCK,.312	7
36	80162	WASHER,LOCK,.375	45
96	80162	WASHER,LOCK,.375	33
18	80476	WASHER,LOCK,M06	71, 75
5	81141	WASHER,SAE,HARDENED,.500	15
412	988969	WASHER,SPECIAL-ARROW BOARD	79
70	80161	WASHER,SPLIT LOCK,.312	43
49	37670	WASHER,SQ,BEVEL,.750	27
25	36614	WASHER,THRUST,1.50IDX.062	51
15	90738-02	WIRE,12GA,BLACK,600V	39
16	90738-04	WIRE,12GA,GREEN,600V	39
14	90738-03	WIRE,12GA,WHT,600V	39

NOTES

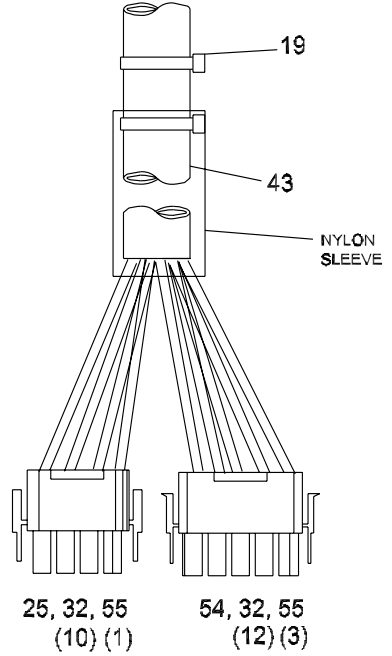
ILLUSTRATED PARTS LIST



NOTES



PLUG 3			
PIN NO	WIRE COLOR	WIRE GA	ITEM #
1	ORG/YEL	18	16
2	BROWN	16	3
3	GRAY	18	6
4	ORANGE	18	4
5	OPEN	16	11
6	BLACK	10	1
7	PURPLE	16	7
8	PRP/WHT	16	13
9	WHITE	16	10
10	BROWN	14	44
11	BLU/RED	18	15
12	GRN/WHT	16	13

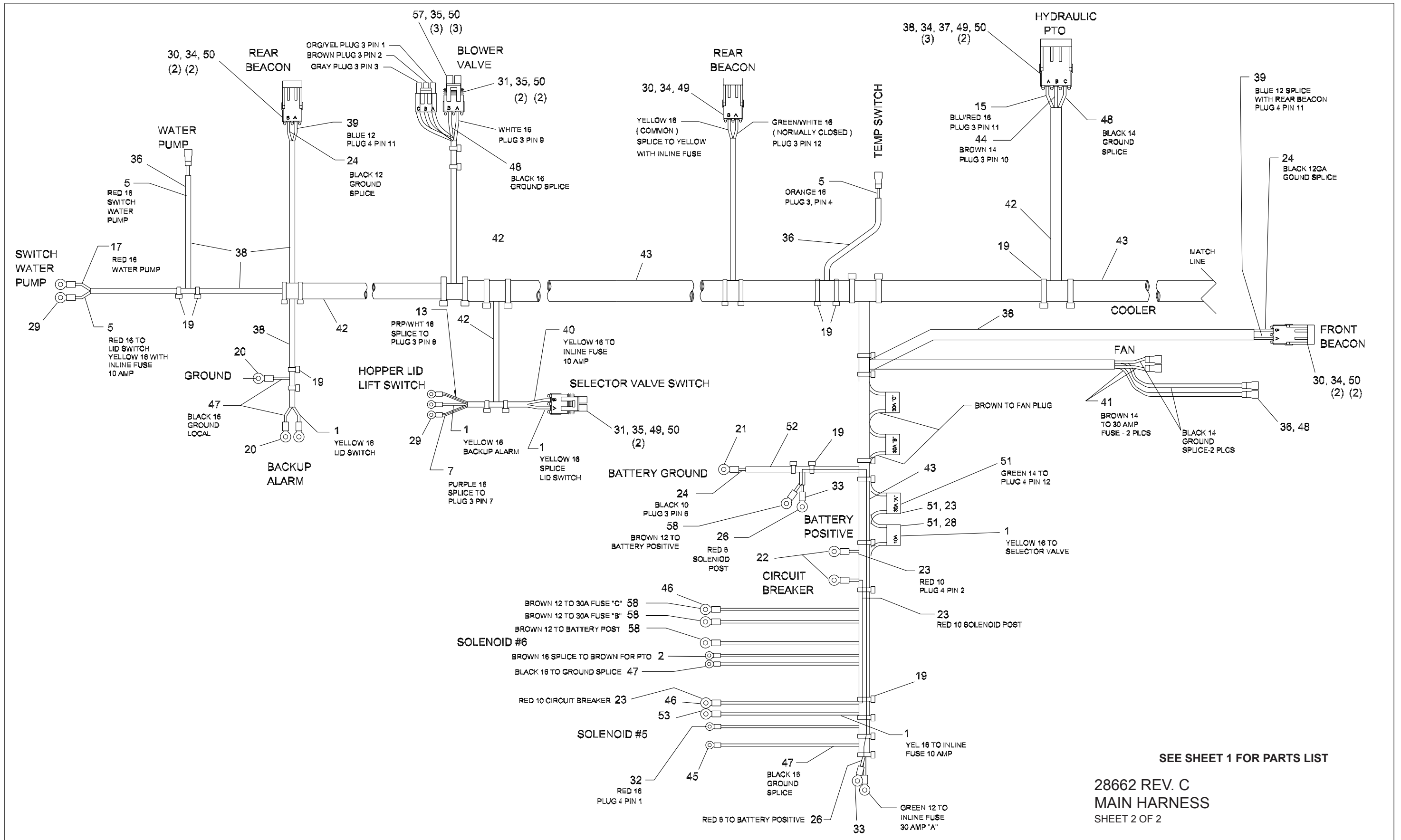


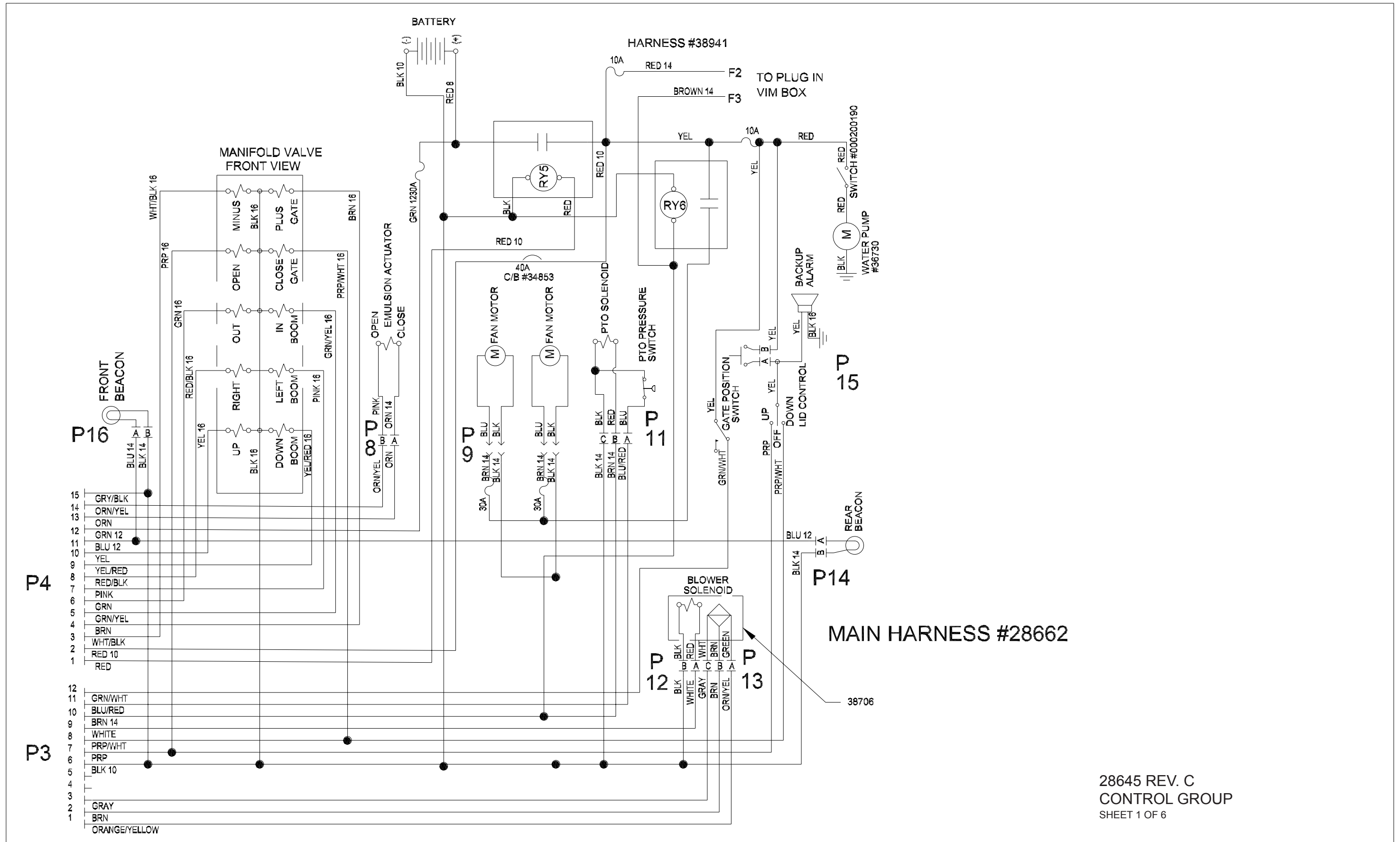
PLUG 4			
PIN NO	WIRE COLOR	WIRE GA	ITEM #
1	RED	16	40
2	RED	10	41
3	WHT/BLK	16	14
4	BROWN	16	2
5	GRN/YEL	16	16
6	GREEN	16	3
7	PINK	16	6
8	RED/BLK	16	9
9	YEL/RED	16	11
10	YELLOW	16	1
11	BLUE	14	39
12	GREEN	14	51
13	ORANGE	16	4
14	ORG/YEL	16	18
15	-	-	-

- NOTES:
- TAPE ALL LOOM TEES WITH BLACK ELECTRICAL TAPE AND TIE WRAPS.
 - WHEN REDUCING, LAY SMALLER LOOM INSIDE LARGER LOOM FOR A LENGTH OF 2.50".
 - AT TEES, SPLIT BRANCHING LOOM ON SIDE OPPOSITE EXISTING SPLIT FOR 2.50" AND RESULTING STRIPS INSIDE MAIN LOOM BEFORE TAPING AND TIE WRAPPING.

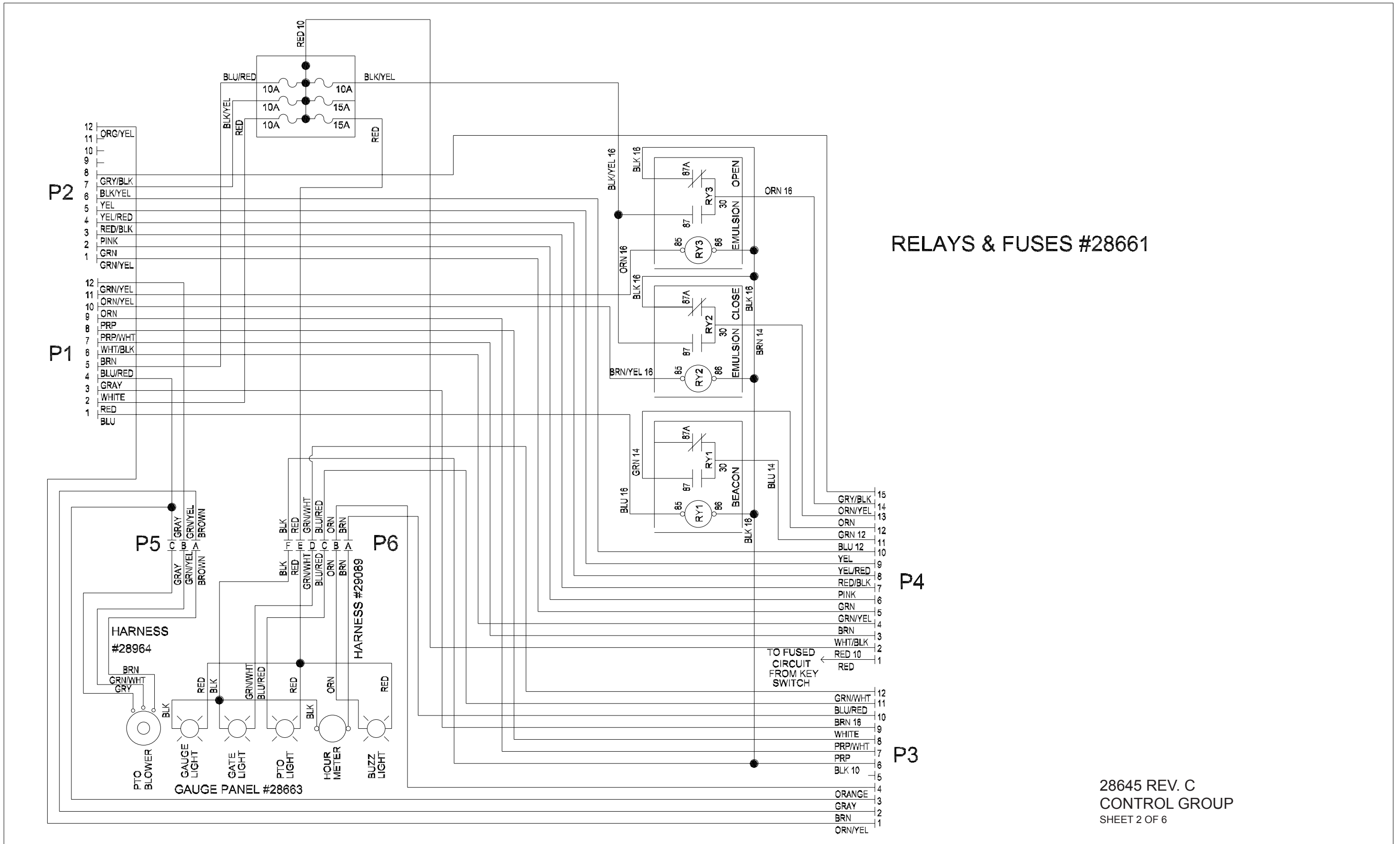
ITEM	PART NO.	DESCRIPTION	QTY.
1	33271-2	WIRE,16GA,YELLOW	45.25
2	33271-3	WIRE,16GA,BROWN	10.25
3	33271-4	WIRE,16GA,GREEN	11.25
4	33271-6	WIRE,16GA,ORANGE	6.25
5	33271-7	WIRE,16GA,RED	32.25
6	33271-8	WIRE,16GA,PINK	9.58
7	33271-9	WIRE,16GA,PURPLE	36.25
8	33271-10	WIRE,16GA,GRN,WHITE STRIPE	26.33
9	33271-12	WIRE,16GA,RED,BLK STRIPE	11.5
10	33271-5	WIRE,16GA,WHITE	21
11	33271-14	WIRE,16GA,YELLOW,RED STRIPE	9.33
12	33882-4	WIRE,12GA,GREEN	19.5
13	33271-16	WIRE,16GA,PURPLE,WHITE STRIPE	36.25
14	33271-17	WIRE,16GA,WHITE,BLACK STRIPE	11
15	33271-18	WIRE,16GA,BLUE,RED STRIPE	16.33
16	33271-19	WIRE,16GA,GRN,YELLOW STRIPE	9.75
17	33271-20	WIRE,16GA,GRAY,BLACK STRIPE	21.75
18	33271-21	WIRE,16GA,ORANGE,YEL STRIPE	6.25
19	33596	TIE WRAP,.188X7.500	56
20	33607	TERM,RING,16-14 GA.,.250 STUD	3
21	33612	TERM,RING,12-10 GA.,.375 STUD	1
22	33620	TERM,RING,12-10 GA,#10 STUD	2
23	36218	FUSE,30 AMP,ATC	0
24	33882-5	WIRE,12GA,BLACK	30.33
25	34467	CONN HOUSING,PLUG,12 CIRCUIT	1
26	38073	WIRE,6GA,RED	6
27	71839	WIRE,6GA,BLK	11
28	36340	FUSE,10 AMP,ATC	0
29	35123	TERM,RING,16-14 GA,#6 STUD	7
30	35138	CONN,SEALED,SHROUD,2-PIN	3
31	35139	CONN,SEALED,TOWER,2-PIN	2
32	34469	CONTACT,PIN,20-14 GA	22
33	71859	TERM,RING,6 GA,.375 STUD	3
34	36164	TERM,SEALED CONN,16-14 GA,MA	9
35	36165	TERM,SEALED CONN,16-14 GA,FEM	2
36	36349	TERM,PUSH-ON,.25,FEM,16-14,SLV	5
37	71060	LOOM,SPLIT,CONVOLUTED,.250	32.5
38	36350	CONNSEALED,SHROUD,3-PIN	1
39	33882-3	WIRE,12GA,BLUE	45.25
40	71861-2	WIRE,10GA,RED	8.25
41	71861-4	WIRE,10GA,BLACK	11.5
42	71864	LOOM,SPLIT,CONVOLUTED,.375	22.5
43	71870	LOOM,SPLIT,CONVOLUTED,.750	32.25
44	72116	WIRE,14GA,BROWN	16.33
45	851390204	TERM,RING,16-14 GA,#10 STUD	4
46	71070	TERM,RING,12-10 GA,.312 STUD	5
47	33271-1	WIRE,16GA,BLACK	15.75
48	71064	WIRE,14GA,BLACK	5.75
49	36166	SEAL,CABLE,18-16 GA,GREEN	9
50	36623	SEAL,CABLE,14-16 GA,GRAY	7
51	37118	FUSE HOLDER,IN LINE,ATC	0
52	33589	LOOM,SPLIT,CONVOLUTED,.500	4.8333
53	33609	TERM,RING,16-14 GA,.375 STUD	1
54	72593	CONN HOUSING,PLUG,15 CIRCUIT	1
55	35391	CONTACT,PIN,12-10 GA	4
56	33271-0	WIRE,16GA,GRAY	21
57	36300	CONN,SEALED,TOWER,3-PIN	1
58	33882-7	WIRE,12GA,BROWN	1

28662 REV. C
MAIN HARNESS
SHEET 1 OF 2



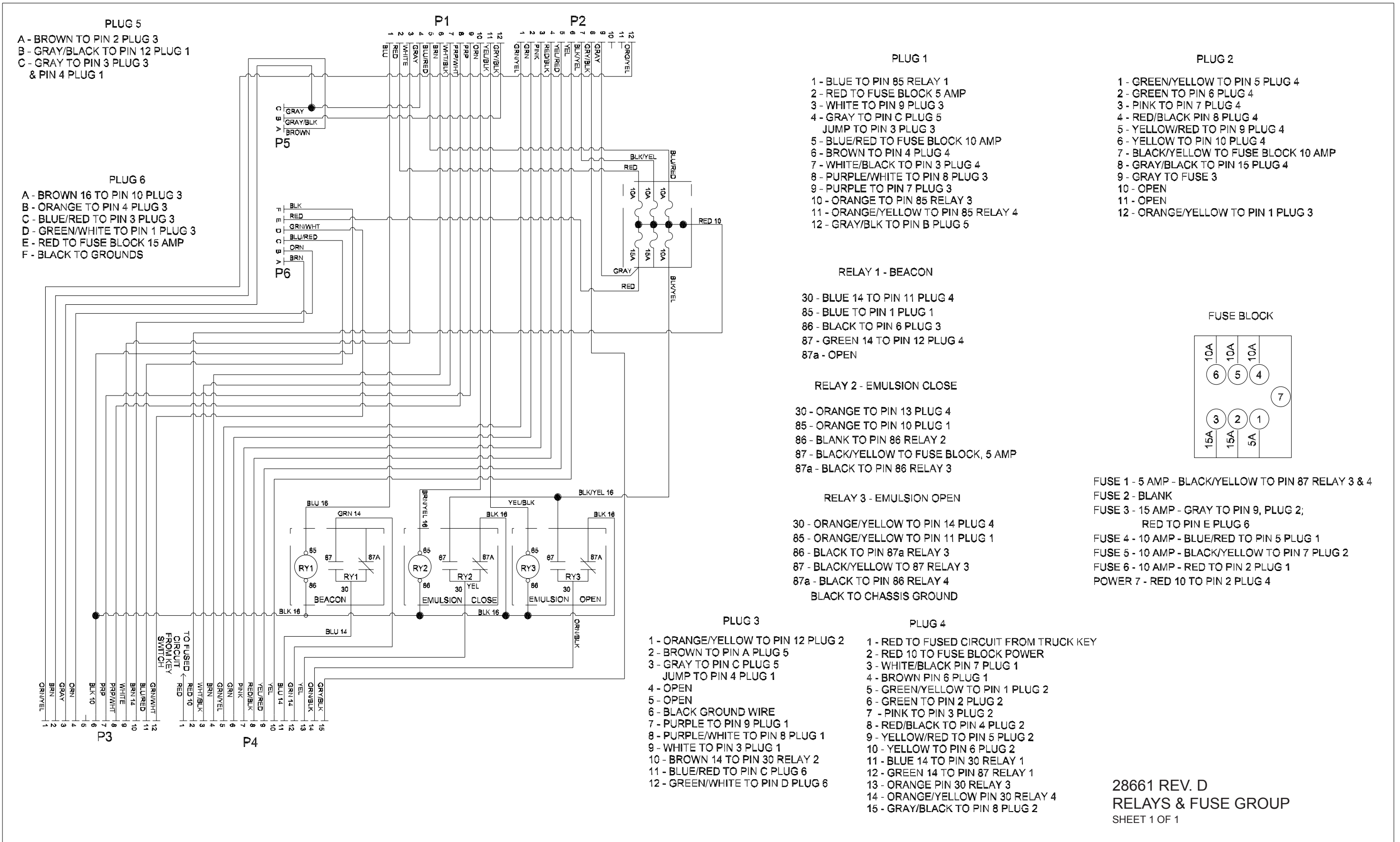


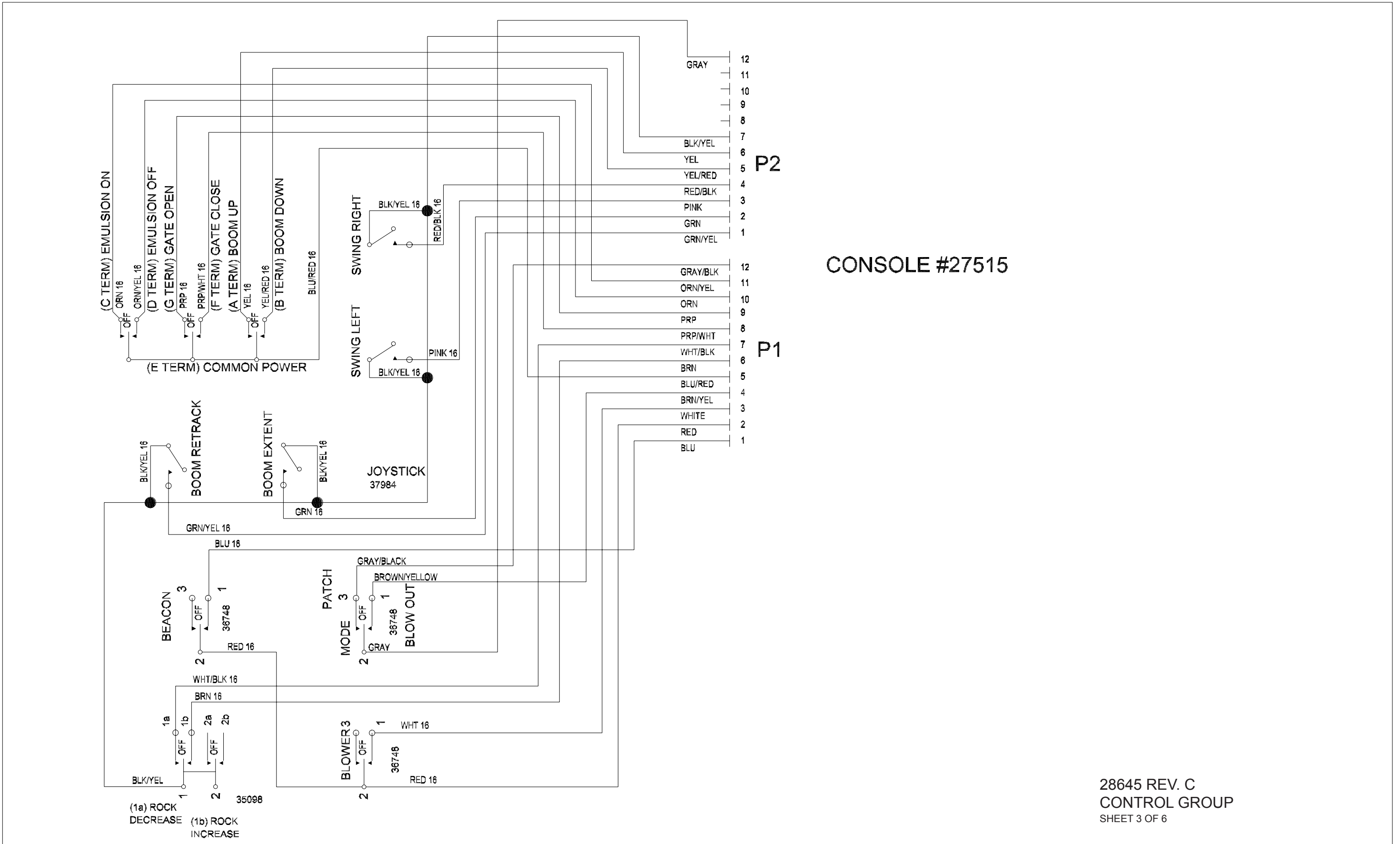
28645 REV. C
CONTROL GROUP
SHEET 1 OF 6



RELAYS & FUSES #28661

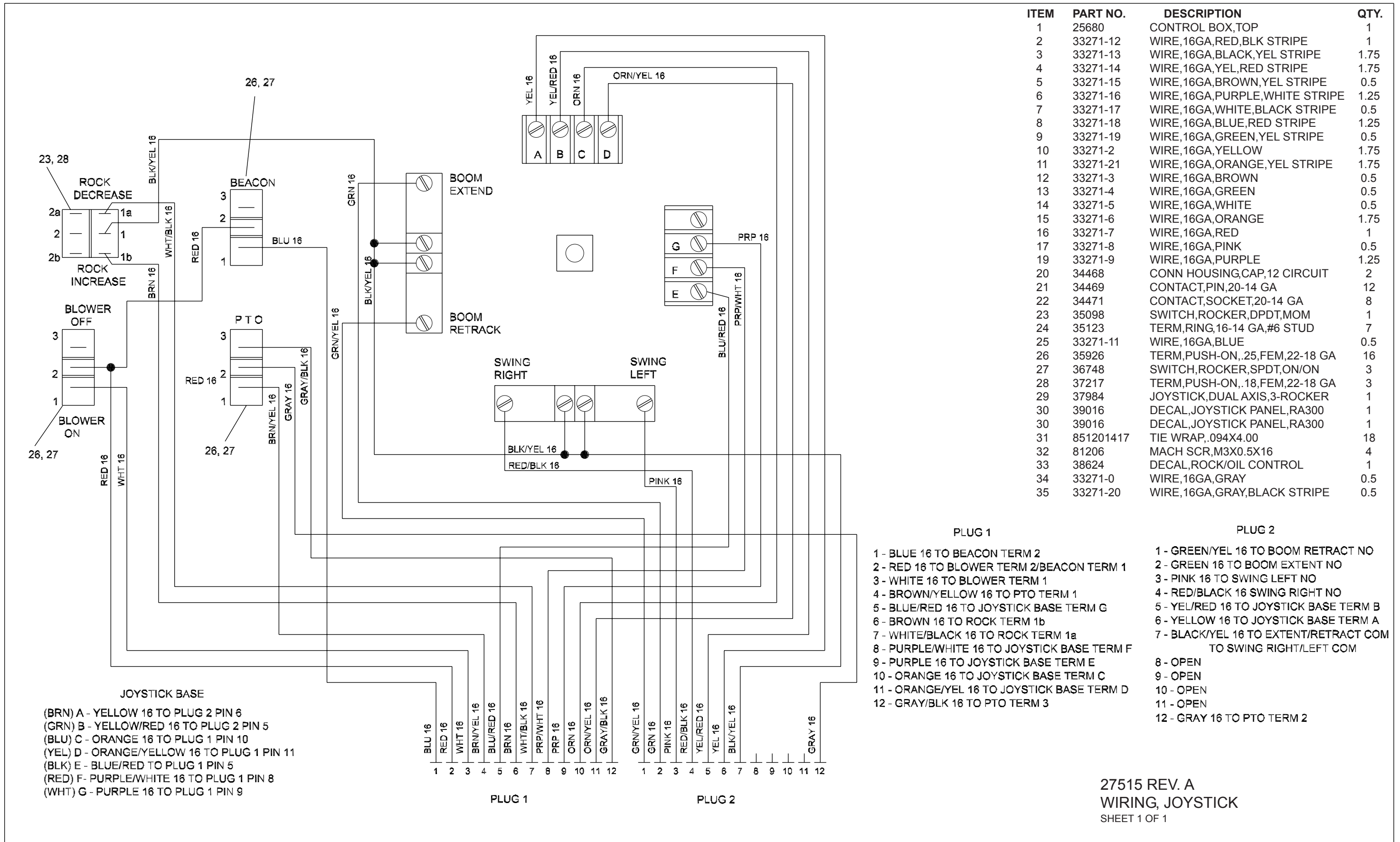
28645 REV. C
CONTROL GROUP
SHEET 2 OF 6



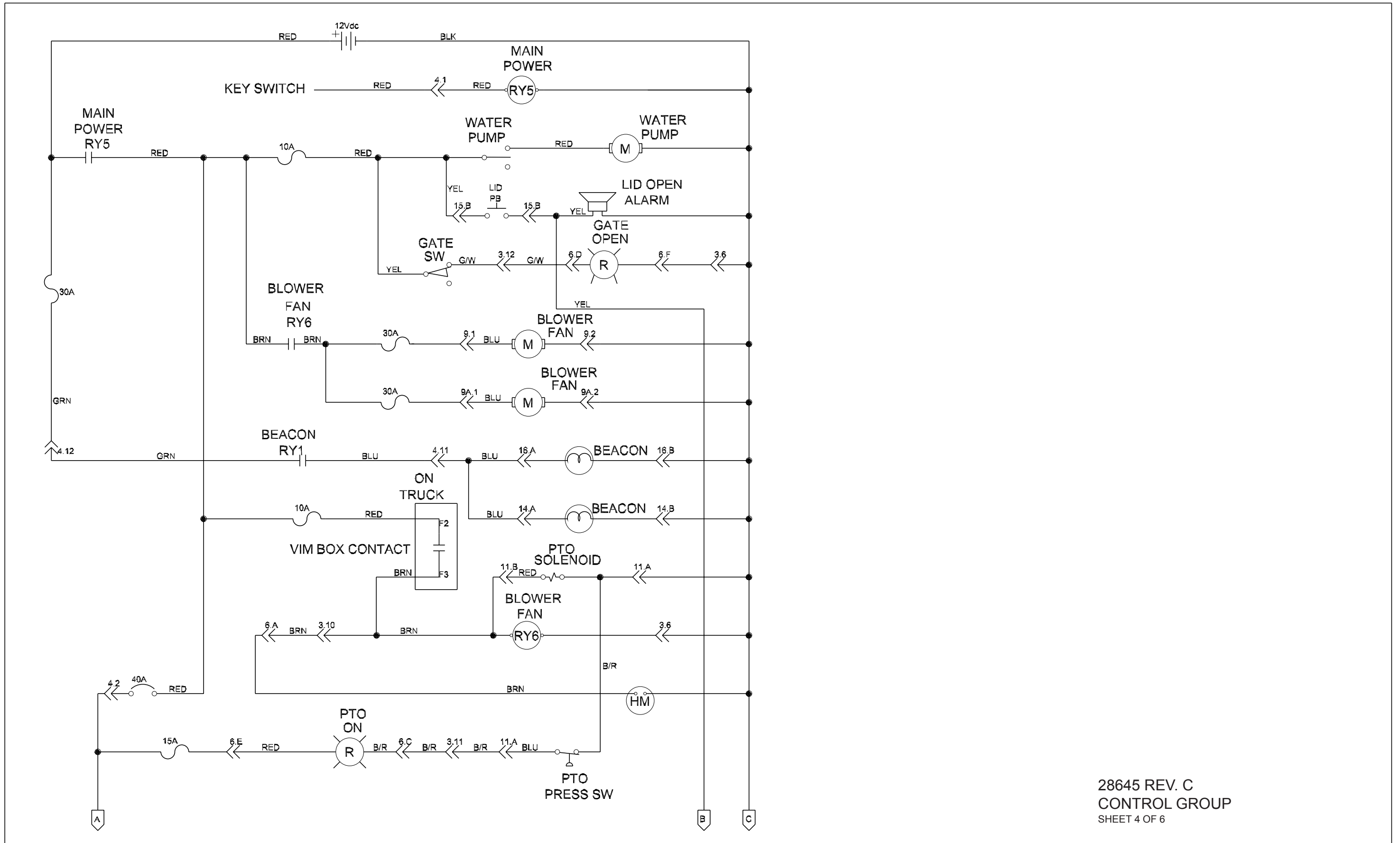


CONSOLE #27515

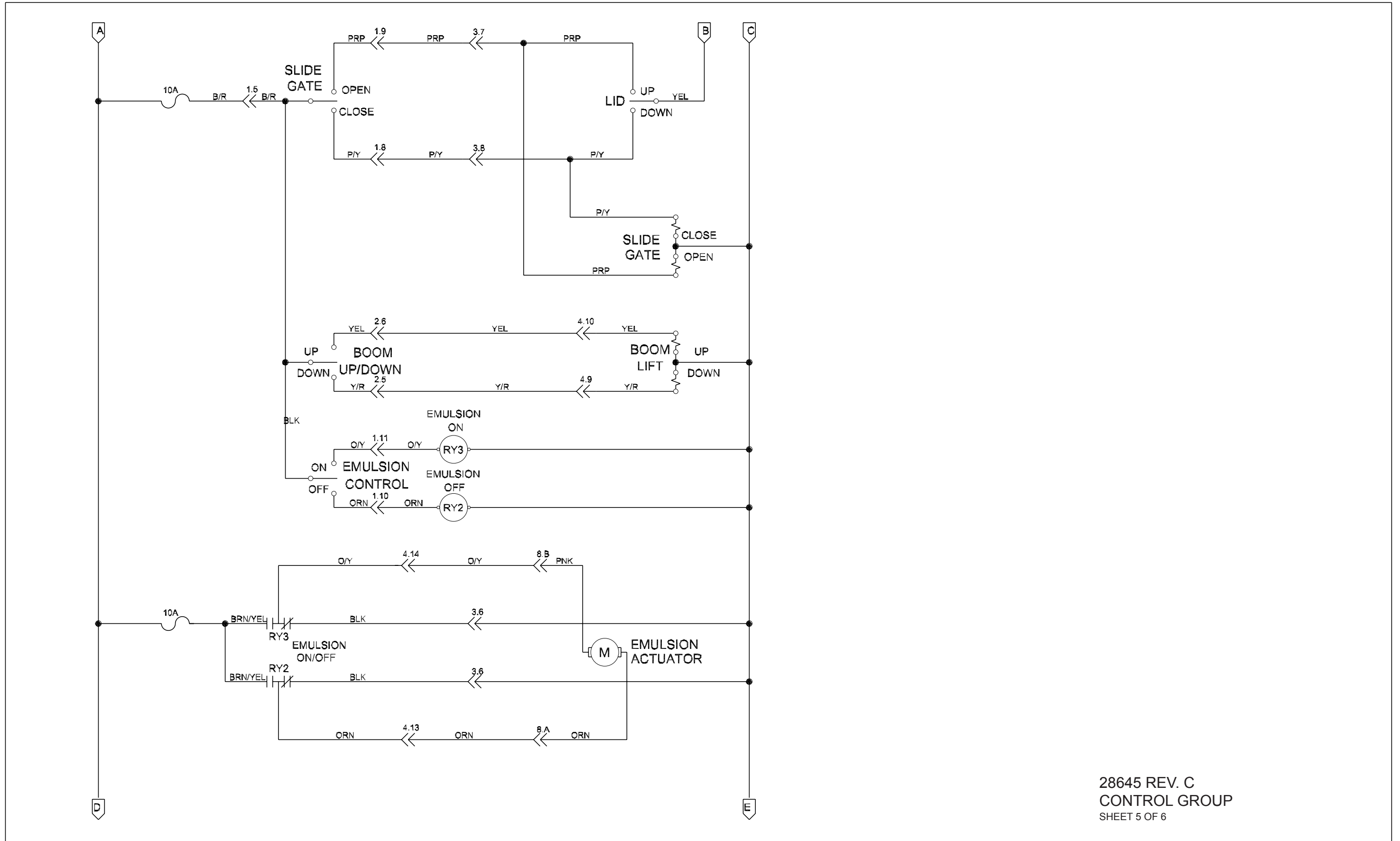
28645 REV. C
CONTROL GROUP
SHEET 3 OF 6



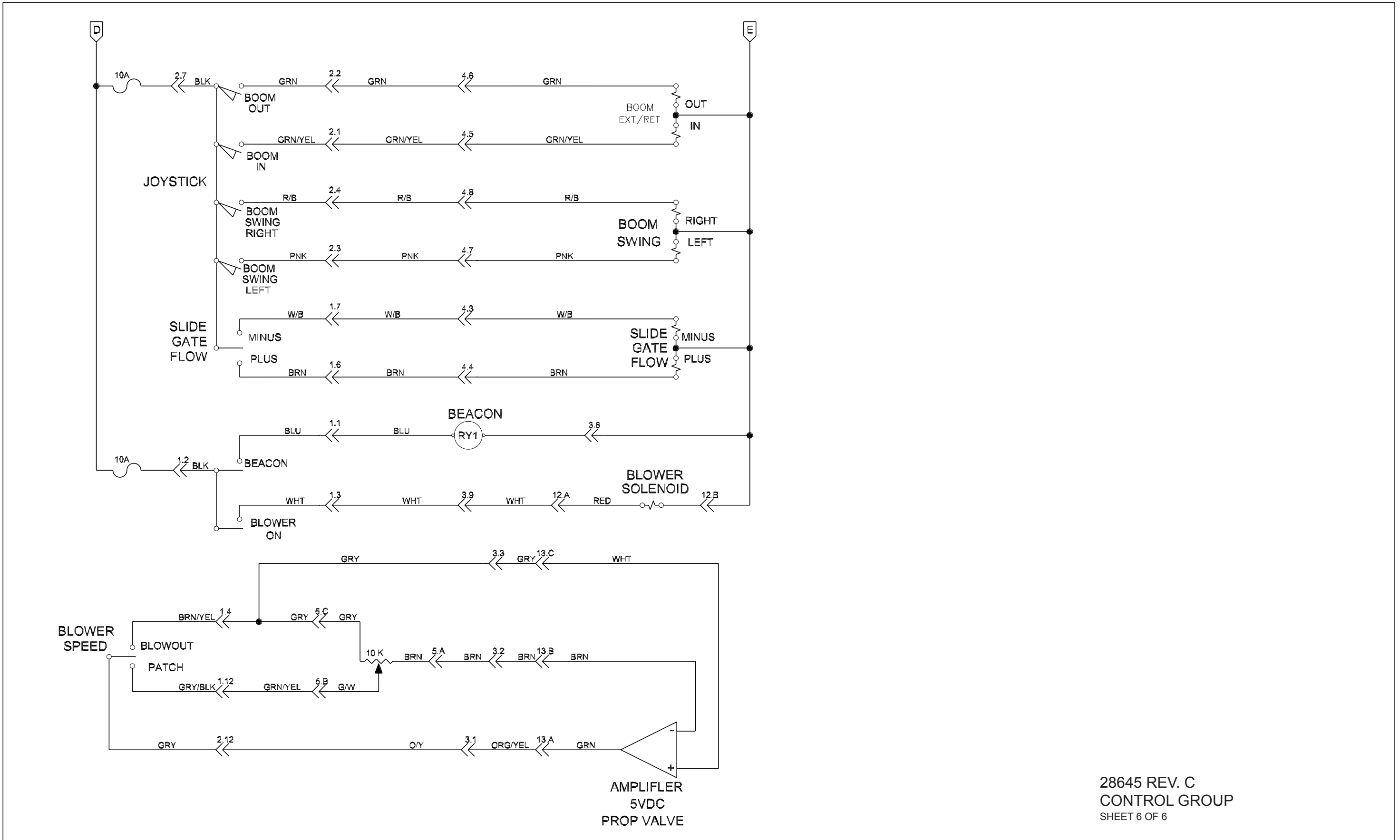
ITEM	PART NO.	DESCRIPTION	QTY.
1	25680	CONTROL BOX, TOP	1
2	33271-12	WIRE, 16GA, RED, BLK STRIPE	1
3	33271-13	WIRE, 16GA, BLACK, YEL STRIPE	1.75
4	33271-14	WIRE, 16GA, YEL, RED STRIPE	1.75
5	33271-15	WIRE, 16GA, BROWN, YEL STRIPE	0.5
6	33271-16	WIRE, 16GA, PURPLE, WHITE STRIPE	1.25
7	33271-17	WIRE, 16GA, WHITE, BLACK STRIPE	0.5
8	33271-18	WIRE, 16GA, BLUE, RED STRIPE	1.25
9	33271-19	WIRE, 16GA, GREEN, YEL STRIPE	0.5
10	33271-2	WIRE, 16GA, YELLOW	1.75
11	33271-21	WIRE, 16GA, ORANGE, YEL STRIPE	1.75
12	33271-3	WIRE, 16GA, BROWN	0.5
13	33271-4	WIRE, 16GA, GREEN	0.5
14	33271-5	WIRE, 16GA, WHITE	0.5
15	33271-6	WIRE, 16GA, ORANGE	1.75
16	33271-7	WIRE, 16GA, RED	1
17	33271-8	WIRE, 16GA, PINK	0.5
19	33271-9	WIRE, 16GA, PURPLE	1.25
20	34468	CONN HOUSING, CAP, 12 CIRCUIT	2
21	34469	CONTACT, PIN, 20-14 GA	12
22	34471	CONTACT, SOCKET, 20-14 GA	8
23	35098	SWITCH, ROCKER, DPDT, MOM	1
24	35123	TERM, RING, 16-14 GA, #6 STUD	7
25	33271-11	WIRE, 16GA, BLUE	0.5
26	35926	TERM, PUSH-ON, .25, FEM, 22-18 GA	16
27	36748	SWITCH, ROCKER, SPDT, ON/ON	3
28	37217	TERM, PUSH-ON, .18, FEM, 22-18 GA	3
29	37984	JOYSTICK, DUAL AXIS, 3-ROCKER	1
30	39016	DECAL, JOYSTICK PANEL, RA300	1
30	39016	DECAL, JOYSTICK PANEL, RA300	1
31	851201417	TIE WRAP, .094X4.00	18
32	81206	MACH SCR, M3X0.5X16	4
33	38624	DECAL, ROCK/OIL CONTROL	1
34	33271-0	WIRE, 16GA, GRAY	0.5
35	33271-20	WIRE, 16GA, GRAY, BLACK STRIPE	0.5



28645 REV. C
CONTROL GROUP
SHEET 4 OF 6

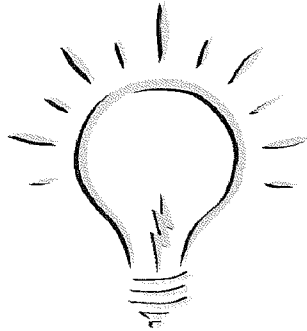


28645 REV. C
CONTROL GROUP
SHEET 5 OF 6



28645 REV. C
CONTROL GROUP
SHEET 6 OF 6

SMARTFLASH II



SmartFlash II Arrowboard Controller Installation & Operation Manual



INDUSTRIES, INC.

81 Texaco Road
Mechanicsburg, PA 17050
717-691-8007
717-697-0813 FAX
www.trafcon.com

Set up and operation

Trailer

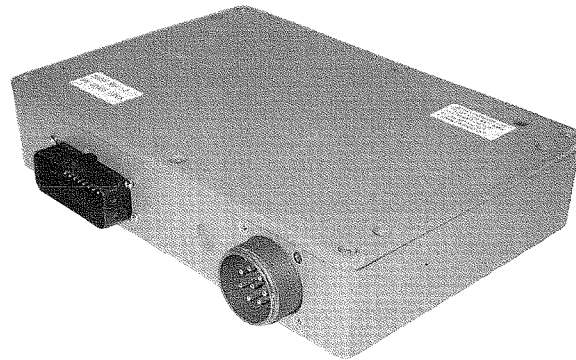
1. Disconnect trailer from towing vehicle
2. Aim rear of trailer toward oncoming traffic
3. Lower and pin rear drop jacks, raise tongue screw jack until rear drop jacks are firmly touching ground.
4. Lower and pin front drop jacks, raise tongue screw jack until the trailer is resting on all 4 drop jacks. Note: trailer is most stable with weight on all 4 drop jacks.
5. Loosen tension on sign lifting hand winch.
6. Remove (2) ½” keeper pins on lift arms.
7. Crank winch, retracting cable, until lift arms are vertical and keeper pin holes align.
8. Insert keeper pins in lift arm and trailer support.
9. Do not attempt to move trailer with drop jacks down. Lower *and* replace keeper pins in arrowboard frame prior to transport.

Main Features

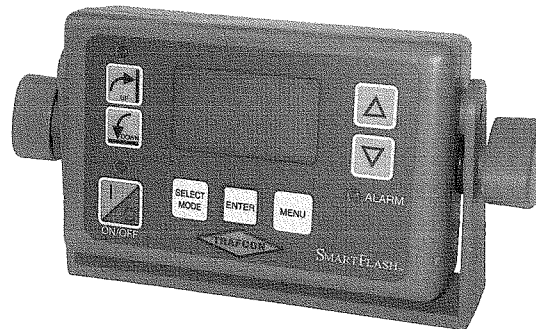
- Advanced solid state technology
- LCD graphic display with backlight
- Soft touch keypad with audible confirmation
- Text description of arrow patterns displayed
- Powers up in a “safe” default caution mode
- Automatic short and open circuit protection
- Polarity protected circuitry
- Ability to “hot-swap” controls and plugs
- Automatic dimming
- Manual dimming
- Alarm detection and notification
- Built in diagnostics
- Low battery warnings, automatic switchover to default caution and power down
- Convenient bulb intensity and battery level displays
- Hour meter with user hours that can be reset.

The control system consists of two parts:

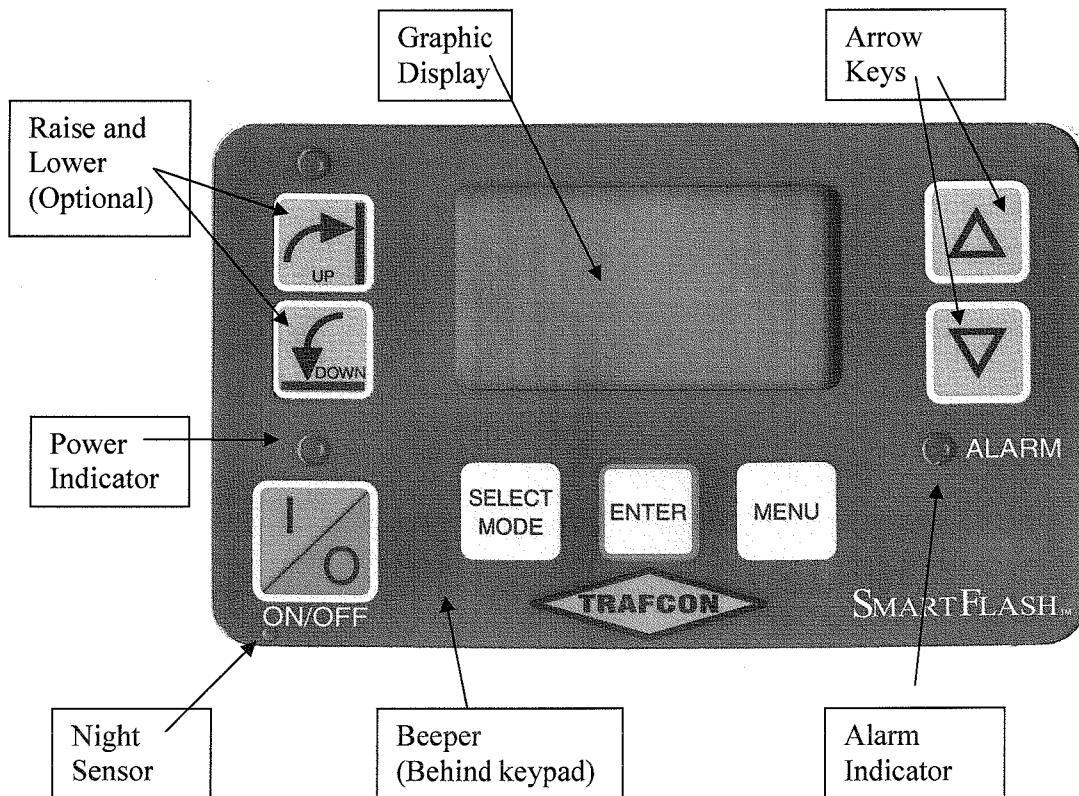
1. Most of the electronics are housed in the **Main Controller** enclosure, which is mounted in the arrowboard.



2. The **Remote** houses a keypad and a graphic display for monitoring & entering data. It is either hardwired or wireless RF linked to the main controller.



Remote Layout & Functions



Power Indicator

This red indicator lights solidly when the remote is "on."

NIGHT SENSOR

This is an ambient light sensor that can be used to automatically illuminate the remote at night.

Alarm Indicator

This red indicator flashes when there is any alarm condition present. It is off if there is no alarm conditions present

Beeper

The beeper (Not visible but hidden just below the keypad) emits a short high-pitched chirp each time a key is pressed. The beeper also emits a longer and lower pitched chirp periodically when any alarm condition is present.

1/0 Button

This button turns the remote and the controller on or off simultaneously.

Note that the controller always returns to its “default” safety pattern every time the main controller is turned “on”, or has its power interrupted and reapplied. This non-directional pattern is meant to warn drivers of a possible situation ahead without unintentionally indicating an incorrect direction. After each power on event, the user is required to select the desired arrow mode for safety reasons.

Also note that in the case of a Wireless RF system, the remote may not be within range of the main controller to send the on or off signal. In this case the remote on/off status might not match the main controller on/off status. To correct this, simply move the remote within range and press the “1/0” key as necessary to correct.

SELECT MODE Button

Pressing this button switches to the mode where the user may select the desired arrow pattern. Pressing this button repeatedly switches through the available arrow patterns.

ENTER Button

This button is used to confirm selections in the menus.

MENU Button

This button calls up the menu of option functions. Within each option function is a sub-menu.

ARROW Buttons

These buttons are used to step through arrow patterns, menu items or increase & decrease data values. The exact function depends on the item selected on the display at the time.

RAISE and LOWER Buttons (Optional)

These buttons are used to initiate sign raise and lower movements. They operate any time the system is ON.

STATUS Display

This is the default display mode for normal operation. If the user does not press any keys for a period of time, the remote always returns to the STATUS display. Elements of the status display are as follows:

1. The main area of the status display reflects the arrow pattern currently being displayed on the arrowboard. This area is also used to indicate problems with individual lamps or circuits on the arrowboard.
Round dot = Normal operation for this circuit
Letter "X" = Open circuit detected at this lamp
Letter "s" = Short circuit detected at this lamp
2. The bar graph at the left shows the voltage reading of the main controller battery. The range is 10 to 14 volts. Voltage readings are taken under loaded conditions and may read slightly lower than an unloaded battery.
3. The bar graph at the right shows the current lamp intensity from 0-100% of the maximum allowable intensity. This is usually automatically set by the ambient light sensor, but some models allow manual intensity setting via the menus.
4. The title line displays the NAME of the arrow pattern currently being displayed on the arrowboard. Because the user may not always be facing the remote in the same way that traffic sees the arrowboard, the name can be useful in avoiding right/left confusion.
5. The alarm line displays any alarms currently detected. If the line is blank, then no alarms are detected. Possible alarm messages are as follows:

LOW BATTERY WARNING!
LOW BATTERY CAUTION!
LOW BATTERY SHUTOFF!
SHORTED CONNECTIONS!
BULBS BURNED OUT!
COMMON WIRE SHORTED!

SELECT MODE Display

Press the “SELECT MODE” button to change the arrow pattern.

The display changes to show the currently displayed arrow pattern and title only. The pattern is displayed with hollow dots instead of solid dots, and the pattern flashes at twice the actual rate to indicate that this is the selection mode rather than the status mode.

Continue pressing the “SELECT MODE” key to advance through all allowable patterns, or use the up and down arrows to browse back and forth through the allowable patterns.

To send the selected pattern to the arrowboard lamps press ENTER. The arrowboard will not change until you press ENTER.

To exit without changing the arrowboard, press “MENU” or simply let the SELECT MODE function time out on its own. Remember, changes will not show on the arrowboard unless you press ENTER.

MENU Display

Press the “MENU” button to access the menu of internal options. Once in the menu, use up & down arrows to select the desired menu item with the arrow at the left, and then press ENTER.

Alternatively, press “MENU” again to exit menu mode, or simply let the menu mode time out and the remote will return to the status display.

Menu mode choices are as follows:

SIGN BRIGHTNESS
SIGN INFO
REMOTE POWER SETUP
REMOTE OPTIONS
DIAGNOSTICS

SIGN BRIGHTNESS Mode

Sign Brightness settings are as follows:

AUTO OR MANUAL?
MANUAL SETTING =
MANUAL TIMEOUT =

Use the up and down keys to select the item you wish to modify by moving the arrow at the left. Press the ENTER key to select that item and modify that value. The item value will then

flash and may be adjusted with the up and down buttons. Press ENTER again to save the new value & return to the item selection arrow.

AUTO OR MANUAL? May be set to either "AUTO" or "MANUAL"

Note that each time power is turned off & back on, the arrowboard always returns to "AUTO." This is a safety feature. Some models do not allow "MANUAL."

MANUAL SETTING = May be set from 0 to 100. This is the bulb intensity setting to be displayed in manual.

MANUAL TIMEOUT = May be set from 0 to 24 hours. Some models may not allow a zero setting or may allow less than 24 hours.

A zero setting allows the manual intensity to stay in effect indefinitely until the arrowboard is powered off.

A setting of 1 to 24 hours means that the intensity will remain at the manual setting for this period of time, and then automatically switch back to AUTO. The time begins when intensity is set to MANUAL or the time is modified.

SIGN INFO Mode

Sign Info settings are as follows:

CFG = Shows one of the following lamp configurations of the main controller.

13 LAMP STANDARD

13 LAMP WIG-WAG

15 LAMP STANDARD

15 LAMP WIG-WAG

25 LAMP STANDARD

25 LAMP WIG-WAG

*This setting is NOT user changeable and MUST be configured at the factory.

SERIAL NO.: shows the serial number of the main controller. This is an 8 digit number. It is not changeable by the user.

CONTROL VERSION: shows the software version in the main controller. It may or may not be the same version as the software in the remote. The version of the software in the remote can be seen in the upper right corner of the display just after the remote is turned on.

TOTAL HOURS: shows the total number of "on" hours that the unit has been in service. Hours accumulate only when the arrowboard is displaying a pattern. This number is not changeable by the user.

USER HOURS: shows another hour meter, but this one is resettable by the user. It can be used as a job or service hourmeter as the user desires.

ZERO USER HOURS? Is used to zero the user hourmeter. Use the up or down arrow keys to change the "N" to a "Y", and then press "ENTER" to zero the user hourmeter.

REMOTE POWER SETUP Mode

Use the up and down keys to select the item you wish to modify by moving the arrow at the left. Press the ENTER key to select that item and modify that value. The item value will then flash and may be adjusted with the up and down buttons. Press ENTER again to save the new value & return to the item selection arrow.

Remote power setup settings are as follows:

WIRING: DIRECT WIRED or RADIO LINK. This should only be set to the actual type of system in use.

NEVER AUTO SHUTOFF
OFF 5 MIN INACTIVE
OFF 2 MIN INACTIVE
OFF 1 MIN INACTIVE
OFF WHEN SIGN IS OFF

These settings are used to save power in the remote. They are primarily of use in a radio linked system where conservation of the remote battery is an issue. NEVER AUTO SHUTOFF is most appropriate for a direct wired system.

REMOTE BATTERY = displays the voltage detected at the remote battery. This is only of any interest in a wireless RF linked system, where the remote & main controller uses different batteries.

REMOTE OPTIONS Mode

This mode makes internal settings in the remote and does not affect the main controller operation in any way. These options are primarily for operator convenience and power saving.

Use the up and down keys to select the item you wish to modify by moving the arrow at the left. Press the ENTER key to select that item and modify that value. The item value will then flash and may be adjusted with the up and down buttons. Press ENTER again to save the new value & return to the item selection arrow.

REMOTE OPTIONS items are as follows:

KEY BEEP
ALARM BEEP
CONTRAST
BACKLIGHT
KEY LIGHTING
LIGHTING TIMEOUT
NIGHT SENSOR

KEY BEEP may be set to ON or OFF as desired. ON will give a short chirp as each key is pressed, OFF will give no beep.

ALARM BEEP may be set to ON or OFF as desired. ON will allow a short beep when an alarm is present, OFF will not.

CONTRAST sets the contrast of the LCD display. It may be set from 1-100, but practical values are about 1-10.

BACKLIGHT may be set from 0 to 100. This sets the intensity percentage of the LCD backlight. It is normally set to 100. Setting to 0 will result in no backlight and can be used to save significant power in a radio linked remote. The user can set to intermediate values to suit personal preference.

LIGHTING TIMEOUT may be set to NONE, 5s, 10s, 30s or 60s. This is the amount of time that the backlight and key illumination will remain on after the last key press. Setting to NONE means that the lighting will always stay on. Setting to a numeric value can be used to save power in a radio linked remote, or can be used to darken the remote when not in use if the user so prefers.

NIGHT SENSOR can be set to OFF or ON. Default is OFF. If set to ON, then the key illumination and LCD backlight will not be illuminated unless a low ambient light condition is detected at the sensor just below the 1/0 key. This can be useful in vehicle cab mounted applications to automatically illuminate the remote only at night. It also can save power in a radio linked remote by only using the illumination power at night.

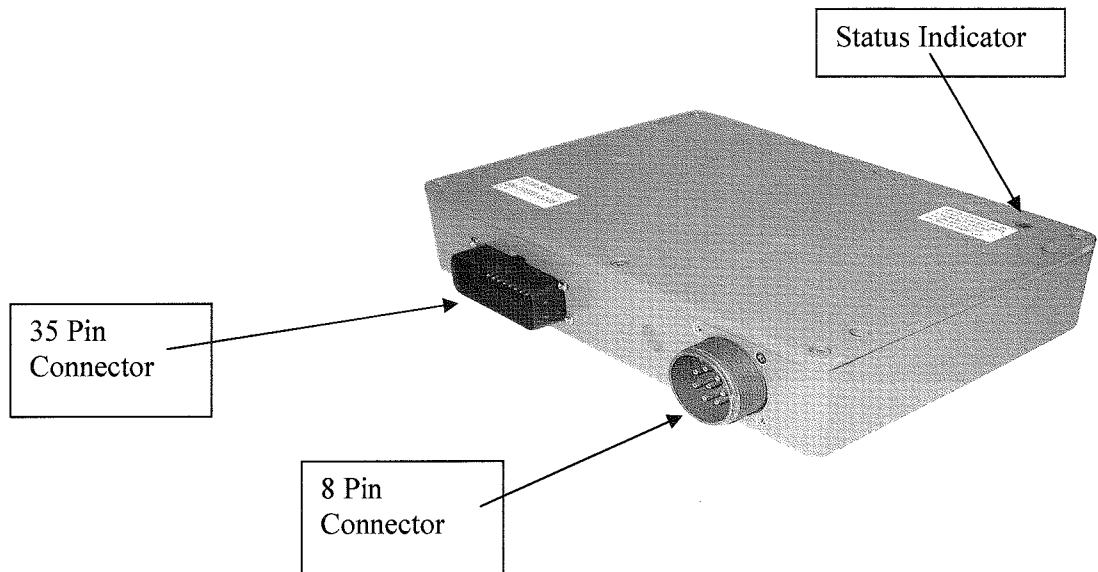
DIAGNOSTICS Mode

Diagnostics mode displays the following values:

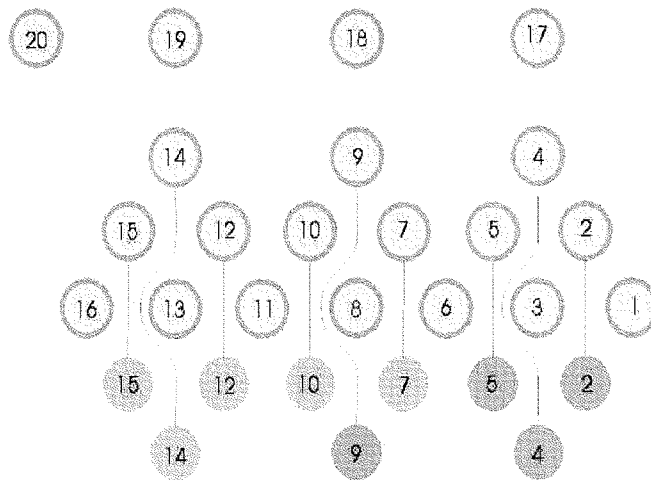
AMBIENT NOW
AMBIENT PERCENT
CONTROLLER BATT
TEMPERATURE

This information is of no real use in ordinary circumstances, but Trafcon service personnel may ask for these readings to assist in troubleshooting.

Connections & Wiring



Lamp Circuit Wiring for Standard Setup

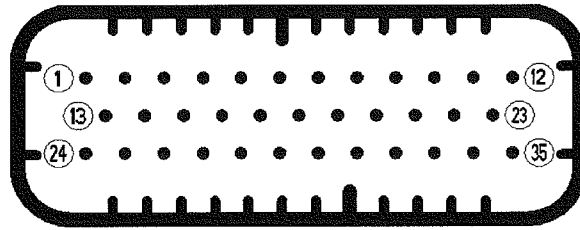


- Lamp circuits 1-20 have a specified Colored 18 gauge wire provided to each lamp. The “Negative” connection will switch on and off causing the lamp to flash.
- Each lamp also has an Orange 14 gauge wire provided for the “Positive Common” lamp connection. The “Positive Common” will turn on with the I/O button.

**35 PIN CONTROLLER CONNECTOR TO
LAMP CIRCUIT STANDARD WIRING**

Pin	Wire Color	Gauge	Function	Application
1	Brown	18	Lamp circuit 1	All
13	Red	18	Lamp circuit 2	All
2	Yellow	18	Lamp circuit 3	15,25
14	Green	18	Lamp circuit 4	All
3	Blue	18	Lamp circuit 5	25
15	White	18	Lamp circuit 6	All
4	Gray	18	Lamp circuit 7	25
16	Black	18	Lamp circuit 8	All
5	Brown/White	18	Lamp circuit 9	25
17	Red/White	18	Lamp circuit 10	25
6	Yellow/White	18	Lamp circuit 11	All
18	Green/White	18	Lamp circuit 12	25
7	Blue/White	18	Lamp circuit 13	15,25
19	White/Black	18	Lamp circuit 14	All
8	Gray/White	18	Lamp circuit 15	All
20	Black/White	18	Lamp circuit 16	All
9	Red/Black	18	Mode lamp 17	All except some miniboards
21	Tan	18	Mode lamp 18	All except some miniboards
10	Purple	18	Mode lamp 19	All except some miniboards
22	Pink	18	Low battery lamp 20	Solar models
33	White	18	Data A	Hardwired remote option
27	Green	18	Data B	Hardwired remote option
35	Red	18	+12V to remote	Hardwired remote option
12	Black	18	Ground to remote	Hardwired remote option
30	White/Red	18	Light sensor +	All
23	White/Green	18	Light Sensor -	All
31		18	Power tilt limit	Power tilt limit switch option
11		18	Power tilt limit	Power tilt limit switch option

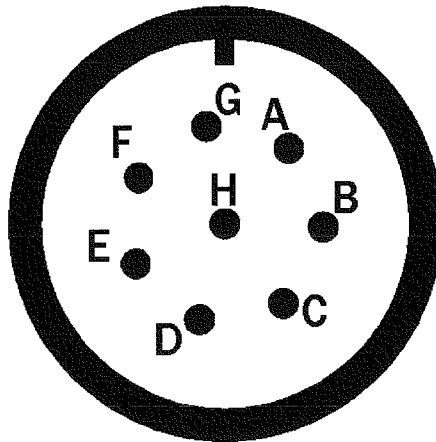
**35 PIN CONTROLLER CONNECTOR
VIEWED FROM WIRE SIDE**



Mating connector housing AMP 776164-1
Mating contact AMP 770520-1
18 AWG wire maximum (0.8mm²)
Wire outer diameter .067" to .106" (1.7-2.7mm)
Wire strip length .200" (5.1mm)

- 1 = LAMP 1
- 2 = LAMP 3
- 3 = LAMP 5
- 4 = LAMP 7
- 5 = LAMP 9
- 6 = LAMP 11
- 7 = LAMP 13
- 8 = LAMP 15
- 9 = LAMP 17
- 10 = LAMP 19
- 11 = Ground (either pin 11 or 12 may be used for RS-232 ground)
- 12 = Ground (either pin 11 or 12 may connect to pin 2 of remote unit)
- 13 = LAMP 2
- 14 = LAMP 4
- 15 = LAMP 6
- 16 = LAMP 8
- 17 = LAMP 10
- 18 = LAMP 12
- 19 = LAMP 14
- 20 = LAMP 16
- 21 = LAMP 18
- 22 = LAMP 20
- 23 = Analog ground for photocell – do not connect to anything else!
- 24 = Not connected
- 25 = Not connected
- 26 = POWER DOWN (connect to ground to turn off & reduce power consumption)
- 27 = DATA B (connect to DATA B of remote unit)
- 28 = RS-232 Receive in (connect to transmit out of configuration computer)
- 29 = RS-232 transmit out (connect to receive in of configuration computer)
- 30 = Photocell positive (photocell connects between pins 30 & 23)
- 31 = Limit switch (for power tilt, optional)
- 32 = IGN (ignition) – (can be used as a power on signal – not currently used)
- 33 = DATA A (connect to DATA A of remote unit)
- 34 = START (can be used to blank sign when engine cranking – not currently used)
- 35 = REMOTE +12V (connect to pin 1 of remote unit)

**8 PIN CONTROLLER CONNECTOR
VIEWED FROM WIRE SIDE**



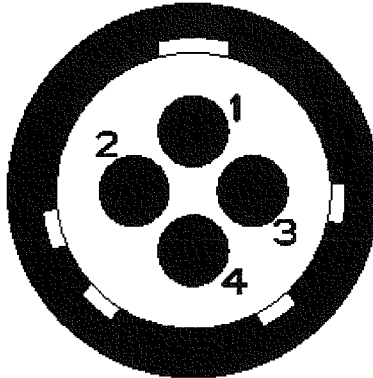
Mating connector ITT-Cannon CA3106E22-23SB
12AWG wire maximum (3.3 mm²)

- A = Power tilt positive
- B = +12V to battery (must connect both terminals B & H to provide adequate current)
- C = Lamp positive common 1
- D = Lamp positive common 2
- E = GROUND to battery (must connect both E & F to provide adequate current)
- F = GROUND to battery (must connect both E & F to provide adequate current)
- G = Power tilt negative
- H = +12V to battery (must connect both terminals B & H to provide adequate current)

**8 PIN CONTROLLER CONNECTOR
STANDARD WIRING**

Pin	Wire Color	Gauge	Function
A	Green/Yellow or White	12	Actuator – Positive
B	Red	12	Power – Positive
C	Orange	12	Common to Lamps
D	Orange	12	Common to Lamps
E	Black	12	Ground - Negative
F	Black	12	Ground - Negative
G	Black/Yellow or Black	12	Actuator - Negative
H	Red	12	Power – Positive

**4 PIN REMOTE CONNECTOR
VIEWED FROM WIRE SIDE
(HARDWIRED REMOTE OPTION ONLY)**



Mating connector housing AMP 206060-1
 Cable clamp AMP 206062-3
 Mating contact AMP 66101-4 or 66100-9
 18 AWG wire maximum (0.8mm²)
 Wire outer diameter .080" to .100" (2.0-2.5mm)
 Wire strip length .200" (5.1mm)

- 1 = +12V battery
- 2 = Ground
- 3 = Data A (connect to data A of controller)
- 4 = Data B (connect to data B of controller)

**4 PIN REMOTE CONNECTOR
STANDARD WIRING**

Circuit	Wire Color	Gauge
1	Red	18
2	Black +Shield	18
3	White	18
4	Green	18

NOTE: Use only shielded cable.

Troubleshooting

Symptom	Possible cause
No display – No backlight	Dead battery Plug(s) not connected Defective controller
No display – Backlight works	No mode selected Plug(s) not connected Defective controller
No dimming	Defective photocell Shorted photocell wires Defective controller
Lamps stay dim	Defective photocell Broken photocell wire Defective controller
Some lamps do not light	Defective lamp(s) Short at lamp Broken wire(s) Defective controller
Power tilt does not work	Broken wire(s) Defective actuator or control Defective controller

MB Series – Smart Flash

Installation of Vehicle Mounted Controllers

1. Connect one 12 gauge Black wire to the Negative terminal of the battery. Do NOT use a smaller wire gauge. **THE BLACK NEGATIVE WIRE MUST BE CONNECTED FIRST.**
* Note if 4412A lamps are used in the sign panel, use the supplied Black 8 gauge wire for the Negative battery connection.
2. Connect the one 12 gauge White wire to the Positive terminal of the battery. Do NOT use a smaller wire gauge.
* Note if 4412A lamps are used in the sign panel, use the supplied Red 8 gauge wire for the Positive battery connection.
3. If fusing is preferred it is recommended that a 35A fuse be installed on the red wire at the battery.
4. Mount the remote control head in a convenient location within the vehicle cab.
5. Route the gray four-conductor cable from the sign panel to the remote control head and connect.
6. Installation is now complete. See Operating Instructions section.
Test all mode and arrow board functions thoroughly before use.

Installation for Wireless Option for Remote Control Head and Arrowboard Panel

1. Locate suitable mounting location for the Smart Flash Remote with Internal RF option. The manufacturer preferred mounting locations are on or above the dash of the vehicle where there is access to a 12VDC power point. Mounting in locations other than these may affect the performance of the internal wireless module.
2. Insert the power plug into a cigarette plug receptacle or a power point of your vehicle. It is recommended that you leave the plug connected at all times. If you prefer to hard wire the remote to a permanent power source, proceed with the following step otherwise proceed to step 6.
3. Cut the power plug off directly behind the plug. Separate the two wires and strip the ends. Terminate the ends with the appropriate terminals for the desired power connection
4. Connect the positive wire to a point that is connected to the positive terminal of a 12volt DC battery.

Alternatively, connecting the positive wire to the ignition switch will only enable arrowboard operation when the ignition is on. This configuration is not normally used.

5. Connect the negative wire to a point that is connected to the negative terminal of a 12volt DC battery.
6. Installation is now complete of the Smart Flash Remote with Internal RF option.
7. Connect and route sign panel power cable per MB Series installation instructions.
8. Turn power on at Remote Control Head and test all modes. If unit tests ok it is now ready to be put in service.

AGENCY NOTICE

Changes or modifications not expressly approved by the manufacturer could void the user's authority to operate the equipment.

TC Series – Smart Flash Solar

Battery Maintenance

Batteries should be carefully inspected on a regular basis; the system can become discharged for a number of reasons, for example:

- Operating conditions during the “winter” months of November through February, when the power provided by the array is reduced.
- Improper maintenance, such as not cleaning the PV array.
- Electrolyte in the battery cells not maintained at the proper level.
- Loose or corroded battery terminal connections.
- Improper position of the system where the PV array is in the shadow of an object, or tilted away from the sun.
- Prolonged cloudy weather where the system is operating.

Maintenance of batteries, especially the proper voltage level, in the above situations should be performed as required. In some instances, it will be necessary to provide multiple recharges from an external source or replace with fresh batteries.

Caution ! It is important to maintain the proper level of electrolyte in the batteries at all times. If the level is too high the electrolyte will “boil” out of the top of the battery during charging and corrode the terminal connections. If the level is too low the battery life will be severely shortened.

Warning ! Charging batteries produce hydrogen, which can explode when proper operating procedures are not followed. To prevent severe personal injury, death, or substantial property damage when working around batteries, be extremely careful. Always use approved eye protection, face shield, rubber gloves, and insulated tools.

Electrolyte levels should be just below the bottom of the vent well, about $\frac{1}{2}$ to $\frac{3}{4}$ inch above the tops of the separators. The electrolyte level should not drop below the top of the plates. See figure 1 for additional information.

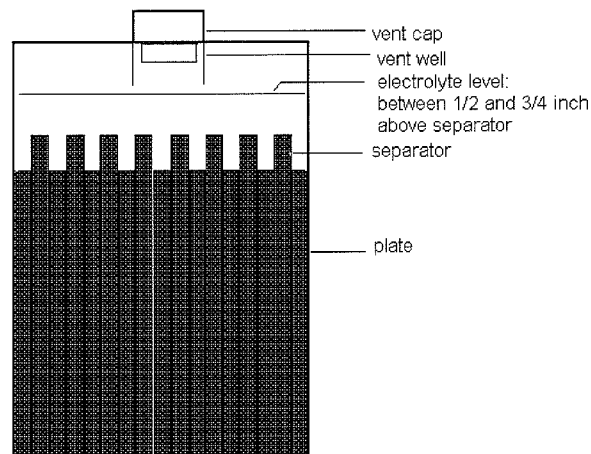


Figure 1. Battery (showing inside elements)

After checking electrolyte, check that all vent caps are tightly in place.

Loose or corroded connections create high resistance that could cause battery bank overcharging or undercharging and possibly damage the battery bank.

Cleaning the terminals, tightening the connections, and applying a thin coat of petroleum jelly (Vaseline) will help to prevent corrosion.

Use the following table to determine the status of each battery in the system:

6-Volt Battery	12-Volt Battery	Specific Gravity	State of Charge
6.36 or more	12.72 or more	1.295 or more	100%
6.15 to 6.36	12.30 to 12.72	1.250 to 1.295	75% to 100%
6.00 to 6.15	12.00 to 12.30	1.200 to 1.250	50% to 75%
5.85 to 6.00	11.70 to 12.00	1.175 to 1.200	25% to 50%
5.70 to 5.85	11.40 to 11.70	1.120 to 1.175	0% to 25%

1. Check the voltage levels with a digital voltmeter and the specific gravity with an approved hydrometer.
2. Before taking any readings, run system on the batteries for a few minutes. This removes any minor surface charge on the battery plates. The surface charge will affect the accuracy of your readings.
3. Service or replace any battery with a specific gravity that is ten percent higher or lower than the average.

Storing and Handling Batteries:

The electrolyte in discharged batteries may freeze if the outside air temperature drops below the freezing point of water: 32°F (0°). When a battery is discharged, the electrolyte solution in the battery is mostly water. The electrolyte in a fully charged battery has a much higher concentration of sulfuric acid and therefore freezes at a much lower temperature.

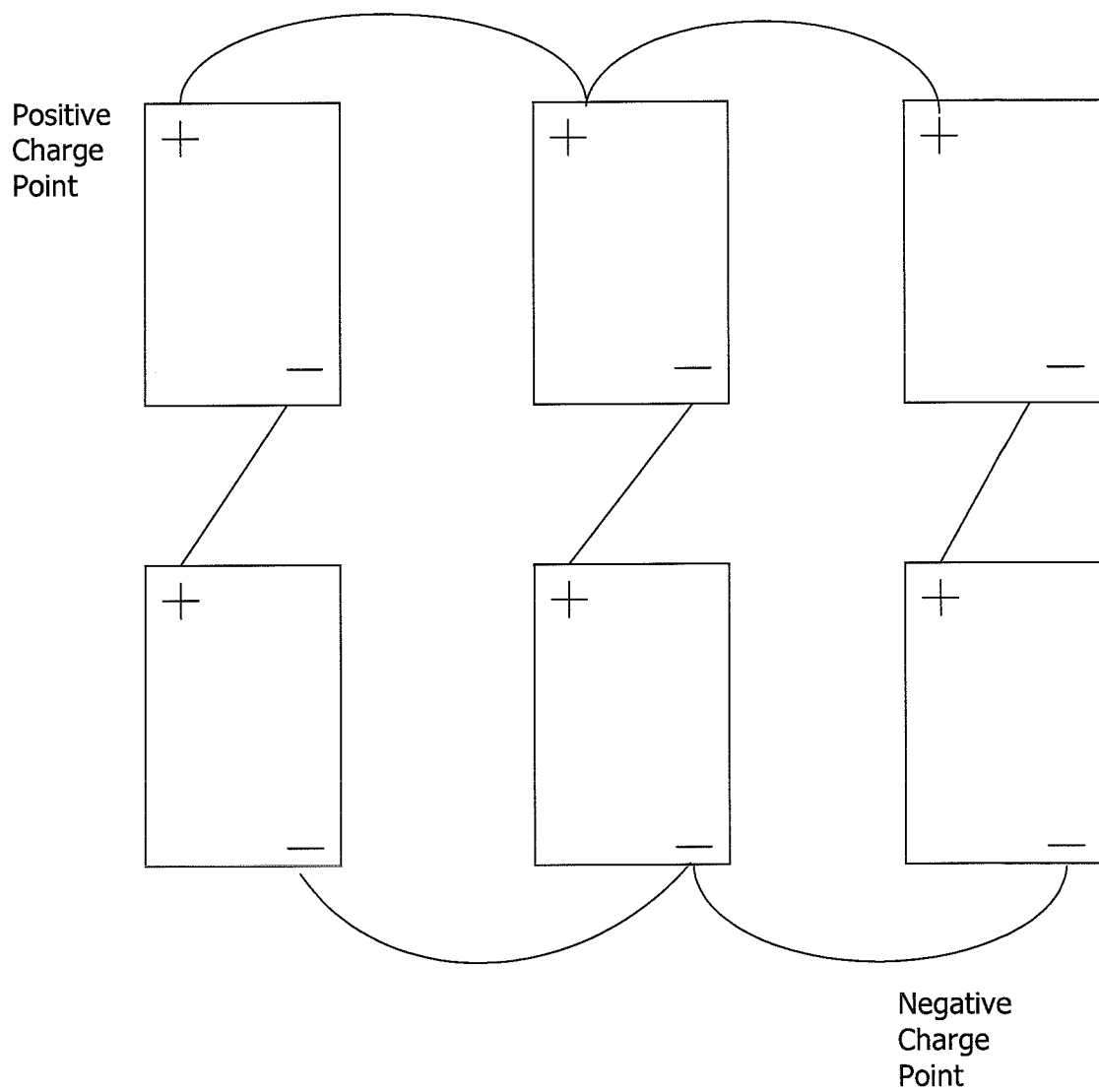
The Specific Gravity/Freeze Temperature chart provides information on specific gravity verses freezing temperature for the batteries used in the system.

Specific Gravity	Freeze Temperature
1.250	-62°F (-52°C)
1.200	-16°F (-27°C)
1.150	5°F (-15°C)
1.100	19°F (-7°C)

Care for batteries that are stored during winter months or slow periods is as follows:

1. Fill battery as required with distilled water.
2. Fully charge to a specific gravity of 1.272.
3. Place in a cool place between the temperatures of 32°F (0°C) and 80°F (38°C). If one battery's voltage differs from the rest of the bank by 5 percent, check its specific gravity.

TC-1 Solar Trailer Battery Wiring Diagram



* The batteries are 6 Volt, Group Size GC2, Deep Cycle Batteries.

TC Series – Smart Flash Diesel

This manual was written to assist the mechanic or technician in troubleshooting the electrical systems of the **Trafcon TC Series** diesel arrowboard.

In order to efficiently troubleshoot these systems, an explanation of each is included in addition to the normal troubleshooting chart. The appropriate section should be read thoroughly prior to an attempt to make repairs.

STARTING

The starting system consists of a toggle switch and a momentary contact starter switch. When the toggle switch is moved to the “on” position, current flows to the electric fuel pump, the alternator voltage regulator and one side of the starter switch. Pushing the starter switch allows current to flow to the starter solenoid and engages the starter.

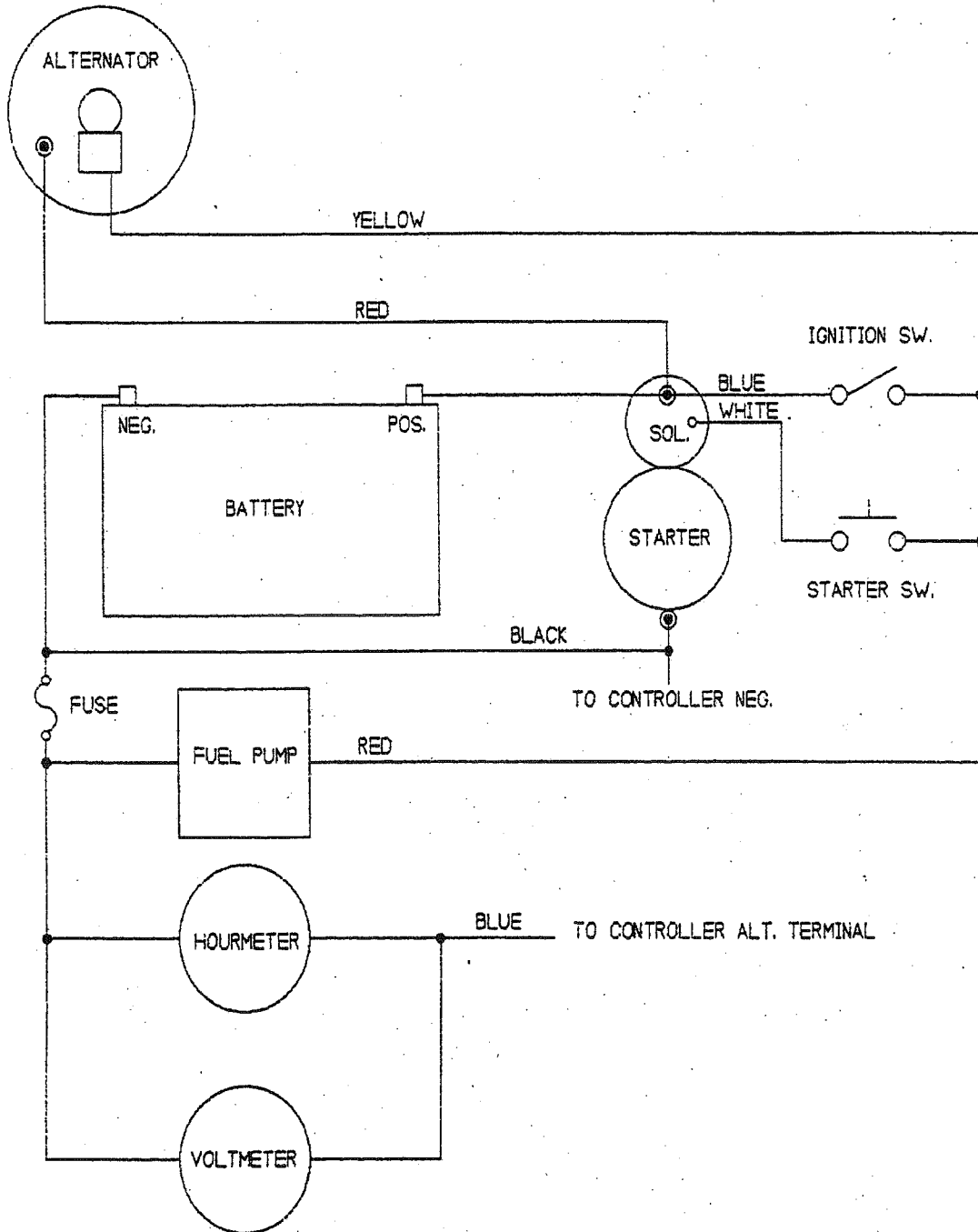
CHARGING

When the toggle switch is in the “on” position, current flows from the battery to the alternator voltage regulator allowing the alternator to charge. The normal charge rate under “no load” conditions is 13.8 – 14.2 volts. When troubleshooting a charging system it is important to check the basics first. The battery connections should be checked, as well as the electrolyte level in the battery. Low electrolyte in only one cell can indicate that the cell is bad. A battery in which all the cells are dry can indicate an overcharging problem and a possible bad battery. If the battery is suspect, check each cell using a hydrometer. Before attempting the check the alternator, allow the engine to run for approximately 15 minutes. This will eliminate false voltmeter readings due to a low battery. This step is absolutely necessary after “jump starting” a unit.

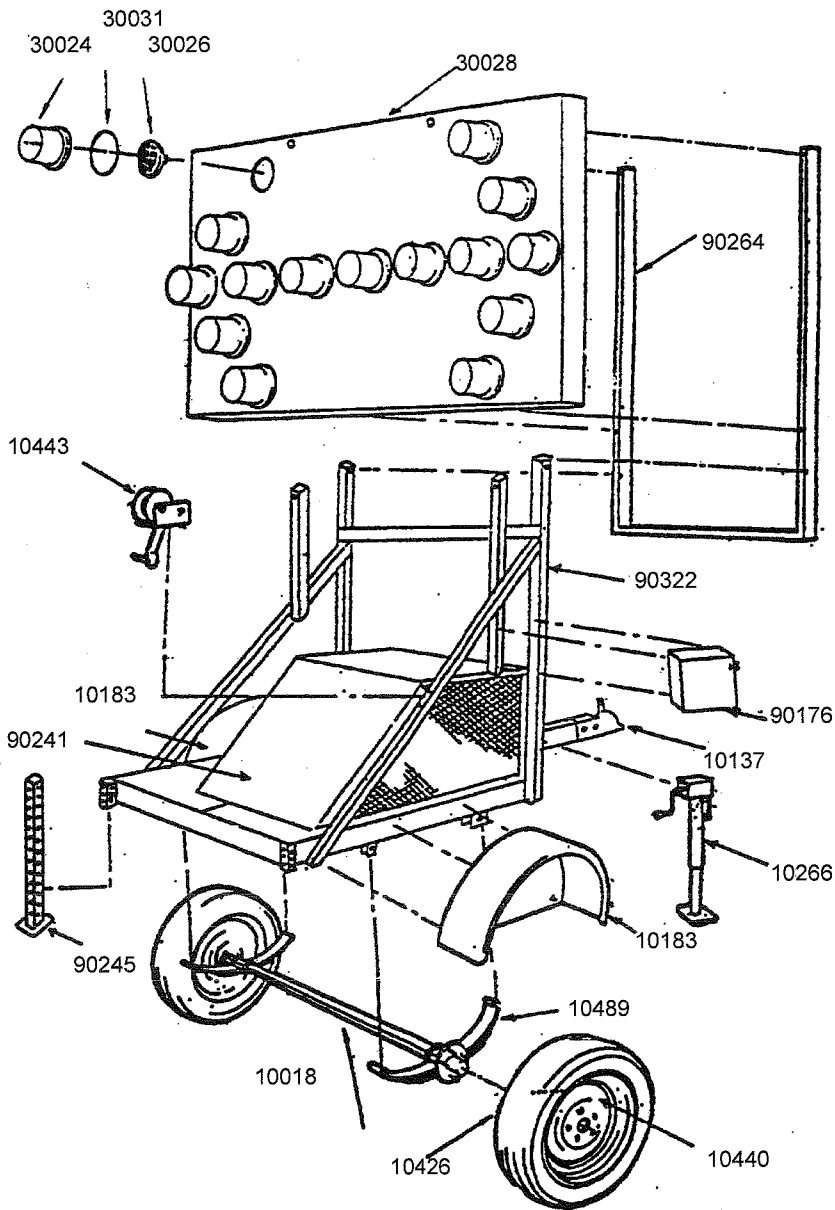
FUEL PUMP

The electric fuel pump is energized when the toggle switch is in the “on” position. When operating normally a steady “clicking” sound can be heard. If the fuel pump does not “click,” check for the presence of voltage with a test light. Also, check the fuse next to the toggle switch.

TC1 SERIES TRAILER WIRING

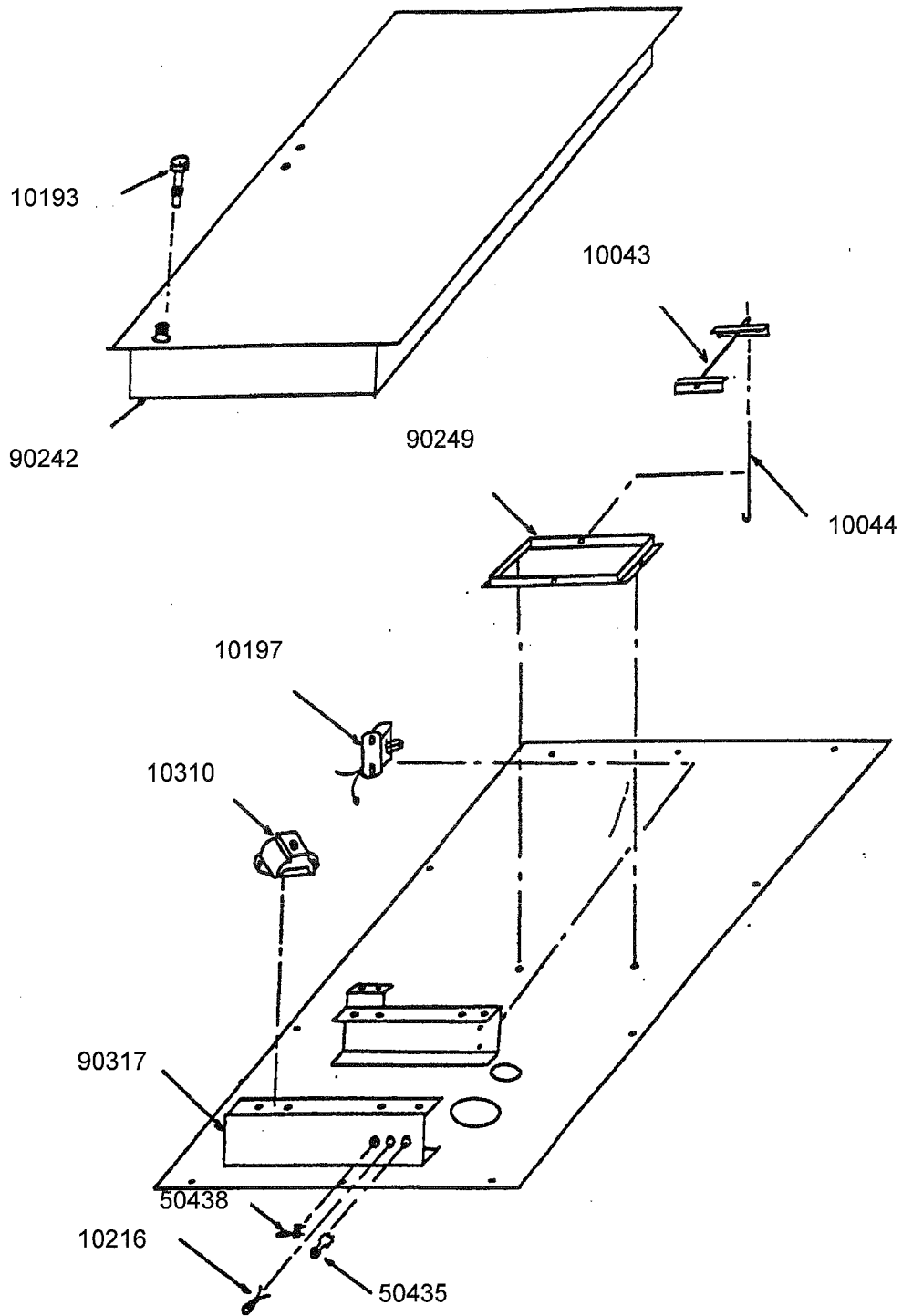


TC1 SERIES TRAILER MOUNTED ADVANCE WARNING PANELS



ARROWBOARD PARTS

FUEL SYSTEM AND ACCESSORIES



TRAFCON INDUSTRIES, INC.

MANUFACTURER'S WARRANTY

LIMITED WARRANTY POLICY

Trafcon Industries, Inc. (Trafcon) hereby warrants to the original purchaser (customer), sold directly or through an authorized dealer, the product(s) listed for the time period(s) listed, from the date of purchase. Trafcon warrants the product(s) against defects in material and workmanship provided the products are installed and maintained properly, and operated under normal conditions. This warranty does not apply to product(s) that have been improperly applied, installed or maintained. The customer will be responsible for removing any defective item(s) from the product and returning the item(s), or the entire product, transportation costs prepaid, to Trafcon 81 Texaco Rd, Mechanicsburg, PA 17050. The customer will be responsible for reinstallation of item(s) upon return. All returns must have a Return Material Authorization (RMA) number prior to shipping. RMA numbers can be obtained by contacting Trafcon at 717-691-8007, or on the Internet at www.Trafcon.com. Proof of purchase will be required to obtain the RMA. Trafcon will, at its option, repair or replace defective product(s) or component part(s). Such item(s) will be returned by Trafcon, transportation costs paid (normal ground delivery), within the United States. Repaired or replaced product(s) or component part(s) will carry the remainder of their respective original warranty term(s).

Exclusions from this warranty are: unauthorized sale outside the United States, the finish, tires, incandescent lamps, any condition(s) caused by abnormal use or service, negligent operation, act of God, and product specific limitations, if any, listed below.

THE LOSS OF USE OF THE PRODUCT, LOSS OF TIME, INCONVENIENCE, COMMERCIAL LOSS OR CONSEQUENTIAL DAMAGES ARE NOT COVERED. TRAFCON RESERVES THE RIGHT TO CHANGE THE DESIGN OF ANY PRODUCT WITHOUT ASSUMING ANY OBLIGATION TO MODIFY ANY PRODUCT PREVIOUSLY MANUFACTURED.

This warranty gives you specific legal rights and you may have other rights, which may vary from state to state.

THERE ARE NO WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING ANY IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS, WHICH EXTEND BEYOND THIS WARRANTY PERIOD. THERE ARE NO WARRANTIES THAT EXTEND BEYOND THE FACE HEREOF. SELLER DISCLAIMS IMPLIED WARRANTY OF MERCHANTABILITY.

THE WARRANTY SHALL NOT APPLY TO ANY TRAFCON PRODUCT WHICH HAS BEEN MODIFIED, IMPROPERLY INSTALLED, IMPROPERLY MAINTAINED OR IMPROPERLY USED.

The product(s) and time period(s) under this warranty are as follows:

**1. FLASHING ARROW BOARDS, TRAILER MOUNTED, SOLAR (TC1)
LIMITED 3 YEAR WARRANTY**

Limited 3 year warranty on these Trafcon products. Trafcon warrants each new unit against factory defects in material and workmanship for a 3 year period from the original date of purchase.

EXCEPTIONS: Batteries- 18 months.

THIS WARRANTY DOES NOT COVER THE FOLLOWING: Tires, Finish.

**2. FLASHING ARROW BOARDS, TRAILER MOUNTED, DIESEL (TC3)
LIMITED 1 YEAR WARRANTY**

Limited 1 year warranty on these Trafcon products. Trafcon warrants each new unit against factory defects in material and workmanship for a 1 year period from the original date of purchase.

EXCEPTIONS: Batteries- 60 months (pro-rated).

THIS WARRANTY DOES NOT COVER THE FOLLOWING: Tires, Finish, Incandescent lamps.

**3. FLASHING ARROW BOARDS-VEHICLE MOUNTED (MB & TM)
LIMITED 1 YEAR WARRANTY**

Limited 1 year warranty on these Trafcon products. Trafcon warrants each new unit against factory defects in material and workmanship for a 1 year period from the original date of purchase.

THIS WARRANTY DOES NOT COVER THE FOLLOWING: Finish, Incandescent lamps.

**4. ARROW DYNAMIC SIGNS-TRAILER MOUNTED (TC-ADS)
LIMITED 1 YEAR WARRANTY**

Limited 1 year warranty on these Trafcon products. Trafcon warrants each new unit against factory defects in material and workmanship for a 1 year period from the original date of purchase.

EXCEPTIONS: Solar modules- 36 months, Batteries- 18 months.

THIS WARRANTY DOES NOT COVER THE FOLLOWING: Tires, Finish.

**5. ARROW DYNAMIC SIGNS- VEHICLE MOUNTED (MB-ADS)
LIMITED 1 YEAR WARRANTY**

Limited 1 year warranty on these Trafcon products. Trafcon warrants each new unit against factory defects in material and workmanship for a 1 year period from the original date of purchase.

THIS WARRANTY DOES NOT COVER THE FOLLOWING; Finish.

**6. SPEED DISPLAY SIGNS- STATIONARY, VEHICLE & TRAILER MOUNTED (SST)
LIMITED 1 YEAR WARRANTY**

Limited 1 year warranty on these Trafcon products. Trafcon warrants each new unit against factory defects in material and workmanship for a 1 year period from the original date of purchase.

EXCEPTIONS: Solar modules- 36 months, Batteries- 18 months.

THIS WARRANTY DOES NOT COVER THE FOLLOWING: Tires, Finish.

**7. WORK ZONE RADIOS- STATIONARY, VEHICLE & TRAILER MOUNTED (WIZARD)
LIMITED 1 YEAR WARRANTY**

Limited 1 year warranty on these Trafcon products. Trafcon warrants each new unit against factory defects in material and workmanship for a 1 year period from the original date of purchase.

EXCEPTIONS: Solar modules-36 months, Batteries- 18 months.

THIS WARRANTY DOES NOT COVER THE FOLLOWING: Tires, Finish.

**7. PORTABLE EQUIPMENT PLATFORMS (PEP)
LIMITED 1 YEAR WARRANTY**

Limited 1 year warranty on these Trafcon products. Trafcon warrants each new unit against factory defects in material and workmanship for a 1 year period from the original date of purchase.

EXCEPTIONS: Solar modules- 36 months, Batteries- 18 months.

THIS WARRANTY DOES NOT COVER THE FOLLOWING: Tires, Finish.

RIGHTS RESERVED

Trafcon reserves the right to make changes in design, materials and specifications or to make product changes as deemed necessary without prior notice. Obligations or liabilities will not be assumed with respect to similar products previously advertised or produced.

PRINTING ERRORS

Every effort has been made to avoid printing errors in our printed literature and on our website. Should there have been any specification or application errors, we must disclaim responsibility.

OMISSIONS

Any product(s) or component(s) not specifically covered or excluded herein, will be covered for a 1 year period from date of purchase or by the Original Equipment Manufacturer's warranty, whichever is greater.

NHTSA Notification Statement (CFR 575.6)

If you believe that your vehicle has a defect which could cause a crash or could cause injury or death, you should immediately inform the National Highway Traffic Safety Administration in addition to notifying Trafcon Industries.

If NHTSA receives similar complaints, it may open an investigation, and if it finds that a safety defect exists in a group of vehicles, it may order a recall and remedy campaign. However, NHTSA cannot become involved in individual problems between you, your dealer, or Trafcon Industries.

To contact NHTSA, you may either call the Auto Safety Hotline toll free at 1-800-424-9393 or (202-366-0123) or write to NHTSA, US Department of Transportation, 400 7th Street, SW, NSA-11, Washington, DC 20590. You can also obtain other information about motor vehicle safety from the hotline.

Tire Safety Information

This portion of the User's Manual contains tire safety information as required by 49 CFR 575.6.

Section 2.1 contains "Steps for Determining Correct Load Limit - Trailer".

Section 2.2 contains "Steps for Determining Correct Load Limit – Tow Vehicle".

Section 2.3 contains a Glossary of Tire Terminology, including "cold inflation pressure", "maximum inflation pressure", "recommended inflation pressure", and other non-technical terms.

Section 2.4 contains information from the NHTSA brochure entitled "Tire Safety – Everything Rides On It".

This brochure, as well as the preceding subsections, describes the following items;

- Tire labeling, including a description and explanation of each marking on the tires, and information about the DOT Tire Identification Number (TIN).
- Recommended tire inflation pressure, including a description and explanation of:
 - A. Cold inflation pressure.
 - B. Vehicle Placard and location on the vehicle.
 - C. Adverse safety consequences of under inflation (including tire failure).
 - D. Measuring and adjusting air pressure for proper inflation.
- Tire Care, including maintenance and safety practices.
- Vehicle load limits, including a description and explanation of the following items:
 - A. Locating and understanding the load limit information, total load capacity, and cargo capacity.
 - B. Calculating total and cargo capacities with varying seating configurations including quantitative examples showing / illustrating how the vehicles cargo and luggage capacity decreases as combined number and size of occupants' increases. This item is also discussed in Section 3.
 - C. Determining compatibility of tire and vehicle load capabilities.
 - D. Adverse safety consequences of overloading on handling and stopping on tires.

Steps for Determining Correct Load Limit – Trailer

Determining the load limits of a trailer includes more than understanding the load limits of the tires alone. On all trailers there is a Federal certification/VIN label that is located on the forward half of the left (road) side of the unit. This certification/VIN label will indicate the trailer's Gross Vehicle Weight Rating (GVWR). This is the most weight the fully loaded trailer can weigh. It will also provide the Gross Axle Weight Rating (GAWR). This is the most a particular axle can weigh. If there are multiple axles, the GAWR of each axle will be provided.

If your trailer has a GVWR of 10,000 pounds or less, there is a vehicle placard located in the same location as the certification label described above. This placard provides tire and loading information. In addition, this placard will show a statement regarding maximum

cargo capacity. Cargo can be added to the trailer, up to the maximum weight specified on the placard. The combined weight of the cargo is provided as a single number. In any case, remember: the total weight of a fully loaded trailer can not exceed the stated GVWR.

For trailers with living quarters installed, the weight of water and propane also need to be considered. The weight of fully filled propane containers is considered part of the weight of the trailer before it is loaded with cargo, and is not considered part of the disposable cargo load. Water however, is a disposable cargo weight and is treated as such. If there is a fresh water storage tank of 100 gallons, this tank when filled would weigh about 800 pounds. If more cargo is being transported, water can be off-loaded to keep the total amount of cargo added to the vehicle within the limits of the GVWR so as not to overload the vehicle. Understanding this flexibility will allow you, the owner, to make choices that fit your travel needs.

When loading your cargo, be sure it is distributed evenly to prevent overloading front to back and side to side. Heavy items should be placed low and as close to the axle positions as reasonable. Too many items on one side may overload a tire. The best way to know the actual weight of the vehicle is to weigh it at a public scale. Talk to your dealer to discuss the weighing methods needed to capture the various weights related to the trailer. This would include the weight empty or unloaded, weights per axle, wheel, hitch or king-pin, and total weight.

Excessive loads and/or underinflation cause tire overloading and, as a result, abnormal tire flexing occurs. This situation can generate an excessive amount of heat within the tire. Excessive heat may lead to tire failure. It is the air pressure that enables a tire to support the load, so proper inflation is critical. The proper air pressure may be found on the certification/VIN label and/or on the Tire Placard. This value should never exceed the maximum cold inflation pressure stamped on the tire.

Trailers 10,000 Pounds GVWR or Less

TIRE AND LOADING INFORMATION		
The weight of cargo should never exceed XXX kg. or XXX lbs.		
TIRE	SIZE	COLD TIRE PRESSURE
FRONT	20.5x8.0-10(E)	621 kPA, 90PSI
REAR		
SPARE		

SEE OWNER'S
MANUAL FOR
ADDITIONAL
INFORMATION

Tire and Loading Information Placard - Figure 1-1

1. Locate the statement, "The weight of cargo should never exceed XXX kg or XXX lbs.," on your vehicle's placard. See figure 1-1.
2. This figure equals the available amount of cargo and luggage load capacity.
3. Determine the combined weight of luggage and cargo being loaded on the vehicle. That weight may not safely exceed the available cargo and luggage load capacity.

The trailer's placard refers to the Tire Information Placard attached adjacent to or near the trailer's VIN (Certification) label at the left front of the trailer.

Trailers Over 10,000 Pounds GVWR (Note: These trailers are not required to have a tire information placard on the vehicle)

1. Determine the empty weight of your trailer by weighing the trailer using a public scale or other means. This step does not have to be repeated.
2. Locate the GVWR (Gross Vehicle Weight Rating) of the trailer on your trailer's VIN (Certification) label.
3. Subtract the empty weight of your trailer from the GVWR stated on the VIN label. That weight is the maximum available cargo capacity of the trailer and may not be safely exceeded.

Steps for Determining Correct Load Limit – Tow Vehicle

1. Locate the statement, "The combined weight of occupants and cargo should never exceed XXX lbs.," on your vehicle's placard.
2. Determine the combined weight of the driver and passengers who will be riding in your vehicle.
3. Subtract the combined weight of the driver and passengers from XXX kilograms or XXX pounds.
4. The resulting figure equals the available amount of cargo and luggage capacity. For example, if the "XXX" amount equals 1400 lbs. and there will be five 150 lb. passengers in your vehicle, the amount of available cargo and luggage capacity is 650 lbs. (1400-750 (5 x 150) = 650 lbs.).
5. Determine the combined weight of luggage and cargo being loaded on the vehicle. That weight may not safely exceed the available cargo and luggage capacity calculated in Step # 4.
6. If your vehicle will be towing a trailer, load from your trailer will be transferred to your vehicle. Consult the tow vehicle's manual to determine how this weight transfer reduces the available cargo and luggage capacity of your vehicle.

Glossary Of Tire Terminology

Accessory weight

The combined weight (in excess of those standard items which may be replaced) of automatic transmission, power steering, power brakes, power windows, power seats, radio and heater, to the extent that these items are available as factory-installed equipment (whether installed or not).

Bead

The part of the tire that is made of steel wires, wrapped or reinforced by ply cords and that is shaped to fit the rim.

Bead separation

This is the breakdown of the bond between components in the bead.

Bias ply tire

A pneumatic tire in which the ply cords that extend to the beads are laid at alternate angles substantially less than 90 degrees to the centerline of the tread.

Carcass

The tire structure, except tread and sidewall rubber which, when inflated, bears the load.

Chunking

The breaking away of pieces of the tread or sidewall.

Cold inflation pressure

The pressure in the tire before you drive.

Cord

The strands forming the plies in the tire.

Cord separation

The parting of cords from adjacent rubber compounds.

Cracking

Any parting within the tread, sidewall, or inner liner of the tire extending to cord material.

CT

A pneumatic tire with an inverted flange tire and rim system in which the rim is designed with rim flanges pointed radially inward and the tire is designed to fit on the underside of the rim in a manner that encloses the rim flanges inside the air cavity of the tire.

Curb weight

The weight of a motor vehicle with standard equipment including the maximum capacity of fuel, oil, and coolant, and, if so equipped, air conditioning and additional weight optional engine.

Extra load tire

A tire designed to operate at higher loads and at higher inflation pressures than the corresponding standard tire.

Groove

The space between two adjacent tread ribs.

Gross Axle Weight Rating

The maximum weight that any axle can support, as published on the Certification / VIN label on the front left side of the trailer. Actual weight determined by weighing each axle on a public scale, with the trailer attached to the towing vehicle.

Gross Vehicle Weight Rating

The maximum weight of the fully loaded trailer, as published on the Certification / VIN label. Actual weight determined by weighing trailer on a public scale, without being attached to the towing vehicle.

Hitch Weight

The downward force exerted on the hitch ball by the trailer coupler.

Innerliner

The layer(s) forming the inside surface of a tubeless tire that contains the inflating medium within the tire.

Innerliner separation

The parting of the innerliner from cord material in the carcass.

Intended outboard sidewall

The sidewall that contains a white-wall, bears white lettering or bears manufacturer, brand, and/or model name molding that is higher or deeper than the same molding on the other sidewall of the tire or the outward facing sidewall of an asymmetrical tire that has a particular side that must always face outward when mounted on a vehicle.

Light truck (LT) tire

A tire designated by its manufacturer as primarily intended for use on lightweight trucks or multipurpose passenger vehicles.

Load rating

The maximum load that a tire is rated to carry for a given inflation pressure.

Maximum load rating

The load rating for a tire at the maximum permissible inflation pressure for that tire.

Maximum permissible inflation pressure

The maximum cold inflation pressure to which a tire may be inflated.

Maximum loaded vehicle weight

The sum of curb weight, accessory weight, vehicle capacity weight, and production options weight.

Measuring rim

The rim on which a tire is fitted for physical dimension requirements.

Pin Weight

The downward force applied to the 5th wheel or gooseneck ball, by the trailer kingpin or gooseneck coupler.

Non-pneumatic rim

A mechanical device which, when a non-pneumatic tire assembly incorporates a wheel, supports the tire, and attaches, either integrally or separably, to the wheel center member and upon which the tire is attached.

Non-pneumatic spare tire assembly

A non-pneumatic tire assembly intended for temporary use in place of one of the pneumatic tires and rims that are fitted to a passenger car in compliance with the requirements of this standard.

Non-pneumatic tire

A mechanical device which transmits, either directly or through a wheel or wheel center member, the vertical load and tractive forces from the roadway to the vehicle,

generates the tractive forces that provide the directional control of the vehicle and does not rely on the containment of any gas or fluid for providing those functions.

Non-pneumatic tire assembly

A non-pneumatic tire, alone or in combination with a wheel or wheel center member, which can be mounted on a vehicle.

Normal occupant weight

This means 68 kilograms (150 lbs.) times the number of occupants specified in the second column of Table I of 49 CFR 571.110.

Occupant distribution

The distribution of occupants in a vehicle as specified in the third column of Table I of 49 CFR 571.110.

Open splice

Any parting at any junction of tread, sidewall, or innerliner that extends to cord material.

Outer diameter

The overall diameter of an inflated new tire.

Overall width

The linear distance between the exteriors of the sidewalls of an inflated tire, including elevations due to labeling, decorations, or protective bands or ribs.

Ply

A layer of rubber-coated parallel cords.

Ply separation

A parting of rubber compound between adjacent plies.

Pneumatic tire

A mechanical device made of rubber, chemicals, fabric and steel or other materials, that, when mounted on an automotive wheel, provides the traction and contains the gas or fluid that sustains the load.

Production options weight

The combined weight of those installed regular production options weighing over 2.3 kilograms (5 lbs.) in excess of those standard items which they replace, not previously considered in curb weight or accessory weight, including heavy duty brakes, ride levelers, roof rack, heavy duty battery, and special trim.

Radial ply tire

A pneumatic tire in which the ply cords that extend to the beads are laid at substantially 90 degrees to the centerline of the tread.

Recommended inflation pressure

This is the inflation pressure provided by the vehicle manufacturer on the Tire Information label and on the Certification / VIN tag.

Reinforced tire

A tire designed to operate at higher loads and at higher inflation pressures than the corresponding standard tire.

Rim

A metal support for a tire or a tire and tube assembly upon which the tire beads are seated.

Rim diameter

This means the nominal diameter of the bead seat.

Rim size designation

This means the rim diameter and width.

Rim type designation

This means the industry of manufacturer's designation for a rim by style or code.

Rim width

This means the nominal distance between rim flanges.

Section width

The linear distance between the exteriors of the sidewalls of an inflated tire, excluding elevations due to labeling, decoration, or protective bands.

Sidewall

That portion of a tire between the tread and bead.

Sidewall separation

The parting of the rubber compound from the cord material in the sidewall.

Special Trailer (ST) tire

The "ST" is an indication the tire is for trailer use only.

Test rim

The rim on which a tire is fitted for testing, and may be any rim listed as appropriate for use with that tire.

Tread

That portion of a tire that comes into contact with the road.

Tread rib

A tread section running circumferentially around a tire.

Tread separation

Pulling away of the tread from the tire carcass.

Treadwear indicators (TWI)

The projections within the principal grooves designed to give a visual indication of the degrees of wear of the tread.

Vehicle capacity weight

The rated cargo and luggage load plus 68 kilograms (150 lbs.) times the vehicle's designated seating capacity.

Vehicle maximum load on the tire

The load on an individual tire that is determined by distributing to each axle its share of the maximum loaded vehicle weight and dividing by two.

Vehicle normal load on the tire

The load on an individual tire that is determined by distributing to each axle its share of the curb weight, accessory weight, and normal occupant weight (distributed in accordance with Table I of CRF 49 571.110) and dividing by 2.

Weather side

The surface area of the rim not covered by the inflated tire.

Wheel center member

In the case of a non-pneumatic tire assembly incorporating a wheel, a mechanical device which attaches, either integrally or separably, to the non-pneumatic rim and provides the connection between the non-pneumatic rim and the vehicle; or, in the case of a non-pneumatic tire assembly not incorporating a wheel, a mechanical device which attaches, either integrally or separably, to the non-pneumatic tire and provides the connection between tire and the vehicle.

Wheel-holding fixture

The fixture used to hold the wheel and tire assembly securely during testing.

Tire Safety - Everything Rides On It

The National Traffic Safety Administration (NHTSA) has published a brochure (DOT HS 809 361) that discusses all aspects of Tire Safety, as required by CFR 575.6. This brochure is reproduced in part below. It can be obtained and downloaded from NHTSA, free of charge, from the following web site:

http://www.nhtsa.dot.gov/cars/rules/TireSafety/ridesonit/tires_index.html

Studies of tire safety show that maintaining proper tire pressure, observing tire and vehicle load limits (not carrying more weight in your vehicle than your tires or vehicle can safely handle), avoiding road hazards, and inspecting tires for cuts, slashes, and other irregularities are the most important things you can do to avoid tire failure, such as tread separation or blowout and flat tires. These actions, along with other care and maintenance activities, can also:

- Improve vehicle handling

- Help protect you and others from avoidable breakdowns and accidents
- Improve fuel economy
- Increase the life of your tires.

This booklet presents a comprehensive overview of tire safety, including information on the following topics:

- Basic tire maintenance
- Uniform Tire Quality Grading System
- Fundamental characteristics of tires
- Tire safety tips.

Use this information to make tire safety a regular part of your vehicle maintenance routine. Recognize that the time you spend is minimal compared with the inconvenience and safety consequences of a flat tire or other tire failure.

Safety First—Basic Tire Maintenance

Properly maintained tires improve the steering, stopping, traction, and load-carrying capability of your vehicle. Underinflated tires and overloaded vehicles are a major cause of tire failure. Therefore, as mentioned above, to avoid flat tires and other types of tire failure, you should maintain proper tire pressure, observe tire and vehicle load limits, avoid road hazards, and regularly inspect your tires.

Finding Your Vehicle's Recommended Tire Pressure and Load Limits

Tire information placards and vehicle certification labels contain information on tires and load limits. These labels indicate the vehicle manufacturer's information including:

- Recommended tire size
- Recommended tire inflation pressure
- Vehicle capacity weight (VCW—the maximum occupant and cargo weight a vehicle is designed to carry)
- Front and rear gross axle weight ratings (GAWR—the maximum weight the axle systems are designed to carry).

Both placards and certification labels are permanently attached to the trailer near the left front.

Understanding Tire Pressure and Load Limits

Tire inflation pressure is the level of air in the tire that provides it with load-carrying capacity and affects the overall performance of the vehicle. The tire inflation pressure is a number that indicates the amount of air pressure—measured in pounds per square inch (psi)—a tire requires to be properly inflated. (You will also find this number on the vehicle information placard expressed in kilopascals (kpa), which is the metric measure used internationally.)

Manufacturers of passenger vehicles and light trucks determine this number based on the vehicle's design load limit, that is, the greatest amount of weight a vehicle can safely carry and the vehicle's tire size. The proper tire pressure for your vehicle is referred to as the

"recommended cold inflation pressure." (As you will read below, it is difficult to obtain the recommended tire pressure if your tires are not cold.) Because tires are designed to be used on more than one type of vehicle, tire manufacturers list the "maximum permissible inflation pressure" on the tire sidewall. This number is the greatest amount of air pressure that should ever be put in the tire under normal driving conditions.

Checking Tire Pressure

It is important to check your vehicle's tire pressure at least once a month for the following reasons:

- Most tires may naturally lose air over time.
- Tires can lose air suddenly if you drive over a pothole or other object or if you strike the curb when parking.
- With radial tires, it is usually not possible to determine underinflation by visual inspection.

For convenience, purchase a tire pressure gauge to keep in your vehicle. Gauges can be purchased at tire dealerships, auto supply stores, and other retail outlets. The recommended tire inflation pressure that vehicle manufacturers provide reflects the proper psi when a tire is cold. The term cold does not relate to the outside temperature. Rather, a cold tire is one that has not been driven on for at least three hours. When you drive, your tires get warmer, causing the air pressure within them to increase. Therefore, to get an accurate tire pressure reading, you must measure tire pressure when the tires are cold or compensate for the extra pressure in warm tires.

Steps for Maintaining Proper Tire Pressure

- Step 1: Locate the recommended tire pressure on the vehicle's tire information placard, certification label, or in the owner's manual.
- Step 2: Record the tire pressure of all tires.
- Step 3: If the tire pressure is too high in any of the tires, slowly release air by gently pressing on the tire valve stem with the edge of your tire gauge until you get to the correct pressure.
- Step 4: If the tire pressure is too low, note the difference between the measured tire pressure and the correct tire pressure. These "missing" pounds of pressure are what you will need to add.
- Step 5: At a service station, add the missing pounds of air pressure to each tire that is underinflated.
- Step 6: Check all the tires to make sure they have the same air pressure (except in cases in which the front and rear tires are supposed to have different amounts of pressure).

If you have been driving your vehicle and think that a tire is underinflated, fill it to the recommended cold inflation pressure indicated on your vehicle's tire information placard or certification label. While your tire may still be slightly underinflated due to the extra pounds of pressure in the warm tire, it is safer to drive with air pressure that is slightly lower than the vehicle manufacturer's recommended cold inflation pressure than to drive with a significantly underinflated tire. Since this is a temporary fix, don't forget to recheck and adjust the tire's pressure when you can obtain a cold reading.

Tire Size

To maintain tire safety, purchase new tires that are the same size as the vehicle's original tires or another size recommended by the manufacturer. Look at the tire information placard, the owner's manual, or the sidewall of the tire you are replacing to find this information. If you have any doubt about the correct size to choose, consult with the tire dealer.

Tire Tread

The tire tread provides the gripping action and traction that prevent your vehicle from slipping or sliding, especially when the road is wet or icy. In general, tires are not safe and should be replaced when the tread is worn down to 1/16 of an inch. Tires have built-in treadwear indicators that let you know when it is time to replace your tires. These indicators are raised sections spaced intermittently in the bottom of the tread grooves. When they appear "even" with the outside of the tread, it is time to replace your tires. Another method for checking tread depth is to place a penny in the tread with Lincoln's head upside down and facing you. If you can see the top of Lincoln's head, you are ready for new tires.

Tire Balance and Wheel Alignment

To avoid vibration or shaking of the vehicle when a tire rotates, the tire must be properly balanced. This balance is achieved by positioning weights on the wheel to counterbalance heavy spots on the wheel-and-tire assembly. A wheel alignment adjusts the angles of the wheels so that they are positioned correctly relative to the vehicle's frame. This adjustment maximizes the life of your tires. These adjustments require special equipment and should be performed by a qualified technician.

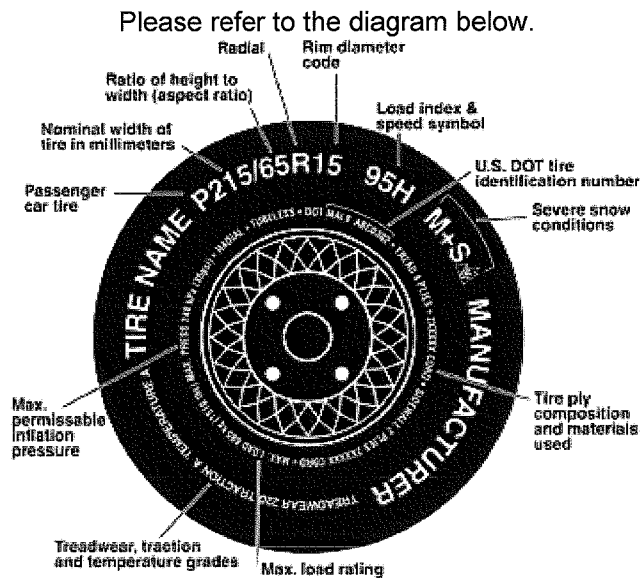
Tire Repair

The proper repair of a punctured tire requires a plug for the hole and a patch for the area inside the tire that surrounds the puncture hole. Punctures through the tread can be repaired if they are not too large, but punctures to the sidewall should not be repaired. Tires must be removed from the rim to be properly inspected before being plugged and patched.

Tire Fundamentals

Federal law requires tire manufacturers to place standardized information on the sidewall of all tires. This information identifies and describes the fundamental characteristics of the tire and also provides a tire identification number for safety standard certification and in case of a recall.

Information on Passenger Vehicle Tires



P

The "P" indicates the tire is for passenger vehicles.

Next number

This three-digit number gives the width in millimeters of the tire from sidewall edge to sidewall edge. In general, the larger the number, the wider the tire.

Next number

This two-digit number, known as the aspect ratio, gives the tire's ratio of height to width. Numbers of 70 or lower indicate a short sidewall for improved steering response and better overall handling on dry pavement.

R

The "R" stands for radial. Radial ply construction of tires has been the industry standard for the past 20 years.

Next number

This two-digit number is the wheel or rim diameter in inches. If you change your wheel size, you will have to purchase new tires to match the new wheel diameter.

Next number

This two- or three-digit number is the tire's load index. It is a measurement of how much weight each tire can support. You may find this information in your owner's manual. If not, contact a local tire dealer. Note: You may not find this information on all tires because it is not required by law.

M+S

The "M+S" or "M/S" indicates that the tire has some mud and snow capability. Most radial tires have these markings; hence, they have some mud and snow capability.

Speed Rating

The speed rating denotes the speed at which a tire is designed to be driven for extended periods of time. The ratings range from 99 miles per hour (mph) to 186 mph. These ratings are listed below. Note: You may not find this information on all tires because it is not required by law.

Tire Safety Information

Letter Rating	Speed Rating
Q	99 mph
R	106 mph
S	112 mph
T	118 mph
U	124 mph
H	130 mph
V	149 mph
W	168* mph
Y	186* mph

* For tires with a maximum speed capability over 149 mph, tire manufacturers sometimes use the letters ZR. For those with a maximum speed capability over 186 mph, tire manufacturers always use the letters ZR.

U.S. DOT Tire Identification Number

This begins with the letters "DOT" and indicates that the tire meets all federal standards. The next two numbers or letters are the plant code where it was manufactured, and the last four numbers represent the week and year the tire was built. For example, the numbers 3197 means the 31st week of 1997. The other numbers are marketing codes used at the manufacturer's discretion. This information is used to contact consumers if a tire defect requires a recall.

Tire Ply Composition and Materials Used

The number of plies indicates the number of layers of rubber-coated fabric in the tire. In general, the greater the number of plies, the more weight a tire can support. Tire manufacturers also must indicate the materials in the tire, which include steel, nylon, polyester, and others.

Maximum Load Rating

This number indicates the maximum load in kilograms and pounds that can be carried by the tire.

Maximum Permissible Inflation Pressure

This number is the greatest amount of air pressure that should ever be put in the tire under normal driving conditions.

UTQGS Information

Treadwear Number

This number indicates the tire's wear rate. The higher the treadwear number is, the longer it should take for the tread to wear down. For example, a tire graded 400 should last twice as long as a tire graded 200.

Traction Letter

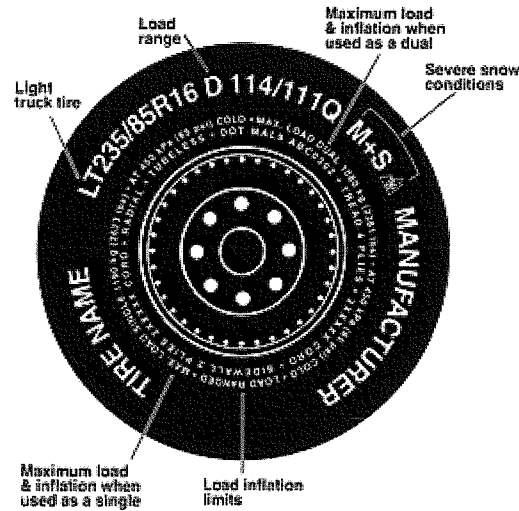
This letter indicates a tire's ability to stop on wet pavement. A higher graded tire should allow you to stop your car on wet roads in a shorter distance than a tire with a lower grade. Traction is graded from highest to lowest as "AA", "A", "B", and "C".

Temperature Letter

This letter indicates a tire's resistance to heat. The temperature grade is for a tire that is inflated properly and not overloaded. Excessive speed, underinflation or excessive loading, either separately or in combination, can cause heat build-up and possible tire failure. From highest to lowest, a tire's resistance to heat is graded as "A", "B", or "C".

Additional Information on Light Truck Tires

Please refer to the following diagram.



Tires for light trucks have other markings besides those found on the sidewalls of passenger tires.

LT

The "LT" indicates the tire is for light trucks or trailers.

ST

An "ST" is an indication the tire is for trailer use only.

Max. Load Dual kg (lbs) at kPa (psi) Cold

This information indicates the maximum load and tire pressure when the tire is used as a dual, that is, when four tires are put on each rear axle (a total of six or more tires on the vehicle).

Max. Load Single kg (lbs) at kPa (psi) Cold

This information indicates the maximum load and tire pressure when the tire is used as a single.

Load Range

This information identifies the tire's load-carrying capabilities and its inflation limits.

Tire Safety Tips

Preventing Tire Damage

- Slow down if you have to go over a pothole or other object in the road.
- Do not run over curbs or other foreign objects in the roadway, and try not to strike the curb when parking.

Tire Safety Checklist

- Check tire pressure regularly (at least once a month), including the spare.

- Inspect tires for uneven wear patterns on the tread, cracks, foreign objects, or other signs of wear or trauma.
- Remove bits of glass and foreign objects wedged in the tread.
- Make sure your tire valves have valve caps.
- Check tire pressure before going on a long trip.
- Do not overload your vehicle. Check the Tire Information and Loading Placard or User's Manual for the maximum recommended load for the vehicle.

Warning Safety Decals

The following are examples of safety warning labels attached to your trailer when you received it. If you repaint the trailer, you will need to replace these labels.

<p>⚠ WARNING</p> <p>Uncoupling will cause trailer to come loose from tow vehicle. You must:</p> <ol style="list-style-type: none"> 1. CHECK that ball LOAD RATING is same as or greater than coupler LOAD RATING. 2. CHECK that ball SIZE is same as coupler. 3. CLOSE COUPLER CLAMP on ball. 4. LIFT coupler upwards to test that it will not separate from ball. 5. LOCK coupler clamp with pin or padlock. <p>©2002 NATM</p>	<p>Open clamp</p> <p>Closed clamp</p> <p>Pin or padlock in place</p> <p>Lift coupler to check</p> <p>UT0016</p>
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<p>⚠ WARNING</p> <p>ALWAYS use safety chains. Chains hold trailer if connection fails. You must:</p> <ol style="list-style-type: none"> 1. CROSS chains underneath coupler. 2. ALLOW slack for trailer to turn. 3. ATTACH chain hooks securely to tow vehicle frame. <p>©2002 NATM</p>	<p>ATTACH HOOKS TO TOW VEHICLE FRAME</p> <p>CROSS CHAINS</p> <p>ENOUGH SLACK FOR TURNS</p> <p>UT0020</p>
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<p>⚠ WARNING</p> <p>Uncoupling will cause trailer to come loose from tow vehicle.</p> <ol style="list-style-type: none"> 1. CHECK that pintle LOAD RATING is same or greater than ring LOAD RATING. 2. LOCK the clamp in place using a pin or lock. <p>©2002 NATM</p>	<p>Open clamp</p> <p>Pin removed</p> <p>Pin in place</p> <p>Closed clamp</p> <p>UT0029</p>
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<p>⚠ WARNING</p> <p>Uncoupling will cause trailer to come loose from tow vehicle.</p> <ol style="list-style-type: none"> 1. CHECK that pintle LOAD RATING is same or greater than ring LOAD RATING. 2. LOCK the clamp in place using a pin or lock. <p>©2002 NATM</p>	<p>Open clamp</p> <p>Pin removed</p> <p>Pin in place</p> <p>Closed clamp</p> <p>UT0029</p>
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<p>⚠ WARNING</p> <p>Tire, wheel or lug nut failure can cause loss of control. Before towing, you must CHECK:</p> <ol style="list-style-type: none"> 1. Tire pressure and tread. 2. Tires and wheels for damage. 3. Lug nuts for tightness. <p>For new and remounted wheels, re-tighten lug nuts at the first 10, 25 and 50 miles of driving.</p> <p><small>©2002 NATM</small></p>	<p style="text-align: right;">Lug Nuts TIGHT?</p> <p style="text-align: left;">Tires and Wheels OK?</p> <p style="text-align: right;"><small>UT0019</small></p>
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<p>⚠ WARNING</p>
<p>It is important to maintain proper torque and to provide safe and secure attachment of the wheel to the hub/drum. Be sure to use wheel nuts that are compatible with the nut seat in the wheel. Improperly torqued wheel nuts can cause the wheel to separate from wheel mounting surface during operation. This could result in property damage, serious personal injury, or loss of life.</p> <ol style="list-style-type: none"> 1. CLEAN mounting surfaces, LUG NUTS & STUDS. DO NOT LUBE lug joint unless specifically instructed in your owner's manual. 2. START NUTS BY HAND to prevent cross threading. 3. TIGHTEN NUTS IN SEQUENCE shown using a CALIBRATED TORQUE WRENCH. DO NOT USE AN IMPACT WRENCH. Wheel nut torque requirements vary depending on the size and manufacturer. ALWAYS use wheel Manufacturer's Recommendations. 4. Wheel NUTS should be TORQUED before FIRST ROAD USE and AFTER EACH WHEEL REMOVAL. Periodically CHECK and RE-TORQUE per Manufacturer's Recommendations.
<p>4 BOLT 5 BOLT 6 BOLT 8 BOLT</p> <p style="text-align: right;"><small>UT0056</small></p>



PUMPS & MOTORS



PRINCE MANUFACTURING CORPORATION/WORLD HEADQUARTERS
NORTH SIOUX CITY, SOUTH DAKOTA

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PRINCE PTO HYDRAULIC PUMPS

Up to 40 gallons per minute and up to 2250 psi

UNIQUE FEATURES:

- Self-adjusting wear plates on both sides of the gears.
- Proper size hose adapters are provided for inlet ports.
- Two outlet ports are provided with a NPT adapter for one port and a plug to seal unused port.
- Center section available in high strength aluminum alloy for std. duty cycle or in high strength cast iron for high duty cycle use.



PLUS STANDARD FEATURES:

- Reliable
- Efficient
- Roller Bearings
- Run fitted body
- Internally splined drive shaft.
- High-tensile cast iron end plates.
- Slips onto tractor PTO shaft (no gear box required).
- Two-bolt installation on farm tractors of all sizes.

IDEAL FOR USE WITH.....

- Tractor front end loaders
- Pull-type cotton pickers
- Cotton balers (module builders)

- Tractors imported without integral hydraulics
- Landscape equipment

- Rotary mowers
- Street Sweepers
- Back hoes

MODEL FEATURES

ALUMINUM CENTER HOUSING

- Standard duty cycle
- Reduced weight
- Smaller housing

CAST IRON CENTER HOUSING

- High duty cycle
- Use in circuits with motors
- Better at higher temperatures
- Increased wear resistance

REAR PORTED

- Higher flows
- Simplified hose connections
- Higher flows at reduced engine rpm as compared to other PTO pumps

Prince PTO pumps are specifically designed for PTO drive operation on all sizes of farm tractors. No additional gear box is required. Pumps are mounted by sliding the internally splined pump onto the PTO splined shaft and restraining rotation with a torque arm.

• SELF ADJUSTING WEAR PLATES

Prince PTO pumps have self-adjusting wear plates that seal around the two unequal size gears. These plates, activated by internal fluid pressure, offset wear or expansion.

• FILTRATION

The pump must be used in a clean system with clean oil. The fluid cleanliness should meet the ISO 4406 17/14 level. As a minimum, 10 micron filtration is recommended.

• HYDRAULIC FLUID

A good quality mineral base hydraulic fluid with a viscosity in the 70-250 SUS range at operating temperature is recommended.

• OPERATING TEMPERATURE

Oil operating temperature should not exceed 180°F. If it does, the reservoir may be too small or a heat exchanger may be needed.

• SHAFT SPEEDS

Prince PTO pumps are designed to operate at up to 110% of standard PTO shaft speeds. Standard speeds are 540 rpm for the 6 tooth shaft and 1000 rpm for the 21 tooth shaft.

• CLOSE RUNNING CLEARANCE FOR HIGH FLOW RATE

Another feature that contributes to the excellent and long-lived efficiency of the PTO-Series pump is the minimum clearance between the gears and the center housing. Each pump is assembled with zero clearance between the housing and the tips of the gear teeth, then test run until the teeth establish a proper wear path in the housing. The result is a much tighter clearance than found in traditional pumps.

• PRESSURE RATING

Pumps are designed for 2250 PSI max. relief valve setting. A relief valve, external to the pump, must be provided in the system.

• PORTS

All pumps are provided with an inlet port adapter (SAE O-ring boss to hose barb) and outlet port adapter (SAE O-ring boss to female pipe thread) sized appropriately for the ports and required line sizes. A steel plug is provided for the second outlet port.

• RESERVOIR

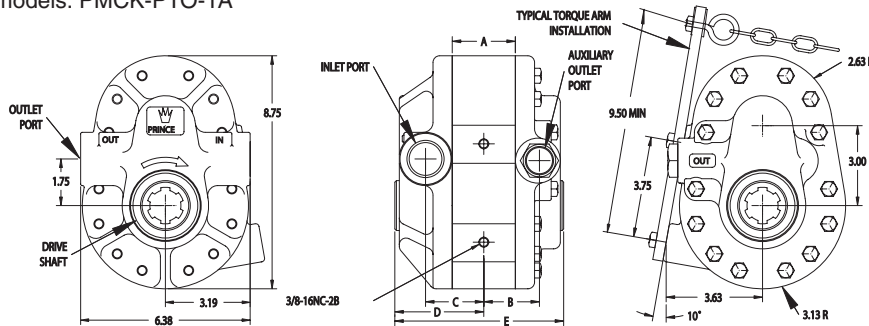
As a guideline, a reservoir size in gallons should equal the pump output in gallons per minute.

ALUMINUM CENTER HOUSING PTO PUMPS

DIMENSIONAL DATA

PUMP MODEL	ACTUAL DISPLACEMENT	A	B	C	D	E	INLET PORTS	OUTLET PORTS ³	RECOMMENDED HOSE SIZES	DRIVE SHAFT REQUIRED	SHIP WT. (LB)
HC-PTO-1A	9.9 CI/REV	2.37	2.09	2.19	3.35	6.35	#16 SAE ¹	#12 SAE	1 1/4" IN, 3/4" OUT	1 3/8 DIA. 6 TOOTH	40
HC-PTO-9A	7.8 CI/REV	2.00	1.91	2.00	3.16	5.97	#16 SAE ¹	#12 SAE	1 1/4" IN, 3/4" OUT	1 3/8 DIA. 6 TOOTH	38
HC-PTO-2A	5.7 CI/REV	1.62	1.72	1.81	2.97	5.60	#16 SAE ²	#12 SAE	1" IN, 1/2" OUT	1 3/8 DIA. 6 TOOTH	36
HC-PTO-3A	5.7 CI/REV	1.62	1.72	1.81	2.97	5.60	#16 SAE ¹	#12 SAE	1 1/4" IN, 3/4" OUT	1 3/8 DIA. 21 TOOTH	36
HC-PTO-7A	3.6 CI/REV	1.26	1.54	1.63	2.78	5.23	#16 SAE ²	#12 SAE	1" IN, 1/2" OUT	1 3/8 DIA. 6 TOOTH	33
HC-PTO-8A	3.6 CI/REV	1.26	1.54	1.63	2.78	5.23	#16 SAE	#12 SAE	1 1/4" IN, 3/4" OUT	1 3/8 DIA. 21 TOOTH	33

1. Barbed adapter for 1 1/4" hose included. 2. Barbed adapter for 1" hose included. 3. Female pipe adaptor for 3/4" NPT included.
Seal kit No. for all models: PMCK-PTO-1A



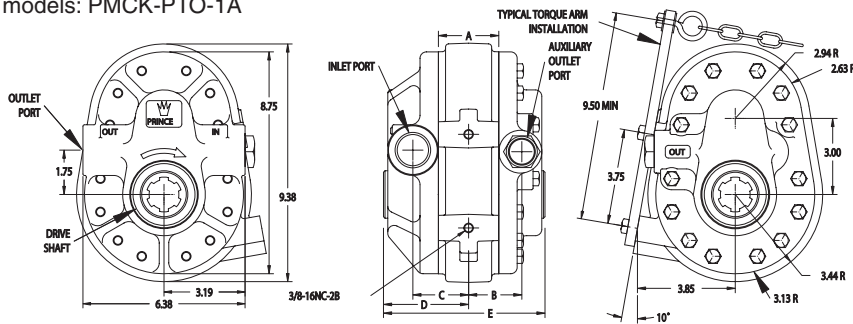
For rear ported versions of these models, contact factory.

CAST IRON CENTER HOUSING PTO PUMPS

DIMENSIONAL DATA

PUMP MODEL	ACTUAL DISPLACEMENT	A	B	C	D	E	INLET PORTS	OUTLET PORTS ³	RECOMMENDED HOSE SIZES	DRIVE SHAFT REQUIRED	SHIP WT. (LB)
HC-PTO-1AC	9.9 CI/REV	2.37	2.09	2.19	3.35	6.35	#16 SAE ¹	#12 SAE	1 1/4" IN, 3/4" OUT	1 3/8 DIA. 6 TOOTH	54
HC-PTO-2AC	5.7 CI/REV	1.62	1.72	1.81	2.97	5.60	#16 SAE ²	#12 SAE	1" IN, 1/2" OUT	1 3/8 DIA. 6 TOOTH	44
HC-PTO-3AC	5.7 CI/REV	1.62	1.72	1.81	2.97	5.60	#16 SAE ¹	#12 SAE	1 1/4" IN, 3/4" OUT	1 3/8 DIA. 21 TOOTH	44
HC-PTO-8AC	3.6 CI/REV	1.26	1.54	1.63	2.78	5.23	#16 SAE	#12 SAE	1 1/4" IN, 3/4" OUT	1 3/8 DIA. 21 TOOTH	42

1. Barbed adapter for 1 1/4" hose included. 2. Barbed adapter for 1" hose included. 3. Female pipe adaptor for 3/4" NPT included.
Seal kit No. for all models: PMCK-PTO-1A



For rear ported versions of these models, contact factory.

PERFORMANCE DATA

PUMP MODEL	RPM	500 PSI		1000 PSI		1500 PSI		2000 PSI	
		INPUT HP	GPM OUTPUT	INPUT HP	GPM OUTPUT	INPUT HP	GPM OUTPUT	INPUT HP	GPM OUTPUT
HC-PTO-1A&HC-PTO-1AC	540	8.4	21.4	16.1	21.0	23.8	21.0	32.1	21.0
HC-PTO-9A	540	7.1	17.2	13.6	17.0	20.4	16.9	27.4	17.1
HC-PTO-2A & HC-PTO-2AC	540	4.9	12.2	9.3	11.9	13.8	11.6	18.1	11.4
HC-PTO-3A & HC-PTO-3AC	1000	9.3	23.4	17.4	23.0	25.9	22.6	34.3	22.4
HC-PTO-7A	540	2.9	7.6	5.9	7.2	8.8	7.2	11.9	7.1
HC-PTO-8A/HC-PTO-8AC	1000	5.5	14.4	11.0	13.8	16.5	13.5	22.6	13.5

NOTE: Performance values are average values. Individual pump performance may vary. Performance based on 140 SUS oil at 120° F.

REAR PORTED PTO PUMPS

PERFORMANCE DATA

PUMP MODEL	RPM	500 PSI		1000 PSI		1500 PSI		2000 PSI	
		HP INPUT	GPM OUTPUT	HP INPUT	GPM OUTPUT	HP INPUT	GPM OUTPUT	HP INPUT	GPM OUTPUT
HC-P-K11 OR HC-P-K11C	1000	15.5	40.7	29.4	40.1	43.4	40.0	58.8	40.0
	540	8.4	21.4	16.1	21.0	23.8	21.0	32.1	21.0

NOTE: Performance values are average values. Individual pump performance may vary. Performance based on 140 SUS oil at 120° F.

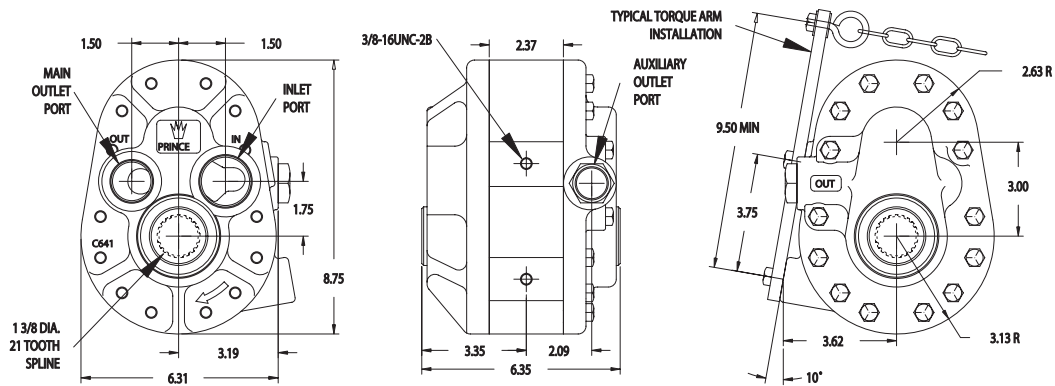
SPECIFICATIONS

PUMP MODEL	ACTUAL DISP.	INLET PORT	MAIN OUTLET PORT	AUXILIARY OUTLET PORT	INLET ADAPTER	OUTLET ADAPTER	SHIP WT. (LB)
HC-P-K11 OR HC-P-K11C	9.9 CI/REV	#20 SAE O-RING (1 5/8-12UN-2B)	#16 SAE O-RING (1 5/16-12UN-2B)	#12 SAE O-RING (1 1/16-12UN-2B)	#20 SAE TO 2" HOSE BARB	#16 SAE TO 1" FEMALE PIPE	40 OR 54

Recommended hose sizes for the HC-P-K11C are 2" for the inlet line and 1" for the outlet line. Seal kit No. for the HC-P-K11 and HC-P-K11C is: PMCK-PTO-1A. HC-P-K11 and HC-P-K11C pumps available with 1 3/8 diameter 21 tooth spline drive only.

HC-P-K26 same as HC-P-K11 except 1 3/8" dia. 6 tooth spline. HC-P-K26C same as HCP-K11C except 1 3/8" dia. 6 tooth spline. For use at 540 RPM.

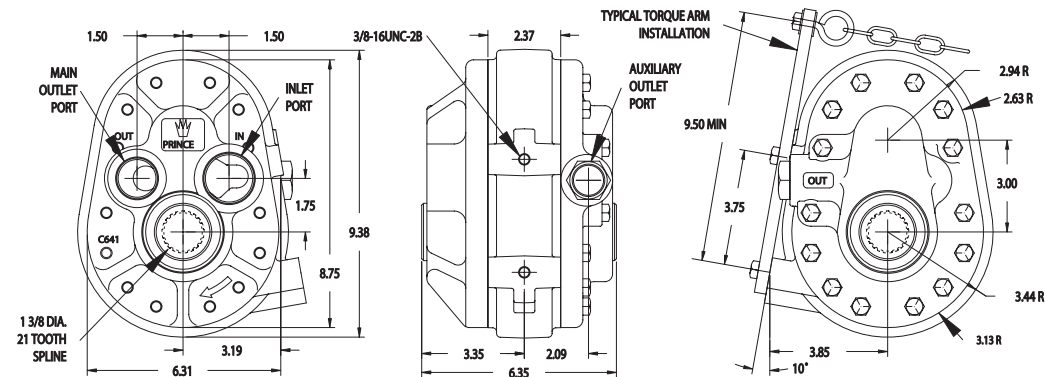
ALUMINUM CENTER HOUSING (HC-P-K11)



Recommended hose sizes for the HC-P-K11 are 2" for the inlet line and 1" for the outlet line. Seal kit No. for the HC-P-K11 and HC-P-K11C is: PMCK-PTO-1A. HC-P-K11 and HC-P-K11C pumps available with 1 3/8 diameter 21 tooth spline drive only.

HC-P-K26 same as HC-P-K11 except 1 3/8" dia. 6 tooth spline. HC-P-K26C same as HCP-K11C except 1 3/8" dia. 6 tooth spline. For use at 540 RPM.

CAST IRON CENTER HOUSING (HC-P-K11C)



Recommended hose sizes for the HC-P-K11C are 2" for the inlet line and 1" for the outlet line. Seal kit No. for the HC-P-K11 and HC-P-K11C is: PMCK-PTO-1A. HC-P-K11 and HC-P-K11C pumps available with 1 3/8 diameter 21 tooth spline drive only.

HC-P-K26 same as HC-P-K11 except 1 3/8" dia. 6 tooth spline. HC-P-K26C same as HCP-K11C except 1 3/8" dia. 6 tooth spline. For use at 540 RPM.

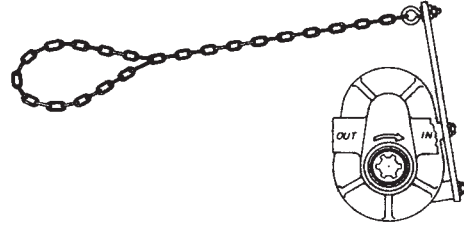
PUMP ACCESSORIES

PUMP TORQUE ARM KIT

The 180900877 torque arm kit was designed to simplify Prince PTO pump installation by eliminating the need to fabricate a custom torque arm. Items included in the kit are:

- 1-Torque arm
- 2-3/8-16 mounting bolts
- 1-Eye bolt/chain assembly

NOTE THAT TORQUE ARM KIT NO. 180900877 FITS ALL MODEL PTO PUMPS



RETURN LINE FILTER-SPIN-ON TYPE

The Prince spin-on filter assemblies listed below all have 10 micron phenol coated paper elements and a 15 PSI bypass spring. FA Series have 3/4-NPTF ports and FB Series have 1 1/4-NPTF ports. See FA and FB Series product bulletins for additional models and information. **(See Filter Products Section of Price List).**

MODEL NUMBER	USAGE
FA 1200-10	PTO-2A, 7A, 8A Does not include indicator gauge or gauge ports
FA 1211-10	PTO-2A, 7A, 8A Includes 200 PSI indicator gauge
FB 1200-10	PTO-1A, 3A, 9A, HC-P-K11-Does not include indicator gauge or gauge ports
FB 1211-10	PTO-1A, 3A, 9A, HC-P-K11-Includes 200 PSI indicator gauge



SUCTION LINE FILTER-SPIN-ON TYPE

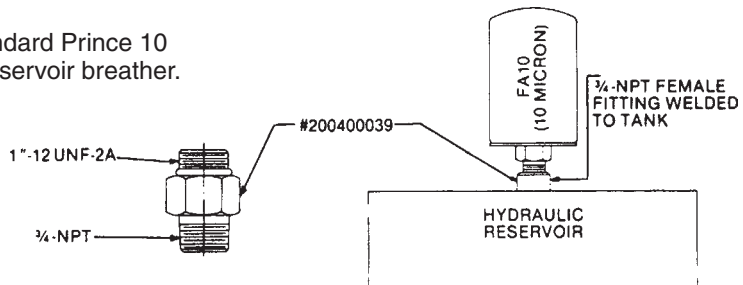
Model number FB 1100-150 suction strainer assembly is recommended for use with all Prince PTO pumps (except HC-P-K11). It has a spin-on element with 140 square inches of 100 mesh (150 micron) screen. A 5 PSI bypass is incorporated in the filter housing. Port size is 1 1/4-NPTF. Model Number FB 1112-150 with a 0-30 in. vac gauge is also available **(See Filter Products Section of Price List).**



RESERVOIR BREATHER ADAPTER

The 200400039 breather adapter enables a standard Prince 10 micron spin-on filter element* to be used as a reservoir breather.

*Part Number FA10



FITTINGS AND ADAPTERS

MODEL NUMBER	DESCRIPTION	CONFIGURATION
500204013	#16 SAE (1 5/16-12) Male, 1 1/4-NPTF Female	Fig. 1
500204011	#12 SAE (1 1/16-12) Male, 3/4-NPTF Female	Fig. 1
270011014	1 1/4-NPTF Male, 1 1/4 Hose Barb	Fig. 2
270011015	1" NPTF Male, 1" Hose Barb	Fig. 2
270011013	#16 SAE (1 5/16-12) Male, 1 1/4 Hose Barb	Fig. 3
270011017	#16 SAE (1 5/16-12) Male, 1 Hose Barb	Fig. 3
270011046	#20 SAE (1 5/8-12) Male, 2 Hose Barb	Fig. 3
500204012	#16 SAE (1 5/16-12) Male, 1-NPTF Female	Fig. 1

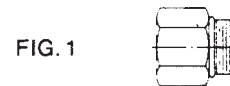


FIG. 1

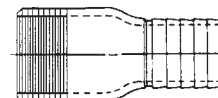


FIG. 2

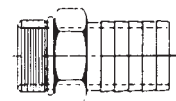


FIG. 3

SP SERIES HYDRAULIC GEAR PUMP

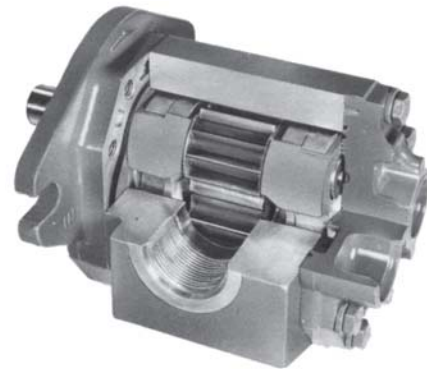
OUTSTANDING FEATURES

- Patented Non-Symmetrical Gears** The adoption of non-symmetrical gears insures greater power per unit volume compared with pumps of conventional design. The compact gear compartment has enabled high-pressure operation. The increased number of gear teeth has reduced the flow pulsation and minimized the noise.

U.S.A.	Patent No.	3817117	
U.K.	Patent No.	1400577	
French	Patent No.	7230448	
German	Patent No.	7231801	Others: Pending
- Bearings** PTFE composite bearings are used do to the ability to handle heavy loads, low shaft speeds, and high levels of contamination. Engineering tests on the PTFE bearings indicate they will withstand bearing loads over twice as high as conventional steel backed aluminum bearings used in many pumps. The PTFE resin layer will absorb a high degree of contamination with out damage to the pump. Also since the PTFE layer is self lubricating, contamination from bearing wear in high load situations (when no oil film is present) is reduced. The side benefit from reduced friction under all conditions is a reduced consumption of power.
- Gears and drive shaft** are hardened alloy steel of one piece of construction.
- Special gear design:** Non-symmetrical gear insures low noise and compactness.
- Highest Quality Workmanship.**
- Pressures Up To 3000 P.S.I.**
- Dependable service:** Balanced pressure loading insures small dispersion, good durability and maintains high performance, **Extremely Efficient.**
- Perfect alignment:** "Through bore" design provides perfect alignment of pump element and assures even bearing load.
- With the aluminum alloy casing,** the SP Series features light weight and easy handling.

- Double pumps:** Available in SP20, SP25 and SP25/SP20 Combinations.
- Maximum speed** from 3000 to 4000 RPM using SAE 10W oil.
- Displacement covers** .400 in³/rev. to 3.869 in³/rev.
- Inlet pressure:** Pump inlet should not exceed 5 in. of mercury vacuum or 14 P.S.I. positive pressure.
- Ports:** SAE straight thread O-ring boss for SP20 & SP25. Other Ports available - consult factory. (Taper pipe threads not available.
- Working oil:** A mineral based oil with additives to resist corrosion, oxidation, and foaming is recommended. Viscosity at any running condition should be 60 SUS minimum and 250 SUS maximum. 180° F is the maximum recommended system operating temperature.
- Filtration:** Per ISO cleanliness code level 17/14. As a minimum, 10 micron filtration is recommended.

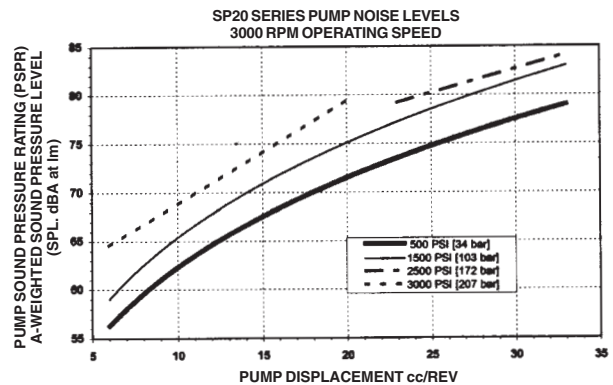
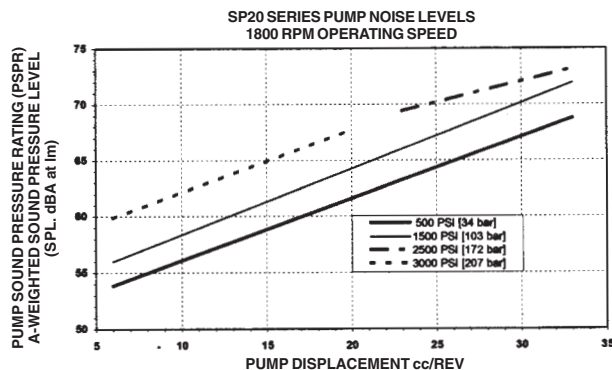
INTERNAL COMPONENTS BREAKDOWN



SP20 SERIES HYDRAULIC PUMPS AND NOISE GENERATION

The accompanying graphs show the typical Pump Sound Pressure Ratings (PSPR, A-weighted Sound Pressure Levels) for the SP20 Series Hydraulic Pumps. The Pump Sound Pressure Ratings (PSPR) shown below in the graphs were computed and determined using Sound Intensity Analysis Methods. Sounds Intensity Analysis provides the most accurate and reliable data for predicting and comparing a Pump Sound Pressure Rating (A-weighted Sound Pressure Level), for a pump exposed to various operating and environmental conditions.

Pumps tested below in the graphs were tested as defined by **ANSI/B93.71M**, (Hydraulic fluid power-Pumps-Test code for the determination of airborne noise levels) in a semi-anechoic room. For free-field conditions (i.e. such as a noise source located above the ground in a open area), pump sound pressure ratings (A-weight Sound Pressure Levels) may be estimated by subtracting 3dB(A) from the values shown on the graphs.



Pump acoustical data was determined in accordance with ANSI/B93.71M. Hydraulic fluid power-Pumps-Test code for the determination of airborne noise levels

SP20 SERIES



New Updated Design

- More Port Options
- More Shaft Options
- Lower Price
- Contact your sales representative for more information

The SP20B pump now utilizes self-lubricating thrust blocks that eliminate the need for separate wear plates. They are made from a high strength aluminum alloy with exceptional anti-galling properties. This new thrust block design also incorporates advanced bearings designed specifically for high pressure hydraulic pumps. This new bearing features a robust fluoropolymer PTFE wear surface that yields unsurpassed load carrying capabilities and cavitation resistance even at low speeds and moderate levels of contamination. Also, since the PTFE resin layer is self-lubricating, contamination from bearing wear in high load situations (when no oil film is present) is reduced. This new thrust block design combined with these advanced bearing results in lower friction and less internal oil loss resulting in higher pump efficiencies.

MODEL CODE

SP20B 14 A 9 H 2-R

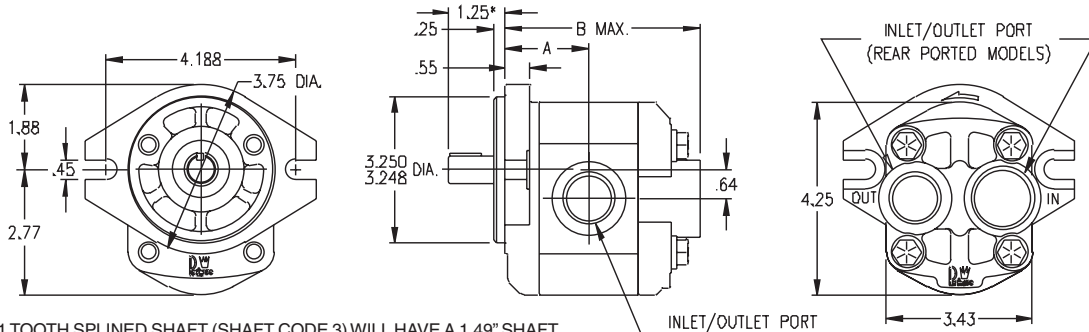
<p>SERIES NO _____</p> <p>DISPLACEMENT CODE (CC/REV) _____</p> <p>PORT LOCATION _____</p> <p style="margin-left: 20px;">A-SIDE INLET AND OUTLET C-BOTH SIDE AND REAR W/STEEL PLUGS D-REAR INLET AND OUTLET E-BOTH SIDE AND REAR W/PLASTIC PLUGS</p> <p>PORT TYPE _____</p> <p style="margin-left: 20px;">9-STANDARD PORTS SAE PER CHART BELOW OPTIONAL PORTS CONSULT FACTORY SIDE PORT ONLY 8-METRIC O-RING 7-BSPP 6-SAE SPLIT FLANGE 16-33 CC ONLY 5-METRIC SPLIT FLANGE 16-33 CC ONLY</p>	<p>SP20B 14 A 9 H 2-R</p>	<p>ROTATION (FACING END OF SHAFT)</p> <p style="margin-left: 20px;">L-COUNTER CLOCKWISE R-CLOCKWISE DRIVE SHAFT</p> <p>DRIVE SHAFT</p> <p style="margin-left: 20px;">9-SAE 9 TOOTH 16/32 SPLINE 2-SAE 5/8" STRAIGHT KEYED 3-11 TOOTH 16/32 SPLINE* 4-3/4" STRAIGHT KEYED* 5 -SAE 10 TOOTH 16/32 SPLINE</p> <p>MOUNTING</p> <p style="margin-left: 20px;">H-SAE "A" 2 BOLT</p> <p style="text-align: right; margin-top: 10px;">*REQUIRED FOR DISPLACEMENT CODES 30 AND 33</p>
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SPECIFICATIONS

MODEL NUMBER	DISP. IN ³ /REV	RATED PRESSURE (PSI)	MAX ^o RPM	A	B	INLET PORT			OUTLET PORT		WT. (LB.)	
						SIZE		FULL THREAD DEPTH	SIZE			FULL THREAD DEPTH
						SIDE	REAR		SIDE	REAR		
SP20B06	.400	3000	4000	1.79	4.22	7/8-14 UN-2B	1 5/16-12 UN-2B	5/8"	3/4-161 UN-2B	1/16-12 UN-2B	9/16"	5.0
SP20B08	.499	3000	4000	1.83	4.30	1 1/16-12 UN-2B	1 5/16-12	3/4"	7/8-14 UNF-2B	1 1/16-12	5/8"	5.1
SP20B09	.589	3000	4000	1.87	4.38							5.3
SP20B11	.677	3000	4000	1.91	4.46							5.5
SP20B14	.860	3000	4000	1.99	4.62							5.7
SP20B16	.976	3000	4000	2.04	4.71	1 5/16-12 UN-2B	3/4"	1 1/16-12 UN-2B	3/4"	6.0		
SP20B20	1.220	3000	3500	2.15	4.93					6.2		
SP20B23	1.403	2500	3500	2.23	5.09	1 5/16-12 UN-2B	3/4"	1 1/16-12 UN-2B	3/4"	6.4		
SP20B27	1.654	2500	3500	2.34	5.31					6.6		
SP20B30	1.881	2500	3500	2.41	5.46					7.1		
SP20B33	2.014	2500	3500	2.49	5.62						7.6	

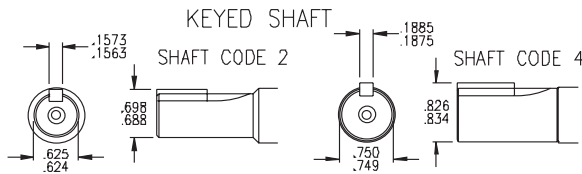
*Max. RPM for side ported models. Rear ported models should be restricted to 21 gpm. Standard Seal Kit for all SP20 Models is Prince Part No. PMCK-SP20.

SP20 SERIES DIMENSIONAL DATA



*NOTE 11 TOOTH SPLINED SHAFT (SHAFT CODE 3) WILL HAVE A 1.49" SHAFT EXTENSION. 10 TOOTH SPLINED SHAFT (SHAFT CODE 5) WILL HAVE A 1.37" SHAFT EXTENSION.

INLET/OUTLET PORT (SIDE PORTED MODELS)



SPLINED SHAFT

SHAFT CODE 9	SHAFT CODE 5	SHAFT CODE 3
9 TOOTH	10 TOOTH	11 TOOTH
16/32 DP	16/32 DP	16/32 DP
30° PA	30° PA	30° PA
FLAT ROOT SIDE FIT	FLAT ROOT SIDE FIT	FLAT ROOT SIDE FIT

TYPICAL PERFORMANCE DATA

MODEL		RPM								PRESSURE (PSI)
		500	1000	1500	2000	2500	3000	3500	4000	
SP20B06	FLOW(GPM)	.78	1.62	2.48	3.35	4.24	5.10	5.98	6.92	3000
	INPUT HORSE POWER	1.85	3.77	5.66	7.57	9.45	11.13	13.06	14.80	
SP20B08	FLOW(GPM)	.88	1.91	2.97	4.04	5.10	6.16	7.27	8.33	
	INPUT HORSE POWER	2.23	4.38	6.53	8.83	11.13	13.57	16.17	18.69	
SP20B09	FLOW(GPM)	1.03	2.30	3.52	4.75	5.97	7.19	8.46	9.74	
	INPUT HORSE POWER	2.61	5.03	7.54	10.14	12.84	15.54	18.43	21.31	
SP20B11	FLOW(GPM)	1.27	2.74	4.16	5.63	7.05	8.51	9.98	11.40	
	INPUT HORSE POWER	2.98	5.77	8.75	11.63	14.80	17.87	21.12	24.38	
SP20B14	FLOW(GPM)	1.61	3.36	5.19	7.01	8.91	10.74	12.56	14.39	
	INPUT HORSE POWER	3.68	7.09	10.51	14.19	18.00	21.68	25.49	29.43	
SP20B16	FLOW(GPM)	1.80	3.82	5.87	7.93	9.98	12.11	14.24	16.22	
	INPUT HORSE POWER	4.01	7.86	11.87	15.87	20.17	24.33	28.78	34.12	
SP20B20	FLOW(GPM)	2.35	4.92	7.49	10.05	12.70	15.26	17.76		
	INPUT HORSE POWER	5.21	9.98	14.89	20.10	25.16	30.52	35.73		
SP20B23	FLOW(GPM)	2.80	5.72	8.73	11.60	14.68	17.61	20.55		
	INPUT HORSE POWER	5.06	9.68	14.44	19.21	24.27	29.48	34.54		
SP20B27	FLOW(GPM)	3.30	6.90	10.47	13.90	17.52	20.94	24.46		
	INPUT HORSE POWER	5.98	11.59	17.20	23.00	28.98	34.78	41.13		
SP20B30	FLOW(GPM)	3.85	7.78	11.47	15.36	19.22	23.03	26.86		
	INPUT HORSE POWER	6.40	12.56	18.38	24.64	30.93	37.59	43.80		
SP20B33	FLOW(GPM)	4.13	8.47	12.60	16.86	21.11	25.26	29.52		
	INPUT HORSE POWER	7.14	13.40	19.98	27.04	33.90	41.05	47.89		

Typical Performance Data Based on 140 SUS Oil at 120° F.

SP25 SERIES



MODEL CODE

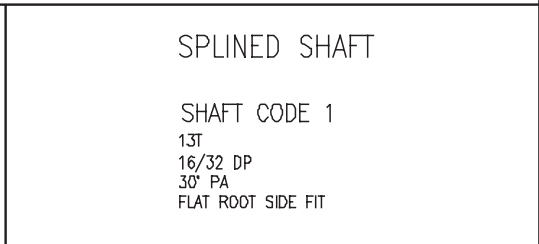
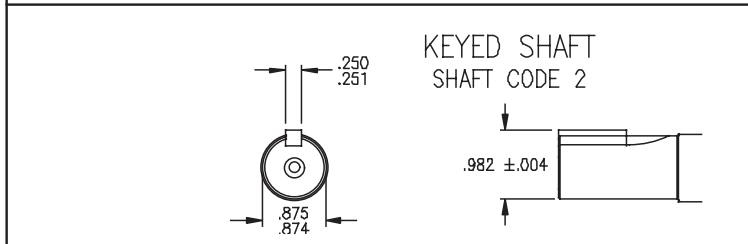
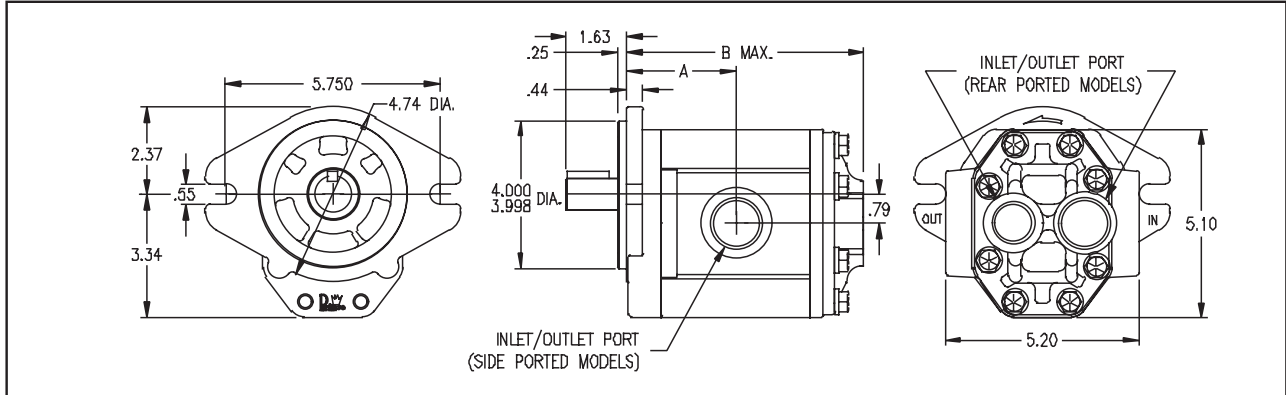
SERIES NO _____	DISPLACEMENT CODE (CC/REV) _____	PORT LOCATION _____	PORT TYPE _____	SP25A 38 A 9 H 1-R	ROTATION (FACING END OF SHAFT) L-COUNTERCLOCKWISE R-CLOCKWISE
		A-SIDE INLET AND OUTLET D-REAR INLET AND OUTLET C-BOTH SIDE AND REAR INLET AND OUTLET, STEEL PLUGS D-BOTH SIDE AND REAR INLET AND OUTLET, PLASTIC PLUGS			DRIVE SHAFT 1-SAE 13 TOOTH 16/32 SPLINE 2-SAE 7/8" STRAIGHT KEYED
					MOUNTING H-SAE "B" 2 BOLT

SPECIFICATIONS

MODEL NUMBER	DISP. IN ³ /REV	RATED PRESSURE (PSI)	MAX ^o RPM	A	B	INLET PORT			OUTLET PORT			WT. (LB.)
						SIZE		FULL THREAD DEPTH	SIZE		FULL THREAD DEPTH	
						SIDE	REAR		SIDE	REAR		
SP25A19	1.141	3000	3000	2.49	5.50	1 5/16-12			1 1/16-12			10.4
SP25A22	1.349	3000	3000	2.55	5.62	UN-2B			UN-2B			10.6
SP25A27	1.660	3000	3000	2.64	5.79							11.0
SP25A32	2.008	3000	3000	2.74	5.99							12.4
SP25A38	2.318	3000	3000	2.83	6.17							13.5
SP25A44	2.697	3000	3000	2.94	6.38	1 5/8-12	UN-2B		1 1/16-12	UN-2B	3/4"	13.9
SP25A52	3.179	2500	3000	3.07	6.66	UN-2B			1 5/16-12			14.4
SP25A63	3.869	2500	3000	3.27	7.05	1 7/8-12			UN-2B			15.4

*Max. RPM for side ported models. Rear ported models should be restricted to 25 GPM due to limitation on the inlet port size. Standard Seal Kit for all SP25 Models is Prince Part No. PMCK-SP25.

SP25 SERIES DIMENSIONAL DATA

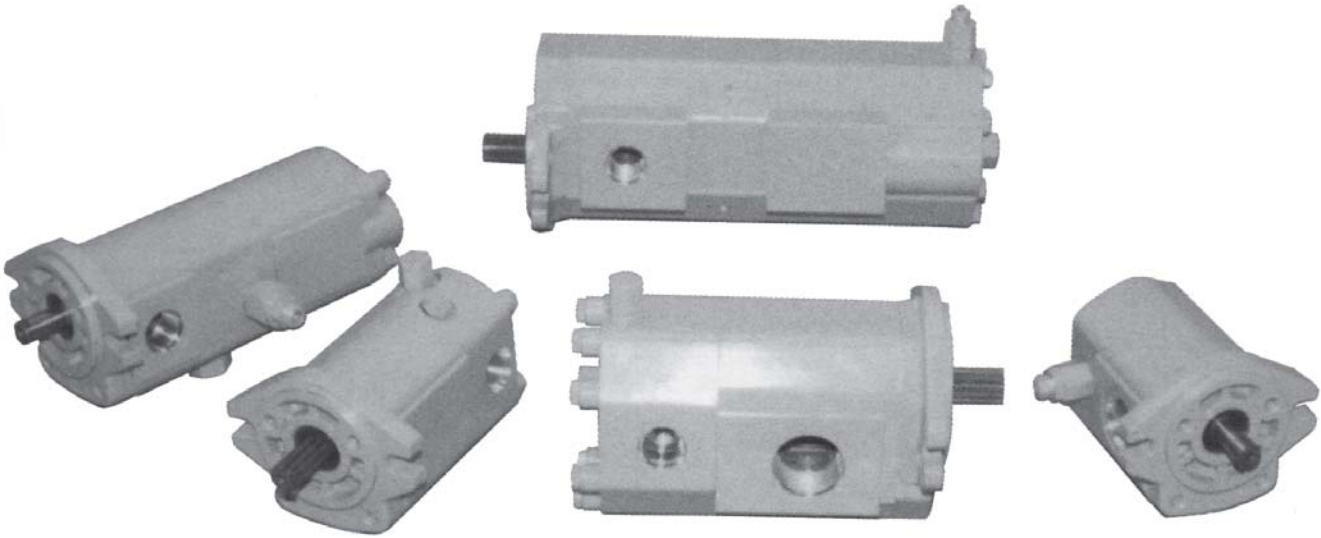


TYPICAL PERFORMANCE DATA

MODEL		RPM						PRESSURE (PSI)	
		500	1000	1500	2000	2500	3000		
SP25A19	FLOW (GPM)	2.09	4.55	6.90	9.39	11.89	14.24	3000	
	INPUT HORSE POWER	4.65	9.31	13.96	18.70	23.45	28.29		
SP25A22	FLOW (GPM)	2.64	5.28	8.22	11.08	13.94	16.81		
	INPUT HORSE POWER	5.58	10.98	16.38	21.96	27.36	33.31		
SP25A27	FLOW (GPM)	3.33	6.75	10.27	13.70	17.22	20.74		
	INPUT HORSE POWER	6.99	13.48	20.22	26.97	33.96	40.95		
SP25A32	FLOW (GPM)	3.91	8.22	12.43	16.73	21.14	25.44		
	INPUT HORSE POWER	8.24	15.98	24.22	32.46	40.95	49.94		
SP25A38	FLOW (GPM)	4.26	9.10	14.09	19.08	24.07	28.77		
	INPUT HORSE POWER	8.56	18.24	27.54	36.85	46.90	56.57		
SP25A44	FLOW (GPM)	4.99	10.86	16.44	22.16	27.89	33.61		2500
	INPUT HORSE POWER	10.42	21.22	32.01	43.18	54.71	66.25		
SP25A52	FLOW (GPM)	6.16	12.92	19.67	26.42	33.17	39.63		
	INPUT HORSE POWER	11.17	21.96	32.38	43.55	55.09	67.00		
SP25A63	FLOW (GPM)	7.52	15.60	23.86	31.93	40.00	48.08		
	INPUT HORSE POWER	14.14	26.43	39.45	52.85	66.62	80.77		

Typical Performance Data Based on 140 SUS Oil at 120° F.

SP PUMP INTEGRAL VALVING OPTIONS



PRINCE SP PUMPS WITH INTEGRAL VALVING FEATURE EXTRUDED ALUMINUM REAR COVERS. THE EXTRUDED REAR COVERS ALLOW EXCEPTIONAL FLEXIBILITY FOR INCORPORATING DIFFERENT VALVING AND PORTING OPTIONS. PRINCE'S USE OF COMPUTER CONTROLLED MACHINING CENTERS IN THE MANUFACTURING PROCESS ALLOW EITHER STANDARD OR CUSTOM DESIGNS TO BE MADE IN BOTH SMALL AND LARGE QUANTITIES.

- **PRIORITY FLOW DIVIDER PUMPS**

Priority flow divider pumps split the flow between a priority port and an excess flow port. The flow is initially directed to the priority port until the priority setting is satisfied. At that time any additional flow is directed to the excess flow port. Priority divider pumps are typically used in steering circuits, brake circuits or any circuit where a primary flow needs to be satisfied first.

- **RELIEF VALVES**

Various styles and configurations of relief valves can be provided in the rear cover. The relief return flow can be either ported external to the pump or internally ported back to the inlet. Caution must be used so that the duration of the internally ported flow does not cause excessive heat build up.

- **CUSTOM DESIGN VALVE PACKAGES**

Prince Manufacturing offers custom designed integral valve packages. Configurations are developed based on customer specifications.

- **SOLENOID VALVES**

Various configurations of controlling pump flow by using solenoid cartridge valves are available.

- **SPECIAL REAR PORTING**

A wide variety of port types as well as port locations can be accommodated with the extruded rear cover.

- **DOUBLE PUMP CONFIGURATIONS**

Integral valve configurations can easily be integrated into double pump configurations. Valves in the rear cover typically control flow from the rear pump section, however valves can also be incorporated into the center section of the double pump for additional control options.

- **HIGH-LO PUMPS (Horse power limiting pumps)**

A high-lo configuration is available based on the SP20 series pump. The typical configuration provides 28 gpm low pressure flow and 7 gpm high pressure flow (at 3500 rpm). Typical horsepower requirements are 19 hp at 3000 psi and 3500 rpm.



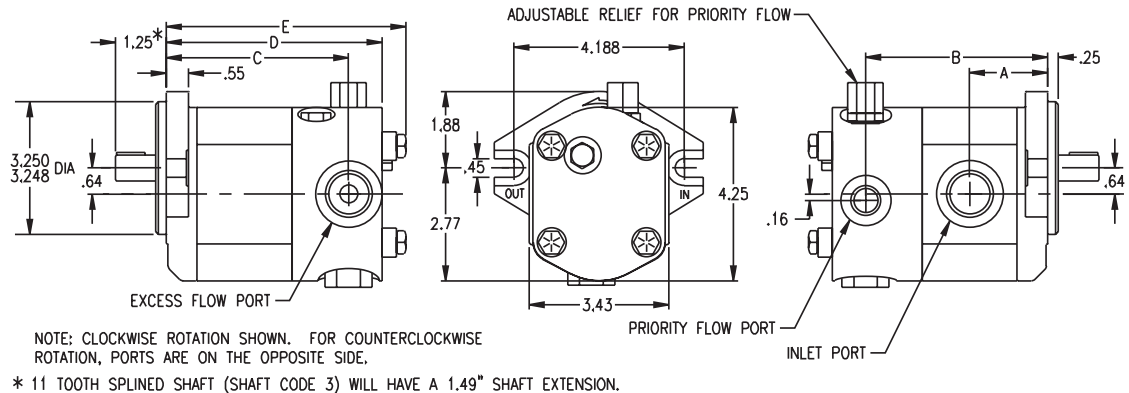
PRINCE MANUFACTURING CORPORATION
P.O. BOX 7000
NORTH SIOUX CITY, SD 57049-7000
TELEPHONE: 605-235-1220
FAX: 605-235-1082

SP20P SERIES - PRIORITY FLOW DIVIDER PUMPS MODEL CODE

SP20PB 23 K 185 H 2 R

<p>SERIES NO. _____</p> <p>DISPLACEMENT CODE (CC/REV) _____</p> <p>PRIORITY FLOW* _____</p> <p>G-1.5 GPM PRIORITY FLOW H - 2.0 GPM PRIORITY FLOW J - 2.5 GPM PRIORITY FLOW K - 3.0 GPM PRIORITY FLOW L - 3.5 GPM PRIORITY FLOW M - 4.0 GPM PRIORITY FLOW N - 4.5 GPM PRIORITY FLOW P - 5.0 GPM PRIORITY FLOW</p> <p>PRIORITY FLOW RELIEF SETTING _____</p> <p>THE THREE DIGIT CODE REPRESENTS RELIEF VALVE SETTING DIVIDED BY 10. FOR INSTANCE A CODE NUMBER OF 185 REPRESENTS A RELIEF SETTING OF 1850 PSI. (RELIEF SETTING MUST BE BETWEEN 1000 AND 2250 PSI.)</p> <p>+ FOR PRIORITY FLOWS AND RELIEF SETTINGS NOT INDICATED, CONTACT FACTORY. ° FOR DISPLACEMENT CODES 08 THROUGH 27, SHAFT CODES 2 AND 9 ARE STANDARD. FOR DISPLACEMENT CODES 30 AND 33, SHAFT CODES 3 AND 4 ARE STANDARD. PUMPS WITH NONSTANDARD SHAFT CODES ARE AVAILABLE IN MINIMUM QUANTITIES.</p>	<p>ROTATION (FACING END OF SHAFT) L-COUNTERCLOCKWISE R-CLOCKWISE</p> <p>DRIVE SHAFT 9- SAE 9 TOOTH 16/32 SPLINE 2- SAE 5/8" STRAIGHT KEYED 3- 11 TOOTH 16/32 SPLINE 4- 3/4" STRAIGHT KEYED 5- SAE 10 TOOTH 16/32 SPLINE</p> <p>MOUNTING H- SAE "A" 2 BOLT</p>
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SP20P SERIES DIMENSIONAL DATA



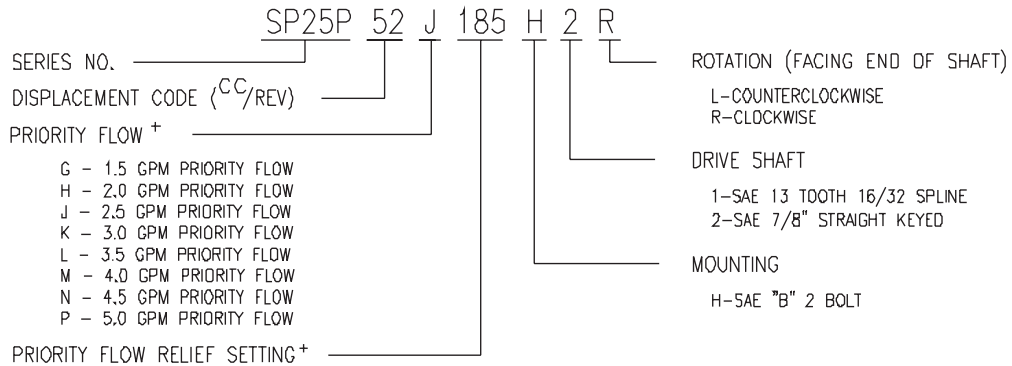
SPECIFICATIONS

MODEL NUMBER	DISP. IN ³ /REV	RATED PRESSURE PSI	MAX [°] RPM	A	B	C	D	E	INLET PORT SIZE	EXCESS FLOW PORT SIZE	PRIORITY FLOW PORT SIZE	WT. (LB.)
SP20PB06	.400	3000	4000	1.79	4.22	4.22	5.04	5.36	7/8-14 UN-2B 5/8" FULL THREAD DEPTH	1 1/16-12 UN-2B	9/16-18 UNF-2B	6.7
SP20PB08	.499	3000	4000	1.83	4.30	4.30	5.12	5.82	1 1/16-12 UN-2B			6.8
SP20PB09	.589	3000	4000	1.87	4.38	4.38	5.20	5.80	3/4" FULL THREAD DEPTH	3/4" FULL THREAD DEPTH	7.0	
SP20PB11	.677	3000	4000	1.91	4.46	4.46	5.28	5.88			7.2	
SP20PB14	.860	3000	4000	1.99	4.62	4.62	5.44	5.81	1 5/16-12 UN-2B	3/4" FULL THREAD DEPTH	7.4	
SP20PB16	.976	3000	4000	2.04	4.72	4.72	5.53	5.84			7.7	
SP20PB20	1.220	3000	3500	2.15	4.93	4.93	5.75	6.35	3/4" FULL THREAD DEPTH	3/4" FULL THREAD DEPTH	7.9	
SP20PB23	1.403	2500	3500	2.23	5.09	5.09	5.91	6.28			8.1	
SP20PB27	1.654	2500	3500	2.34	5.31	5.31	6.12	6.82	3/4" FULL THREAD DEPTH	3/4" FULL THREAD DEPTH	8.3	
SP20PB30	1.881	2500	3000	2.41	5.46	5.46	6.28	6.88			8.8	
SP20PB33	2.014	2500	3000	2.49	5.62	5.62	6.44	6.81			9.3	

FOR PUMP PERFORMANCE DATA AND DIMENSIONAL DATA, REFER TO THE SP20B PUMP SECTION Standard Seal Kit for all SP20B Models is Prince Part No. PMCK-SP20.

PUMPS AND MOTORS

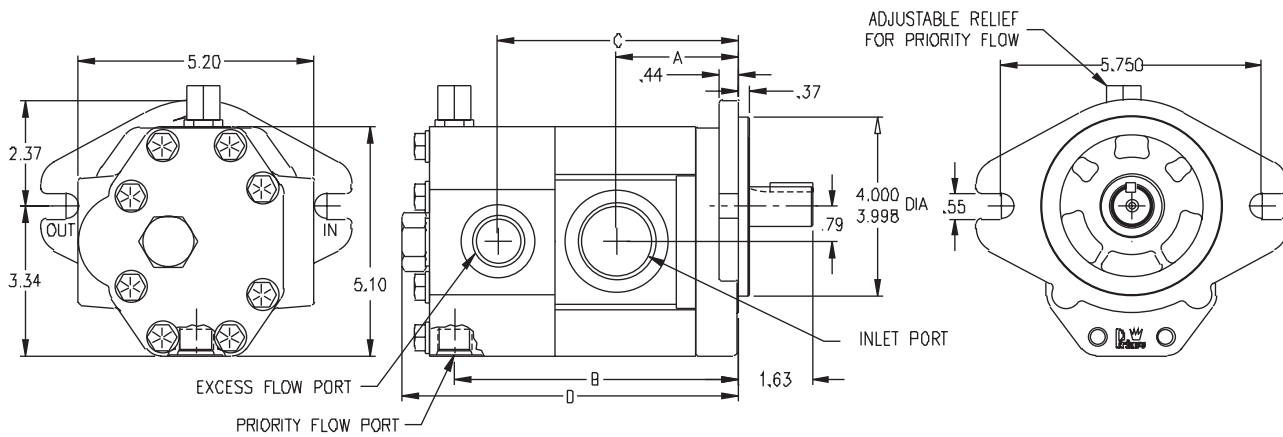
SP25P SERIES - PRIORITY FLOW DIVIDER PUMPS MODEL CODE



THE THREE DIGIT CODE REPRESENTS RELIEF VALVE SETTING DIVIDED BY 10. FOR INSTANCE A CODE NUMBER OF 185 REPRESENTS A FULL FLOW RELIEF SETTING OF 1850 PSI. (RELIEF SETTING MUST BE BETWEEN 1000 AND 2250 PSI.)

+ FOR PRIORITY FLOWS AND RELIEF SETTINGS NOT INDICATED, CONTACT FACTORY.

SP25P SERIES DIMENSIONAL DATA



RIGHT HAND ROTATION SHOWN. FOR LEFT HAND ROTATION, INLET AND EXCESS FLOW PORTS GO TO THE OPPOSITE SIDE OF THE PUMP, PRIORITY FLOW PORT GOES FROM THE BOTTOM TO THE TOP OF THE PUMP.

SPECIFICATIONS

MODEL NUMBER	DISP. IN ³ /REV	RATED PRESSURE	MAX. RPM	A	B	C	D	INLET PORT SIZE		EXCESS FLOW PORT SIZE	PRIORITY FLOW PORT SIZE	WT. (LB.)
SP25P19	1.141	3000	3000	2.49	6.26	5.32	7.42	1 5/16-12 UN-2B	3/4" FULL THREAD DEPTH	1 1/16-12 UN-2B	3/4-16 UN-2B	14.7
SP25P22	1.349	3000	3000	2.55	6.38	5.44	7.54					14.9
SP25P27	1.660	3000	3000	2.64	6.56	5.62	7.71	1 5/8-12 UN-2B	3/4" FULL THREAD DEPTH	9/16" FULL THREAD DEPTH	15.3	
SP25P32	2.008	3000	3000	2.74	6.75	5.82	7.91				16.7	
SP25P38	2.318	3000	3000	2.83	6.93	5.99	8.09	1 7/8-12	3/4" FULL THREAD DEPTH	9/16" FULL THREAD DEPTH	17.8	
SP25P44	2.697	3000	3000	2.94	7.15	6.21	8.30				18.2	
SP25P52	3.179	2500	2500	3.07	7.42	6.49	8.58	1 7/8-12	3/4" FULL THREAD DEPTH	9/16" FULL THREAD DEPTH	18.7	
SP25P63	3.869	2500	2100	3.27	7.82	6.88	8.97				19.7	

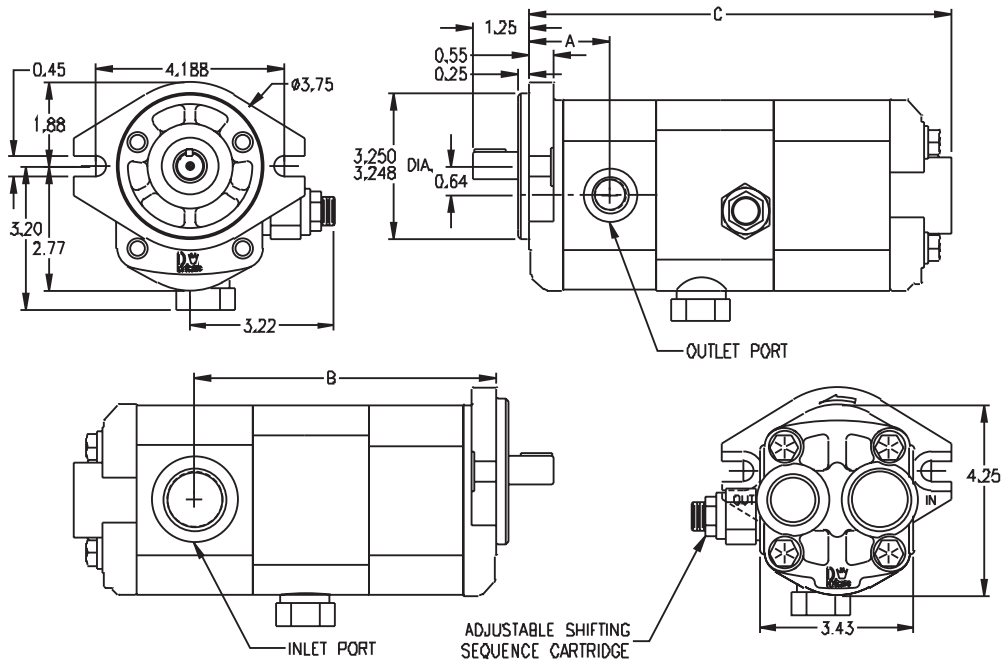
FOR PUMP PERFORMANCE DATA AND SHAFT DIMENSIONAL DATA, REFER TO THE SP25A PUMP SECTION.
Standard Seal Kit for all SP25 Models is Prince Part No. PMCK-SP25.

SPHL1 HI-LO PUMP SERIES MODEL CODE

SPHL1B 0616 H 2 R

<p>SERIES NO. _____</p> <p>DISPLACEMENT CODE (CC/REV) _____</p> <p>06 16 (CC/REV) 08 23 (CC/REV)</p> <p>MOUNTING _____</p> <p>H-SAE "A" 2 BOLT TIME FACTORY SETTING FOR THE SHIFTING SEQUENCE CARTRIDGE IS SET FOR 500 PS. SHIFTING SEQUENCE CARTRIDGE IS ADJUSTABLE.</p>	<p>ROTATION (FACING END OF SHAFT) L-COUNTERCLOCKWISE R-CLOCKWISE</p> <p>DRIVE SHAFT 9-SAE 9 TOOTH 16/32 SPLINE 2-SAE 5/8" STRAIGHT KEYED</p>
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SPHL1 DIMENSIONAL DATA



NOTE: CLOCKWISE ROTATION SHOWN. FOR COUNTERCLOCKWISE ROTATION, PORTS ARE ON THE OPPOSITE SIDES.

SPECIFICATIONS

MODEL NUMBER	FRONT DISP. IN ³ /REV.	REAR DISP. IN ³ /REV.	RATED PRESSURE	MAX RPM	A	B	C	INLET PORT SIZE	OUTLET PORT SIZE	FULLTHREAD DEPTH	WT. (LB.)
SPHL1B0616	.400	.976	3000	3600	1.79	6.72	9.39	1 5/16-12 UN-2B	3/4-16 UN-2B	3/4"	14.4
SPHL1B0823	.499	1.403	3000	3600	1.83	6.99	9.85		1 1/16-12 UN-2B		14.7

PERFORMANCE

PUMP	RPM	HIGH FLOW (GPM)	LOW FLOW (GPM)	RECOMMENDED INPUT HORSEPOWER FOR 3000 PSI MAXIMUM WORKING PRESSURE	<p>*NOTE: PLEASE CONSULT FACTORY FOR HORSEPOWER REQUIREMENTS OF DIFFERENT WORKING AND SHIFT PRESSURES.</p>
SPHL1B0616	1800	10.51	2.98	7.8	
	3600	21.01	6.00	16.0	
SPHL1B0823	1800	14.40	3.70	10.0	
	3600	28.52	7.51	22.0	

Standard Seal Kit for all SP20 Models is Prince Part No. PMCK-SPHL1.

PUMPS AND MOTORS

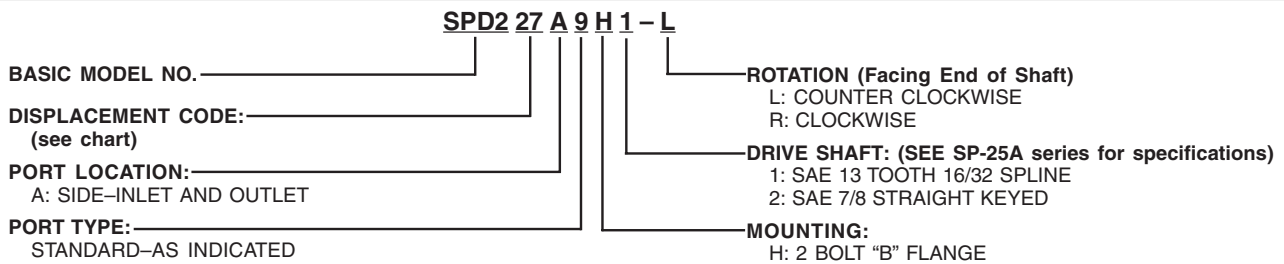
SPD2 DOUBLE PUMPS



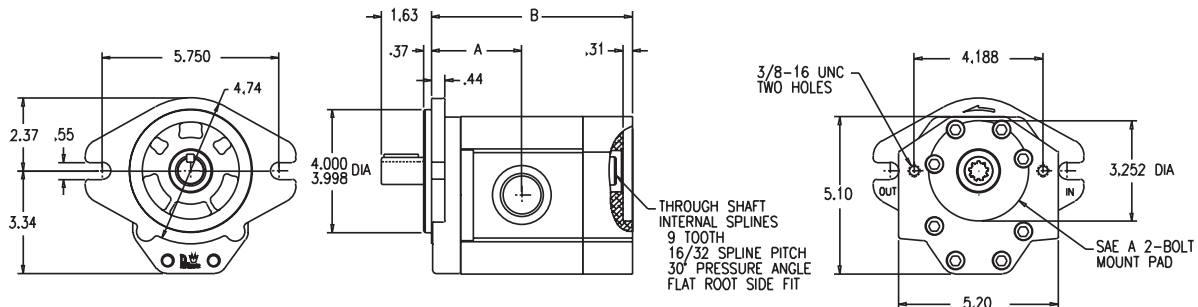
SPD2 as shown from rear

The SPD2 series of pumps are special SP-25A series pumps with through shafts. The through shafts have 9 tooth internal splines at the rear and the pump's rear cover has an integral SAE A-2 bolt mount pad. For double pump operation, a standard SAE A-2 bolt-splined shaft pump can be directly mounted on the rear on the SPD2. Typical performance of the pump is the same as indicated for the SP-25A series pump.

MODEL NO. CODING



SPECIFICATIONS



SPD2 THROUGH SHAFT PUMPS (PLUG-IN STYLE DOUBLE PUMPS)

MODEL NUMBER & DISPLACEMENT CODE	DISP. IN ³ /REV	RATED* PRESSURE (PSI)	MAX RPM	A (IN)	B (IN)	INLET PORT SIZE [°]	OUTLET PORT SIZE [°]	WT. (LB.)
SPD219	1.141	3000	3000	2.49	5.65	1 5/16-12	1 1/16-12	12.9
SPD222	1.349	3000	3000	2.55	5.77	1 5/16-12	1 1/16-12	13.1
SPD227	1.660	3000	3000	2.64	5.95	1 5/16-12	1 1/16-12	13.5
SPD232	2.008	3000	3000	2.74	6.15	1 5/8-12	1 5/16-12	13.9
SPD238	2.318	3000	3000	2.83	6.32	1 5/8-12	1 5/16-12	14.4
SPD244	2.697	3000	3000	2.94	6.54	1 5/8-12	1 5/16-12	14.9
SPD252	3.179	2500	3000	3.07	6.81	1 5/8-12	1 5/16-12	15.7
SPD263	3.869	2500	3000	3.27	7.21	1 7/8-12	1 5/16-12	16.4

[°] Standard ports as indicated are UN-2B straight thread O-Ring boss ports. Optional sizes and configurations are available. Consult factory.
 *Maximum operating pressure may be decreased depending on the displacement and operating pressure of the rear pump. The combination must conform to the following equation $PF \times DF + PR \times DR < 13200$ where PF and PR are the operation pressures (psi) and DF and DR are the displacements (in³/rev) for the front and rear pumps respectively.

SPD1 DOUBLE PUMPS

The SPD1 series of double pumps consists of two SP20B pump sections. The typical performance of each section and the features of the pump are the same as indicated for the SP20B series of pumps.



SPD1 DOUBLE PUMPS

SPD1B 16 09 - 1 H 9 L

BASIC MODEL NO. _____

FRONT PUMP (SHAFT END)
Displacement Code (see chart)

REAR PUMP _____
DISPLACEMENT CODE (SEE CHART)

ROTATION: (FACING END OF SHAFT)

L: COUNTER CLOCKWISE
R: CLOCKWISE

Drive Shaft Code:*

9: SAE 9 TOOTH 16/32 SPLINE
2: SAE 5/8" STRAIGHT KEYED
3 - 11 TOOTH 16/32 SPLINE
4 - 3/4" STRAIGHT KEYED

MOUNTING:

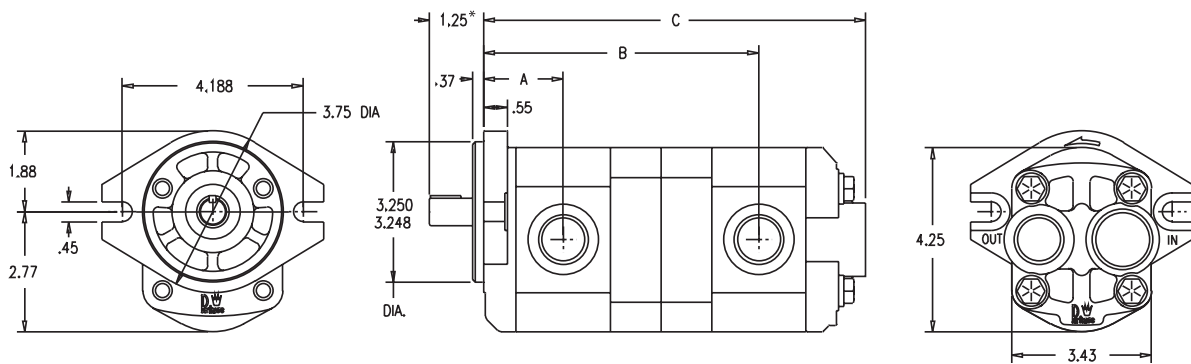
H: 2 BOLT "A" FLANGE

INLET CODE:

1: COMMON INLET (NO REAR INLET)
2: SEPARATE INLET (INLETS-BOTH SECTIONS)

*Pumps with nonstandard shafts available in minimum quantities.

SPD1 DOUBLE PUMPS



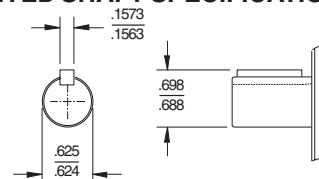
*NOTE 11 TOOTH SPLINED SHAFT (SHAFT CODE 3) WILL HAVE A 1.49 SHAFT EXTENSION.

SPLINED SHAFT SPECIFICATIONS

SHAFT CODE 9
9 Tooth
16/32 DP
30° PA
Flat Root Side Fit

SHAFT CODE 3
11 Tooth
16/32 DP
30° PA
Flat Root Side Fit

KEYED SHAFT SPECIFICATIONS



SPD1 SERIES DOUBLE PUMPS

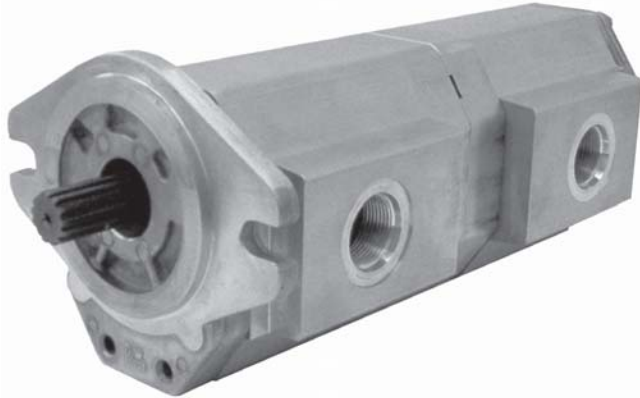
BASIC MODEL NUMBER & DISPLACEMENT CODES	DISPLACEMENT		MAXIMUM PRESSURE		MAXIMUM SPEED RPM	OUTLET PORT ^o SIZE		INLET PORT SIZE ^o SEPARATE INLET PUMP		INLET PORT SIZE ^o COMMON INLET PUMP		PUMP DIMENSIONS			WT. (LBS.)
	FRONT	REAR	FRONT PSI	REAR PSI		FRONT PUMP	REAR PUMP	FRONT PUMP	REAR PUMP	FRONT PUMP	REAR PUMP	A IN.	B IN.	C IN.	
SPD1B 08 08	0.499	0.499	3000	3000	3500	7/8-14	7/8-14	1 1/16-12	1 1/16-12	1 1/16-12	1 1/16-12	1.83	6.35	8.81	11.6
SPD1B 09 08	0.589	0.499	3000	3000	3500	7/8-14	7/8-14	1 1/16-12	1 1/16-12	1 1/16-12	1 1/16-12	1.87	6.43	8.89	11.8
SPD1B 09 09	0.589	0.589	3000	3000	3500	7/8-14	7/8-14	1 1/16-12	1 1/16-12	1 1/16-12	1 1/16-12	1.87	6.46	8.97	12.0
SPD1B 11 08	0.677	0.499	3000	3000	3500+	7/8-14	7/8-14	1 1/16-12	1 1/16-12	1 1/16-12	1 1/16-12	1.91	6.50	8.97	12.0
SPD1B 11 09	0.677	0.589	3000	3000	3500+	7/8-14	7/8-14	1 1/16-12	1 1/16-12	1 1/16-12	1 1/16-12	1.91	6.54	9.05	12.2
SPD1B 11 11	0.677	0.677	3000	3000	3500+	7/8-14	7/8-14	1 1/16-12	1 1/16-12	1 1/16-12	1 1/16-12	1.91	6.58	9.13	12.4
SPD1B 14 08	0.860	0.499	3000	3000	3500	7/8-14	7/8-14	1 1/16-12	1 1/16-12	1 1/16-12	1 1/16-12	1.99	6.66	9.13	12.2
SPD1B 14 09	0.860	0.589	2800*	2800*	3500	7/8-14	7/8-14	1 1/16-12	1 1/16-12	1 1/16-12	1 1/16-12	1.99	6.70	9.21	12.4
SPD1B 14 11	0.860	0.677	2600*	2800*	3500	7/8-14	7/8-14	1 1/16-12	1 1/16-12	1 1/16-12	1 1/16-12	1.99	6.74	9.29	12.6
SPD1B 14 14	0.860	0.860	2400*	2400*	3500	7/8-14	7/8-14	1 1/16-12	1 1/16-12	1 1/16-12	1 1/16-12	1.99	6.82	9.44	12.8
SPD1B 16 08	0.976	0.499	2800*	2800*	3500	7/8-14	7/8-14	1 1/16-12	1 1/16-12	1 1/16-12	1 1/16-12	2.04	6.76	9.23	12.5
SPD1B 16 09	0.976	0.589	2600*	2600*	3500	7/8-14	7/8-14	1 1/16-12	1 1/16-12	1 1/16-12	1 1/16-12	2.04	6.80	9.30	12.7
SPD1B 16 11	0.976	0.677	2400*	2600*	3500	7/8-14	7/8-14	1 1/16-12	1 1/16-12	1 1/16-12	1 1/16-12	2.04	6.84	9.38	12.9
SPD1B 16 14	0.976	0.860	2200*	2400*	3500	7/8-14	7/8-14	1 1/16-12	1 1/16-12	1 1/16-12	1 1/16-12	2.04	6.92	9.54	13.1
SPD1B 16 16	0.976	0.976	2000*	2200*	3500+	7/8-14	7/8-14	1 1/16-12	1 1/16-12	1 1/16-12	1 1/16-12	2.04	6.97	9.64	13.4
SPD1B 20 08	1.220	0.499	2400*	2400*	3500	1 1/16-12	7/8-14	1 1/16-12	1 1/16-12	1 1/16-12	1 1/16-12	2.15	6.98	9.44	12.7
SPD1B 20 09	1.220	0.589	2200*	2400*	3500	1 1/16-12	7/8-14	1 1/16-12	1 1/16-12	1 1/16-12	1 1/16-12	2.15	7.02	9.52	12.9
SPD1B 20 11	1.220	0.677	2200*	2200*	3500	1 1/16-12	7/8-14	1 1/16-12	1 1/16-12	1 1/16-12	1 1/16-12	2.15	7.06	9.60	13.1
SPD1B 20 14	1.220	0.860	2000*	2000*	3500	1 1/16-12	7/8-14	1 1/16-12	1 1/16-12	1 1/16-12	1 1/16-12	2.15	7.13	9.76	13.3
SPD1B 20 16	1.220	0.976	1800*	2000*	3500+	1 1/16-12	7/8-14	1 1/16-12	1 1/16-12	1 1/16-12	1 1/16-12	2.15	7.18	9.86	13.6
SPD1B 20 20	1.220	1.220	1600*	1800*	3500+	1 1/16-12	1 1/16-12	1 1/16-12	1 1/16-12	1 1/16-12	1 1/16-12	2.15	7.29	10.07	13.8
SPD1B 23 08	1.403	0.499	2200*	2200*	3500	1 1/16-12	7/8-14	1 1/16-12	1 1/16-12	1 1/16-12	1 1/16-12	2.23	7.13	9.60	12.9
SPD1B 23 09	1.403	0.589	2000*	2200*	3500	1 1/16-12	7/8-14	1 1/16-12	1 1/16-12	1 1/16-12	1 1/16-12	2.23	7.17	9.68	13.1
SPD1B 23 11	1.403	0.677	2000*	2000*	3500	1 1/16-12	7/8-14	1 1/16-12	1 1/16-12	1 1/16-12	1 1/16-12	2.23	7.21	9.76	13.3
SPD1B 23 14	1.403	0.860	1800*	2000*	3500	1 1/16-12	7/8-14	1 1/16-12	1 1/16-12	1 1/16-12	1 1/16-12	2.23	7.29	9.92	13.5
SPD1B 23 16	1.403	0.976	1800*	1800*	3500	1 1/16-12	7/8-14	1 1/16-12	1 1/16-12	1 1/16-12	1 1/16-12	2.23	7.34	10.01	13.8
SPD1B 23 20	1.403	1.220	1600*	1600*	3500+	1 1/16-12	1 1/16-12	1 1/16-12	1 1/16-12	1 1/16-12	1 1/16-12	2.23	7.45	10.23	14.0
SPD1B 23 23	1.403	1.403	1400*	1600*	3500+	1 1/16-12	1 1/16-12	1 1/16-12	1 1/16-12	1 1/16-12	1 1/16-12	2.23	7.53	10.39	14.2
SPD1B 27 08	1.654	0.499	1800*	2000*	3500	1 1/16-12	7/8-14	1 1/16-12	1 1/16-12	1 1/16-12	1 1/16-12	2.34	7.35	9.82	13.1
SPD1B 27 09	1.654	0.589	1800*	2000*	3500	1 1/16-12	7/8-14	1 1/16-12	1 1/16-12	1 1/16-12	1 1/16-12	2.34	7.39	9.90	13.3
SPD1B 27 11	1.654	0.677	1800*	1800*	3500	1 1/16-12	7/8-14	1 1/16-12	1 1/16-12	1 1/16-12	1 1/16-12	2.34	7.43	9.97	13.5
SPD1B 27 14	1.654	0.860	1600*	1800*	3500	1 1/16-12	7/8-14	1 1/16-12	1 1/16-12	1 1/16-12	1 1/16-12	2.34	7.51	10.13	13.7
SPD1B 27 16	1.654	0.976	1600*	1600*	3500	1 1/16-12	7/8-14	1 1/16-12	1 1/16-12	1 1/16-12	1 1/16-12	2.34	7.56	10.23	14.0
SPD1B 27 20	1.654	1.220	1400*	1600*	3500+	1 1/16-12	1 1/16-12	1 1/16-12	1 1/16-12	1 1/16-12	1 1/16-12	2.34	7.67	10.45	14.2
SPD1B 27 23	1.654	1.403	1400*	1400*	3500+	1 1/16-12	1 1/16-12	1 1/16-12	1 1/16-12	1 1/16-12	1 1/16-12	2.34	7.74	10.60	14.4
SPD1B 27 27	1.654	1.654	1200*	1400*	3500+	1 1/16-12	1 1/16-12	1 1/16-12	1 1/16-12	1 1/16-12	1 1/16-12	2.34	7.85	10.82	14.6

^o Standard ports as indicated are UN-2B straight thread O-Ring boss ports. Optional sizes and configurations are available. Consult factory.

* Different pressure combinations may be used if required provided they conform to the following equation $PF \times DF + PR \times DR < 4150$ where PF and PR are the operating pressures (psi) and DF and DR are the displacements (cu in/rev) for the front and rear pumps respectively (maximum pressures are 3000 psi for displacement codes 8 -20 and 2500 psi for displacement codes 23 - 27).

+ Common inlet pumps require a reduction in maximum rpm. Consult factory.

SPD3 DOUBLE PUMPS



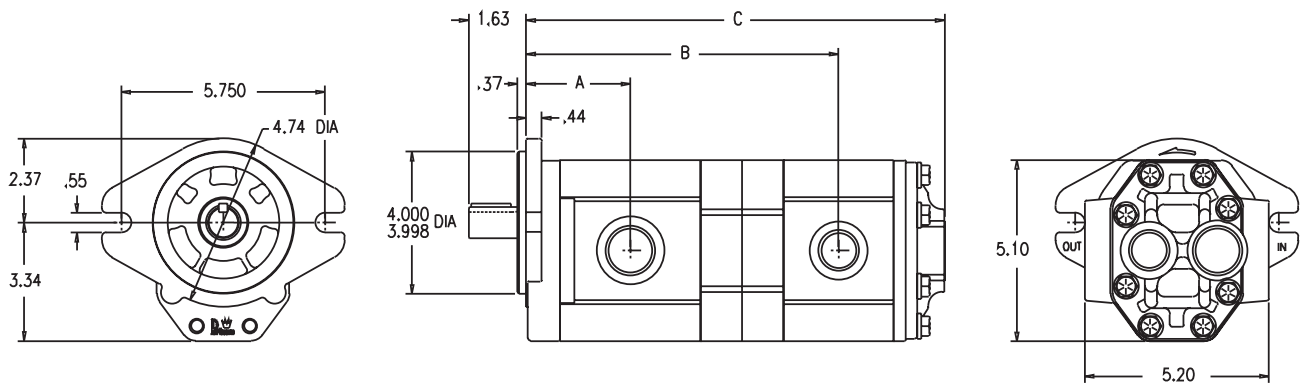
The SPD3 series of double pumps consists of two SP-25A pump sections. The typical performance of each section and the features of the pump are the same as indicated for the SP-25A series of pumps.

MODEL NO. CODING

SPD3 44 22 - 1 H 1 L

<p>BASIC MODEL NO. _____</p> <p>FRONT PUMP (SHAFT END) DISPLACEMENT CODE (SEE CHART) _____</p> <p>REAR PUMP DISPLACEMENT CODE (SEE CHART) _____</p>	<p>ROTATION: (FACING END OF SHAFT) L: COUNTER CLOCKWISE R: CLOCKWISE</p> <p>Drive Shaft Code: 1: SAE 13 TOOTH 16/32 SPLINE 2: SAE 7/8" STRAIGHT KEYEDd</p> <p>MOUNTING: H: 2 BOLT "B" FLANGE</p> <p>INLET CODE: 1: COMMON INLET (NO REAR INLET) 2: SEPARATE INLET (INLETS-BOTH SECTIONS)</p>
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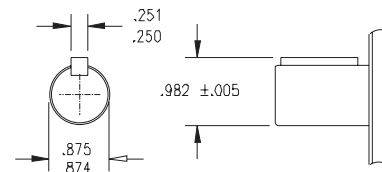
DIMENSIONS



SPLINED SHAFT SPECIFICATIONS

Per SAE Specifications
 13 Tooth
 16/32 Spline Pitch
 30 Degree Pressure Angle
 Flat Root Side Fit

KEYED SHAFT SPECIFICATIONS



SPD3SERIES DOUBLE PUMPS

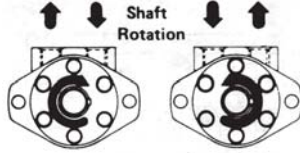
BASIC MODEL NUMBER & DISPLACEMENT CODES	DISPLACEMENT		MAXIMUM PRESSURE		MAXIMUM SPEED RPM	OUTLET PORT ^o SIZE		INLET PORT SIZE ^o SEPARATE INLET PUMP		INLET PORT SIZE ^o COMMON INLET PUMP		PUMP DIMENSIONS			WTL (L.B.)
	FRONT CU/IN/REV	REAR CU/IN/REV	FRONT PSI	REAR PSI		FRONT PUMP	REAR PUMP	FRONT PUMP	REAR PUMP	FRONT PUMP	REAR PUMP	A IN.	B IN.	C IN.	
SPD3 19 19	1.141	1.141	3000	3000	3000	1/1/16-12	1/1/16-12	1/5/16-12	1/5/16-12	1/5/16-12	1/5/16-12	2.49	7.93	10.93	23.3
SPD3 22 19	1.349	1.141	3000	3000	3000	1/1/16-12	1/1/16-12	1/5/16-12	1/5/16-12	1/5/16-12	1/5/16-12	2.55	8.05	11.05	23.5
SPD3 22 22	1.349	1.349	3000	3000	3000	1/1/16-12	1/1/16-12	1/5/16-12	1/5/16-12	1/5/16-12	1/5/16-12	2.55	8.11	11.17	23.7
SPD3 27 19	1.660	1.141	3000	3000	3000	1/1/16-12	1/1/16-12	1/5/16-12	1/5/16-12	1/5/16-12	1/5/16-12	2.64	8.23	11.23	23.9
SPD3 27 22	1.660	1.349	3000	3000	3000	1/1/16-12	1/1/16-12	1/5/16-12	1/5/16-12	1/5/16-12	1/5/16-12	2.64	8.29	11.35	24.1
SPD3 27 27	1.660	1.660	3000	3000	3000	1/1/16-12	1/1/16-12	1/5/16-12	1/5/16-12	1/5/16-12	1/5/16-12	2.64	8.37	11.52	24.5
SPD3 32 19	2.008	1.141	3000	3000	3000	1/5/16-12	1/1/16-12	1/5/16-12	1/5/16-12	1/7/8-12	NONE	2.74	8.42	11.42	24.3
SPD3 32 22	2.008	1.349	3000	3000	3000	1/5/16-12	1/1/16-12	1/5/16-12	1/5/16-12	1/7/8-12	NONE	2.74	8.48	11.54	24.5
SPD3 32 27	2.008	1.660	3000	3000	3000	1/5/16-12	1/1/16-12	1/5/16-12	1/5/16-12	1/7/8-12	NONE	2.74	8.57	11.72	24.9
SPD3 32 32	2.008	2.008	3000	3000	3000	1/5/16-12	1/5/16-12	1/5/16-12	1/5/16-12	1/7/8-12	NONE	2.74	8.67	11.92	25.3
SPD3 38 19	2.318	1.141	3000	3000	3000	1/5/16-12	1/1/16-12	1/5/16-12	1/5/16-12	1/7/8-12	NONE	2.83	8.60	11.60	24.8
SPD3 38 22	2.318	1.349	3000	3000	3000	1/5/16-12	1/1/16-12	1/5/16-12	1/5/16-12	1/7/8-12	NONE	2.83	8.66	11.72	25.0
SPD3 38 27	2.318	1.660	3000	3000	3000	1/5/16-12	1/1/16-12	1/5/16-12	1/5/16-12	1/7/8-12	NONE	2.83	8.75	11.90	25.4
SPD3 38 32	2.318	2.008	3000	3000	3000	1/5/16-12	1/5/16-12	1/5/16-12	1/5/16-12	1/7/8-12	NONE	2.83	8.85	12.09	25.8
SPD3 38 38	2.318	2.318	3000	3000	3000	1/5/16-12	1/5/16-12	1/5/16-12	1/5/16-12	17/8-12	NONE	2.83	8.94	12.27	26.3
SPD3 44 19	2.697	1.141	3000	3000	3000	1/5/16-12	1/1/16-12	1/5/16-12	1/5/16-12	1/7/8-12	NONE	2.94	8.82	11.82	25.3
SPD3 44 22	2.697	1.349	3000	3000	3000	1/5/16-12	1/1/16-12	1/5/16-12	1/5/16-12	1/7/8-12	NONE	2.94	8.88	11.94	25.5
SPD3 44 27	2.697	1.660	3000	3000	3000	1/5/16-12	1/1/16-12	1/5/16-12	1/5/16-12	1/7/8-12	NONE	2.94	8.96	12.11	25.9
SPD3 44 32	2.697	2.008	2900*	2700*	3000	1/5/16-12	1/5/16-12	1/5/16-12	1/5/16-12	1/7/8-12	NONE	2.94	9.06	12.31	26.3
SPD3 44 38	2.697	2.318	2800*	2500*	3000+	1/5/16-12	1/5/16-12	1/5/16-12	1/5/16-12	1/7/8-12	NONE	2.94	9.15	12.49	26.8
SPD3 44 44	2.697	2.697	2600*	2300*	3000+	1/5/16-12	1/5/16-12	1/5/16-12	1/5/16-12	1/7/8-12	NONE	2.94	9.26	12.70	27.3
SPD3 52 19	3.179	1.141	2500	3000	3000	1/5/16-12	1/1/16-12	1/5/16-12	1/5/16-12	1/7/8-12	NONE	3.07	9.09	12.09	26.1
SPD3 52 22	3.179	1.349	2500	3000	3000	1/5/16-12	1/1/16-12	1/5/16-12	1/5/16-12	1/7/8-12	NONE	3.07	9.15	12.21	26.3
SPD 52 27	3.179	1.660	2500	3000	3000	1/5/16-12	1/1/16-12	1/5/16-12	1/5/16-12	1/7/8-12	NONE	3.07	9.24	12.39	26.7
SPD3 52 32	3.179	2.008	2500*	2500*	3000	1/5/16-12	1/5/16-12	1/5/16-12	1/5/16-12	1/7/8-12	NONE	3.07	9.34	12.59	27.1
SPD3 52 38	3.179	2.318	2300*	2500*	3000+	1/5/16-12	1/5/16-12	1/5/16-12	1/5/16-12	1/7/8-12	NONE	3.07	9.43	12.76	27.6
SPD3 52 44	3.179	2.697	2100*	2400*	3000+	1/5/16-12	1/5/16-12	1/5/16-12	1/5/16-12	1/7/8-12	NONE	3.07	9.54	12.98	28.1
SPD3 52 52	3.179	3.179	2000*	2100*	3000+	1/5/16-12	1/5/16-12	1/5/16-12	1/5/16-12	1/7/8-12	NONE	3.07	9.67	13.26	28.9
SPD3 63 19	3.869	1.141	2500*	2900*	3000	1/5/16-12	1/1/16-12	1/7/8-12	1/5/16-12	1/7/8-12	NONE	3.27	9.49	12.49	26.8
SPD3 63 22	3.869	1.349	2500*	2500*	3000	1/5/16-12	1/1/16-12	1/7/8-12	1/5/16-12	1/7/8-12	NONE	3.27	9.55	12.61	27.0
SPD3 63 27	3.869	1.660	2300*	2500*	3000	1/5/16-12	1/1/16-12	1/7/8-12	1/5/16-12	1/7/8-12	NONE	3.27	9.63	12.78	27.4
SPD3 63 32	3.869	2.008	2100*	2500*	3000+	1/5/16-12	1/5/16-12	1/7/8-12	1/5/16-12	1/7/8-12	NONE	3.27	9.73	12.98	27.8
SPD3 63 38	3.869	2.318	2000*	2300*	3000+	1/5/16-12	1/5/16-12	1/7/8-12	1/5/16-12	1/7/8-12	NONE	3.27	9.82	13.16	28.3
SPD3 63 44	3.869	2.697	1900*	2100*	3000+	1/5/16-12	1/5/16-12	1/7/8-12	1/5/16-12	1/7/8-12	NONE	3.27	9.93	13.37	28.8
SPD3 63 52	3.869	3.179	1700*	2000*	3000+	1/5/16-12	1/5/16-12	1/7/8-12	1/5/16-12	1/7/8-12	NONE	3.27	10.07	13.65	29.6
SPD3 63 63	3.869	3.869	1500*	1800*	3000+	1/5/16-12	1/5/16-12	1/7/8-12	1/5/16-12	1/7/8-12	NONE	3.27	10.26	14.04	30.3

^o Standard ports as indicated are UN-2B straight thread 0-Ring boss ports. Optional sizes and configurations are available. Consult factory.

* Different pressure combinations may be used if required provided they conform to the following equation $PF \times DF + PR \times DR < 13200$ where PF and PR are the operating pressures (psi) and DF and DR are the displacements (cu in/rev) for the front and rear pumps respectively (maximum pressures are 3000 psi for displacement codes 19 - 44 and 2500 psi for displacement codes 52 - 63).

+ Common inlet pumps require a reduction in maximum rpm. Consult factory.

ADM SERIES GEROTOR MOTOR – LOW SPEED – HIGH TORQUE



The Prince ADM Series of high-torque, low speed motors incorporates the orbiting gerotor principle for dependable operation over a wide range of applications. Although dimensionally small, this motor is capable of providing considerable power over a wide speed range and is instantly reversible by simply reversing the direction of the hydraulic fluid flow. The needs of many applications requiring high starting, stall and running torque combined with slow speed are met by this motor.

Feature

- Fully reversible simply by reversing the direction of hydraulic fluid flow.
- Alternative port positioning for versatility of installation. (see next page).
- Optional shaft configurations. (see next page).
- Modular construction for economical servicing and repair, also permits special adaptations.

Filtration

10 micron or finer. (Per ISO cleanliness code level 17/14.

APPLICATIONS

Use the ADM Series for light to medium duty applications such as grain augers and elevators, salt and sand spreaders, car wash and sweeper brushes, conveyors, winches, scissor lifts, and many other. To assure optimum motor life, run motor for approximately one hour at 30% of rated pressure before application of full load.

CROSS REFERENCE

CHARLYNN "H" Series
DANFOSS "DH" Series

It is not recommended to operate at a condition requiring both maximum torque and speed. Splined shafts are recommended in application operating at above 2500 in-lbs. continuous torque or under conditions of frequent reversal.

Ordering Code

MOTOR TYPE:
ADM _____

MOTOR SIZE:

50
75
100
150
200
250
300
400

MOUNTING:

2 Hole Flange – 2
4 Hole Flange – 4

SHAFT TYPE:

Standard 1" Key R
1" Splined S
1" Tapered T
1" w/Cross-hole U



PORTS:

P – 1/2 NPTF (Standard)
O – 7/8 x 14 SAE O-Ring Port
T – Manifold Port Face (See Next Page)

END PLATE:

(Blank for Standard)
X – Drain Port (if required)

ADM MOTORS ONLY

ADM	DISPLACEMENT		MAXIMUM PRESSURE				MAXIMUM SPEED		WT. *
	CC/REV	CU.IN/REV	PSI		Kgf/CM ²		RPM		
			CONT	INT ^o	CONT	INT ^o	CONT	INT ^o	
50	49.1	3.0	1400	2200	98	153	800	1000	12.8
75	76.6	4.7	1400	2100	98	146	750	950	13.1
100	99.6	6.1	1300	2000	91	139	600	750	13.4
150	153.2	9.3	1200	1900	84	132	400	500	14.0
200	199.2	12.2	1200	1800	84	125	300	400	14.5
250	252.8	15.3	1100	1700	77	118	250	325	15.0
300	293.2	17.9	1000	1600	70	111	200	250	15.5
400	398.4	24.4	900	1300	63	90	125	160	16.7

Maximum Axial Thrust Load on Shaft 1000 lbs.

^oIntermittent operation = 10% Operation of every minute

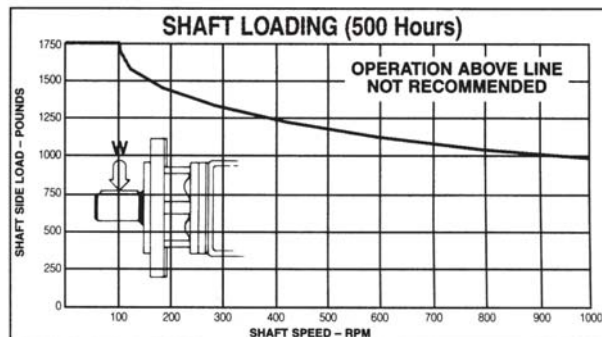
TEMP: NORMAL OPERATING 80° F TO 140° F, MAX 185° F

Maximum inlet pressure 2,500 psi for motors in series

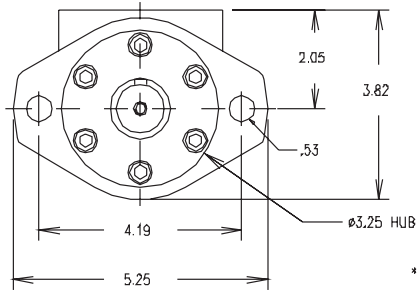
Maximum back pressure 1,000 psi

OIL: Mineral based hydraulic fluid 100-200 SUS @ operating temperature.

ADM SERIES

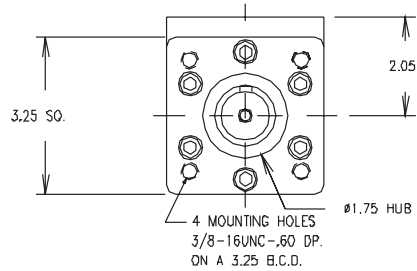


MOUNTING DIMENSIONS ADM



2 BOLT FLANGE

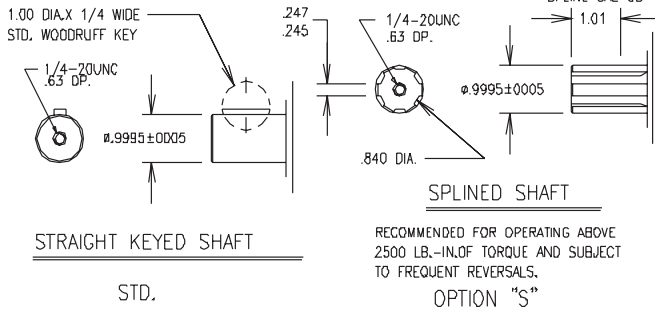
MOUNTING



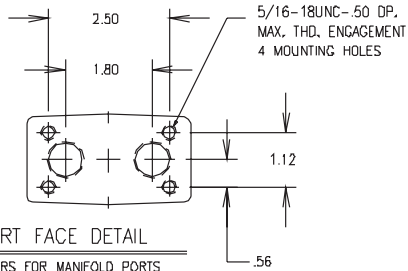
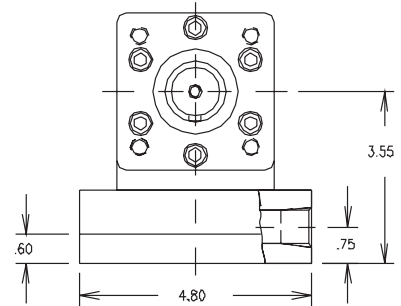
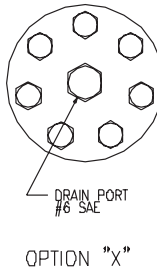
4 BOLT FLANGE

* NOTE: MOUNTING DIMENSIONS ARE THE SAME FOR THE ADM & ABM MOTORS.

SHAFT TYPE



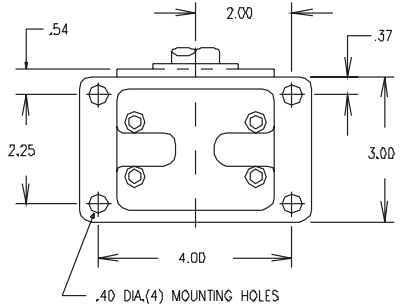
DRAIN PORT (IF REQUIRED)



PORT FACE DETAIL
MOTORS FOR MANIFOLD PORTS OR BASE BLOCK MOUNTING OR CROSS PORT RELIEF VALVE.
OPTION "T"

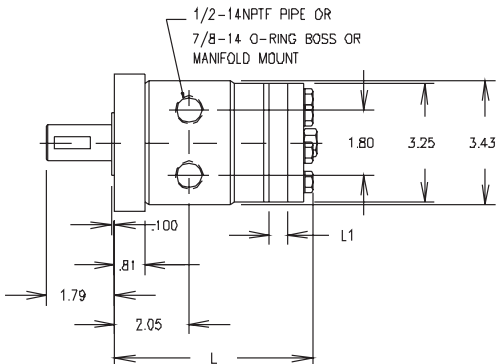
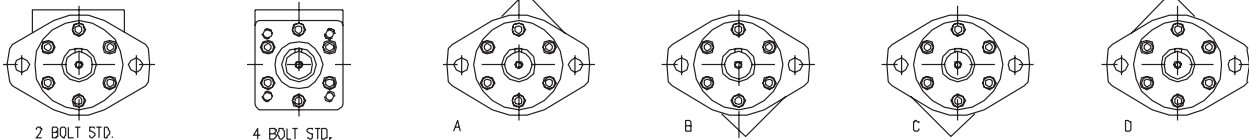
BASE BLOCK MANIFOLD MOUNTING KIT

KIT NO.: 786030001 1/2 NPT PORTS
786030002 #10 SAE PORTS
KIT INCLUDES BASE BLOCK, O-RINGS, AND MOUNTING BOLTS.



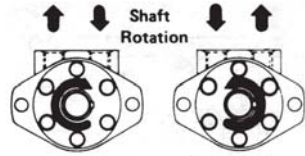
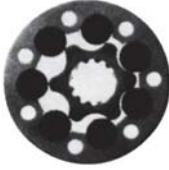
* NOTE: CAN ONLY BE USED ON MOTORS WITH OPTION "T".

PORT POSITIONS



ADM	50	75	100	150	200	250	300	400
L	5.14	5.26	5.40	5.75	5.89	6.14	6.39	6.89
L1	.250	.375	.520	.863	1.00	1.25	1.50	2.00

AEM SERIES ROLLER MOTOR – LOW SPEED – HIGH TORQUE



The Prince AEM Series Motors incorporate the roller principle of operation offering higher torque than the ADM and extended life in heavy-duty continuous high torque operation along with modular, compact construction. Although dimensionally small, this motor is capable of providing considerable power over a wide speed range and is instantly reversible by simply reversing the direction of the hydraulic fluid flow. The needs of many applications requiring high starting, stall and running torque combined with slow speed are met by this motor.

Feature

- Fully reversible simply by reversing the direction of hydraulic fluid flow.
- Alternative port positioning for versatility of installation. (see next page).
- Optional shaft configurations. (specials possible).
- Modular construction for economical servicing and repair, also permits special adaptations.

Filtration

10 micron or finer. (Per ISO cleanliness code level 17/14.

CROSS REFERENCE

CHARLYNN	"S" Series
WHITE	"RS" Series
ROSS-TRW	"MG/MF" Series
DANFOSS	"DS" Series

It is not recommended to operate at a condition requiring both maximum torque and speed. Splined shafts are recommended in application operating at above 2500 in-lbs. continuous torque or under conditions of frequent reversal.

To assure optimum motor life, run motor for approximately one hour at 30% of rated pressure before application of full load.

AEM	DISPLACEMENT CC/REV	CU.IN/REV	MAXIMUM PRESSURE PSI				MAXIMUM SPEED RPM		WT.*
			CONT	INT ^o	CONT	INT ^o	CONT	INT ^o	
75	75.1	4.6	1700	2400	119	167	800	1000	16.0
100	100.1	6.1	1600	2300	112	160	650	800	16.4
150	150.2	9.2	1500	2200	105	153	400	500	17.2
200	200.2	12.2	1400	2000	98	139	300	400	18.0
250	250.3	15.3	1300	1800	91	125	250	325	18.7
300	300.3	18.4	1200	1600	84	111	200	250	19.5
400	400.4	24.4	1200	1400	84	97	125	160	21.1

Ordering Code

MOTOR TYPE:
AEM

MOTOR SIZE:
50
75
100
150
200
250
300
400

MOUNTING:
2 Hole Flange – 2
4 Hole Flange – 4

SHAFT TYPE:
Standard 1" Key R
1" Splined S
1" Tapered T
1" w/Cross-hole U



PORTS:

P – 1/2 NPTF (Standard)
O – 7/8 x 14 SAE O-Ring Port
T – Manifold Port Face (See Next Page)

END PLATE:
(Blank for Standard)

X – Drain Port (if required)

AEM MOTORS ONLY

Maximum Axial Thrust Load on Shaft 1000 lbs.

^oIntermittent operation = 10% Operation of every minute

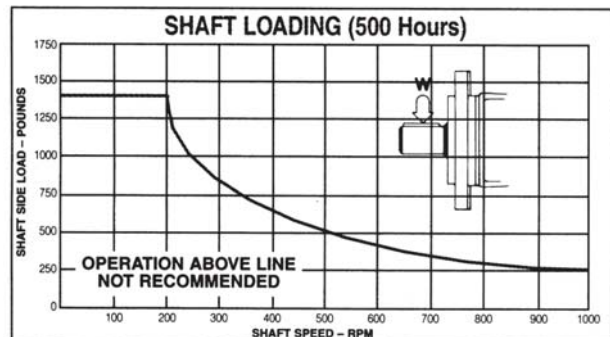
TEMP: NORMAL OPERATING 80° F TO 140° F, MAX 185° F

Maximum inlet pressure 2,500 psi for motors in series

Maximum back pressure 1,000 psi

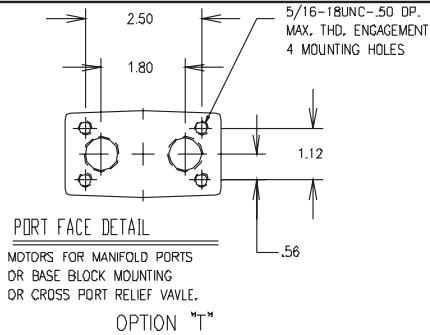
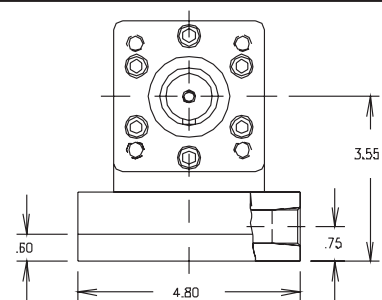
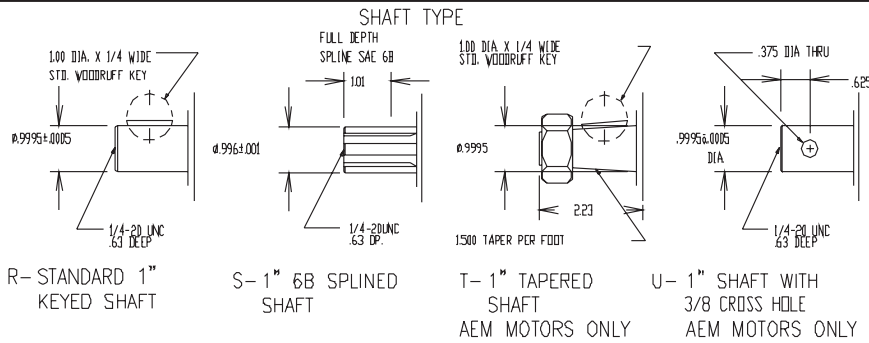
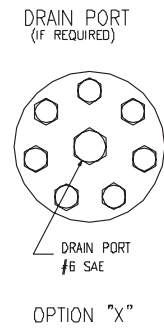
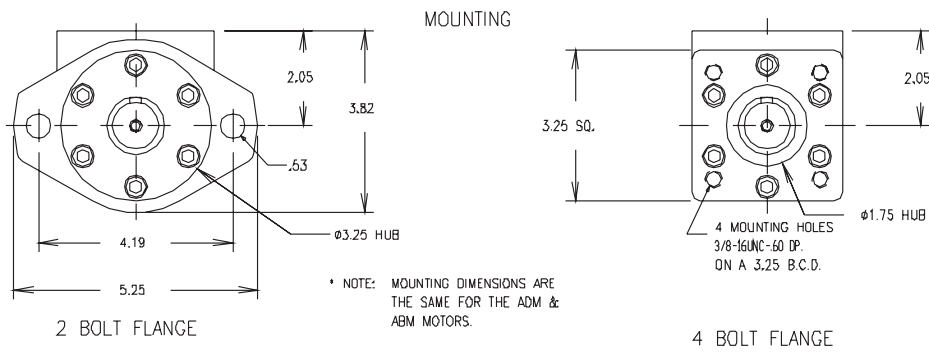
OIL: Mineral based hydraulic fluid 100-200 SUS @ operating temperature.

AEM SERIES



Standard Seal Kit: OHCK-AEM

MOUNTING DIMENSIONS AEM

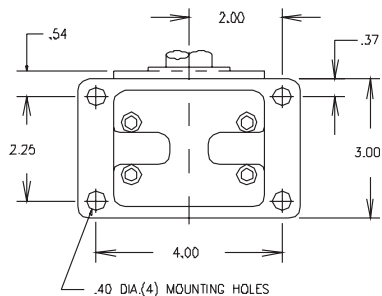


BASE BLOCK MANIFOLD MOUNTING KIT

KIT NO.: 786030001 1/2 NPT PORTS

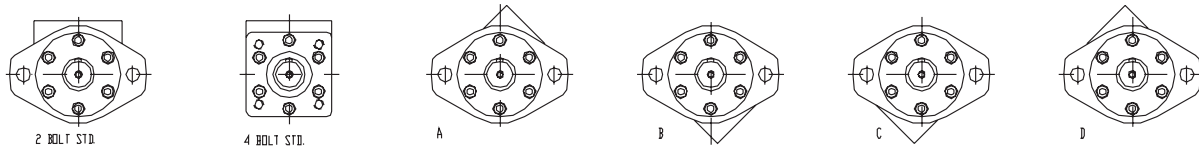
786030002 #10 SAE PORTS

KIT INCLUDES BASE BLOCK, O-RINGS, AND MOUNTING BOLTS.

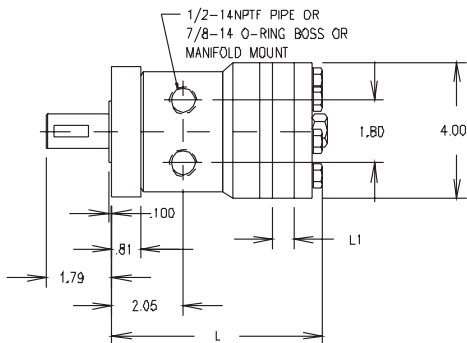


* NOTE: CAN ONLY BE USED ON MOTORS WITH OPTION "T".

FOR OPTIONAL PORT POSITIONS ROTATE MOUNTING FLANGE



AEM SERIES



AEM	75	100	150	200	250	300	400
L	5.44	5.59	5.93	6.07	6.32	6.57	7.07
L1	.375	.520	.863	1.00	1.25	1.50	2.00

ADM SERIES MOTORS

Performance Data

346
280

Colored number on top = TORQUE (in-lbs)
Black number on bottom = SPEED (RPM)

■ GREATEST EFFICIENCY
■ HIGH EFFICIENCY

ADM 50
3.0 Cu. In. REV Δ PSI

GPM	Δ PSI							Peak
	200	400	600	800	1000	1200	1400	
2	69	139	209	279	349	419	489	787
	149	143	137	131	125	119	113	63
4	66	136	206	276	346	416	486	784
	304	298	292	286	280	274	268	218
6	62	132	202	272	342	412	482	780
	459	453	447	441	435	429	423	373
8	55	125	195	265	335	405	475	775
	614	608	602	596	590	584	578	529
10	47	117	187	257	327	397	467	768
	769	763	757	751	745	739	733	684
12	37	107	177	247	317	387	457	758
	924	918	912	906	900	894	888	839

ADM 100
6.07 Cu. In. REV Δ PSI

GPM	Δ PSI							Peak
	200	400	600	800	1000	1200	1400	
2	144	292	440	588	736	884	1032	1950
	72	68	64	60	56	52	48	30
4	138	286	434	582	730	878	1026	1437
	147	143	139	135	131	127	123	105
6	130	278	426	574	722	870	1018	1423
	222	219	216	213	210	207	204	185
8	119	267	415	563	711	859	1007	1412
	300	297	294	291	288	285	282	263
10	104	252	400	548	696	844	992	1397
	375	372	369	366	363	360	357	368
12	85	233	381	529	677	825	973	1378
	452	449	446	443	440	437	434	415
14	64	212	360	508	656	804	952	1357
	528	525	522	519	516	513	510	491

ADM 200
12.15 Cu. In. REV Δ PSI

GPM	Δ PSI					Peak
	200	400	600	800	1000	
2	283	563	843	1123	1403	1650
	35	32	29	26	23	20
4	273	553	833	1113	1393	2305
	74	71	68	65	62	45
6	258	538	818	1098	1378	2290
	112	109	106	103	100	83
8	237	517	797	1077	1357	2269
	149	146	143	140	137	120
10	209	489	769	1049	1329	2241
	187	184	181	178	175	158
12	180	460	740	1020	1300	2112
	225	223	220	217	214	197
14	136	416	696	976	1256	2168
	264	261	258	255	252	235

ADM 300
17.9 Cu. In. REV Δ PSI

GPM	Δ PSI				Peak
	200	400	600	800	
2	426	856	1286	1716	1350
	23	21	18	16	14
4	413	843	1273	1703	2890
	49	46	44	41	27
6	392	822	1252	1682	2865
	75	72	70	67	53
8	362	791	1222	1652	2830
	101	98	95	93	79
10	324	754	1184	1614	2785
	126	124	121	119	105
12	277	707	1137	1567	2735
	152	150	147	144	131
14	222	652	1082	1512	2680
	178	175	173	170	157

ADM 75
4.67 Cu. In. REV Δ PSI

GPM	Δ PSI								Peak
	200	400	600	800	1000	1200	1400	1600	
2	111	219	327	435	543	651	759	867	1138
	93	89	86	82	78	74	70	66	50
4	107	215	323	431	539	647	755	863	1134
	193	189	185	181	177	173	169	165	149
6	100	208	316	424	532	640	748	856	1127
	293	289	285	281	277	273	269	265	249
8	90	198	306	414	522	630	738	846	1117
	393	389	385	381	377	373	369	365	349
10	78	186	294	402	510	618	726	834	1105
	493	489	485	481	477	473	469	465	449
12	52	170	278	386	494	602	710	818	1089
	591	587	583	579	575	571	567	563	547
14	45	153	261	369	477	585	693	801	1072
	691	687	683	679	675	671	667	663	647

ADM 150
9.37 Cu. In. REV Δ PSI

GPM	Δ PSI							Peak
	200	400	600	800	1000	1200	1400	
2	221	467	713	959	1205	1451	1697	2193
	46	43	40	37	34	31	28	15
4	214	460	706	952	1198	1444	1690	2186
	95	92	89	86	83	80	77	64
6	202	448	694	940	1186	1432	1678	2174
	145	142	139	136	133	130	127	114
8	186	432	678	924	1170	1416	1662	2158
	194	191	188	185	182	179	176	163
10	164	410	656	902	1148	1394	1640	2136
	242	239	236	233	230	227	224	211
12	137	383	629	875	1121	1367	1613	2109
	291	288	285	282	279	276	273	260
14	106	352	598	844	1090	1336	1582	2078
	340	337	334	331	328	325	322	309

ADM 250
15.25 Cu. In. REV Δ PSI

GPM	Δ PSI					Peak
	200	400	600	800	1000	
2	357	711	1065	1419	1773	1500
	27	24	21	19	16	14
4	346	700	1054	1408	1762	2647
	58	55	53	50	47	33
6	327	681	1035	1389	1743	2628
	88	85	83	80	77	63
8	301	655	1009	1363	1717	2602
	119	116	114	111	108	94
10	267	621	975	1529	1683	2037
	149	146	143	141	137	123
12	225	570	924	1278	1632	2517
	179	176	173	171	168	154
14	176	530	884	1238	1592	2477
	210	207	205	202	199	185

ADM 400
24.4 Cu. In. REV Δ PSI

GPM	Δ PSI				Peak
	200	400	600	800	
2	565	1136	1707	2279	1200
	16	14	12	10	9
4	549	1120	1691	2262	3392
	36	33	31	29	20
6	520	1091	1653	2229	3371
	55	53	51	48	39
8	481	1053	1624	2195	3355
	74	73	70	68	59
10	430	1002	1573	2144	3274
	94	91	89	86	77
12	368	939	1511	2082	3213
	113	111	108	106	97
14	296	867	1438	2009	3147
	132	130	127	125	116

Δ PSI – is the actual pressure difference between the inlet and outlet ports.

A SITUATION OF SIMULTANEOUS PEAK TORQUE AND MAXIMUM RPM SHOULD NOT BE ALLOWED TO OCCUR.

Splined shafts are recommended in applications that operate at torques higher than 2500 in-lbs. Operating motors at both low rpm (10-20 depending on disp) and low torque may result in rpm fluctuations during operation.

To calculate horsepower from chart data use formula: HP (out) = RPM x TORQUE (in-lbs).

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AEM SERIES MOTORS

Colored number on top = TORQUE (in-lbs)
Black number on bottom = SPEED (RPM)

	GREATEST EFFICIENCY
	HIGH EFFICIENCY

Performance Data

The performance charts reproduced on these pages indicate normal performance characteristics for the size motors indicated. Through use of the horizontal scale – GPM – correct motor size can be determined for specific applications. Interpolation may be used for numbers not given in these charts.

To assure optimum motor life, run motor for approximately one hour at 30% of rated pressure before application of full load. Be sure motor is filled with fluid prior to any load applications.

These are typical motor performances and actual data may vary slightly from unit in production.

AEM 75

GPM	5.59 Cu. In. REV								Peak	
	100	300	500	700	900	1100	1300	1500		1700
1	54	108	238	358	468	578	678	778	*	2400
	50	47	43	37	31	25	19	12		*
3	49	140	282	410	542	684	815	945	1075	1512
	148	144	139	134	130	126	122	117	108	59
5	41	162	302	432	562	702	837	972	1102	1555
	248	247	242	236	232	225	217	210	201	153
7	30	162	302	432	568	707	842	983	1112	1577
	346	344	340	335	328	320	312	302	293	250
9	13	151	301	423	562	698	840	974	1091	1544
	444	443	400	434	427	420	410	400	390	323
11	130	275	408	545	680	826	950	1075		**
	542	538	533	526	518	509	499	498		**
13	108	253	389	526	660	807	940	1071		**
	641	638	633	627	618	609	598	589		**
15	81	227	365	518	637	786	918	1059		**
	739	733	727	719	710	700	691	**		**

AEM 100

GPM	6.12 Cu. In. REV									Peak
	100	300	500	700	900	1100	1300	1500	1600	
1	74	221	389	546	714	872	1029			2400
	37	35	32	27	21	15	10	†	†	†
3	84	231	410	567	746	913	1082	1239	1323	1869
	109	107	104	100	96	90	85	77	69	37
5	74	231	410	578	756	924	1092	1260	1344	1964
	183	181	178	174	170	164	157	149	142	107
7	63	221	399	567	746	914	1092	1260	1334	2016
	257	257	252	247	242	238	228	223	214	176
9	42	200	389	557	735	903	1071	1239	1334	2016
	333	328	323	318	313	309	304	295	285	242
11	179	357	525	704	882	1050	1218	1314		**
	404	399	394	390	383	377	370	362		**
13	147	336	504	683	850	1029	1187	1281		**
	473	470	466	461	456	451	442	437		**
15	116	310	473	641	809	987	1165			**
	551	546	542	537	532	523	513	**		**

AEM 150

GPM	9.18 Cu. In. REV								Peak	
	100	300	500	700	900	1100	1300	1500		2200
1	114	361	599	836	†	†	†	†	†	†
	24	23	20	17						
3	114	380	627	874	1121	1378	1634	1881	2696	†
	74	71	69	67	63	59	55	50	37	2636
5	105	371	618	884	1131	1387	1634	1881	2736	†
	121	121	119	117	114	110	106	102	81	2736
7	95	352	599	865	1112	1378	1634	1862	2736	†
	171	169	168	165	161	156	154	150	127	2736
9	67	323	570	836	1093	1349	1596	1843	2717	†
	219	217	215	213	209	205	201	196	175	2717
11	276	532	808	1055	1311	1558	1824	247	2679	†
	268	268	263	263	263	257	252	247	226	2679
13	238	494	760	1055	1264	1501	1768	†	†	**
	315	315	310	305	299	294	289	†	†	**
15	181	447	713	960	1216	1463	1729	†	†	**
	368	362	362	357	352	347	341	†	†	**

AEM 200

GPM	12.23 Cu. In. REV								Peak	
	100	300	500	700	900	1100	1300	1400		
1	140	441	788	1091	*	*	*	*	*	2000
	18	17	15	11						
3	140	464	810	1123	1447	1771	2009	2246	3197	†
	55	55	53	52	50	46	44	42	28	3380
5	130	464	799	1123	1447	1771	2030	2268	3380	†
	93	93	90	88	88	85	81	81	64	3413
7	97	454	767	1102	1426	1728	2030	2246	3413	†
	130	130	126	124	122	121	119	117	102	3380
9	54	432	745	1080	1392	1706	2009	2225	3380	†
	167	165	163	161	159	157	155	154	137	3348
11	356	702	1037	1350	1663	1964	2160	†	†	**
	202	202	198	198	193	193	193	175	†	**
13	324	702	994	1307	1609	1922	2177	†	†	**
	239	239	239	235	230	230	225	†	†	**
15	270	605	929	1253	1566	1879	2052	†	†	**
	276	276	271	271	267	262	262	†	†	**

AEM 250

GPM	15.26 Cu. In. REV								Peak	
	100	300	500	700	900	1100	1200	1800		
1	173	572	940	1372	†	†	†	†	†	†
	15	14	13	10						
3	194	605	983	1415	1782	2138	2344	3521	†	†
	44	42	40	38	36	34	32	21	†	†
5	151	605	1015	1415	1793	2203	2408	3629	†	†
	74	72	72	70	66	64	62	52	†	†
7	140	572	983	1393	1782	2203	2419	3629	†	†
	104	102	100	98	95	92	90	81	†	†
9	86	518	940	1350	1739	2160	2396	3629	†	†
	133	131	129	128	125	122	120	108	†	†
11	464	886	1307	1696	2117	2344	3596	†	†	**
	161	159	157	154	152	150	137	†	†	**
13	400	821	1242	1652	2052	2290	3769	†	†	**
	193	189	189	184	179	175	166	†	†	**
15	324	756	1188	1598	1987	2214	†	†	†	**
	221	216	216	212	207	202	†	†	†	**

AEM 300

GPM	18.35 Cu. In. REV								Peak	
	100	300	500	700	900	1100	1200	2000		
1	216	680	1145	1566	2009	†	†	†	†	†
	12	11	10	8	6					
3	194	702	1210	1685	2138	2614	2873	3812	†	†
	37	36	35	34	33	25	20	9	†	†
5	162	680	1231	1706	2160	2657	2894	3845	†	†
	63	61	61	59	57	53	50	35	†	†
7	130	659	1199	1685	2138	2635	2873	3845	†	†
	86	85	83	81	79	75	72	61	†	†
9	81	616	1156	1642	2117	2570	2830	3812	†	†
	111	110	109	107	103	99	93	81	†	†
11	11	572	1091	1577	2030	2527	2756	3737	†	†
	137	135	133	131	128	126	121	111	†	†
13	508	1015	1490	1966	2441	2678	3661	†	†	**
	159	157	154	152	148	144	133	†	†	**
15	454	940	1426	1901	2354	2614	3596	†	†	**
	154	181	179	177	174	172	161	†	†	**

AEM 400

GPM	24.43 Cu. In. REV								Peak	
	100	300	500	700	900	1100	1200	1300		
1	281	702	1377	2001	†	†	†	†	†	†
	9	8	7	5						
3	254	783	1539	2182	2786	3413	3737	4104	†	†
	28	27	26	22	17	9	5	†	†	†
5	205	810	1566	2225	2851	3445	3769	4104	†	†
	46	45	44	43	39	34	29	24	†	†
7	151	788	1544	2203	2830	3413	3737	4061	†	†
	64	64	63	63	59	55	52	48	†	†
9	86	745	1485	2138	2765	3380	3704	4028	†	†
	83	83	81	79	77	73	71	68	†	†
11	22	691	1426	2074	2678	3305	3629	3953	†	†
	102	101	100	98	96	92	89	86	†	†
13	626	1323	1987	2592	3197	3521	3845	†	†	**
	121	120	119	117	109	107	104	†	†	**
15	540	1215	1901	2484	3121	3413	3737	†	†	**
	139	137	135	133	130	126	121	†	†	**

† LESS THAN 5 RPM * LESS THAN 10 RPM ** OPERATION UNDER THESE CONDITIONS NOT RECOMMENDED

ADM SERIES HYDRAULIC MOTOR CROSS REFERENCE

DISPLACEMENT CU. IN./REV.													
	SHAFT	PORTS	MOTOR BRAND	2.9	4.4	6.1	10.1	11.7	14.6	17.5	23.4		
4 BOLT FLANGE MOUNTING	WOODRUFF KEYS	1/2" NPT	PRINCE	ADM50-4RP 101-1001 151-2121	ADM75-4RP 101-1002 151-2122	ADM100-4RP 101-1003 151-2123	ADM150-4RP 101-1004 151-2125	ADM200-4RP 101-1005 151-2126	ADM250-4RP 101-1006 151-2127	ADM300-4RP 101-1007 151-2128	ADM400-4RP 101-1008 151-2129		
			DANFOSS DH	ADM50-4RO 101-1009 151-2041	ADM75-4RO 101-1010 151-2042	ADM100-4RO 101-1011 151-2043	ADM150-4RO 101-1012 151-2045	ADM200-4RO 101-1021 151-2046	ADM250-4RO 101-1014 151-2047	ADM300-4RO 101-1015 151-2048	ADM400-4RO 101-1016 151-2049		
		MANIFOLD	PRINCE	ADM50-4RT 101-1017 151-2201	ADM75-4RT 101-1018 151-2202	ADM100-4RT 101-1019 151-2203	ADM150-4RT 101-1020 151-2205	ADM200-4RT 101-1021 151-2206	ADM250-4RT 101-1022 151-2207	ADM300-4RT 101-1023 151-2208	ADM400-4RT 101-1024 151-2209		
			DANFOSS DH	ADM50-4SP 101-1049 151-2131	ADM75-4SP 101-1050 151-2132	ADM100-4SP 101-1051 151-2133	ADM150-4SP 101-1052 151-2135	ADM200-4SP 101-1053 151-2136	ADM250-4SP 101-1054 151-2137	ADM300-4SP 101-1055 151-2138	ADM400-4SP 101-1056 151-2139		
		SPLINED	#10 SAE	PRINCE	ADM50-4SO 101-1057 151-2051	ADM75-4SO 101-1058 151-2052	ADM100-4SO 101-1059 151-2053	ADM150-4SO 101-1060 151-2055	ADM200-4SO 101-1061 151-2056	ADM250-4SO 101-1062 151-2057	ADM300-4SO 101-1063 151-2058	ADM400-4SO 101-1064 151-2059	
				DANFOSS DH	ADM50-4ST 101-1065 151-2211	ADM75-4ST 101-1066 151-2212	ADM100-4ST 101-1067 151-2213	ADM150-4ST 101-1068 151-2215	ADM200-4ST 101-1069 151-2216	ADM250-4ST 101-1070 151-2217	ADM300-4ST 101-1071 151-2218	ADM400-4ST 101-1072 151-2219	
	2 BOLT FLANGE MOUNTING	WOODRUFF KEYS	1/2" NPT	PRINCE	ADM50-2RP 101-1025 151-2081	ADM75-2RP 101-1026 151-2082	ADM100-2RP 101-1027 151-2083	ADM150-2RP 101-1028 151-2085	ADM200-2RP 101-1029 151-2086	ADM250-2RP 101-1030 151-2087	ADM300-2RP 101-1031 151-2088	ADM400-2RP 101-1032 151-2089	
				DANFOSS DH	ADM50-2RO 101-1033 151-2001	ADM75-2RO 101-1034 151-2002	ADM100-2RO 101-1035 151-2003	ADM150-2RO 101-1036 151-2005	ADM200-2RO 101-1037 151-2006	ADM250-2RO 101-1038 151-2007	ADM300-2RO 101-1039 151-2008	ADM400-2RO 101-1040 151-2009	
			MANIFOLD	PRINCE	ADM50-2RT 101-1041 151-2161	ADM75-2RT 101-1042 151-2162	ADM100-2RT 101-1043 151-2163	ADM150-2RT 101-1044 151-2165	ADM200-2RT 101-1045 151-2166	ADM250-2RT 101-1046 151-2167	ADM300-2RT 101-1047 151-2168	ADM400-2RT 101-1048 151-2169	
				DANFOSS DH	ADM50-2SP 101-1073 151-2091	ADM75-2SP 101-1074 151-2092	ADM100-2SP 101-1075 151-2093	ADM150-2SP 101-1076 151-2095	ADM200-2SP 101-1077 151-2096	ADM250-2SP 101-1078 151-2097	ADM300-2SP 101-1079 151-2098	ADM400-2SP 101-1080 151-2099	
			SPLINED	#10 SAE	PRINCE	ADM50-2SO 101-1081 151-2011	ADM75-2SO 101-1082 151-2012	ADM100-2SO 101-1083 151-2013	ADM150-2SO 101-1084 151-2015	ADM200-2SO 101-1085 151-2016	ADM250-2SO 101-1086 151-2017	ADM300-2SO 101-1087 151-2018	ADM400-2SO 101-1088 151-2019
					DANFOSS DH	ADM50-2ST 101-1089 151-2171	ADM75-2ST 101-1090 151-2172	ADM100-2ST 101-1091 151-2173	ADM150-2ST 101-1092 151-2175	ADM200-2ST 101-1093 151-2176	ADM250-2ST 101-1094 151-2177	ADM300-2ST 101-1095 151-2178	ADM400-2ST 101-1096 151-2179

NOTE: THE CROSS REFERENCE INFORMATION IN THIS CHART IS TO BE USED ONLY AS A REFERENCE FOR GUIDELINE PURPOSES ONLY. AFTER SELECTING A MODEL FROM ABOVE, REVIEW THE MOTOR SPECIFICATIONS TO DETERMINE COMPATIBILITY WITH SPECIFIC APPLICATION.

AEM SERIES HYDRAULIC MOTOR CROSS REFERENCE

		DISPLACEMENT CU. IN./REV.									
	SHAFT	PORTS	MOTOR BRAND	4.2	5.9	9.7	11.3	14.1	16.9	22.5	
4 BOLT FLANGE MOUNTING	WOODRUFF KEVED	1/2" NPT	PRINCE CHARLYNNS ROSS	AEM75-4RP 103-1002 MG05-13-10 RS-04010100	AEM100-4RP 103-1003 MG06-13-10 RS-06010100	AEM150-4RP 103-1004 MG10-09-10 RS-10010100	AEM200-4RP 103-1005 MG12-13-10 RS-12010100	AEM250-4RP 103-1006 MG16-13-107 RS-14010100	AEM300-4RP 103-1007 MG18-13-10 RS-18010100	AEM400-4RP 103-1008 MG24-13-10 RS-24010100	
			DANFOSS DS	AEM75-4RO 103-1010 MG05-09-10 RS-04020100	AEM100-4RO 103-1011 MG06-09-10 RS-06020100	AEM150-4RO 103-1012 MG10-09-10 RS-10020100	AEM200-4RO 103-1013 MG12-09-10 RS-12020100	AEM250-4RO 103-1014 MG16-09-10 RS-14020100	AEM300-4RO 103-1015 MG18-09-108 RS-18020100	AEM400-4RO 103-1016 MG24-09-10 RS-24020100	
			PRINCE CHARLYNNS ROSS	AEM75-4RT 103-1018 MG05-11-10 RS-04050100	AEM100-4RT 103-1019 MG06-11-10 RS-06050100	AEM150-4RT 103-1020 MG10-11-10 RS-10050100	AEM200-4RT 103-1021 MG12-11-10 RS-12050100	AEM250-4RT 103-1022 MG16-11-10 RS-14050100	AEM300-4RT 103-1023 MG18-11-10 RS-18050100	AEM400-4RT 103-1024 MG24-11-10 RS-24050100	
		MANIFOLD	PRINCE CHARLYNNS ROSS	AEM75-4SP 103-1050 MG05-13-11 RS-04010600	AEM100-4SP 103-1051 MG06-13-11 RS-06010600	AEM150-4SP 103-1052 MG10-13-11 RS-10010600	AEM200-4SP 103-1053 MG12-13-11 RS-12010600	AEM250-4SP 103-1054 MG16-13-11 RS-14010600	AEM300-4SP 103-1055 MG18-13-11 RS-18010600	AEM400-4SP 103-1056 MG24-13-11 RS-24010600	
			DANFOSS DS	AEM75-4SO 103-1058 MG05-09-11 RS-06020600	AEM100-4SO 103-1059 MG06-09-11 RS-06020600	AEM150-4SO 103-1060 MG10-09-11 RS-10020600	AEM200-4SO 103-1061 MG12-09-11 RS-12020600	AEM250-4SO 103-1062 MG16-09-11 RS-14020600	AEM300-4SO 103-1063 MG18-09-11 RS-18020600	AEM400-4SO 103-1064 MG24-09-11 RS-24020600	
			PRINCE CHARLYNNS ROSS	AEM75-4ST 103-1066 MG05-11-11 RS-04050600	AEM100-4ST 103-1067 MG06-11-11 RS-06050600	AEM150-4ST 103-1068 MG10-11-11 RS-10050600	AEM200-4ST 103-1069 MG12-11-11 RS-12050600	AEM250-4ST 103-1070 MG16-11-11 RS-14050600	AEM300-4ST 103-1071 MG18-11-11 RS-18050600	AEM400-4ST 103-1072 MG24-11-11 RS-24050600	
	SPLINED	1/2" NPT	PRINCE CHARLYNNS ROSS	AEM75-2RP 103-1026 MG05-12-10 RS-04030100	AEM100-2RP 103-1027 MG06-12-10 RS-06030100	AEM150-2RP 103-1028 MG10-12-10 RS-10030100	AEM200-2RP 103-1029 MG12-12-10 RS-12030100	AEM250-2RP 103-1030 MG16-12-10 RS-14030100	AEM300-2RP 103-1031 MG18-12-10 RS-18030100	AEM400-2RP 103-1032 MG24-12-10 RS-24030100	
			DANFOSS DS	AEM75-2RO 103-1034 MG05-06-10 RS-04040100	AEM100-2RO 103-1035 MG06-06-10 RS-06040100	AEM150-2RO 103-1036 MG10-06-10 RS-10040100	AEM200-2RO 103-1037 MG12-06-10 RS-12040100	AEM250-2RO 103-1038 MG16-06-10 RS-14040100	AEM300-2RO 103-1039 MG18-06-10 RS-18040100	AEM400-2RO 103-1040 MG24-06-10 RS-24040100	
			PRINCE CHARLYNNS ROSS	AEM75-2RT 103-1042 MG05-10-10 RS-04060100	AEM100-2RT 103-1043 MG06-10-10 RS-06060100	AEM150-2RT 103-1044 MG10-10-10 RS-10060100	AEM200-2RT 103-1045 MG12-10-10 RS-12060100	AEM250-2RT 103-1046 MG16-10-10 RS-14060100	AEM300-2RT 103-1047 MG18-10-10 RS-18060100	AEM400-2RT 103-1048 MG24-10-10 RS-24060100	
		MANIFOLD	PRINCE CHARLYNNS ROSS	AEM75-2SP 103-1074 MG05-12-11 RS-04030600	AEM100-2SP 103-1075 MG06-12-11 RS-06030600	AEM150-2SP 103-1076 MG10-12-11 RS-10030600	AEM200-2SP 103-1077 MG12-12-11 RS-12030600	AEM250-2SP 103-1078 MG16-12-11 RS-14030600	AEM300-2SP 103-1079 MG18-12-11 RS-18030600	AEM400-2SP 103-1080 MG24-12-11 RS-24030600	
			DANFOSS DS	AEM75-2SO 103-1082 MG05-06-11 RS-04040600	AEM100-2SO 103-1083 MG06-06-11 RS-06040600	AEM150-2SO 103-1084 MG10-06-11 RS-10040600	AEM200-2SO 103-1085 MG12-06-11 RS-12040600	AEM250-2SO 103-1086 MG16-06-11 RS-14040600	AEM300-2SO 103-1087 MG18-06-11 RS-18040600	AEM400-2SO 103-1088 MG24-06-11 RS-24040600	
			PRINCE CHARLYNNS ROSS	AEM75-2ST 103-1090 MG05-10-11 RS-04060600	AEM100-2ST 103-1091 MG06-10-11 RS-06060600	AEM150-2ST 103-1092 MG10-10-11 RS-10060600	AEM200-2ST 103-1093 MG12-10-11 RS-12060600	AEM250-2ST 103-1094 MG16-10-11 RS-14060600	AEM300-2ST 103-1095 MG18-10-11 RS-18060600	AEM400-2ST 103-1096 MG24-10-11 RS-24060600	
2 BOLT FLANGE MOUNTING	SPLINED	#10 SAE	PRINCE CHARLYNNS ROSS	AEM75-2RP 103-1074 MG05-12-11 RS-04030600	AEM100-2RP 103-1075 MG06-12-11 RS-06030600	AEM150-2RP 103-1076 MG10-12-11 RS-10030600	AEM200-2RP 103-1077 MG12-12-11 RS-12030600	AEM250-2RP 103-1078 MG16-12-11 RS-14030600	AEM300-2RP 103-1079 MG18-12-11 RS-18030600	AEM400-2RP 103-1080 MG24-12-11 RS-24030600	
			DANFOSS DS	AEM75-2SO 103-1082 MG05-06-11 RS-04040600	AEM100-2SO 103-1083 MG06-06-11 RS-06040600	AEM150-2SO 103-1084 MG10-06-11 RS-10040600	AEM200-2SO 103-1085 MG12-06-11 RS-12040600	AEM250-2SO 103-1086 MG16-06-11 RS-14040600	AEM300-2SO 103-1087 MG18-06-11 RS-18040600	AEM400-2SO 103-1088 MG24-06-11 RS-24040600	
			PRINCE CHARLYNNS ROSS	AEM75-2ST 103-1090 MG05-10-11 RS-04060600	AEM100-2ST 103-1091 MG06-10-11 RS-06060600	AEM150-2ST 103-1092 MG10-10-11 RS-10060600	AEM200-2ST 103-1093 MG12-10-11 RS-12060600	AEM250-2ST 103-1094 MG16-10-11 RS-14060600	AEM300-2ST 103-1095 MG18-10-11 RS-18060600	AEM400-2ST 103-1096 MG24-10-11 RS-24060600	
	MANIFOLD	PRINCE CHARLYNNS ROSS	AEM75-4RP 103-1002 MG05-13-10 RS-04010100	AEM100-4RP 103-1003 MG06-13-10 RS-06010100	AEM150-4RP 103-1004 MG10-09-10 RS-10010100	AEM200-4RP 103-1005 MG12-13-10 RS-12010100	AEM250-4RP 103-1006 MG16-13-107 RS-14010100	AEM300-4RP 103-1007 MG18-13-10 RS-18010100	AEM400-4RP 103-1008 MG24-13-10 RS-24010100		
		DANFOSS DS	AEM75-4RO 103-1010 MG05-09-10 RS-04020100	AEM100-4RO 103-1011 MG06-09-10 RS-06020100	AEM150-4RO 103-1012 MG10-09-10 RS-10020100	AEM200-4RO 103-1013 MG12-09-10 RS-12020100	AEM250-4RO 103-1014 MG16-09-10 RS-14020100	AEM300-4RO 103-1015 MG18-09-108 RS-18020100	AEM400-4RO 103-1016 MG24-09-10 RS-24020100		
		PRINCE CHARLYNNS ROSS	AEM75-4RT 103-1018 MG05-11-10 RS-04050100	AEM100-4RT 103-1019 MG06-11-10 RS-06050100	AEM150-4RT 103-1020 MG10-11-10 RS-10050100	AEM200-4RT 103-1021 MG12-11-10 RS-12050100	AEM250-4RT 103-1022 MG16-11-10 RS-14050100	AEM300-4RT 103-1023 MG18-11-10 RS-18050100	AEM400-4RT 103-1024 MG24-11-10 RS-24050100		

NOTE: THE CROSS REFERENCE INFORMATION IN THIS CHART IS TO BE USED ONLY AS A REFERENCE FOR GUIDELINE PURPOSES ONLY. AFTER SELECTING A MODEL FROM ABOVE, REVIEW THE MOTOR SPECIFICATIONS TO DETERMINE COMPATIBILITY WITH SPECIFIC APPLICATION.

NOTE: THE ROSS "MF" SERIES TO THE PRINCE "ACW" SERIES. THE CODING AFTER THE "MF" AND "ACW" IS THE SAME AS AFTER THE "MG" AND "AEM" AS SHOWN IN THE TABLE ABOVE.

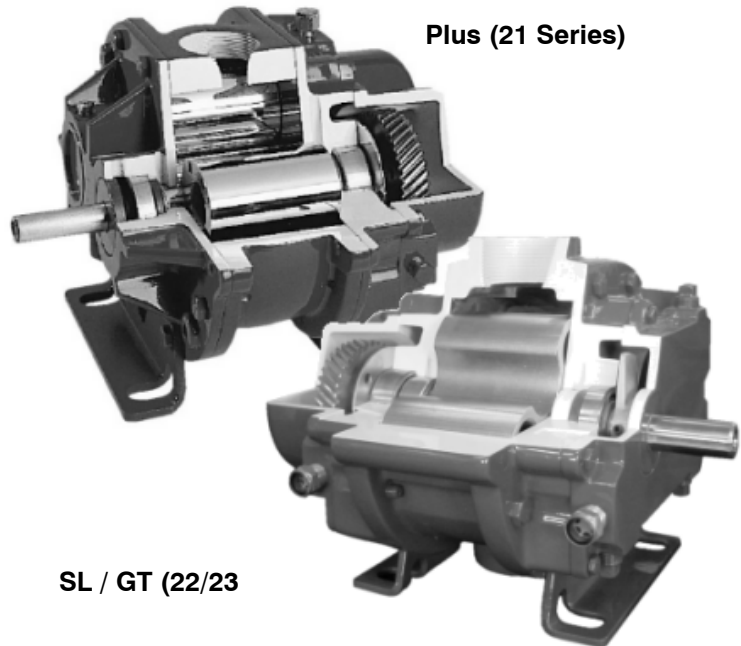
M-D Pneumatics™

COMPETITOR®

Rotary Positive Displacement Air & Gas Blowers

SERIES : 21 – Grease Lubrication / Air Service (Plus)
22 – Splash Lubrication / Air Service (SL)
23 – Splash Lubrication / Gas Service (GT)

INSTALLATION OPERATION MAINTENANCE REPAIR MANUAL



WARNING

DO NOT OPERATE BEFORE
READING MANUAL.



04/2005

LEADING THE SEARCH FOR INNOVATIVE SOLUTIONS

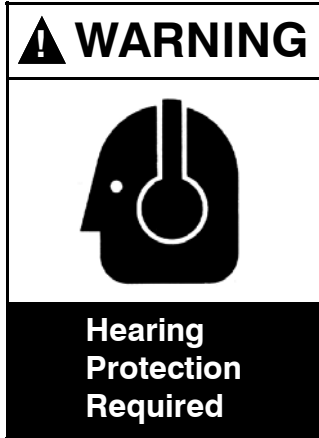


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E-mail: vacuum@tuthill.com

<http://vacuum.tuthill.com>

SAFETY INSTRUCTIONS

1. Do not operate before reading the enclosed instruction manual.
2. Use adequate protection, warning and safety equipment necessary to protect against hazards involved in installation and operation of this equipment.



SAFETY WARNING

- Keep hands and clothing away from rotating machinery, inlet and discharge openings.
- Blower and drive mounting bolts must be secured.
- Drive belts and coupling guards must be in place.
- Noise level may require ear protection.
- Blower heat can cause burns if touched.

TUTHILL VACUUM & BLOWER SYSTEMS

Springfield, MO USA

NOTICE

The above safety instruction tags were attached to your unit prior to shipment. Do not remove, paint over or obscure in any manner.

Failure to heed these warnings could result in serious bodily injury to the personnel operating and maintaining this equipment.

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IMPORTANT

In order to assure you of the full benefits of our product warranty, please complete, tear out and return the warranty registration card located on the back cover of this manual, or you can register your product online at http://vacuum.tuthill.com/product_registration

SAFETY PRECAUTIONS

For equipment covered specifically or indirectly in this instruction book, it is important that all personnel observe safety precautions to minimize the chances of injury. Among many considerations, the following should particularly be noted:

- Blower casing and associated piping or accessories may become hot enough to cause major skin burns on contact.
- Internal and external rotating parts of the blower and driving equipment can produce serious physical injuries. Do not reach into any opening in the blower while it is operating, or while subject to accidental starting. Cover external moving parts with adequate guards.
- Disconnect power before doing any work, and avoid bypassing or rendering inoperative any safety or protective devices.
- If blower is operated with piping disconnected, place a strong, coarse screen over the inlet and avoid standing in discharge air stream.
- Avoid extended exposure in close proximity to machinery with high intensity noise levels.
- Use proper care and good procedures in handling, lifting, installing, operating, and maintaining the equipment.
- Other potential hazards to safety may also be associated with operation of this equipment. All personnel working in or passing through the area should be warned by signs and trained to exercise adequate general safety precautions.
- Hearing protection may be required depending on silencing capabilities.

INTRODUCTION

CONGRATULATIONS on your purchase of a new COMPETITOR® Rotary Positive Displacement Blower from Tuthill Vacuum & Blower Systems. Please examine the blower for shipping damage, and if any damage is found, report it immediately to the carrier. If the blower is to be installed at a later date make sure it is stored in a clean, dry location and rotated regularly. Make sure covers are kept on all openings. If blower is stored outdoors be sure to protect it from weather and corrosion.

COMPETITOR blowers are built to exacting standards and if properly installed and maintained will provide many years of reliable service. We urge you to take time to read and follow every step of these instructions when installing and maintaining your blower. We have tried to make these instructions as straightforward as possible. We realize getting any new piece of equipment up and running in as little time as possible is imperative to production.

WARNING: Serious injury can result from operating or repairing this machine without first reading the service manual and taking adequate safety precautions.

IMPORTANT: Record the blower model and serial numbers of your machine in the OPERATING DATA form below. You will save time and expense by including this reference identification on any replacement part orders, or if you require service or application assistance.

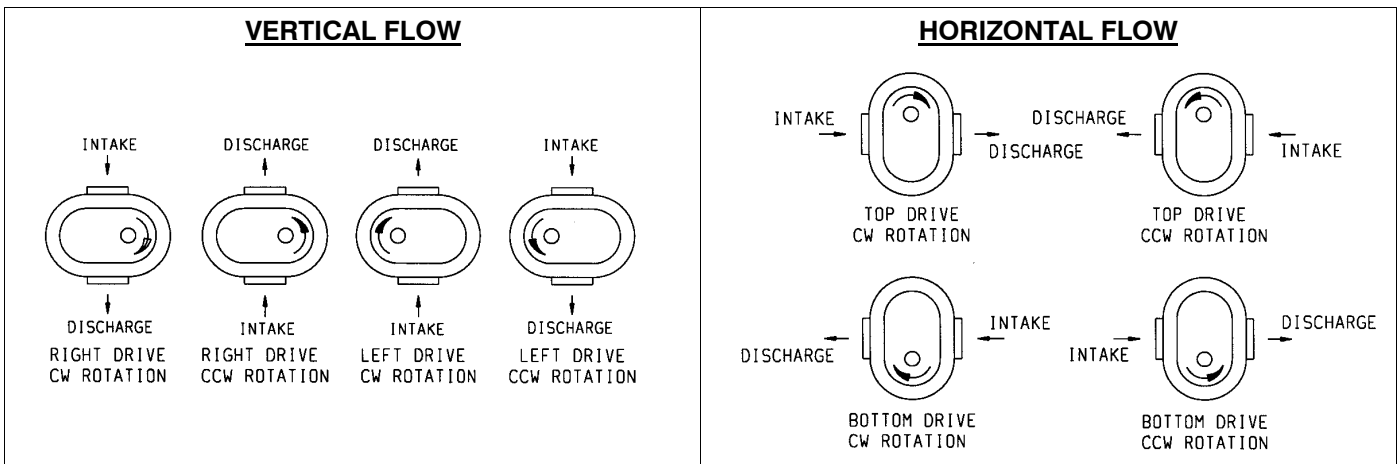
OPERATING DATA

It will be to the user's advantage to have the requested data filled in and available in the event a problem should develop in the booster or the system. This information is also helpful when ordering spare parts.

Model No. _____	V-Belt Size _____ Length _____
Serial No. _____ (Recorded from nameplate on unit)	Type of Lubrication: _____
Startup Date _____	_____
Blower RPM _____	Pressure _____
Blower Sheave Diameter _____	Vacuum _____
Motor Sheave Diameter _____	Any other special accessories with this unit _____
Motor RPM _____ HP _____	_____

FLOW DIRECTION BY ROTATION

Refer to the illustrations below before installing inlet and discharge piping.



INSTALLATION

WARNING: Customers are cautioned to provide adequate protection, warning and safety equipment necessary to protect personnel against hazards involved in the installation and operation of this equipment in the system or facility.

Do not use air blowers on explosive or hazardous gases. Casing pressure must not exceed 25 PSIG (1.72 bar g). Each size blower has limits on pressure differential, running speed, and discharge temperature, which **must not** be exceeded. These limits are shown on the Specification Sheet "Maximum Operating Limits" on page 14.

LOCATION

Install the blower in a clean, dry, and well lighted area if possible. Leave plenty of room around the blower for inspection and maintenance.

FOUNDATION

We recommend a solid foundation be provided for permanent installation. It is necessary that a suitable base be used, such as a steel combination base under blower and motor, or a separate sole plate under each.

Before tightening the bolts, check to see that both mounting feet are resting evenly on the foundation, shim as necessary to eliminate stress on the base when the bolts are tightened.

Where a solid foundation is not feasible, care must be taken to insure that equipment is firmly anchored to adequate structural members.

DRIVE

When the blower is V-belt driven the sheaves must be positioned so that the hub face of the blower sheave is not more than 1/4" (6.5 mm) from the blower drive end plate and the driver sheave is as close to the driver bearing as possible. Care should be taken when installing sheave onto shaft. The faces of the sheaves should be accurately in line to minimize belt wear.

Adjust the belt tension to the belt manufacturer's specifications.

For installations where the blower is to be operated by direct drive, selection of the driver should be such as not to exceed the maximum speed ratings of the blower. (See Specification Sheet "Maximum Operating Limits" on page 14.)

A flexible type coupling should be used to connect driver and blower shafts. The two shafts must be aligned within .005" (.13 mm) T.I.R. (Total Indicated Runout) Coupling face run out .003 (.8 mm) T.I.R..

PROTECTIVE MATERIALS

Remove protective materials from the shaft.

Remove the protective covers from the inlet and outlet ports and inspect the interior for dirt and foreign material.

WARNING: Keep hands, feet, foreign objects and loose clothes from inlet and outlet openings to avoid injury or damage if lobes are to be rotated at this point.

LUBRICATION

Do not start up the blower until you are positive that it has been properly and fully lubricated. (See Lubrication Section on page 6.)

PIPING

Inlet and outlet connections on all blowers are large enough to handle maximum volume with minimum friction loss. Maintain same diameter piping. Silencers must not be supported by the blower. Stress loads and bending moments must be avoided.

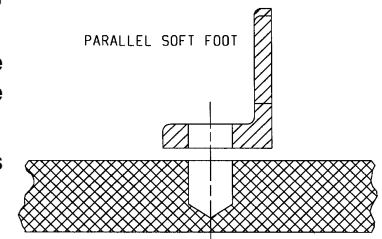
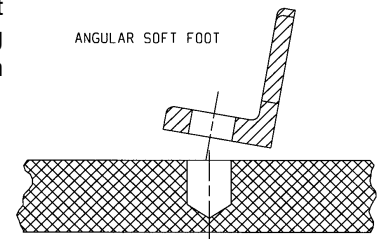
Be certain all piping is clean internally before connecting to the blower. We recommend placing a 16-mesh wire screen backed with hardware cloth at or near the inlet connections for the first 50 hours of use until the system is clean. Make provisions to clean the screen after a few hours of operation and completely discard it once the system is clean, as it will eventually deteriorate and small pieces going into the blower can cause serious damage. A horizontal or vertical air flow piping configuration is easily achieved by rearranging the mounting feet position.

WARNING: Do not operate equipment without adequate silencing devices since high noise level may cause hearing damage. (Reference OSHA Standards.)

RELIEF VALVES

We recommend the use of relief valves to protect against excessive pressure or vacuum conditions. These valves should be tested at initial start-up to be sure they are properly adjusted to relieve at or below the maximum pressure differential rating of the blower.

CAUTION: Upon completion of the installation, and before applying power, rotate the drive shaft by hand. It must move freely. If it does not, look for uneven mounting, piping strain, excessive belt tension or coupling misalignment or any other cause for binding. If blower is removed and still does not rotate freely, check inside the blower housing for foreign material.



Examples of Soft Foot

LUBRICATION

Every Tuthill blower is factory tested, oil drained and shipped dry to its installation point. Both independent oil reservoirs must be filled to the proper level before operation.

Shaft bearings at the gear end of the blower are splash lubricated by one or both gears dipping into an oil reservoir formed in the gear end plate and cover. Shaft bearings at the drive end of the blower are lubricated by a slinger assembly dipping into an oil reservoir. Before starting the blower, fill oil sumps as shown below under "Filling Procedure." Tuthill approved mineral-based, synthetic and food grade lubricants are listed on page 15.

FILLING PROCEDURE

1. Remove fill plugs or breathers from both gear end and drive end plates.
2. SLOWLY pour oil through fill until oil appears in the oil sight glass. Bring oil level to center of sight glass.
3. Verify oil level is at proper level in BOTH gear end and drive end sight glasses.
4. Replace fill plugs or breathers that were removed in step 1.

CAUTION: Do not start the blower until you are sure oil has been put in the gear housing. Operation of the blower without proper lubrication will cause the blower to fail and void its warranty.

WARNING: NEVER ATTEMPT TO CHANGE OIL WHILE THE BLOWER IS IN OPERATION. Failure to heed this warning could result in damage to the equipment and/or serious personal injury. Oil level must be checked while the blower is not running.

APPROXIMATE OIL CAPACITIES

Gear end amounts are for all series. Drive end amounts are for SL & GT (22 & 23 series)

MODEL	Horizontal Flow		Vertical Air Flow	
	GEAR END	DRIVE END	GEAR END	DRIVE END
2002 – 2004	1.7 ounces (50 mL)	N/A	3.4 ounces (100 mL)	N/A
3002 – 3006	3.4 ounces (100 mL)	2.5 ounces (75 mL)	6.0 ounces (180 mL)	4.0 ounces (120 mL)
4002 – 4007	5.8 ounces (170 mL)	4.7 ounces (140 mL)	8.5 ounces (250 mL)	6.4 ounces (190 mL)
5003 – 5009	7.1 ounces (210 mL)	5.4 ounces (160 mL)	18.3 ounces (540 mL)	10.2 ounces (300 mL)
6005 – 6015	16.9 ounces (500 mL)	9 ounces (265 mL)	25.5 ounces (750 mL)	18 ounces (530 mL)
7006 – 7018	20.3 ounces (600 mL)	N/A	28.7 ounces (850 mL)	N/A

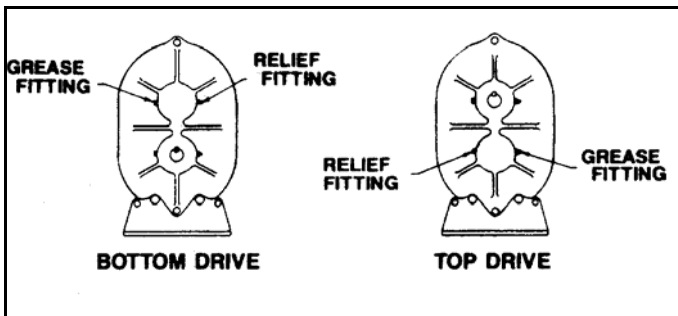
* Oil capacities are based on filling from dry condition. Less oil may be needed depending on emptiness of oil reservoir(s) after draining.

Always fill the gear housing until oil drips out of the oil level hole. Replace plugs in their respective holes. Following this procedure will insure proper oil level.

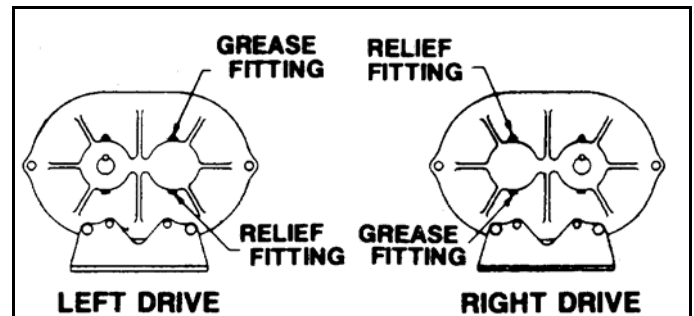
GREASE LUBRICATED BEARINGS (21 Series Only)

Service drive end bearing at regular intervals. (See " Suggested Lubrication Intervals for Grease Lubricated Bearings" below.) Use NLGI #2 premium grade, petroleum base grease with high temperature resistance and good mechanical stability, such as PneuLube grease available from your local Tuthill Vacuum & Blower System Professional. Using a pressure gun, force new grease into each bearing until traces of clean grease comes out of the relief fitting.

CAUTION: To avoid blowing out the drive shaft seal, do not grease too rapidly.



HORIZONTAL FLOW



VERTICAL FLOW

NOTE: Drawings above show location of grease fitting and grease relief for horizontal and vertical flow units (21 series).

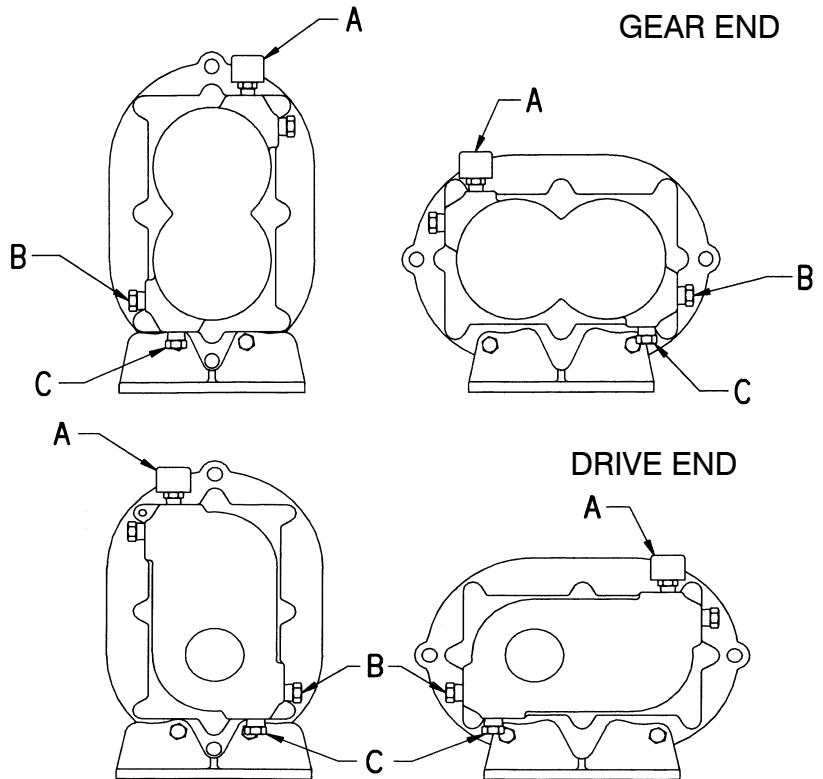
CAUTION!

Most Competitor blowers are shipped from the factory in a left hand drive, vertical flow configuration.

If drive shaft location is changed, the oil level plugs, sight glasses and breathers must be relocated to proper positions, as shown to the right.

Failure to change plug location will result in blower failure and void the product warranty.

A = Breather
 B = Oil Level Sight Glass
 (Plug on 21 series)
 C = Magnetic Oil Drain Plug



LUBRICATION INSTRUCTIONS FOR OIL LUBRICATED GEARS AND BEARINGS

Add fresh oil as required to maintain proper level. Drain and refill after the first 100 hours of operation and thereafter every 1,000 hours of operation under normal service, more frequently depending on the type of oil and oil operating temperature. Use a good quality oil, such as PneuLube, available through your local Tuthill Pneumatics Sales Professional.

See page 15 for list of recommended lubricants.

SUGGESTED LUBRICATION INTERVALS FOR GREASE LUBRICATED BEARINGS

SPEED IN RPM	OPERATING HOURS PER DAY		
	8	16	24
GREASING INTERVALS IN WEEKS			
750-1000	7	4	2
1000-1500	5	2	1
1500-2000	4	2	1
2000-2500	3	1	1
2500-3000	2	1	1
3000 and up	1	1	1

PREVENTATIVE MAINTENANCE

A good maintenance program will add years of service to your blower.

A newly installed blower should be checked frequently during the first month of operation, especially lubrication. Check oil level in both the drive end and gear end of the blower and add oil as needed. Complete oil changes are recommended every 1000 operating hours, or more frequently depending on the type of oil and oil operating temperature.

DAILY MAINTENANCE

1. Check and maintain oil level, and add oil as necessary.
2. Check for unusual noise or vibration (See Troubleshooting on page 8)

WEEKLY MAINTENANCE

1. Clean all air filters. A clogged air filter can seriously affect the efficiency of the blower and cause overheating and oil usage.
2. Check relief valve to assure it is

MONTHLY MAINTENANCE

1. Inspect the entire system for leaks.
2. Inspect condition of oil and change if necessary (see page 6)
- 3 Check drive belt tension and tighten if necessary.

START-UP CHECKLIST

We recommend that these startup procedures be followed in sequence and checked (√) off in the boxes provided in any of the following cases:

- During initial installation
- After any shutdown period
- After maintenance work has been performed
- After blower has been moved to a new location

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Date Checked

--	--	--	--

1. Check the unit for proper lubrication. Proper oil level cannot be over-emphasized. Refer to Lubrication Section.

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2. Check Alignment.
For Direct Drive: Check coupling and shaft alignment.
For Belt Drive: Check for proper belt alignment and tension.

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3. Turn the rotors by hand to be certain they do not bind.

WARNING: Disconnect power. Make certain power is off and locked out before touching any rotating element of the blower, motor or drive components.

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4. "Bump" the unit with the motor a few times to check rotation and to be certain it turns freely and smoothly.

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5. Start the unit and operate it for 30 minutes at no load. During this time. feel the cylinder for hot spots. If minor hot spots occur, refer to the Troubleshooting Section (page 8).

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6. Apply the load and observe the operation of the unit for one hour. Check the unit frequently during the first day of operation.

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7. If minor malfunctions occur, discontinue operation and refer to the Troubleshooting Section (page 8).

RECOMMENDED SHUTDOWN PROCEDURE TO MINIMIZE RISK OF FREEZING OR CORROSION

When high humidity or moisture is present in an air piping system, condensation of water can occur after the blower is shut down and the blower begins to cool. This creates an environment favorable to corrosion of the iron internal surfaces, or in cold weather, the formation of ice. Either of these conditions can close the operating clearances, causing the blower to fail upon future start-up.

The following shutdown procedure outlined below minimizes the risk of moisture condensation, corrosion and freezing. **Care must be taken so as not to overload or overheat the blower during this procedure.**

1. Isolate the blower from the moist system piping, allowing the blower to intake atmospheric air. Operate the blower under a slight load allowing the blower to heat within safe limits. The heat generated by the blower will quickly evaporate residual moisture.
2. For carpet cleaning applications, after the work is completed, simply allow the blower to run a few (3-5) minutes with the suction hose and wand attached. The suction hose and wand will provide enough load to the blower to evaporate the moisture quickly.
3. For extended shutdown, inject a small amount of a light lubricating oil such as 3-in-One® or a spray lubricant such as WD-40® into the inlet of the blower just prior to shutdown. The lubricant will provide an excellent protective coating on the internal surfaces. If using a spray lubricant, exercise care to prevent the applicator tube from getting sucked into the blower. The applicator tube will damage the blower, most likely to the point that repair would be required.

3-in-One and WD-40 are registered trademarks of WD-40 Company.

TROUBLESHOOTING

Although Competitor blowers are well designed and manufactured, problems may occur due to normal wear and the need for readjustment. The chart below lists symptoms that may occur along with probable causes and remedies.

SYMPTOM	PROBABLE CAUSE	REMEDIES
Loss of oil.	Gear housing not tightened properly. Lip seal failure. Insufficient sealant.	Tighten gear housing bolts. Disassemble and replace lip seal. Remove gear housing and replace sealant. (See Disassembly and Inspection section on page 10)
Excessive bearing or gear wear.	Improper lubrication. Excessive belt tension.	Correct oil level. Replace dirty oil. (See Lubrication section on page 6) Check belt manufacturer's specifications for tension and adjust accordingly.
Lack of volume.	Slipping belts. Worn lobe clearances. Speed too low. Obstruction in piping.	Check belt manufacturer's specifications for tension and adjust accordingly. Check for proper clearances (See Assembly Clearances on page 14) Increase blower speed within limits. Check system to assure an open flow path.
Knocking.	Unit out of time. Distortion due to improper mounting or pipe strains. Excessive pressure differential.	Re-time. Check mounting alignment and relieve pipe strains. Reduce to manufacturer's recommended pressure. Examine relief valve and reset if necessary.
Excessive blower temperature.	Too much or too little oil in gear reservoir. Too low operating speed. Clogged filter or silencer. Excessive pressure differential. Elevated inlet temperature. Worn lobe clearances.	Check oil level. (See Lubrication section on page 6) Increase blower speed within limits. Remove cause of obstruction. Reduce pressure differential across the blower. Reduce inlet temperature. Check for proper clearances (See Assembly Clearances on page 14)
Rotor end or tip drag.	Insufficient assembled clearances. Case or frame distortion. Excessive operating pressure.	Correct clearances (See Assembly Clearances on page 14) Check mounting and pipe strain. Reduce pressure differential.
Vibration.	Belt or coupling misalignment. Lobes rubbing. Worn bearings or gears. Unbalanced or rubbing lobes. Driver or blower loose. Piping resonance.	Check carefully, realign if necessary. Check cylinder for hot spots, then check for lobe contact at these points. Correct clearances (See Assembly Clearances on page 14). Check condition of gears and bearings; replace if necessary. Possible buildup on casing or lobes, or inside lobes. Remove buildup and restore clearances. Check mounting and tighten if necessary. Check pipe supports, check resonance of nearby equipment, check foundation.

DISASSEMBLY & INSPECTION

With proper maintenance and lubrication, normal life expectancy for gears, bearings, and seals can be achieved. However, over a period of time these parts must be repaired or replaced to maintain the efficiency of your blower. This section is written in a way that will allow you to completely disassemble your blower. The inspection of certain repairable or replaceable parts is referred to at the point of disassembly where these parts are exposed. If at any point of inspection, repair or replacement is deemed necessary, appropriate instruction will be given to achieve these repairs or replacements.

Remove the oil drain plugs [18] in the bottom of the end covers [Items 5 & 10] and drain the oil. Take out eight cap screws [16] and remove the gear cover. It may be necessary to tap the sides with a mallet or wooden block to break the seal joint.

Gears are not exposed for visual inspection. Items in brackets [] are referenced to item numbers on page 16.

Inspect the gears for the following:

- Broken Teeth
- Chipped Teeth
- Uneven Wear
- Excessive Wear
- Any Other Abnormalities

WARNING: Before performing any repair or replacement, disconnect and lock out power.

Position blower with the drive gear on the left when facing the gears. Remove socket head screws and washers. [items 29 & 26].

Align timing marks and count three (3) teeth up and place reference marks on the gears. (Refer to Figure 1 below)

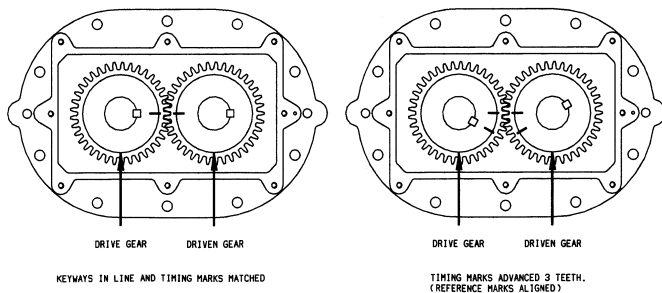


Figure 1. Timing Gear Alignment

Align reference marks and use puller to pull the driven gear. (shown on right side in Figure 2 below)

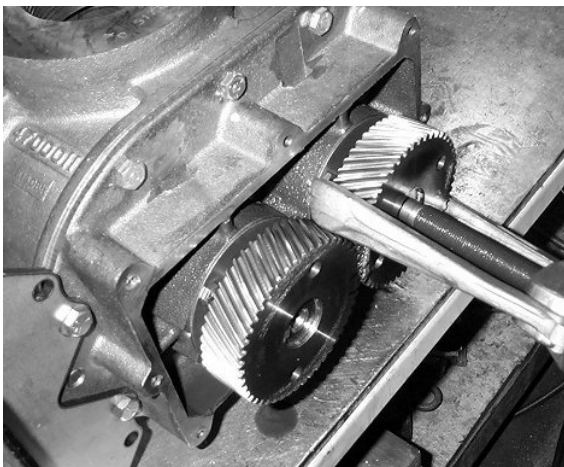


Figure 2. Pulling Driven Gear with Jaw Puller

Use puller to remove drive gear. A bar puller (Refer to Figure 3 below) or jack screws can be used.

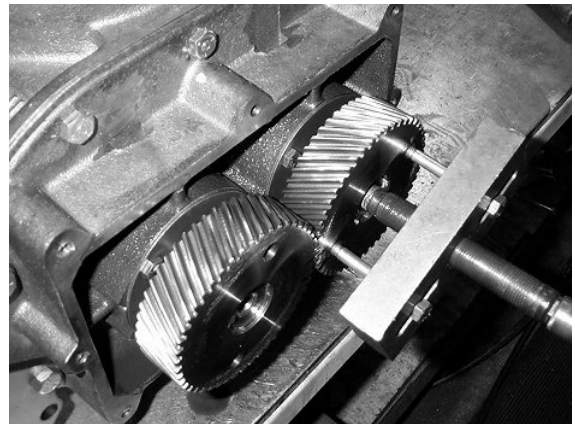


Figure 3. Pulling Drive Gear with Bar Puller

Remove shim and spacer. [Items 28 & 30], and note from which shaft the shim is removed.

Turn blower around and remove eight (8) cap screws securing the drive end cover [10]. Remove cover.

Loosen the set screws on the oil slingers [Items 45 & 46] and remove the oil slingers from the rotor shafts. (Refer to Figure 4 below)

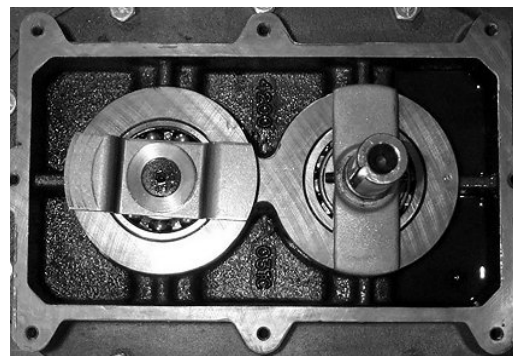


Figure 4. Drive End Oil Slingers

Remove ten (10) cap screws [15] that secure drive end plate [3] to housing [1].

Use a jaw puller to remove drive end plate. (Refer to Figure 5 below)

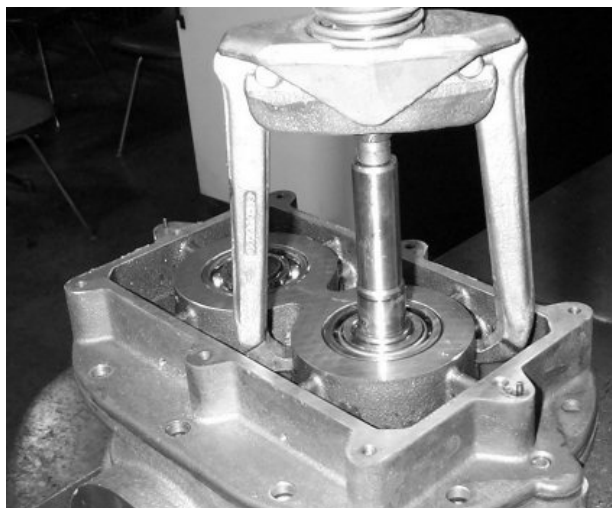


Figure 5. Pulling Drive End Plate

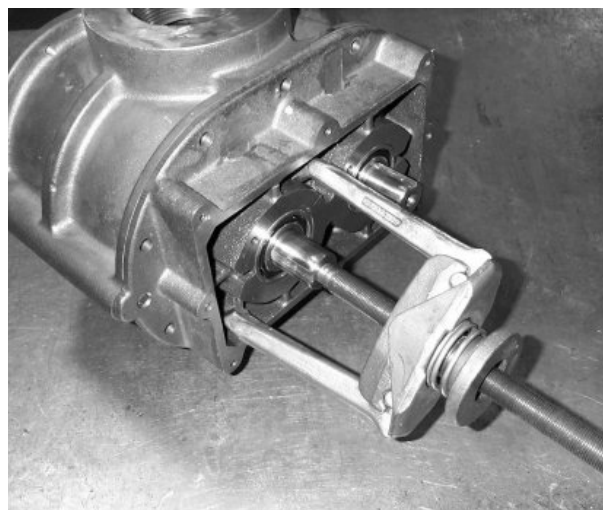


Figure 7. Driving Rotors Out Using Jaw Puller

Using a tube or round bar of a slightly smaller diameter than the shaft clearance holes in the end plates, tap the bearings out of the end plates. Bearing retainers [22] must be removed before knocking out the bearings. (Refer to Figure 8 below)

Press rotors out of end plate in press if available. If press is not available, support end plate and rotors in the housing. Block up housing and use a soft mallet to drive the rotors out. (Refer to Figure 6 below)



Figure 6. Driving Rotors Out Using Soft

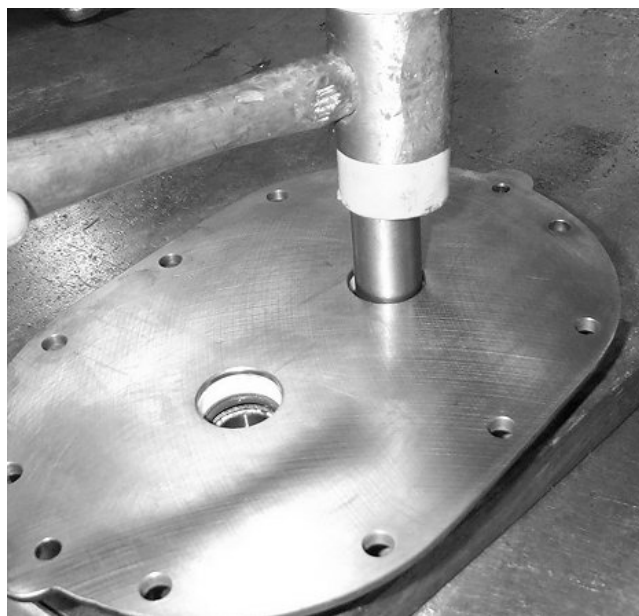


Figure 8. Tapping Bearings Out of End Plates

Remove seals from both end plates with a punch or dull chisel. The seals **will** be damaged during removal and must be replaced.

Inspect all parts for wear and or damage.

Clean and inspect all parts for burrs and polish seal journals with at least 320 grit emery or crocus cloth.

Items in brackets [] are referenced to item numbers on page 16.

A jaw type puller can also be used. (Refer to Figure 7 above right)

BLOWER ASSEMBLY

After thorough cleaning of the seal and bearing bores of both end plates apply a thin coat of sealant on the outside diameter of the new seals and press them into the end plate using a tool that will bear on the outer edge of the seal. Spring side of the seal should be facing you. Apply a thin coat of grease to the seal lip.

See page 15 for drawings and dimensions of seal and bearing pressing tools.

Using the drive end plate as a fixture, support it high enough so the input shaft of the drive rotor clears the assembly surface. (Refer to Figure A1 below). Place rotors in fixture with the drive rotor to the left. (See Figures A1 and A2 below)

MECHANICAL SEAL INSTALLATION

Clean and deburr seal bore in endplate. Clean the face of the carbon and mating ring with alcohol etc. Apply a thin layer of silicon to the bottom face of the seal.



Figure A1. Rotors Assembled on Drive End Plate (Model 4000 with tri-lobe rotors shown)

Place end plate [Item 4] on rotors.

Apply a thin coat of lubricant on the rotor shafts and the inner race of the bearings. Tap the bearings [13] into place using a tube with a flanged end that will contact both the inner and outer bearing races. (Refer to Figure A3 below).

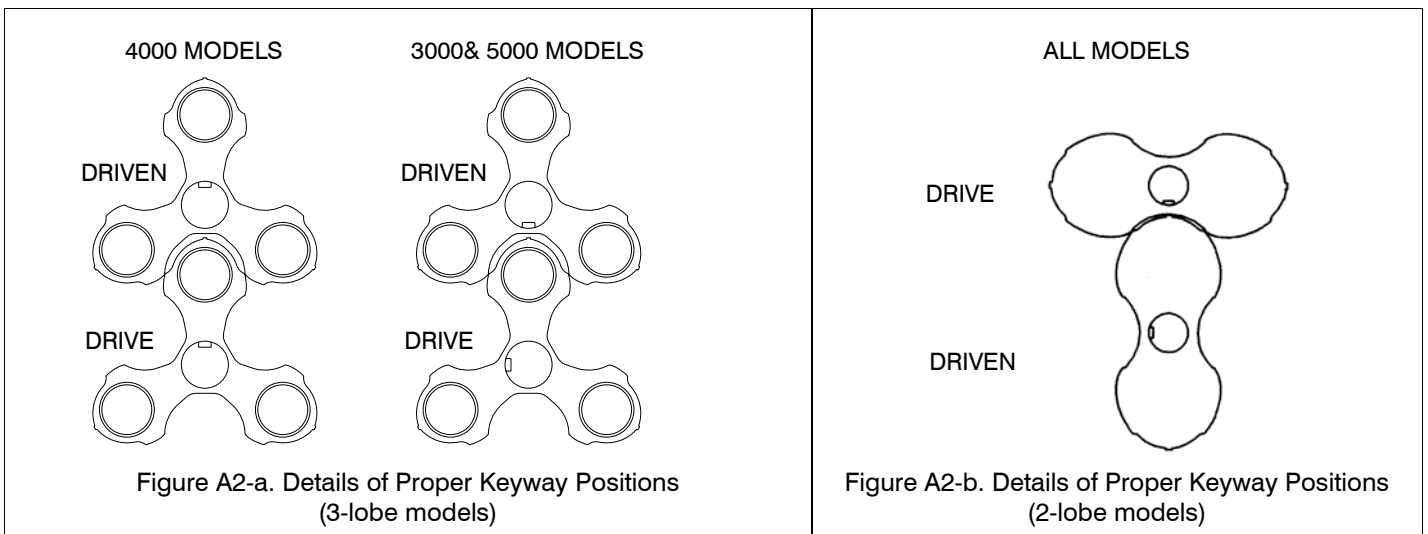


Figure A3. Tapping Bearings into End Plates

WARNING: Keep hands and loose clothing away from lobes and gears.

Install bearing retainers [Items 22 & 25] to both bearings.

Check clearances between the end of the rotors and the face of the end plate. Refer to assembly clearances chart on page 14 for proper clearances for your model blower, and refer to page 13 for procedures for checking and adjusting clearances.



If clearances check OK, put a spacer [28] and a shim [30] on each shaft. Timing shims that were removed should be put back on the shaft from which they were



Figure A4. Checking Gear End Clearances

Lubricate shafts and bores on gears. Begin by pressing on the DRIVE gear. This will be pressed on the drive rotor, which is to the left.

Start the driver gear on the shaft and align the reference timing marks and press gear on. Lock gears in place with socket head screw [29] and washer [26]. Turn assembly over and rest the unit on the socket head screws and washers on the gear end.

Set dowel pins [9] in housing and position housing over the rotors and fasten with cap screws [15]. Check housing to rotor clearance. (Refer to Figure A5) A depth mic can be used.

Set on drive end plate [3] and fasten with cap screws [15]. (**ATTENTION:** There are four cap screws [17] which are used to attach the feet.) Lubricate shafts and bearings. Install the ball bearing [12] on the driven rotor and the roller bearing [11] on the input shaft.

Apply a bead of a good quality RTV silicone sealant to the inner surface of the drive end cover [10] that mates to the drive end plate [3]. Install drive end cover and drive shaft seal [23].

Install any removed plugs [18], sight glasses [21] and replace breather [27] if required.

Items in brackets [] are referenced to item numbers on page 16.

LUBRICATION, FINAL ASSEMBLY AND MOUNTING

Apply a bead of a good quality RTV silicone sealant to the inner surface of the gear end cover [5] that mates to the gear end plate [4]. Install the gear end cover with cap screws [16] and tighten evenly.

Fill both end covers with oil. Refer to the Lubrication Section in this manual (page 6) for filling procedure, and page 17 for recommended lubricants.

To insure blower has not been distorted during mounting in the installation, turn the lobes by hand to make sure they are not making contact prior to connecting to the driver.

ADJUSTING ROTOR INTERLOBE CLEARANCE

Using feeler gauges take interlobe readings and record on each side of housing as indicated in Figure A5 below. By removing or adding shim behind the helical gear, it rotates as it is moved in or out and the driven rotor turns with it, thus changing the clearance between rotor lobes.

Changing the shim thickness .006" (.15 mm) will change the rotor lobe clearance .003" (.08 mm) or one-half the amount.

EXAMPLE: Referring to Figure A5 below, check the clearance at AA (right hand reading) and BB (left hand reading). If AA reading is .009" (.23 mm) and BB reading is .003" (.08 mm) by removing .006" (.15 mm) shims. the readings will change one half the amount removed or .003" (.08 mm). AA should then read .006" (.15 mm) and BB should read .006" (.15 mm). The final reading should be within .002" (.05 mm) of each other.

To determine the amount of shim to add or remove, subtract the small figure from the larger. If the right side is higher than the left side, remove shim. If the right side is reading lower, add shim.

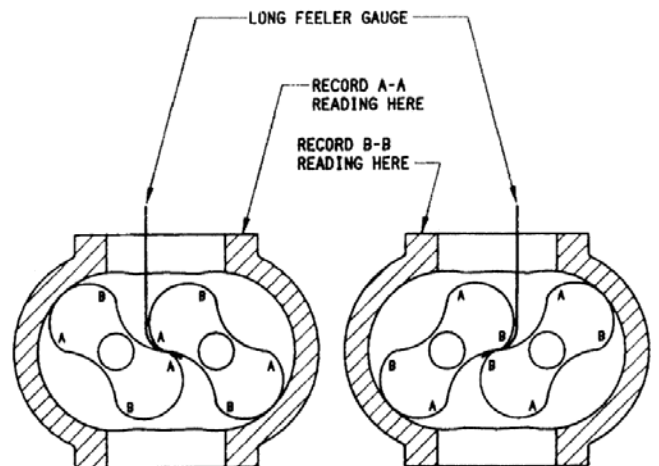


Fig. 5A Checking Interlobe Clearance on 2-lobe Models

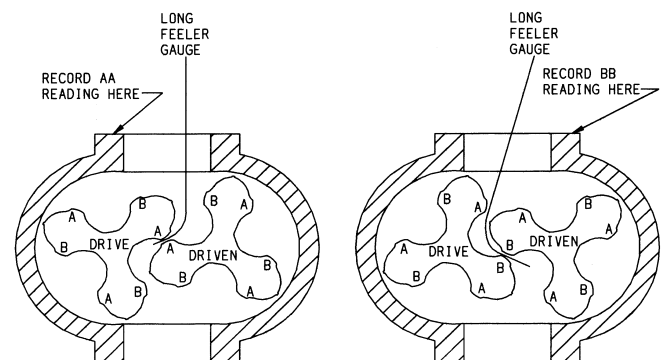


Figure 5B. Checking Interlobe Clearance on 3-lobe Models

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MAINTENANCE AND SERVICE SPECIFICATIONS SHEET ASSEMBLY CLEARANCES

Metric values (mm) are shown in parentheses ()

All other values are in inches

MODEL	LOBES TO END PLATES			INTERLOBE	LOBE TO CASING	
	DRIVE END	GEAR END	TOTAL		TIP-DOWEL	TIP-PORT
2002, 2004	.004" - .007" (.10 - .18)	.003" - .005" (.08 - .13)	.008" - .011" (.20 - .28)	.005" - .009" (.13 - .23)	.002" - .004" (.05 - .10)	.003" - .006" (.08 - .15)
3002	.004" - .007" (.10 - .18)	.003" - .005" (.08 - .13)	.008" - .012" (.20 - .30)	.006" - .012" (.15 - .30)	.002" - .005" (.05 - .13)	.004" - .007" (.10 - .18)
3003	.005" - .008" (.13 - .20)	.003" - .005" (.08 - .13)	.009" - .012" (.23 - .30)	.006" - .012" (.15 - .30)	.002" - .005" (.05 - .13)	.004" - .007" (.10 - .18)
3006	.006" - .010" (.15 - .25)	.003" - .005" (.08 - .13)	.010" - .013" (.25 - .33)	.006" - .012" (.15 - .30)	.002" - .005" (.05 - .13)	.004" - .007" (.10 - .18)
4002	.004" - .009" (.10 - .23)	.004" - .006" (.10 - .15)	.009" - .013" (.23 - .33)	.008" - .012" (.20 - .30)	.003" - .006" (.08 - .15)	.005" - .008" (.13 - .20)
4005, 4007	.005" - .010" (.13 - .25)	.004" - .006" (.10 - .15)	.010" - .014" (.10 - .36)	.008" - .012" (.20 - .30)	.003" - .006" (.08 - .15)	.005" - .008" (.13 - .20)
5003	.004" - .009" (.10 - .23)	.004" - .006" (.10 - .15)	.009" - .013" (.23 - .33)	.014" - .018" (.36 - .46)	.003" - .006" (.08 - .15)	.005" - .008" (.13 - .20)
5006, 5009	.005" - .010" (.13 - .25)	.004" - .006" (.10 - .15)	.010" - .014" (.10 - .36)	.014" - .018" (.36 - .46)	.003" - .006" (.08 - .15)	.005" - .008" (.13 - .20)
6005, 6008	.008" - .013" (.20 - .33)	.005" - .007" (.13 - .18)	.015" - .019" (.38 - .48)	.010" - .014" (.10 - .36)	.004" - .007" (.10 - .18)	.006" - .009" (.15 - .23)
6015	.009" - .014" (.23 - .36)	.005" - .007" (.13 - .18)	.016" - .020" (.41 - .51)	.010" - .014" (.10 - .36)	.004" - .007" (.10 - .18)	.006" - .009" (.15 - .23)
7006	.010" - .014" (.10 - .36)	.005" - .007" (.13 - .18)	.017" - .020" (.43 - .51)	.012" - .016" (.30 - .41)	.004" - .007" (.10 - .18)	.006" - .009" (.15 - .23)
7011, 7018	.010" - .014" (.10 - .36)	.005" - .007" (.13 - .18)	.017" - .020" (.43 - .51)	.012" - .016" (.30 - .41)	.004" - .007" (.10 - .18)	.006" - .009" (.15 - .23)

MAXIMUM OPERATING LIMITS				
MODEL	RPM	PRESSURE PSI (mbar)	VACUUM in. Hg (mbar)	TEMPERATURE RISE F° (C°)
2002	5275	12 (825)	16 (540)	225 (125)
2004	5275	7 (480)	16 (540)	185 (103)
3002	3600	15 (1035)	16 (540)	210 (116)
3003	3600	12 (825)	15 (508)	180 (100)
3006	3600	7 (480)	15 (508)	170 (94)
4002	3600	15 (1035)	16 (540)	220 (122)
4005	3600	10 (690)	16 (540)	210 (116)
4007	3600	7 (480)	15 (508)	170 (94)
5003	2850	15 (1035)	16 (540)	195 (108)
5006	2850	13 (900)	16 (540)	195 (108)
5009	2850	7 (480)	15 (508)	160 (89)
6005	2350	15 (1035)	16 (540)	250 (139)
6008	2350	14 (965)	16 (540)	240 (133)
6015	2350	7 (485)	12 (410)	180 (100)
7006	2050	15 (1035)	16 (540)	235 (130)
7011	2050	10 (690)	16 (540)	210 (116)
7018	2050	6 (415)	12 (410)	120 (66)

RECOMMENDED LUBRICANTS
OIL CAPACITIES ARE SHOWN ON PAGE 6

RECOMMENDED MINERAL BASED LUBRICANTS

AMBIENT	SHELL	CITGO	CHEVRON TEXACO	EXXONMOBIL
0° F (-18° C) to	TELLUS® PLUS 68	A/W 68	RANDO HD 68	DTE HEAVY MEDIUM
32° F (0° C) to	TELLUS® PLUS 100	A/W 100	RANDO HD 100	DTE HEAVY
90° F (32° C) to	TELLUS® PLUS 150	A/W 150	RANDO HD 150	DTE EXTRA HEAVY

RECOMMENDED SYNTHETIC BASED LUBRICANTS

AMBIENT	TUTHILL	EXXONMOBIL	SHELL
0° F (-18° C) to	PneuLube™	SHC 626	MADRELA® AS 68
32° F (0° C) to		SHC 627	MADRELA® P 100
90° F (32° C) to		SHC 629	MADRELA® P 150

NOTE: Tuthill Vacuum & Blower Systems cannot accept responsibility for damage to seals, O-rings and gaskets caused by use of synthetic lubricants not recommended by Tuthill Vacuum and Blower Systems.

Due to its superior viscosity index, Tuthill PneuLube™ provides the greatest ambient temperature flexibility. Contact your local Tuthill Vacuum & Blower Systems Sales Professional for availability of this superior lubricant.

RECOMMENDED MINERAL BASED, FOOD GRADE LUBRICANTS

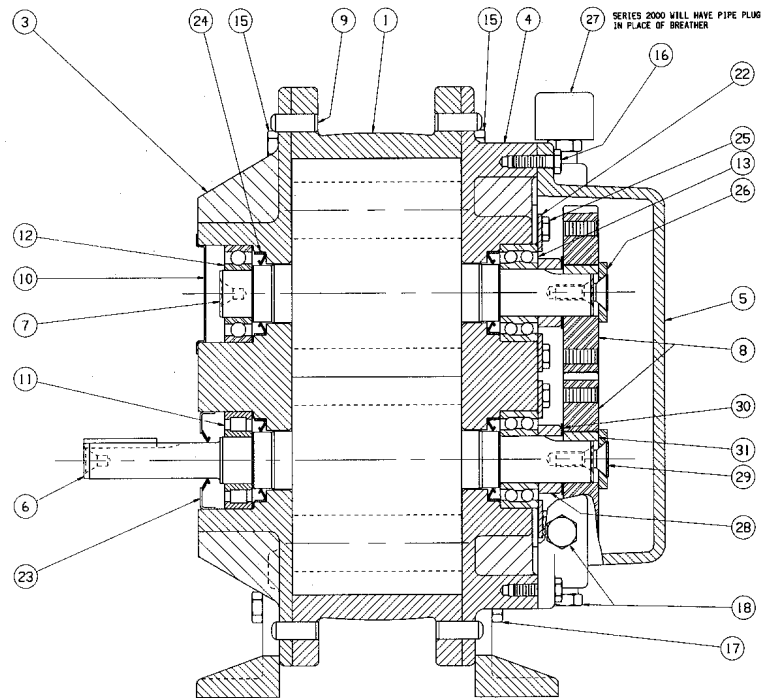
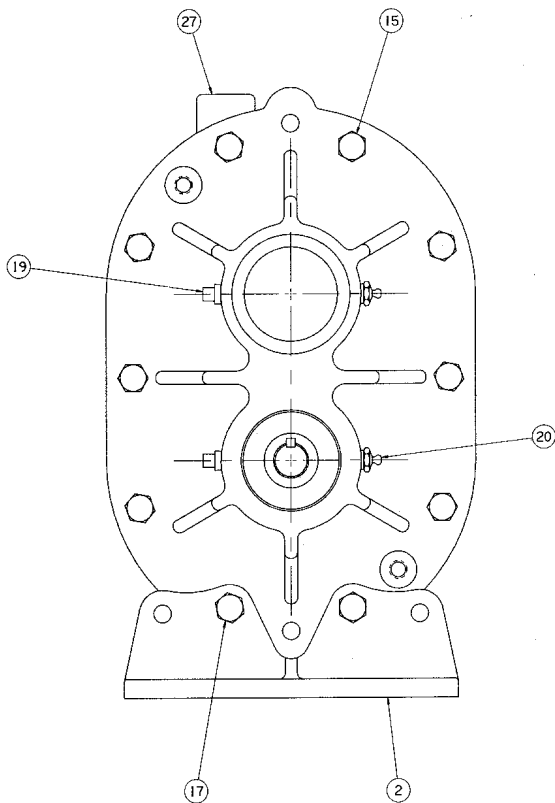
AMBIENT TEMPERATURE	Lubricant meeting U. S. FDA regulation 21 CFR 178.3570 governing petroleum products which may have incidental contact with food,	Lubricant meeting U.S. FDA regulations 21 CFR 172.878 and 178.3620(a) for direct and indirect food contact
0° F (-18° C) to	CITGO CLARION® A/W 68	CITGO CLARION® 350 FOOD GRADE
32° F (0° C) to	CITGO CLARION® A/W 100	CONSULT FACTORY
90° F (32° C) to	CONSULT FACTORY	CONSULT FACTORY

RECOMMENDED SYNTHETIC BASED, FOOD GRADE LUBRICANTS

AMBIENT TEMPERATURE	Lubricant meeting U. S. FDA regulation 21 CFR 178.3570 governing petroleum products which may have incidental contact with food,	Lubricant meeting U.S. FDA regulations 21 CFR 172.878 and 178.3620(a) for direct and indirect food contact
0° F (-18° C) to	PneuLube™ FG (ISO 100)	CONSULT FACTORY
32° F (0° C) to		
90° F (32° C) to		

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CUTAWAY VIEW AND PARTS LIST – 21 Series



ITEM	DESCRIPTION	QTY	ITEM	DESCRIPTION	QTY
1	Housing	1	18	Plug, Oil	3
2	Mounting Foot	2 *	19	Relief Fitting	2
3	Drive End Plate	1	20	Grease Fitting	2
4	Gear End Plate	1	22	Bearing Retainer	4
5	Gear Cover	1	23	Lip Seal, Drive Shaft	1
6	Drive Rotor	1	24	Lip Seal	4
7	Driven Rotor	1	25	Screw, Hex Head	4
8	Timing Gear	2	26	Washer	2
9	Dowel Pin	4	27	Breather	1 †
10	Bearing Cover Plate	1	28	Spacer	2
11	Roller Bearing, Drive Shaft	1	29	Screw, Hex Head	2
12	Bearing	1	30	Timing Shims	10
13	Bearing	2	31	Gear Timing Key	2
15	Screw, Hex Head	16	42	Alum. Nameplate Kit	1
16	Screw, Hex Head	8 **	43	Dr, Screw	2
17	Screw, Hex Head	4	47	Teflon Vent Insert	8

* Item 2: Models 6005, 6008, 6015, 7006, 7011 and 7018 require (2) each of left and right feet.

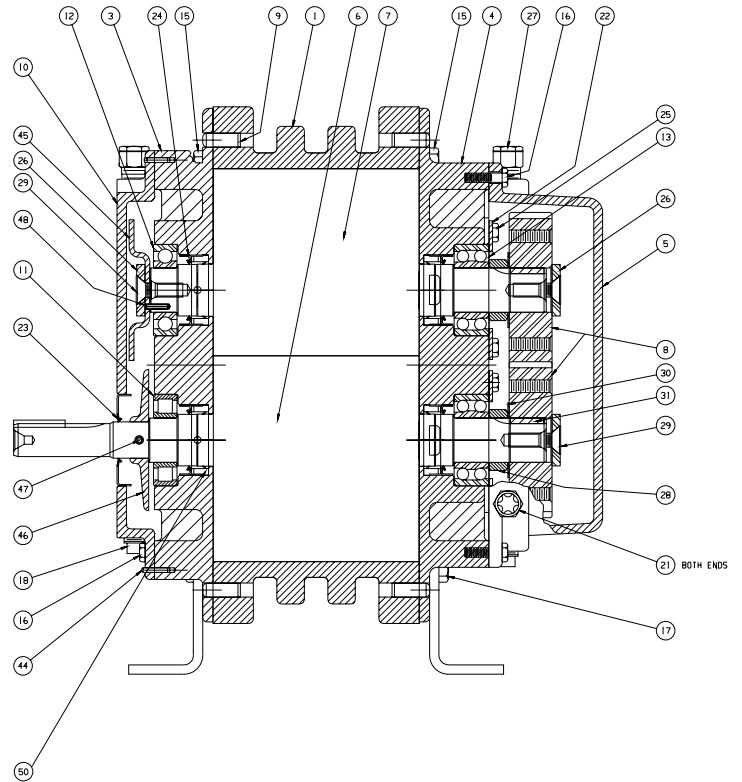
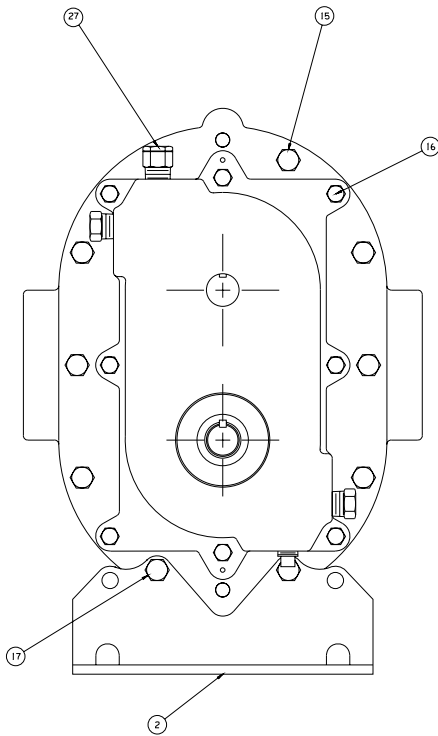
** Item 16: Models 5003, 5006 and 5009 require (6) each.

† Item 27: Models 2002 and 2004 requires a pipe plug in lieu of breather.

When ordering parts, use the item number shown, plus your model and serial number.

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CUTAWAY VIEW AND PARTS LIST – 22 & 23 Series

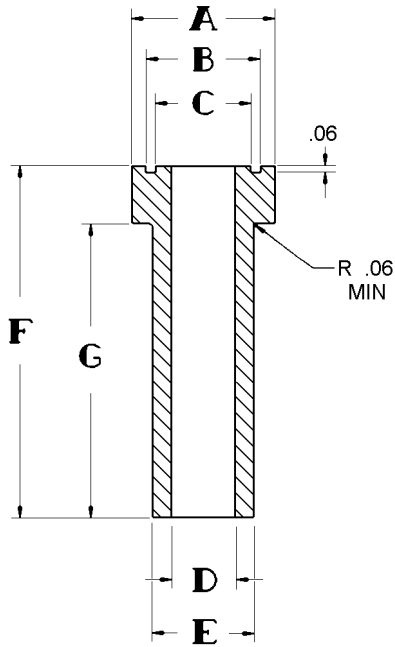


ITEM	DESCRIPTION	QTY	ITEM	DESCRIPTION	QTY
1	Housing	1	21	Sight Gauge	2
2	Mounting foot	2	22	Bearing Retainer	2
3	Drive End Plate	1	23	Lip Seal	1
4	Gear End Plate	1	24	Lip Seal (Series 22 – SL units)	4
5	Gear Cover	1	24	Mechanical Seal (Series 23 – GT units)	4
6	Drive Rotor	1	25	Screw, Hex Head	4
7	Driven Rotor	1	26	Washer	2
8	Timing Gear	2	27	Breather	2
9	Dowel Pin	4	28	Spacer	2
10	Drive Cover	1	29	Screw, Socket Head	3
11	Roller Bearing	1	30	Timing Shims	1
12	Bearing	1	31	Timing Gear Key	2
13	Bearing	2	44	Dowel Pin	1
15	Screw, Hex Head	16	45	Slinger	1
16	Screw, Hex Head	16	46	Slinger	1
17	Screw, Hex Head	4	47	Set Screw	2
18	Drain Plug	2	48	Roll Pin	2
19	Pipe Plug	2	50	Lab Seal	4

When ordering parts, use the item number shown, plus your model and serial number.

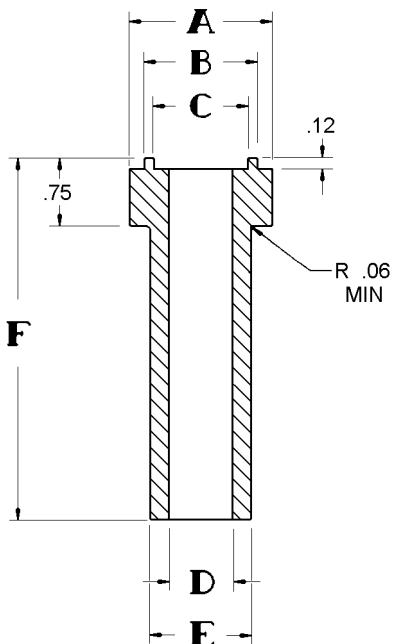
SPECIAL TOOL DRAWINGS

All dimensions shown are in inches.



Bearing Pressing Tool (For All Series)

MODEL	PART NUMBER	A	B	C	D	E	F	G
2000	2200718B	1.560 ±.001	1.27 ±.005	.98 ±.005	.70 ±.005	1.10 ±.005	3.50 ±.005	3.00 ±.005
3000	3300718B	2.035 ±.001	1.70 ±.005	1.335 ±.005	1.015 ±.005	1.415 ±.005	3.75 ±.005	3.00 ±.005
4000	4200718B	2.425 ±.001	2.02 ±.005	1.61 ±.005	1.21 ±.005	1.61 ±.005	4.50 ±.005	3.75 ±.005
5000	5300718B	2.820 ±.001	2.42 ±.005	1.81 ±.005	1.41 ±.005	1.81 ±.005	5.00 ±.005	4.25 ±.005
6000	6500718B	3.135 ±.001	2.73 ±.005	2.00 ±.005	1.605 ±.005	2.00 ±.005	6.25 ±.005	5.50 ±.005
7000	7600718B	3.525 ±.001	2.98 ±.005	2.46 ±.005	1.605 ±.005	2.00 ±.005	6.25 ±.005	5.50 ±.005

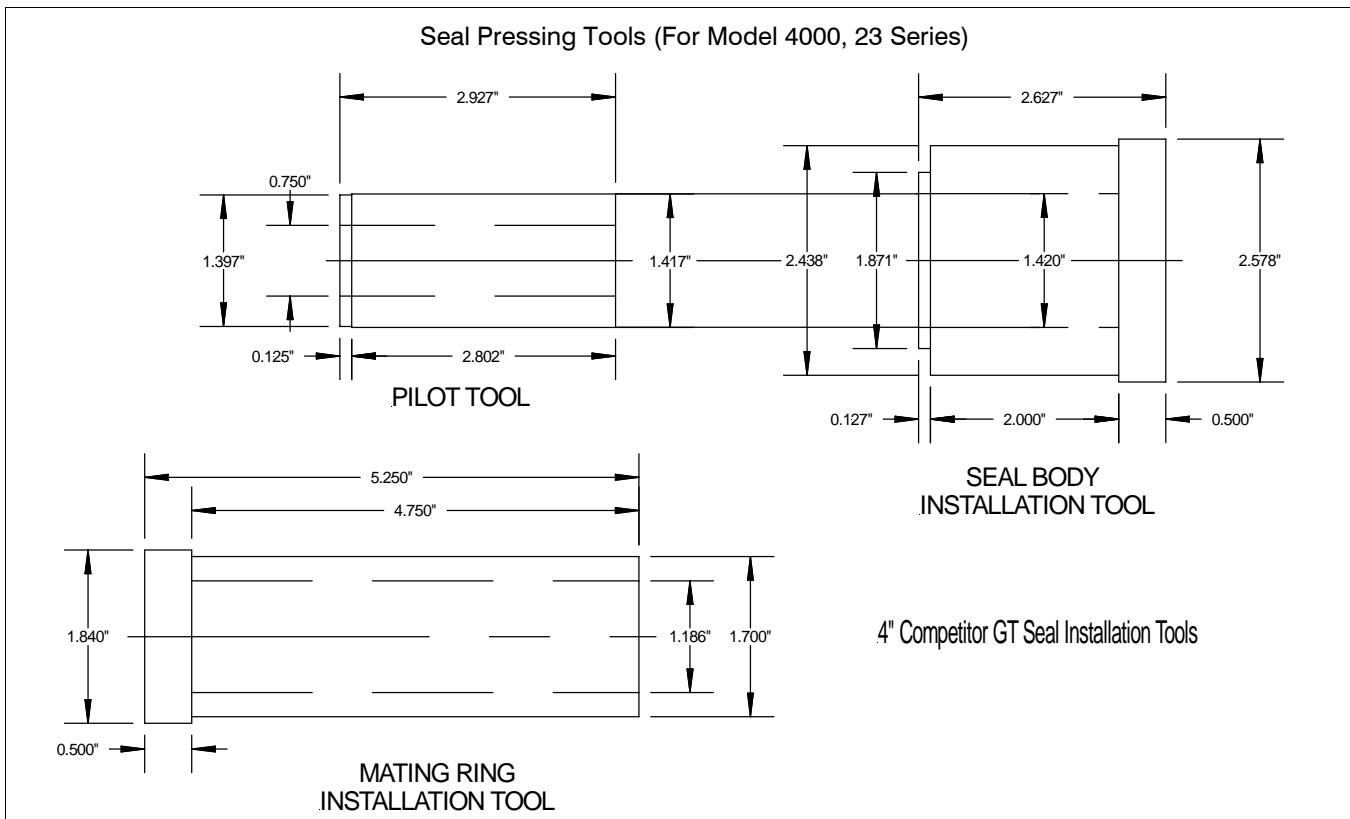
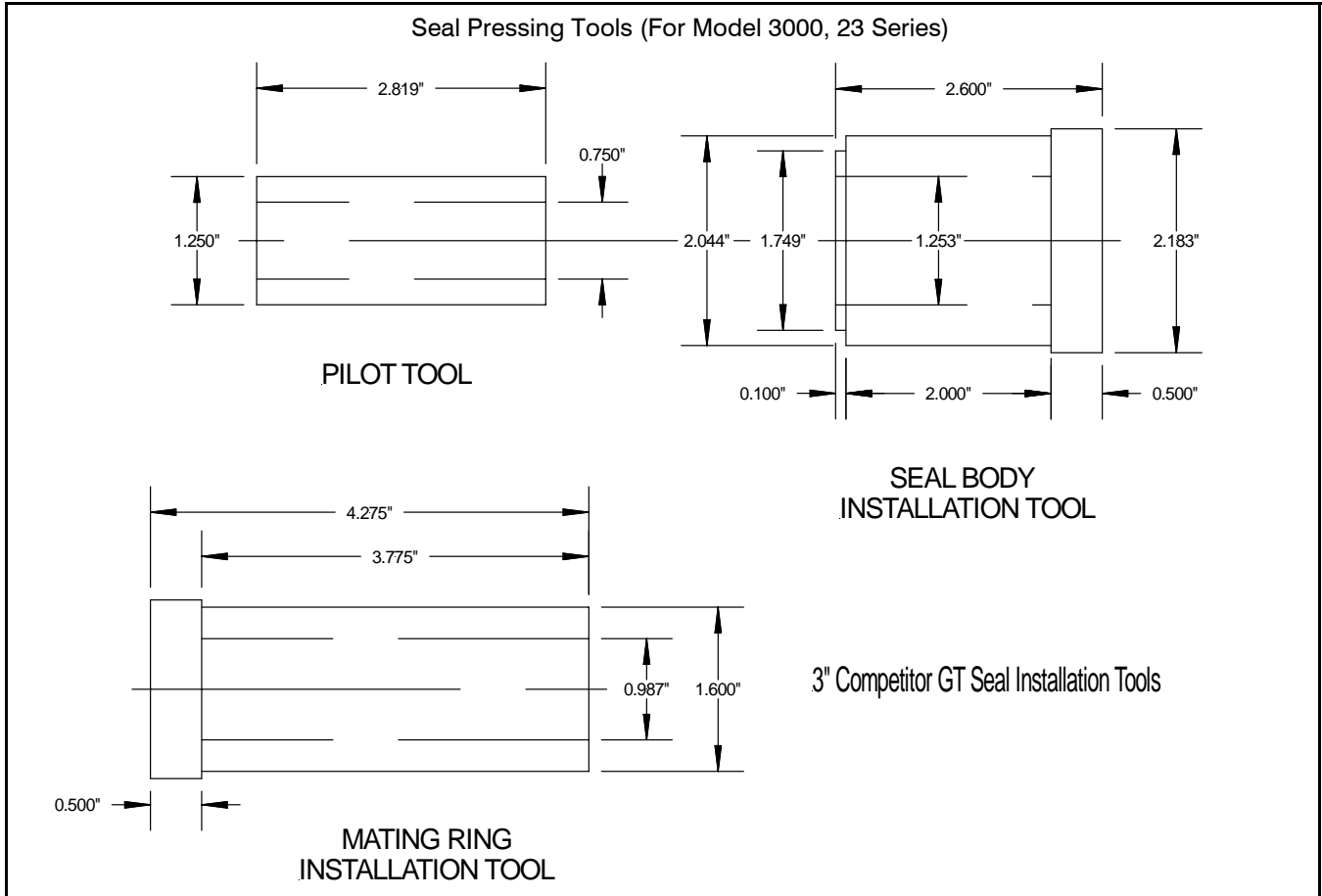


Seal Pressing Tool (For 21 & 22 Series)

MODEL	PART NUMBER	A	B	C	D	E	F
2000	2200708B	1.560 ±.001	1.24 ±.005	1.04 ±.005	.70 ±.005	1.10 ±.005	4.00 ±.005
3000	3300708B	2.035 ±.001	1.74 ±.005	1.54 ±.005	1.015 ±.005	1.415 ±.005	4.37 ±.005
4000	4200708B	2.425 ±.001	1.865 ±.005	1.665 ±.005	1.21 ±.005	1.61 ±.005	5.25 ±.005
5000	5300708B	2.820 ±.001	2.427 ±.005	2.227 ±.005	1.41 ±.005	1.81 ±.005	5.68 ±.005
6000	6500708B	3.135 ±.001	2.74 ±.005	2.54 ±.005	1.605 ±.005	2.00 ±.005	7.00 ±.005
7000	7600708B	3.525 ±.001	2.99 ±.005	2.79 ±.005	1.605 ±.005	2.00 ±.005	7.00 ±.005

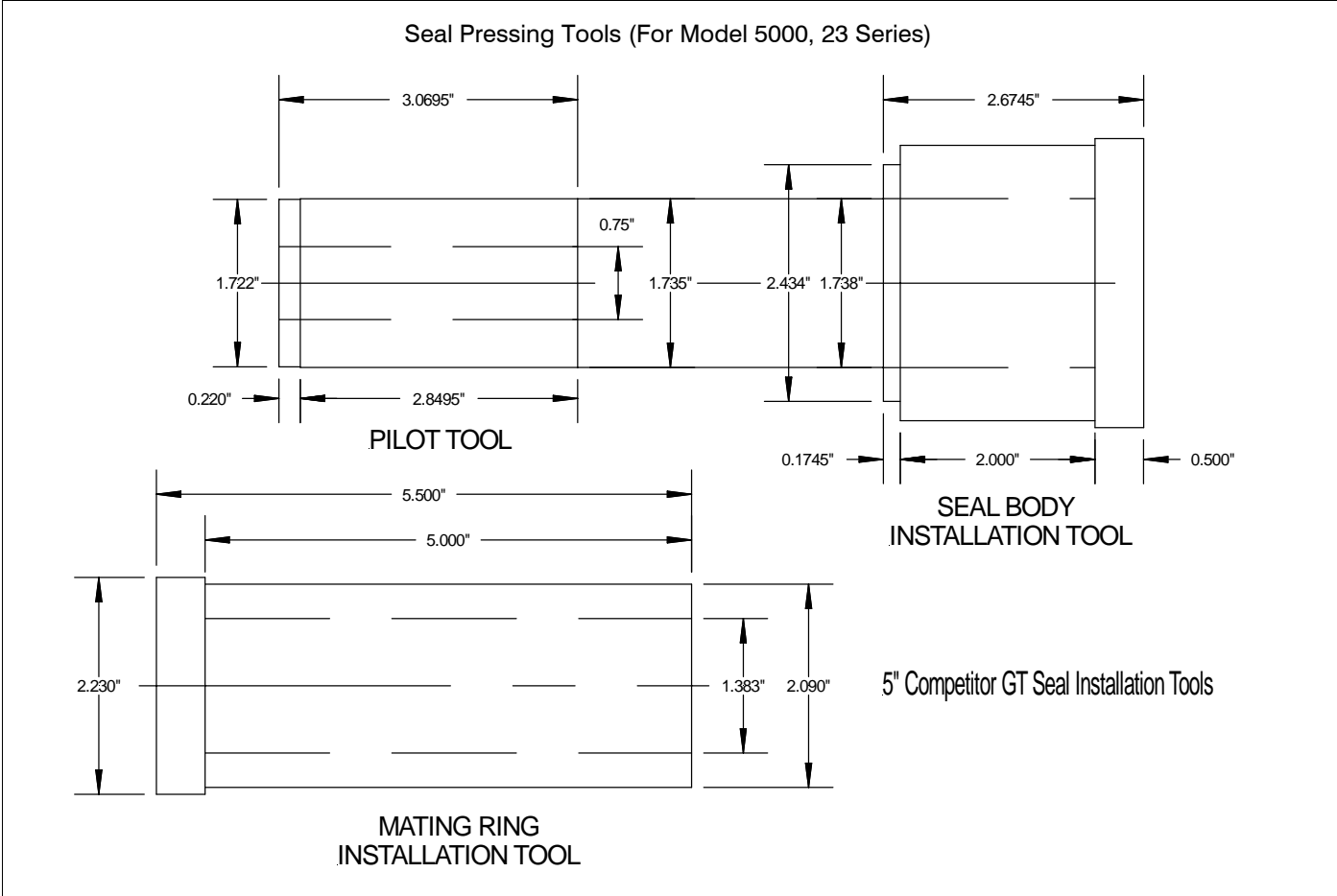
SPECIAL TOOL DRAWINGS

All dimensions shown are in inches.



SPECIAL TOOL DRAWINGS

All dimensions shown are in inches.



SETTING V-BELT TENSION

Proper belt tension is essential to long blower life. The following diagrams and procedures are provided to aid in field adjusting V-belts (when blower is so equipped) for maximum performance. A visual inspection of the V-belt drive should yield the appearance shown in Figure 6 below:

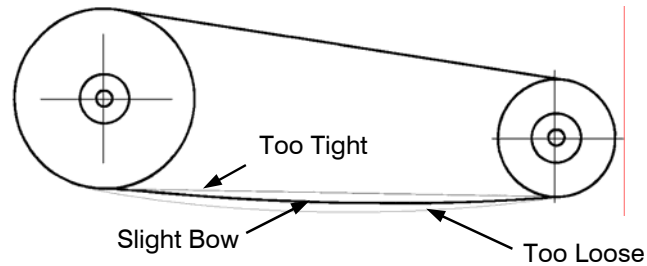


Figure 6. General appearance of a V-belt drive

Factors outside the control of the belt tensioning system used on an individual blower package assembly may contribute to decreased belt life, such as environmental factors, and quality of the belts installed. This can cause wear of the belts beyond the ability of the tensioning system to compensate.

As such, it is recommended to check belt tension monthly and make any manual adjustments found necessary.

1. Turn off and lock out power.
2. Remove the fasteners from the belt guard (if equipped)
3. Remove the belt guard.
4. Check and adjust the belt tension as necessary. It should be $1/64$ " deflection per inch of span (0.157 mm deflection per centimeter of span) between sheaves, with 8-10 lbs. (3.6-4.5 kg) force applied at center point of the top section of belt.
5. Install the belt guard, making sure that all drive components are free of contact with the guard.
6. Install belt guard fasteners removed in step 2.
7. Unlock the power and start your blower.
8. Resume normal operation.

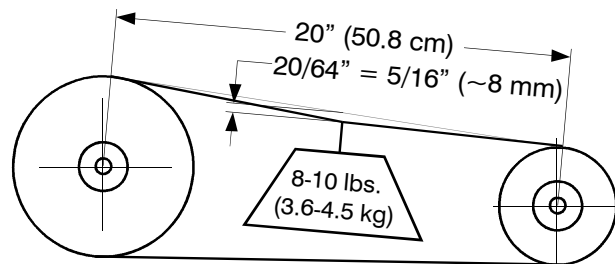


Figure 7. Setting of proper tension for a V-belt drive

WARRANTY

Subject to the terms and conditions hereinafter set forth and set forth in General Terms of Sale, Tuthill Vacuum & Blower Systems (the seller) warrants products and parts of its manufacture, when shipped, and its work (including installation and start-up) when performed, will be of good quality and will be free from defects in material and workmanship. This warranty applies only to Seller's equipment, under use and service in accordance with seller's written instructions, recommendations and ratings for installation, operating, maintenance and service of products, for a period as stated in the table below. Because of varying conditions of installation and operation, all guarantees of performance are subject to plus or minus 5% variation. (Non-standard materials are subject to a plus or minus 10% variation)

Product Type	Type of Application	
	Atmospheric Air or Process Air Without Liquids Present	Process Gases Other Than Air, or Any Liquid Injected Application
New	24 months from date of shipment, or 18 months after initial startup date, whichever occurs first	18 months from date of shipment, or 12 months after initial startup date, whichever occurs first
Repair	12 months from date of shipment, or remaining warranty period, whichever is greater	12 months from date of shipment, or remaining warranty period, whichever is greater

THIS WARRANTY EXTENDS ONLY TO BUYER AND/OR ORIGINAL END USER, AND IN NO EVENT SHALL THE SELLER BE LIABLE FOR PROPERTY DAMAGE SUSTAINED BY A PERSON DESIGNATED BY THE LAW OF ANY JURISDICTION AS A THIRD PARTY BENEFICIARY OF THIS WARRANTY OR ANY OTHER WARRANTY HELD TO SURVIVE SELLER'S DISCLAIMER.

All accessories furnished by Seller but manufactured by others bear only that manufacturer's standard warranty.

All claims for defective products, parts, or work under this warranty must be made in writing immediately upon discovery and, in any event within one (1) year from date of shipment of the applicable item and all claims for defective work must be made in writing immediately upon discovery and in any event within one (1) year from date of completion thereof by Seller. Unless done with prior written consent of Seller, any repairs, alterations or disassembly of Seller's equipment shall void warranty. Installation and transportation costs are not included and defective items must be held for Seller's inspection and returned to Seller's Ex-works point upon request.

THERE ARE NO WARRANTIES, EXPRESSED, IMPLIED OR STATUTORY WHICH EXTEND BEYOND THE DESCRIPTION ON THE FACE HEREOF, INCLUDING WITHOUT LIMITATION, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS OF PURPOSE.

After Buyer's submission of a claim as provided above and its approval, Seller shall at its option either repair or replace its product, part, or work at the original Ex-works point of shipment, or refund an equitable portion of the purchase price.

The products and parts sold hereunder are not warranted for operation with erosive or corrosive material or those which may lead to build up of material within the product supplied, nor those which are incompatible with the materials of construction. The Buyer shall have no claim whatsoever and no product or part shall be deemed to be defective by reason of failure to resist erosive or corrosive action nor for problems resulting from build-up of material within the unit nor for problems due to incompatibility with the materials of construction.

Any improper use, operation beyond capacity, substitution of parts not approved by Seller, or any alteration or repair by others in such manner as in Seller's judgment affects the product materially and adversely shall void this warranty.

No employee or representative of Seller other than an Officer of the Company is authorized to change this warranty in any way or grant any other warranty. Any such change by an Officer of the Company must be in writing.

The foregoing is Seller's only obligation and Buyer's only remedy for breach of warranty, and except for gross negligence, willful misconduct and remedies permitted under the General Terms of Sale in the sections on **CONTRACT PERFORMANCE, INSPECTION AND ACCEPTANCE** and the **PATENTS** Clause hereof, the foregoing is **BUYER'S ONLY REMEDY HEREUNDER BY WAY OF BREACH OF CONTRACT, TORT OR OTHERWISE, WITHOUT REGARD TO WHETHER ANY DEFECT WAS DISCOVERED OR LATENT AT THE TIME OF DELIVERY OF THE PRODUCT OR WORK.** In no event shall Buyer be entitled to incidental or consequential damages. Any action for breach of this agreement must commence within one (1) year after the cause of action has occurred.

July, 2002

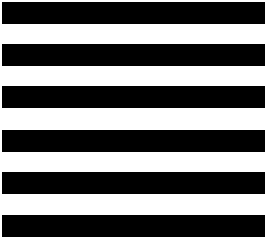


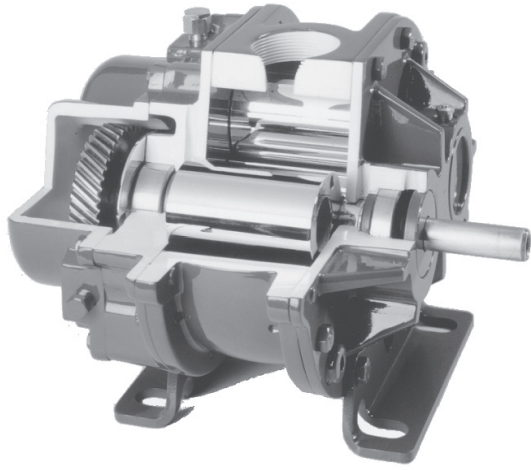
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TUTHILL VACUUM & BLOWER SYSTEMS
PO BOX 2877
SPRINGFIELD MO 65890-2150





M-D Pneumatics™

COMPETITOR[®] PLUS™

Rotary Positive Blowers

COMPETITOR PLUS rotary blowers are designed to be interchangeable with equivalent sizes of Roots Universal RA[®], and many Sutorbilt[®] California Series B and F, and Legend™ Series L and P blowers. **COMPETITOR PLUS** models are rated up to 15 PSIG discharge pressure or 16" Hg dry vacuum.

In addition to interchangeability, Tuthill Vacuum & Blower Systems has improved on existing designs with the following superior features ordinarily found only on premium blowers:

Helical Gearing

COMPETITOR PLUS blowers are timed with hardened, precision helical gears, keyed to the rotor shafts, not taper fit spur gears as offered by other manufacturers, which have greater backlash, and can slip and lose timing. Helical gears are also quieter, reducing mechanical noise.

Stronger Bearings

All **COMPETITOR PLUS** blowers include double row ball bearings at the gear end, stronger than single row ball bearings offered by other manufacturers. Drive shaft bearing is cylindrical roller type for additional strength against side loading from V-belt drives. As a result of this superior design, **COMPETITOR PLUS** blowers offer design bearing life as much as 50% greater than models offered by other manufacturers.

Rotors with Integral Shafts

COMPETITOR PLUS blowers include precision machined ductile iron rotors with large, integrally cast shafts, not press fit and/or pinned shafts offered by other manufacturers, which can loosen over time and cause rotor clash. All rotors are dynamically balanced for vibration-free rotation.

Positive End Clearances

End clearances are positively established at the blower gear end, eliminating the risk of shifting end clearances when installing or removing drive components. This also eliminates the need for those special fork and saddle tools required by other brands to reset end clearances.

Polished Sealing Surfaces

All shaft surfaces in contact with sealing members are polished to reduce seal wear and risk of leakage.

Individually Tested

Every **COMPETITOR PLUS** blower is factory tested to assure you of the highest quality. While some manufacturers perform only sample testing, We go the distance to insure that your blower meets our rigid ISO 9001 registered quality standards.

ISO 9001 Registration

COMPETITOR PLUS blowers are manufactured under the Tuthill Vacuum & Blower Systems ISO 9001 registered quality assurance program, the first American manufacturer of rotary blowers to gain such international recognition.

Warranty

Every **COMPETITOR PLUS** blower is backed by the Tuthill Vacuum & Blower Systems limited warranty for a period of 18 months after installation or 2 years after original blower shipment, whichever occurs first.

Reduced Noise Versions Available

Many **COMPETITOR PLUS** models are available with tri-lobe rotors and specially tuned housing to reduce blower noise.

Worldwide Sales and Service

With sales offices and service facilities located on six continents, you can be assured of availability and service for your **COMPETITOR PLUS** blowers.

Material Specifications:

Housing: Cast iron

End Plates: Cast iron

End Cover: Cast iron

Rotors: Ductile iron

Shafts: Ductile iron, cast integrally with rotors

Bearings: Gear end - Double row ball, both rotors

Drive end - Cylindrical roller on drive rotor

Single row ball on driven rotor

Drive Shaft: Ductile iron, cast integrally with drive rotor

Gears: Heat treated alloy steel, helical cut

Seals: Lip seals on rotor shafts and drive shaft

Lubrication: Oil splash on gear end, grease on drive end

Model Size	Max. Press. PSI	Max. Vac. (in. Hg)	Maximum RPM	Displacement CFR
2002	12	16	5275	.016
2004	7	16	5275	.032
3002	15	16	3600	.0467
3003	12	15	3600	.0616
3006	7	15	3600	.102
4002	15	16	3600	.061
4005	12	16	3600	.121
4007	7	15	3600	.160
5003	15	16	2850	.132
5006	13	16	2850	.221
5009	7	15	2850	.323
6005	15	16	2350	.246
6008	14	16	2350	.395
6015	7	14	2350	.740
7006	15	16	2050	.402
7011	10	16	2050	.738
7018	6	12	2050	1.200

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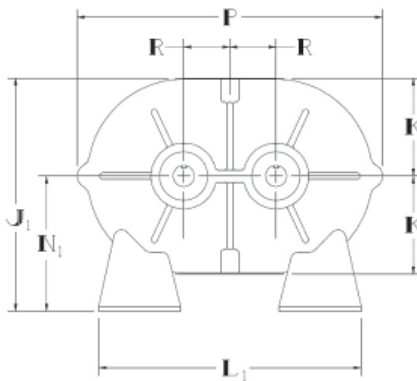
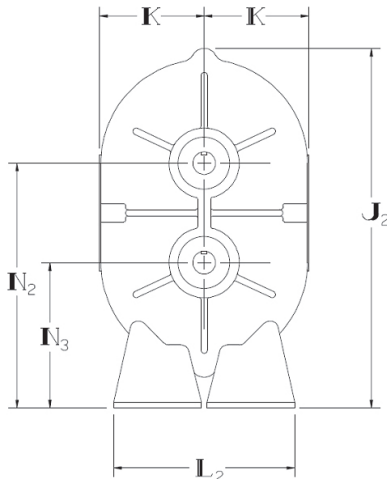
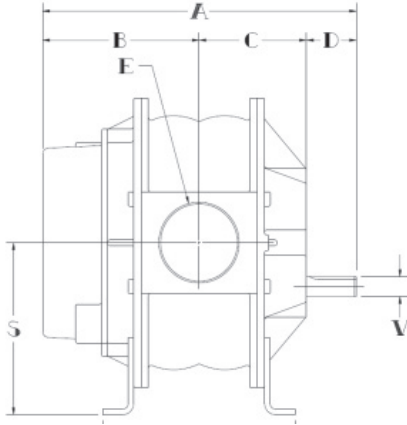
TUTHILL
Vacuum & Blower Systems

4840 West Kearney Street, P. O. Box 2877
Springfield, Missouri USA 65801-2877
Tel 417 865-8715 800 825-6937 Fax 417 865-2950
<http://vacuum.tuthill.com>



Performance

Pressure performance is based on inlet conditions of 14.70 PSIA and 70° F. Vacuum performance is based on inlet temperature of 70° F and discharge pressure of 14.70 PSIA. In conjunction with our program of continuous testing and upgrading, all specifications are subject to change without notice. All data are approximate. Request a quotation for your specific application.



Blower Model	SPEED (RPM)	6 PSIG		7 PSIG		10 PSIG		12 PSIG		13 PSIG		14 PSIG		15 PSIG		Max. Vacuum		
		CFM	BHP	CFM	BHP	CFM	BHP	CFM	BHP	CFM	BHP	CFM	BHP	CFM	BHP	"Hg	CFM	BHP
2002	1750	8	0.9	6	1	2	1.4									9	7	0.7
	3600	38	1.8	36	2.1	32	2.8	29	3.3							14	28	2.1
	5275	64	2.7	63	3.1	59	4.2	56	4.9							16	51	3.4
2004	1750	24	1.6	22	1.9											10	21	1.4
	3600	83	3.3	81	3.8											15	65	4
	5275	137	4.9	135	5.6											16	116	6.3
3002	1150	22	1.6	19	1.8											10	18	1.3
	2700	94	3.8	92	4.3	85	6	81	7.1	79	7.6	77	8.2	75	8.7	16	72	4.8
	3600	136	5	134	5.7	127	7.9	123	9.4	121	10	119	11	118	12	16	114	6.4
3003	1150	30	2	27	2.4											10	26	1.7
	2700	126	4.8	122	5.5	114	7.7	109	9.2						14	107	5.4	
	3600	181	6.4	178	7.4	169	10	164	12						15	158	7.7	
3006	1150	61	3.3	57	3.8											11	50	3
	2700	219	7.7	215	8.9											15	187	9.3
	3600	311	10	306	12											15	279	12
4002	850	17	1.5	15	1.7											10	14	1.3
	1760	72	3.1	70	3.6	62	5	58	5.9	56	6.4	54	6.9		14	56	3.5	
	3600	184	6.4	181	7.4	174	10	170	12	168	13	166	14	164	15	16	161	8.2
4005	850	41	2.9	36	3.3											9	39	2.2
	1760	151	5.9	146	6.9	133	9.6	125	11						14	122	6.7	
	3600	373	12	368	14	355	20	348	24						16	331	16	
4007	850	54	3.7	47	4.3											9	51	2.8
	1760	199	7.7	192	8.9										13	168	8.2	
	3600	492	16	486	18										15	445	19	
5003	700	37	2.6	32	3											10	31	2.2
	1760	176	6.6	172	7.6	160	11	153	13	150	14	147	15		14	150	7.5	
	2850	320	11	316	12	304	17	297	21	294	22	291	24	288	25	16	282	14
5006	700	70	4.3	63	4.9											10	60	3.5
	1760	304	11	297	12	279	17	269	21	264	23				14	264	12	
	2850	545	17	538	20	520	28	510	34	505	37				16	487	22	
5009	700	118	6.1	109	7.1											11	97	5.5
	1760	460	15	451	18										14	409	18	
	2850	812	25	803	29										15	750	30	
6005	700	94	4.9	88	5.6	71	7.9									12	72	4.8
	1760	355	12	348	14	332	20	322	24	318	26	313	27	309	29	16	302	16
	2350	500	16	493	19	477	27	467	32	463	34	458	37	454	39	16	447	21
6008	700	151	7.6	141	8.8	114	12	129	14	124	15					12	115	7.5
	1760	569	19	559	22	533	31	517	37	510	40	503	43		15	498	23	
	2350	802	26	792	30	766	42	750	50	743	54	736	58		16	717	33	
6015	700	282	14	263	16											10	257	11
	1760	1067	35	1048	41										14	957	40	
	2350	1503	47	1484	54										14	1393	53	
7006	650	168	7.2	160	8.3	141	12	129	14	124	15					13	133	7.6
	1760	614	19	606	23	587	32	575	38	570	41	565	44	560	47	16	551	25
	2050	731	23	723	26	703	37	692	44	686	48	681	51	676	55	16	667	29
7011	650	317	13	304	15	270	21									13	257	14
	1760	1136	35	1123	41	1089	58								16	1026	45	
	2050	1350	41	1337	47	1303	67								16	1240	53	
7018	650	545	21													10	519	17
	1760	1877	56												12	1811	55	
	2050	2225	65												12	2159	64	

Dimensions

Model Size	A	B	C	D	E	H	J1	J2	K	L1	L2	N1	N2	N3	P	R	S	V	
2002	10.00	4.88	2.63	2.50	1" NPT	5.00	6.88	9.69	3.13	5.13	5.13	3.75	6.25	3.75	9.38	1.25	5.00	.625	
2004	12.00	5.88	3.63		2" NPT	7.00													
3002	11.56	5.69	3.38		1 1/4" NPT	6.75													
3003	12.44	6.19	3.75	2.50	2" NPT	7.63	8.94	12.81	3.94	7.25	7.25	5.00	8.50	5.00	12.19	1.75	6.75	.875*	
3006	14.81	7.38	4.94		2 1/2" NPT	10.00													
4002	12.94	6.25	3.69		1 1/2" NPT	7.25													
4005	15.69	7.63	5.06		2 1/2" NPT	10.00	10.63	15.13	4.38	8.00	8.00	6.25	10.25	6.25	13.69	2.00	8.25	.875	
4007	17.44	8.50	5.94	3.00	3" NPT	11.75													
5003	15.25	7.38	4.50		2 1/2" NPT	8.38													
5006	17.88	8.69	5.81	3.38	4" NPT	11.00	12.13	17.38	5.38	10.50	10.50	6.75	11.25	6.25	17.19	2.50	8.75	1.125	
5009	20.88	10.19	7.31		4" NPT	14.00													
6005	18.75	9.44	5.63		3" NPT	10.13	15.06		6.25										
6008	21.75	10.94	7.13	3.69	5" NPT	13.13	15.06	21.69	6.25	17.00	11.00	8.75	14.75	8.75	19.81	3.00	11.75	1.375	
6015	28.75	14.44	10.63		6" FLG	20.13	16.44		7.50										
7006	20.31	10.31	5.94		4" NPT	11.75	20.63		9.63										
7011	25.31	12.69	8.44		6" FLG	16.75	19.50	26.13	8.50	21.00	14.00	11.00	18.00	11.00		23.25	3.50	14.50	1.562
7018	32.31	16.31	11.94	4.06	8" FLG	23.75	19.50		8.50										

Values shown are approximate and should not be used for construction.

Certified drawings are available through your local Tuthill Vacuum & Blower Systems Sales Professional.

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