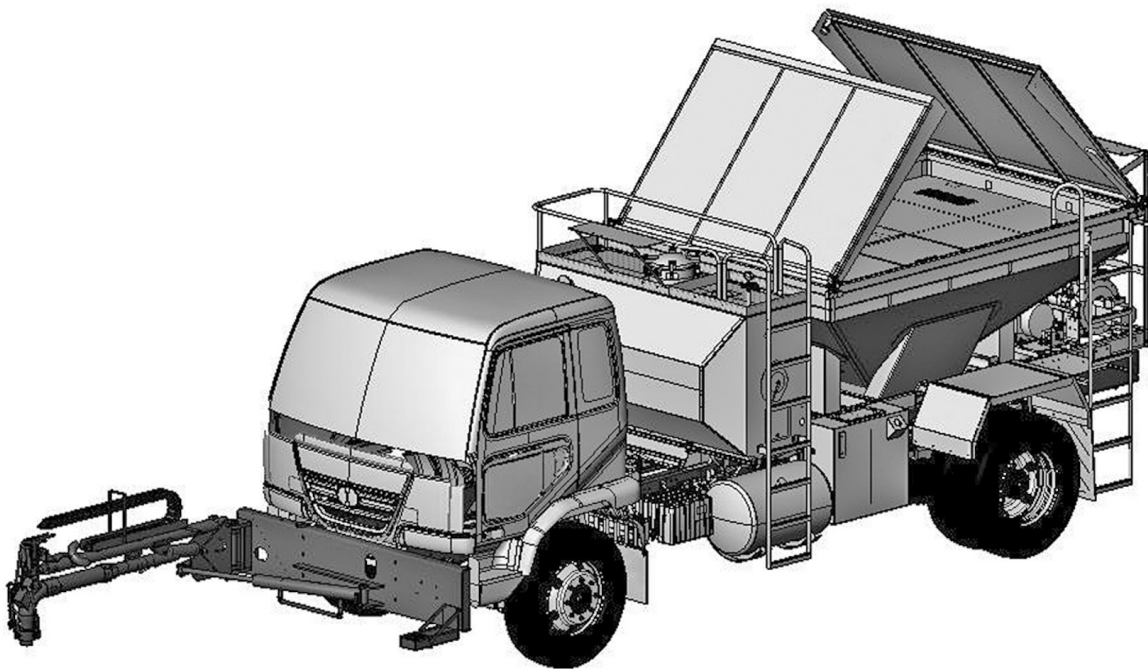


ROSCO

A LeBoey Company

OPERATIONS, SERVICE AND PARTS MANUAL



RA400-1

**RA-400 PATCHER
FOR NISSAN TRUCK**
Manual No. 1003242-03

Introduction**1****Safety****2****General Information****3****Specifications****4****Component Location****5****Operation****6****Maintenance****7****Troubleshooting****8****Schematics****9****Illustrated Parts List (IPL)****10**

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A *LeeBoy* Company

1

Section 1 INTRODUCTION

Thank you for purchasing the LeeBoy Model RA-400 Patcher. We wish you many years of safe and efficient operation of your Patcher.

LeeBoy's ROSCO RA-400 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 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. 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-400 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.

This manual is intended as a guide for the safe and efficient use of the Patcher. This manual covers the procedures for proper operation and maintenance of the Patcher. This manual contains information that was available at the time of printing.

This manual provides information for use by the equipment operator under the following headings:

Safety—See Section 2 for important safety guidelines information.

General Information—See Section 3 for important warranty, contact, and nameplate information.

Specifications—See Section 4 for all major system specifications and typical torque value tables.

Component Location—See Section 5 for general overview of controls and major components.

Operation—See Section 6 for control functionality and normal machine operation.

Maintenance—See Section 7 for basic preventive maintenance and repair procedures.

Troubleshooting—See Section 8 for problem descriptions and recommended solution tables.

Schematics—See Section 9 for schematic diagrams of electrical wiring.

Illustrated Parts List—See Section 10 for illustrations, descriptions and part numbers of available service parts.

Introduction

RECEIVING THE RA-400 PATCHER

CAUTION

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

The RA-400 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.

NOTES:**1**

Introduction

NOTES:



Section 2

SAFETY

2

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Safety

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 the RA-400 Patcher and follow its instructions when operating the machine.

Safety is everyone's business and is our top concern. Knowing the guidelines covered in this section and in Section 1 will help ensure 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 THE SAFETY OF YOU AND YOUR COWORKERS. READ AND UNDERSTAND THOROUGHLY. HEED THE WARNING AND FOLLOW THE INSTRUCTIONS.

Keep safety labels in good condition. If safety labels become missing or damaged, replacement safety labels are available from your authorized LeeBoy Dealer.



DANGER

Indicates a hazardous situation which, if not avoided, **will** result in death or serious injury.



WARNING

Indicates a hazardous situation which, if not avoided, **could** result in death or serious injury.



CAUTION

Indicates a hazardous situation which, if not avoided, **could** result in minor or moderate injury.

NOTICE

Indicates a situation which can cause damage to the equipment, personal property and/or the environment, or cause the RA-400 Patcher to operate improperly.

NOTE: Indicates a procedure, practice, or condition that should be followed in order for the machine or component to function in the manner intended.

SAFETY PRECAUTIONS

⚠ CAUTION

The safety messages that follow have CAUTION level hazards.

Pre-Operation Hazard



Read and understand this Operation Manual before operating or servicing the engine to ensure that safe operating practices and maintenance procedures are followed.

- Never permit anyone to service or operate the RA-400 Patcher without proper training.
- Safety signs and labels are additional reminders for safe operating and maintenance techniques.
- Contact LeeBoy or an authorized LeeBoy Dealer for additional training.
- Make sure you are aware of all laws and regulations that are in effect where the machine is operated. Make sure you have all necessary licenses to operate the machine.

⚠ WARNING

The safety messages that follow have WARNING level hazards.

Crush Hazard

Keep bystanders away from work area before and during operation.

Modification Hazard

Never modify the RA-400 Patcher without written consent of LeeBoy. Any modification can affect the safe operation of the machine and may cause personal injury or death.

Exposure Hazard



Always wear personal protective equipment, including appropriate clothing, gloves, work shoes, and eye and hearing protection, as required by the task at hand.

Explosion Hazard

While the engine is running or the battery is charging, hydrogen gas is being produced and can be easily ignited. Keep the area around the battery well-ventilated and keep sparks, open flame and any other form of ignition out of the area.



- Always disconnect the negative (-) battery cable before servicing the machine.
- Do not start the engine by shorting the starter circuit or any other starting method not stated in this manual. Only use the starting procedure as described in this manual to start the engine.
- Never charge a frozen battery. Always slowly warm the battery to room temperature before charging.

Fire and Explosion Hazard

- Diesel fuel is flammable and explosive under certain conditions.
- Never use a shop rag to catch the fuel.
- Wipe up all spills immediately.
- Never refuel with the engine running.
- Store any containers containing fuel in a well-ventilated area, away from any combustibles or sources of ignition.

Fire Hazard

Have appropriate safety equipment available. Have all fire extinguishers checked periodically for proper operation and/or readiness.



- Always read and follow safety-related precautions found on containers of hazardous substances like parts cleaners, primers, sealants and sealant removers.
- Undersized wiring systems can cause an electrical fire.

WARNING

The safety messages that follow have **WARNING** level hazards.

Exhaust Hazard



All internal combustion engines create carbon monoxide gas during operation and special precautions are required to avoid carbon monoxide poisoning:

- Never block windows, vents or other means of ventilation if the RA-400 Patcher is operating in an enclosed area.
- Always ensure that all connections are tightened to specifications after repair is made to the exhaust system.

Entanglement/Sever Hazard



Verify there are no people, obstacles or other equipment near the RA-400 Patcher before starting the engine. Sound the horn as a warning before starting the engine.

If the engine must be serviced while it is operating, remove all jewelry, tie back long hair and keep hands, other body parts and clothing away from moving/rotating parts.



- Always stop the engine before beginning service.
- Verify that all machine guards and covers are attached properly to the machine before starting the engine. Do not start the engine if any guards or covers are not properly installed on the machine.
- If you must run the engine during maintenance procedures, make sure you have a helper to keep bystanders clear of the machine and make observations of moving parts as requested by the operator.
- Always turn the start switch to the OFF position after operation is complete and remove the key from the switch. Keep the key in your possession when the machine is not operating.
- Attach a "Do Not Operate" tag near the key switch while performing maintenance on the equipment.
- Never operate the engine while wearing a headset to listen to music or radio because it will be difficult to hear the warning signals.

- Always start the engine or operate the controls while you are seated in the operators seat.

Alcohol and Drug Hazard



Never operate the engine while under the influence of alcohol or drugs, or when ill.

Piercing Hazard



Avoid skin contact with high-pressure hydraulic fluid or diesel fuel spray caused by a hydraulic or fuel system leak such as a broken hydraulic hose or fuel injection line. High-pressure hydraulic fluid or fuel can penetrate your skin and result in serious injury. If you are exposed to high-pressure hydraulic fluid or fuel spray, obtain prompt medical treatment.

- Never check for a hydraulic fluid or fuel leak with your hands. Always use a piece of wood or cardboard. Have your authorized LeeBoy Dealer or distributor repair the damage.

Flying Object Hazard



Always wear eye protection when cleaning the RA-400 Patcher with compressed air or high-pressure water. Dust, flying debris, compressed air, pressurized water or steam may injure your eyes.

Coolant Hazard



Wear eye protection and rubber gloves when handling engine coolant. If contact with the eyes or skin should occur, flush eyes and wash immediately with clean water.

Burn Hazard

Some of the machine surfaces become very hot during operation and shortly after shutdown.



- Keep hands and other body parts away from hot machine surfaces.
- Handle hot components with heat-resistant gloves.

**CAUTION**

The safety messages that follow have CAUTION level hazards.

Poor Lighting Hazard

Ensure that the work area is adequately illuminated.
Always install wire cages on portable safety lights.

Tool Hazard

Always use tools appropriate for the task at hand and use the correct size tool for loosening or tightening RA-400 Patcher parts.

NOTICE

The safety messages that follow have NOTICE level hazards.

Any part which is found defective as a result of inspection or any part found to have a measured value that does not satisfy the standard or limit must be replaced.

Always tighten components to the specified torque. Loose parts can cause RA-400 Patcher damage or cause it to operate improperly.

Only use replacement parts approved by LeeBoy. Other replacement parts may affect warranty coverage.



Follow the guidelines of the EPA or other governmental agencies for the proper disposal of hazardous materials such as engine oil, diesel fuel and engine coolant. Consult the local authorities or reclamation facility.

Clean all accumulated dirt and debris away from the body of the machine and its components before you inspect the machine or perform preventive maintenance procedures or repairs. Operating a machine with accumulated dirt and debris will cause premature wear of machine components. Accumulated dirt and debris also hinder effective machine inspection.

Retrieve any tools or parts that may have dropped inside of the machine to avoid improper machine operation.

Dispose of hazardous materials in accordance with all applicable laws and regulations. Never dispose of hazardous materials by dumping them into a sewer, on the ground, or into groundwater or waterways.

If any alert indicator illuminates during machine operation, stop the engine immediately. Determine the cause and repair the problem before continuing to operate the machine.

Safety Label Precautions

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 7, **Maintenance**.

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.



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, Roll Over Protective Structure (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 6 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 (nega-

tive (-) 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 6, **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 7, **Maintenance**, for more detailed instructions.



Section 3

GENERAL INFORMATION

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General Information

LIMITED WARRANTY POLICY

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.

THE FOREGOING WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHER EXPRESSED, STATUTORY AND IMPLIED WARRANTIES APPLICABLE TO UNITS, ENGINES, OR PARTS INCLUDING WITHOUT LIMITATION, ALL IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR USE OR PURPOSE OR AGAINST INFRINGEMENT.

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.

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.

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.

General Information

CONTACT INFORMATION

For information regarding parts and repairs about your LeeBoy product, first contact the dealer you purchased your product from.

If you have a persistent problem your dealer is unable to resolve, contact LeeBoy directly.

Record dealer information in the space provided. For additional information about LeeBoy, please visit: www.leeboy.com.

Sales Representative: _____

Dealership Name: _____

Dealership Address: _____

Dealership Phone: _____

RECORD OF OWNERSHIP

Please fill out the following information and use it when you need to contact LeeBoy for service, parts or literature.

Model Number: _____

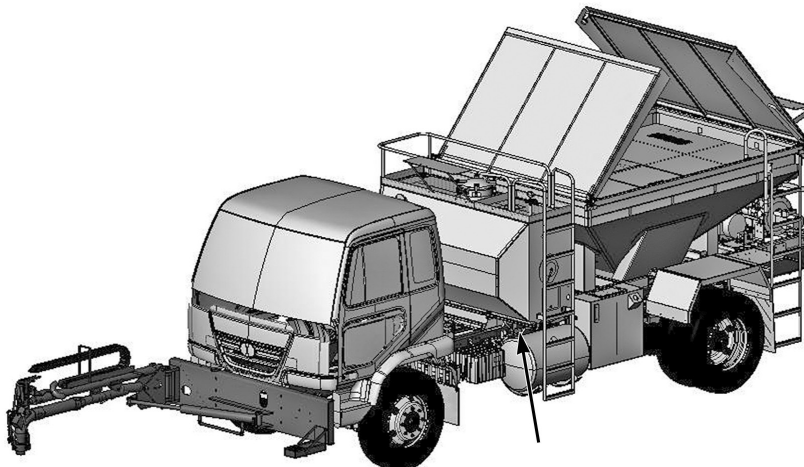
Serial Number: _____

Engine Type/Number: _____

Date of Purchase: _____

SERIAL NUMBER LOCATION

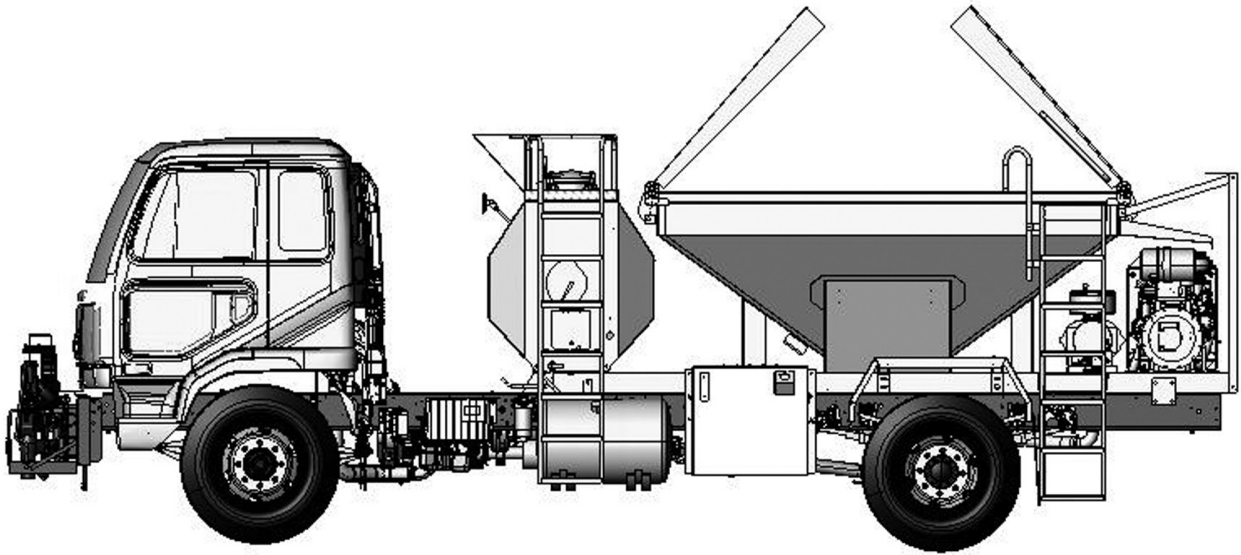
Serial numbers used to identify the components for any parts or service information are listed on the **plate located on the side of the Patcher**.



RA400-56

Serial Number Location

Figure 3-1



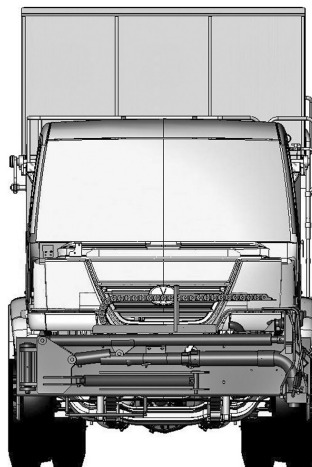
RA400-2

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.



RA400-3

Front View

General Information

NOTES:



Section 4

SPECIFICATIONS

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Specifications

GENERAL INFORMATION

The descriptions and specifications provided in this section are applicable to the RA-400 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-400 Patcher.

MAJOR COMPONENTS

The RA-400 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 13 GPM per section, driven from auxiliary engine
- B. Four (4) solenoid valves
- C. Five (5) hydraulic cylinders
- D. One (1) proportional valve
- E. Two (2) 3-way solenoid valves
- F. Hydraulic oil reservoir tank and filter
- G. Electric controls in the truck cab

The hydraulic pump is driven off the auxiliary engine. 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). Four (4) 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 auxiliary engine RPM 2500/2600.

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 hydraulic motor, capable of 850 CFM @ 2,850 RPM
- D. Muffler
- E. Delivery hose
- F. Telescoping discharge boom with emulsion hose E-Chain hose carrier
- G. +/- Gate set, emulsion flow and blower speed

Appropriate sized, relatively clean aggregate is loaded into the aggregate hopper (see **Material Selection** in Section 6). The slide gate feeder introduces the aggregate into the 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

Tables 4-1 through 4-9 list major system specifications for the RA-400 Patcher. Additional maintenance tables are shown in Section 7, **Maintenance**.

Table 4-1. Machine Requirements

ITEM	SPECIFICATION
Weight	18,000 lbs (8,165 kg)
Length (with boom stored)	26 ft 11 in. (8.20 m)
Length (with boom extended)	38 ft 5 in. (11.78 m)
Maximum Height	9 ft 9 in. (3.00 m)
Machine Width	8 ft 0 in. (2.44 m)
Turning Radius	25 ft 5 in. (7.75 m)

Table 4-2. Chassis Requirements

ITEM	SPECIFICATION
Cab Forward	32,900 GVW (14,923 kg)
Front Axle	11,900 lbs (5,397 kg)
Rear Axle	21,000 lbs (9,525 kg)
Rear Spring Rating	23,000 lbs (10,433 kg)
Air Brakes	20.8 CFM (0.589 m) compressor minimum
Truck Engine	230 HP (171 kw)
Truck Wheelbase	14' 9" (4.50 m)

Table 4-3. Hydraulic System Specifications

ITEM	SPECIFICATION
Pump (dual)	13 to 43 GPM (49 to 162 LPM)
Hydraulic Reservoir	38 gallons (144 liters)
Hydraulic Return Filter	10-Micron Spin-On Cartridge (P/N 6442)
Hydraulic Strainer	In-Tank (P/N 72243)

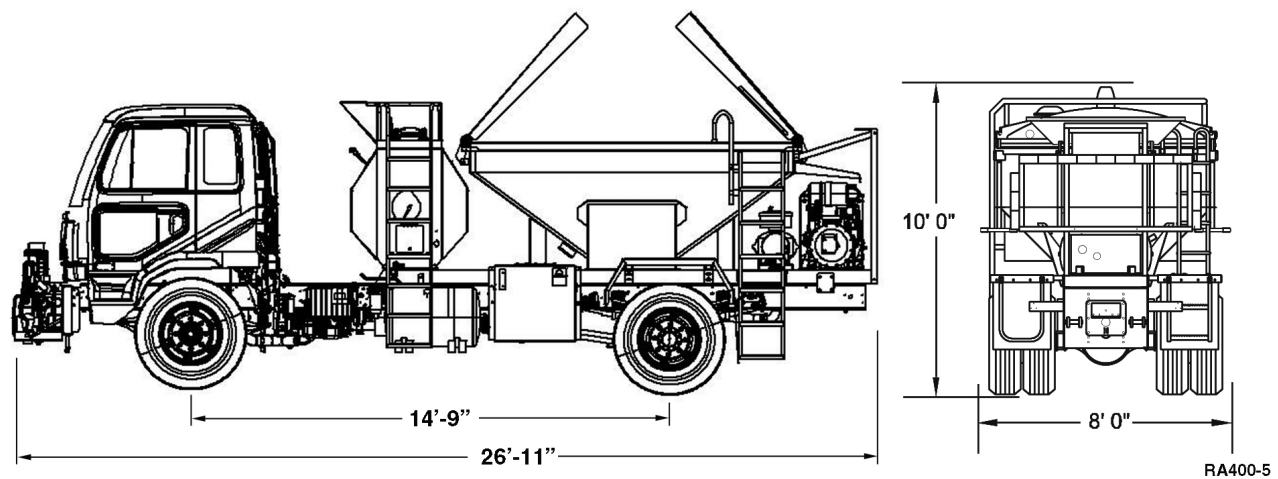
Table 4-4. Auxiliary Engine Specifications - Kubota Tier 3

ITEM	SPECIFICATION
Manufacturer and Model	Kubota V3600-E3B
Emission Regulation	Tier 3/Stage III A
Type	Vertical 4-cycle Liquid Cooled Diesel
Number of Cylinders	4
Bore, Stroke and Displacement	3.86 in. (98 mm); 4.72 in. (120 mm); 220.9 cu.in. (3.62 L)
Combustion System	Direct Injection (IDI)
Intake System	Naturally Aspirated

Table 4-4. Auxiliary Engine Specifications - Kubota Tier 3 (Continued)

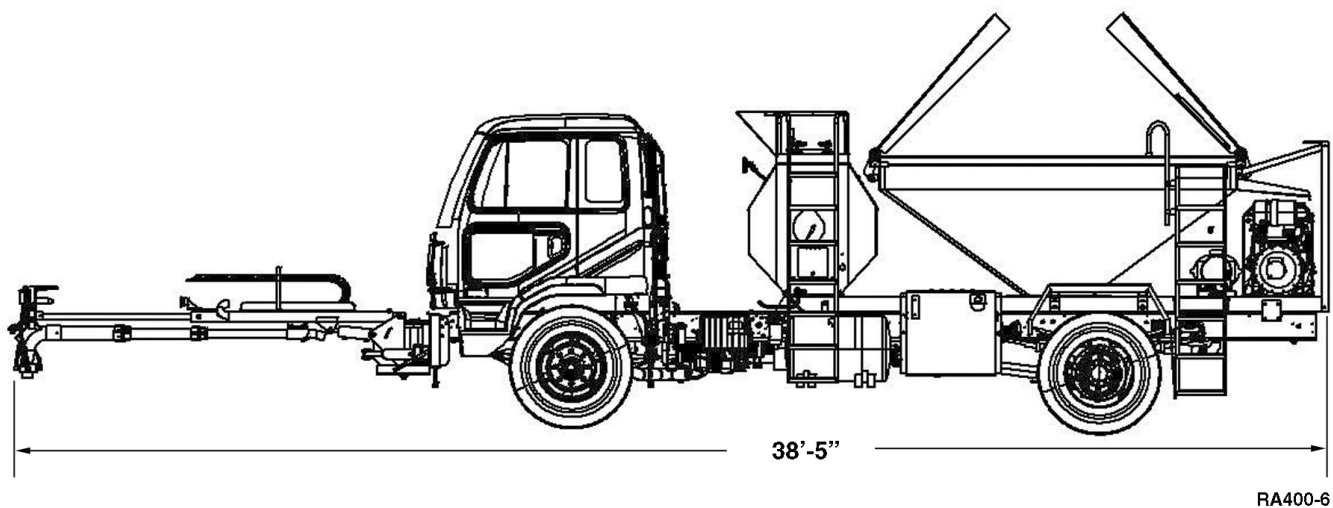
ITEM	SPECIFICATION
Power Rating	66.8 HP - 49.8kW
Alternator	12 Vdc - 60 amp
Maximum Speed	2600 RPM
Crank Case Capacity	3.49 gal (13.2 L)
Cooling Capacity	3.65 gal (13.8 L)

DIMENSIONS



Dimensional Drawing with Boom Retracted

Figure 4-1



Dimensional Drawing with Boom Extended

Figure 4-2

Table 4-5. Air System Specifications

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 4-6. Asphalt Emulsion System Specifications

Nominal Tank Capacity	300 gallons (1,135 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 4-7. Aggregate System Specifications

Type	Open Hopper with Lids
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 4-8. Discharge Hose, Nozzle and Boom Specifications

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	10' 10" (3.30 m)
Boom Suspension	Hydraulic Cylinders

Specifications

Table 4-9. Cleanout System Specifications

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

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 4-10.

Table 4-10. 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	1/9

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 4-11.
6. Tighten while holding body of fitting with a wrench.

Table 4-11. 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)
(in)	(in)				
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
1-7/8	2-1/8	217	160	1/2	1/12

Specifications

TORQUE SPECS: INCH

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 4-12. 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 UNC	19	24	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

TORQUE SPECS: METRIC

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 4-13. Torque Specifications for Metric Fasteners

Nominal Size and 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	1476.0	1107.00	2000.0	1500.0

N•m = Newton meter

ft-lb = Foot pound

Specifications

NOTES:



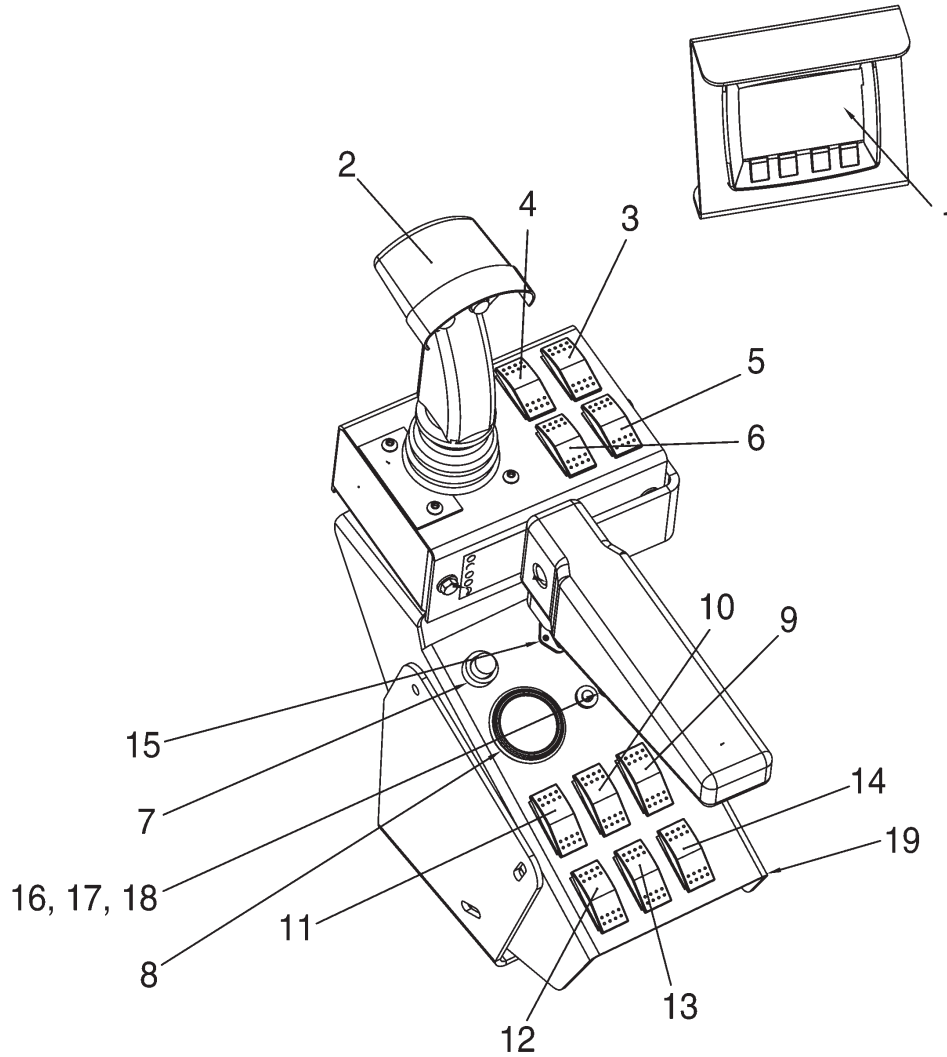
Section 5

COMPONENT LOCATION

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Component Location

CONTROL STATION

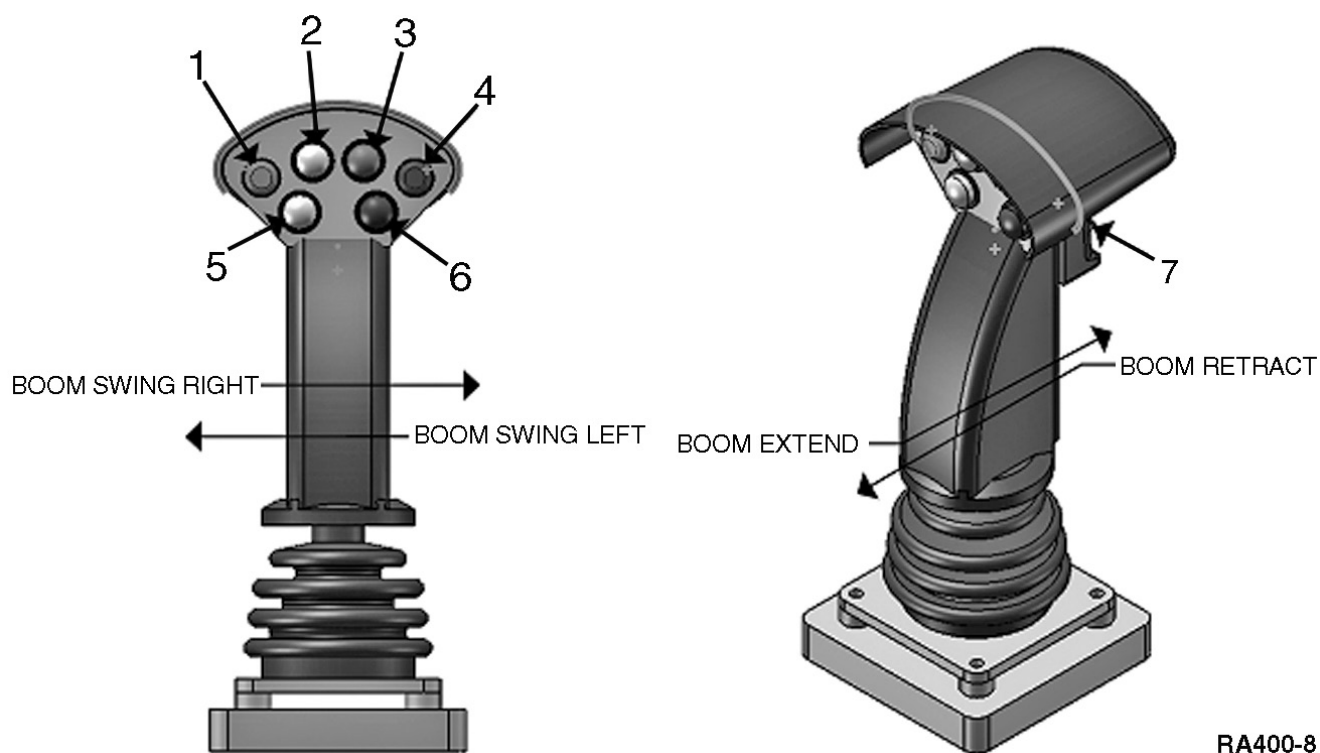


RA400-7

Control Station
Figure 5-1

Table 5-1. RA-400 Patcher Operation Controls

ITEM	DESCRIPTION
1	Graphic Display (see Figure 5-1 for detail)
2	Joystick (see Figure 5-2 for detail)
3	Blower On/Off
4	Blower Speed Inc/Dec
5	Rock Flow Inc/Dec
6	Emulsion Flow Inc/Dec
7	Engine Alarm Buzz/Lite
8	Engine Tachometer
9	Engine Pre-heat
10	Engine Start Start/On/Off
11	Engine RPM Min/Max
12	Boom Functions
13	Vibrator
14	Beacon
15	Hourmeter
16	Circuit Breaker 10A CPU Power
17	Circuit Breaker 10A CPU Power
18	Circuit Breaker 10A Beacon, Vibrator
19	Relay for Emulsion Valve (not shown)



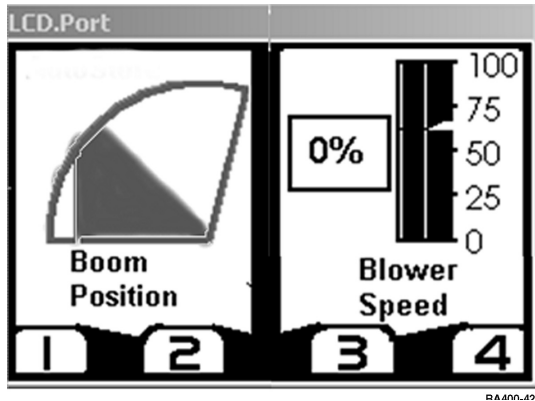
RA400-8

Joystick Function
Figure 5-2

Table 5-2. Joystick Function

ITEM	COLOR	TYPE	OPERATION	FUNCTION
1	Amber	Light		Illuminate when emulsion valve is open
2	White	Pushbutton	Alternate Action	Stop/Start emulsion flow
3	Red	Pushbutton	Alternate Action	Stop/Start rock flow
4	Red	Light		Illuminate when rock flow gate is open
5	Yellow	Pushbutton	Momentary	Hold to lower boom
6	Blue	Pushbutton	Momentary	Hold to raise boom
7	Red	Trigger	Alternate Action	Stop/Start blow out mode

GRAPHIC DISPLAY OPERATIONAL SCREENS



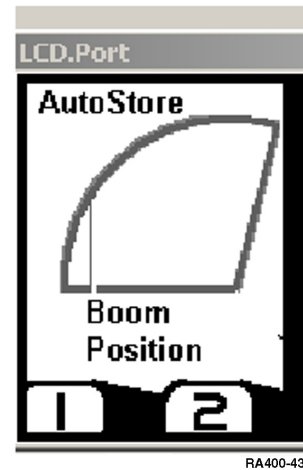
Pushbutton 1

Figure 5-3

Figure 5-3 - Screen 1 shows the position of the Boom during normal operation and Screen 2 shows the Blower Speed. The speed is controlled by the INC/DEC rocker switch on the Joystick Panel. This allows the operator to set the blower speed in % and can use this percent for future reference.

The blower must be turned ON to control the blower speed. The Blower Speed is controlled by a set point indicated by the white arrow. The set point may be adjusted up or down by the operator.

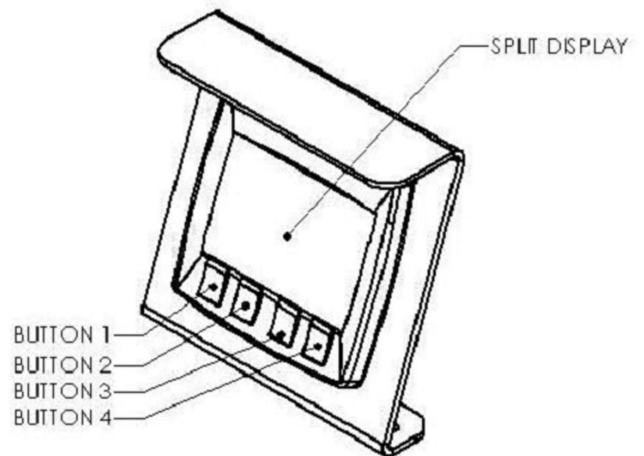
When activated, the Blower will go from 0 to the Set Point. When turned off, the Blower will return to 0%. The Black bar on the Left will move up and down matching the % shown in the digital readout. This setting is maintained until changed by the operator.



Boom Override

Figure 5-4

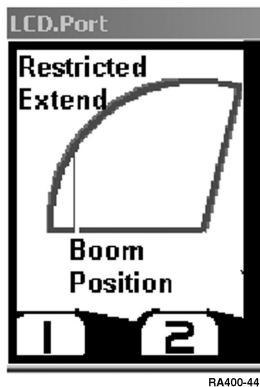
Figure 5-4 - If Auto Store is activated, Screen 1 will display the message as shown. The rocker switch on the switch panel requires being held down for the Auto Store feature to be activated. If rocker is released, the procedure must be restarted. This operation is time based and you have to continue to hold the rocker until the entire process is complete. This may take up to thirty (30) seconds or more, depending on the position of the boom when activated.



Graphic Display

Figure 5-5

Component Location



Restricted Zone

Figure 5-6

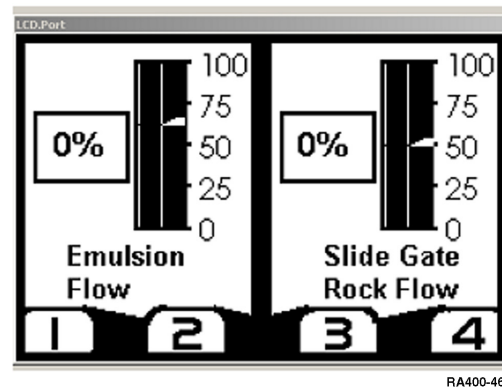
Figure 5-6 - The Restricted Extend will display (Screen 1) when the Boom has swung into the Restricted Zone (Area where Boom could extend into traffic lane). The buzzer will beep when you are approaching the Restricted Zone and will beep again when you exit the zone. When the Restricted Zone is violated the Boom will retract and cannot be extended until the Boom is swung out of the Restricted Zone.



Boom Override Activated

Figure 5-7

Figure 5-7 - Boom Override Activated will display (Screen 1) to indicate that the Restricted Zone has been overridden and that the operator should use caution when in this mode. To activate this mode hold the Auto rocker switch down until Figure 5-7 is displayed. To return to the normal mode, push and release the Auto rocker switch.



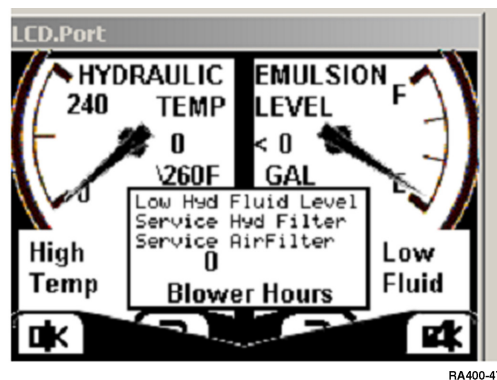
Pushbutton 2

Figure 5-8

Figure 5-8 - Screen 1 the Emulsion Flow is turned on by pushing the white button on the joystick. The amber light will illuminate when the valve is open. Pushing the button again will close the valve. The set point is controlled by a set point indicated by the white arrow. The set point may be adjusted up or down by the operator using the rocker switch on the Joystick panel. When activated, the Emulsion Valve will go from 0 to the Set Point. When turned off, the Emulsion Valve will return to 0%.

The Black bar on the Left will move up and down matching the % shown in the digital readout. This setting is maintained until changed by the operator.

Screen 2 shows the Rock Flow and works similarly to the Emulsion Flow control.



Pushbutton 3

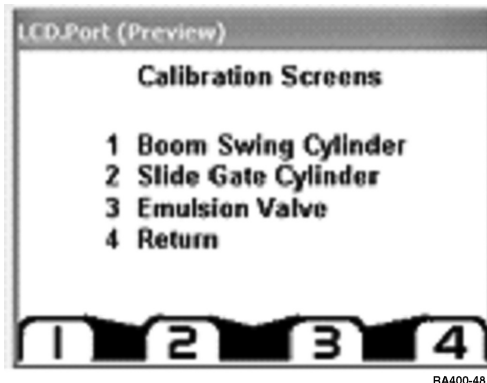
Figure 5-9

Figure 5-9 - Screen 1-Shows the Hydraulic Temperature. If the Hydraulic Oil temperature rises above 210 degrees F, then the Display will automatically move to this screen, the High Temp Indicator will flash, and the Red LED will light. The Red LED will remain illuminated until the Temperature drops below 210 degrees.

Figure 5-9 - Screen 2 shows the Emulsion Level. When the Emulsion level is below 25 gal, the Low Fluid Indicator will flash, and the Red LED will light.

Figure 5-9 - Screen 3 will also show how many hours the blower has operated. The Hydraulic Fluid Level is Low, the Hydraulic Filter needs service, or the Air Filter needs service, if these options are available on your unit.

GRAPHIC DISPLAY CALIBRATION SCREENS



Calibration Screens

Figure 5-10

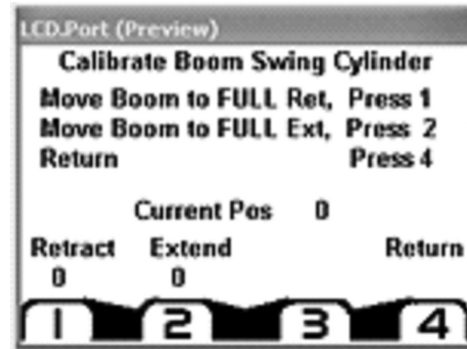
Figure 5-10- This is the Calibration Screens. To get to this screen, hold buttons #1 and #4 for 2 seconds. This is the screen where the Boom Swing Cylinder, Slide Gate Cylinder, and the Emulsion Valve are set to their minimum and maximum positions. This allows the computer to determine the parameters for the device to operate.

Pushing #1 button will get you to the Boom Swing Cylinder Calibration screen.

Pushing #2 button will get you to the Slide Gate Cylinder (Rock Flow) Calibration screen.

Pushing #3 button will get you to the Emulsion Valve (Emulsion Flow) Calibration screen.

Pushing #4 button will return you to the main screens.



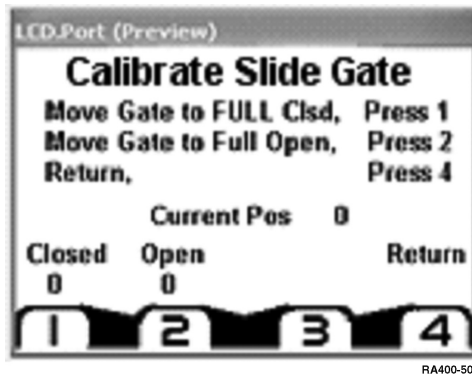
Boom Swing Calibration

Figure 5-11

Figure 5-11 - This screen allows you to set the minimum and maximum swing of the boom. Using the Joystick, (Auxiliary Engine must be running) swing the boom to the left until it reaches its stored position. At this point, push button #1 and hold for a second to store the value in the Current Pos. The value in Retract should now match the value in Current Pos. Proceed to swing the boom to the right until it has reached its maximum position. Push button #2 and hold for a second to store the Extend value in the Current Position. The value in Extend should now match the value in Current Pos.

To exit this screen, hold the #4 button for 2 seconds.

Component Location



Slide Gate Calibration

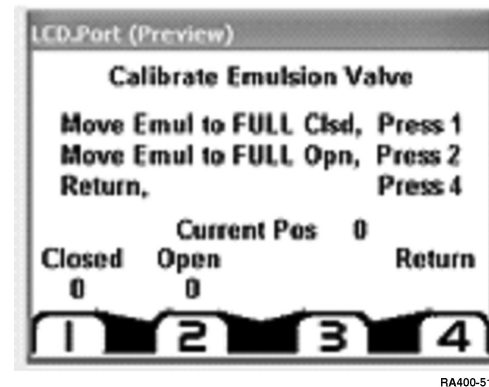
Figure 5-12

Figure 5-12 - This screen allows you to set the minimum and maximum Slide Gate position. NOTE: Rock Hopper should be empty when performing this calibration. Using the Rock Flow INC/DEC button (Auxiliary Engine must be running), hold the DEC button until the Slide Gate is Closed. At this point, push button #1 and hold for a second to store the value in the Current Pos.

The value in Closed should now match button until it has reached its maximum position.

Push button #2 and hold for a second to store the Open value in the Current Position. The value in Open should now match the value in Current Pos.

To exit this screen, hold the #4 button for 2 seconds.



Emulsion Valve Calibration

Figure 5-13

Figure 5-13 - This screen allows you to set the minimum and maximum Emulsion Valve (Emulsion Flow) position.

NOTE: Ensure that Manual Valve to Emulsion flow has been cut off. Using the Emulsion Flow INC/DEC button, hold the DEC button until the Emulsion Valve is Closed.

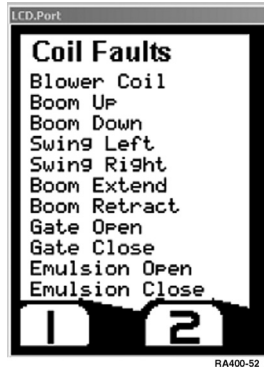
At this point, push button #1 and hold for a second to store the value in the Current Pos. The value in Closed should now match the value in Current Pos.

Proceed to hold the INC button until it has reached its maximum position.

Push button #2 and hold for a second to store the Open value in the Current Position. The value in Open should now match the value in Current Pos.

To exit this screen, hold the #4 button for 2 seconds.

GRAPHIC DISPLAY FAULT CODE SCREENS



Coil Faults

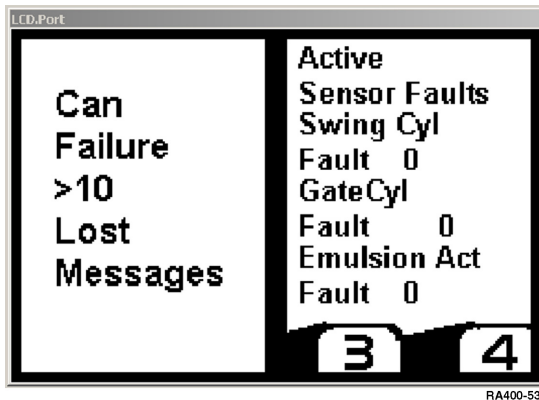
Figure 5-14

Figure 5-14 - This screen shows the following faults:

Blower Coil - The current sent to the proportional coil is 500 mA out of range (3.3%) for more than 1 second.

Boom Up, Boom Down, Swing Left, Swing Right, Gate Open, Gate Close - The coil has detected an Overload Condition.

Boom Extend, Boom Retract, Emulsion Open, and Emulsion Close - The coil has detected an Open Circuit.



CAN and Sensor Faults

Figure 5-15

Figure 5-15 - The left screen shows CPU faults and the right screen shows fault codes for the three sensors. The number shown indicates which fault is active per the following table:

Table 5-3. Status Codes

Bit Position	Value	Range/Type
--	--	Block is OK
1	0x0001	Block is not calibrated
2	0x0002	Block is currently in a calibration cycle
3	0x0004	Parameters are corrupt
4	0x0008	Invalid Setup/Calibration
5	0x0010	Checksum Error
6	0x0020	Time Out Error

CPU Information

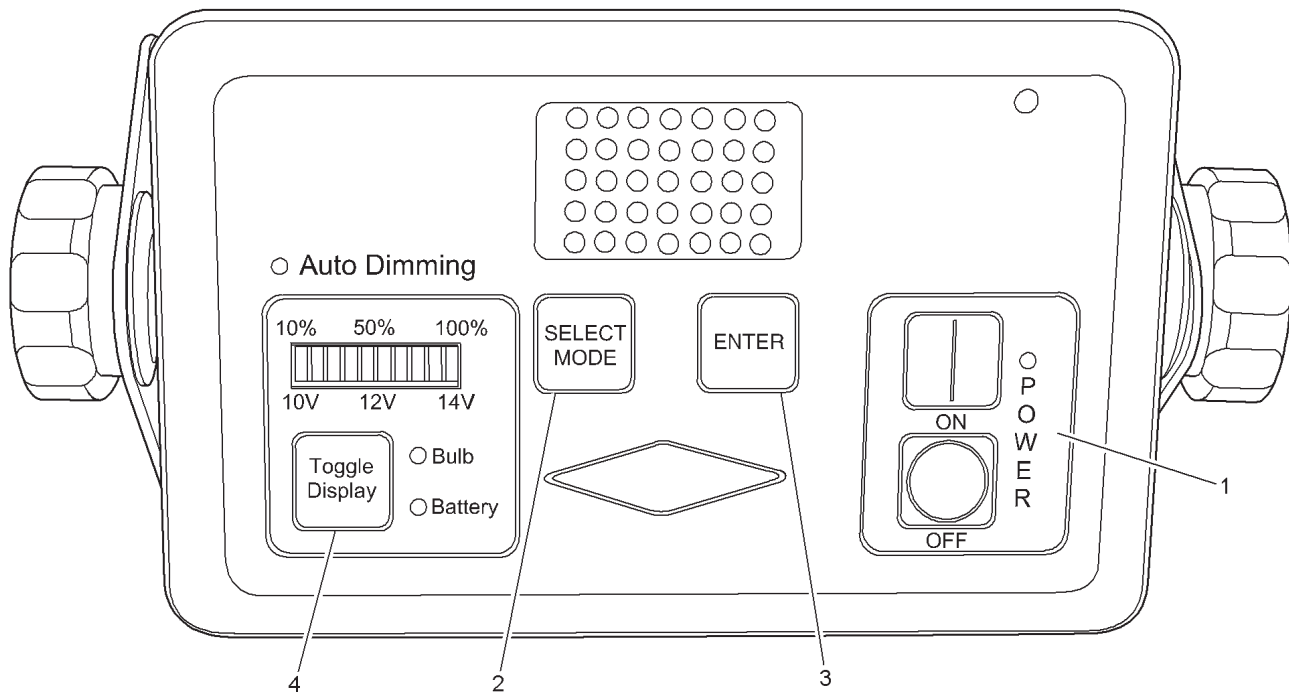
The processor is located behind and to the right of the operator seat.

This is a MC050-10 controller and has one green and one red LED.

When the system has power, the green LED will light.

The red LED is used to indicate CAN communication failure.

Component Location



Arrowboard Control Panel

Figure 5-16

Table 5-4. Arrowboard Control Panel

FIGURE	ITEM	CONTROL NAME	TYPE	FUNCTION
5-16	1	Power	On/Off Touchpads	Turns the arrowboard on and off.
5-16	2	Select Mode	Touchpad Button	Used to scroll through selectable sequences.
5-16	3	Enter	Touchpad Button	Used to set the sequences as displayed at "Select Mode".
5-16	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.



Section 6

OPERATION

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Operation

GENERAL INFORMATION

This section provides the Operating instructions for the RA-400 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 2 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-400 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-400 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 (Control Station and Joystick) for the RA-400 Patcher are shown in *Figures 5-1 and 5-2* and described in Tables 5-1 and 5-2 in Section 5.

The Operational Screens seen on the Graphic Display Unit are described and shown in Figures 5-4 through Figure 5-15, in Section 5.

PRELIMINARY PROCEDURES

Before starting or operating the machine, it is important to READ, UNDERSTAND, and FOLLOW all Operating instructions, Danger, Warning, Caution, and Notice messages in this manual as well as all Safety information contained in Section 2 of this manual.

Recommended fluid types and required quantities are listed in Specifications, Section 4 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 7 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.

NOTICE

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-400 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-400 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.

Classifications and 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

CAUTION 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-400 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.

CAUTION Do not use asphalt cements in the RA-400 Patcher. The RA-400 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-400 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-400.

Liquid Asphalt Storage and 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.

CAUTION 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.

CAUTION 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.

Operation

Storage Facilities for Emulsified Asphalt

NOTE: These guidelines apply only to emulsified asphalts. Do not use cutback asphalts or asphalt cements with the RA-400 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.

OPERATOR CONTROLS

Your unit is equipped with a Joystick Controller mounted on a pedestal on the driver's right side. The pushbuttons on the joystick control rock flow, emulsion flow, and up/down movement of the boom. The trigger on the front of the Joystick controls the Blow Out Mode of the blower. The rocker switches on the Joystick pedestal control the Blower ON/OFF, Blower Speed, Rock Flow and Emulsion Flow. These, along with other controls and indicators, are described below.

Joystick Controller

By moving the Joystick (**Figure 5-2**, Section 5) 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 pushbutton (*Figure 5-2*, Section 5) raises and lowers the boom by repeated brief pushes on the buttons.

Rock Flow

Rock flow is controlled with two switches. The first control is the Rock On/Off switch (*Figure 5-2*, Section 5) located on the joystick. Press and release the pushbutton to open the Rock Gate and start the rock flow. Press the release the pushbutton to stop the flow and close the Rock Gate. A red light (*Figure 5-2*, Section 5) indicates that the Rock Gate is open.

The second control is the Rock Flow INC/DEC rocker switch (*Figure 5-1*, Section 5), 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 4 seconds to notice the change in increase or decrease.

You can monitor the percentage of rock flow on the Graphic Display.

Emulsion Flow

Emulsion flow is controlled in two ways. The Emulsion On/Off switch (*Figure 5-2*, Section 5), located on the joystick, starts and stops the emulsion flow. A green light indicates that the Emulsion Valve is Open.

The second control is the Emulsion Flow INC/DEC rocker switch (*Figure 5-1*, Section 5) which regulates the amount of rock flow. This switch is a momentary switch. Increase or decrease the amount of emulsion by pressing the switch briefly in the desired direction and then releasing.

Manual Emulsion Override

The Vernier cable, near the floor at the operator's left, regulates the emulsion flow. This also can turn the Emulsion OFF if needed.

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 rocker switch (*Figure 5-1*, Section 5). The blower speed is controlled by the INC/DEC switch to the left. The switch is a momentary switch. Increase or decrease the blower speed by pressing the switch briefly in the desired direction and then release. The percentage of blower speed is displayed on the Graphic Display.

The red trigger on the Joystick controls the Blowout feature. Pulling trigger activates the Blowout Mode (Maximum Blower Speed) and pulling the trigger a second time deactivates the 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 to the "I" position. Push the switch to the "O" position to turn off the beacons.

Hydraulic Mode

The hydraulic system is functioning when the auxiliary engine is running. The Graphic Display will display the hydraulic temperature and signal a warning if the system overheats.

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 5-16*, items 2 and 3, Section 5) on the Arrowboard Control Panel.

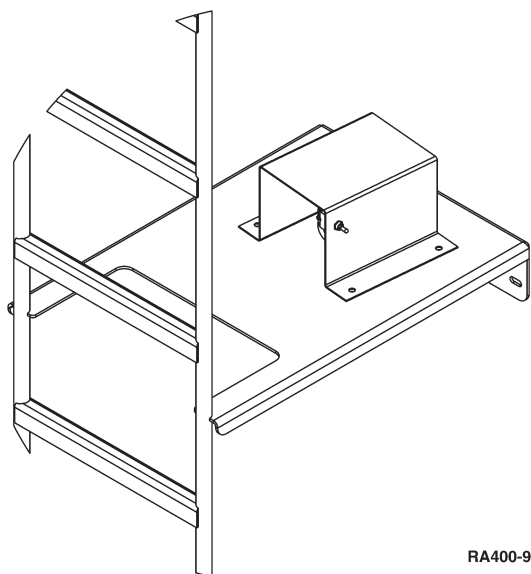
PREPARING THE MACHINE FOR PATCHING

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 (see *Figure 10-16*, Section 10).



RA400-9

Aggregate Hopper Lid

Figure 6-1

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

1. Push the Raise/Lower switch up and hold until lid is fully open.

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

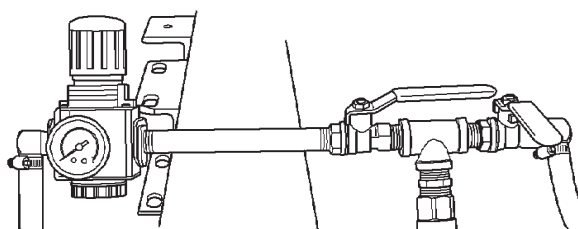
1. Push the Raise/Lower switch down and hold until lid is fully closed.

Emulsion Tank

NOTICE 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.

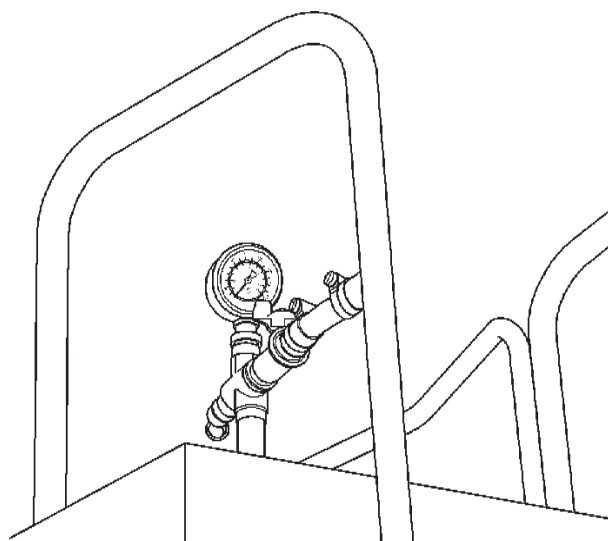
DANGER The Emulsion Tank Air Regulator valve (the left hand valve) is located between the Emulsion Tank and the Aggregate Hopper. Close the valve before opening the Emulsion Tank Vent Valve to relieve tank pressure prior to filling. Failure to do so can lead to loss of truck brake pressure.



Air Regulator Valves

Figure 6-2

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.



Emulsion Tank Vent Valve

Figure 6-3

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.

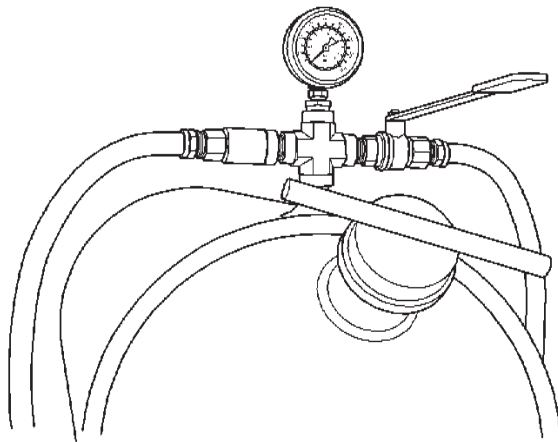
Solvent Tank

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

⚠ DANGER 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.

NOTICE 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.



Solvent Tank Vent Valve

Figure 6-4

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-400 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 6-1 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 6-1. Asphalt Spraying Temperatures

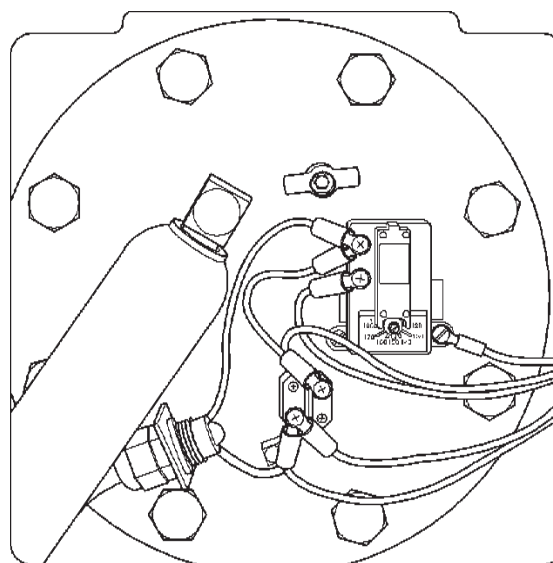
Emulsified Asphalts		
Type & Grade	Fahrenheit	Celsius
RS-1	70° to 140°	21° to 60°
RS-2	125° to 185°	52° to 85°
MS-1	70° to 160°	21° to 71°
MS-2	70° to 160°	21° to 71°
MS-2h	70° to 160°	21° to 71°
HFMS-1	70° to 160°	21° to 71°
HFMS-2	70° to 160°	21° to 71°
HFMS-2h	70° to 160°	21° to 71°
SS-1	70° to 160°	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 coolant system, 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 6-5).

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.

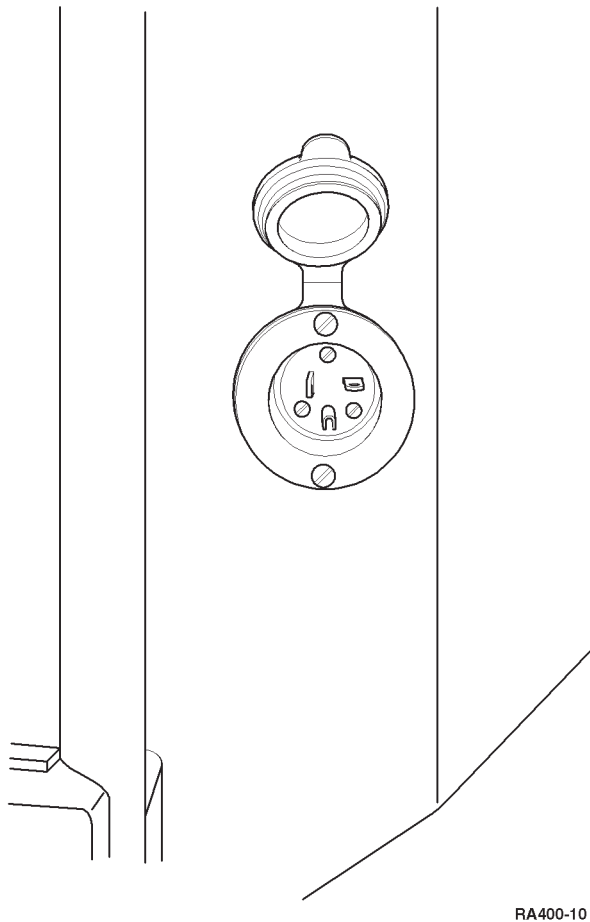


Electric Heating Temperature Controls

Figure 6-5

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.



Heating Element Indicator Light and Outlet

Figure 6-6

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.

PATCHING INSTRUCTIONS

Theory of Operation

The RA-400 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-400 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.

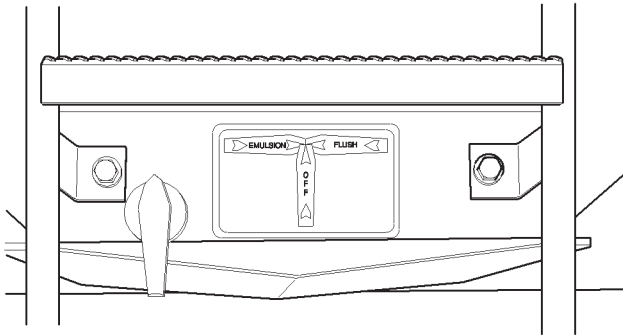
General Preparation

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

NOTICE

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 6-7) and the Blower On/Off switch to “O”. Place the waste catch bucket under the nozzle and be sure both asphalt supply valves at the discharge nozzle are open.



3-Way Valve

Figure 6-7

Turn the Emulsion On/Off switch (*Figure 5-1*, Section 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 the truck. If you must travel to the job site, move the boom to the travel position.

Preparing to Patch

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

Cleaning Out the Hole

1. Start the blower by pressing the Blower On/Off switch (*Figure 5-1*, Section 5) to the "1" position. Pull the red trigger on the joystick and release. When hole is cleaned out, pull the trigger to deactivate.
2. Clean out the hole using the Joystick to move the nozzle around the entire pothole and an area 4 to 6 in. (10.2 to 15.2 cm) surrounding the pothole edge.
3. 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

1. Raise the discharge nozzle to a patching height of 24 to 48 in. (61 to 122 cm) above the hole by pushing the Boom Up/Down switch in the UP direction.
2. Push the White Emulsion button to activate the Emulsion flow. Regulate the emulsion flow using the rocker switch on the Joystick panel. INC indicates increase the flow and DEC decrease the flow.

Take note of the percentage on the Graphic Display for future reference.

3. The liquid asphalt should be carried out of the nozzle in a mist. If excessive dribbling occurs, try one or more of the following:
 - a. Slightly increase the blower speed for more airflow.
 - b. vCheck that both asphalt supply valves at the discharge nozzle are completely open.
 - c. Use INC to increase the flow and DEC to decrease the flow. Dribbling may occur because of too much asphalt spray or not enough asphalt spray to properly mix with the air stream.
 - d. 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.
 - e. Replace the emulsion spray nozzles.
 - f. Increase air pressure at the Air Regulator valves (*Figure 6-2*). This increases discharge pressure in the emulsion tank and at the spray nozzles.

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

- g. 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 button (*Figure 5-2, Section 5*) UP to open the Rock Gate and start the aggregate delivery. Do this while the Emulsion On/Off switch (*Figure 5-2, Section 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 button 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 INC/DEC switch (*Figure 5-1, Section 5*). Refer to Operator Controls in Section 5, 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 increasing or decreasing the Emulsion flow (*Figure 5-1, Section 5*).

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.

4. 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 switch 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 switch OFF to stop the flow of aggregate.
4. Place the discharge boom to the home 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. 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.
 - 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.
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.

Operation

Patching in Cold Climate

The RA-400 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-400 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-400 Patch-On-The-Go

Some customers want to use the RA-400 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 by an Auxiliary Engine, 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.

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

7. Turn the 3-way Valve (*Figure 6-7*) on the Emulsion Tank to the Flush position.
8. Position the waste catch bucket below the discharge boom nozzle.
9. Turn the Emulsion On/Off switch (*Figure 5-1, Section 5*) ON to start the solvent circulating through the system.
10. 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.

Combatting 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.

⚠️ CAUTION Use a step-trailer to transport the RA-400 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.

1. 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.

2. Block Patcher tires to prevent Patcher from moving forward or backward.
3. Lower the boom and secure it to the raised deck of the step-trailer.
4. Place transmission in park.
5. Place ignition switch in the OFF position and remove the key.
6. Secure the Patcher to the trailer using chains rated in excess of Patcher weight.
7. 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.

NOTES:



Section 7

MAINTENANCE

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Maintenance

MAINTENANCE SCHEDULE

Preventative Maintenance

Preventive maintenance on the RA-400 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 *Table 4-12* and *4-13* in *Section 4* for torque specifications.

Routine Maintenance

This section gives the necessary procedures for routine and general maintenance on the RA-400 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 2* of this manual.

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

NOTICE By following a careful service and maintenance program for your machine, you will ensure 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.

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.

NOTICE 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 7-1, Maintenance Interval Chart, lists recommended maintenance procedures and time intervals between machine maintenance inspections and lubrication procedures.

Machine Lubrication

Proper lubrication is necessary to maintain the machine at top efficiency. Refer to the lubrication information in *Table 7-1*, Maintenance Interval Chart. All lubrication points are shown in *Figure 7-1*. *Section 4* Specifications contains tables listing recommended torque values for fittings and fasteners commonly used on this machine.

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 *Table 4-10* and *4-11* in Section 4 for fitting 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.

HYDRAULIC SYSTEM

The RA-400 Patcher's hydraulic system consists of an auxiliary engine mounted hydraulic gear pump, five hydraulic cylinders, hydraulic reservoir, filter, and a four-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 lose 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.

⚠ CAUTION 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.

Maintenance

⚠ CAUTION 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.

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.

⚠ CAUTION 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 filter element from 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.

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 *Figure 7-2* through *7-5* and *Table 7-2*.

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.

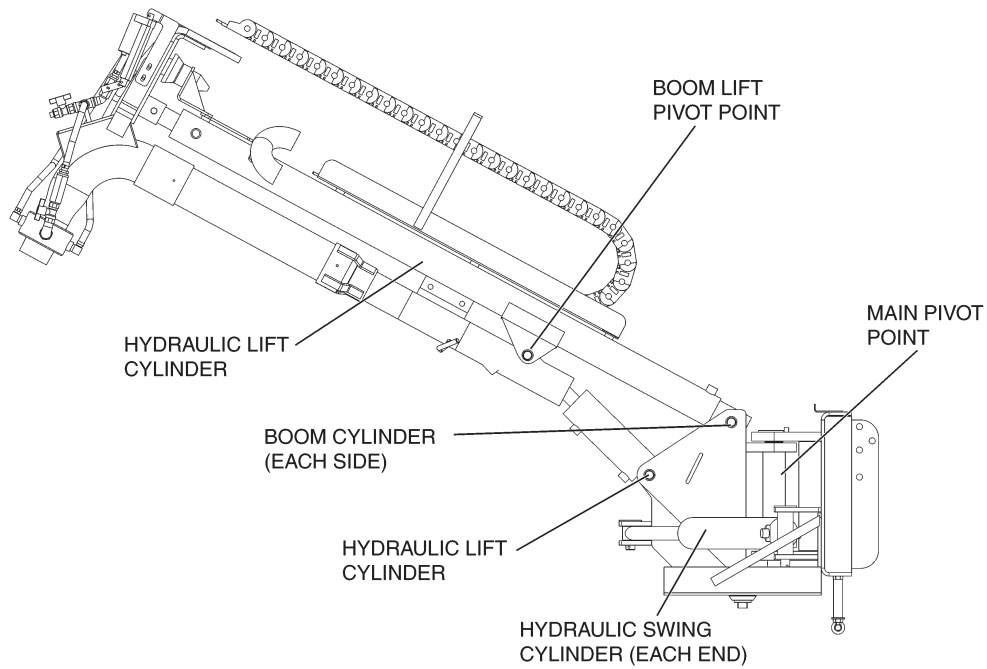
⚠ CAUTION Reset the pressure to 1500 PSI to prevent damage to valve and manifold components.

Table 7-1. Maintenance Interval Chart

Interval/	Action	Notes
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 Filter:		
Return Filter	Check	P/N 6442
Discharge Filter	Check	P/N 36353
50 HOURS OR WEEKLY		
Hose Fittings	Check	Tighten as necessary
FIRST 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 Filter:		
Return	Replace	P/N 6442
Hydraulic Strainer	Replace	P/N 72243 In-Tank
Discharge Hose	Replace	P/N 36353

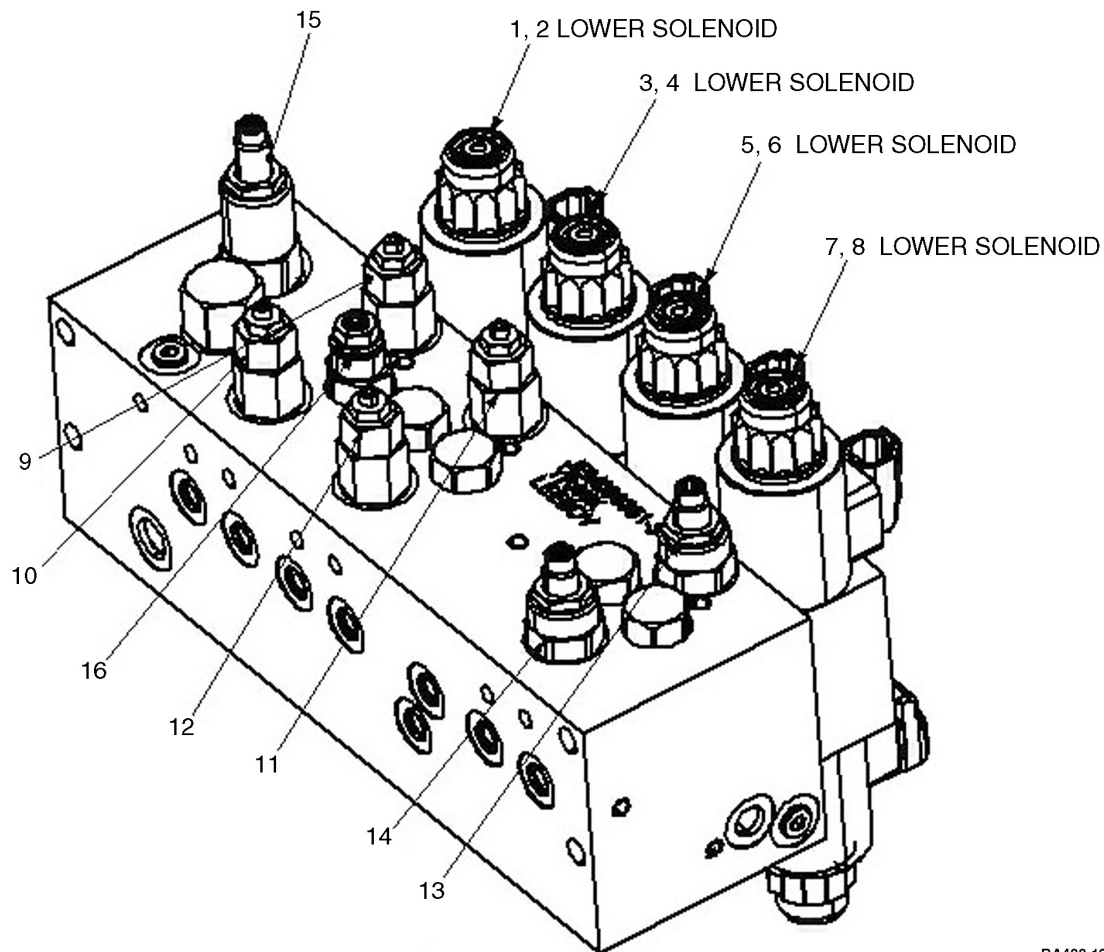
* Refer to truck manufacturer's manual for additional information.

** Refer to *Figure 7-5*, and air blower manuals at end of this section.



RA400-11

7***Lubrication Points******Figure 7-1***



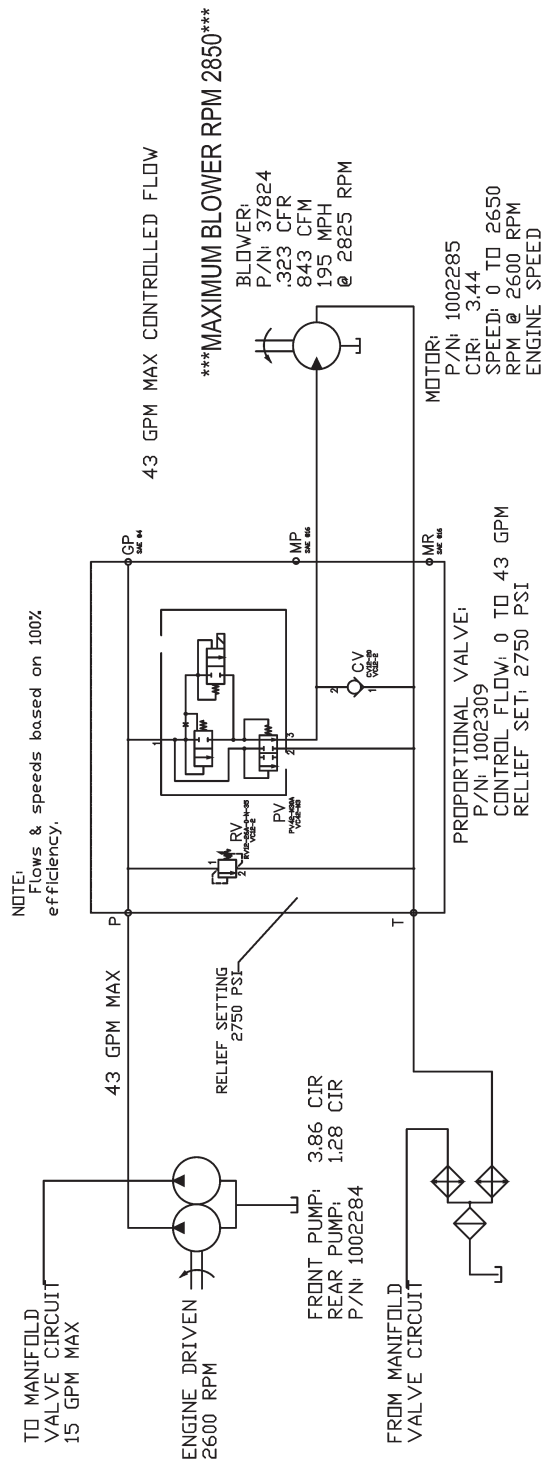
RA400-12

Hydraulic Manifold

Figure 7-2

Table 7-2. Hydraulic Manifold Valve Functions

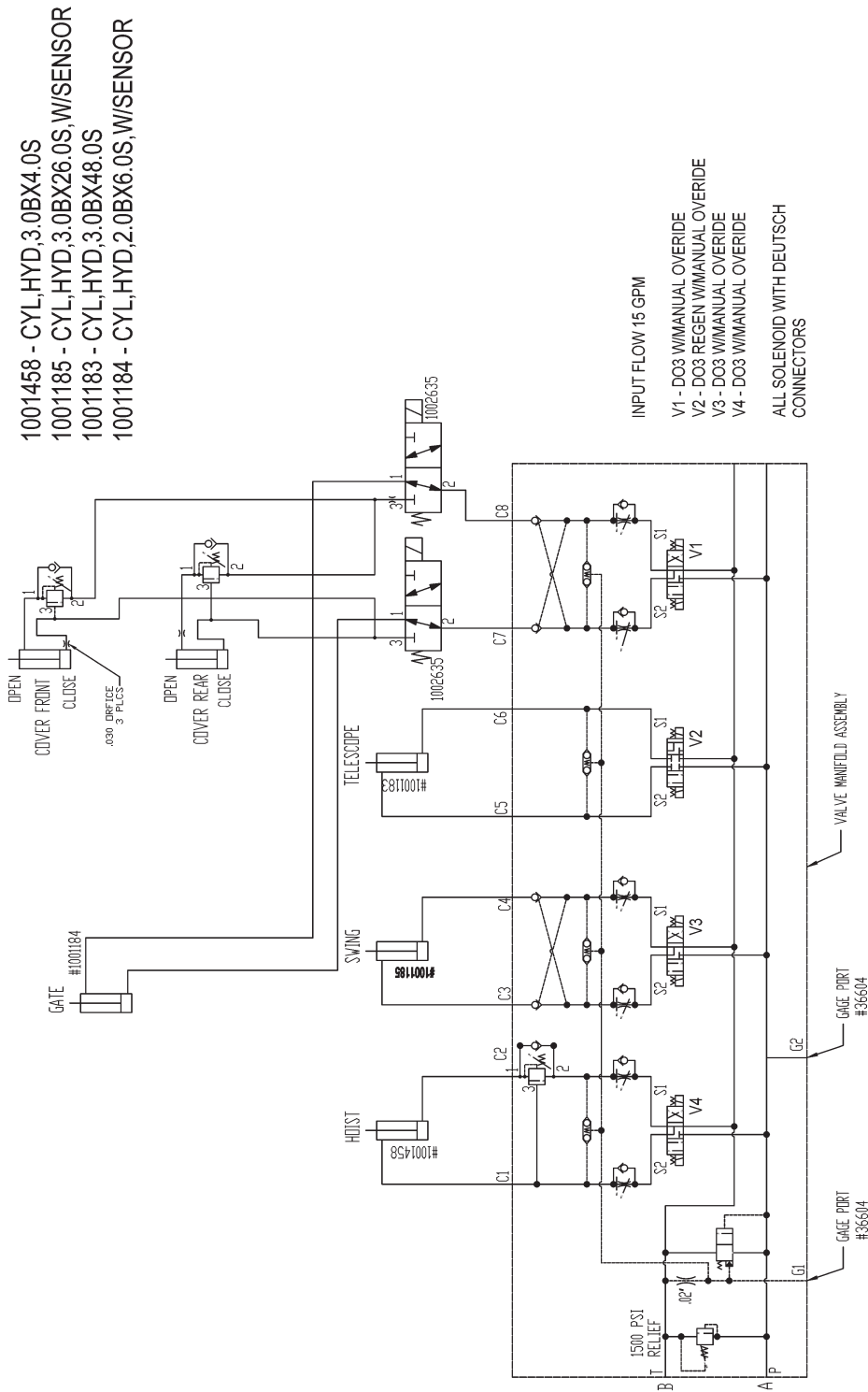
Item	Control	Valve Function	Wire Color
1	Raise Boom	Push in on Pin to Activate	Yellow w/Red Stripe
2	Lower Boom	Push in on Pin to Activate	Yellow
3	Swing Boom Left	Push in on Pin to Activate	Red w/Black Stripe
4	Swing Boom Right	Push in on Pin to Activate	Pink
5	Extend Boom	Push in on Pin to Activate	Green w/Yellow Stripe
6	Retract Boom	Push in on Pin to Activate	Green
7	Open Slide Gate Raise Hopper Gate	Push in on Pin to Activate	Purple w/White Stripe
8	Close Slide Gate Lower Hopper Gate	Push in on Pin to Activate	Purple
9	Control Speed to Raise Boom	Turn Clockwise to Increase Turn Counterclockwise to Decrease	
10	Control Speed to Lower Boom	Turn Clockwise to Increase Turn Counterclockwise to Decrease	
11	Control Speed to Swing Boom Left	Turn Clockwise to Increase Turn Counterclockwise to Decrease	
12	Control Speed to Swing Boom Right	Turn Clockwise to Increase Turn Counterclockwise to Decrease	
13	Control Speed to Open Slide Gate	Turn Clockwise to Increase Turn Counterclockwise to Decrease	
14	Control Speed to Close Slide Gate	Turn Clockwise to Increase Turn Counterclockwise to Decrease	
15	System Relief Pressure Valve	Factory Set @ 1500 PSI	
16	Counter-Balance Valve	Turn Clockwise to Decrease Turn Counterclockwise to Increase	



RA400-13

Hydraulic Manifold Schematic - View 1

Figure 7-3



Hydraulic Manifold Schematic - View 2

Figure 7-4

RA400-14

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-400 Patcher is equipped with a medium-pressure air blower. *Figure 7-5* 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 4, Specifications, for system capacities.

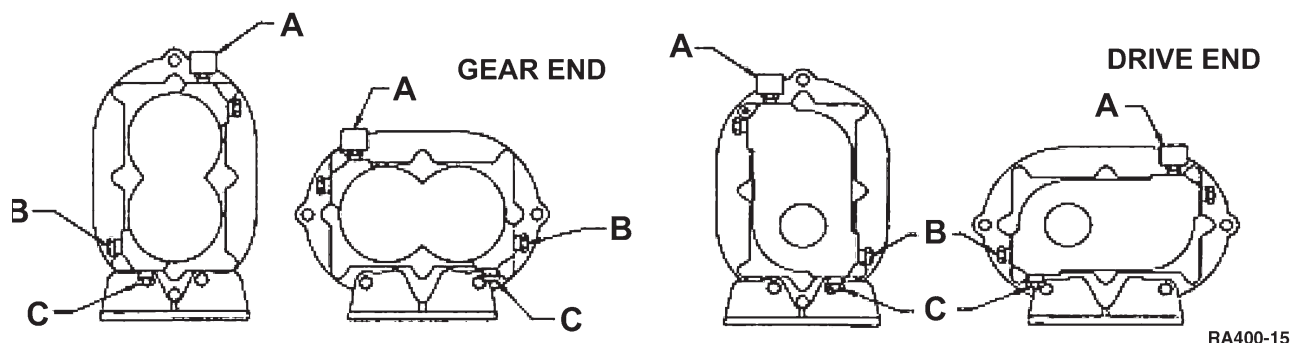
CAUTION Do not overfill the air blower gear case. This will cause the gears to overheat and may damage the unit.

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

1. Remove the Oil Drain Plug.
2. Drain the used oil through the drain port and replace the plug.
3. 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.
4. Refer to Section 4, Specifications, for system capacities.

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.



A = Breather

B = Oil Level Sight Glass (Plug on 21 series)

C = Magnetic Oil Drain Plug

Air Blower Lubrication

Figure 7-5

⚠ CAUTION Keep the Relief Fittings open at all times to prevent damage to seals.

⚠ CAUTION 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-400, consult the asphalt supplier for the proper solvent for each type of asphalt used.

⚠ CAUTION 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 6. 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.

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 6. 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.

⚠ CAUTION Some rust inhibitors can destroy painted surfaces. Do not spray rust inhibitor on painted surfaces.

Lubricate all grease points. Make sure all grease cavities are filled with grease. See Table 7-1, Maintenance Interval Chart.

6. Fill bearings with grease at the drive end cavities of the air blower.
7. Top up all fluid levels to minimize condensation forming inside the tanks.
8. Check hydraulic oil sight gauge and fill as necessary.
9. Inspect all air and hydraulic hoses, couplers, fittings and cylinders. Tighten any loose fittings and replace any hoses that are worn.
10. Use tape to seal the inlet, discharge, and all vent openings on the air blower. Do not store the unit piped to the system.
11. Check all safety decals. Replace any decals that are damaged or illegible. Refer to Decal Installation in this section.
12. 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 7-1*, 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.
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 7-1*, Lubrication Points.
5. Rotate the PTO drive shaft three or four revolutions every two weeks.



CAUTION 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.

Removing the Machine from Storage

1. Follow steps above in Periodic Maintenance During Storage.
2. Refer to *Table 7-1*, 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

Be sure that the installation area is clean and dry. Use hot soapy water and dry the area thoroughly before installing decals.

1. Determine the exact position by taking measurements and test fitting before you remove the backing paper.
2. For decals with no top protection paper, determine the decal location and remove the smallest portion of the split backing paper.
3. Align the decal over the specified area and carefully press the small portion with the exposed adhesive backing into place.
4. Peel back the remaining paper and carefully smooth the remaining portion of the decal in place.
5. Small air pockets can be pierced with a pin and smoothed out using the piece of decal backing paper.
6. 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.
7. 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.

Maintenance

NOTES:



Section 8

TROUBLESHOOTING

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Troubleshooting

TROUBLESHOOTING CHART

The troubleshooting chart below identifies the most common symptoms of failure. Use this chart to help identify the failed component and possible remedies. For specific engine and hydraulic problems not covered here, see the engine or hydraulic manufacturer's manual.

⚠ CAUTION 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.

Table 8-1. Troubleshooting Chart - 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. Check for air leaks in discharge piping and at aggregate hopper lid, slide gate, and hoses.
	Slide gate jammed or frozen closed.	If frozen, use heat to thaw. If jam is used 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.

Poor or uneven aggregate flow.	Aggregate is wet and/or bridging.	Run vibrator. Use clean, dry rock. Swing the boom side to side rapidly. This will cause material to slide down hopper walls.
	Delivery hose is clogged.	Remove and clean hose. Flush nozzle. Flush delivery system with water (optional).
	Insufficient air volume.	Check blower RPM. Should be 1400-1800. Check & clean blower air filter. Check for air leaks in discharge piping and at aggregate hopper lid, slide gate and hoses.
Dusty delivery of aggregate.	Dry, dusty material.	Dampen rock in hopper.
	Excessive fines in aggregate.	Replace with new aggregate material.
Aggregate lid settles.	Pressure setting on counter-balance valve set too low.	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.
	Hydraulic cylinder seals are leaking.	Replace seals.
	Counter-balance valve and/or seals are bad.	Replace valve and/or seals.

Table 8-2. Troubleshooting Chart - Emulsion System Problems

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

Table 8-3. Troubleshooting Chart - Solvent System Problems

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

Table 8-4. Troubleshooting Chart - Hydraulic System Problems

SYMPTOM	CAUSE	REMEDY
Hydraulic system overheats.	Low hydraulic fluid level.	Fill reservoir to proper level in sight gauge.
	Running hydraulic system when ridding for long distances.	Shut off PTO for hydraulics when not needed.
	Hydraulic oil cooler plugged with debris.	Clean oil cooler fins.
	Manifold relief valve set too low.	Set relief valve to 1500 psi.
	Flow modulating valve defective.	Replace valve.
	Worn or defective pump.	Replace pump.
	Defective electric fans.	Check / replace fuse.
No movement of boom, hopper lid, or slide gate.	No or low hydraulic oil pressure.	Check oil level in reservoir. Check that inlet oil valve is open. Adjust relief pressure on valve block.
	Electrical or hydraulic failure.	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.
	Boom flow controls out of adjustment.	Adjust flow controls.
	Blown fuse, tripped circuit breaker or bad electrical connection.	Check fuse, reset circuit breaker. Check control panel power line at battery. Check electrical connections at solenoid valve.
Poor or uneven cylinder action.	Low hydraulic fluid level.	Check level. Check that oil inlet valve is open.
	Boom flow controls out of adjustment.	Adjust (applies to Lift and Side Shift only).
	Relief valve set too low.	Adjust relief valve.
Discharge boom settles.	Pressure setting on counter-balance valve is set too low.	Extend boom fully. Loosen jam nut and turn adjusting screw in until boom no longer settles.
	Hydraulic cylinder seals are leaking.	Replace seals.
	Counter-balance valve and/or seals are bad.	Replace valve and/or seals.

Table 8-4. Troubleshooting Chart - Hydraulic System Problems (Continued)

Hydraulic cylinders on boom not operating properly.	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.	Clean the cartridge component on the valve. Check hydraulic filter and replace if necessary.
	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.	Check all connections. Replace any bad connections. Replace micro-switch if necessary.

Table 8-5. Troubleshooting Chart - General System Problems

SYMPTOM	CAUSE	REMEDY
Low, or no air from blower.	Valve not activated.	Activate valve.
	Plugged air cleaner.	Clean or replace element.
	Plugged discharge hose or piping	Clean out hose or piping.
Control panel is inoperative.	Tripped circuit breakers or blown fuse.	Reset or replace.
	Loose wire.	Check all wiring.
120-volt AC heat system not working.	Tripped circuit breakers or blown fuse.	Reset or replace.
	Thermostat not set to desired temperature.	Reset temperature or thermostat.
	Faulty wiring.	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.
	Electric element(s) burned out.	Replace element(s).
Truck coolant system not heating emulsion to a high enough temperature.	Asphalt temperatures needed are above 180° F (82° C).	Coolant heating system was not intended to heat asphalts / emulsions above 180° F (82° C).
	Faulty truck engine thermostat.	Replace with 195° F (91° C) or higher thermostat.
	Pinched or plugged circulation hose.	Inspect, clean or replace.

Troubleshooting

NOTES:



Section 9

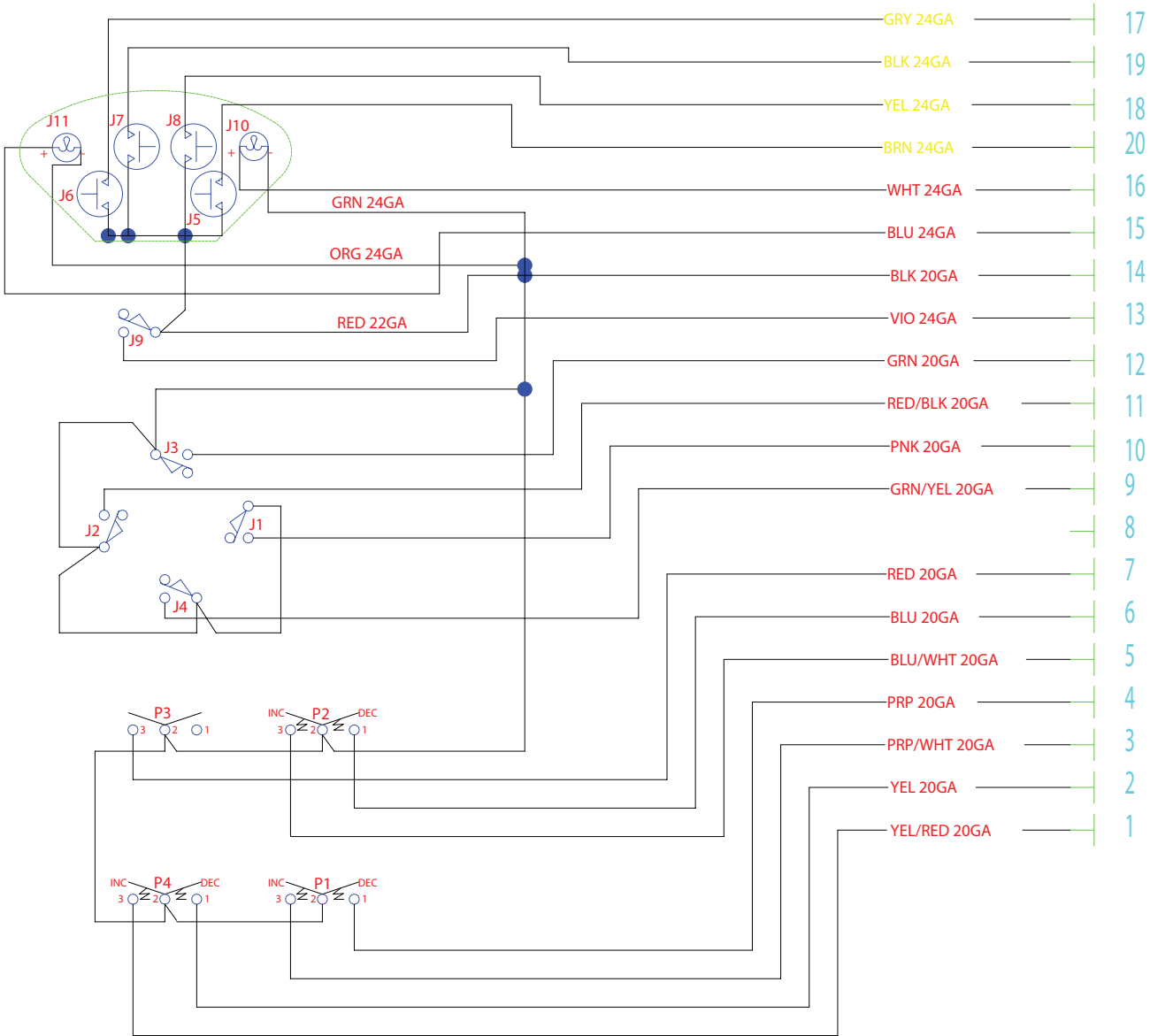
SCHEMATICS

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NOTES

NO	TYPE	FUNCTION
J10	LIGHT	EMULSION ON INDICATOR
J08	PUSHBUTTON	EMULSION ON/OFF
J07	PUSHBUTTON	SLIDE GATE OPEN/CLOSE
J11	LIGHT	SLIDE GATE OPEN INDICATOR
J06	PUSHBUTTON	BOOM UP
J05	PUSHBUTTON	BOOM DOWN
J09	TRIGGER	BLOW OUT MODE ON/OFF
J04	LIMIT SWITCH	JOYSTICK BOOM RETRACT
J01	LIMIT SWITCH	JOYSTICK BOOM SWING LEFT
J03	LIMIT SWITCH	JOYSTICK BOOM EXTEND
J02	LIMIT SWITCH	JOYSTICK BOOM SWING RIGHT
P03.1	ROCKER SW	BLOWER SPEED DEC
P03.3	ROCKER SW	BLOWER SPEED INC
P02.3	ROCKER SW	BLOWER ON/OFF
P04.1	ROCKER SW	SLIDE GATE DEC
P04.3	ROCKER SW	SLIDE GATE INC
P01.1	ROCKER SW	EMULSION FLOW DEC
P01.3	ROCKER SW	EMULSION FLOW INC

C2 DEUTSCH CONNECTOR HDP24-18-21-PN

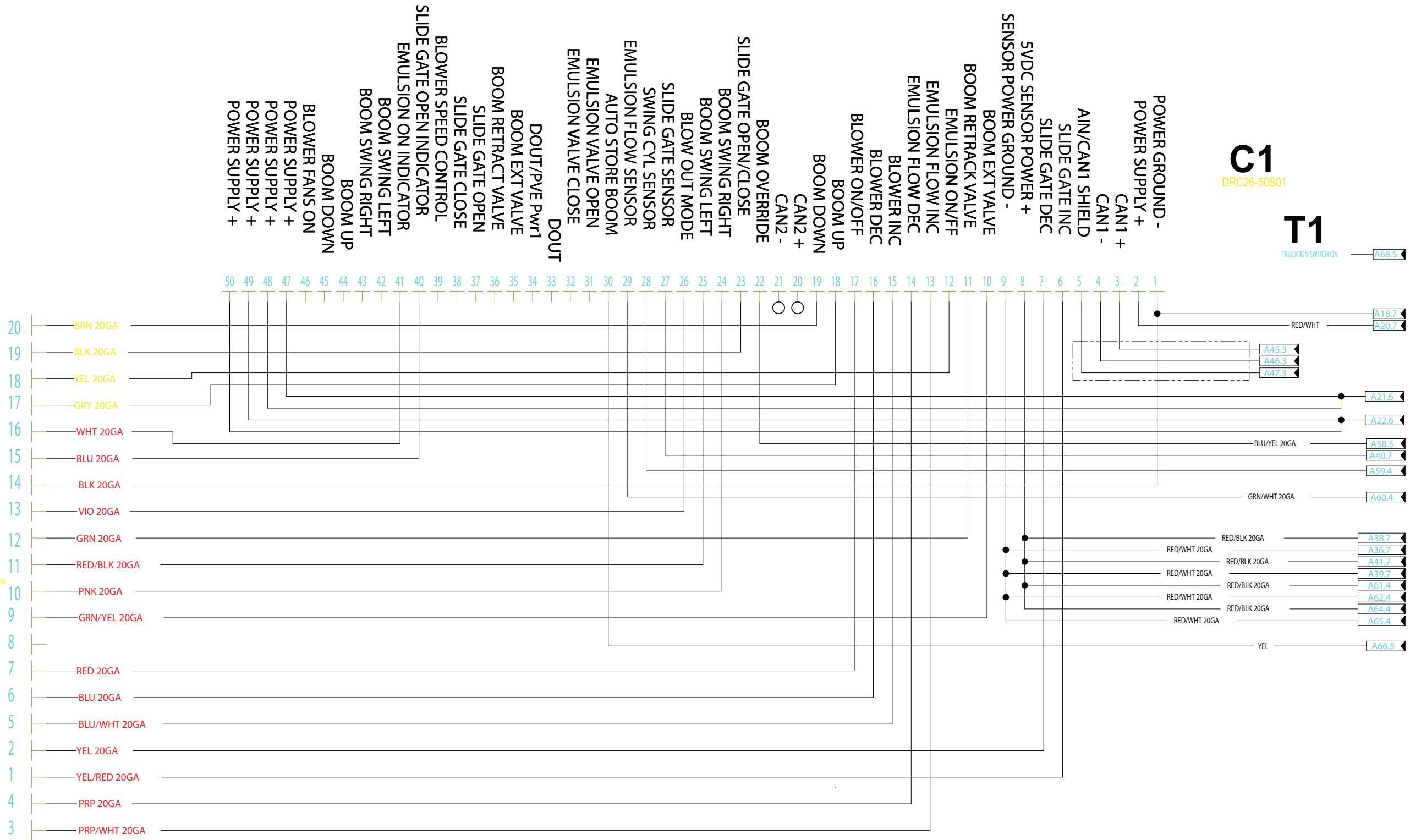


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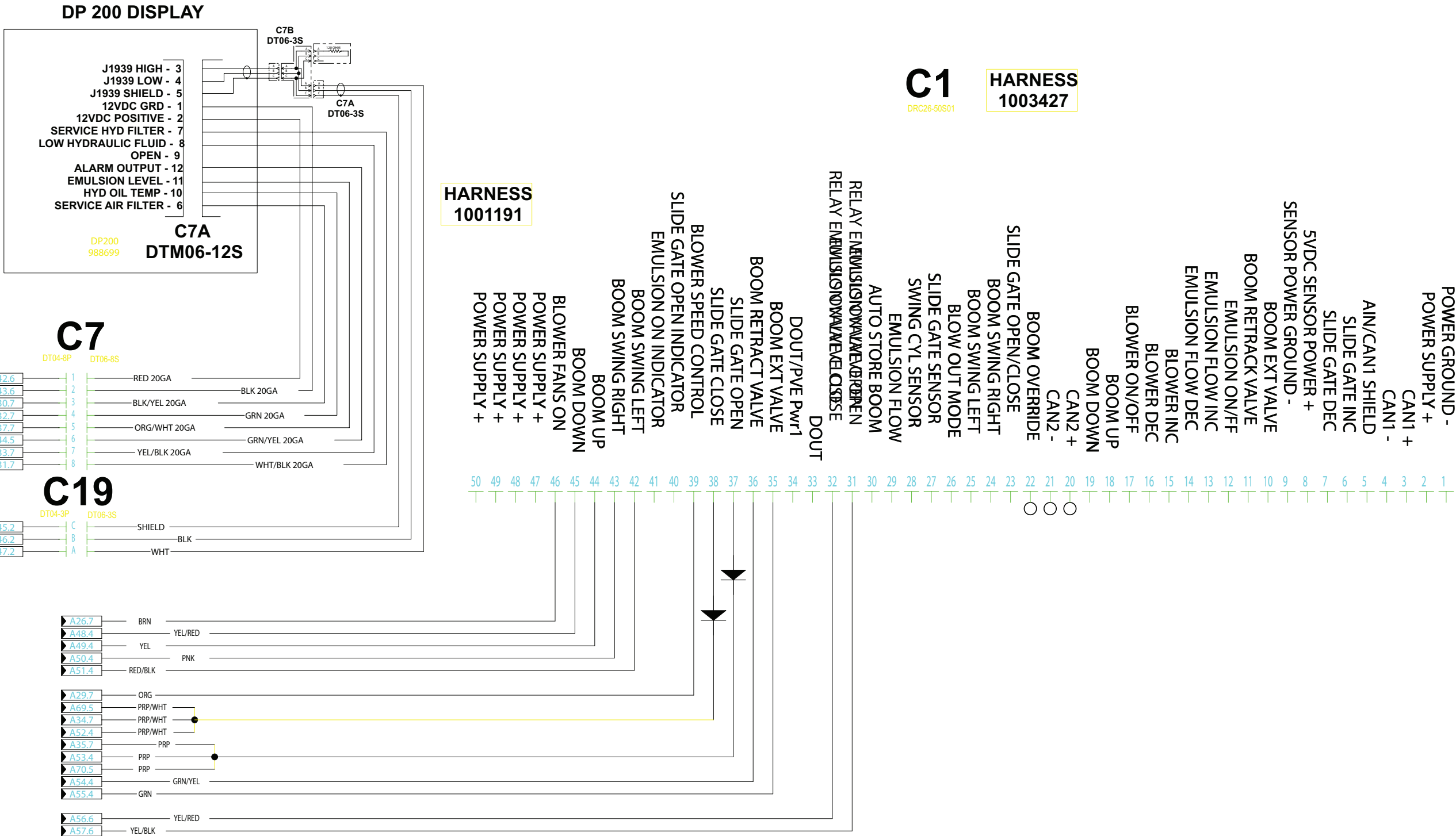
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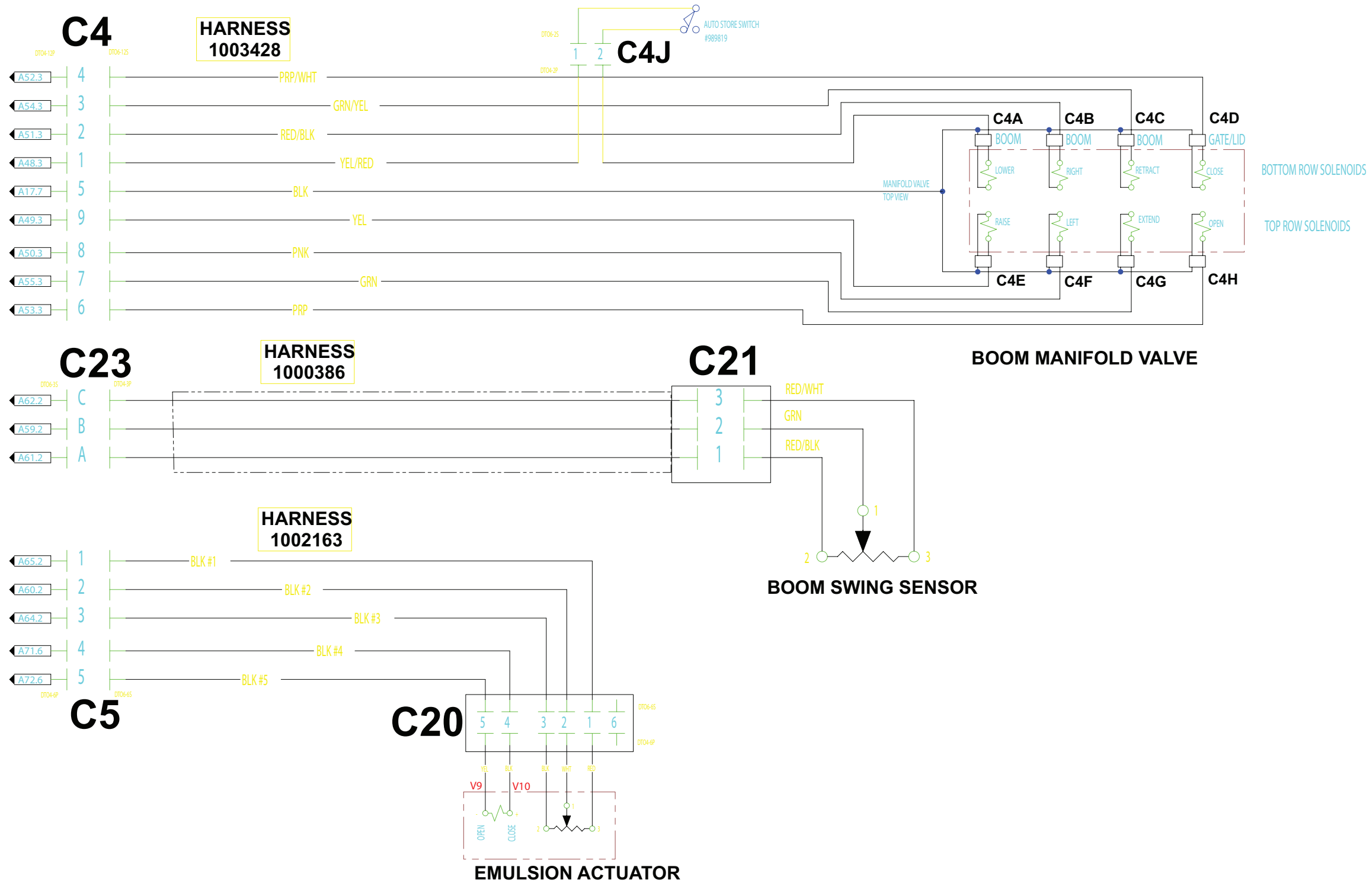
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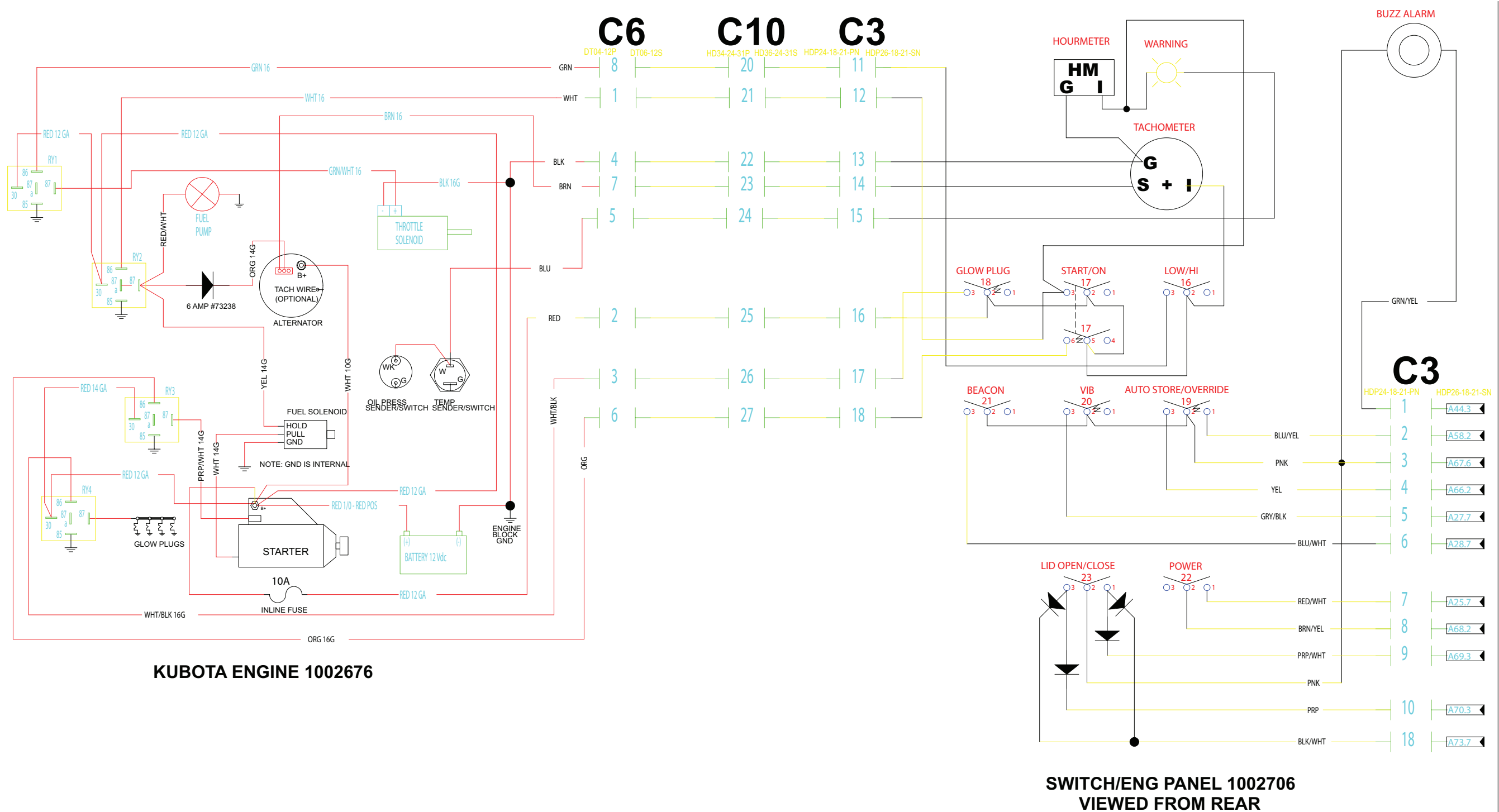
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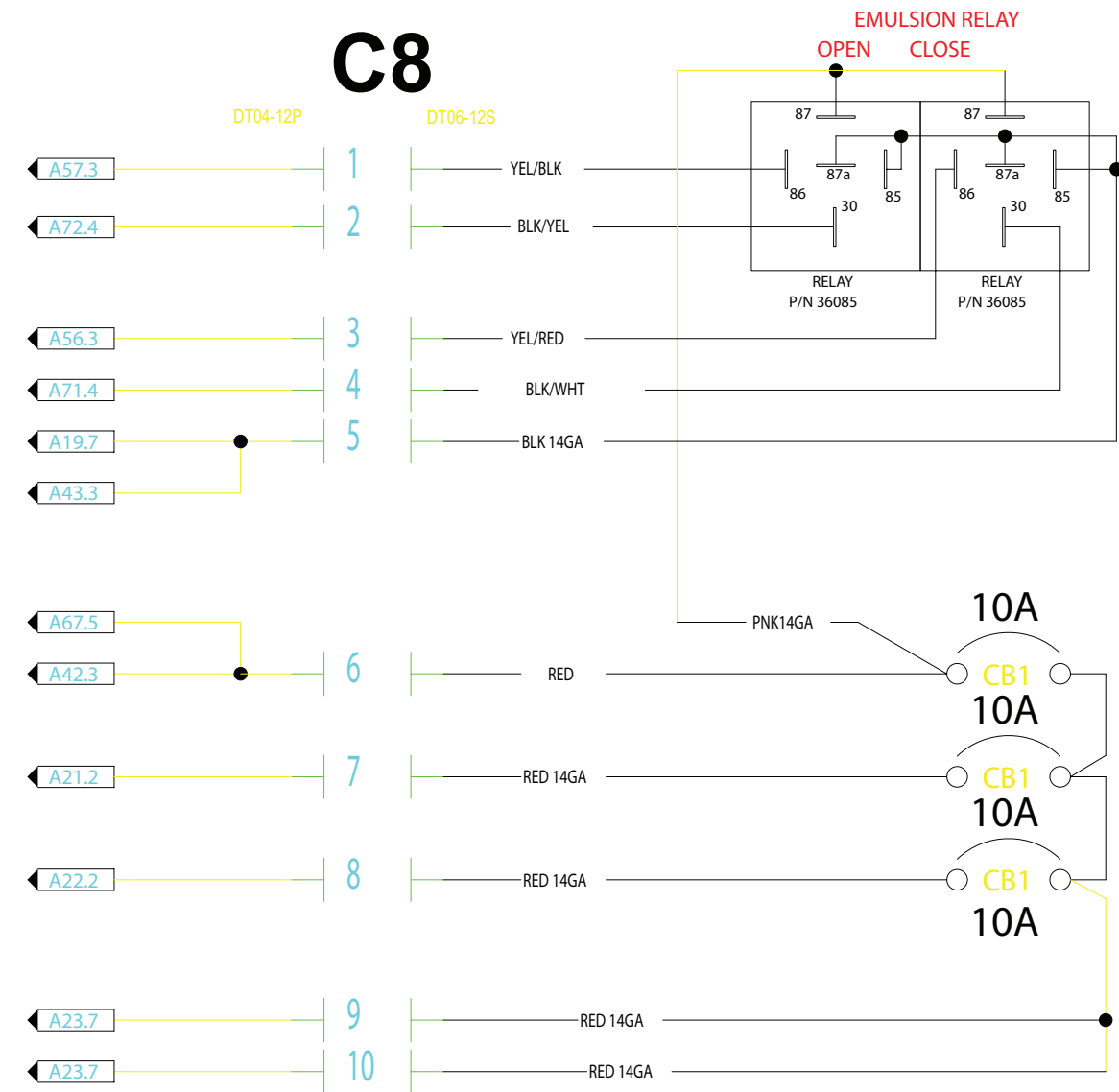
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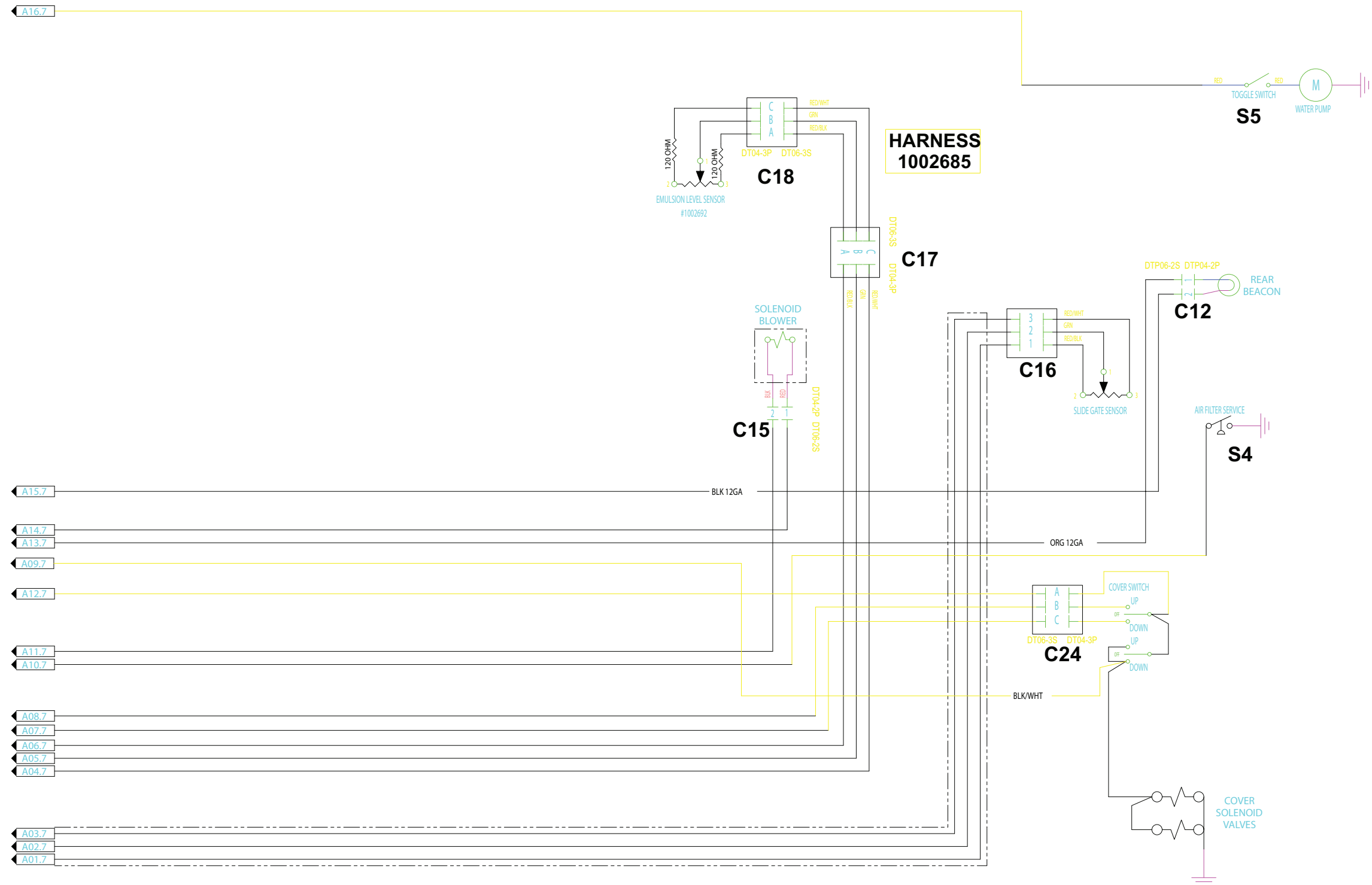
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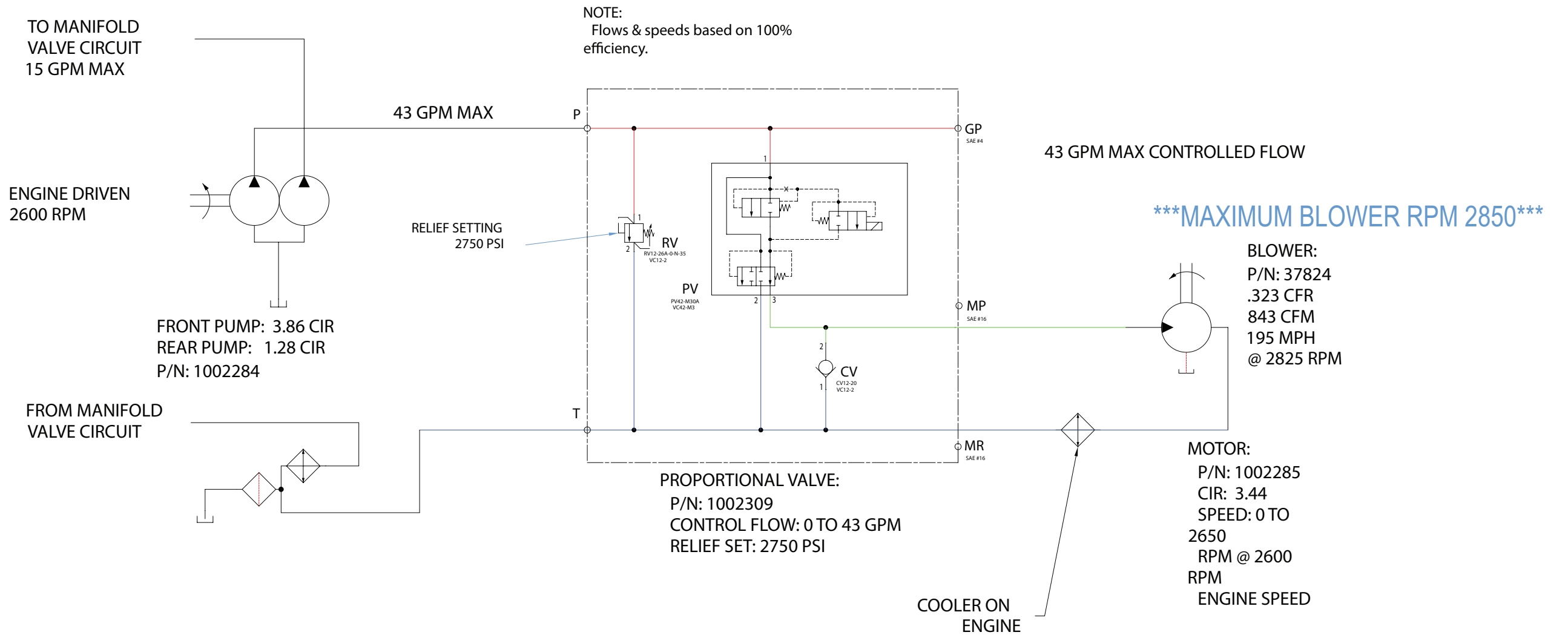
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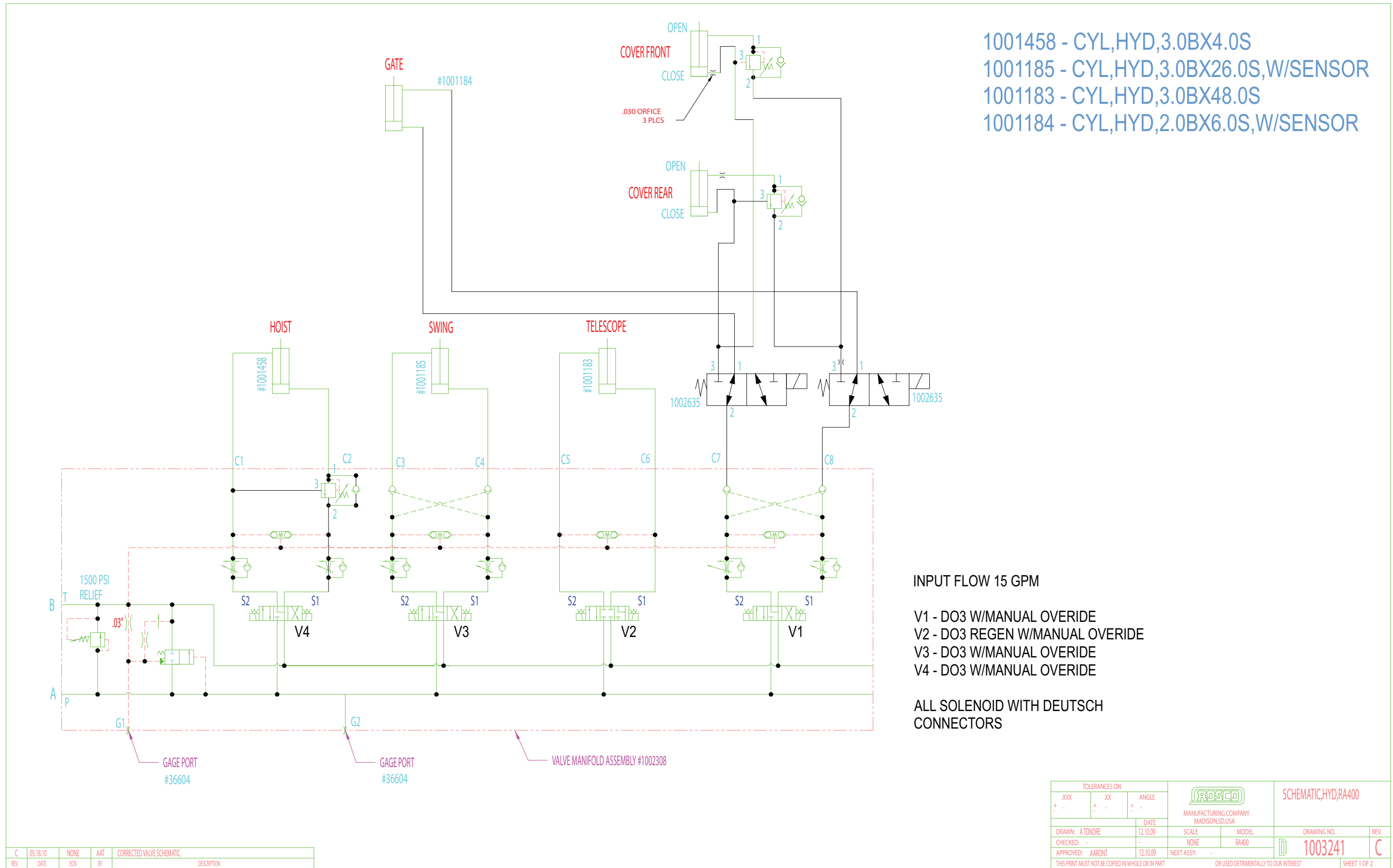


NOTES		VT LEEBOY, INC. 500 LINCOLN COUNTY PARKWAY EXT LINCOLNTON, NC 28092	UNLESS OTHERWISE SPECIFIED			-		-		-		-		-		
1. ADDITIONAL CONTACTS FOR CONNECTOR "C10" ON SHT 6 OF 7			DIMENSIONS ARE IN INCHES AND APPLY TO FINISHED PART ROUGH CUTS MUST INCLUDE APPROPRIATE FACING ALLOWANCE FOR MACHINED PARTS			REV.	BY	DATE	ECN	ECN DESCRIPTION						
						APPROVALS		DATE		DESCRIPTION: SCHEMATIC,ELEC RA400						
						AT		06.11.09								
						TOLERANCES ARE:			CHECKED		PART NO. 1002361					
						FRACTIONAL (NON-DECIMAL)			INFORMATION CONTAINED ON THIS DRAWING IS THE SOLE PROPERTY OF VT LEEBOY, INC. ANY REPRODUCTION IN PART OR WHOLE WITHOUT THE WRITTEN PERMISSION OF VT LEEBOY, INC. IS PROHIBITED							
			DECIMALS			ANGLES		PART NO. 1002361		LBS		SHEET 8 OF 8				
			.XX ± .03 ± 1/16 ± 1/2			.XXX ± .015 SURFACE FINISH: 250		SCALE 1:4		PART NO. 1002361		LBS		SHEET 8 OF 8		



REV.	DATE	ECN	BY	DESCRIPTION
-	-	-	-	SEE SHEET 1

TOLERANCES ON			ROSCO MANUFACTURING COMPANY MADISON, SD, USA	SCHEMATIC, HYD, RA400	
.XXX	.XX	ANGLE		DRAWING NO.	REV.
+	-	+			
DATE			SCALE	MODEL	
DRAWN: A TONDRE			12.10.09	NONE	RA400
CHECKED: -					
APPROVED: AARONT			12.10.09	NEXT ASSY: -	
THIS PRINT MUST NOT BE COPIED IN WHOLE OR IN PART			OR USED DETRIMENTALLY TO OUR INTEREST		





Section 10

ILLUSTRATED PARTS LIST (IPL)

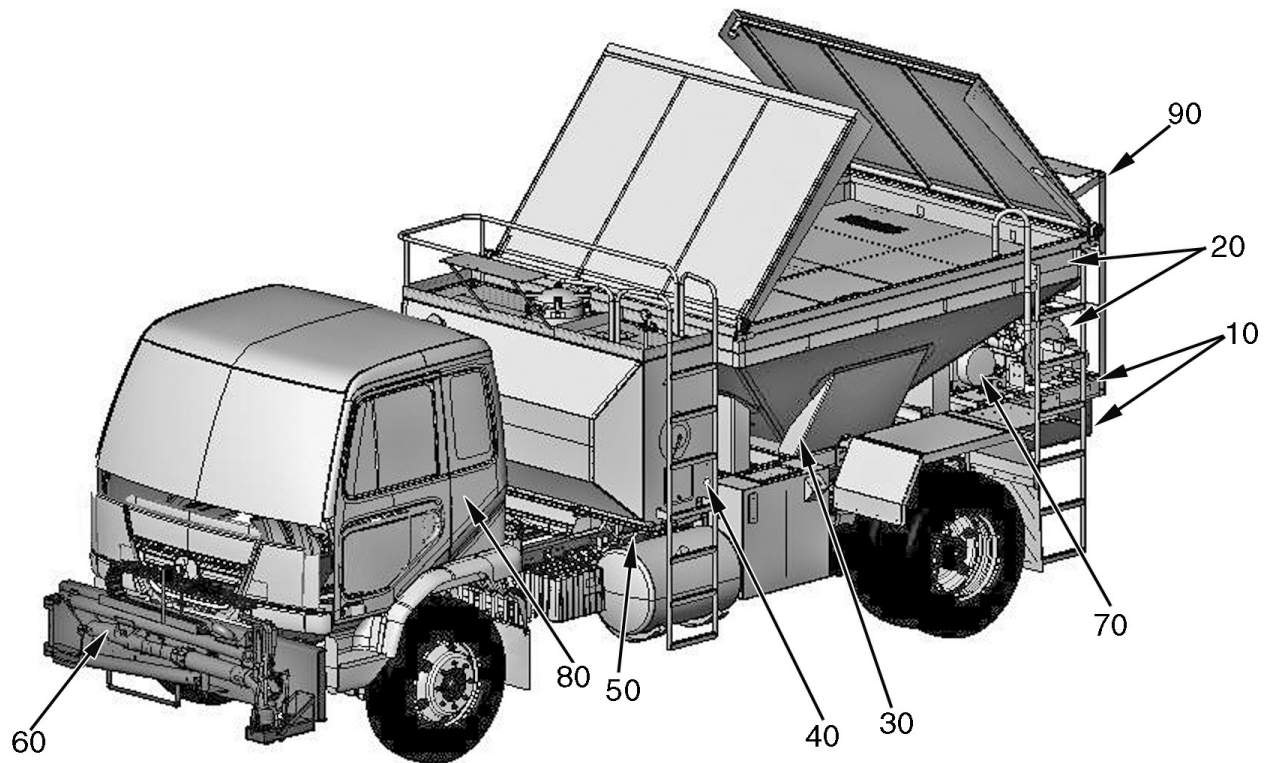
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TOP ASSEMBLY



RA400-16

Figure 10-1

Figure 10-1. TOP ASSEMBLY, RA400 BASE UNIT, NISSAN

Figure/ Item	Part Number	Nomenclature	Units Per Assembly
Figure 10-1	1002627	RA400 BASE UNIT, NISSAN	
Figure 10-2 through Figure 10-5; Figure 10-1, Item 10	1001430	BOOM, HORIZ (NISSAN), GRP	1
Figure 10-6 and 10-7; Figure 10-1, Item 70	1002478	WIRING/CONTROL, RA400, GRP	1
Figure 10-8, 10-9, and 10-10; Figure 10-1, Item 50	1002476	HYD SYS, RA400, GRP	1
Figure 10-11 and 10-12; Figure 10-1, Item 20	1001983	EMUL TANK, 300 GAL, RA400, GRP	1
Figure 10-14	24326	PRESSURIZED AIR GROUP, RA300	1
Figure 10-15	24327	SOLVENT TANK GROUP, RA300	1
Figure 10-16 and 10-17; Figure 10-1, Item 30	1002473	BLOWER/SLIDE GATE GRP	1
Figure 10-18; Figure 10-1, Item 40	1002475	AUX ENG, RA400, GRP	1
Figure 10-19; Figure 1, Item 80	1002665	FRAME/HOPPER/COVER, RA400, GRP	1
Figure 10-22	1001407	REAR BUMPER ASSY, RA300, NISSAN	1
Figure 10-23	24188	OPTIONAL JET FLUSH SYSTEM	1
Figure 10-24	24358	LIGHTING GRP, RA300, INCLUDING AMBER BEACON, ARROW BOARD LEDS, ARROW BOARD, 30 X 60, W/40 FT CABLE	1
Figure 10-25	37596	MISCELLANEOUS GRP	2

Illustrated Parts List (IPL)

HORIZONTAL BOOM (NISSAN)

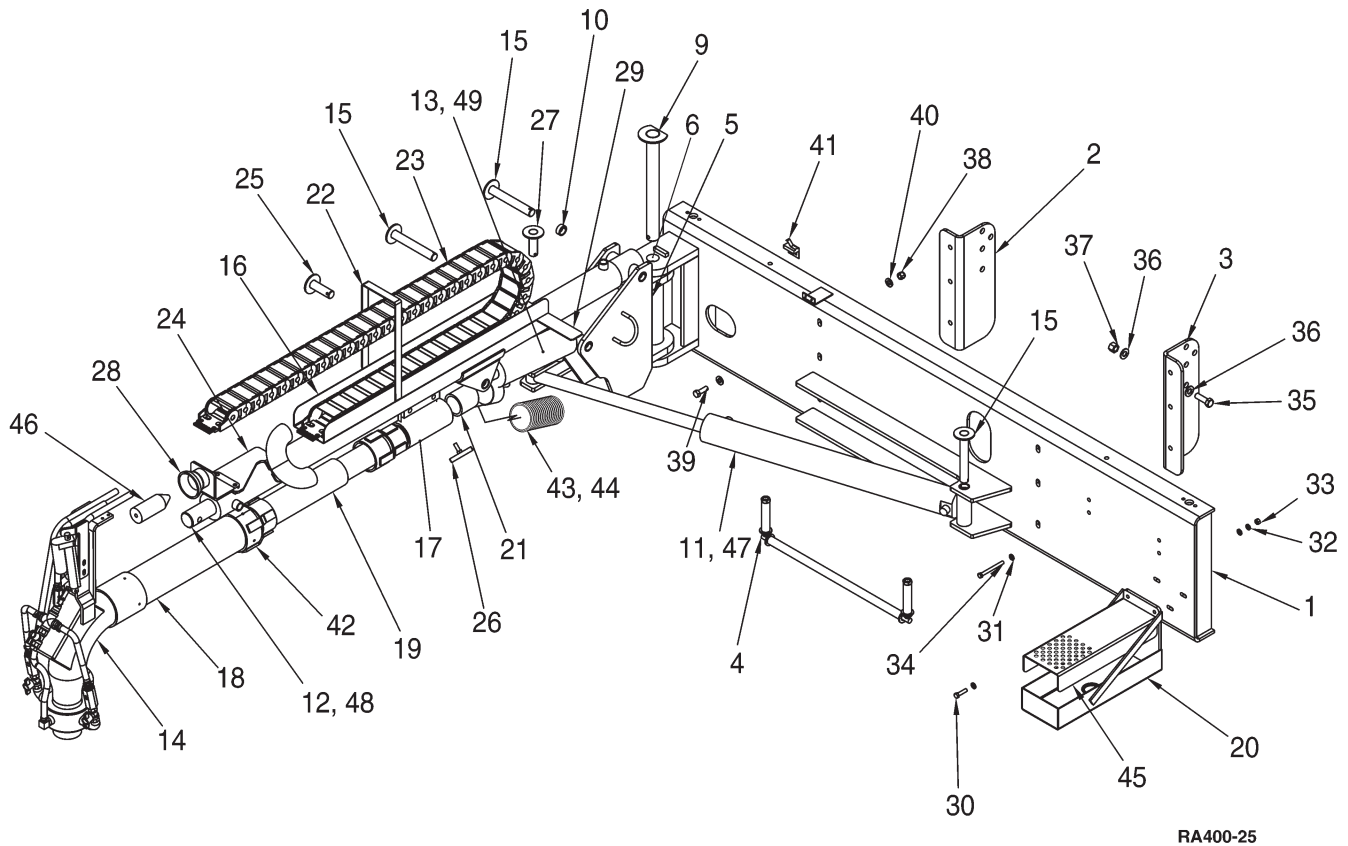


Figure 10-2

Figure 10-2. HORIZONTAL BOOM (NISSAN)

Figure/ Item	Part Number	Nomenclature	Units Per Assembly
1	1001457	W/M BUMPER, HORIZ BOOM, NISSAN	1
2	1000926	SUPP, RH, FRT BUMPER, RA300, NISSAN	1
3	1000927	SUPP, LH, FRT BUMPER, RA300, NISSAN	1
4	1000948	W/M, GUIDE, HOSE, RA300 BUMPER	1
5	1001434	W/M, PIVOT, HORIZ BOOM	1
6	32833	BUSHING, 1.503 ID, 1.754 OD, 1.5	2
7	36613	BEARING, THRUST, 1.50 ID X 0.62 (SEE FIGURE 10-3)	1
8	36614	WASHER, THRUST, 1.50 ID X 0.62 (SEE FIGURE 10-3)	3
9	20491SRV	W/M, PIVOT PIN (SEE FIGURE 10-3)	1
10	930041	BUSHING, 1.25 OD X .00 ID X .50	10
11	1001185	CYL, HYD, 3.0B X 26.0S, W/SENSOR	1
12	1001183	CYL, HYD, 3.00 X 48.00 X 2.00 ROD	1
13	1001458	CYL, HYD, 3.0B X 4.0S	1
14	1001481	NOZZLE, DISCHARGE	1
15	20874SRV	W/M, PIN, CYLINDER, 1.00 OD	3
16	1002175	W/M, CHAIN GUIDE, RA400	1
17	1001440	W/M, DISCHARGE TUBE, HORIZ BOOM	1
18	1001442	PIPE, 4.00 X 23.50, SCH 40, ABS	1
19	1001443	MID BOOM DISCHARGE, GRP	1
20	1001445	DRIP PAN, BOOM, GRP	1
21	24549SRV	CONNECTOR PIPE, W/M	1
22	1001456	GUIDE, CHAIN, HORIZ BOOM	1
23	1001452	E-CHAIN, ENERGY TUBE, 40 LINKS	1
24	1001454	W/M, HOSE RET, HORIZ BOOM	1
25	20872SRV	W/M, PIN, CYLINDER, 1.00 OD	1
26	21553SRV	W/M, T-BOLT, .375-6	2
27	22201	W/M, PIN, CYLINDER, 1.00 OD	1
28	1002693	W/M, RECEIVER, BOOM LOCK	1
29	1002688	ACTUATOR, LIMIT SWITCH, BOOM	1
30	80226	CSHH, .375-16 X 1.50 GR5	6
31	80996	WASHER, FLAT, SAE, .375	10
32	80162	WASHER, LOCK, .375	3
33	80038	NUT, HEX, .375-16 UNC	3
34	80816	CSHH, .375-16 X 3.75, GR5	4
35	80983	CSHH, .625-11 X 2.00, GR8	10

Illustrated Parts List (IPL)

HORIZONTAL BOOM (NISSAN)

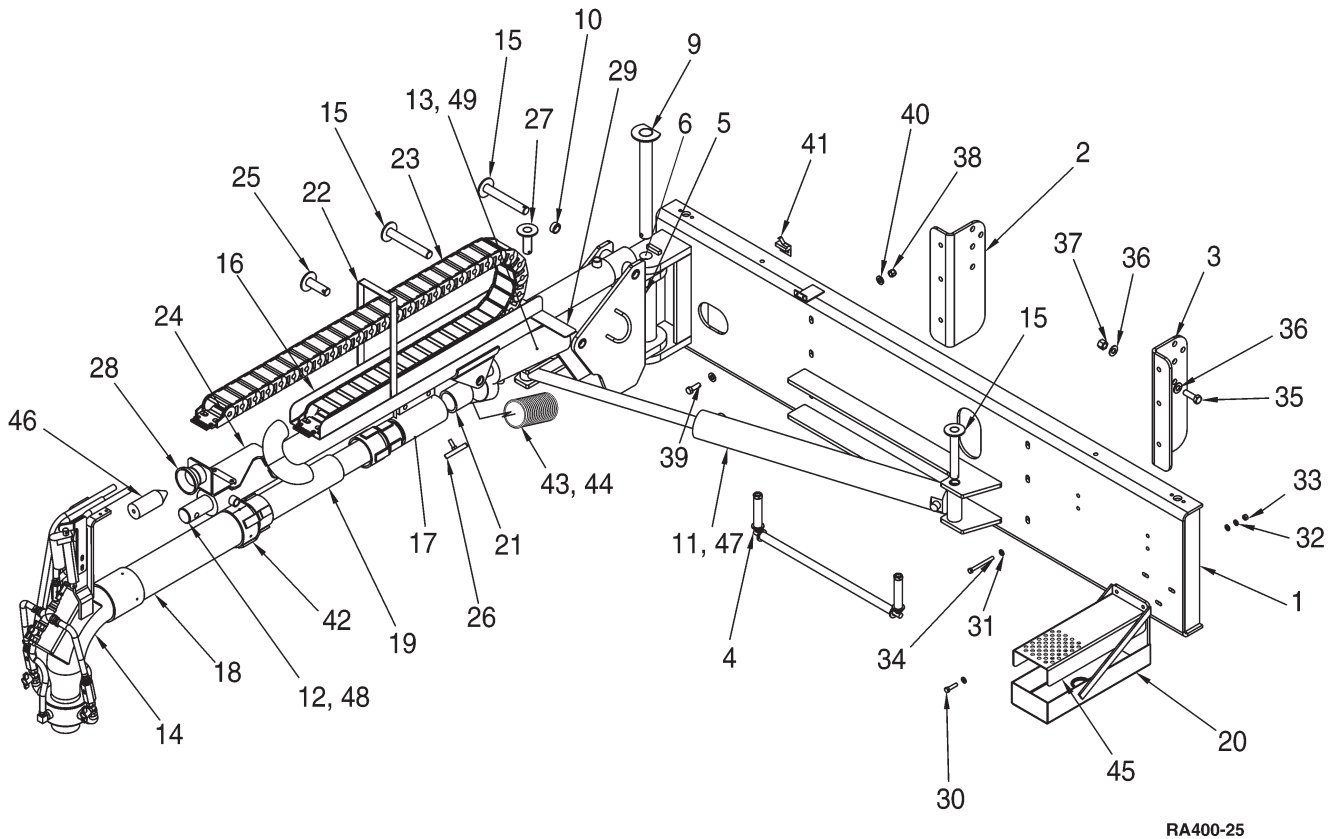
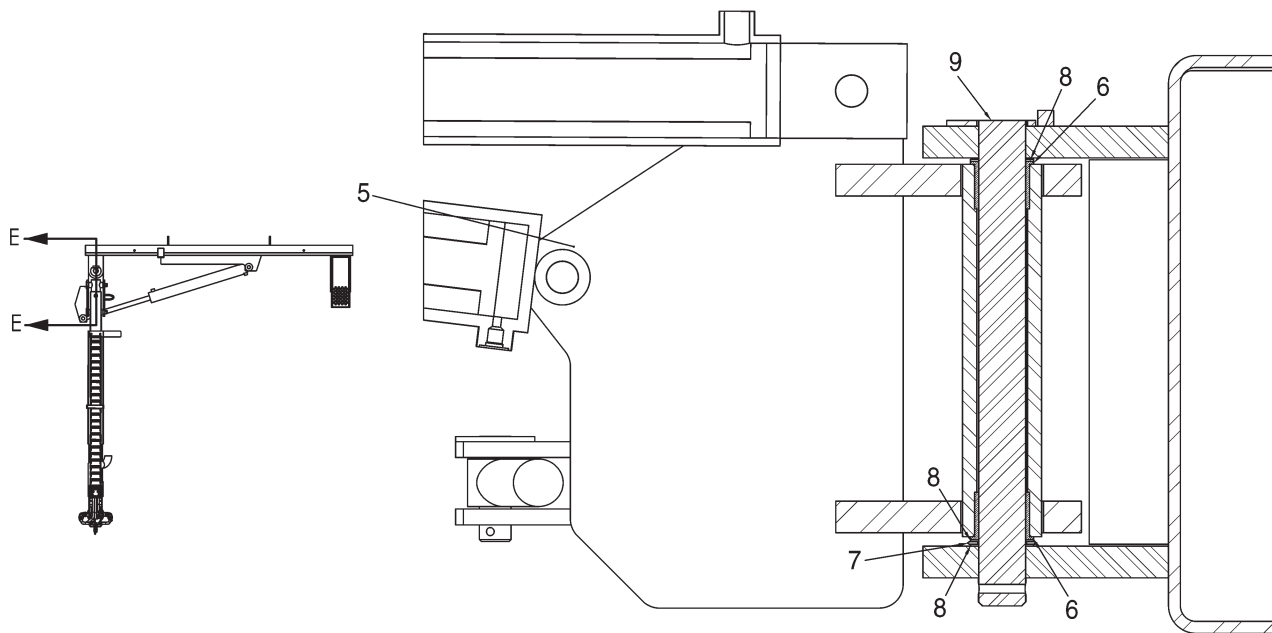


Figure 10-2

Figure 10-2. HORIZONTAL BOOM (NISSAN) (Continued)

Figure/ Item	Part Number	Nomenclature	Units Per Assembly
36	81201	WASHER, FLAT, SAE, .625, HARDENED	20
37	80356	NUT, FLEXLOC, .625-11, FULL, LT	10
38	80354	NUT, FLEXLOC, .500-13, FULL, LT	6
39	81113	CSHH, .500-13 X 1.50, GR8	6
40	81141	WASHER, FLAT, SAE, .500, HARDENED	12
41	989818	SWITCH, LIMIT, NC, C.P.I.	1
42	20798	REDUCER, W/M 4 PVC	1
43	985583-025	HOSE, 3.00 ID, POLY CONV X 25 FT	1
44	985594	CLAMP, HOSE, 3.50 ID, SPIRAL LOCK	2
45	1001451	COVER, DRIP PAN, BOOM	1
46	1002661	PIN, BOOM CYL POS, RA400	1
47	1001185-01	KIT, SEAL, HYD CYLINDER	1
48	1003340-01	KIT, SEAL, HYD CYLINDER	1
49	1003339-01	KIT, SEAL, HYD CYLINDER	1

HORIZONTAL BOOM PIVOT (NISSAN)



SECTION E-E
SCALE 1 : 3

RA400-27

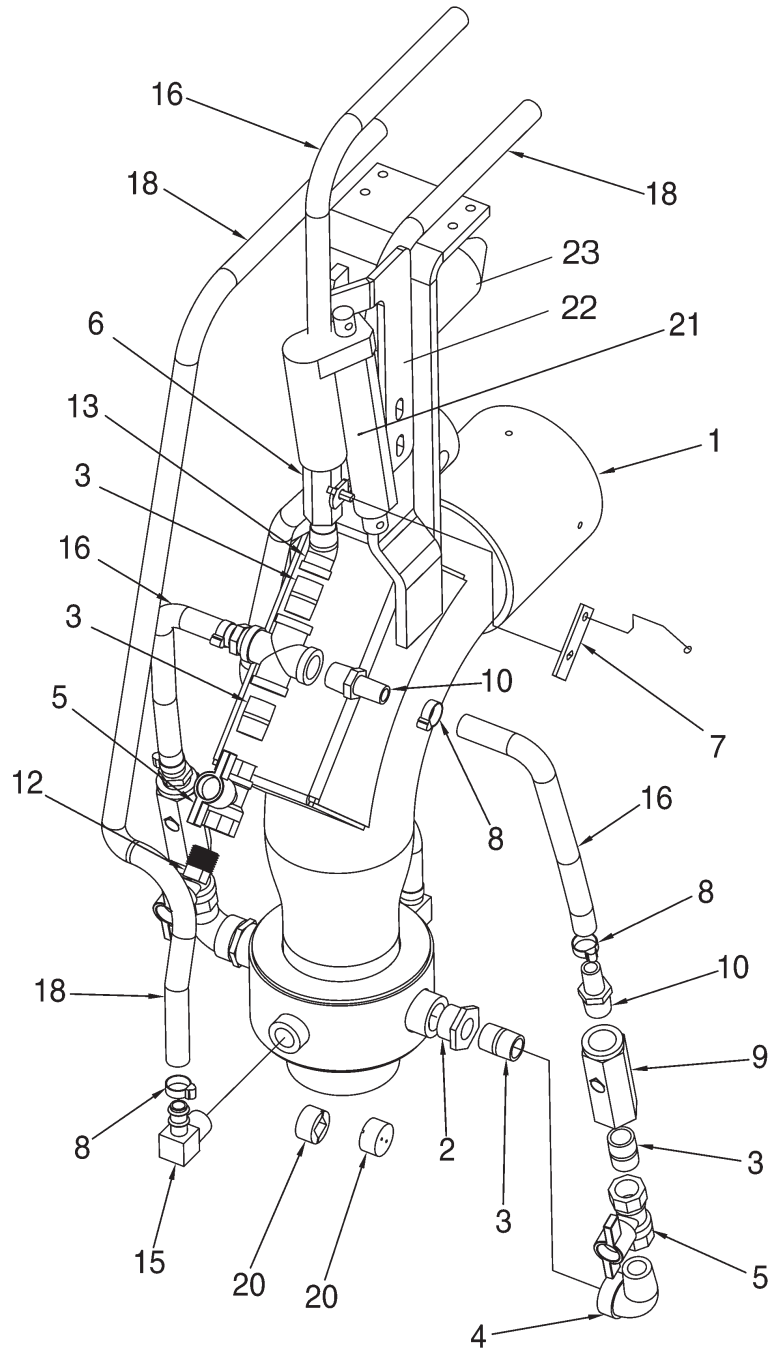
Figure 10-3

Figure 10-3. HORIZONTAL BOOM PIVOT (NISSAN)

Figure/ Item	Part Number	Nomenclature	Units Per Assembly
Ref	1001430	BOOM, HORIZ, NISSAN, GRP	
5	1001434	W/M, PIVOT, HORIZ BOOM	1
6	32833	BUSHING, 1.503 ID, 1.754 OD, 1.5	2
7	36613	BEARING, THRUST, 1.50 ID X 0.62	1
8	36614	WASHER, THRUST, 1.50 ID X 0.62	3
9	20491SRV	W/M, PIVOT PIN	1

Illustrated Parts List (IPL)

DISCHARGE NOZZLE



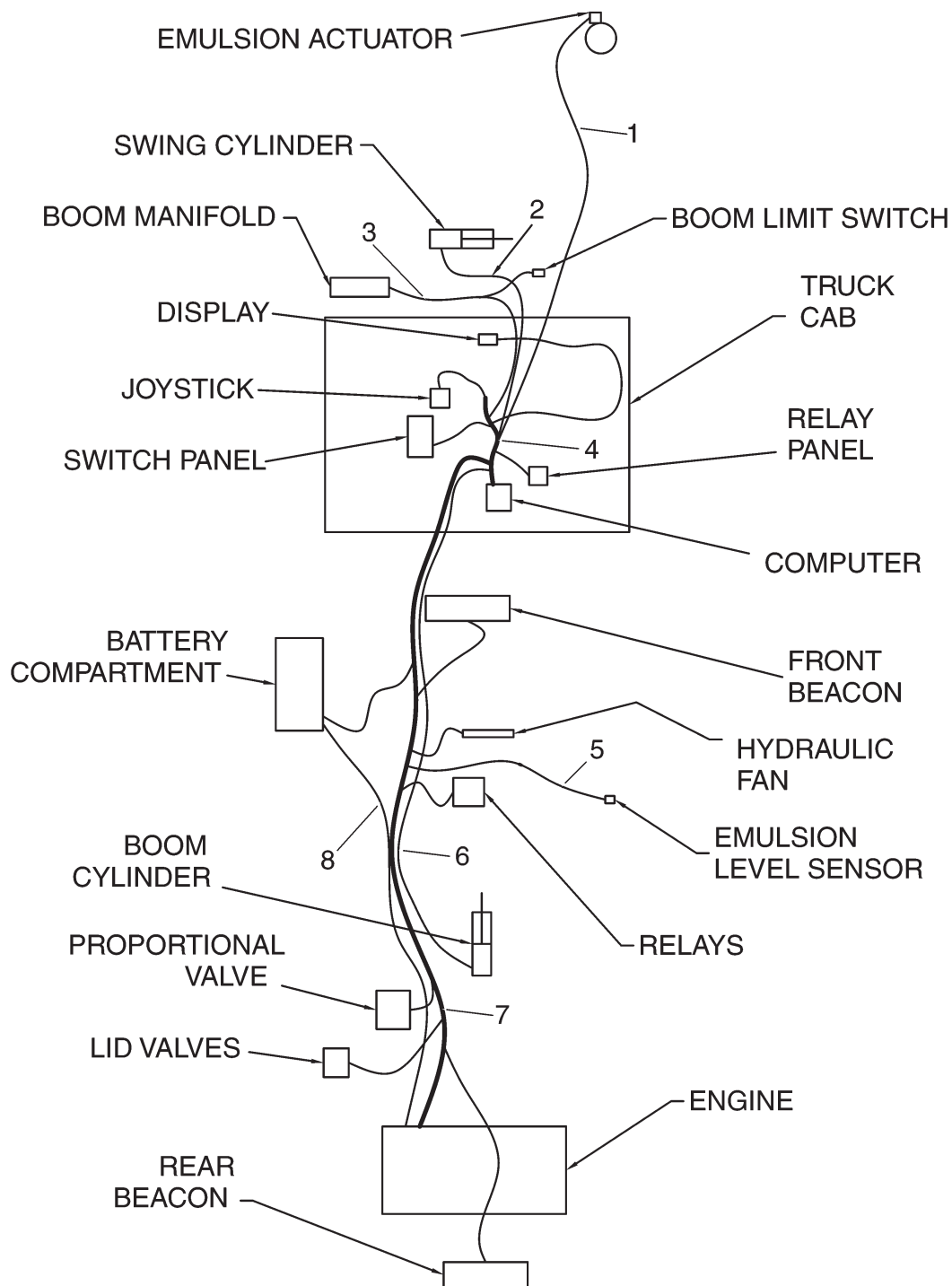
RA400-26

Figure 10-4

Figure 10-4. DISCHARGE NOZZLE

Figure/ Item	Part Number	Nomenclature	Units Per Assembly
Ref	1001481	GRP, NOZZLE, DISCHARGE	
1	1001438	W/M, NOZZLE, HORIZ BOOM	1
2	99985	PIPE, BUSH, 12 MP-08FP, STL	2
3	99596	PIPE, NIPPLE, 2.00 X 5.00	6
4	99526	ELBOW, PIPE, 90, .500 STREET, MI	2
5	36622	VALVE, BALL, .500 NPT, T HANDLE	3
6	36220	VLV, BALL, .08 NPT	1
7	24679	LEVER, 3-WAY, 08 NPT VALVE	1
8	33163	CLAMP, HOSE, #8	7
9	36871	VALVE, CHECK, .500 FPT, 5 PSI	2
10	31046	FITT, STR 08 MP-08 HB, PUSH-ON	5
12	99537	PIPE, PLUG, 08 MP, SQ HEAD	1
13	99519	PIPE, ELBOW, 45, .500 STREET, MI	1
15	33328	FITT, 90 08 MP-08 GB, CRIMPED	2
16	6352R	HOSE, 08, PUSH-ON, RED	25
18	6352B	HOSE, 08, PUSH-ON, BLUE	50
20	24594-078	NOZZLE, EMULSION SPRAY, .078	2
21	1002226	ACTUATOR, LINEAR, 12V, W/POT	1
22	1002589	MOUNT, ACTUATOR, RA300	1
23	1002661	PIN, BOOM CYL POS, RA400	1
24	38642	SLEEVE, ABRASIVE, NOZZLE, RA400	1
25	1002685	HARNESS, EMUL LEVEL TO MAIN	1

ELECTRICAL SYSTEM



RA400-62

Figure 10-5

Figure 10-5. ELECTRICAL SYSTEM

Figure/ Item	Part Number	Nomenclature	Units Per Assembly
Ref	1002478	ELECTRICAL SYSTEM	
1	1002163	HARNESS, BOOM, RA300	1
2	1000386	HARNESS, CYL CABLE 20 FT 90	1
3	1003428	HARNESS, MANIFOLD, RA400	1
4	1003427	HARNESS, CAB, RA400	1
5	1002685	HARNESS, EMUL LEVEL TO MAIN	1
6	1000386-01	HARNESS, CYL CABLE, 30 FT, 90	1
7	1002362	HARNESS, MAIN, RA400	1
8	1001191	HARNESS, DP200 PANEL, RA400	1
9	1002361	SCHEMATIC, ELEC, RA400	0
10	1002560	GRP, DISPLAY, DP200, RA400	1
11	1002575	CONTROLLER, PLUS 1, RA400	1
12	1003484	GRP, RELAY/BREAKER, RA400	1
13	1003487	GRP, SOLENOIDS/FUSES, RA400	1
14	1003494	GRP, SWITCH/ENG PANEL, RA400	1

IN-CAB CONTROL GROUPS, CONTROL STATION

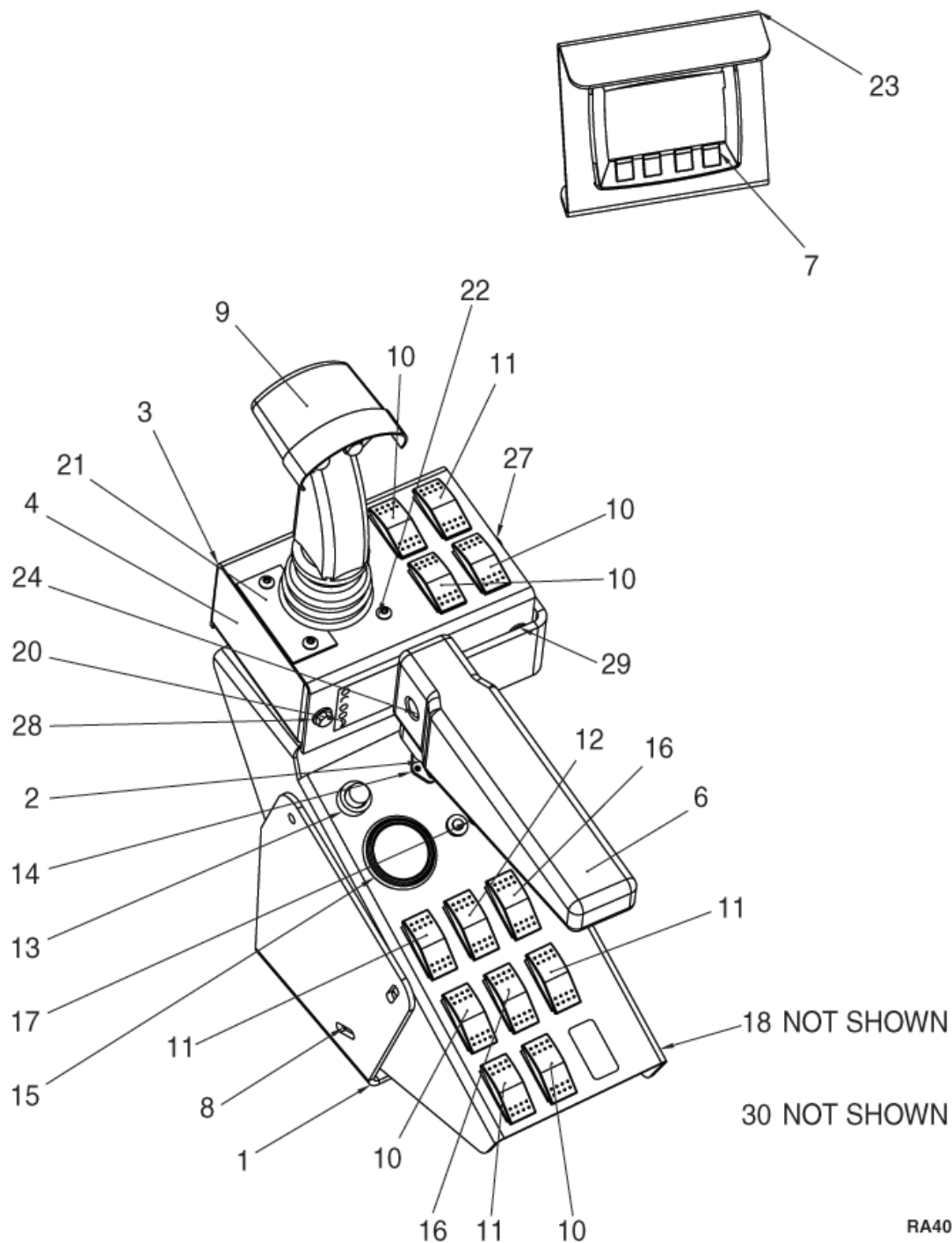


Figure 10-6

Figure 10-6. IN-CAB CONTROL GROUPS, CONTROL STATION

Figure/ Item	Part Number	Nomenclature	Units Per Assembly
Ref	1002559	JOYSTICK/CONTROL RA400	
1	1002663	PL, MNT, SWITCH PANEL, RA400	1
2	24422	MOUNT, ARM REST	1
3	1002562	PL, CONTROL, JOYSTICK, RA400	1
4	25681	CONTROL BOX, BOTTOM	1
5	986812	WASHER, FRICTION, .520 X 2.00 X .09	1
6	37547	ARM REST	1
7	988699	DISPLAY, GRAPHIC, B&W, DP 200	1
8	1002561	PL, CONTROL PANEL, RA400	1
9	1002261	JOYSTICK, 4-BUT, 2-LITE, RA400	1
10	1002552	SWITCH, ROCKER, (ON) -OFF-(ON)	4
11	1002553	SWITCH, ROCKER, ON-OFF	3
12	1002554	SWITCH, ROCKER, (ON) -ON-OFF	1
13	36150	ALARM, BUZZ/LIGHT, RED	1
14	39140-07	GAUGE, HOUR METER DIGITAL	1
15	72365	GAUGE, TACHOMETER, 2.06	1
16	1002555	SWITCH, ROCKER, (ON) -OFF	2
17	34964	CIRCUIT BREAKER, 10A	3
18	36085	RELAY, SPDT, 12V	2
19	36208	BUZZER, 12 VDC, CONTINUOUS TONE	1
20	1002658	DECAL, JOYSTICK NOTES, RA400	1
21	1002657	SH, COVER, JOYSTICK, RA400	1
22	1003230	CSSH, .250-20 X .500, BLK	4
23	1002563	SH, DISPLAY, DP200, RA400	1
24	80226	CSHH, .375-16 X 1.50, GR5	1
25	80352	NUT, HEX, .375-16	1
26	80140-	WASHER, FLAT, USS, .250	2
27	80185	CSHH, .250-20 X 1.00, GR5	2
28	80970	WASHER, FLAT, SAE, .250	2
29	80192	CSHH, .250-20 X .75, GR5	2
30	1002575	CONTROLLER, PLUS 1, RA400	1

Illustrated Parts List (IPL)

GROUP RELAY/BREAKER

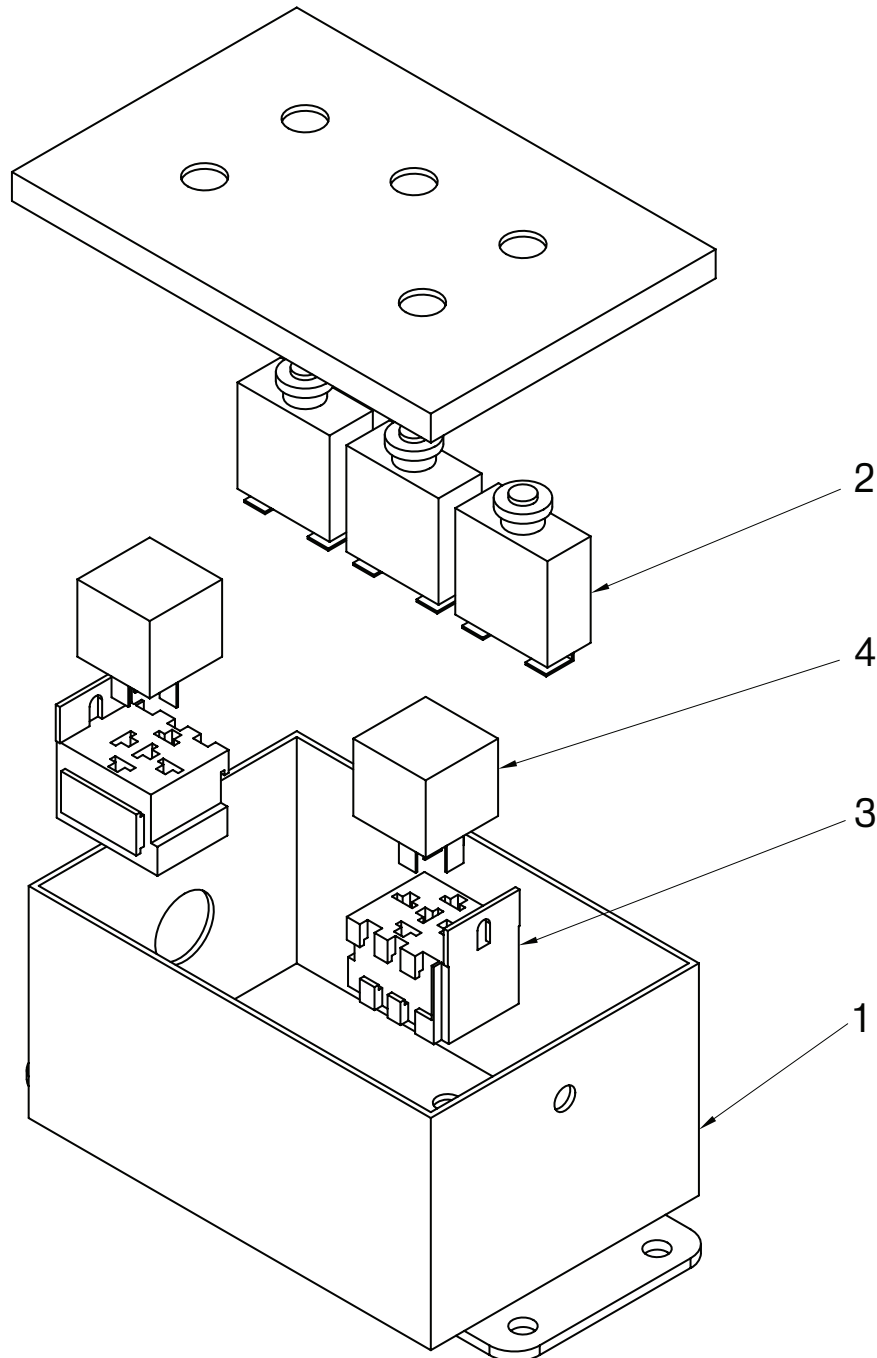


Figure 10-7

Figure 10-7. IN-CAB CONTROL GROUPS, CONTROL STATION

Figure/ Item	Part Number	Nomenclature	Units Per Assembly
Ref	1003484	GRP,RELAY/BREAKER,RA400	
1	984433-01	ENCLOSURE, FUSE PANEL, 4" X 6"	1
2	34964	CIRCUIT BREAKER, 10A	3
3	36086	BRACKET, RELAY MOUNT	2
4	36085	RELAY, SPDT, 12V	2

Illustrated Parts List (IPL)

GROUP RELAY/FUSES

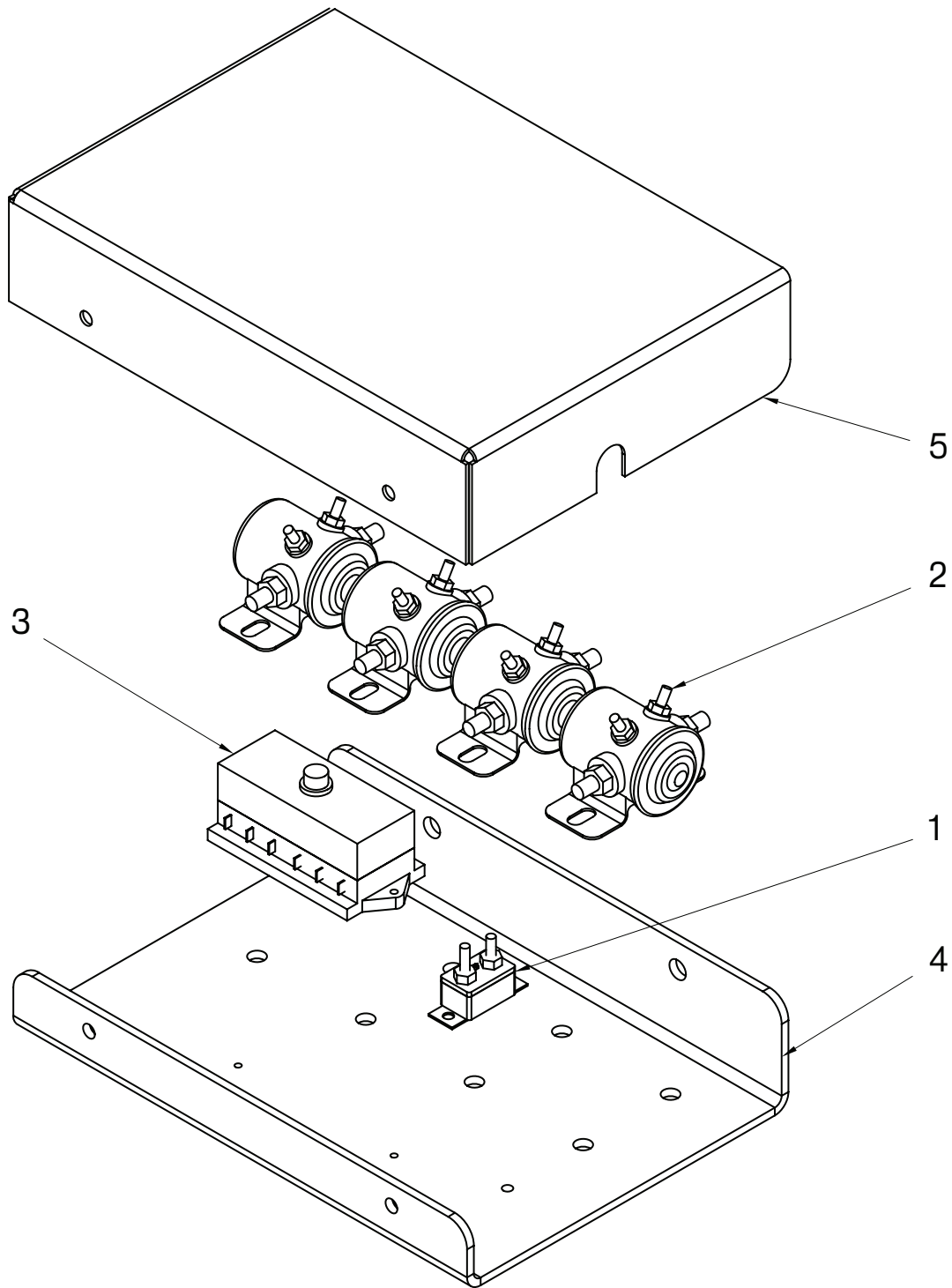


Figure 10-8

Figure 10-8. IN-CAB CONTROL GROUPS, CONTROL STATION

Figure/ Item	Part Number	Nomenclature	Units Per Assembly
Ref	1003487	GRP,RELAY/FUSES,RA400	
1	34853	CIRCUIT BREAKER, 40A	1
2	720290	SOLENOID, 12V, CONSTANT DUTY	4
3	1003395	FUSE BLOCK, 6 FUSE, HD, W/COVER	1
4	1003488	BASE, RELAY/FUSES, RA400	1
5	1003489	COVER, RELAY/FUSES, RA400	1

Illustrated Parts List (IPL)

IN-CAB CONTROL GROUPS, EMULSION CABLE

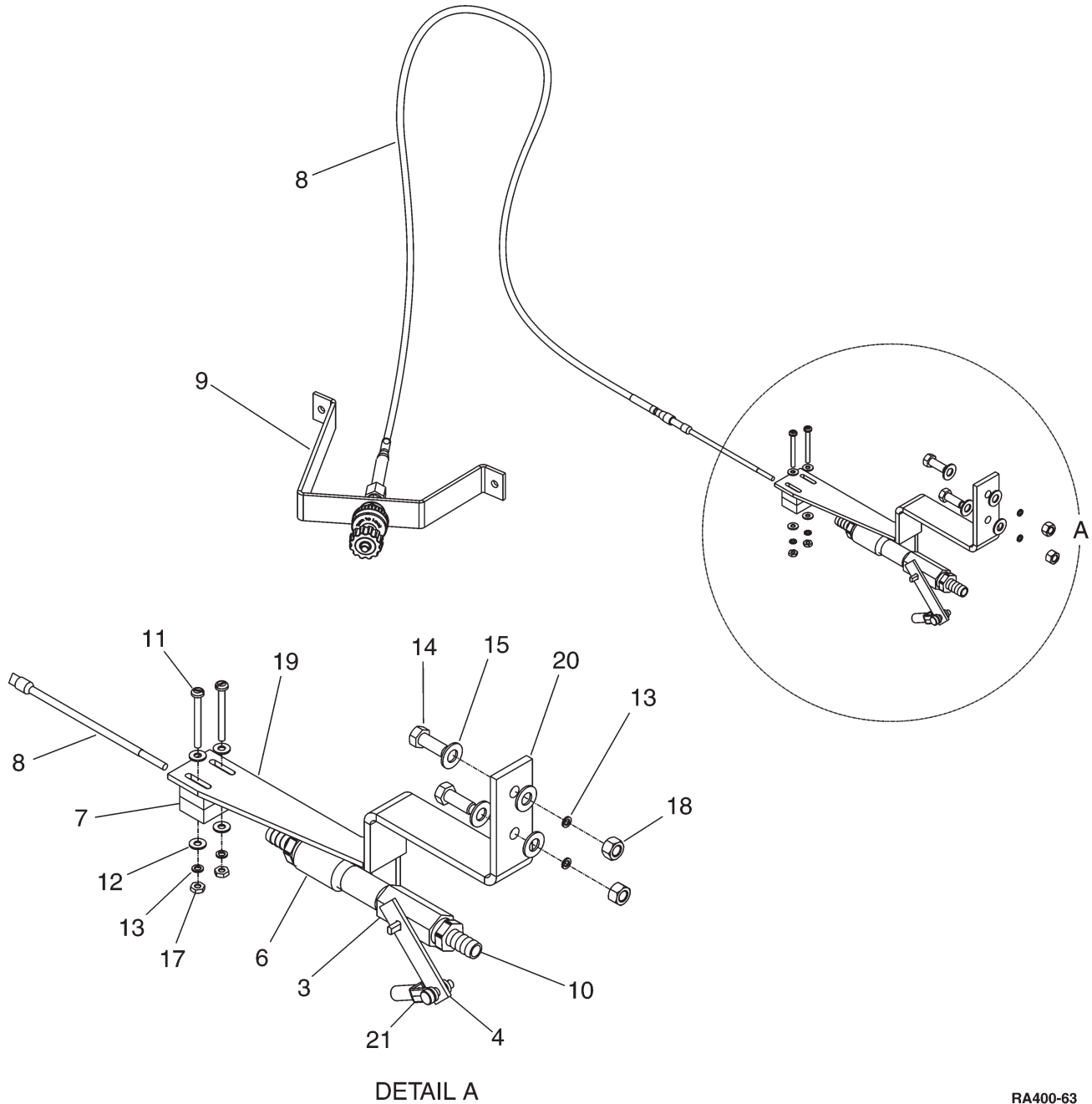
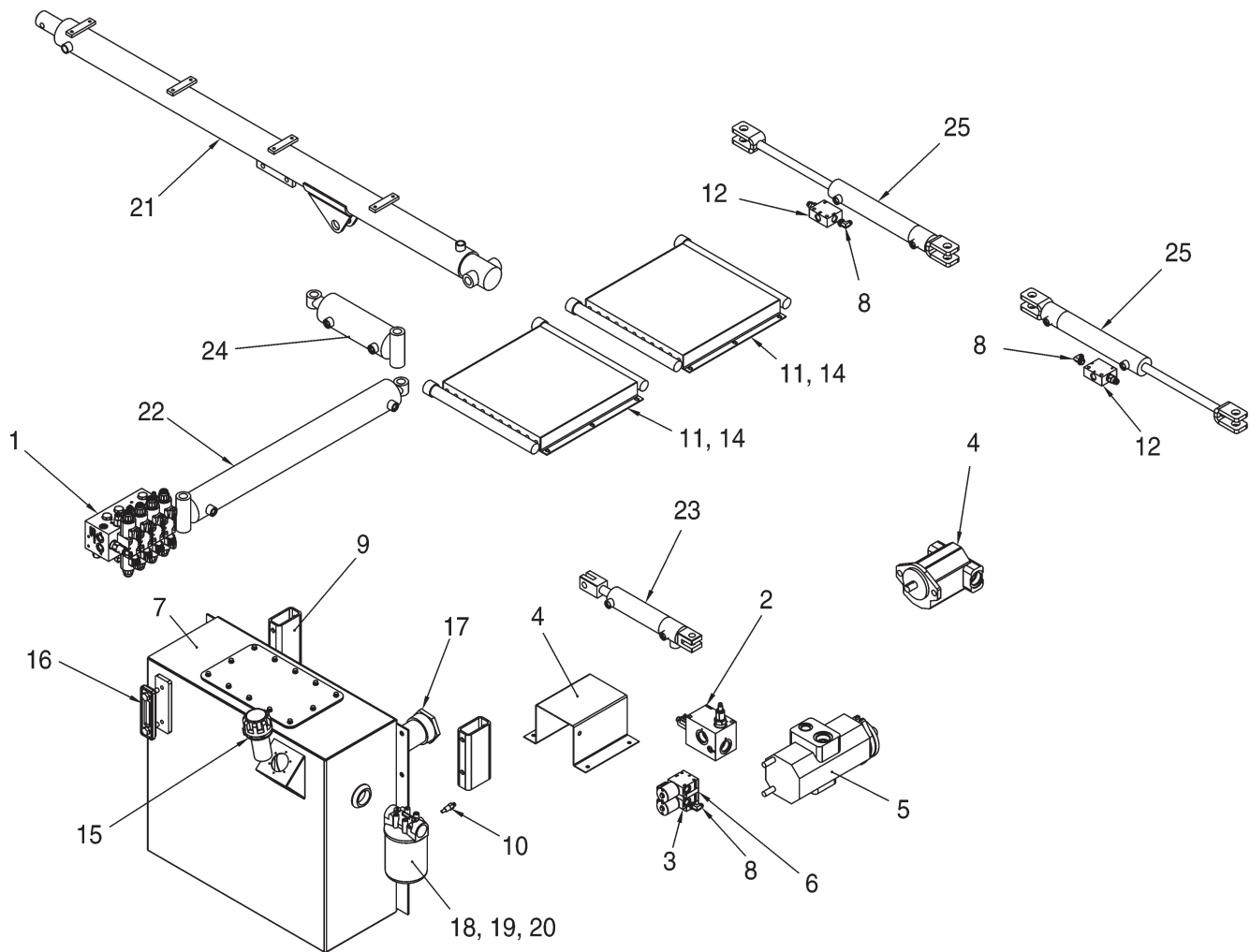


Figure 10-9

Figure 10-9. IN-CAB CONTROL GROUPS, EMULSION CABLE

Figure/ Item	Part Number	Nomenclature	Units Per Assembly
Ref	988543	EMULSION CABLE	
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" T X 126	1
9	29292	BRACKET, CAB EMULSION	1
10	X427	FITT, STR 08 MP-08 HB, CRIMPED	2
11	80997	MACH SCR, PH, #10-24 X 2.00	2
12	80995	WASHER, FLAT, USS, #10	4
13	80879	WASHER, LOCK, #10	4
14	80221	CSHH, .375-16 X 1.00, 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, 10-32 X 1.25, W/.250 PIN	1

HYDRAULIC SYSTEM



RA400-28

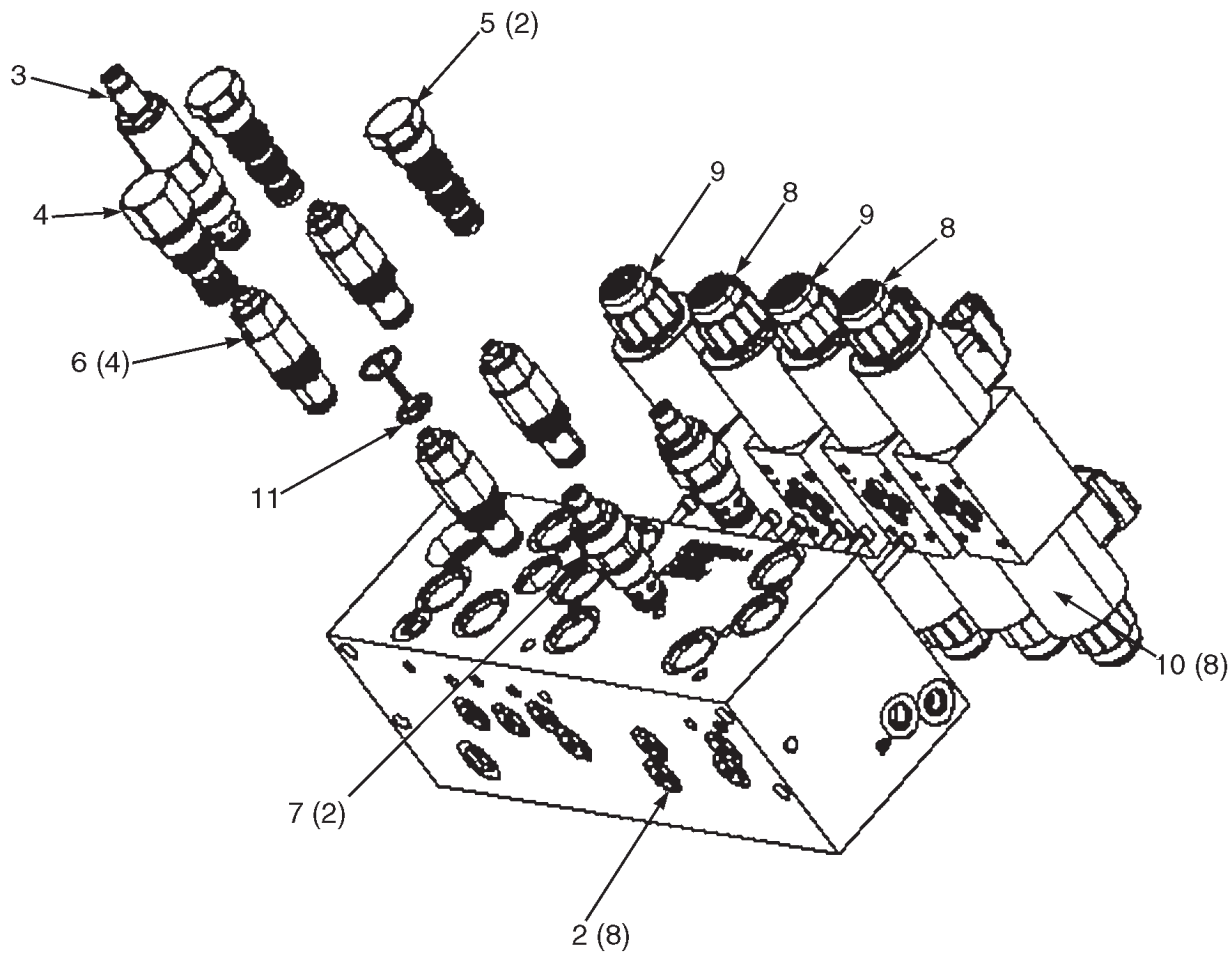
Figure 10-10

Figure 10-10. HYDRAULIC SYSTEM

Figure/ Item	Part Number	Nomenclature	Units Per Assembly
Ref	1002476	HYD SYSTEM, RA400, GRP	1
1	1002308	VLV, HYD, MAN, 4-DO3 (See Page 10-22 for breakdown)	1
2	1002309	VLV, HYD, PROP, 43 GPM, W/RELIEF (See Page 10-24 for break-down)	1
3	1002635	VLV, HYD, 3-WAY, SOLENOID 12V	2
3A	1002635-01	COIL, SOLENOID, 12V	1
3B	1002635-02	CART, VLV, 3-WAY	1
4	1002686	COVER, VLV, 3-WAY, RA400	1
5	1002707	KIT, HOSE/FITT, RA400	1
6	1002710	SPACER, SOLENOID VALVE	2
7	1003038	W/M, HYD RESERVOIR, 38 GAL, RA400	1
8	23373	FITT, 90 06MJ-06MB, ORF.030 MODF	3
9	27046	SPACER, HYD TANK MOUNT	2
10	35368	SENDER, TEMP GAUGE, 04 MP	1
11	35735	COOLER, HYD OIL	2
12	36523	VALVE, COUNTER BALANCE	2
13	36604	GAUGE, PRESS, 0-2000 PSI, 2.50	1
14	36997	FAN, ELEC, 12VDC, 1940 CFM	2
15	37680	CAP W/STRAINER, HYD FILLER	1
16	500070	GAUGE, SIGHT LEVEL/TEMP, HYD OIL	1
17	72243	STRAINER, SUCTION, 50 GPM	1
18	72543	FILTER ASSY, HYD RETURN	1
19	38327-01	ELEMENT, HYD FILTER	1
20	72543-01	INDICATOR, AIR FILTER SERVICE	1
21	1001183	CYL, HYD, 3.0B X 48S X 2.0R	1
22	1001185	CYL, HYD, 3.0B X 28S X 1.5R, SENSOR	1
23	1001184	CYL, HYD, 2.0B X 6.0 S, W/SENSOR	1
24	1001458	CYL, HYD, 3.0B X 4.0S X 1.5R	1
25	260060	CYL, HYD, 2.0B X 12.0S	2

Illustrated Parts List (IPL)

HYDRAULIC MANIFOLD VALVE



RA400-29

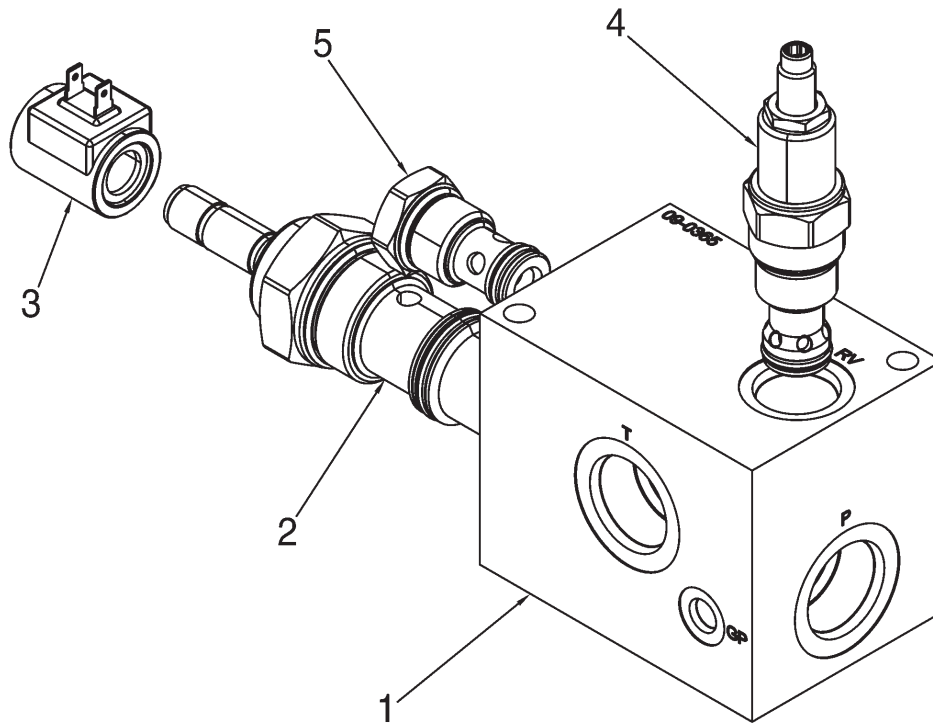
Figure 10-11

Figure 10-11. HYDRAULIC MANIFOLD VALVE

Figure/ Item	Part Number	Nomenclature	Units Per Assembly
Ref	1002308	VLV, HYD, MAN, 4-DO3	
1	1002308-02	0.030 ORIFICE, 3/8-16 NA NA	1
2	1002308-04	CHECK VALVE 12-14 ft lbs SK04-2N-T	8
3	1002308-05	PILOT OPERATED RELIEF VALVE 25 ft-lbs SK10-2N-B	1
4	1002308-06	PRESSURE COMPENSATOR, INT LS FC 25 ft-lbs SK10-3N-MM	1
5	1002308-07	PILOT OP CHECK VALVE 25 FT LBS SK10-4X-MMM	3
6	1002308-08	PRESSURE COMP FLOW CONTROL NA SK10-2N-B	4
7	1002308-09	FLOW CONTROL 25 FT-LBS SK10-2N-B	2
8	1002308-10	DO3 VALVE WITH DEUTSCH NA 484-9961	3
9	1002308-11	4/3 DO3 SOLENOID VALVE NA 484-9961	1
10	1002308-12	COIL, SOLENOID, D03	8
11	1002308-13	VLV, COUNTER BALANCE	1

Illustrated Parts List (IPL)

HYDRAULIC PROPORTIONAL VALVE



RA400-61

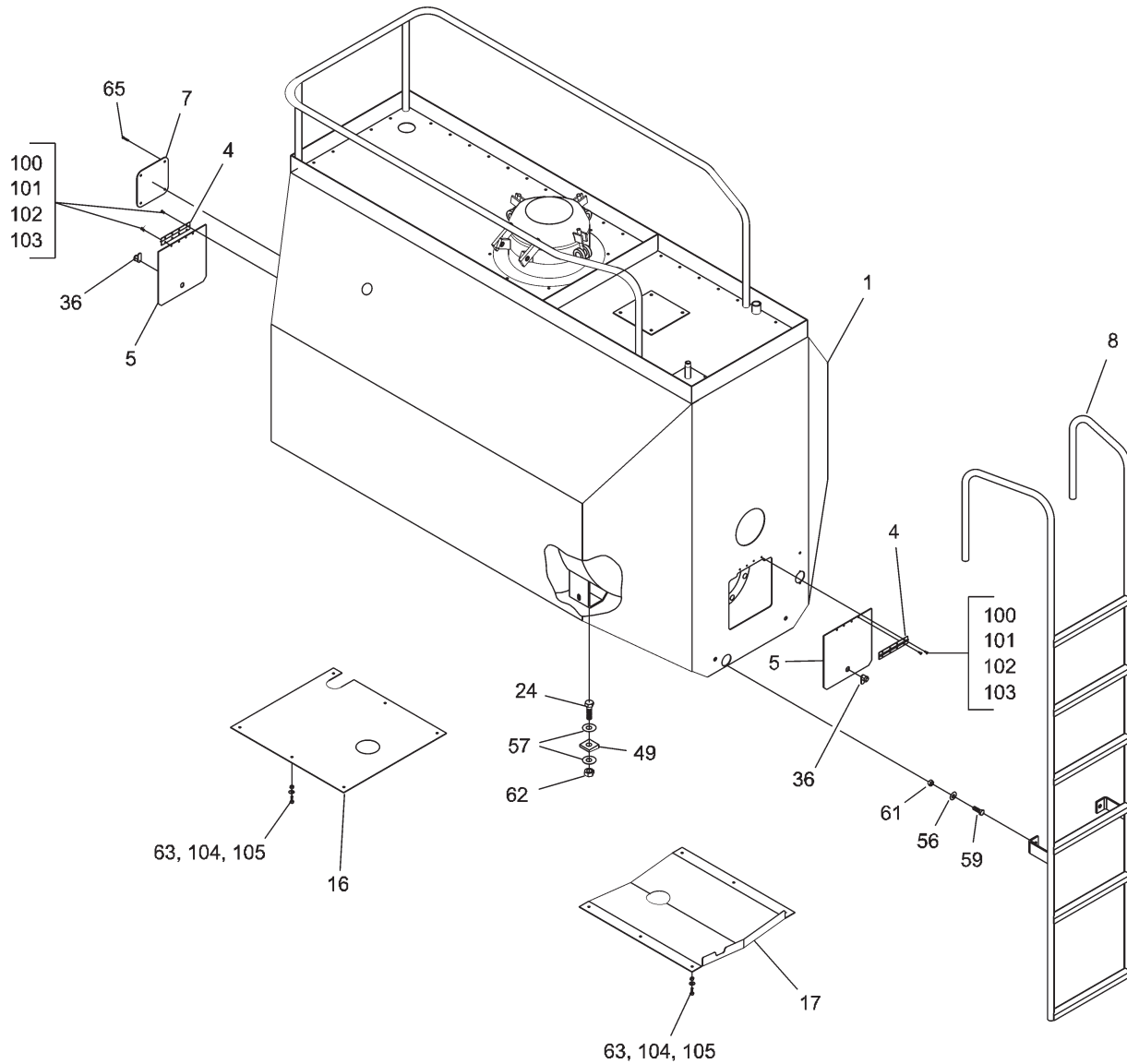
Figure 10-12

Figure 10-12. HYDRAULIC PROPORTIONAL VALVE

Figure/ Item	Part Number	Nomenclature	Units Per Assembly
Ref	1002309	VLV, HYD, MAN, 4-DO3	
1	1002309-05	BLOCK, MANIFOLD, PROP VLV	1
2	1002309-01	CART, VLV, PROP, 45 GPM	1
3	1002309-02	COIL, SOLENOID, 12V	1
4	1002309-03	CART, VLV, RELIEF	1
5	1002309-04	CART, VLV, CHECK	1

Illustrated Parts List (IPL)

EMULSION TANK - TANK SHELL DETAIL



RA400-57

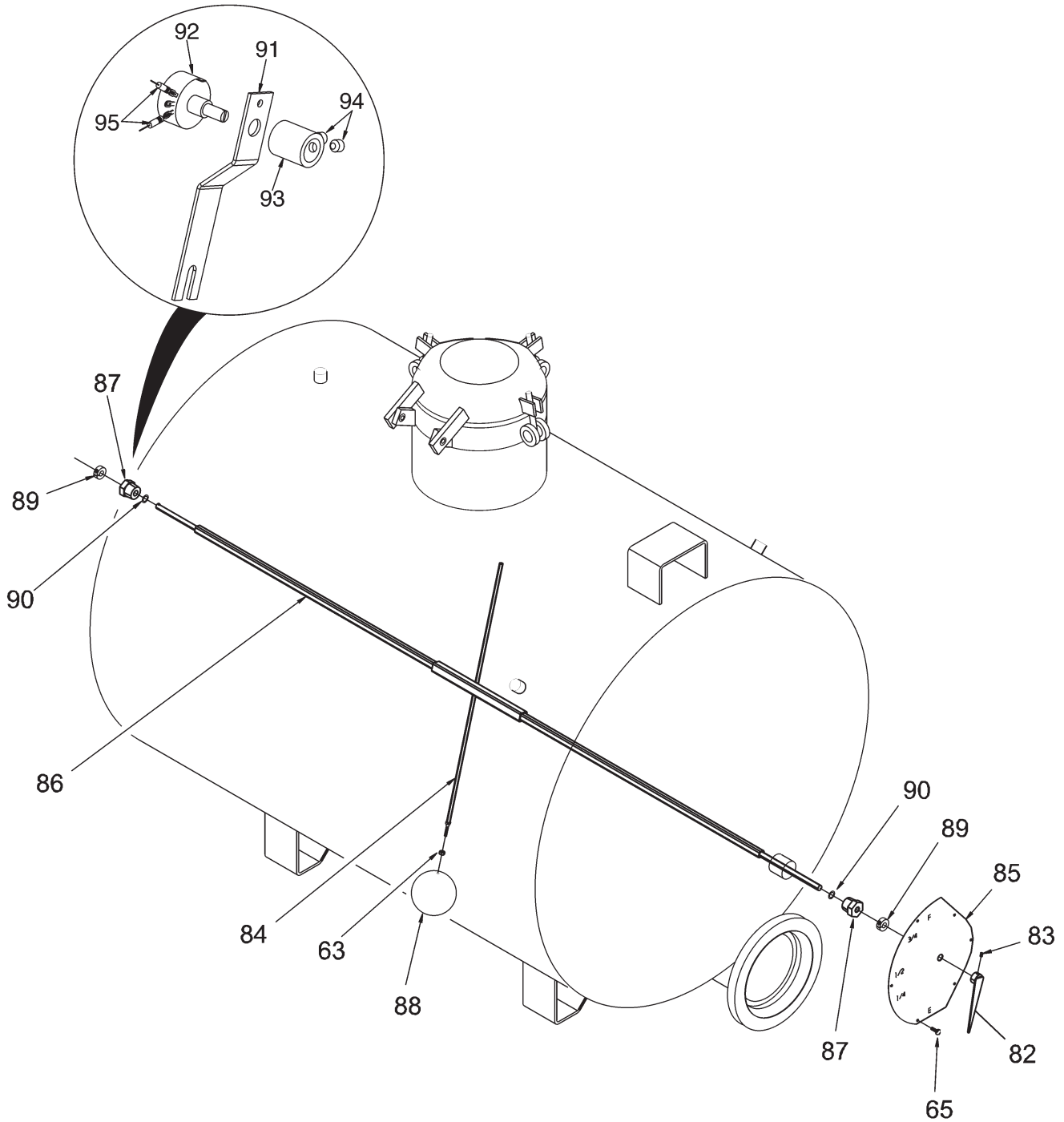
Figure 10-13, Sheet 1 of 4

Figure 10-13. EMULSION TANK - TANK SHELL

Figure/ Item	Part Number	Nomenclature	Units Per Assembly
Ref	1001983	EMULSION TANK, 300 GAL, RA400, GRP	
1	1002077	EMUL TANK, INSULATE, RA400, GRP	1
4	20963	HINGE, CONTROL BOX	2
5	20974	SERVICE DOOR	2
7	23729	COVER, POTENTIOMETER	1
8	1002062	LADDER, SIDE, W/M, RA400	1
16	1002055	COVER DRAIN	1
17	1002056	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

Illustrated Parts List (IPL)

EMULSION TANK - FLOAT DETAIL



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Figure 10-13, Sheet 2 of 4

Figure 10-13. EMULSION TANK - FLOAT

Figure/ Item	Part Number	Nomenclature	Units Per Assembly
Ref	1001983	EMULSION TANK, 300 GAL, RA400, GRP	
63	80036	NUT, HEX, .250-20	2
65	81160	SCR, SLFDRL, HH, #10 X 1.00, #3 PT	1
82	8119SRV	POINTER ASSY	1
84	1002067	FLOAT ROD W/M, RA400, GALLONS	1
85	1002636	PL, CONTENTS, GALLONS, RA400	1
86	23730SRV	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, .501 D X 1.12 OD	2
90	39084	O-RING, #310, .18 X .50 ID VITON	2
91	1002572	MOUNT, EMUL LEVEL INDICATOR	1
92	72050	POTENTIOMETER, 1000 OHM	1
93	1002483	CPLG, POTENIOMETER, RA400	1
94	80300	SET S, HSKT, K CUP, .250-20 X .25	2
95	73289	RESISTOR, 120 OHM, 1/2 WATT	2

Illustrated Parts List (IPL)

EMULSION TANK - HOSE ROUTING DETAIL

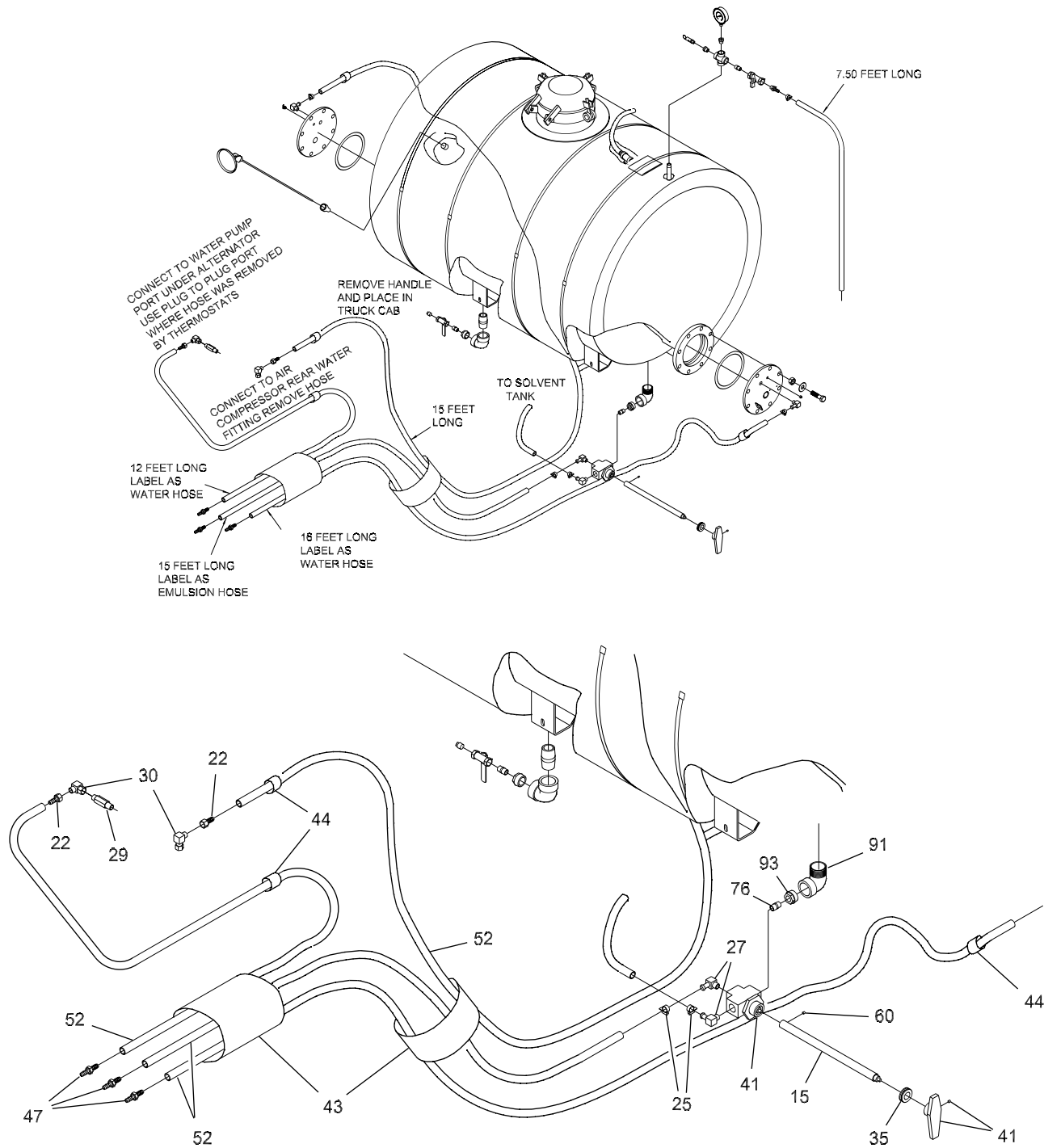


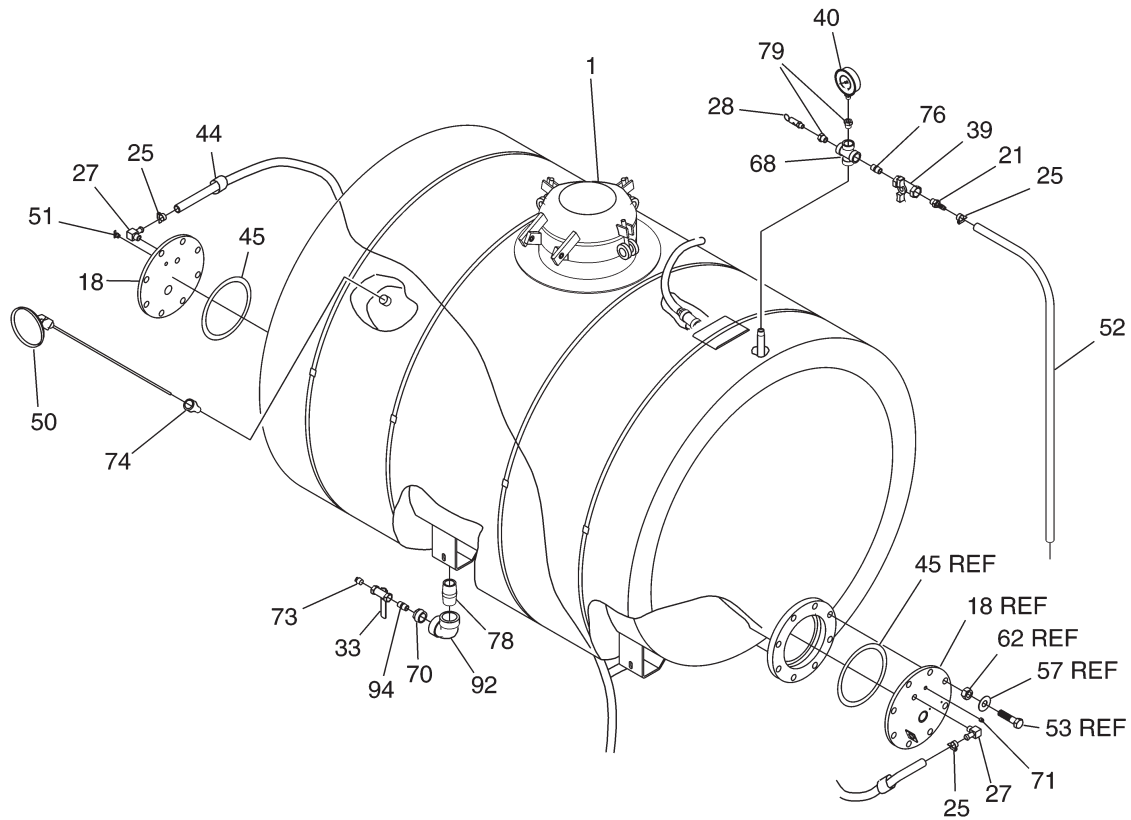
Figure 10-13, Sheet 3 of 4

Figure 10-13. EMULSION TANK - HOSE ROUTING

Figure/ Item	Part Number	Nomenclature	Units Per Assembly
Ref	1001983	EMULSION TANK, 300 GAL, RA400, GRP	
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, .100 ID	1
41	36662	VALVE, BALL, .500 NPT, 3-WAY	1
43	36664	INSULATION, TUBE, 1.62 ID X .38 WALL	20
44	36665	INSULATION, TUBE, 1.12 ID X .38 WALL	15
47	37003	FITT, STR 08HB-08HB	3
52	6352	HOSE, 08, PUSH-ON, 250	66
60	80300	SET S, HSKT, KCUP, .250-20 X .25	1

Illustrated Parts List (IPL)

EMULSION TANK - HOSE ROUTING DETAIL



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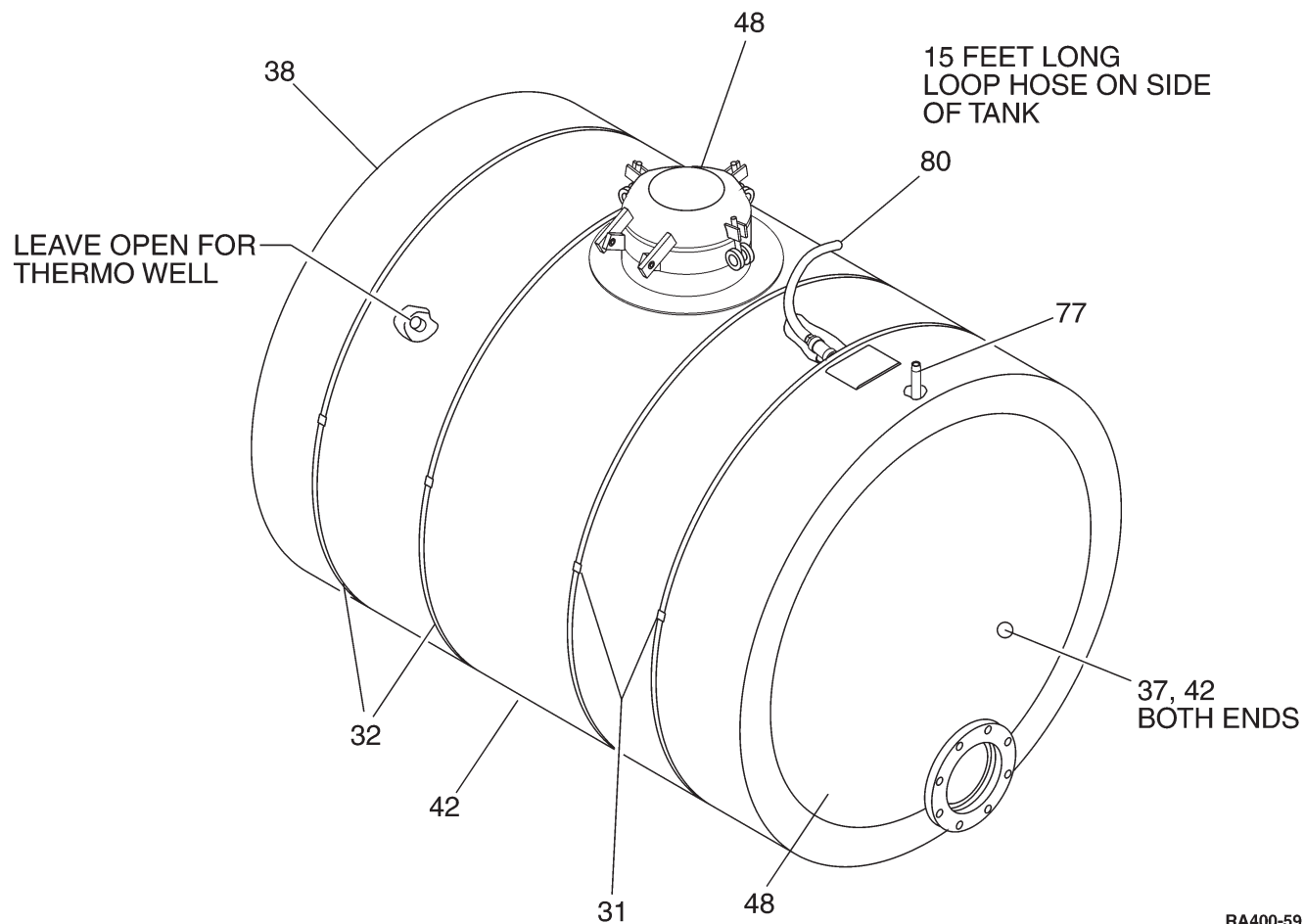
Figure 10-13, Sheet 4 of 4

Figure 10-13. EMULSION TANK - HOSE ROUTING

Figure/ Item	Part Number	Nomenclature	Units Per Assembly
Ref	1001983	EMULSION TANK, 300 GAL, RA400, GRP	
1	1002077	EMULSION TANK INSULATE GRP	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, 125 PSI, 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, 1.12 ID X .38 WALL	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,.750-10 X 3.00, GR5 (Part of Tank Insulate Group)	Ref
-54	81177	MACH SCR, PH, #8-32 X .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, 2.00 MP-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, .500 X CLOSE	2
78	99436	PIPE, NIPPLE, 2.00 X 5.00	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, 1.00 X CLOSE	1
-96	80162	WASHER, LOCK, .375	4
-97	80219	CSHH, .375-16 X .75, GR5	4

- ITEM NOT ILLUSTRATED

EMULSION TANK INSULATE - TANK INSULATE DETAIL



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Figure 10-14, Sheet 1 of 2

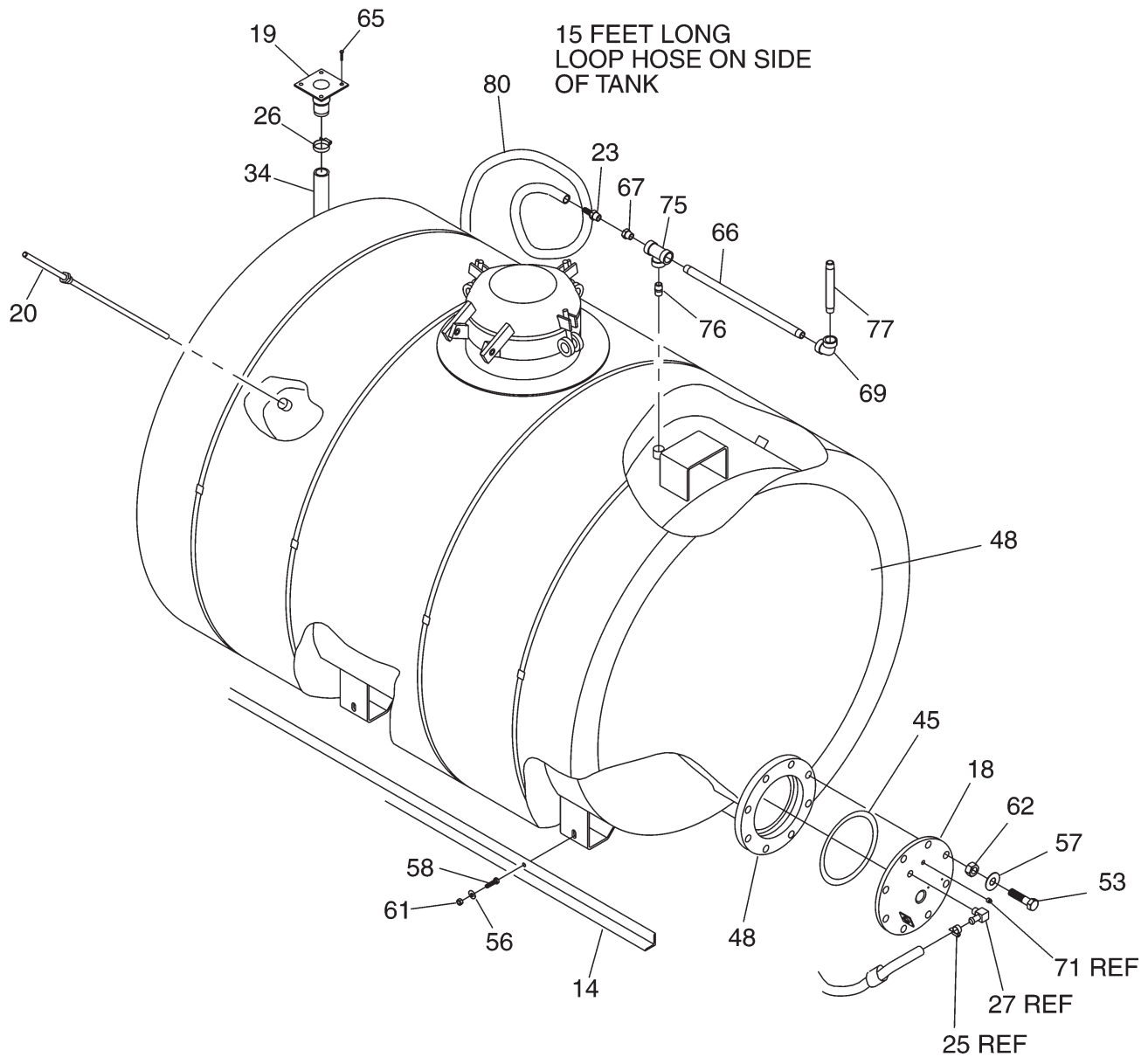
Figure 10-14. EMULSION TANK INSULATE

Figure/ Item	Part Number	Nomenclature	Units Per Assembly
Ref	1002077	EMULSION TANK INSULATE GRP	2
1	12677-4	WASHER, INS, SQ, .94 DIA X 4.00	4
-2	20952	BAFFLE, EMULSION TANK	1
-3	20953-01	BAR, .375 X 2.00 X 70.00 (99052)	2
4	20963	HINGE, CONTROL BOX	1
31	34069	BUCKLE, BAND-IT, .625, SS	50
32	34070	BAND, BAND-IT, .625, SS	1
38	36553	FITT, CAP 08FJ	4
42	1002190	INSULATE, THERM, CEL, 4.00, RA400	1
48	1001846	TANK, PRESS, 300 GAL, 36 OD X 76	1
77	99670	PIPE, NIPPLE, .500 X 7.00	15
80	38579	HOSE, 06, LOW PRESS PUSH-ON	1

- ITEM NOT ILLUSTRATED

Illustrated Parts List (IPL)

EMULSION TANK INSULATE - TANK INSULATE DETAIL



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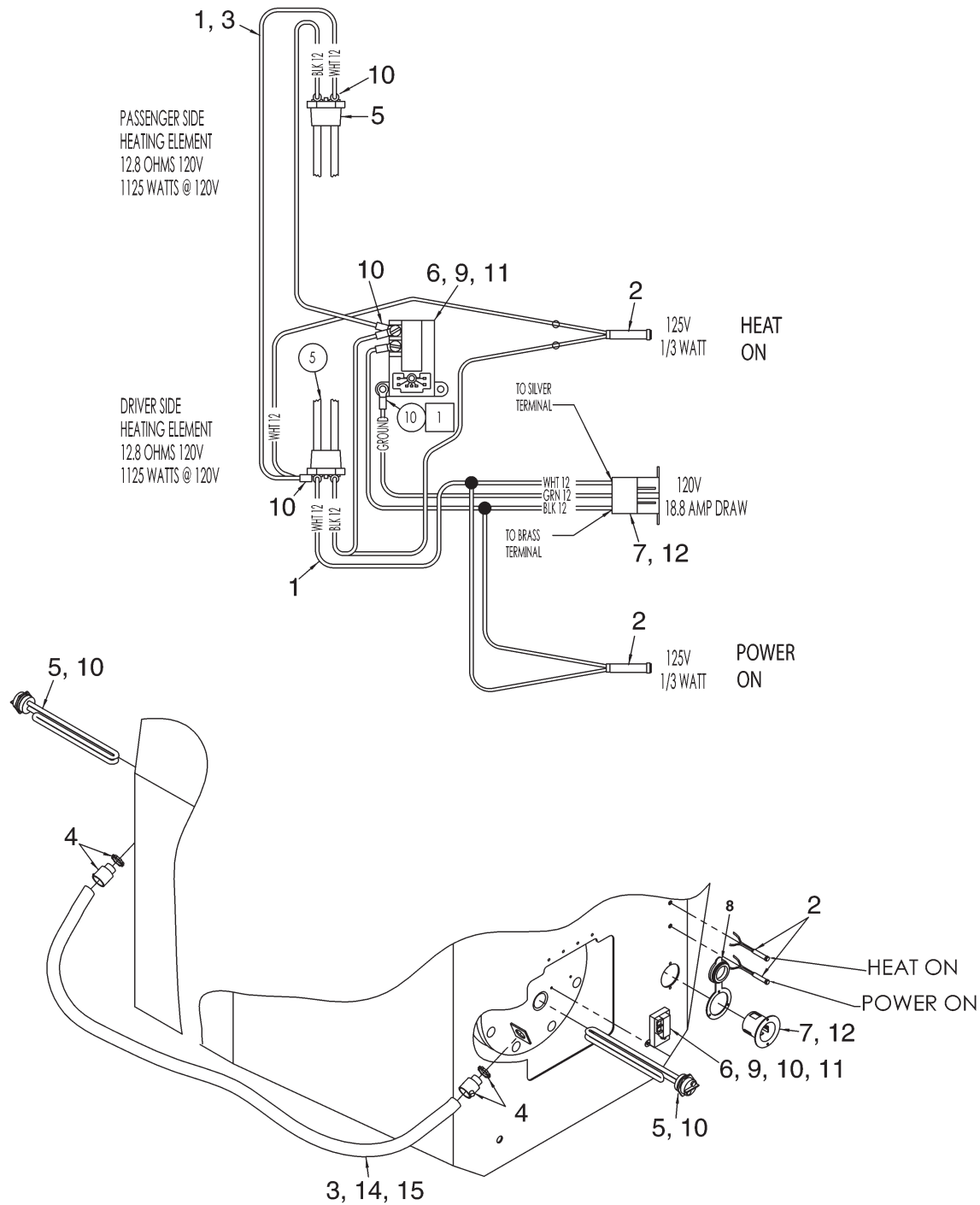
Figure 10-14, Sheet 2 of 2

Figure 10-14. EMULSION TANK INSULATE

Figure/ Item	Part Number	Nomenclature	Units Per Assembly
Ref	1002077	EMULSION TANK INSULATE GRP	2
14	1002059	ANGLE, EMULSION TANK	2
18	24490	FLANGE W/M, WATER TUBE	1
19	24509	OVERFLOW DRAIN W/M	1
20	26981	THERMO WELL, 08 X 30.25, W/ENDSLUG	1
23	31959	FITT, STR 06MP-06HB, PUSH-ON	1
25	33163	CLAMP, HOSE, #08 (Part of Emulsion Tank)	Ref
26	33169	CLAMP, HOSE, #28	1
27	33328	FITT, 90 08MP-08HB, CRIMPED (Part of Emulsion Tank)	Ref
34	34501	HOSE, 24, HYD SUCTION	7.2
45	36684	GASKET, FLANGE, 6.00, NON-ASB	2
48	1001846	TANK, PRESS, 300 GAL, 36 OD X 76	1
53	71646	CSHH, .750-10 X 3.00, GR5	16
56	80144	WASHER, FLAT, USS, .500	4
57	80147	WASHER, FLAT, USS, .750	16
58	80185	CSHH, .250-20 X 1.00, 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, #10 X 1.00, #3PT	192
66	853210683	PIPE, TBE, 08 X 18.00	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, .500 X CLOSE	1
77	99670	PIPE, NIPPLE, .500 X 7.00	1
80	38579	HOSE, 06, LOW PRESS PUSH-ON	15

Illustrated Parts List (IPL)

EMULSION TANK ELECTRICAL HEATER



RA400-55

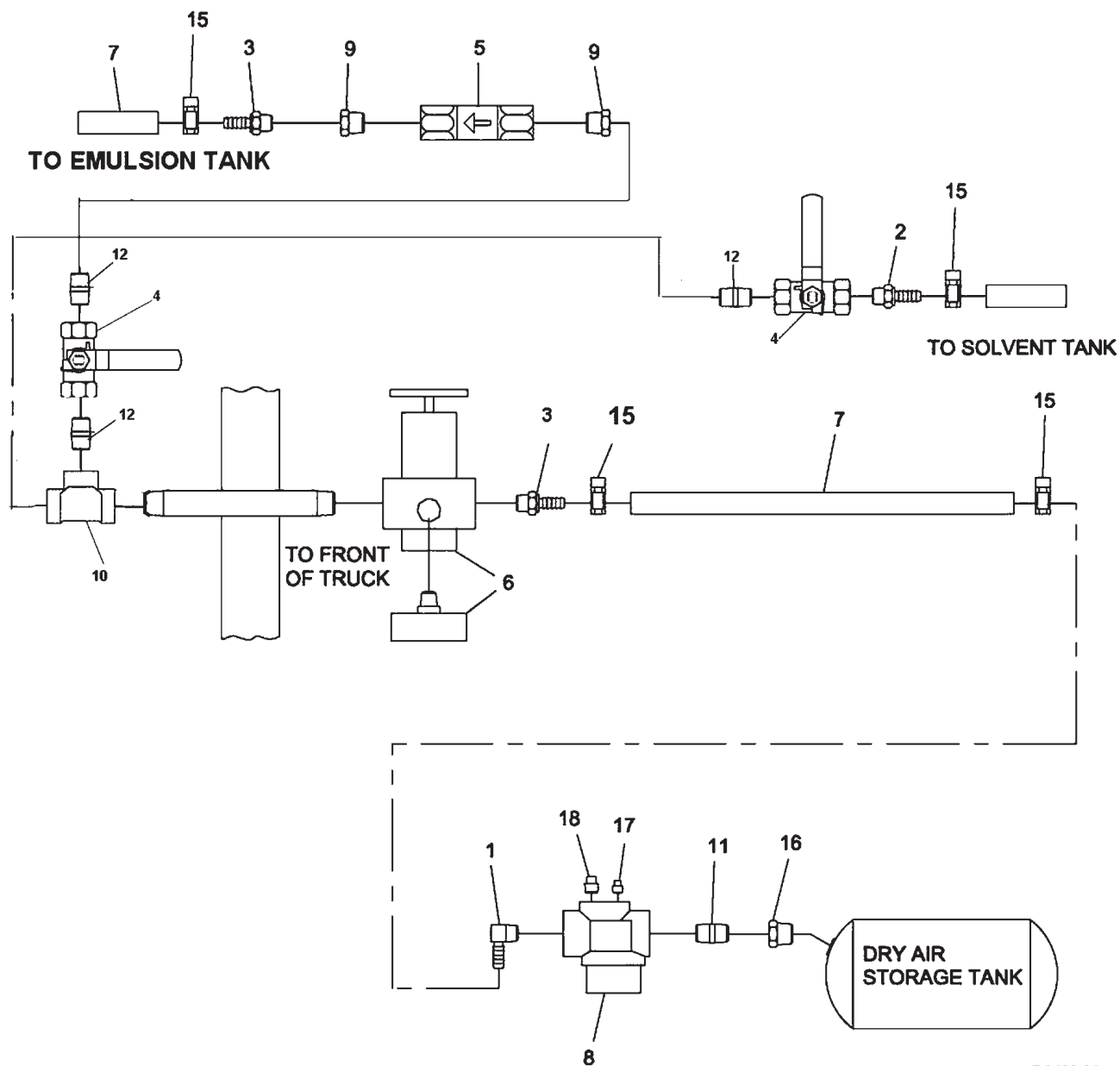
Figure 10-15

Figure 10-15. EMULSION TANK ELECTRICAL HEATER

Figure/ Item	Part Number	Nomenclature	Units Per Assembly
Ref	20993	EMULSION TANK HEATER	
2	34167	LIGHT, GREEN INDICATOR	2
3	34729	CONDUIT, METAL FLEX, .50 ID	9 ft
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, #10-32 X .25, PHIL	2
10	851390204	TERM, RING, 16-14 GA, #10 STUD	11
11	871071601	WASHER, LOCK, #10	2
12	81150	SCR, SLFTPG, PH, #10 X .500, AB	2
13	37728	PLUG, ELEC, FEMALE, 20A,125V	1
14	90738-03	WIRE,12GA, WHT, 600V	15 ft
15	90738-02	WIRE,12GA, BLACK, 600V	15 ft
-16	90738-04	WIRE, 12GA, GREEN, 600V	2 ft

- ITEM NOT ILLUSTRATED

PRESSURIZED AIR GROUP



RA400-64

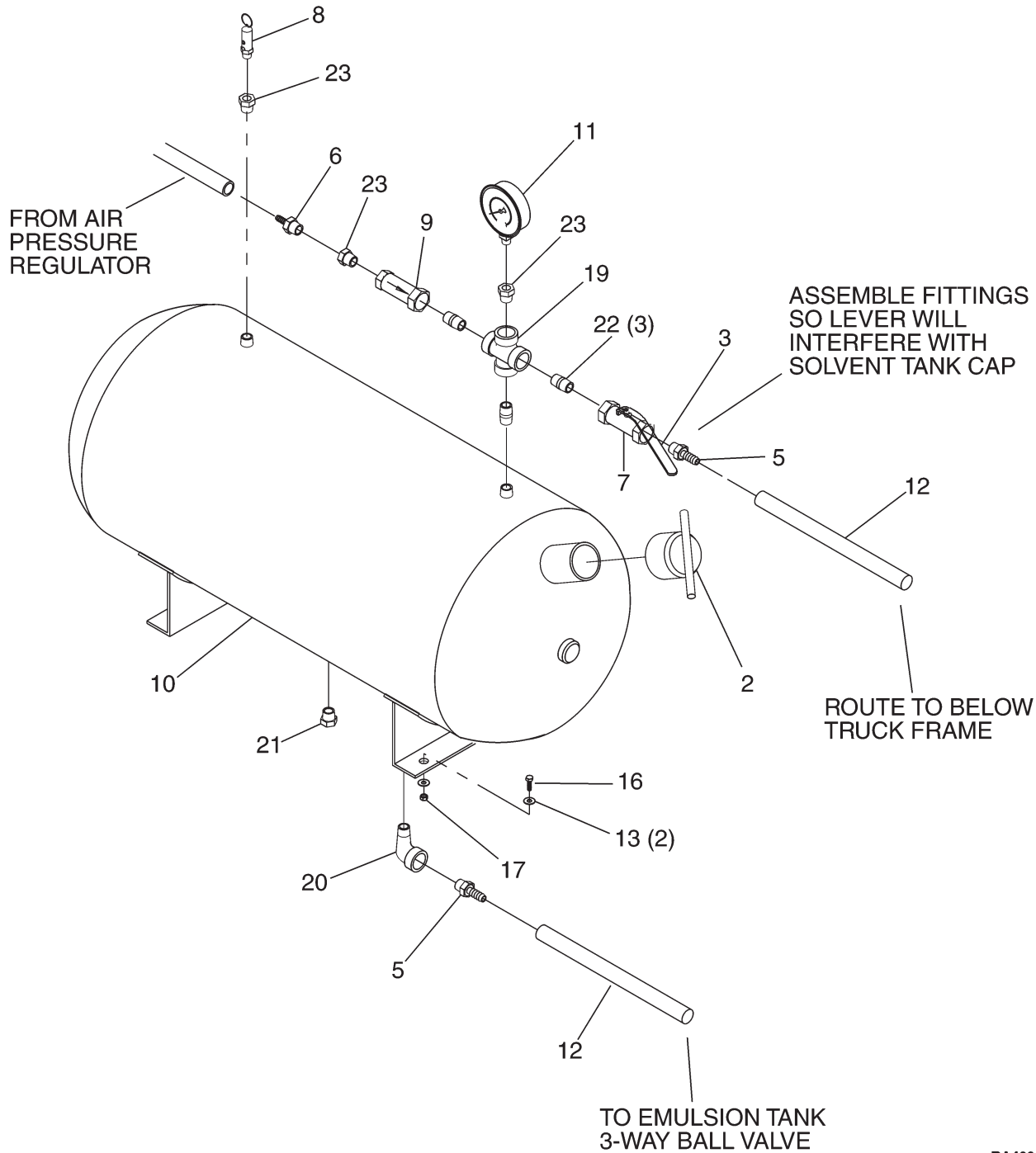
Figure 10-16

Figure 10-16. PRESSURIZED AIR GROUP

Figure/ Item	Part Number	Nomenclature	Units Per Assembly
Ref	24326	PRESSURIZED AIR GROUP	
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	2
5	36871	VALVE, CHECK, .500 FPT, 5 PSI	1
6	35435	AIR PRESS REGULATOR 5-125 PSIG	1
6A	35435-01	GAUGE, PRESS, 160 PSI	1
6B	35435-03	KIT, REPAIR, REGULATOR	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, .250 X CLOSE	1
12	99638	PIPE, NIPPLE, .375 X CLOSE	3
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

Illustrated Parts List (IPL)

SOLVENT TANK GROUP



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Figure 10-17, Sheet 1 of 2

Figure 10-17. SOLVENT TANK GROUP

Figure/ Item	Part Number	Nomenclature	Units Per Assembly
Ref	24327	SOLVENT TANK GROUP	
2	20954SRV	CAP W/M, 2.00 NPT	1
3	28895	HANDLE, AIR VALVE	1
5	31046	FITT, STR 08 MP-08 HB, PUSH-ON	2
6	31167	FITT, STR 04 MP-04 HB, PUSH-ON	1
7	32874	VALVE, BALL,.500 (BRASS)	1
8	33750	VALVE, AIR SAFETY, 125 PSI, 04 NPT	1
9	36871	VALVE, CHECK,.500 FPT, 5 PSI	1
10	36537	TANK, SOLVENT, 30GAL,100 PSI	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, .375-16 X 1.75, GR5	4
17	80352	NUT, FLEXLOC, .375-16, FULL, LT	4
19	99498	PIPE, CROSS, .500, MI 1	1
20	99526	ELBOW, PIPE, 90, .500 STREET, MI	1
21	99537	PIPE, PLUG,08 MP, SQ HD, MI	1
22	99596	PIPE, NIPPLE, .500 X CLOSE	3
23	99980	PIPE, BUSH, 08 MP-04 FP, STL	3

Illustrated Parts List (IPL)

SOLVENT TANK GROUP

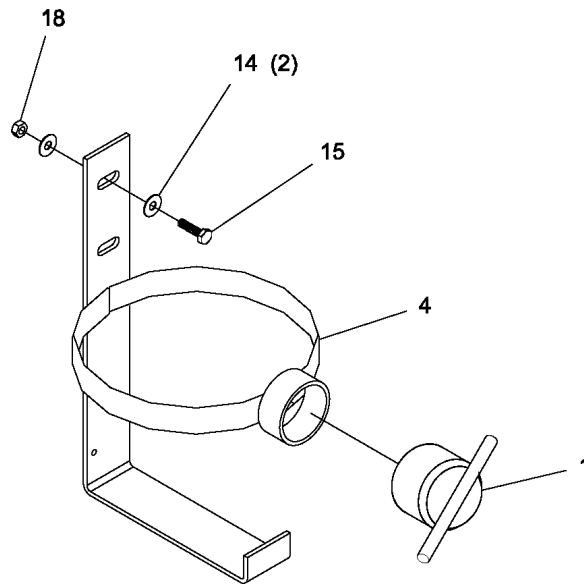
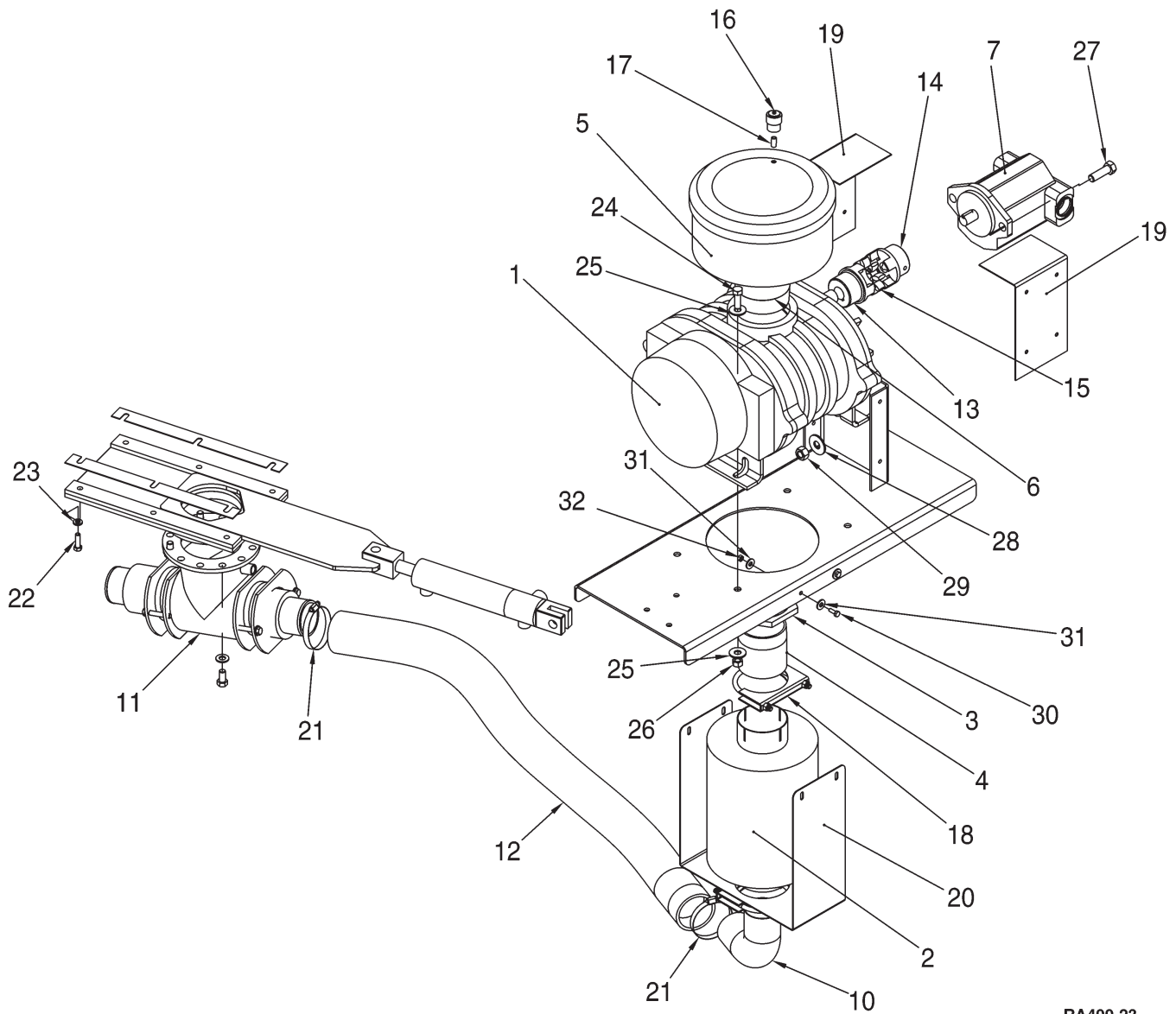


Figure 10-17, Sheet 2 of 2

Figure 10-17. SOLVENT TANK GROUP

Figure/ Item	Part Number	Nomenclature	Units Per Assembly
Ref	24327	SOLVENT TANK GROUP	
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, .500-13 X 1.75, GR5	1
18	80354	NUT, FLEXLOC, .500-13, FULL, LT	1

BLOWER



RA400-23

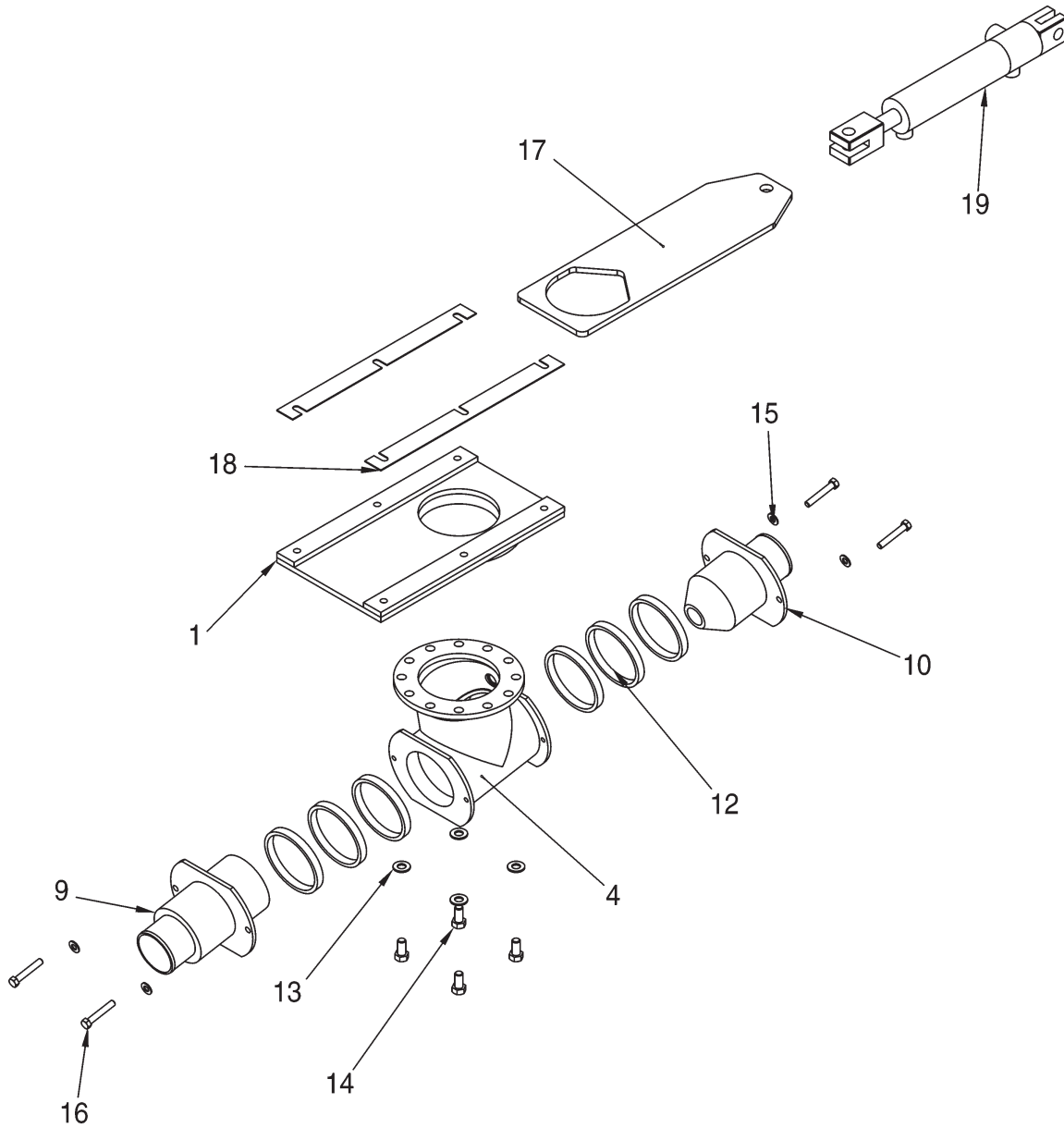
Figure 10-18

Figure 10-18. BLOWER

Figure/ Item	Part Number	Nomenclature	Units Per Assembly
Ref	1002473	BLOWER, RA400, GRP	
1	1002118	BLOWER, POS DISPLAY, 323C, VERT	1
2	36534	MUFFLER, 4 IN. ID INLET/OUTLET	1
3	1001727	PIPE, BUSH 4.00 MP-3.50FP, MI	1
4	90656	PIPE, NIPPLE, TOE, 3.50 X 4.00	1
5	36531	FILTER ELEMENT, SILENCER	1
6	99813	PIPE, NIPPLE, 4.00 X CLOSE	1
7	1002285	MOTOR, HYD, GEAR, 2.0 CIR	1
10	1002588	W/M, ELBOW, BLOWER, RA400	1
11	1002474	SLIDE GATE, RA400, GRP	1
12	36876	HOSE, SUCTION, 3.00, WIRE HELIX	1
13	39199	HUB, ROTEX 38, 1.125B X .25 KEY	1
14	39199-01	HUB, ROTEX 38, .875 X .25 KEY	1
15	39201	CPLG, ROTEX 38, SPIDER, RED	1
16	853521158	INDICATOR, RESTRICTOR	1
17	99610	PIPE, NIPPLE, 02 X CLOSE	1
18	34040	CLAMP, MUFFLER, 4.00 ID	2
19	1002785	GUARD, COUPLING, HYD MOTOR	2
20	1003050	SH, SUPPORT, SILENCER, RA400	1
21	700620	CLAMP, HOSE, #52 (3.50 IN.)	2
22	80224	CSHH, .375-15 X 1.25 LG, GR5	1
23	80162	WASHER, LOCK, .375	1
24	80250	CSHH, .500-13 X 1.25, GR5	1
25	80695	WASHER, FLAT, SAE, .500	2
26	80354	NUT, FLEXLOC, .500-13, FULL, LT	1
27	80283	CSHH, .625-11 XC 2.00, GR5	2
28	80697	WASHER, FLAT, SAE, .625	2
29	80356	NUT, FLEXLOC, .625-11, FULL, LT	2
30	80192	HBOLT, 0.2500-20 X 0.75 X 0.75-N	4
31	80141	WASHER, FLAT, USS, .313	8
32	80350	NUT, FLEXLOC, .250-20	4

Illustrated Parts List (IPL)

SLIDE GATE



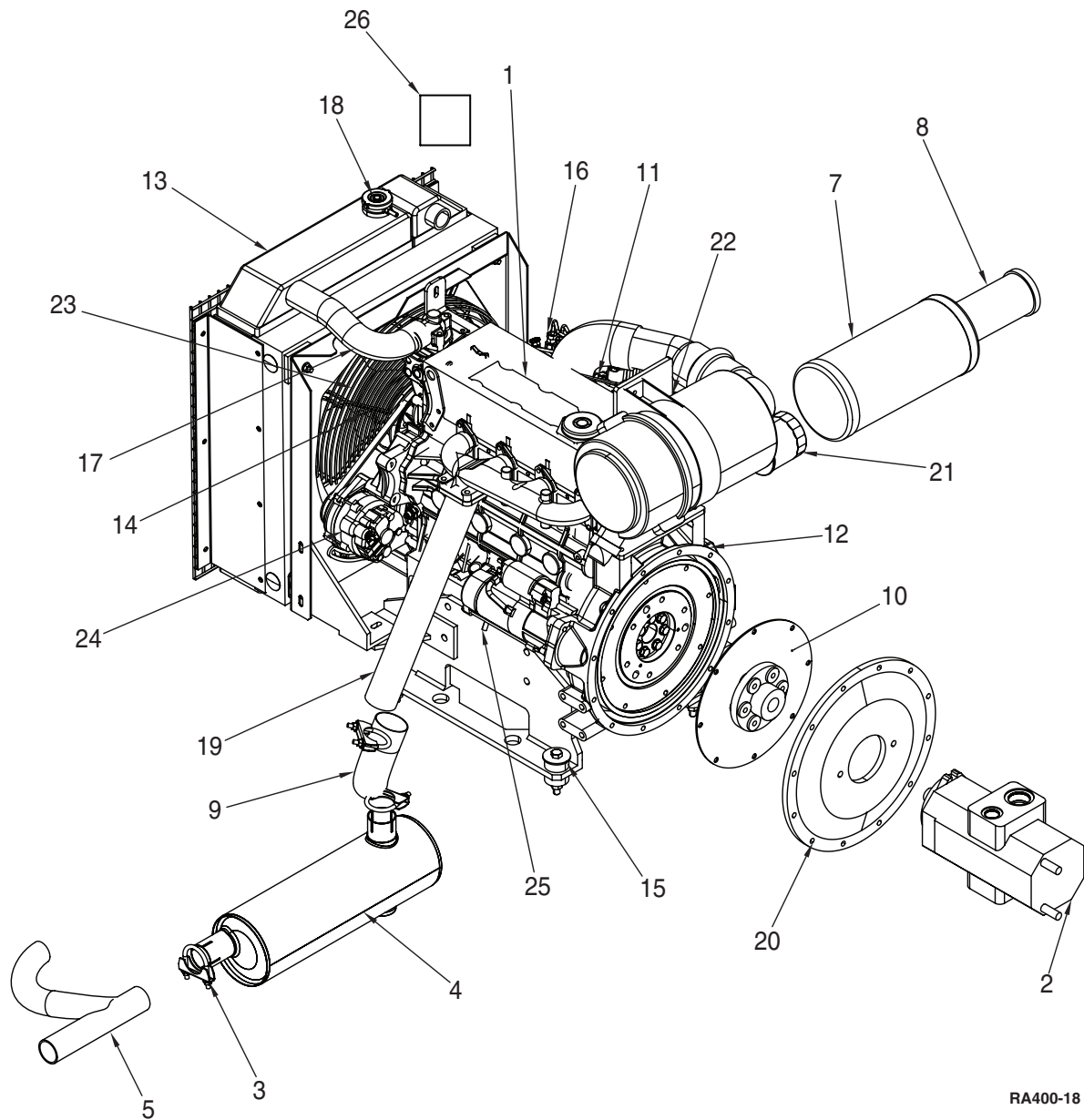
RA400-24

Figure 10-19

Figure 10-19. SLIDE GATE

Figure/ Item	Part Number	Nomenclature	Units Per Assembly
Ref	1002474	SLIDE GATE, RA400, GRP	
1	1002263	W/M, BASE SLIDE GATE, VENTURI	1
4	1002264	W/M, PIPE TEE, SLIDE GATE	1
7	1002268	C PLG, BASE, HOLD, SLIDE GATE	1
9	1002265	W/M, EDUCTOR, SLIDE GATE	1
10	1002266	W/M, NOZZLE, SLIDE GATE	2
12	1002274	SPACER, SLIDE GATE, VENTURI	6
13	80144	WASHER, FLAT, SAE, .500	4
14	80248	CSHH, .500-13 X 1.00, GR5	4
15	80996	WASHER, FLAT, SAE, .375	4
16	80406	CSHH, .375-16 X 2.25, GR5	4
17	1001998	SLIDE GATE, EDUCTOR, RA400	1
18	25825	SHIM, SLIDE GATE, 16 GAUGE	2
19	1001184	CYL, HYD, 2.0B X 6.0 S, W/SENSOR	1
19.A	1001184-01	KIT, SEAL, HYD CYLINDER	1

AUXILIARY ENGINE



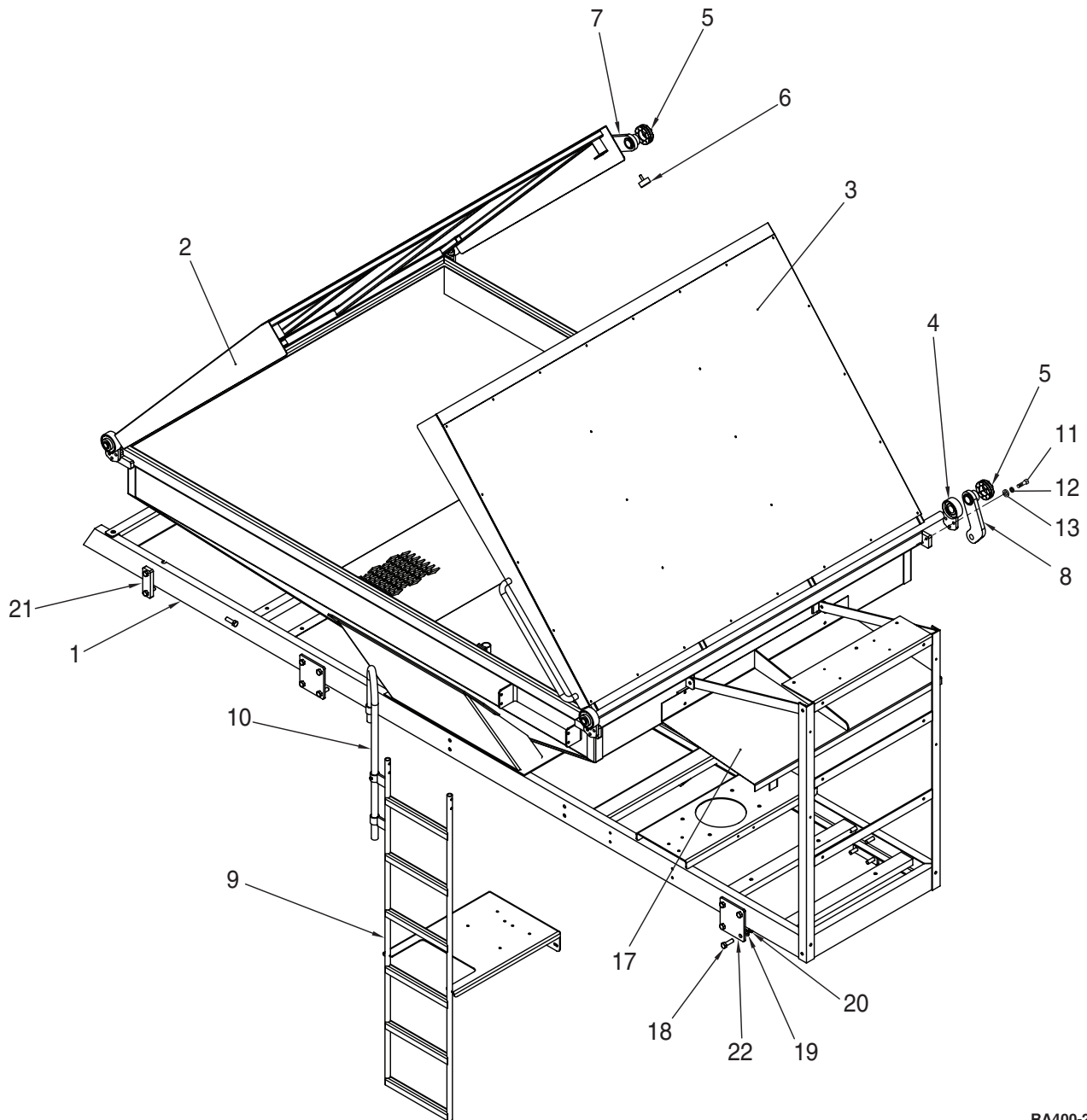
RA400-18

Figure 10-20

Figure 10-20. AUXILIARY ENGINE, RA400

Figure/ Item	Part Number	Nomenclature	Units Per Assembly
Ref	1002475	AUX, ENG, RA400, GRP	
1	1002676	ENGINE, KUBOTA, 68 HP, RA400	1
2	1002284	PUMP, HYD, DUAL, 3.86/1.28	1
3	71172	CLAMP, MUFFLER, 2.00 ID	3
4	986537-35	MUFFLER, 2" OUTLET, 2' SIDE INLET, 6' OD BODY	1
5	1001826	W/M, EXHAUST, VALVE, 3-WAY	1
7	38385-01	AIR FILTER, PRIMARY, CAT C3.4T	1
8	38385-02	AIR FILTER, SECONDARY, CAT 3.4	1
9	1003273	TUBE, FLEX EXH, 1.50 ID X 30 LG	1
10	1002676-03	DRIVE, PUMP, COUPLING	1
11	1002676-04	SOLENOID, THROTTLE	1
12	1002676-05	PUMP, FUEL, ELECT, 12VDC	1
13	1002676-06	RADIATOR/OIL COOLER, RA400	1
14	1002676-07	FAN, ENGINE, SUCTION	1
15	1002676-08	ISOLATOR, ENG MOUNT	4
16	1002676-09	HOSE, RADIATOR, LOWER	1
17	1002676-10	HOSE, RADIATOR, UPPER	1
18	1002676-11	CAP, RADIATOR	1
19	1002676-12	EXHAUST, EXTENSION, RA400	1
20	1002676-02	PLATE, DRIVE, SAE 4, B-MNT	1
21	986537-03	ELEMENT, OIL FILTER, ENG	1
22	982080-02	ELEMENT, FUEL FILTER	1
23	1002676-15	BELT, ENGINE, KUBOTA	1
24	1002676-16	ALTERNATOR, 12V	1
25	1002676-17	STARTER, 12V	1
26	1002676-18	TANK, COOLANT RECOVERY, KUBOTA	1

AGGREGATE TANK



RA400-21

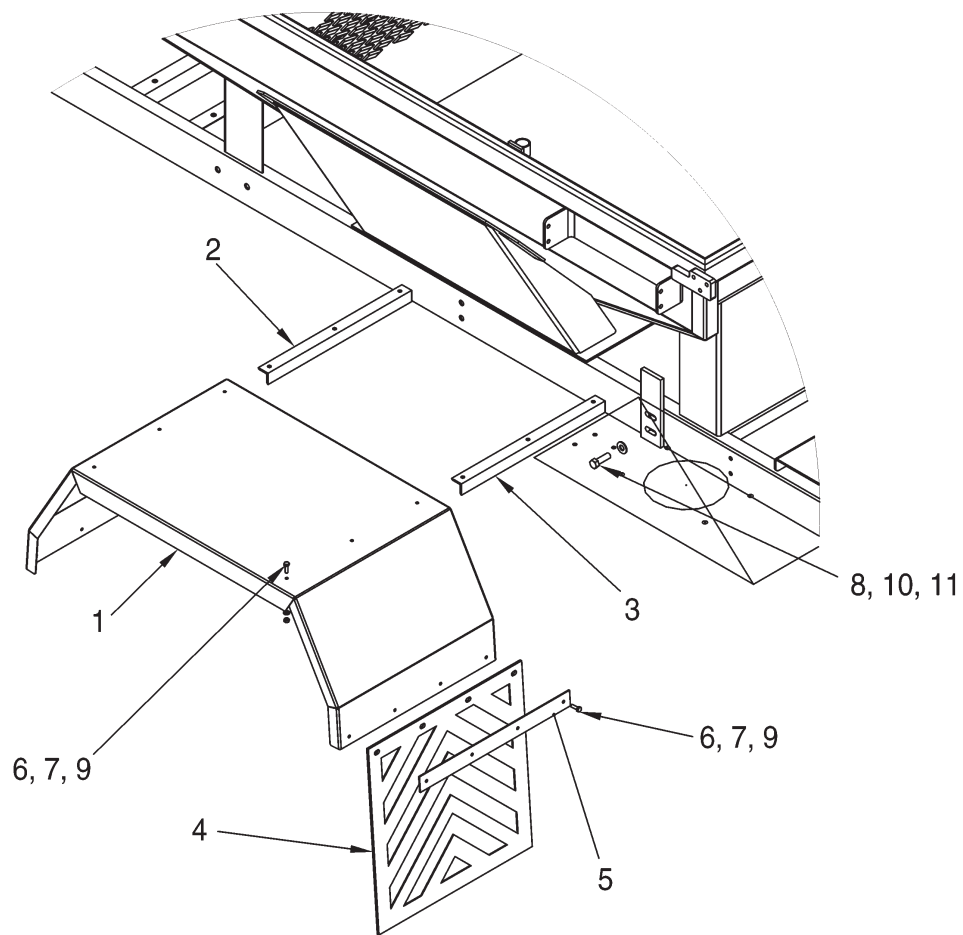
Figure 10-21

Figure 10-21. AGGREGATE TANK

Figure/ Item	Part Number	Nomenclature	Units Per Assembly
Ref	1002665	FRAME/HOPPER/COVER RA400, GRP	
1	1001949	W/M, FRAME, RA400 (INCLUDES ITEMS 1-4)	1
2	1002573	COVER, HOPPER, FRONT, RA400, GRP	1
3	1002574	COVER, HOPPER, REAR, RA400, GRP	1
4	1002151	BEARING, MOUNTED, 1.438 ID	4
5	1002558	BEARING, DISC LOCK, 1.9 BORE	2
6	410070	BUMPER, 2" OD 3/8"-16 STUD	4
7	1002150	W/M, ARM, FRONT COVER, RA400	1
8	1002145	W/M, ARM, REAR COVER,,	1
9	1002479	W/M, LADDER, REAR RA400	1
10	1002891	W/M, GRAB HANDLE, RA400	1
11	80250	CSHH, .500-13 X 1.25, GR5	12
12	80164	WASHER, LOCK, .500	12
13	80695	WASHER, FLAT SAE, .500	12
14	80228	CSHH, .375-16 X 1.75, GR5	4
15	80996	WASHER, FLAT, SAE, .375	8
16	80352	NUT, FLEXLOC, .375-16	4
17	1003047	W/M, ENG COVER, RA400	1
18	80983	CSHH, .625-11 X 2.00, GR8	20
19	80697	WASHER, FLAT, SAE, .625	1
20	80356	NUT, FLEXLOC, .625-11, FULL, LT	1
21	985781	BAR, TIE DOWN SPACER	2
22	29266	TIE DOWN, MACK	4

Illustrated Parts List (IPL)

FENDER



RA400-19

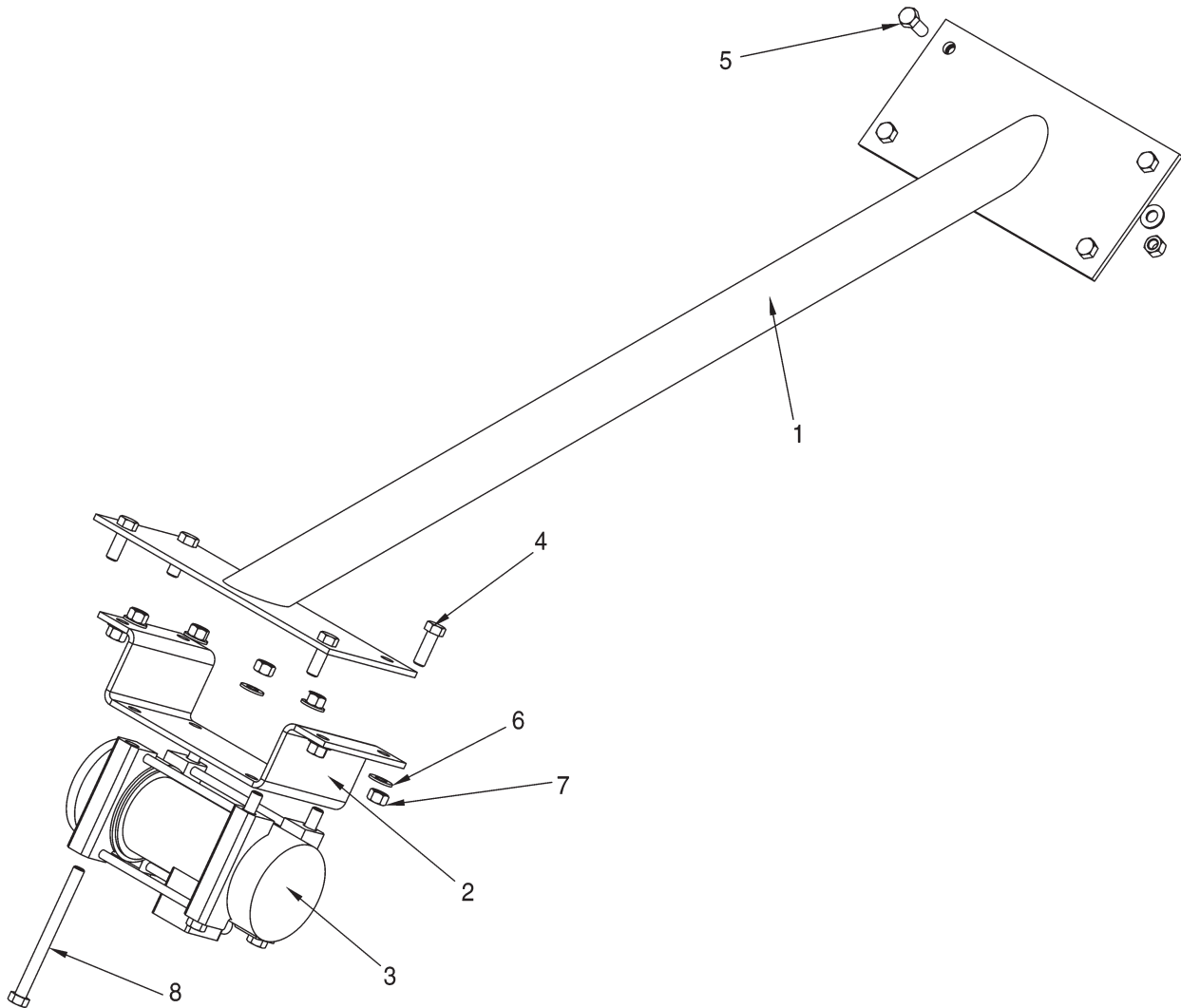
Figure 10-22

Figure 10-22. FENDER GROUP

Figure/ Item	Part Number	Nomenclature	Units Per Assembly
Ref	1002665E	FENDER GRP	
1	22181	FENDER, SINGLE AXLE, STL	2
2	1002567	W/M, SUPP, FR REAR FENDER, RA400	2
3	29489	W/M, FENDER SUPPORT	2
4	27737	MUD FLAP, 24 X 24	2
5	13960	MOUNT BAR, MUD FLAP	2
6	80351	NUT, FLEXLOC .312-18	20
7	80141	WASHER, FLAT, USS, .313	20
8	80146	WASHER, FLAT, USS, .625	16
9	80208	CSHH, .312-19 X 1.00, GR5	20
10	80983	CSHH, .625-12 X 2.00, GR8	8
11	80356	NUT, FLEXLOC, .625-11, FULL LT	8

Illustrated Parts List (IPL)

VIBRATOR



RA400-22

Figure 10-23

Figure 10-23. VIBRATOR GROUP

Figure/ Item	Part Number	Nomenclature	Units Per Assembly
Ref	1003276	VIBRATOR, RA400, GRP	
1	1003091	W/M, CROSSOVER, VIBRATOR, RA400	1
2	1002041	MNT, VIBRATOR BRKT, RA400	1
3	37985	VIBRATOR, DC 1600 W/SWITCH KIT	1
4	860045	CSHH, .500-13 X 1.50, GR5	4
5	80250	CSHH, .500-13 X 1.25, GR5	4
6	80696	WASHER, FLAT, SAE, .500	12
7	80354	NUT, FLEXLOC, .500-13, FULL, LT	12
8	80467	CSHH, .500-13 X 6.00, GR5	4
8A	118-5	WASHER, LOCK, 1/2"	12

Illustrated Parts List (IPL)

REAR BUMPER ASSEMBLY

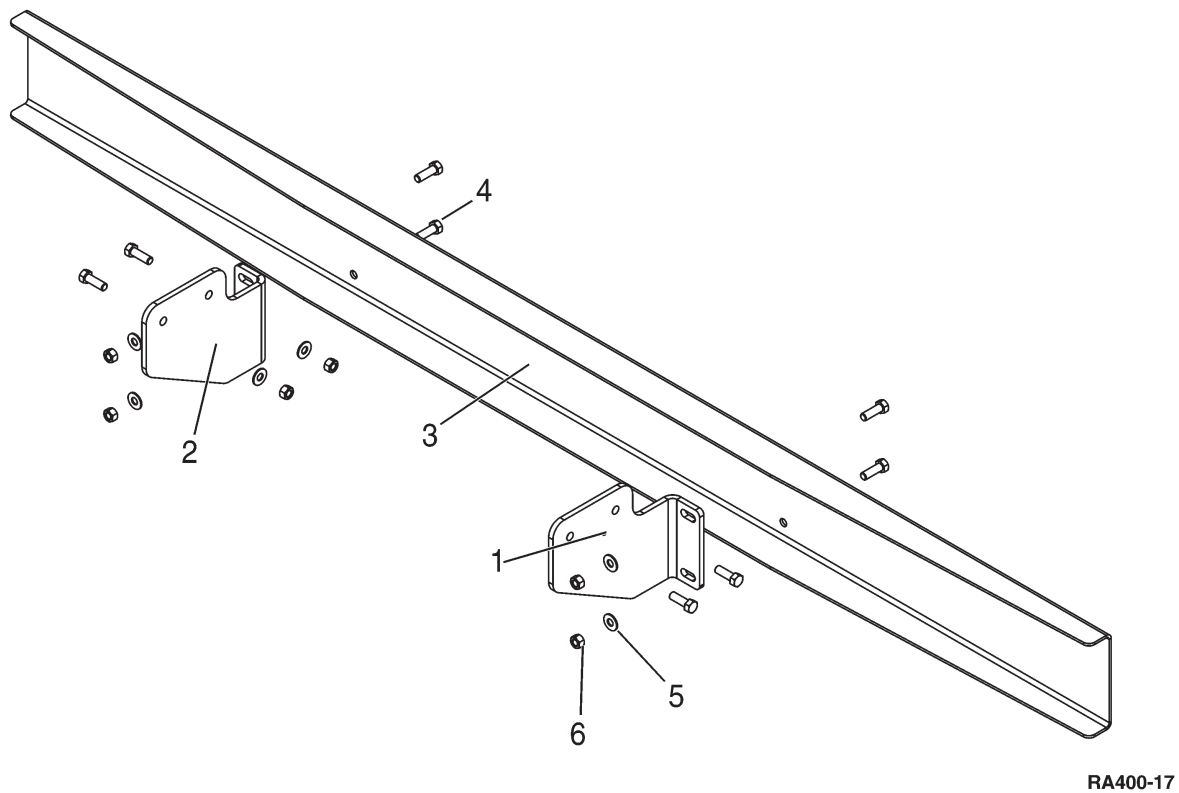
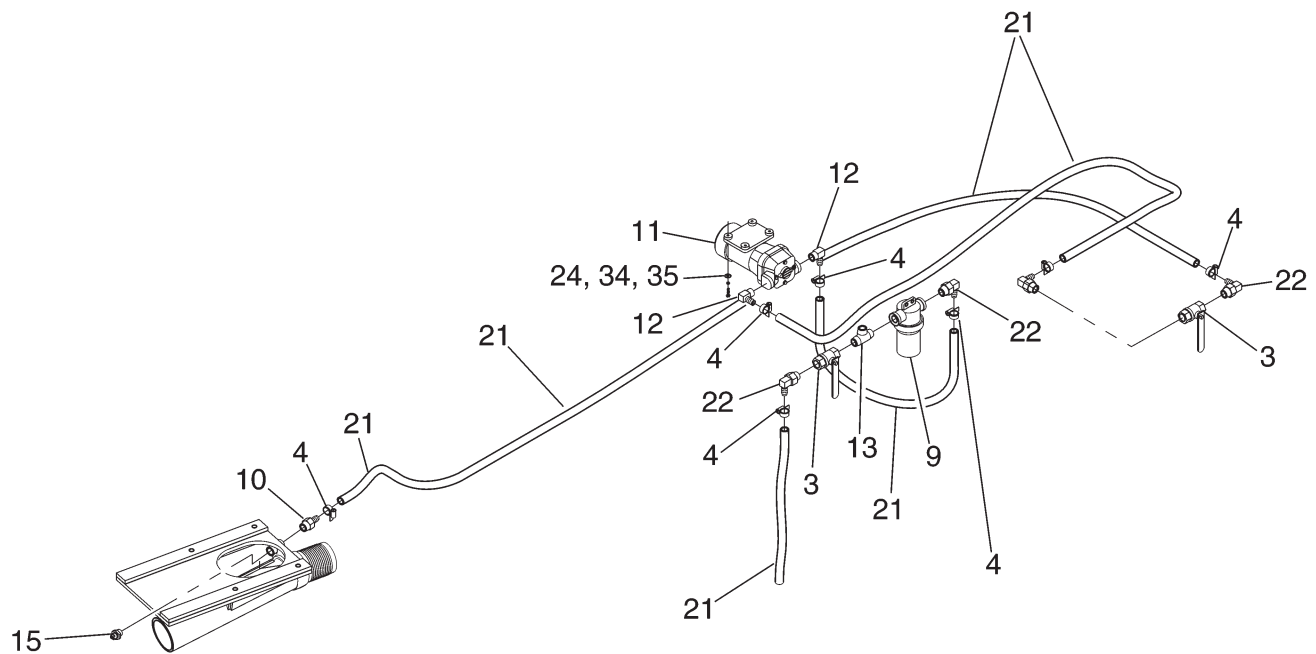


Figure 10-24

Figure 10-24. REAR BUMPER ASSEMBLY, RA300. NISSAN

Figure/ Item	Part Number	Nomenclature	Units Per Assembly
Ref	1001407	REAR BUMPER ASSY, RA300, NISSAN	1
1	1001405	BUMPER MOUNT, LH, RA300, NISSAN	1
2	1001406	BUMPER MOUNT, RH, RA300, NISSAN	1
3	23555	BUMPER, REAR	1
4	312160	CSHH, .500-13 X 1.50, GRB	1
5	81141	WASHER, FLAT, SAE, .500 HARDENED	8
6	80354	NUT, FLEXLOC, .500-13, FULL, LT	8

OPTIONAL JET FLUSH SYSTEM



RA400-66

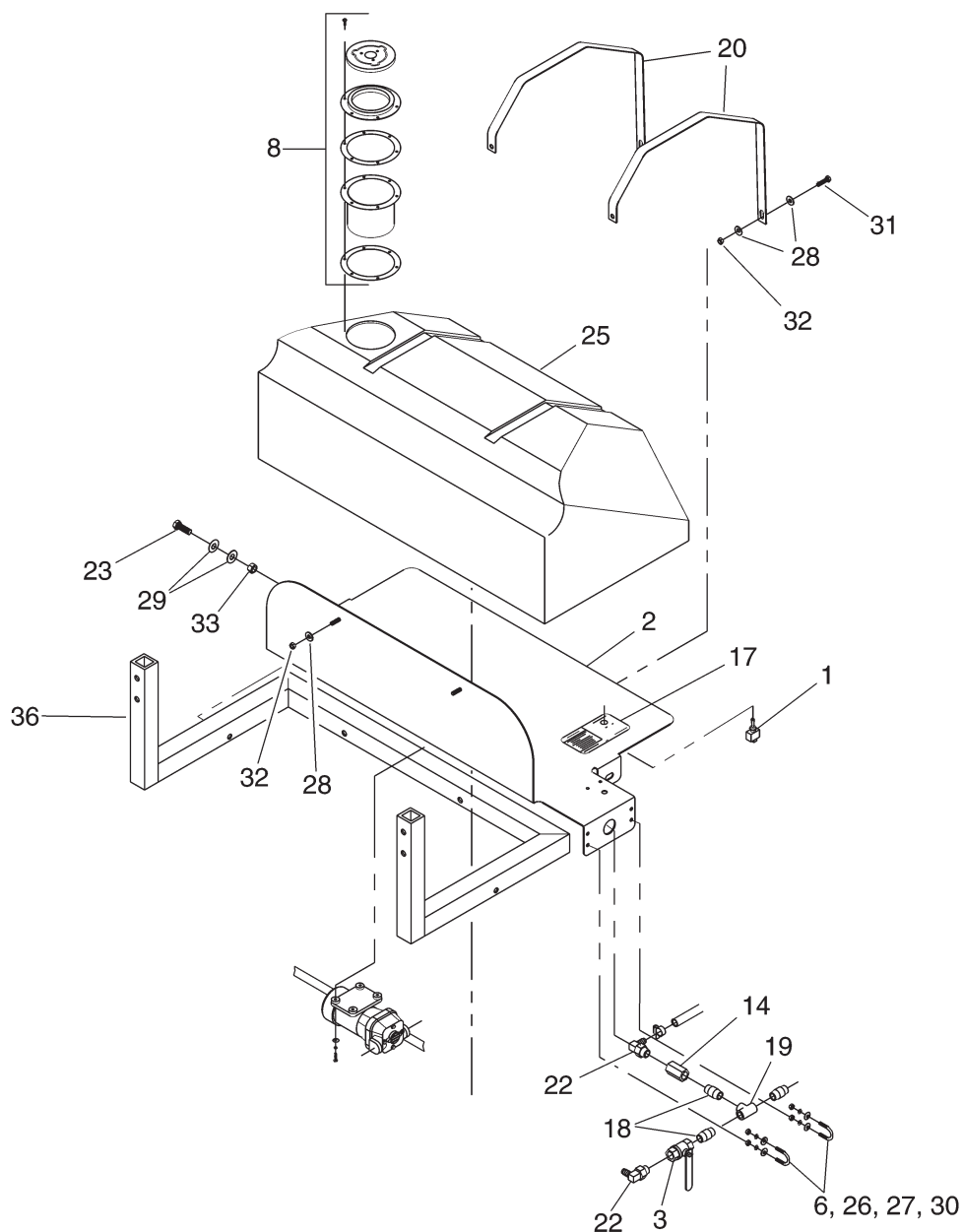
Figure 10-25, Sheet 1 of 2

Figure 10-25. OPTIONAL JET FLUSH SYSTEM

Figure/ Item	Part Number	Nomenclature	Units Per Assembly
Ref	1003459	OPTIONAL JET FLUSH SYSTEM	
3	32874	VALVE, BALL, .500 (BRASS)	2
4	33164	CLAMP, HOSE, #10	8
-5	33598	TIE WRAP, .188 X 15.50	25
9	36926	STRAINER ASSY	1
10	36174	FITT, STR 06MP-08HB, BLK POLY	1
11	36730	PUMP, WATER, DIAPHRAM	1
12	36809	PORT KIT, 08BARB X 90, EPDM	1
13	36846	FITT, TEE 08MP, NYLON	1
15	36849	NOZZLE, FULL JET, 06MP, BRASS	1
21	6352	HOSE, 08, PUSH-ON, 250	35
22	70319	FITT, 90 08MP-08HB, POLY	4
24	80891	MACH SCR, PH, #10-32 X 1.00	4
34	80995	WASHER, FLAT, USS, #10	4
35	871071601	WASHER, LOCK, #10	4

- ITEM NOT ILLUSTRATED

OPTIONAL JET FLUSH SYSTEM



RA400-67

Figure 10-25, Sheet 2 of 2

Figure 10-25. OPTIONAL JET FLUSH SYSTEM

Figure/ Item	Part Number	Nomenclature	Units Per Assembly
Ref	24188	OPTIONAL JET FLUSH SYSTEM	
1	851391	SWITCH, TOGGLE, SPST, 2-POS	1
2	24189SRV	MOUNT, WATER TANK, W/M	1
3	32874	VALVE, BALL, .500 (BRASS)	3
-5	33598	TIE WRAP, .188 X 15.50	25
6	35077	U-BOLT, .250-20, 1.00/W, 1.75 IL	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-08FT-08FP, BRASS	2
20	54960	STRAP, DELUXE WATER TANK	2
22	70319	FITT, 90 08MP-08HB, POLY	6
23	71621	CSHH, .375-16 X 2.75, GR5	2
25	72670SRV	TANK ASSY, WATER, 35 GAL, 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, .312-18 X 1.25, 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

Illustrated Parts List (IPL)

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Figure 10-26. LIGHTING PACKAGES

Figure/ Item	Part Number	Nomenclature	Units Per Assembly
Ref	24358	LIGHTS AND REFLECTORS	
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, #10-24 X 1.00	4
7	80995	WASHER, FLAT, USS, #10	4
8	81005	NUT, FLEXLOC, #10-24, FULL, LT	4
9	81160	SCR, SLFDRL, HH, #10 X 1.00, #3 PT	8
-100	37596	BEACON, AMBER, DUAL MIRROR, ROTATING	2
200	38238	ARROW BOARD, 30 X 60, W/40 FT CABLE	1
-300	37686	OPTIONAL ARROW BOARD, LED, 30 X 60, W/40 FT CABLE	1
-400	985623	OPTIONAL ARROW BOARD, 48 X 96	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, 48 X 96, 40 FT HARNESS	1
-404	985427	MOUNT, STORBE LIGHT, BASE	1
-405	985428	MOUNT, STROBE, LIGHT, HOOD	1
-406	80250	CSHH, .500-13 X 1.25, GR5	8
-407	80144	WASHER, FLAT, USS, .500	8
-408	80354	NUT, FLEXLOC, .500-13, FULL, LT	8
-409	110-205	CSHH, .375-16 X 1.00, GR5	9
-410	80142	WASHER, FLAT, 7SS, .375	9
-411	80352	NUT, FLEXLOC, .375-16, FULL, LT	9
-412	988969	WASHER, SPECIAL-ARROW BOARD	9

- ITEM NOT ILLUSTRATED

Illustrated Parts List (IPL)

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Figure 10-27. MISCELLANEOUS GROUPS

Figure/ Item	Part Number	Nomenclature	Units Per Assembly
Ref	1002477	DECAL/FINAL RA400, GRP	
-1	1002592	DECAL,VACUUM OPER, RA400	2
-2	1002593	DECAL,HOPPER SIDE, RA400	2
-3	31893	BRACKET, LICENSE PLATE	1
-4	35355	PLATE, SERIAL NUMBER, ROSCO	1
-5	35375	LIGHT, LICENSE PLATE	1
-6	36542	TIE DOWN, RUBBER,15,W/HOOKS	1
-7	8711116	CLAMP, INSULATED BAND,1/2"	1
-8	984960	KIT, DECAL, RA300, PRIME	1
-9	986665	BAR, SPACER, LEAF SPRING	4
-10	986791	W/M, CLAMP W/CHAIN LINK	1
-11	988389	DECAL, IDENTIFICATION, GVWR, MAX	1
-3	988342	MANUAL-PAK GROUP	1
-301	985234-01	•MANUAL-PAK CASE,10.5 X 13.5 X 2.5	1
-302	80192	•CSHH, .250-20 X .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 (IPL)

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