OPERATING AND MAINTENANCE MANUAL

MODEL: DSD
SERIAL NO._____

⚠ WARNING

Failure to follow the operating, lubrication, and maintenance requirements set forth in the operating and instruction manual may result in serious personal injury and/or damage to equipment.

A Hale pump is a quality product; ruggedly designed, accurately machined, carefully assembled and thoroughly tested. In order to maintain the high quality of your pump and to keep it in a ready condition, it is important to follow the instructions on care and operation. Proper use and good preventive maintenance will lengthen the life of your pump.

ALWAYS INCLUDE THE PUMP SERIAL NUMBER IN CORRESPONDENCE

HALE PRODUCTS INC. • Fire Suppression Division
A Unit of IDEX Corporation
700 Spring Mill Avenue • Conshohocken, PA 19428
610/825-6300 • Fax: 610/825-6440
www.haleproducts.com

Limited Warranty

EXPRESS WARRANTY: Hale Products Inc. ("Hale") hereby warrants to the original buyer that products manufactured by it are free of defects in material and workmanship for two (2) years or 2000 hours usage whichever shall first occur. The "Warranty Period" commences on the date the original buyer takes delivery, of the product from the manufacturer.

LIMITATIONS: HALE'S obligation is expressly conditioned on the Product being:

- Subjected to nominal use and service.
- Properly maintained in accordance with HALE'S Instruction Manual as to recommended services and procedures.
- Not damaged due to abuse, misuse, negligence or accidental causes.
- Not altered, modified, serviced (non-routine) or repaired other than by an Authorized Service Facility.
- Manufactured per design and specifications submitted by the original Buyer.

THE ABOVE EXPRESS LIMITED WARRANTY IS EXCLUSIVE. NO OTHER EXPRESS WARRANTIES ARE MADE. SPECIFICALLY EXCLUDED ARE ANY IMPLIED WARRANTIES INCLUDING WITHOUT LIMITATIONS, THE IMPLIED WARRANTIES OF MERCHANTABILITY OF FITNESS FOR A PARTICULAR PURPOSE OR USE; QUALITY; COURSE OF DEALING; USAGE Of TRADE; OR PATENT INFRINGEMENT FOR A PRODUCT MANUFACTURED TO ORIGINAL BUYER'S DESIGN AND SPECIFICATIONS.

EXCLUSIVE REMEDIES: If Buyer promptly notifies HALE upon discovery of any such defect (within the Warranty Period), the following terms shall apply:

- Any notice to HALE must be in writing, identifying the Product (or component) claimed defective and circumstances surrounding its failure.
- HALE reserves the right to physically inspect the Product and require Buyer to return same to HALE'S plant or other Authorized Service Facility.
- In such event, Buyer must notify HALE for a Returned Goods Authorization number and Buyer must return the Product F.O.B. within (30) days thereof.
- If determined defective, HALE shall, at its option, repair or replace the Product, or refund the purchase price (less allowance for depreciation).
- Absent proper notice *within* the Warranty Period, HALE shall have no further liability or obligation to Buyer therefore.

THE REMEDIES PROVIDED ARE THE SOLE AND EXCLUSIVE REMEDIES AVAILABLE. IN No EVENT SHALL HALE BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGE' INCLUDING, WITHOUT LIMITATION, LOSS OF LIFE; PERSONAL INJURY; DAMAGE TO REAL OR PERSONAL PROPERTY DUE TO WATER OR FIRE; TRADE OR OTHER COMMERCIAL LOSSES ARISING, DIRECTLY OR INDIRECTLY, OUT OF PRODUCT FAILURE.

IDEX CORPORATION

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700 Spring Mill Avenue • Conshohocken, PA. 19428
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Material Return Procedure

- A Material Return Authorization (RGA) number must be requested from Hale Products Inc., *prior* to returning any merchandise.
- Replacement parts, complete items or accessories must be in new condition or are able to be resold, properly identified with Hale part numbers.
- Any material that is returned that does not reflect the original purchase will be accepted upon Hale's discretion and evaluation fee.
- Special order items are not returnable for credit.
- Hale will accept no product without a valid RGA number.
- Complete items or accessories that are beyond Hale's warranty period will receive an inspection fee of $100.00.
- Material that is acceptable for re-stocking will receive a minimum evaluation fee of $25.00 or 20% of material valued over $125.00.
- ***Merchandise received at Hale that does not meet the above criteria will be returned at senders cost***

Hale Products, 700 Spring Mill Avenue Conshohocken, Pa. 19428

Revised March 1, 2000

1. INTRODUCTION

OVERVIEW

Hale single-stage and two-stage midship pumps are favorites of firefighters throughout the world. Covering a range of capacities from 750 Gallons Per Minute (GPM) to 2000 GPM, Hale pumps offer the versatility, dependability, reliability, and ease of operation so necessary to effective fire fighting. This section reviews the principles of operation of Hale's single-stage and two-stage midship pumps.

CENTRIFUGAL FORCE

A centrifugal pump operates on the principle that centrifugal force is heated by a rapidly spinning disk. Figure 1-1 shows that an amount of water has been placed at the center of a disk. The disk is rotated at some speed, and the water is thrown outward from the center toward the outer circumference of the disk. The distance that the water travels from the center directly relates to the diameter of the disk and the speed of rotation.

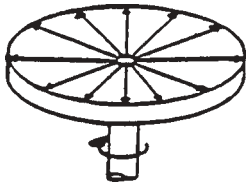


Figure 1.1 Centrifugal Force From a Rotating Disc

When water is confined in a closed container (such as the pump body), its pressure rises to a level that depends on the speed of rotation. There are three interrelated factors that regulate the performance of a centrifugal pump:

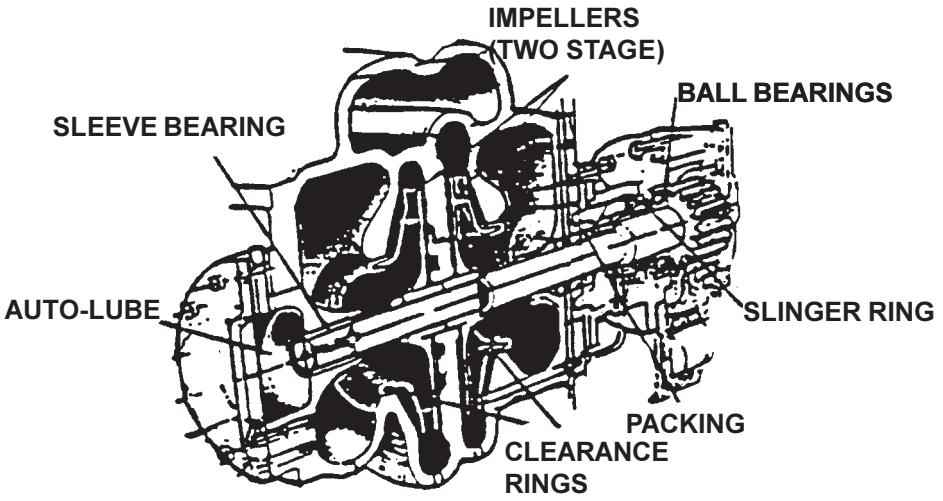
- Speed (RPM) If the speed of rotation increases with flow held constant, the water pressure increases.

- Pressure. If pressure changes with speed held constant. The flow (measured in GPM) will change inversely. That is, if pressure increases, flow decreases.

- Flow. Flow is usually measured in the number of gallons of water per minute (GPM) that a pump can deliver when supplied from draft If the pressure is held constant, the flow will increase with an increase in the speed of rotation.

The centrifugal pump is preferred by the fire protection service due to its ability to fully utilize any positive suction inlet pressure, reducing the amount of work done by the pump. For example, if the required discharge pressure is 120 PSIG, and the inlet pressure is 45 PSIG, the pump must only produce the difference in pressures of 75 PSIG. This contributes to low engine and pump speeds with reduced maintenance. Decreased maintenance is aided by the fact a centrifugal pump has basically only two moving parts: the impeller and the shaft

BASIC PARTS OF A HALE Midship CENTRIFUGAL PUMP
Figure. 1-2 shows the basic parts of a Hale midship centrifugal pump. These parts are briefly described in the following text



Impeller
The impeller provides velocity to the water. This part is mounted on a shaft that is rotated by the drive. Water enters the rotating impeller at the intake (or eye), and is confined by the shrouds and the vanes mounted in the impeller to build pressure The vanes guide water from the inlet to the discharge and reduce the turbulence of the spinning water. Vanes curve away from the direction of rotation so water moves toward the outer edge. The shrouds form the sides of the impeller and keep the water confined to centrifugal acceleration.

Figure 1-3 traces a drop of water from the intake of the impeller to the discharge outlet The impeller is mounted so that the discharging tribe is widest at the pump outlet. The increasing discharge path, known as the volute, collects the water at a constant velocity. A further increase in pressure and a decrease in velocity takes place in the diffuser.

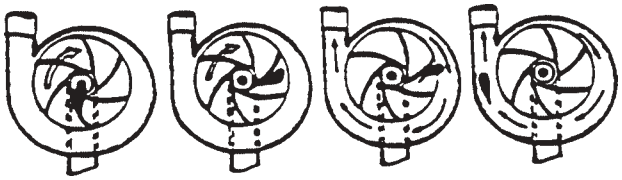


Figure 1-3. Impeller Operation

Clearance Rings
Clearance rings prevent the water that is pressurized and leaving the pump volute from returning to the intake of the impeller. Centrifugal pumps have clearance rings at the impeller intake to prevent leakage. This is accomplished by limiting the radial clearance between the spinning impeller and the stationary clearance ring. Refer to Figure 1-2.

A clearance ring usually has a radial clearance of about 0.0075-inch per side, or a 0.015-inch diameter. However, the clearance will increase over time as the pump is operated. Wear is due to foreign material found in the water. Clearance rings are designed for replacement as the clearance increases from usage and wear.

If a pump is operated without water for extended periods or without discharging water, it may overheat. This may damage the pump and the drive mechanism.

Bearings
Bearings support and align the impeller shaft for smooth operation. See Figure 1-2.

Pump Body
The standard pump body (Figure 1-2) and related parts are constructed from fine grain alloy cast iron, with a minimum tensile strength of 30,000 PSI. All moving parts subject to water contact are of high quality bronze with stainless steel shafts.

The body is split horizontally on a single plane in two sections for easy removal of the entire impeller assembly, including clearance rings and bearings. The impeller assembly is removed from the bottom of the pump to avoid interference with the rounding piping and pump mounting on the apparatus chassis.

The pump has two large suction inlets, on the left and right side. Additional front and rear inlets may be added as requested by the customer. Impeller inlets are on opposite sides of the pump to balance axial forces; discharges are on opposite sides to balance radial forces.

Two tank suction on valve locations are available to allow higher flows from the booster tank Optional built-in check valves we available to prevent tank overpressurizations.

Discharge valves in the basic pump configuration are mounted at either side of the pump body. However, the pump body provides several additional discharge locations (facing front, back, or up) that can accommodate optional discharge valves.

Packing
Packing forms a nearly watertight seal at the point where the shaft passes from the inside to the outside of the pump. See Figure 1-4. Packing material is lubricated with pump water. The packing gland should not be excessively tightened or the material will lose us built-in lubricant and dry out, which may result in damage to the pump.

The single packing gland is located on the low pressure side of the pump. Its split design promotes ease of repacking The packing gland is a full circle thread type to exert uniform pressure on packing and to prevent cocking and uneven packing load. The packing is easily adjusted with a rod or screw driver. The packing rings are made of a combination of unique materials and have sacrificial zinc separators to protect the pump shaft from galvanic corrosion.

Packing material may also deteriorate if the pump is kept dry for long periods of time during winter months (for example, to prevent freezing). In this case, charging the pump with water at least once weekly will lubricate the packing. See the Maintenance Instructions in Section 3 for details.

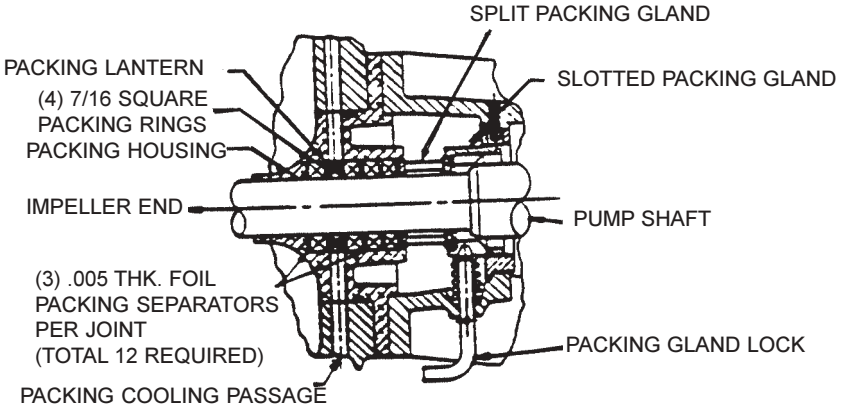
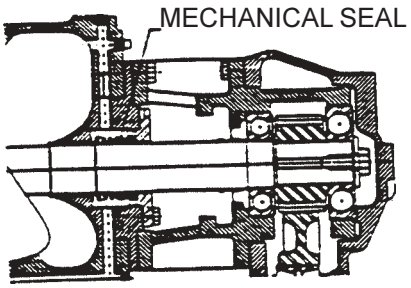


Figure 1-4. Pump Packing

Mechanical Seal

The mechanical seal is an option to pump packing. As shown m Figure 1-5, a stationary seal seat is in constant contact with a rotating carbon face to prevent high pressure leakage. The sealing boot is made of a rubber elastomer that is specifically designed for high temperature operation.



Auto-Lube

A miniature centrifugal pump (A) is built into the shaft of Hale midship pumps (see Figure 1-6). This miniature pump continuously forces oil from the reservoir (B), through the bearing (C), and back again.

A balancing chamber (D) behind the oil reservoir is connected by a passage to the inlet side of the pump. This chamber always keeps the pressure in the oil reservoir equal to water pressure - whether you are pumping at high inlet pressure or pulling vacuum

The miniature pump adds enough extra pressure to constantly keep the flowing oil a few PSI higher than water pressure Thus, oil pressure inside the double lip-type seal (E) is always slightly higher than water pressure outside. Dirt and water are repelled by this higher pressure. Auto-Lube does more than just fight off dirt. It ensures continuous lubrication, even when you are pumping dry. It cools the bearing, because water chambers surround the water reservoir. It permits the use of a compact, double lip-type oil seal, and maintains a constant film of oil under this seal to prevent shaft wear. Because it is built into the main pump body, it completely eliminates the need for high pressure packing.

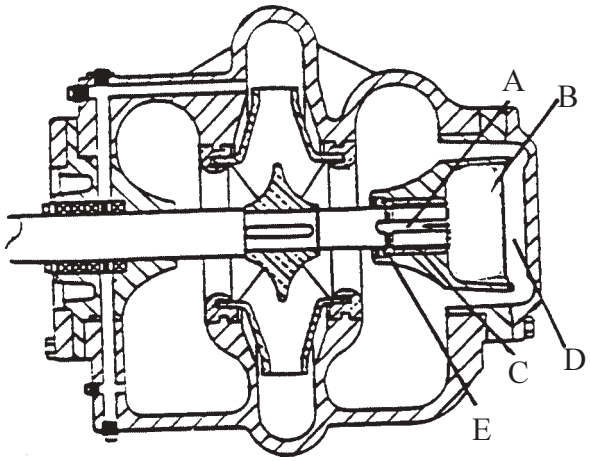


Figure 1.6 - Auto-Lube System

CENTRIFUGAL PUMP DRIVE
There are four common types of centrifugal pump drives used with fire fighting apparatus:

• Operation from the truck chassis drive shaft (split-shaft PTO).

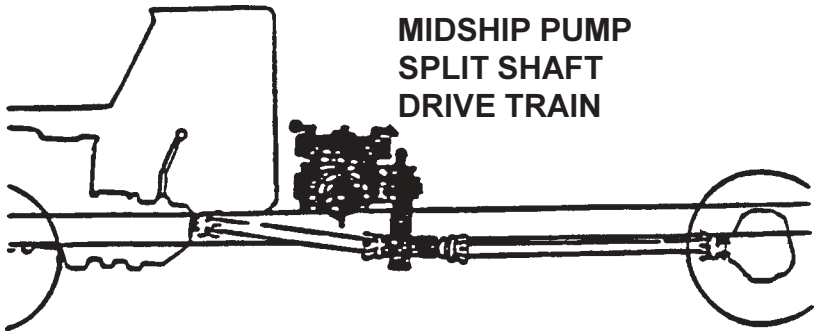
• Operation from a separate engine.

• Operation from the front of the truck chassis engine (front engine PTO) crankshaft

• Operation from a PTO from the truck transmission. A PTO before the engine transmission or a PTO from the (four wheel-drive) transfer case.

Midship pumps are so named because of their mounting location on the fire apparatus. They are normally driven through an integral transmission that has a sliding gear shaft and sliding gear that selectively directs the engine power to the pump or the rear axle. Figure 1-7 shows the midship pump split-shaft arrangements.

The midship transmission is capable of handling full engine horsepower enabling the pump to meet optimum performance levels as well as all torque requirements for over-the-road applications.



GEARBOX
Hale offers a variety of pump gear ratios to accommodate a wide range of apparatus manufacturer requirements.

The gearbox (Figure 1-8) consists of a gearbox, gear set, and input and output drive shafts that are both made of heat treated nickel steel. This unit can withstand the full torque of the engine in road operating conditions up to 16,000 pounds-feet.

If the gearbox is equipped with a power shift system, an in-cab control valve is provided for mode selection. This control locks in place for road or pump operation. Warning lights are provided to alert the operator when the gearbox has fully shifted from road to pump position.

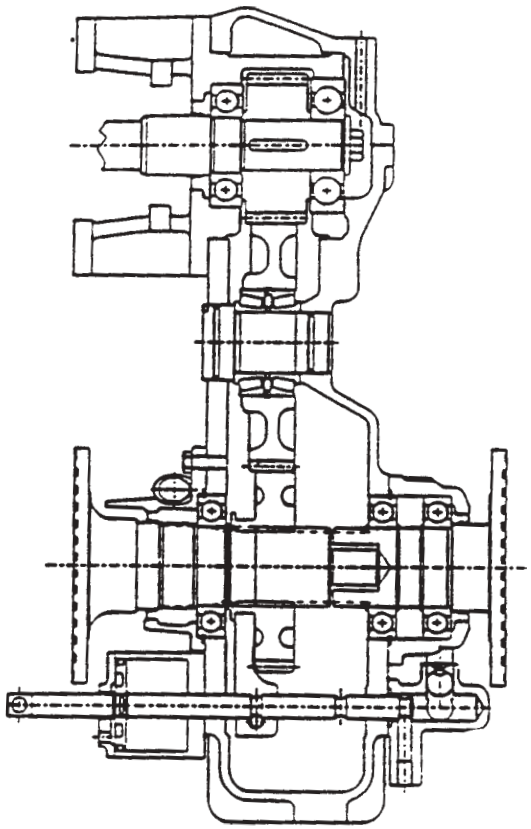


Figure 1-8. Gearbox

DESCRIPTION OF HALE MIDSHIP PUMPS

SINGLE-STAGE

There are two series of single-stage pumps:

- 750 GPM to 1250 GPM
- 1000 GPM to 2000 GPM

Hale single-stage pumps are of a size and design to attach to the chassis rails of commercial and custom chassis. The pump is driven from the truck main drive line. Generally, it consists of the following major components:

- Pump Body
- Impeller and Shaft Components
- Gearbox
- Priming System
- Pressure Control Device
- Valves

The number of impellers on a common shaft determines the number of pump stages. The Hale series of single stage pumps provides the same normal operating and rating test pressures as the Hale series of two-stage pumps. The two-stage pump provides an additional level of operating pressures if required, but adds some operating complexity.

Single-Stage Pump Operation

Hale single-stage pumps use a single impeller with a double suction entry to develop the required volume and pressure. Dual cutwaters strip water from the rotating impeller and direct it to the discharge path. Figure 1-9 shows the flow of water through a Hale single-stage pump. Water enters the two suction channels and both sides of the impeller, thereby maintaining axial balance. The double suction impeller develops discharge pressure and directs the water to the dual cutwaters and then to the discharge valves. The impellers are radially and axially balanced. Radial hydraulic balance is maintained by the opposed discharge volute cutwaters The cutwaters are wedge shaped and divide the water between the volute and the pump discharge.

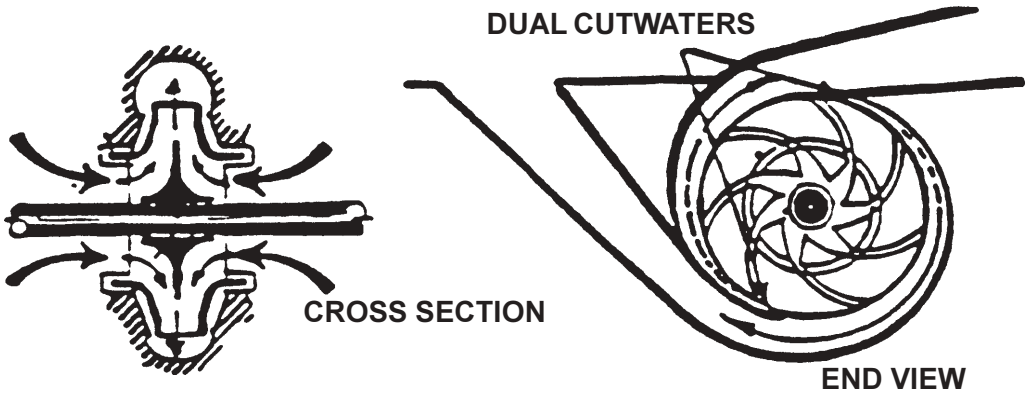


Figure 1.9. Water Flow Through a Hale Single Stage Pump

TWO-STAGE PUMPS
There are two series of two-stage pumps:

- 750 GPM to 1250 GPM
- 1000 to 2000 GPM

Hale two-stage pumps are of a size and design to mount on the chassis rails of commercial and custom trucks The pump is driven from the truck main drive line. Generally, the pump consists of the following major components:

- Pump Body
- Impeller and Shaft Components
- Gearbox
- Priming System
- Pressure control Device
- Valves

Two-Stage Pump Operation
The primary difference between a single-stage and a two-stage pump is that the former has only one impeller and no transfer valve to switch between volume and pressure operation. A transfer valve is a two-position valve that permits the impellers in a two-stage pump to be operated in parallel (volume) or series (pressure). Both types of operation are explained in the following paragraphs.

Volume (Parallel) Operation
Volume operation, Figure 1-10, results in the pressure at the pump intake being added to the pressure developed by both impellers, and the amount of water delivered to the discharge being the sum of the flows of the two impellers. For example, if the inlet pressure is 30 pounds per square inch (PSI), and the flow of each impeller is 500 GPM at 150 PSI, the pressure and volume at the discharge is 1000 GPM at 180 PSI:

500 GPM per Impeller X 2 Impellers = 1000 GPM
30 PSI Inlet Pressure + 150 PSI Pump Pressure =180 PSI

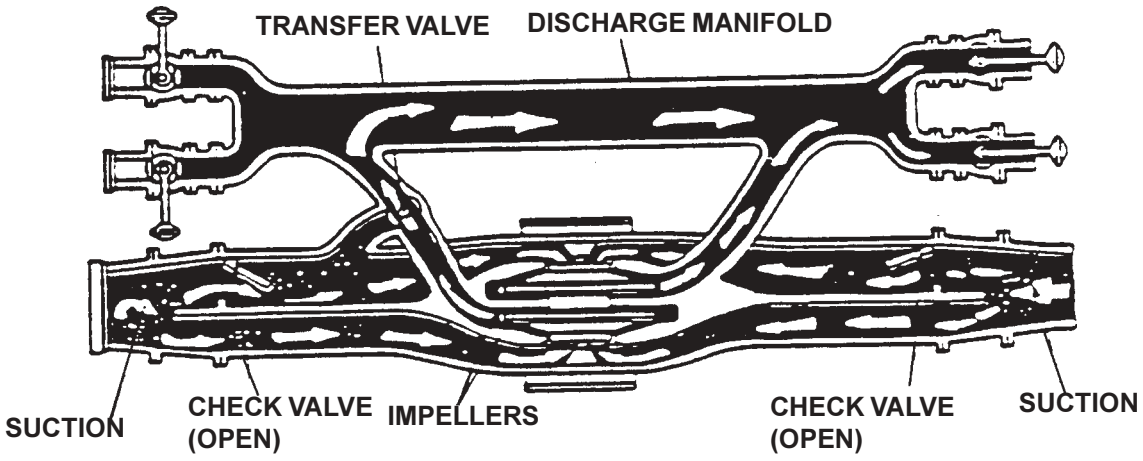


Figure 1-10. Two-Stage Pump Volume Operation

Pressure (Series) Operation
Pressure operation, Figure 1-11, finds the impellers connected in series. That is, the output of the impeller supplied from the pump intake is supplied to the input of the next impeller. The pressure at the pump discharge is the sum of the pressures of the two impellers plus the pressure at the intake. The amount of water delivered to the discharge is the same amount that entered the first impeller. Using the example above when in series operation. The discharge pressure will be 330 PSI and the discharge volume will be 500 GPM.

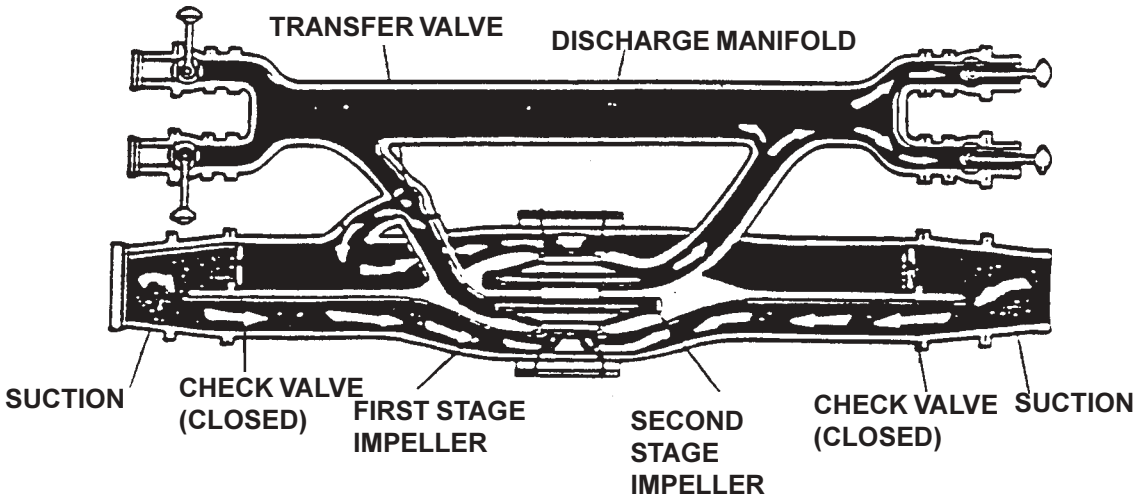


Figure 1-11. Two-Stage Pump Pressure Operations

Volume Versus Pressure Operation
Selection of volume versus pressure operation is determined by three factors:

• Generally, the pump should be operated so that the pump gives the desired result at the lowest engine speed

• Transfer to volume (parallel) operation for higher flows (see below).

• Transfer to pressure (series) operation when higher water pressures are required (see below). .

Transfer Valve
A transfer valve, which is controlled from the apparatus pump control panel, allows the operator of a two-stage pump to select volume or pressure operation. This valve is an all bronze waterway device that can transfer between pumping modes with two and one-half turns of its control hand wheel. The position of the valve is indicated on the apparatus pump control panel via a positive mechanical indicator. An optional power transfer valve is available.

Choosing Between Volume and Pressure Operation
In deciding which range to pump (pressure or volume), choose the one that gives the desired flow and pressure at the lowest engine speed. When a change of range is desired, slow down to idle speed, and shift the transfer valve to the desired range.

When shifting the transfer valve from volume to pressure operation, the pressure will be doubled. You may hear a metallic click or two clicks, which will be the check valves closing. If the clicks sound too harshly, you are changing the transfer valve while the pressure is too high. This happens when the truck engine is running at high speed.

Refer to your fire department policy for when to use volume operation and when to use pressure operation.

If your fire department does not have a policy to follow, here are general guidelines:

1. Hale pumps are designed to pump up to 200 PSI net pressure in volume operation at reasonable engine speeds.

2 Generally, volume operation should be used at any net pump pressure under 150 PSI, especially when pumping from a hydrant

3. When pumping from draft or a water tank, pressure operation may be used when the volume is less than one-half the pump capacity and when the desired pressure is over 150 PSI

4. Be certain to warn everyone involved before changing pump range.

Transferring Between Volume and Pressure Operation

Transferring between volume and pressure operation is evidenced by a metallic click, which results from the check valves closing. If the click is too loud or perhaps, somewhat violent, the pumping pressure is too high for switching. In this case, you should ease back on the engine throttle.

Switching between volume and pressure operation is generally governed by prevailing fire department policy. However, here are some general guidelines if your fire department does not have an established policy:

1. The pump should be operated so that engine speed is within its best operating range.

2 Transfer to volume (parallel) operation if the pump has to discharge more than 50 percent of its rated capacity. Be certain to warn everyone involved before switching between volume and pressure operation.

3. While the switch can be done at any pressure, it is highly recommended to reduce the pump pressure to 50 to 60 PSI before switching. The engine speed should especially be reduced when switching from volume to pressure operation with hand held hoses in use.

BOOSTER PUMPS

Hale booster pumps offer the added dimension of low volume and high pressure for use with the midship pumps. The booster is ideal for high pressure, hose reel operation.

As shown in Figure 1-12, the booster pump is designed for direct mounting at the accessory port of the Hale gearbox. The booster pump is driven by the gearbox intermediate gear to provide a positive drive.

Water is directed to the booster pump through a pre-piped supply hose. The optional air clutch allows the water flow to the booster pump to be closed off.

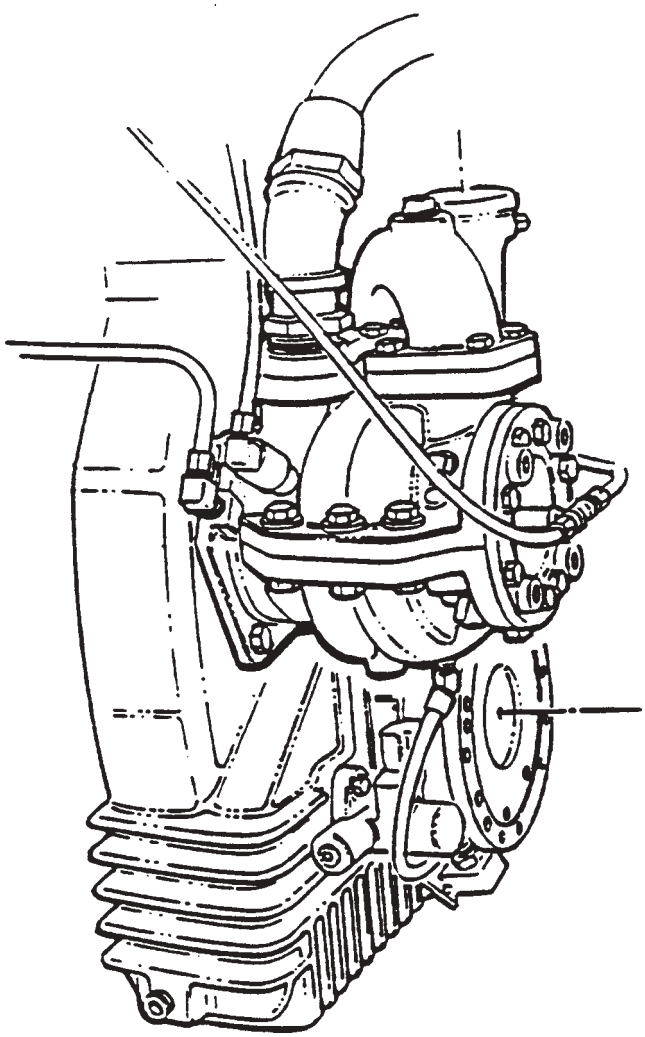


Figure 1-12. Booster Pump Option

PRIMING PUMP

Priming pumps are used to create a vacuum; they are designed to evacuate air through the suction hose and into the pump. The vacuum created allows atmospheric pressure to push water from the open body of water through the suction hose and into the pump. Hale centrifugal midship pumps use Rotary Vane Positive Displacement pumps for priming. A positive displacement pump moves a specified amount of air or fluid with each revolution.

As shown in Figure 1-13, the priming pump has a single rotor mounted off-center (eccentric) to the pump body housing. The vanes in the rotor slide in grooves and are held against the body housing by centrifugal force. As a vane turns toward the discharge, it recedes into the rotor. As the rotor continues past the discharge, the vane advances outward from its groove and against the body housing. During this cycle, the space between the rotor and housing case fills with air, and the vanes, acting as wipers, force air out of the discharge, creating a vacuum in the main pump allowing atmospheric pressure to push water into the suction side of the main pump, filling it with water.

While the rotor draws air from the main pump, lubricant is pulled in from the lubricant tank This lubricates the pump and the bearings and helps to create a better vacuum by scaling close tolerances in the priming pump. The pump should not be operated unless the lubricant tank is filled

A Hale priming pump has a single control that both opens the priming valve between the midship pump and the priming pump and starts the priming motor. The primer is automatically lubricated during operation.

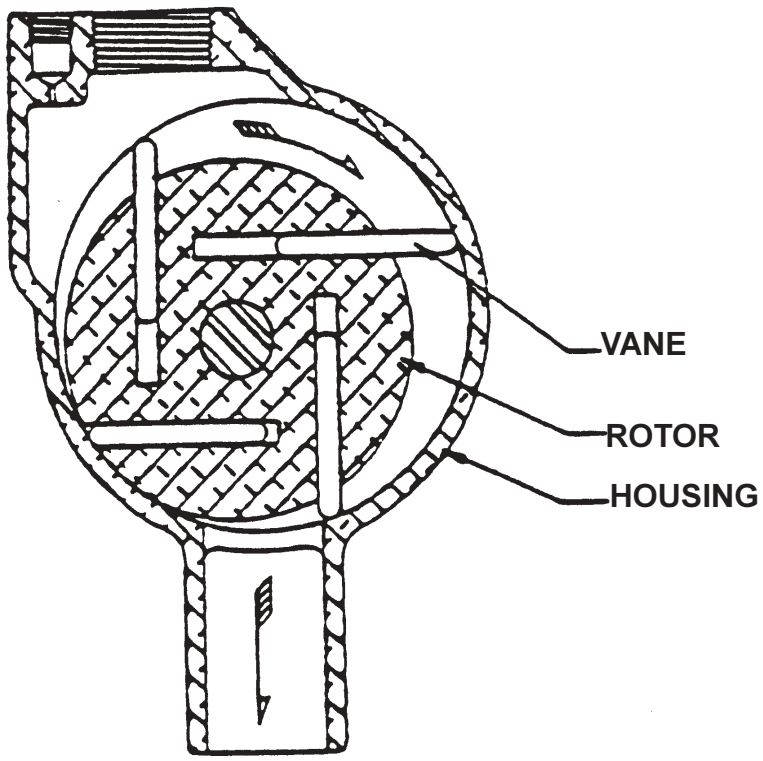


Figure 1-13. Priming System

PRESSURE CONTROL DEVICES

Three basic types of pressure control devices are used with Hale Midship pumps:

- Engine speed governor system (optional).
- Relief valve system (standard).
- Hale Total Pressure Master Relief Valve System (optional). Relief Valve System

As shown in Figure 1-14, the Relief Valve System is a single bronze, variable press= setting relief valve of sufficient capacity to prevent an undue pressure rise (NFPA Pamphlet No. 1901). The relief valve is normally closed; it opens against pump pressure. A control light signals when the valve is open.

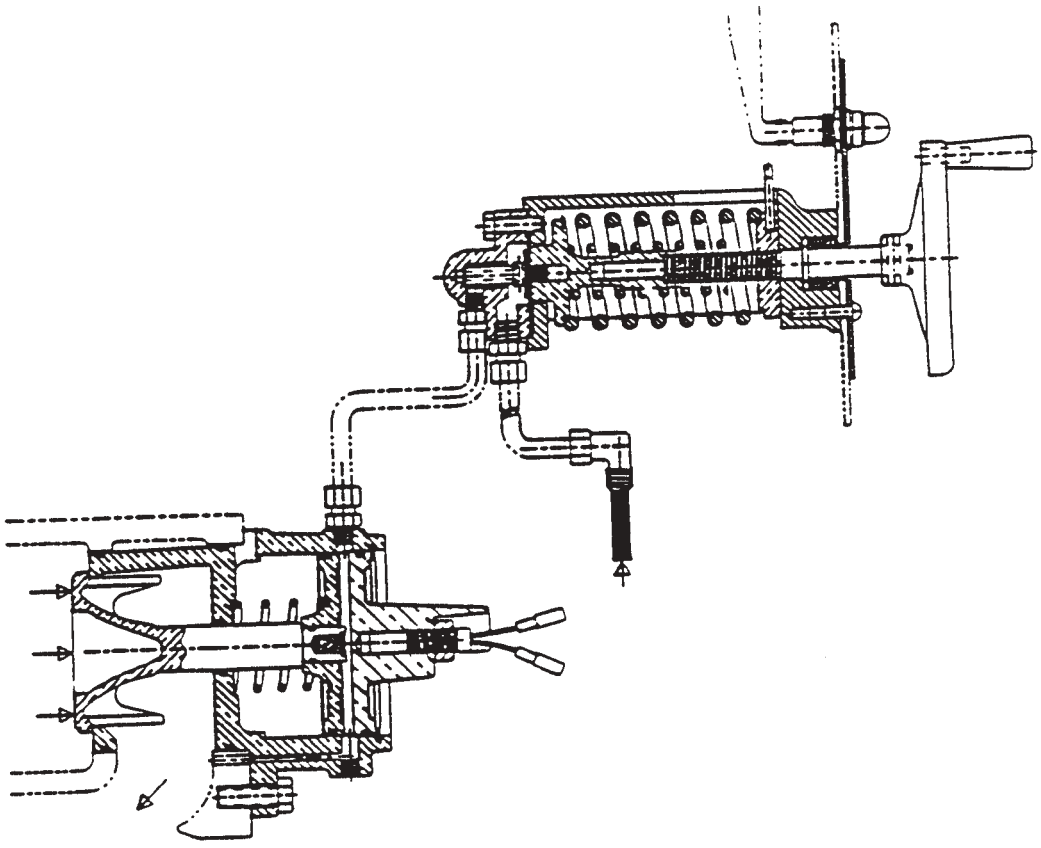


Figure 1-14. Relief Valve System

Hale Total Pressure Master (TPM) Relief Valve System

This system, Figure 1-15, includes a sensing device connected to the inlet side of the pump that works in conjunction with a Pressure Master control on the pump panel to give complete control over the entire system. The operating point is set by the Pressure Master control. Small changes in pump pressure are normally handled internally by the recirculating relief valve. Large changes on either the inlet or discharge side of the pump are controlled by dumping excess pressure to atmosphere from the discharge side of the pump.

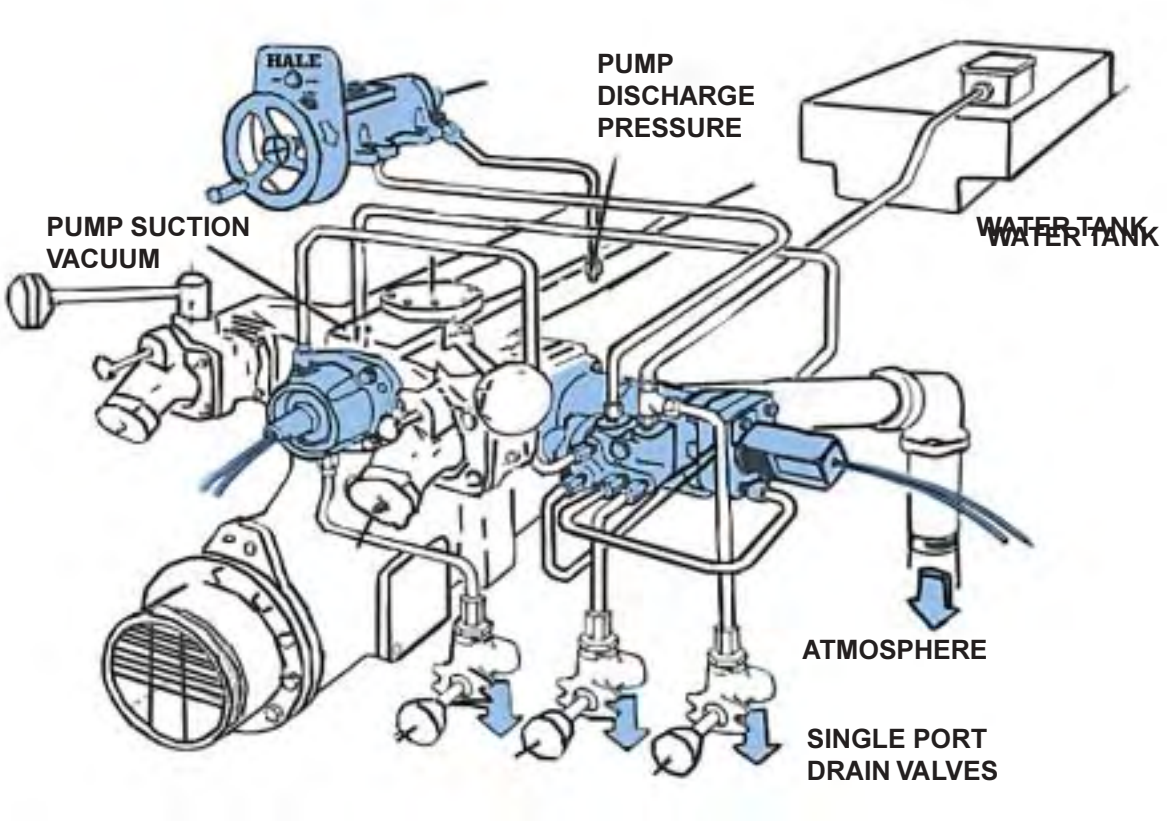


Figure 1-15. Hale Total Pressure Master Relief Valve System

CAVITATION
Often referred to as “running away from the water supply.” Cavitation simply means that the operator is trying to pump more water out of the pump than is going into the pump.

AUXILIARY COOLING
Model K Auxiliary Heat Exchanger/Cooler
NFPA 1901 requires a supplementary heat exchanger cooling system for the pump drive engine during pumping operations. Hale model “K” heat exchangers meet the NFPA 1901 requirements. The units can be used with any size radiator and *use* water from the pump to help maintain the proper a temperature of the engine coolant. The cast-iron housing and copper tubing coil keep the water and coolant from contaminating each other. A valve is supplied on the operator’s panel to allow the operator to control the amount of water being supplied to the Model “K” heat exchanger This valve is needed to keep the apparatus from operating at a temperature below the recommended level

Pump Overheating Protection
An optional Thermal Relief Valve (TRV) can be attached to the main pump body. This valve prevents the Overheating of the pump under certain operating conditions The valve monitors and controls the temperature of the water in the pump. When the temperature exceeds 120°F, the valve automatically opens and discharges a small amount of water either to the ground or into the water tank, allowing cooler water to enter the pump. After the temperature reduces to a safe level, the valve closes until the temperature is exceeded again.

DISCHARGE, SUCTION, DRAIN, AND INLINE VALVES
Discharge and suction valves regulate the amount of water entering and leaving a pump. Each valve includes a locking device that permits operation in any position from fully opened to fully closed. Several types of valves are available for Hale midship pumps.

The suction and discharge valves are quarter-turn ball-type with a locking handle. As the valve handle is moved, the ball can rotate from being in-line with the waterway to a position 90 degrees to the waterway, or any position in between, thus reducing or stopping the flow of water. Inline valves are also quarter-turn ball-type valves. These valves can be used in either suction or discharge lines

The optional Hale tank-to-pump valve is a flanged, three-inch, full flow ball device that includes a three-inch NPT and four-inch flexible coupling inlet connection An optional built-in Hale bronze check valve is specifically designed for the purpose of avoiding accidental overpressure of the booster tank and is strongly recommended.

At least one full flow suction valve with locking handle can be provided on the pump. The body of each suction valve connects into the pump suction with a maximum of one long sweep 90° elbow between the valve and the pump suction.

The Hale drain valve is a sliding plug type valve used to relieve pressure from hose lines after pumping. To open, pull the knob out; to close, push the knob in. The valve must be seated completely to prevent leakage while priming and pumping.

Each suction and discharge valve on a Hale pump may be equipped with a drain. Opening the drain before uncoupling the hose relieves the pressure in the line. Also, water must be drained from the pump during freezing conditions through the master drain valve.

2. OPERATING PROCEDURES

A. Overview

This section supplies information and procedures for the operation of Hale single-stage and two-stage pumps. Included in this section are procedures for pumping from a hydrant, pumping from draft, pumping from a booster tank, pumping in relay, tandem pumping from a hydrant, and post-operation procedures.

B. Operating Procedures

THE PROCEDURES IN THIS SECTION ARE GENERAL OPERATING PROCEDURES. THEY DO NOT REPLACE THE PROCEDURES AND POLICIES ESTABLISHED BY YOUR FIRE DEPARTMENT, NOR DO THEY REPLACE THE RECOMMENDATIONS AND PROCEDURES PROVIDED BY THE FIRE TRUCK MANUAL.

Pumping From a Hydrant, General Operation

1. Position the truck for the best hydrant hookup and discharge hose layout.

NOTICE

REFER TO THE FIRE DEPARTMENT PROCEDURES ON SETTING WHEEL CHOCKS AS WELL AS LAY OUT AND CONNECTION OF SUCTION AND DISCHARGE HOSES.

ALL VALVES, DRAIN COCKS, AND CAPS SHOULD BE CLOSED.

⚠ CAUTION

NEVER ATTEMPT TO SHIFT THE PUMP TRANSMISSION WHILE THE TRUCK TRANSMISSION IS IN GEAR. ALWAYS SWITCH THE TRANSMISSION TO "N" AND VERIFY THE SPEEDOMETER IS "0" BEFORE MAKING PUMP TRANSMISSION SHIFT.

2. Bring the truck to a complete stop before you attempt to shift from road to pump.

3. Apply the truck parking brake.

4. Shift the truck transmission to the NEUTRAL position.

5. Move the in-cab pump shift control valve from the ROAD position to the PUMP position. The shift warning lights should come on in a second or two, indicating a complete shift.

   If the truck manufacturer has used another in-cab valve to achieve pump shift or has an electric switch, follow the instructions supplied with that valve.

6. After pump shift is completed, put the truck transmission in the proper pump operating range or gear. For most pumpers this will be direct drive (1:1) ratio. In addition, the speedometer should read 5 to 15 MPH after the shift has been completed. If the shift does not seem to be completed, shift truck transmission to "N" and repeat the entire procedure. Note that some vehicles drive the speedometer from the front wheel of the chassis. In this case, the speedometer will not read 5 to 15 MPH after shifting to the pump position. See the chassis manual for details.

⚠ WARNING

DO NOT LEAVE THE CAB OR ATTEMPT TO PUMP UNTIL ALL THE GREEN PUMP LIGHTS IN THE CAB AND PANEL ARE ON.

7. Exit the driving compartment only after all the above steps are completed and you are sure that the shift completed lights in the cab and panel are on.

⚠ WARNING

DO NOT OPEN THROTTLE UNLESS ALL GREEN PUMP INDICATOR LIGHTS ARE ON.

8. Verify that the pump panel shift indicator green "OK TO PUMP" light is on.

9. Open the hydrant.

10. If necessary, open the suction valve.

11. If applicable, set the transfer valve to either *volume* or *pressure*, as required.

12. If necessary to eliminate air pockets open valve to let air out or prime the pump: see "Pumping From Draft" for instructions.

13. Note the intake and discharge pressures then open the engine throttle gradually until the master discharge gauge indicates the desired pressure.

14. Set the automatic relief valve according to your fire department policy. If your fire department does not have a policy to follow, see the "Relief Valve or TPM Procedures" later in this section

⚠ CAUTION

DO NOT REDUCE THE PRESSURE ON THE INTAKE GAUGE TO ZERO; SERIOUS DAMAGE TO THE WATER MAIN COULD RESULT.

If the master intake gauge shows a vacuum before the desired discharge pressure or flow is reached, this is an indication that you are getting all the water that the hydrant will supply. To increase the pressure when this occurs, reduce the pump flow. The master intake gauge reading must be maintained at 5 PSI (.5 BAR), minimum.

As the throttle is opened, the pressure gauge reading increases with the engine speed. If the engine speed increases without an increase in pressure, the pump may be cavitating. In this case, close the throttle slowly until the pressure begins to drop, and the engine returns to an idle. If this does not correct the problem you are trying to pump more capacity than is available from the hydrant.

15. Open the discharge valves.

16. If the pump overheats and is not equipped with the Hale TRV valve, open the valve to access the pump auxiliary cooling system, or slightly open the tank fill line.

17. After completion of pumping procedures, gradually reduce the pump pressure until the engine is at an idle speed. Use the "Pump to Road Shift Procedure" and "Post Operation Procedure" provided later in this section.

TPM Operation from a Hydrant

When operating from a positive inlet pressure, during some operational conditions, it may be necessary to adjust the TPM Relief Valve to a point where water is dumping to the ground. The internal relief valve will always open first, and if it cannot handle the pressure rise, the external relief valve will dump water on the ground. When the internal relief valve opens, the panel light will be on, and when the external dump valve opens, the pilot light on the panel will flash.

Pumping From Draft, General Operation.

1. Get as close to the water source as possible. The pump can do better than its rated capacity with less than a 10-foot vertical lift. As the vertical lift increases to above 10 feet, the maximum pump capacity will be reduced.

NOTICE

REFER TO THE FIRE DEPARTMENT PROCEDURES IN SETTING WHEEL CHOCKS AS WELL AS LAY OUT AND CONNECTION OF SUCTION AND DISCHARGE HOSES.

ALL VALVES, DRAIN COCKS, AND CAPS SHOULD BE CLOSED.

⚠ CAUTION

NEVER ATTEMPT TO SHIFT THE PUMP TRANSMISSION WHILE THE TRUCK TRANSMISSION IS IN GEAR. ALWAYS SWITCH THE TRANSMISSION TO "N" AND VERIFY THE SPEEDOMETER IS "0" BEFORE MAKING PUMP TRANSMISSION SHIFT.

2. Bring the truck to a complete stop before you attempt to connect suction hoses or shift from road to pump.

3. Apply the truck parking brake.

4. Shift the truck transmission to the NEUTRAL position.

5. Move the in-cab pump shift control valve from the ROAD to the PUMP position. The shift warning light should come on in a second or two, indicating a completed shift. If the truck manufacturer has used another in-cab valve to achieve pump shift, follow the instructions supplied with that valve

6. After pump shift is complete, put the truck transmission in the proper pump operating range or gear. For most pumpers this will be direct drive (1:1) ratio. In addition, the speedometer should read 5 to 15 MPH after the shift has been completed. If the shift does not seem to be completed, shift truck transmission to "N" and repeat the entire procedure. Note that some vehicles drive the speedometer from the front wheel of the chassis. In this case, the speedometer will not read 5 to 15 MPH after shifting to the pump position. See the chassis manual for details.

⚠ WARNING

DO NOT LEAVE THE CAB OR ATTEMPT TO PUMP UNTIL ALL THE GREEN PUMP LIGHTS IN THE CAB AND PANEL ARE ON.

7. Exit the driving compartment only after all the above steps are completed and you are sure that the shift completed lights in the cab and panel are on.

⚠ WARNING

DO NOT OPEN THROTTLE UNLESS ALL GREEN PUMP INDICATOR LIGHTS ARE ON.

8. Verify that the pump shift indicator light is on.

9. Activate the priming pump by pulling the control handle located on the pump panel or depressing the push button.

   The departmental manual for pumping should specify the correct RPM for priming, but in general, for priming the pump should be operated at idle with an engine speed of about 1,000 to 1,200 RPM.

10. Watch the intake and discharge master gauges. When the pump is primed, the intake indication reading falls below zero, and the discharge pressure starts to increase. You may also hear water discharging on the ground, indicating that the pump is primed.

    Running the engine at speeds higher than 1,200 RPM during priming is not recommended, because it will not improve priming operation. Running the pump at higher RPM will increase wear.

⚠ CAUTION

IF THE DISCHARGE GAUGE READING DOES NOT INCREASE, THE INTAKE GAUGE READING DOES NOT FALL BELOW ZERO, OR THE PRIMING PUMP DOES NOT DISCHARGE WATER ON THE GROUND IN 30 SECONDS, DO NOT CONTINUE TO RUN THE PRIMING PUMP. STOP THE PUMP, AND CHECK FOR AIR LEAKS OR POSSIBLE PUMP TROUBLE.

11. After priming, select the desired transfer valve position (for two-stage pumps).

12. Gradually open the discharge valve until the water emerges as a steady stream. Then open the other discharge valves to the desired setting.

13. Open the engine throttle gradually until the desired pressure or flow is reached.

⚠ CAUTION

DO NOT PUMP ENOUGH WATER TO CAUSE A WHIRLPOOL AT THE STRAINER. THIS ALLOWS AIR INTO THE PUMP, RESULTING IN ROUGH OPERATION AND PULSATION. REPOSITION THE STRAINER OR REDUCE FLOW TO CORRECT THE SITUATION.

As the throttle is opened, the pressure gauge reading increases with the engine speed. If the engine speed increases without an increase in pressure, the pump may be cavitating.

If the pump is cavitating, warn personnel that the pressure is being dropped. In this case, close the throttle slowly until the pressure begins to drop, and the engine returns to an idle. If this does not correct the problem, here are two possibilities that can also lead to this condition:

a. Cavitation can occur with large nozzle tips. Solve this problem by reducing flow.

b. Cavitation can also occur when you are pumping if air enters with the water. Even though the pump may be primed, air leaks can cause rough operation and an increase of engine speed without an increase in pressure or flow. If an air leak is suspected, discontinue pumping and refer to Section 4 for maintenance.

14. If a pump shutdown is desired while pumping from draft, reduce the engine speed to idle, and close the discharge valves. To resume pumping, open the throttle and discharge valves. If the pump overheats from continued churning without water flow, open the discharge valves periodically to release hot water.

15. Set the automatic relief valve according to your fire department policy. If your fire department does not have a policy to follow, see the "TPM or Relief Valve Procedures" later in this section.

16. If the pump overheats and is not equipped with the Hale TRV valve, open the valve to access the pump auxiliary cooling system, or slightly open the tank fill line.

17. After completion of pumping procedures, gradually reduce the engine RPM until it is at an idle speed. Use the "Pump to Road Shift Procedure" and "Post Operation Procedure" provided later in this section.

Pumping From the Onboard Water Tank

1. Position the truck for convenient discharge hose layout, and bring the truck to a complete stop.

NOTICE

REFER TO THE FIRE DEPARTMENT PROCEDURES ON SETTING WHEEL CHOCKS AS WELL AS LAY OUT AND CONNECTION OF SUCTION AND DISCHARGE HOSES.

2. Bring the truck to a complete stop before you attempt to shift from road to pump.

3. Apply the truck parking brake.

4. Shift the truck transmission to the NEUTRAL position.

5. Move the in-cab pump shift control valve from the ROAD position to the PUMP position. The shift warning light should come on in a second or two, indicating a completed shift. If the truck manufacturer has used another in-cab valve to achieve pump shift, follow the instructions supplied with that valve.

6. After pump shift is complete, put the truck transmission in the proper pump operating range or gear. For most pumpers this will be direct drive (1:1) ratio. In addition, the speedometer should read 5 to 15 MPH after the shift has been completed. If the shift does not seem to be completed, shift truck transmission to "N" and repeat the entire procedure. Note that some vehicles drive the speedometer from the front wheel of the chassis. In this case, the speedometer will not read 5 to 15 MPH after shifting to the pump position. See the chassis manual for details.

⚠ WARNING

DO NOT LEAVE THE CAB OR ATTEMPT TO PUMP UNTIL ALL THE GREEN PUMP LIGHTS IN THE CAB AND PANEL ARE ON.

7. Exit the driving compartment only after all the above steps are completed and you are sure that the shift completed warning lights in the cab and panel are on.

⚠ WARNING

DO NOT OPEN THROTTLE UNLESS ALL GREEN PUMP INDICATOR LIGHTS ARE ON.

8. Verify that the pump panel shift indicator light is on.

9. Open the tank suction valve.

10. For two-stage pumps, select the desired transfer valve position.

11. Check the master discharge gauge to see if priming is necessary. If necessary, start the priming pump by pulling the control handle located on the pump panel or depressing the prime push button or just crack the tank fill valve.

⚠ CAUTION

IF THE DISCHARGE GAUGE READING DOES NOT INCREASE, THE INTAKE GAUGE READING DOES NOT FALL BELOW ZERO, OR THE PRIMING PUMP DOES NOT DISCHARGE WATER ON THE GROUND IN 30 SECONDS, DO NOT CONTINUE TO RUN THE PRIMING PUMP. STOP THE PUMP, AND CHECK FOR AIR LEAKS OR POSSIBLE PUMP TROUBLE.

Watch the intake and discharge pressure gauges. When the pump is primed, the compound gauge indication falls below zero, and the pressure starts to increase. You may also hear water splashing on the ground, indicating that the pump is primed.

12. Open the engine throttle gradually until the desired pressure or flow is reached. As the throttle is opened, the discharge pressure gauge reading increases with the engine speed. If the engine speed increases without an increase in pressure, the pump may be cavitating.

    If the pump is cavitating, warn personnel that the pressure is being dropped. In this case, close the throttle slowly until the pressure begins to drop, and the engine returns to an idle. If this does not correct the problem, reduce flow.

⚠ WARNING

DO NOT OPEN THROTTLE UNLESS ALL GREEN PUMP INDICATOR LIGHTS ARE ON.

13. Gradually open the discharge valves until the water emerges as a steady stream. Then open the discharge valves to the desired setting.

14. Set the automatic relief valve according to your fire department policy. If your fire department does not have a policy to follow, see the “TPM or Relief Valve Procedures” later in this section.

15. If the pump overheats and is not equipped with the Hale TRV valve, open the valve to access the pump auxiliary cooling system, or slightly open the tank fill line.

16. After completion of pumping procedures, gradually reduce the engine RPM until it is at an idle speed. Use the “Pump to Road Shift Procedure” and “Post Operation Procedure” provided later in this section.

Pumping In Relay

Relay operations are necessary when the water source is too far away from the fire to be pumped efficiently by one pumper. Relay pumping is the movement of water through a number of consecutive pumpers, from suction to discharge. The number of pumpers is determined by how far the water source is from the fire.

In some cases, when you are on the receiving end of a relay, it may help to set the suction dump or

TPM (if available) very low in order to limit the incoming pump pressure by dumping water on the ground before you have discharge hose lines connected and are flowing water. Then, as you are able to use the incoming water, the relief valve control can be moved up to the desired operating pressure and set as instructed. This technique will also help you to purge the air from the incoming hose and the pump before it can get to a dangerously high pressure.

Use this procedure after the hose is laid, the apparatus are in position, and the pumps are engaged. See the "Pumping from a Hydrant" procedure for setup and engagement instructions for apparatus receiving pressurized water.

1. Open two discharge gates on all pumps, except on the pump at the source, to get rid of air from hose lines and pumps.

2. On each pump, attach the hose lines to one of the discharges, and leave the other discharge uncapped (only for trucks without a relay valve).

3. Watch the intake gauge for a high-pressure reading. If this is reached, open the gate controlling the uncapped discharge to remove excess water.

4. Supply the pump at the water source with water; prime if necessary. The discharge pressure must not be over 150 PSI (10 BAR) or the maximum pressure rating of the relay hose to start water moving. Use either the "Pumping From Hydrant" or "Pumping From Draft" procedures that appear earlier in this section.

5. When the water reaches the second pump, close the uncapped discharge gate. Repeat this step for all pumps until the water reaches the fire ground.

6. Adjust the throttle on the pump at the water source for the required operating pressure. Watch the gauges to avoid cavitation. (The pump operator at the fire scene will advise all other pump operators of the amount of water needed at the fire ground).

7. Adjust the discharge pressure or flow at the fire scene to supply the lines being used.

8. Observe the gauges carefully, and adjust the pressure or flow as needed.

9. Shutdown starts from the fire ground pump and works toward the water source. Gradually reduce pressure at the fire ground pump until you can disengage it. Follow this procedure for every pump in the relay until the pump at the water source is shut down.

NOTICE

LOCAL TRAINING PROCEDURES MAY VARY SLIGHTLY FROM ABOVE.

Tandem Pumping Operation From a Hydrant

1. Using the large intake hose, connect the first pumper to the hydrant steamer. Open the hydrant until the pump is primed, then partially close the hydrant.

2. Position the second pumper intake-to-intake with the first pumper.

3. Open a discharge to flow water.

4. With the hydrant partially closed, adjust the throttle on the first pumper until the intake gauge reads about 5 PSI (.5 BAR)

5. Remove the unused intake cap.

6. Connect the second pumper to the unused steamer intake of the first pumper, using a large intake hose.

7. Open the hydrant completely. Both pumpers pump water to the fire, (refer to the procedure on "Pumping From a Hydrant").

NOTICE

LOCAL TRAINING PROCEDURES MAY VARY FROM ABOVE.

Pump To Road Shift Procedures

1. Verify that the operator's hand throttle or governor control has returned to idle speed.

2. Shift the truck transmission into the NEUTRAL position, and wait four seconds. Check to make sure the speedometer reads 0.

3. Moving pump shift control valve lever to the ROAD position. The in-cab and panel pump indicator lights should go out when the pump transmission starts to shift into the ROAD position.

NOTICE

REFER TO THE FIRE DEPARTMENT PROCEDURES ON REMOVING WHEEL CHOCKS AS WELL AS LAY OUT AND CONNECTION OF SUCTION AND DISCHARGE HOSES.

Standard Relief Valve Procedures

These procedures are for setting the operating point of the standard relief valve.

1. Increase the engine RPM to reach the desired pump operating pressure while reading the discharge pressure gauge.

2. Turn the hand wheel slowly counterclockwise until the relief valve opens, the pilot light comes on, and the master pressure gauge drops a couple of PSI (BAR).

3. Turn the hand wheel slowly clockwise until the master pressure gauge rises to the desired pressure and pilot light goes out. The relief valve will now operate at the set pressure.

4. When the pump is not in operation, turn the hand wheel clockwise so that the control is set slightly above the normal operating pressure. When the pump is put into operation again, reset the control valve to the desired operating pressure.

TPM Relief Valve Procedures

These procedures cover the Hale TPM Relief Valve System. Be sure to select the correct procedure, according to relief valve.

TPM System (only)

1. Set the pressure indicator on the PMD control valve to a position slightly above the normal operating pressure (even before water starts to flow).

2. After normal operating pressure has been achieved (as indicated on the master pressure gauge and with the pump discharging water), slowly move the adjusting handwheel counterclockwise until the relief valve opens, the amber pilot light comes on, and the master pressure gauge reading drops a couple of PSI (BAR).

3. Turn the handwheel slowly clockwise until the master pressure gauge reading is at the correct operating pressure and the pilot light goes out. The relief valve will operate at the set pressure.

NOTICE

THE INDICATOR ON THE PANEL IS ONLY A ROUGH INDICATION OF TPM SETTING. ALWAYS USE THE ABOVE PROCEDURE TO PROPERLY SET THE TPM RELIEF VALVE SYSTEM.

TPM System with Engine Governor

1. Set the pressure indicator on the PMD control valve to a position slightly above the normal operating pressure (even before water starts to flow).

2. Power on the governor control.

3. Set the discharge pressure using the RPM mode of the pressure governor control.

4. Move the TPM handwheel counterclockwise until the relief valve opens and the amber pilot light comes on.

5. Turn the hand wheel slowly clockwise, until the amber light just goes out. Then turn the hand wheel one additional full turn clockwise for proper operation.

⚠ CAUTION

THE TPM PRESSURE CONTROL VALVE MUST BE SET SLIGHTLY HIGHER THAN THE GOVERNOR CONTROL FOR PROPER OPERATION.

6. Put the governor control in the Pressure Governor mode; the system is now set.

7. Use the following procedures to change the set pressure while running:

Increasing Pressure

a. Set the TPM to a pressure (by the indicator) slightly higher than the desired new pressure.

b. Put the governor control in the RPM mode, and increase the speed to the new pressure.

c. Move the TPM handwheel counterclockwise until the relief valve opens and the amber pilot light comes on.

d. Turn the handwheel slowly clockwise, until the amber light just goes out. Then turn the handwheel one additional full turn clockwise for proper operation.

⚠ CAUTION

THE TPM PRESSURE CONTROL VALVE MUST BE SET SLIGHTLY HIGHER THAN THE GOVERNOR CONTROL FOR PROPER OPERATION.

e. Put the governor control in the Pressure Governor mode; the system is now set.

Decreasing Pressure

a. Put the governor control in the RPM mode, and reduce the speed to the new pressure.

b. Move the TPM handwheel counterclockwise until the relief valve opens and the amber pilot light comes on.

c. Turn the handwheel slowly clockwise, until the amber light just goes out. Then turn the handwheel one additional full turn clockwise for proper operation.

⚠ CAUTION

THE TPM PRESSURE CONTROL VALVE MUST BE SET SLIGHTLY HIGHER THAN THE GOVERNOR CONTROL FOR PROPER OPERATION.

d. Put the governor control in the Pressure Governor mode; the system is now set.

Emergency Pump Shift Procedures

Before implementing manual override shift procedures, repeat recommended procedures. If the shift fails to take place, follow these procedures.

1. Bring the truck to a complete stop.

2. Apply the truck parking brake, and chock the wheels.

3. Shift the truck transmission to the NEUTRAL position.

4. For Pump or Road position, put the in-cab shift control in the Neutral position. (Neutral position is exactly in the middle of the road and pump position.

5. Shut down the engine.

⚠ WARNING

DO NOT ATTEMPT EMERGENCY SHIFT PROCEDURES WHILE THE ENGINE IS RUNNING.

6. Employ manual override procedure at the shift cylinder on the pump gearbox as follows:

   An eyebolt is provided in the shift shaft to accept a drift punch or screwdriver. By inserting this tool into the hole provided, it will enable you to pull or push the shaft manually. Pull the shift shaft Out for Pump Position (after in-cab control valve selection), or push shift shaft for Road Position (after in-cab control valve selection). If the shift stroke cannot be completed manually, turn the driveshaft slightly by hand to realign the internal gears and repeat the manual shift effort.

Post Operation Procedures

1. If you have been pumping seawater, dirty water, alkaline water, or using an around the pump proportioner, flush the pump with clean water.

2. After using the pump, drain the pump as follows (especially important in freezing weather):

   a. Open discharge valves, remove suction tube caps, and discharge valve caps.

   b. Open the pump body drain cocks or Hale multiple drain valve. If a multiple drain valve is used, all pump drain lines should be connected to this valve.

   c. On two-stage pumps, move the transfer valve back and fourth to both the *volume* and *pressure* positions.

   d. If installed, drain the gearbox cooler.

   e. After the pump is completely drained, replace all caps and close all valves.

3. Fill out the pump run log, indicating total pumping time and total out-of-station time.

4. Report all pump, vehicle equipment malfunctions, and irregularities to the proper authority.

3. PREVENTATIVE MAINTENANCE

A. Overview

Hale Midship Pumps require very little care and maintenance. However, the little required is extremely important. Preventive maintenance tasks require very little time to accomplish and consist mainly of testing for leaks, lubrication, and cleaning.

The procedures supplied in this section are for normal use and conditions. Extreme conditions may indicate a need for increased maintenance. The procedures in this section identify some extreme conditions and the additional measures needed to ensure lengthened pump life and continuing dependability.

The first part of this section includes some extreme condition maintenance guidelines. Sections with recommended activities to be accomplished on a weekly, a monthly, and an annual basis follow this. A separate maintenance checklist is provided to record completed maintenance actions.

B. Procedures

Post Operation Maintenance

1. If necessary, follow the procedures in the Extreme Maintenance Conditions paragraph.

2. On two-stage pumps, remove the suction tube strainers, and reach in to ensure that check valves are free to swing. Also, verify that no foreign matter is caught between the valve and the seat.

3. Inspect the suction hose rubber washers and washers in the suction tube caps. Remove foreign matter from under these washers. Replace worn, damaged, or dry washers.

4. Verify that all discharge valves, booster line valves, drain valves, and cocks are closed.

5. Tighten suction caps.

Extreme Conditions Maintenance Guidelines

Extreme conditions occur when the pump has been operated during freezing weather and as a result of pumping from a water source that contains material that will be harmful to the pump if not purged.

During Freezing Weather

In freezing weather, drain the pump as follows:

1. Open all discharge and suction valves, remove suction tube caps, and discharge valve caps.

2. Open pump body drain cocks and/or Hale multiple drain valve.

3. On two-stage pumps, move the transfer valve back and forth to both the *volume* and the *pressure* positions.

4. After the pump is completely drained, replace all caps and close all valves.

After Pumping from Salt Water, Contaminated Water, or With Foam Solution

After drafting from sea water, contaminated, sandy or dirty water, flush the pump and suction hoses by using water from a hydrant or other clean water source. After pumping foam through the pump, flush as above until all residues of foam have gone.

Weekly Maintenance

Weekly maintenance consists of testing the relief valve system or governor, the transfer valve on two-stage pumps, the priming system, and the pump shift warning indicator lights. If testing criteria is not met, refer to Section 4 for corrective maintenance.

Relief Valve and TPM Test

When the relief valve is not in operation, maintain a setting above the normal operating pressure.

1. Set up to pump from the onboard water tank with the discharge valve back to the water tank open less than 1/2 way. See the procedures in Section 2 for assistance.

2. Bring the pump pressure up to 150 PSI (10 BAR) per normal operating procedures.

3. Turn the control valve handwheel counterclockwise until the relief valve opens and the pilot light is lit. Master pressure gauge should drop at least 5 to 10 PSI (0.5 to 1 BAR).

4. Turn the control valve handwheel clockwise then counterclockwise a few times to ensure that the handwheel turns freely. Master pressure gauge should increase and pilot light should go out. This action also ensures proper valve operation.

5. Reset the relief valve to its normal operational setting.

Governor Test

If your apparatus is equipped with an electronic governor, follow the manufacturer's instructions for weekly preventive maintenance.

Transfer Valve Test (Two Stage Pumps Only)

1. For manual transfer valves:

    a. With the apparatus engine turned off, turn the handwheel between the volume and pressure positions a few times to verify that the valve operates freely.

    b. Set the truck up for pumping per the procedure in Section 2, with the transfer valve in the volume position.

    c. Leave the engine at idle speed, and move the transfer valve to the pressure position.

    d. Verify that the discharge pressure gauge readings have approximately doubled.

2. For power transfer valves:

    a. With the apparatus engine turned off, use either a 3/8-inch socket on the indicator hex nut or a rod in the hole in the indicator hex nut to manually transfer the valve to verify that the valve operates freely.

    b. Set the truck up for pumping per the procedures in Section 2, with the transfer valve in the volume position. Note the discharge gauge readings.

    c. Leave the engine at idle speed, and move the transfer valve to the pressure position.

    d. Verify that the master intake gauge readings have approximately doubled.

Priming System Test

1. Tighten all pump caps, and close all pump valves.

2. Pull the primer control while you watch for a below-zero reading on the master intake gauge.

3. Verify that the master intake gauge readings hold for approximately 5 minutes after you release the primer control. A drop of 10 inches hg in this 5 minute period is anticipated per NFPA 1901.

Pump Shift Warning Indicator Lights

⚠ WARNING

BE SURE THAT THE PARKING BRAKE IS SET AND EVERYONE IS CLEAR OF THE TRUCK BEFORE SHIFTING TO THE PUMP POSITION. THE WHEELS MUST BE BLOCKED TO PREVENT ANY MOVEMENT OF THE TRUCK.

1. Follow the operating procedures in Section 2 to engage the pump.

2. Verify that the warning indicators in the cab and the pump control panel are on.

3. Switch to non-pumping operations, and verify the warning indicators are off.

Valve Lubrication

1. Spray all moving parts of the suction, discharge, hose drain, and multi drain valves with a good grade of lithium base grease.

2. Lubricate all of the valve linkages.

Monthly Maintenance

Monthly maintenance includes the Weekly Maintenance procedures plus lubrication, the packing gland adjustment, dry vacuum testing, and checking the drive line bolts. The Weekly Maintenance includes testing the relief valve system or governor, the transfer valve on two-stage pumps, the priming system, and pump shift warning indicator lights.

Suction Check Valve Testing

On two-stage pumps remove the suction tube strainers, and reach inside the pump to ensure that the check valves are free to swing. Also, verify that no foreign matter is caught between the valve and the seat.

Lubrication

1. On handwheel-type valves, including PM, PMD, and Transfer Valve Controls, if necessary, first remove old grease and paint, use a dry lubricating spray on gears.

2. Remove the gearbox oil fill plug (refer to the Hale Service Chart), and check the level of the oil in the gearbox. The level should be up to the plug hole. If necessary, add oil, using only a good grade of SAE EP 90 (oil should meet GL-5 requirements).

3. Lubricate suction threads with a light coat of grease.

Packing Gland Adjustment

The packing gland is adjusted for a leakage of about 8 to 10 drops per minute at 150 PSI (10 BAR). This slight leakage will lubricate and cool the shaft and packing to prevent burning and scoring the shaft. First, check the leakage rate, and adjust the packing gland only if necessary. If the leakage rate cannot be adjusted within satisfactory limits, replace the packing per the instructions under Repacking in this section, page 3-6. Packing should be replaced every three years. The packing gland is adjusted as follows.

1. Connect the pump to a hydrant or some other source of water of about 150 pounds of pressure. If this is not possible, operate the pump at about 150 pounds from draft or from the booster tank discharging through the booster line, another small nozzle, or circulating back to the tank. Count the drops per minute.

2. Shut down engine to make adjustments.

⚠ WARNING

DO NOT RUN ENGINE WHILE MAKING PACKING ADJUSTMENTS.

3. Loosen the packing nut lock. The lock is either a spring-loaded pin or a screw and locknut. The end of the lock fits into a slot in the gland.

4. To loosen or tighten the packing gland:

   a. Insert a screwdriver or rod into one of the slots. Refer to the Hale Service Chart.

   b. To loosen the nut, turn it in the direction of engine rotation.

   c. To tighten the nut, turn it in the direction that is opposite to engine rotation.

5. Repeat step 1 and verify that leakage is correct. Tighten for less leakage, loosen for more leakage.

Drive Line and Flange Bolts

Check all drive line and flange bolts to ensure:

1. No bolts are missing.
2. All bolts are tight.
3. Bolts used are “Grade 8” strength.

Pump Mounting Bolts

1. No bolts are missing.
2. All bolts are tight.

Priming System Test (Dry Vacuum Test)

NOTICE

IN THE FOLLOWING PRIMING SYSTEM TEST, IF LEAKS CANNOT BE DETECTED BY FOLLOWING THE PROCEDURE BELOW, IT IS ADVISABLE TO TEST THE PUMP HYDROSTATICALLY. TO DO THIS CONNECT THE PUMP TO A SOURCE OF WATER, AND LOOK FOR LEAKS.

1. Close all valves and drains. Cap all suction openings and the outlet of the suction side relief valve (if so equipped).
2. Connect a test vacuum gauge or manometer to the intake test gauge connection on the pump panel.
3. Engage the priming pump until the gauge indicates 22 inches or more mercury vacuum.
4. Watch the gauge. If the vacuum falls more then 10 inches in 5 minutes, it is a certain indication of at least one air leak. Vacuum leaks may often be detected by ear if the apparatus engine is turned off. Correct leaks immediately to return the pump to a serviceable condition.
5. Test the suction hose as follows:
   a. Attach the suction hose to the pump.
   b. Place the suction tube cap on the end of the hose in place of a strainer.
   c. Close all valves and drains. Cap all suction openings and the outlet of the suction side relief valve (if so equipped).
   d. Connect a test vacuum gauge or manometer to the intake test gauge connection on the pump panel.
   e. Engage the priming pump until the gauge indicates at least 22 inches mercury.
   f. Watch the gauge. If the vacuum falls more then 10 inches in 5 minutes, it is a certain indication of at least one air leak. Vacuum leaks may often be detected by ear if the apparatus engine is turned off. Correct leaks immediately to return the pump to a serviceable condition.

Relief Valve System Check

1. Place apparatus out of service in accordance with departmental procedures.
2. Test relief valve system in accordance with Weekly Maintenance Check. If the relief valve is not working, clean the strainers as follows:
   a. Open pump compartment panel and locate the relief valve system strainer(s). (On all relief valve systems the strainer is located in one of the pump pressure taps. On TPM an additional strainer is located in one of the pump vacuum taps).
   b. Disconnect tubing then remove strainer from respective tap.
   c. Clean any debris from strainer and check strainer for damage.
   d. Using a suitable thread sealant (Loctite PST or equal) reinstall strainer.
   e. Reconnect tubing.

f. Test apparatus and check for leaks around strainer fittings

3. Place apparatus back in service.

Indicator Light Test

1. Operate component with indicator lights and observe the respective indicator lights. If the indicator light fails to light replace the bulb and test again.

Annual Maintenance

Annual maintenance consists of post-operation, weekly, and monthly maintenance. Maintenance for extreme conditions may also apply. In addition, the annual maintenance includes the following tasks.

- Gauge calibration check.
- Autolube® assembly oil level check: fill or replace with SAE EP 90 or 80W90 weight oil.
- Lubricating the power transfer cylinder, power shift cylinder, and shift control valve with air cylinder oil.
- Replacing the pump gearbox oil: use SAE EP 90 or 80W90 weight oil (GL-5 equivalent).
- Checking individual drain lines from the pump to the multi-drain to ensure proper drainage and protection from freezing.
- Running the yearly pump test to check performance levels. (See NFPA 1911 pamphlet for more details).
- Repacking the pump at three-year intervals.

Performance Testing Overview

The yearly standard performance test consists of checking the pumper, according to rating, at three capacities and comparing the results to when the pump was new. This provides some measure of performance deterioration, if any. For performance testing criteria refer to the latest version of NFPA 1911 pamphlet. Pumpers are rated at capacities of 500, 750, 1000, 1250, 1500, 1750, 2000, or 2250 GPM (1892, 2839, 3785, 4731, 5678, 6624, 7570, or 8516 LPM). See Table 3-1.

Performance Testing Equipment and Materials

To accurately test pumper performance, you will require a pitot gauge, a pump master pressure gauge, and a master vacuum gauge or manometer. ALL gauges must be carefully tested for accuracy. Gauge testing is appropriately accomplished with a dead weight gauge tester, which is usually available at the local water works.

Pumpers should be tested from draft at not over a 10-foot lift with 20 feet of suction hose. Pumpers rated at 1500 GPM and over often require two separate 20-foot lengths of suction hose and a lower lift height.

Use smooth bore test nozzles of accurate size with the pitot gauge. The volume pumped is then determined by reference to discharge tables for smooth nozzles. Refer to Table 3-2 for Nozzle Flow Rates. Preferably, nozzles will be used on a Siamese deluge gun for greatest accuracy. A stream straightener, just upstream of the nozzle is advisable.

The amount of discharge hoses required for the service tests is dependent on the flow requirements and capacity test point. The most common discharge hose used is 2-1/2 inches in diameter 100 feet long. The number of hoses and length should be sufficient to reduce nozzle pressure to between 30 and 85 PSIG (2 and 6 BAR). In general refer to the hose friction loss chart in Table 3-3 for a determination as to the friction loss in 100 feet of hose. Refer to Table 3-4 for suggested nozzle sizes for service testing of common size pumps.

TABLE 3-1.

		PUMP RATING GPM (LPM)							
CAPACITY	PRESSURE PSI (BAR)	**500**	**750**	**1000**	**1250**	**1500**	**1750**	**2000**	**2250**
FULL	150 (10)	500 (1892)	750 (2839)	1000 (3785)	1250 (4731)	1500 (5678)	1750 (6624)	2000 (7570	2250 (8516)
FULL	165 (11)	500 (1892)	750 (2839)	1000 (3785)	1250 (4731)	1500 (5678)	1750 (6624)	2000 (7570	2250 (8516)
70%	200 (13)	350 (1325)	525 (1987	700 (2650)	875 (3312)	1050 (3974)	1225 (4637)	1400 (5299)	1575 (5961)
50%	250 (17)	250 (946)	375 (1419)	500 (1893)	625 (2366)	750 (2839)	875 (3312)	1000 (3785)	1125 (4258)

TABLE 3-2.

NOZZLE	GPM AT VARIOUS NOZZLE SIZES							
PRESS	½"	5/8"	¾"	7/8"	1"	1 1/8"	1 ¼"	1 3/8"
30	41	64	92	125	163	206	254	308
35	44	69	99	135	176	222	275	332
40	47	73	106	144	188	238	294	355
45	50	78	112	153	199	252	311	377
50	53	82	118	161	210	266	328	397
55	55	86	124	169	220	279	344	417
60	58	90	130	176	230	291	360	435
62	58	91	132	179	234	296	366	442
64	59	93	134	182	238	301	371	449
66	60	94	136	185	241	305	377	456
68	61	96	138	188	245	310	383	463
70	62	97	140	190	248	315	388	470
72	63	99	142	193	252	319	394	477
74	64	100	144	196	255	323	399	483
76	65	101	146	198	259	328	405	490

TABLE 3-2. (Continued)

NOZZLE PRESS	GPM AT VARIOUS NOZZLE SIZES							
	½"	5/8"	¾"	7/8"	1"	1 1/8"	1 ¼"	1 3/8"
78	66	103	148	201	262	332	410	496
80	66	104	150	203	266	36	415	502
85	68	107	154	210	274	347	428	518
90	70	110	159	216	282	357	440	533
95	72	113	163	222	289	366	452	547
100	74	116	167	228	297	376	464	562
105	76	119	171	233	304	385	476	575
110	78	122	175	239	311	394	487	589
115	80	125	179	244	319	403	498	602
120	81	127	183	249	325	412	509	615

NOZZLE PRESS	GPM AT VARIOUS NOZZLE SIZES							
	1 ½"	1 5/8"	1 ¾"	1 7/8"	2"	2 1/4"	2 ½"	3"
30	366	430	498	572	651	824	1017	1464
35	395	464	538	618	703	890	1098	1581
40	423	496	575	660	751	951	1174	1691
45	448	525	610	700	797	1009	1245	1793
50	473	555	643	738	840	1063	1313	1890
55	496	582	675	774	881	1115	1377	1982
60	518	608	705	809	920	1165	1438	2071
62	526	618	716	822	935	1184	1462	2105
64	535	628	728	835	950	1203	1485	2138
66	543	637	739	848	965	1222	1508	2172
68	551	647	750	861	980	1240	1531	2204
70	559	656	761	874	994	1258	1553	2236

TABLE 3-2. (Continued)

NOZZLE PRESS	GPM AT VARIOUS NOZZLE SIZES							
	1 ½"	1 5/8"	1 ¾"	1 7/8"	2"	2 1/4"	2 ½"	3"
72	567	666	772	886	1008	1276	1575	2268
74	575	675	783	898	1022	1293	1597	2299
76	583	684	793	910	1036	1311	1618	2330
78	590	693	803	922	1049	1328	1639	2361
80	598	702	814	934	1063	1345	1660	2391
85	616	723	839	963	1095	1386	1711	2465
90	634	744	863	991	1127	1427	1761	2536
95	651	765	887	1018	1158	1466	1809	2605
100	668	784	910	1044	1188	1504	1856	2673
105	685	804	932	1070	1217	1541	1902	2739
110	701	823	954	1095	1246	1577	1947	2803
115	717	841	976	1120	1274	1613	1991	2867
120	732	859	997	1144	1301	1647	2034	2928

TABLE 3-3.

HOSE FRICTION LOSS (PSI PER 100 FEET)													
GPM Flowing	¾" Booster	1" Booster	1 1/2" Hose	GPM Flowing	1 ¾" Hose with 1 1/2" Couplings	2" Hose with 1 1/2" couplings	2 1/2" Hose	3" Hose with 2 1/2" Couplings	3" Hose	GPM Flowing	3 1/2" Hose	4" Hose	5" Hose
10	13.5	3.5		95	14	8				500	9.5	3	
20	44	6		125	24	13				750	20	11	5
30	99	14		150	35	18				1000	34	20	8
40	176	24	4	175	47	25	6			1250	53	31	13
50		38	7	200	62	32	8			1500	74	45	18
60		54	9	225			10			1750		61	25
70			12	250			13	5	4	2000			32
80			15	275			15						
95			22	300			18						
125			38	325			22	8					
150			54	350			25		8				
				500				20	17				
				750				45	38				
				1000				80	68				

NOTE: Add 5 PSI for each story of building and each wye or siamese. Friction Loss Calculations courtesy of IFSTA.

TABLE 3-4.

	SUGGESTED NOZZLE SIZE (INCHES)		
PUMP RATING	FULL CAPACITY	70% CAPACITY	50% CAPACITY
750	1-3/4	1-3/8	1-1/4
1000	2	1-5/8	1-3/8
1250	(2) 1-1/2 or 2-1/4	1-7/8	1-1/2
1500	(2) 1-3/4 or 2-1/4	2	1-3/4
1750	(2) 2	(2) 1-1/2 or 2-1/4	1-7/8
2000	(2) 2	(2) 1-3/4 or 2-1/4	2
2250	(2) 2-1/4	(2) 1-3/4 or 2-1/4	2

The following general guidelines should be used when testing the apparatus.

For 750 GPM (2839 LPM) test, two 2-1/2-inch lines should be laid from the pumper to the nozzle. For 1000 GPM (3785 LPM) test, three lines are required, and for the 1250 (4731 LPM) and 1500 GPM (5677 LPM) tests, four or more lines are required between the pumper and the nozzle. For 1750 (6624 LPM) and 2000 GPM (7570 LPM) tests four or more hose lines and two nozzles are required. For testing a 2250 GPM (8516 LPM) pumper up to six hose lines into two separate nozzles should be used.

Because deluge guns are not always available, other hose layouts may be used, such as one, 2 1/2-inch line to a 1-3/8-inch nozzle for 500 GPM (1892 LPM). Generally, the nozzle used on one, 2 1/2-inch line should not be larger than 1 1/2 inches for accuracy in measuring GPM (LPM). Another alternative when a deluge gun is not available consists of a 1 1/4 inch nozzle on one and a 1 1/2 inch nozzle on the other to pass 1000 GPM (3785 LPM). The sum of the flow from both nozzles is the GPM (LPM) delivered by the pump. For good pilot gauge accuracy, the nozzle pressures should be between 30 and 85 PSIG (2.1 and 5.8 BAR).

Because NFPA standards specify both GPM (LPM) and pressure, it is usually necessary to restrict the flow somewhat to build up the pump pressure. In normal pumping, this restriction would be caused by the friction loss in the lines. However, depending on line loss alone would require a large amount of hose for some tests. For example, testing a 500 GPM (1892 LPM) Class A pumper at 250 GPM (946 LPM) and 250 PSI (17.2 BAR) requires 72-PSI (5 BAR) nozzle pressure on a one-inch tip. To reduce the pressure from 250 PSI (17.2 BAR) at the pump to 72 PSI (5 BAR) at the nozzle would require approximately 1100 feet of 2 1/2-inch hose. Therefore, it is common practice to use 50 to 100 feet of hose and gate the discharge valves as required.

Performance Testing

Note that the NFPA standards require a 10 percent reserve in pressure at the capacity run when the apparatus is delivered.

1. Check the relief valve according to the Relief Valve Testing procedure under Weekly Maintenance.

2. Perform steps 1 and 2 of the Post Operation Maintenance procedures in this section.

3. Run the standard pump test in accordance with NFPA standards to check pump performance.

4. Run the engine for 20 to 30 minutes to stabilize the engine temperature. Then run the pump for 20 minutes at capacity, 10 minutes at 70 percent capacity, and 10 minutes at 50 percent capacity.

5. If the apparatus does not reach performance levels, refer to the Hale diagnostic/service chart (Section 4).

6. Compare the results of this test to those from when the apparatus was delivered. It maybe that the apparatus did not show the 10 percent reserve at delivery. If the apparatus

performance has dropped appreciably compared to its original performance, it needs to be serviced. (Apparatus test results should be on file with the delivery documents. If not, they may be obtained from the apparatus manufacturer or from the original certifying authority).

Repacking

Refer to figure 1-9 for a cross-section showing the packing arrangement and number of packing rings. The three rings adjacent to the packing gland can be replaced without disassembling the pump. The ring in front of the lantern does not need to be replaced. Repack the pump as follows.

⚠ WARNING

DO NOT RUN ENGINE WHILE MAKING PACKING ADJUSTMENT.

1. Loosen the packing nut lock.

2. Loosen the packing gland. If necessary, soak the threads with penetrating oil and work the nut back and fourth to loosen it. Loosen the adjusting gland just enough to remove the split glands. If the front part of the gland is of the split type, remove the two halves.

3. Remove the old packing rings with a packing hook. The hook can be made from a bent piece of stiff wire or small pointed rod. Another type of packing hook consists of a corkscrew on the end of a flexible shaft. Be sure to remove all shreds of old packing, and clean out the packing housing as much as possible.

4. Remove all old packing, dirt, and foreign matter from the bearing housing under the gland.

5. Repack using the Hale packing kit recommended for your particular pump. For most pumps, the packing is 7/16 inch square cut to the proper length. Wrap one length of packing around the shaft to form a ring, and push the ring into the packing housing. Install the second ring the same way, but stagger the joint one-third ofthe way around from the firstjoint. Put a foil separator between each packing ring. The foil separator must be cut tofit the shaft. Install the other rings, again staggering the joints.

6. Replace the gland and adjust it according to the Packing Gland Adjustment procedure in this section.

7. Operate the pump normally for about 15 minutes at 130 PSI (9 BAR), and check the packing gland. If necessary, adjust the packing nut again according to the Packing Gland Adjustment procedure in this section.

Annual MIV and 40BD Relief Valve Test and Adjustment

⚠ WARNING

NEVER SET RELIEF VALVE ABOVE HOSE MANUFACTURERS RATED WORKING PRESSURE. ALWAYS USE THE LOWEST POSSIBLE RELIEF VALVE SETTING TO ENHANCE OPERATOR AND EQUIPMENT SAFETY.

⚠ WARNING

PER NFPA 1962 REQUIREMENTS, LARGE DIAMETER HOSE MARKED “SUPPLY HOSE” 3-1/2 TO 5 INCHES (89 TO 127 MM) DIAMETER SHALL NOT BE USED AT OPERATING PRESSURES EXCEEDING 185 PSI (13 BAR).

⚠ WARNING

PER NFPA 1962 REQUIREMENTS, LARGE DIAMETER HOSE MARKED “SUPPLY HOSE” 6 INCHES (152 MM) DIAMETER SHALL NOT BE USED AT OPERATING PRESSURES EXCEEDING 135 PSI (9 BAR).

The 40BD MIV relief valve is factory set to open at 125 PSI (9 BAR). The relief valve can be adjusted to open from 75 to 250 PSI (5 to 17

BAR). Test and set relief valve as necessary using the following procedures and figure 3-1.

1. Open operator panel and gain access to the relief valve adjustment cap screw.

2. Make sure the valve is closed and install a pressure test cap on the suction tube or discharge fitting.

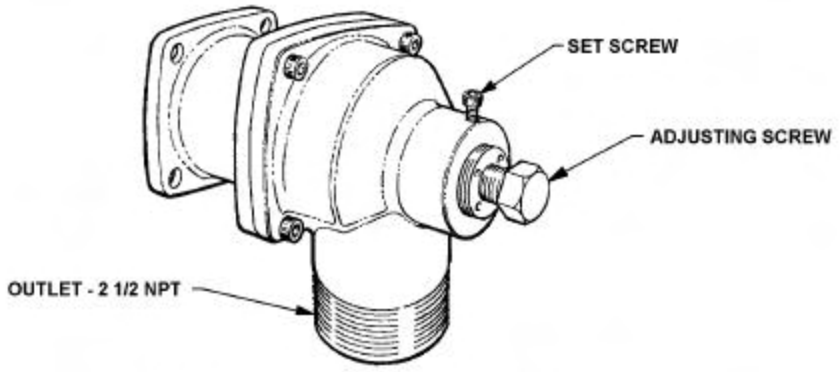


Figure 3-1. MIV/40BD Relief Valve Adjustment

3. Connect a pressurized water source or hydrostatic test pump and water supply to the pressure test cap fitting.

4. Open water supply valve and air bleed valve. Fill suction tube or discharge connection until water flows from air bleed. Close air bleed.

5. Pressurize to desired set pressure in accordance with the above warnings. Observe whether relief valve opens or remains closed at the desired pressured.

6. Using a 3/16 inch allen wrench loosen, BUT DO NOT REMOVE, the set screw that locks the pressure adjustment cap screw.

7. Using 7/8 inch open end wrench, turn pressure adjustment cap screw to set relief valve pressure (clockwise to increase opening pressure or counterclockwise to decrease opening pressure). Turn cap screw until relief valve just opens or closes.

   Once relief valve opens or closes turn pressure adjustment cap screw 1/4 turn in the clockwise (increase pressure) direction.

8. Lock the pressure setting by turning the adjustment locking screw until tight. Lock screw in place with Loctite #290 or equivalent.

9. Turn off water source and relieve pressure through the air bleeder allowing relief valve to reset.

10. Reenergize water source and return the pressure to the relief valve set point to verify valve-opening point. Repeat adjustment procedures as necessary to verify relief valve operation.

11. Open drain valve and drain water from suction tube or discharge connection.

12. Disconnect water supply and remove test cap from suction tube or discharge connection.

13. Close operator panel and return apparatus to normal ready condition.

Worn Clearance Rings and Impeller Hubs

Because clearance ring replacement requires pump disassembly, it is advisable to thoroughly check other possible causes (see Table 4-1) of low performance before assuming that clearance ring wear is at fault.

Clearance (that is, sealing) rings limit the internal bypass of water from the discharge side of the pump back to the suction. The radial clearance between the impeller hub and the clearance rings is only a few thousandths of an inch when new, effectively preventing a large bypass.

In clear water, the clearance rings continue to effectively seal for hundreds of hours of pumping. In dirty or sandy water, the impeller hub and clearance rings will wear faster than in clear water. The more the wear, the greater the bypass and the lower pump performance. Also, the greater the pressure at which each stage is operated, the larger will be the bypass and the more the performance will be lowered.

When new, the radial clearance between the impeller hubs and the clearance ring is from 0.005 to 0.007 inch per side. Any increase will allow more bypass and result in lower performance. But when the pump is adequately powered, it should not be necessary to replace clearance rings and impellers until the average radial clearance reaches 0.015 to 0.020 inch or more per side, as measured by a feeler gauge.

Often, replacement of the clearance rings is all that is necessary. This will largely reduce the bypass and restore the pump to near original performance. A complete restoration requires that oversize clearance rings be installed and the impeller turned or the impeller may also be replaced.

Anode Check

The zinc anodes should be inspected every 12 months. Replace when over 75% of the zinc has been consumed (Refer to figure 6-15 for original dimensions). Performance of the anode life will vary with water quality and pH. Anodes conform to MIL Spec A180001.

TRV Test

The TRV should be tested every 12 months. The following procedure should be used to test the TRV. Before testing, make sure a clear view is available to the TRV discharge.

⚠ CAUTION

DO NOT RUN PUMP FOR LONGER THAN IS SHOWN IN THE TABLE, AS OVERHEATING COULD OCCUR AND SERIOUS DAMAGE TO PUMP WILL RESULT.

1. Close all discharge valves including pump and engine coolers so there is no flow through the pump.

2. Use care that engine does not overheat, set the pump discharge pressure to one of the pressures listed.

PRESSURE	Time in Minutes	
	TRV120 TRVM120	TRV170 TRVM170
200 PSIG (13.8 Bar)	10	20
400 PSIG (27.6 Bar)	4	8
600 PSIG (41.4 Bar)	2	4

3. The thermal relief valve should discharge water through the 1/8 NPT or metric discharge line approximately within the time specified.

4. The table is for midship type pumps. The thermal relief valve will open faster on smaller pumps, dependent on how close it is to the impeller.

5. The table is based on 70°F (21°C) water and 70°F (21°C) air temperature. The thermal relief valve will open faster in hotter conditions and slower in cooler conditions.

6. Units equipped with TRV-L kit will flow up to 1-2 GPM (3-7 LPM) of water before lamp turns on.

If unit fails to open in time allotted, remove TRV in accordance with Procedures in Section 5.

Place TRV-120 on work area with inlet facing up. Pour water of 120°-130°F (66° to 72°C) into opening of TRV. Element should open allowing water to flow out, if valve does not open replace valve. For TRV-170, use water at 170° to 180° (77° to 82° C).

Refer to figure 3-2 for a service chart including recommended service points and intervals.

Midship Pump Maintenance Check List

Truck Manufacturer _____
Pump Model & Serial Number _____
Year _____ Unit# _____

RECOMMENDED WEEKLY PROCEDURES

- ❑ Test relief valve system or governor at 150, 200, 250 PSIG.
- ❑ Test transfer valve (if applicable).
- ❑ Test the priming system (check lubrication level in priming tank were installed).
- ❑ Lubricate all valves, discharge, suction, hose, drain, and multi-drain.
- ❑ Check pump shift warning indicator lights.

RECOMMENDED MONTHLY PROCEDURES	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Complete weekly checks												
Lubricate threads on PM relief valve panel control and check light												
Lubricate remote valve controls												
Check controlled packing leakage and adjust if necessary (8 to 10 drops per minute)												
Perform dry vacuum test*												
Check drive flange bolts to ensure tightness												
Lubricate suction tube threads												
Clean strainer												
Inspect gaskets												
Check oil level in pump gearbox; add oil if necessary												
If necessary, replace oil with SAE EP 90 oil												

**Per NFPA-1911, 22 inches Hg minimum vacuum: loss not to exceed 10 inches Hg vacuum in 5 minutes.*

RECOMMENDED ANNUAL PROCEDURES

- ❑ Complete all previous checks on all questions.
- ❑ Check gauge calibration.
- ❑ Check oil level in AutoLube® assembly (SAE-EP 90 or 80W-90); see operation and maintenance manual for details.
- ❑ Lubricate power transfer cylinder, power shift cylinder, and shift control valve with vacuum cylinder oil, if applicable.
- ❑ Change pump gearbox oil and refill (SAE-EP 90 oil or 80W-90).
- ❑ Check individual drain lines from pump to multi-drain to ensure proper drainage and protection from freezing.
- ❑ Lubricate transfer valve mechanism on two stage pumps. Dry moly spray is preferred.
- ❑ Run yearly standard pump test (per NFPA-1911) to check pump performance levels – chart provided below.
- ❑ Repacking of pump is recommended every two or three years.

NOTE: The above general recommendations are provided for normal use and conditions. Extreme conditions or variables may indicate a need for increased maintenance. Good preventative maintenance lengthens pump life and ensures greater dependability. Consult service or diagnostic chart in operator's manual for detailed information.

ANNUAL PUMP TEST RESULTS

	Capacity @ 150 PSI	70% Capacity @ 200 PSI	50% Capacity @ 250 PSI
Hose Layout			
Nozzle Size			
Nozzle Pressure			
Gallons Per Minute			
Pump Pressure Current Engine Speed			
Engine Speed from Original Test Documents			
Lift and Suction Hose Size and Number			

4. TROUBLESHOOTING

Table 4-1 lists the symptoms of some common problems and possible corrective measures. Before calling Hale or a Hale authorized parts service center for assistance, eliminate problem causes using Table 4-1. If you cannot correct a problem, please have the following information ready prior to calling the Hale Customer Service Technician Department for assistance. Customer Service Number: 610-825-6300.

- Pump Model and Serial Number
- Pump Configuration Information
- Observed Symptoms and Under What Conditions The Symptoms Occur

TABLE 4-1. HALE MIDSHIP PUMP TROUBLE ANALYSIS

CONDITION	POSSIBLE CAUSE	SUGGESTED CORRECTION
PUMP WILL NOT ENGAGE Standard transmission with Manual Pump Shift	Clutch not fully disengaged or malfunction in shift linkage	Check clutch disengagement. Drive shaft must come to a complete stop before attempting pump shift
Automatic Transmission with Manual Pump Shift	Automatic transmission not in neutral position	Repeat recommended shift procedures with transmission in neutral position
Standard Transmission with Power Shift System	Insufficient air supply in shift system Clutch not fully engaged or malfunction in shift linkage.	Repeat recommended shift procedures. Check system for loss of air supply. Check clutch disengagement. Drive shaft must come to a complete stop before attempting pump shift Turn the engine off and employ shift override procedures as follows: 1. Hole is provided in shift shaft to accomplish emergency shifting. 2. Complete shift of control in cab to neutral and proceed to complete shift of lower control manually.
Automatic Transmission With Power Shift System		Repeat recommended shift procedures with transmission in neutral position. Release braking system momentarily. Then reset and repeat recommended shifting procedures. Release braking system momentarily. Then reset and repeat recommended shifting procedures.

CONDITION	POSSIBLE CAUSE	SUGGESTED CORRECTION
Automatic Transmission With Power Shift System (continued)	Insufficient air in shift system	Repeat recommended shift procedures.
	Air leaks in shift system	Check system for loss of air. Check of leak in system. Employ manual override procedures if necessary. See Standard Transmission with Power Shift System. Attempt to locate and repair leak(s). Leakage, if external, may be detected audibly. Leakage could be internal and not as easily detected.

NOTICE

DO NOT LEAVE THE CAB AFTER PUMP SHIFTING UNLESS THE SHIFT INDICATOR LIGHT IS ON, OR A SPEEDOMETER READING IS NOTED.

CONDITION	POSSIBLE CAUSE	SUGGESTED CORRECTION
PUMP LOSES PRIME OR IT WILL NOT PRIME NOTE: Weekly priming pump operation is recommended to provide good operation.	Electric Priming System	No recommended engine speed is required to operate the electric primer, however, 1,000 engine RPM will maintain truck electrical system while providing enough speed for initial pumping operation
	Defective Priming System	Check priming system by performing "Dry Vacuum Test" per NFPA standards. If pump is tight, but primer pulls less than 22 inches of vacuum, it could indicate excessive wear in the primer.
	Suction lifts too high	Do not attempt lifts exceeding 22 feet except at low elevation.
	Blocked suction strainer	Remove obstruction from suction hose strainer.
	Suction connections	Clean and tighten all suction connections. Check suction hose and hose gaskets for possible defects.
	Primer not operated long enough.	Proper priming procedures should be followed. Do not release the primer control before assuring a complete prime. Open the discharge valve slowly during completion of prime to ensure same. NOTICE: Do not run the primer over 45 seconds. If prime is not achieved in 45 seconds, stop and look for causes (for example, air leaks or blocked suction).

CONDITION	POSSIBLE CAUSE	SUGGESTED CORRECTION
PUMP LOSES PRIME OR IT WILL NOT PRIME (CONTINUED)	Air Trap in Suction Line	Avoid placing any part of the suction hose higher than the suction intake. Suction hose should be laid with continuous decline to water supply. If trap in hose is unavoidable, repeated priming may be necessary to eliminate air pocket in suction hose.
	Pump Pressure too low when nozzle is opened	Prime the pump again and maintain higher pump pressure while opening discharge valve slowly.
	Air Leaks	Attempt to locate and correct air leaks using the following procedure. 1. Perform dry vacuum test on pump per NFPA standards with 22 inches minimum vacuum required with loss not to exceed 10 inches of vacuum in 5 minutes. 2. If a minimum of 22 inches of vacuum cannot be achieved, the priming device or system may be defective, or the leak is too big for the primer to overcome (such as an open valve). The loss of vacuum indicates leakage and could prevent priming or cause loss of prime. 3. Attempt above dry prime and shut off engine. Audible detection of a leak is often possible. 4. Connect the suction hose from the hydrant or the discharge of another pumper to pressurize the pump with water, and look for visible leakage and correct. A pressure of 100 PSI (6.9 BAR) should be sufficient. Do not exceed pressure limitations of pump, pump accessories, or piping connections. 5. Check pump packing during attempt to locate leakage. If leakage is in excess of recommendations, adjust accordingly following instructions in Section 3. 6. The suction side relief valve can leak. Plug the valve outlet connection and retest.

CONDITION	POSSIBLE CAUSE	SUGGESTED CORRECTION
INSUFFICIENT PUMP CAPACITY	Insufficient engine power	Engine power check or tune up may be required for peak engine and pump performance.
	Transfer Valve not in proper "Volume" position	**TWO STAGE PUMPS ONLY.** Place transfer valve in "Volume" position (parallel) when pumping more than 1/2 rated capacity. For pressure above 200 PSI (13.8 BAR), pump should be placed in "Pressure" (series) position.
	Relief Valve improperly set	If relief valve control is set for too low a pressure, it will allow relief valve to open and bypass water. Reset Relief Valve control per the procedures in Section 3. Other bypass lines (such as foam system or inline valves) may reduce pump capacity or pressure.
	Engine Governor set incorrectly	Engine governor, if set too low a pressure when on automatic, will decelerate engine speed before desired pressure is achieved. Reset the governor per manufacturer's procedures.
	Truck transmission in wrong gear or clutch is slipping	Recheck the pumping procedure for the recommended transmission or gear range; see Section 3 for assistance. Use mechanical speed counter on the pump panel to check speed against possible clutch or transmission slipping or inaccurate tachometer. (Check the truck manual for the proper speed counter ratio).
	Air Leaks	See air leaks under **"PUMP LOSES PRIME OR WILL NOT PRIME".**
INSUFFICENT PRESSURE	Check similar causes for insufficient capacity	Recheck pumping procedure for recommended transmission gear or range. Use mechanical speed counter on pump panel to check actual speed against possible clutch or transmission slippage or inaccurate tachometer. (Check the truck manual for proper speed counter ratio).
	Transfer Valve not in "Pressure" position	**TWO STAGE PUMPS ONLY.** For desired pump pressure above 200 PSI (13.8 BAR), transfer valve should be in "Pressure" position.

CONDITION	POSSIBLE CAUSE	SUGGESTED CORRECTION
LEAK AT PUMP PACKING	Packing out of adjustment or worn.	Adjust the packing per the procedure in Section 3 of this manual (8 to 10 drops per minute leakage at 150 PSI (10 BAR) preferred). Replace pump packing per Section 3 of this manual. Packing replacement is recommended every 2 or 3 years depending on usage.
REMOTE CONTROL DIFFICULT TO OPERATE	Lack of lubrication	Lubricate the remote control linkages and collar with oil.
ENGINE SPEEDS TOO HIGH FOR REQUIRED CAPACTICTY OR PRESSURE	Truck transmission in wrong range or gear	Check recommended procedures for correct transmission selection; see Section 3 and truck manual.
	Lift too high, suction hose too small	Higher than normal lift (10 feet) will cause higher engine speeds, high vacuum and rough operation. Use larger suction hose.
	Defective suction hose	Inner line of suction hose may collapse when drafting and is usually undetectable. Try a different suction hose on same pump; test for comparison against original hose.
	Blockage of suction hose entry	Clean suction hose strainer of obstruction and follow recommended practices for laying suction hose. Keep off the bottom of the water supply but a least 2 feet below the surface of the water.
	Worn pump impeller(s) and clearance rings	Installation of new parts required.
	Impeller blockage	Blockage in the impeller can prevent loss of both capacity and pressure. Back flushing of pumps from discharge to suction may free blockage. Removal of one half of the pump body may be required (this is considered a major repair).
RELIEF VALVE DOES NOT RELIEVE PRESSURE WHEN VALVES ARE CLOSED	Incorrect setting of Control (Pilot) Valve	Check and repeat proper procedures for setting relief valve system. (see Section 3)
	Relief Valve inoperative	Possibly in need of lubrication. Remove relief valve from pump; dismantle; clean and lubricate. Weekly use of the Relief Valve is recommended.

CONDITION	POSSIBLE CAUSE	SUGGESTED CORRECTION
RELIEF VALVE DOES NOT RECOVER AND RETURN TO ORGINAL PRESSURE SETTING AFTER OPENING VALVES	Dirt in system causing sticky or slow reaction	Relief valve dirty or sticky. Follow instructions for disassembling, cleaning, and lubricating. Blocked relief valve. Clean the valve with a small wire or straightened paper clip.
RELIEF VALVE OPENS WHEN CONTROL VALVE IS LOCKED OUT	Drain hole in housing, piston, or sensing valve blocked	Clean the hole with a small wire or straightened paper clip. Dismantle and clean the sensing valve.
UNABLE TO OBTAIN PROPER SETTING ON RELIEF VALVE	Wrong procedure Blocked strainer Foreign matter in the Control Valve Hunting condition	Check instruction for setting the relief valve and reset. Check and clean the strainer in the supply line from the pump discharge to the control valve. Check the truck manual for the exact location. Check and clean tubing lines related to the relief valve and control valve. Remove the control valve and clean. Insufficient water supply coming from the pump to the control valve. Check the strainer in the Relief Valve system. Remove the control valve and clean.
WATER IN PUMP GEARBOX	Leak coming from above pump	Check all piping connections and tank overflow for possible spillage falling directly on the pump gearbox. Follow the procedures in Section 3 of this manual for adjustment or replacement of packing. Excess packing leakage permits the flushing of water over the gearbox casing to the input shaft area. Induction of this excessive water may occur through the oil seal or speedometer connection. If mechanical seal is installed, there should be no leaks. Inspect the oil seal and replace if necessary.
DISCHARGE VALVES DIFFICULT TO OPERATE	Lack of lubrication Valve in need of more clearance	Recommended weekly lubrication of discharge and suction valve, use a good grade of petroleum base or silicone grease. Add gasket to the valve cover per the truck manual. Multi-gasket design allows additional gaskets for more clearance and free operation. NOTE: Addition of too many gaskets to the valve will permit leakage.

Atmospheric Pressure	Pressure caused by the elevation of air above the earth.
Auxiliary Cooling Valve	Permits water from a pump to cool the radiator water through a heat exchange.
Capacity	Pump flow rating.
Cavitation	Caused by the pump attempting to deliver more water than is being supplied. This causes the formation of water vapor, and liquid water, under pressure, rushes in to fill the empty space. This damages the pump.
Centrifugal Force	Force that tends to make rotating bodies move away from the center of rotation.
Centrifugal Pump	A pump that uses a rapidly spinning disk to create the pressure for water movement.
Certification	Pumper test in accordance with NFPA standards to determine if a pump can deliver its rated volume and pressure.
Check valve	In two stage pumps, there are two swing check or flap valves in the suction passage of the second stage. They are located in each side of the pump between the suction tube and the pump body. These valves swing open when pumping in parallel for volume. They are closed by first stage pressure when pumping in series for pressure.
Clearance Rings	Prevent discharge water from returning to the eye of the impeller.
Compound Gauge	A compound gauge is graduated to read pressure in pounds per square inch and vacuum in inches of mercury.
Double Suction Impeller	Water enters on both sides of the impeller.
Dry prime Test	Provides information on the ability of a pump to evacuate air and draft water.
Eye, Impeller	Point where water enters the impeller.
Flow Meter	Measures the volume of water flowing.
Friction Loss	Loss of pressure in hose, fittings, standpipes, and other appliances because of the resistance between the water molecules and the inside surfaces of hoses, fittings, standpipes, and other appliances.
Front-mount Pump	Pump mounted ahead of the engine.

Gauge Pressure	Pressure read from a gauge (PSIG).
Governor	Minimizes pressure changes by controlling engine speed.
Horsepower	A measure of mechanical work.
Impeller	The working part of a centrifugal pump that, when rotating, imparts energy to water. Essentially, an impeller consists of two disks separated by curved vanes. The vanes force the water to move outward between the disks so that it is thrown outward at high velocity by centrifugal force.
Net Pump Pressure	The difference in pressure between discharge and suction pressure.
Packing	Material that maintains an airtight seal at point where the impeller shaft enters and exits the pump body.
Parallel	Capacity position in which each impeller on a two-stage pump works independently into the discharge.
Pitot Gauge	Measures velocity head at the discharge of a nozzle.
Positive Displacement Pump	A pump with a fixed flow delivered to the discharge with each revolution.
Positive Pressure	Pressure above atmospheric.
Power Valve	A valve that uses hydraulic pressure to transfer pump operation from volume to transfer pressure and vice area.
Pressure	Force per unit area.
Pressure Gauge	The pressure gauge is usually graduated in pounds per square inch only. It is connected to the pump discharge manifold, thus indicating pump discharge pressure.
Priming	Priming evacuates the air from the main pump and suction hose, thus creating a vacuum. This allows atmospheric pressure on the source of water to push the water up into the suction hose and pump.
Priming Pump	A positive displacement pump that creates a vacuum to prime the main pump.
Priming Valve	A valve located in the priming line between the priming pump and the main pump. It remains closed at all times except when priming. Thecontrol is located on the pump panel.

Pump Shift	A midship pump is usually mounted with a split gearbox installed in the drive shaft. The pump shift moves a sliding gear in the gearbox that transmits power either to the pump or the rear axle. In road position, power is transmitted to the rear axle for driving; in pump position, the rear axle is disconnected, and power is transmitted to the pump shaft.
Relay	Movement of water from apparatus at a water source to additional apparatus until water Reaches the fire ground.
Relief Valve	An automatic valve which, when activated by the relief valve control, will hold pump pressure steady when discharge valves or shutoff nozzles are closed. The valve maintains its given pressure by dumping the pump discharge flow into the pump suction.
Relief Valve Control	A handwheel adjustment valve which, set to control the desired pressure, will control the relief valve to maintain the working pressure.
Series	Pressure position in which the first impeller's discharge is fed to the eye of the second Impeller in a two-stage pump which then discharges the water from the pump.
Service Test	Pump test performed to determine if the apparatus can deliver its rated volume and pressure.
Shrouds	Sides of an impeller that confine the water.
Slinger Ring	Prevents water from continuing to travel down a shaft to the gears and ball bearings.
Stages	The number of impellers in a pump that are used in series; that is, one following another in terms of flow. Each impeller develops part of the total pump pressure.
Tachometer	Indicates the speed of the engine crankshaft in revolutions per minute.
Torque	The force that acts to produce rotation.
Transfer Valve	A two-position valve in a pump that changes the operation from parallel (volume) to series (pressure) operation and vice versa (not used on single stage pumps).
Vanes	Guides inside an impeller that direct water to the volute.
Volute	Gradually increasing discharge waterway.
Water Horsepower	Amount of work that a pump can perform.
Wear Rings	See Clearance rings.

HALE Products

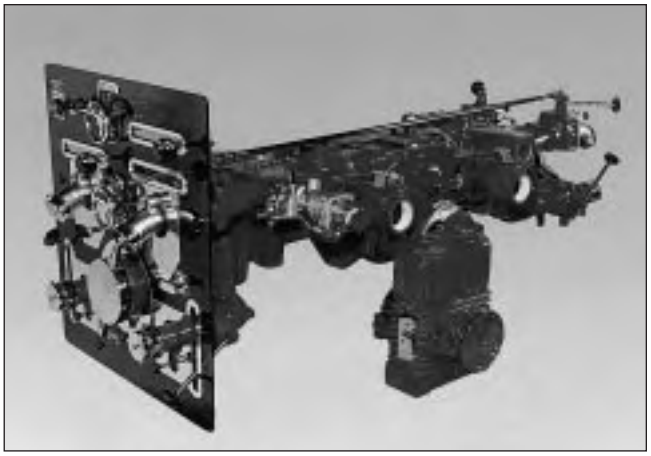
Pro-Tech

MAXIMUM WARRANTY

Let Us Put Out A Few Fires For You.

IDEX CORPORATION

Fighting Fires Is Your Business. Looking Out For Your Pump Is Ours.



Few things in life are more reliable than your new Hale midship pump. We do our best to keep it that way, too, with our standard two-year/2,000-hour warranty.

Now we're going ourselves one better, with an extended warranty that can keep your Hale midship pump covered for up to five whole years.

We call it the Pro•Tech Maximum Warranty. It's an exceptional value in long-term protection and peace of mind.

Buy More, Pay Less.

With the Pro•Tech Maximum Warranty, you can choose your own coverage in one-year increments. And the longer your coverage, the lower your annual cost.

You can buy one year for $350, two years for $675, or three years for $1,000.

Whichever term you choose, you'll get the same coverage that makes our standard warranty great — and lots more time to make the most of it. (For details, check the actual Limited Warranty text on the next page.)

There's A Sixty-Day Deadline.

Strong as the Pro•Tech Maximum Warranty is, it's only as good as your commitment to maintaining and caring for your new Hale pump. So we must ask you to begin that process by committing to an extended warranty within sixty days of placing your new pump in service.

Just complete the form on the opposite page, tear it off, fold it as indicated, and return it to us with your check. Keep the upper portion for your records.

And if you have any questions, please feel free to call us at 610/825-6300 — and ask for our Warranty Department.

Warranty Coverage

Standard, No-Charge Warranty	Two Years/2,000 Hours
Extended Warranty Plans	One Year/1,000 Hours Two Years/2,000 Hours Three Years/3,000 Hours
Total Available	Five Years/5,000 Hours

Keep This Portion For Your Records.

Pump Model #:_____

Pump Serial #: _____

Dealer Purchased From: _____

Date: _____

Apparatus Manufacturer: _____

Date Placed In Service:_____

Express Warranty: In addition to the standard two-year/2,000-hour limited warranty provided at no charge, Hale Products, Inc. ("Hale") hereby warrants to the original buyer that split-shaft midship type pumps manufactured by it are free of defects in material and workmanship for the additional warranty period selected. The extended warranty period commences two (2) years after the date the Product is first placed in service — that is, upon the date on which the standard warranty expires. The length of the extended warranty period (one year/1,000 hours, two years/2,000 hours, or three years/3,000 hours) shall be as selected and purchased by the original buyer of the product.

Limitations: Hale's obligation is expressly conditioned on the Product being

- Subjected to normal use and service;
- Properly maintained in accordance with Hale's Instruction Manual and the Hale Midship Recommended Maintenance List as to recommended services and procedures (documentation may be required);
- Not damaged due to abuse, misuse, negligence or accidental causes;
- Not altered, modified, serviced (non-routine) or repaired other than by an Authorized Service Facility;
- Manufactured per design and specifications submitted by the original Buyer.

(Continued on other side.)

HALE Products

Pro-Tech MAXIMUM WARRANTY

Midship Pump Registration Form

Complete and return (with your check payable to Hale Products, Inc.) to the address below.

Equipment Description

Pump Model #: _____

Pump Serial #: _____

Dealer Purchased From: _____

Dealer Salesman: _____

Date: _____

Apparatus Manufacturer: _____

Engine Model: _____

Transmission Model: _____

Date Placed In Service: _____

Vehicle Type (check one):

☐ Pumper ☐ Aerial ☐ Tanker

☐ Tanker Pumper ☐ Mini Pumper ☐ Rescue Pumper

Purchasing Company/Department

Name: _____

Street: _____

City: _____ County: _____

State: _____ Country: _____

Zip/Postal Code: _____

Authorized Signature: _____

Today's Date: _____

Extended Warranty Period/Payment Enclosed (check one):

■ Two years/2,000 hours — No Charge

☐ Additional One year/1,000 hours — $350

☐ Additional Two years/2,000 hours — $675

☐ Additional Three years/3,000 hours — $1,000

HALE PRODUCTS, INC. • 700 Spring Mill Avenue • Conshohocken, PA 19428

(Continued from other side.)

THIS EXPRESS LIMITED WARRANTY IS EXCLUSIVE. NO OTHER EXPRESS WARRANTIES ARE MADE. SPECIFICALLY EXCLUDED ARE ANY IMPLIED WARRANTIES, INCLUDING WITHOUT LIMITATION, THE IMPLIED WARRANTIES OF MERCHANTABILITY; FITNESS FOR A PARTICULAR PURPOSE OR USE; QUALITY; COURSE OF DEALING; USAGE OF TRADE; OR PATENT INFRINGEMENT FOR A PRODUCT MANUFACTURED TO ORIGINAL BUYER'S DESIGN AND SPECIFICATIONS.

Exclusive Remedies: If Buyer promptly notifies Hale upon discovery of any such defect (within the Warranty Period), the following terms shall apply:

- Any notice to Hale must be in writing, identifying the Product (or component) claimed defective and circumstances surrounding its failure;
- Hale reserves the right to physically inspect the Product and require Buyer to return same to Hale's plant or other Authorized Service Facility;
- In such event, Hale will provide a Returned Goods Authorization and Buyer must return the Product F.O.B. within thirty (30) days thereof;
- If determined defective, Hale shall, at its option, repair or replace the Product, or refund the purchase price (less allowance for depreciation);
- Absent proper notice within the Warranty Period, Hale shall have no further liability or obligation to Buyer therefore.

THE REMEDIES PROVIDED ARE THE SOLE AND EXCLUSIVE REMEDIES AVAILABLE. IN NO EVENT SHALL HALE BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES INCLUDING, WITHOUT LIMITATION, LOSS OF LIFE; PERSONAL INJURY; DAMAGE TO REAL OR PERSONAL PROPERTY DUE TO WATER OR FIRE; LOSS OF TIME OR USE OF THE PRODUCT; INCONVENIENCE; TRADE OR OTHER COMMERCIAL LOSSES ARISING, DIRECTLY OR INDIRECTLY, OUT OF THE PRODUCT FAILURE.

Hale Products, Inc.

700 Spring Mill Ave.
Conshohocken, PA 19428

TEL: (610) 825-6300
FAX: (610) 825-6440

HALE PRODUCTS INC. ISO 9001 Certificate A4026

HALE PRODUCTS INC. *A Unit of Idex Corporation*

700 Spring Mill Ave. • Conshohocken, PA • USA • 19428
TEL: (610) 825-6300 • FAX: (610) 825-6440

HALE Products

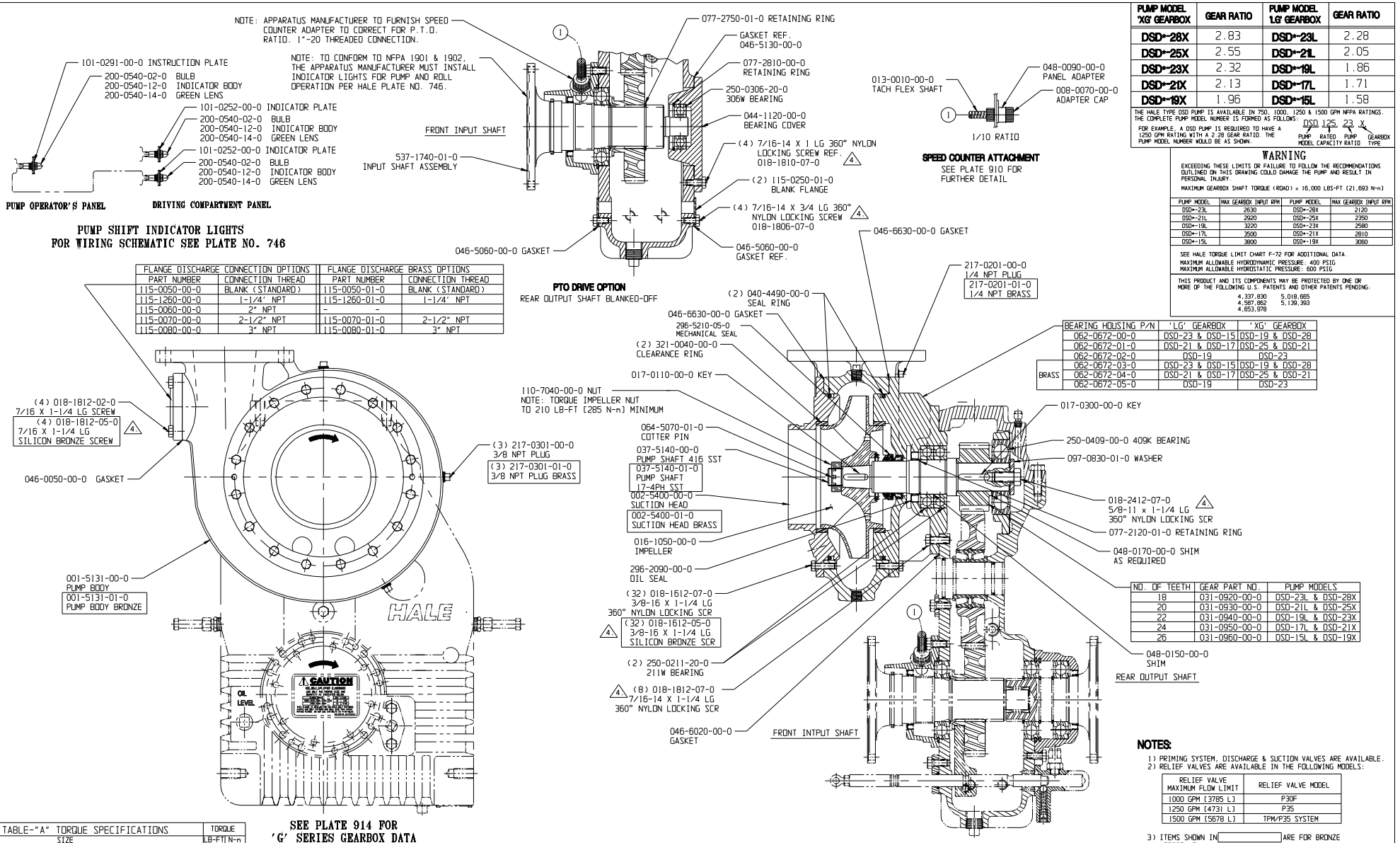
Printed in U.S.A.

Bulletin #539 Rev. 3, 02/00

IDEX CORPORATION

HALE TYPE DSD SERIES PUMP
WITH "G" SERIES GEARBOX

PLATE NO. 789AC



FLANGE DISCHARGE CONNECTION OPTIONS		FLANGE DISCHARGE BRASS OPTIONS	
PART NUMBER	CONNECTION THREAD	PART NUMBER	CONNECTION THREAD
115-0050-00-0	BLANK (STANDARD)	115-0050-01-0	BLANK (STANDARD)
115-1260-00-0	1-1/4" NPT	115-1260-01-0	1-1/4" NPT
115-0060-00-0	2" NPT	-	-
115-0070-00-0	2-1/2" NPT	115-0070-01-0	2-1/2" NPT
115-0080-00-0	3" NPT	115-0080-01-0	3" NPT

BEARING HOUSING P/N		'LG' GEARBOX	'XG' GEARBOX
062-0672-00-0		DSD-23 & DSD-15	DSD-19 & DSD-28
062-0672-01-0		DSD-21 & DSD-17	DSD-25 & DSD-21
062-0672-02-0		DSD-19	DSD-23
062-0672-03-0	BRASS	DSD-23 & DSD-15	DSD-19 & DSD-28
062-0672-04-0	BRASS	DSD-21 & DSD-17	DSD-25 & DSD-21
062-0672-05-0	BRASS	DSD-19	DSD-23

NO. OF TEETH	GEAR PART NO.	PUMP MODELS
18	031-0920-00-0	DSD-23L & DSD-28X
20	031-0930-00-0	DSD-21L & DSD-25X
22	031-0940-00-0	DSD-19L & DSD-23X
24	031-0950-00-0	DSD-17L & DSD-21X
26	031-0960-00-0	DSD-15L & DSD-19X

TABLE-"A" TORQUE SPECIFICATIONS	TORQUE	
SIZE	LB-FT	N-m
3/8-16 (360° NYLON LOCK) CARBON STEEL SAE GRADE 5	30	30
3/8-16 SILICON BRONZE	18	24
7/16-14 CARBON STEEL SAE GRADE 5	50	68
7/16-14 SILICON BRONZE	29	39
5/8-11 CARBON STEEL SAE GRADE 5	150	203
5/8-11 SILICON BRONZE	85	115

SEE PLATE 914 FOR 'G' SERIES GEARBOX DATA

PUMP MODEL 'XG' GEARBOX	GEAR RATIO	PUMP MODEL 'LG' GEARBOX	GEAR RATIO
DSD**-28X	2.83	DSD**-23L	2.28
DSD**-25X	2.55	DSD**-21L	2.05
DSD**-23X	2.32	DSD**-19L	1.86
DSD**-21X	2.13	DSD**-17L	1.71
DSD**-19X	1.96	DSD**-15L	1.58

THE HALE TYPE DSD PUMP IS AVAILABLE IN 750, 1000, 1250 & 1500 GPM NFPA RATINGS. THE COMPLETE PUMP MODEL NUMBER IS FORMED AS FOLLOWS: DSD 125 23 X

FOR EXAMPLE, A DSD PUMP IS REQUIRED TO HAVE A 1250 GPM RATING WITH A 2.28 GEAR RATIO. THE PUMP MODEL NUMBER WOULD BE AS SHOWN.

PUMP MODEL | RATED PUMP CAPACITY | GEARBOX RATIO | TYPE

WARNING

EXCEEDING THESE LIMITS OR FAILURE TO FOLLOW THE RECOMMENDATIONS OUTLINED ON THIS DRAWING COULD DAMAGE THE PUMP AND RESULT IN PERSONAL INJURY.

MAXIMUM GEARBOX SHAFT TORQUE (ROAD) = 16,000 LBS-FT (21,693 N-m)

PUMP MODEL	MAX GEARBOX INPUT RPM	PUMP MODEL	MAX GEARBOX INPUT RPM
DSD**-23L	2630	DSD**-28X	2120
DSD**-21L	2920	DSD**-25X	2350
DSD**-19L	3220	DSD**-23X	2580
DSD**-17L	3500	DSD**-21X	2810
DSD**-15L	3800	DSD**-19X	3060

SEE HALE TORQUE LIMIT CHART F-72 FOR ADDITIONAL DATA.
MAXIMUM ALLOWABLE HYDRODYNAMIC PRESSURE: 400 PSIG
MAXIMUM ALLOWABLE HYDROSTATIC PRESSURE: 600 PSIG

THIS PRODUCT AND ITS COMPONENTS MAY BE PROTECTED BY ONE OR MORE OF THE FOLLOWING U.S. PATENTS AND OTHER PATENTS PENDING:
4,337,830 5,018,665
4,587,862 5,139,393
4,653,978

NOTES:

1) PRIMING SYSTEM, DISCHARGE & SUCTION VALVES ARE AVAILABLE.
2) RELIEF VALVES ARE AVAILABLE IN THE FOLLOWING MODELS:

RELIEF VALVE MAXIMUM FLOW LIMIT	RELIEF VALVE MODEL
1000 GPM [3785 L]	P30F
1250 GPM [4731 L]	P35
1500 GPM [5678 L]	TPM/P35 SYSTEM

3) ITEMS SHOWN IN [ ] ARE FOR BRONZE VERSION ONLY.

(4) FOR ALL TORQUE SPECIFICATIONS REFERENCE TABLE- "A"

01-210	C	ADDED SHIM 048-0170-00-0/ AND BRONZE VERSION PARTS	TC	4-26-01	MAL	
01-041	B	ADDED DESCRIPTIONS REMOVED IMPELLERS 016-5120-00-0 & 016-5410-00-0	JBS	01-23-01	MAL	
99-211	A	RELEASE TO PRODUCTION	DPL	8-6-99	RET	
ECO NO	REV	CHANGED FROM	BY	DATE	APVD	

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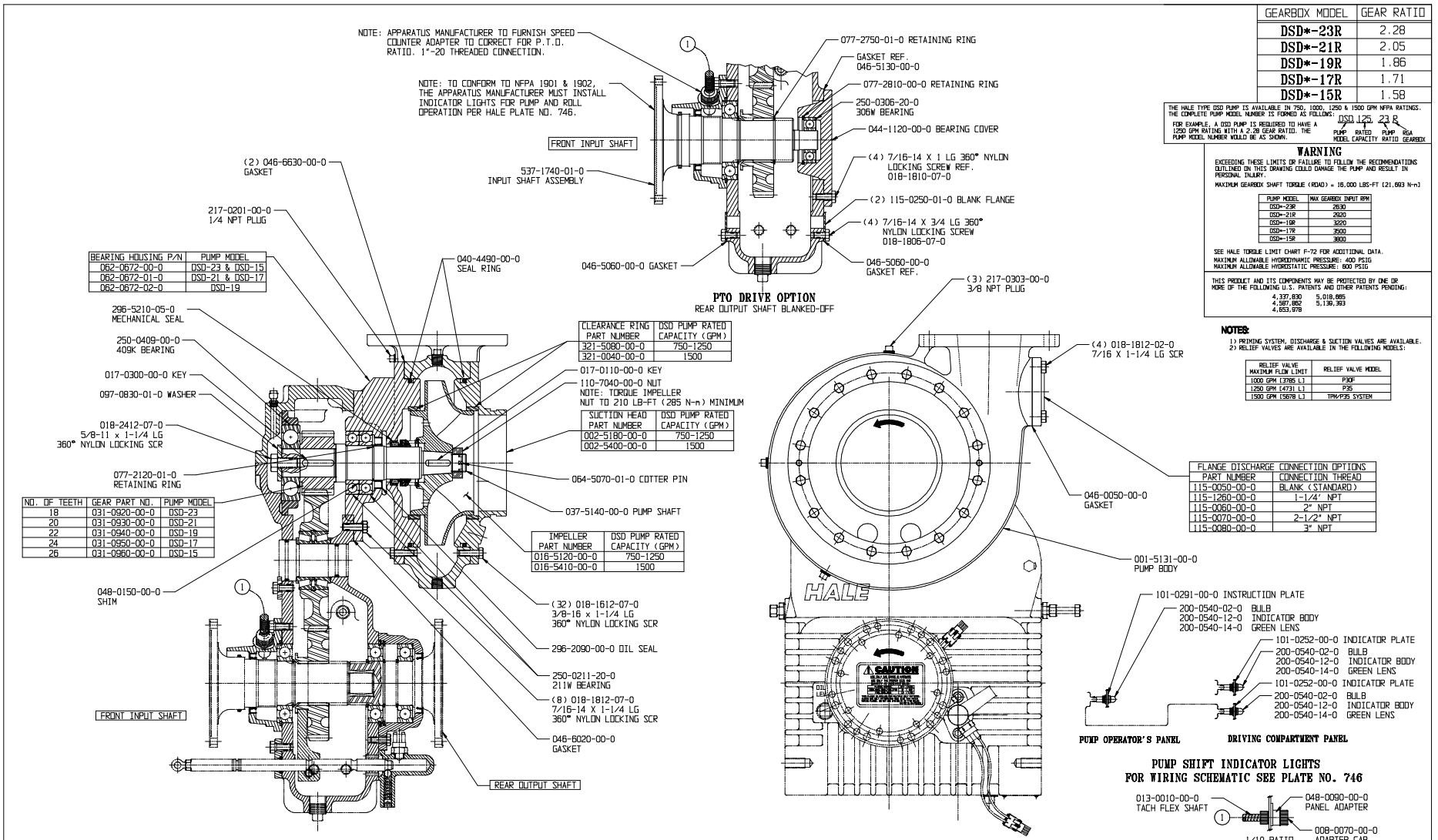
A Unit of IDEX Corporation
Conshohocken, PA 19428 USA

DRAWN DPL | CHECKED MD | DATE 8-6-99 | SIZE D | SCALE: .25



GEARBOX MODEL	GEAR RATIO
DSD*-23R	2.28
DSD*-21R	2.05
DSD*-19R	1.86
DSD*-17R	1.71
DSD*-15R	1.58

THE HALE TYPE DSD PUMP IS AVAILABLE IN 750, 1000, 1250 & 1500 GPM NFPA RATINGS. THE COMPLETE PUMP MODEL NUMBER IS FORMED AS FOLLOWS: DSD 125 23 R (PUMP MODEL, RATED CAPACITY, RATIO, GEARBOX)

FOR EXAMPLE, A DSD PUMP IS REQUIRED TO HAVE A 1250 GPM RATING WITH A 2.28 GEAR RATIO. THE PUMP MODEL NUMBER WOULD BE AS SHOWN.

WARNING

EXCEEDING THESE LIMITS OR FAILURE TO FOLLOW THE RECOMMENDATIONS OUTLINED ON THIS DRAWING COULD DAMAGE THE PUMP AND RESULT IN PERSONAL INJURY.

MAXIMUM GEARBOX SHAFT TORQUE (ROAD) = 16,000 LBS-FT (21,693 N-m)

PUMP MODEL	MAX GEARBOX INPUT RPM
DSD*-23R	2630
DSD*-21R	2920
DSD*-19R	3520
DSD*-17R	3900
DSD*-15R	3800

SEE HALE TORQUE LIMIT CHART F-72 FOR ADDITIONAL DATA.
MAXIMUM ALLOWABLE HYDRODYNAMIC PRESSURE: 400 PSIG
MAXIMUM ALLOWABLE HYDROSTATIC PRESSURE: 600 PSIG

THIS PRODUCT AND ITS COMPONENTS MAY BE PROTECTED BY ONE OR MORE OF THE FOLLOWING U.S. PATENTS AND OTHER PATENTS PENDING:
4,337,030 5,018,885
4,567,862 5,136,393
4,653,378

NOTES:
1) PRIMING SYSTEM, DISCHARGE & SUCTION VALVES ARE AVAILABLE.
2) RELIEF VALVES ARE AVAILABLE IN THE FOLLOWING MODELS:

RELIEF VALVE MAXIMUM FLOW LIMIT	RELIEF VALVE MODEL
1000 GPM (3785 L)	P30F
1250 GPM (4731 L)	P35
1500 GPM (5678 L)	TPM/P35 SYSTEM

BEARING HOUSING P/N	PUMP MODEL
062-0672-00-0	DSD-23 & DSD-15
062-0672-01-0	DSD-21 & DSD-17
062-0672-02-0	DSD-19

CLEARANCE RING PART NUMBER	DSD PUMP RATED CAPACITY (GPM)
321-5080-00-0	750-1250
321-0040-00-0	1500

SUCTION HEAD PART NUMBER	DSD PUMP RATED CAPACITY (GPM)
002-5180-00-0	750-1250
002-5400-00-0	1500

IMPELLER PART NUMBER	DSD PUMP RATED CAPACITY (GPM)
016-5120-00-0	750-1250
016-5410-00-0	1500

NO. OF TEETH	GEAR PART NO.	PUMP MODEL
18	031-0920-00-0	DSD-23
20	031-0930-00-0	DSD-21
22	031-0940-00-0	DSD-19
24	031-0950-00-0	DSD-17
26	031-0960-00-0	DSD-15

FLANGE DISCHARGE CONNECTION OPTIONS	
PART NUMBER	CONNECTION THREAD
115-0050-00-0	BLANK (STANDARD)
115-1260-00-0	1-1/4" NPT
115-0060-00-0	2" NPT
115-0070-00-0	2-1/2" NPT
115-0080-00-0	3" NPT

HALE TYPE DSD SERIES PUMP
WITH "RG" GEARBOX

PLATE NO. 790AB

ECO NO	REV	CHANGED FROM	BY	DATE	APVD
01-041	B	ADDED PART DESCRIPTIONS, DSD-5180-00-0 & 301-5080-00-0, REVISED DSD-1060-00-0	JBS	01-23-01	MAL
99-211	A	RELEASE TO PRODUCTION	DL	8-6-99	RET

HALE PRODUCTS, INC.
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Conshohocken, PA 19428 USA

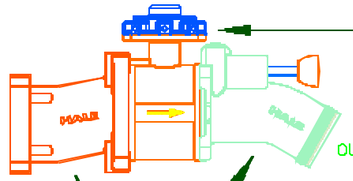
DRAWN DPL | CHECKED MD | DATE 9-6-99 | SIZE D | SCALE: .25

NOTE:

1. ARROW ON VALVE BODY INDICATES DIRECTION OF WATER FLOW THROUGH VALVE.
2. P/N 725-1415-10-0 SHOWN
3. LEVER/HANDLE SHIPPED LOOSE
4. "*" - IMPLIES VALVE WILL BE SUPPLIED WITH HALE STANDARD PUSH/PULL DRAIN ACTUATOR.

SVS STAINLESS VALVE SYSTEM OPTIONS

DISCHARGE ASSEMBLY
725-1415-10-0 SHOWN



"SSS" VALVE SIZE
715= 1.5 INCH
720= 2.0 INCH
725= 2.5 INCH
726= 2.5 INCH INTAKE
730= 3.0 INCH
731= 3.0 INCH INTAKE

SSS-XXYY-ZZ-A

"XX" VALVE INLET ADAPTER	AVAILABLE SIZES 1½" 715	2" 720	2½" 725 726	3" 730 731
00= NO ADAPTER				
01= NPT THREADS	●	●	●	●
02= 115 PUMP MT. ADAPTER	●	●	●	●
03= 115 X 90° PUMP MT 70/72				●
04= 115 X 90° PUMP MT 74/76				●
05= 2433 ADAPTER		●	●	●
06= 2433A ADAPTER		●	●	●
07= 115A ADAPTER				●
08= VICTAULIC W/DRAIN	●	●	●	●
11= WELD FLANGE	●	●	●	●
12= ISO FLANGE	●	●	●	●
13= OFFSET ADAPTER 70/72 DOWN				●
14= OFFSET ADAPTER 70/72 UP				●
16= NPT W/DRAIN	●	●	●	●
17= *SUCTION COVER W/SWIVEL R				●
18= *SUCTION COVER W/SWIVEL L				●
19= *SUCTION COVER W/O SWIVEL R				●
20= *SUCTION COVER W/O SWIVEL L				●
21= OFFSET ADAPTER 74/76 DOWN				●
22= OFFSET ADAPTER 74/76 UP				●
24= TANK HOSE BARB				●
26= SUCTION COVER W/SWIVEL R				●
27= SUCTION COVER W/SWIVEL L				●
28= SUCTION COVER W/O SWIVEL R				●
29= SUCTION COVER W/O SWIVEL L				●

VALVE OUTLET ADAPTER	AVAILABLE SIZES 1½" 715	2" 720	2½" 725 726	3" 730 731
00= NO ADAPTER				
01= NPT THREADS	●	●	●	●
02= 115 PUMP MT. ADAPTER	●	●	●	●
03= 115 X 90° PUMP MT 70/72				●
04= 115 X 90° PUMP MT 74/76				●
05= 2433 ADAPTER		●	●	●
06= 2433A ADAPTER		●	●	●
07= 115A ADAPTER				●
08= VICTAULIC W/DRAIN	●	●	●	●
09= VICTAULIC 45° SWIVEL	●	●	●	●
10= VICTAULIC 90° SWIVEL		●	●	●
11= WELD FLANGE	●	●	●	●
12= ISO FLANGE	●	●	●	●
15= *NH DROOP				●
16= NPT W/DRAIN	●	●	●	●
23= NH				●
25= NH DROOP				●

"ZZ" ACTUATOR

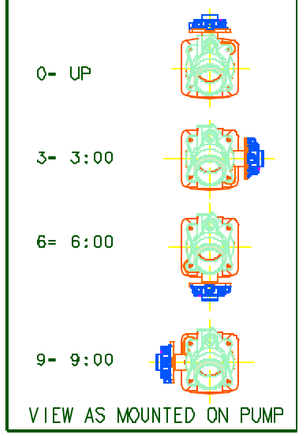
LOCKING "LK"
- 10= "L" SH HANDLE
- 11= "L" LG HANDLE (3" DISCHARGE)
- 12= "L" SH LEVER
- 13= "L" LG LEVER
- 15= "R" SH HANDLE
- 16= "R" LG HANDLE (3" DISCHARGE)
- 17= "R" SH LEVER
- 18= "R" LG LEVER

LOCKING AND SLOW CLOSE "SC"
- 20= "L" SH HANDLE
- 21= "L" LG HANDLE (3" DISCHARGE)
- 22= "L" SH LEVER
- 23= "L" LG LEVER
- 25= "R" SH HANDLE
- 26= "R" LG HANDLE (3" DISCHARGE)
- 27= "R" SH LEVER
- 28= "R" LG LEVER

PLAIN LEVER
- 05= LEVER SHORT (1 1/2" & 2")
- 06= LEVER LONG (2 1/2" & 3")

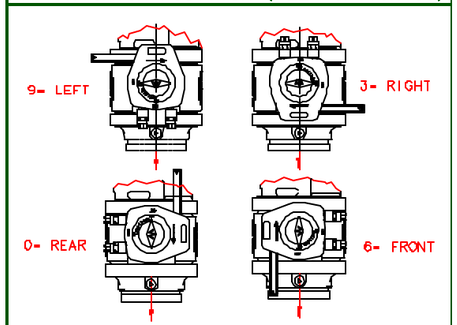
GEAR ACTUATOR
- 30= MANUAL

"A" ACTUATOR POSITION



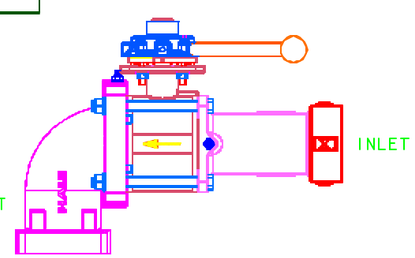
VIEW AS MOUNTED ON PUMP

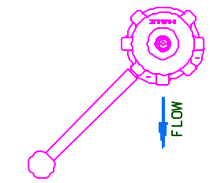
"A" ACTUATOR POSITION ("ZZ" OPTION 30)



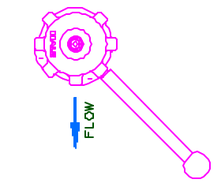
TOP VIEW, AS MOUNTED ON PUMP

SUCTION ASSEMBLY
726-2603-15-3 SHOWN

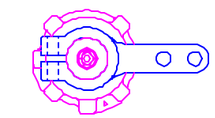




"L" HANDLE IN CLOSED POSITION (10,11,20,21)

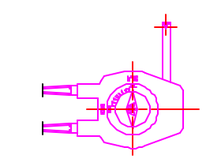


"R" HANDLE IN CLOSED POSITION (15,16,25,26)



LOCKING/SLOW CLOSE LEVER (12,13,17,18,22,23,27,28)

PLAIN LEVER (05,06)



GEAR ACTUATORS (30)

ECO NO	REV	CHANGED FROM	BY	DATE	APVD
02-321	A	RELEASE FOR PRODUCTION	MAB	10-30-02	MAL

HALE PRODUCTS, INC.
A Unit of IDEX Corporation
Conshohocken, PA 19428 USA

DRAWN AM | CHECKED AJG | DATE 10-30-02 | SIZE D | SCALE: NONE

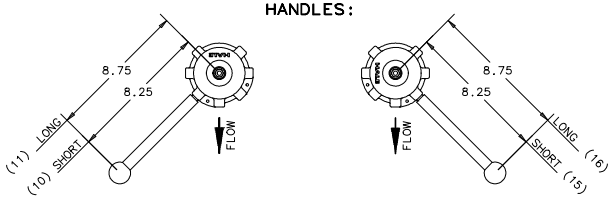
PLATE NO. 940AA

SVS STAINLESS VALVE SYSTEM OPTIONS

ACTUATOR OPTIONS

LOCKING ONLY:

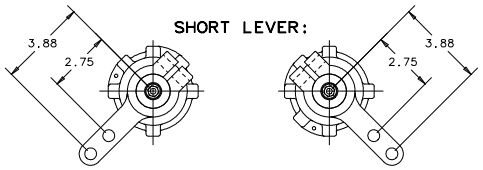
HANDLES:



"L" HANDLE IN CLOSED POSITION **(10,11)**

"R" HANDLE IN CLOSED POSITION **(15,16)**

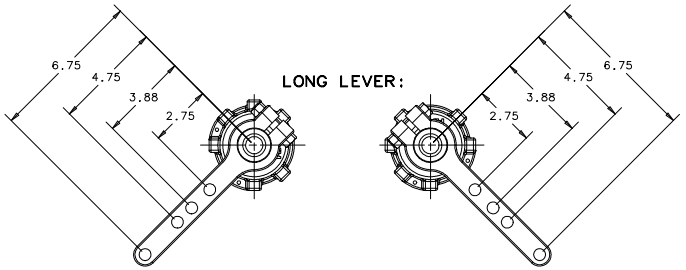
SHORT LEVER:



"L" LEVER IN CLOSED POSITION **(12)**

"R" LEVER IN CLOSED POSITION **(17)**

LONG LEVER:

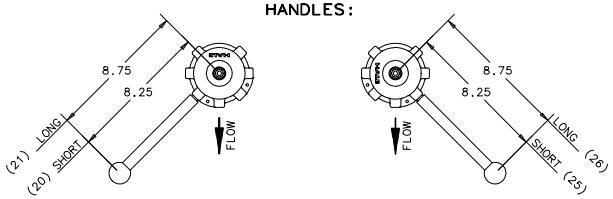


"L" LEVER IN CLOSED POSITION **(13)**

"R" LEVER IN CLOSED POSITION **(18)**

LOCKING, SLOW CLOSE:

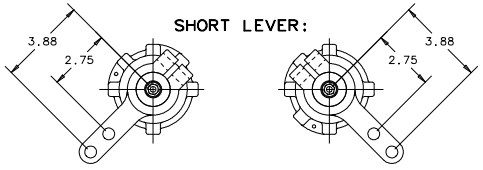
HANDLES:



"L" HANDLE IN CLOSED POSITION **(20,21)**

"R" HANDLE IN CLOSED POSITION **(25,26)**

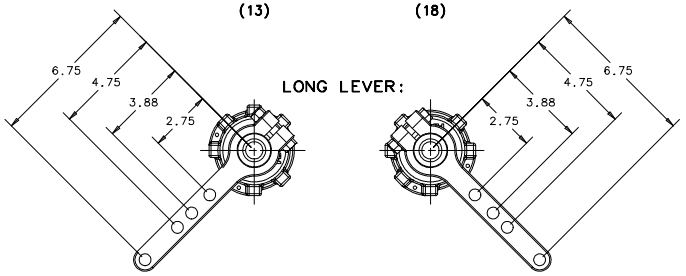
SHORT LEVER:



"L" LEVER IN CLOSED POSITION **(22)**

"R" LEVER IN CLOSED POSITION **(27)**

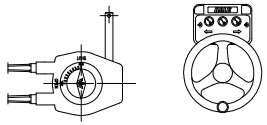
LONG LEVER:



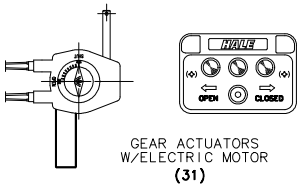
"L" LEVER IN CLOSED POSITION **(23)**

"R" LEVER IN CLOSED POSITION **(28)**

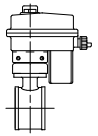
ACTUATORS:



GEAR ACTUATORS **(30)**

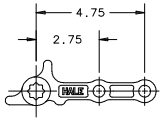


GEAR ACTUATORS W/ELECTRIC MOTOR **(31)**

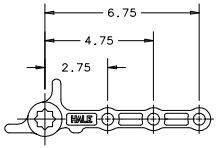


ELECTRIC ACTUATORS **(32)**

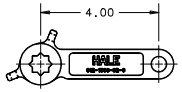
PLAIN LEVER:



(1-1/2", 2" VALVES) **(05)**



(2-1/2", 3" VALVES) **(06)**



(2-1/2", 3" VALVES) **(07)**

NOTE:

1. OPTION NUMBER SHOWN IN ( ).
2. REFER TO PLATES 940AB AND 940 BB FOR FULL LIST OF VALVE OPTIONS.

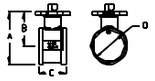
ECO NO	REV	CHANGED FROM	BY	DATE	APVD
03-109	B	RELEASE FOR PRODUCTION	MAC	04-11-03	AJG

HALE PRODUCTS, INC.
A Unit of IDEX Corporation
Conshohocken, PA 19428 USA

DRAWN MAC | CHECKED AJG | DATE 04-11-03 | SIZE D | SCALE: NONE

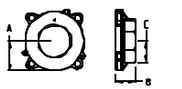
PLATE NO. 940CB

SVS VALVE



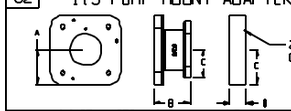
	PART NUMBER	A	B	C	D
1-1/2	538-1720-15-0	4.11 (104)	2.66 (68)	2.06 (52)	2.90 (74)
2	538-1720-20-0	4.78 (121)	2.97 (75)	2.55 (64)	3.62 (92)
2-1/2	538-1720-25-0	6.00 (155)	3.78 (96)	3.41 (87)	4.61 (117)
INTAKE	538-1720-25-0	6.00 (155)	3.78 (96)	3.41 (87)	4.61 (117)
3	538-1720-30-0	6.87 (174)	4.13 (105)	3.90 (99)	5.47 (139)
INTAKE	538-1720-31-0	6.87 (174)	4.13 (105)	3.90 (99)	5.47 (139)

01 NPT THREAD



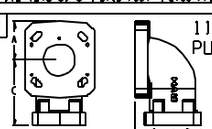
	PART NUMBER	A	B	C
1-1/2	044-1750-02-0	1.60 (41)	1.34 (34)	1.13 (29)
2	044-1760-02-0	1.85 (47)	1.46 (37)	1.31 (33)
2-1/2	044-1770-02-0	2.43 (62)	1.53 (39)	1.69 (43)
3	044-1780-02-0	2.78 (71)	2.00 (51)	1.97 (50)

02 115 PUMP MOUNT ADAPTER



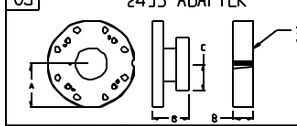
	PART NUMBER	A	B	C
1-1/2	115-1510-01-0	2.13 (54)	2.86 (73)	2.13 (54)
2	115-1520-01-0	2.13 (54)	1.31 (33)	2.13 (54)
2-1/2	115-1530-01-0	2.77 (70)	2.86 (73)	2.25 (57)
3	115-1540-01-0	3.13 (80)	2.86 (73)	2.25 (57)

03 D4 115 X 90° PUMP MOUNT



	PART NUMBER	A	B	C	D
2-1/2	038-1070-00-0	3.02 (77)	3.04 (77)	5.25 (133)	2.25 (57)
3	038-1070-01-0	3.02 (77)	2.56 (65)	5.25 (133)	2.25 (57)
2-1/2	038-1070-02-0	3.02 (77)	5.20 (134)	5.25 (133)	2.25 (57)
3	038-1070-03-0	3.02 (77)	4.81 (122)	5.25 (133)	2.25 (57)

05 2433 ADAPTER

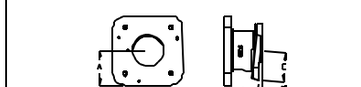


	PART NUMBER	A	B	C
2	115-1520-02-0	3.38 (86)	3.45 (88)	2.13 (54)
2-1/2	115-1530-02-0	3.45 (88)	1.62 (41)	3.45 (88)
3	115-1540-02-0	3.38 (86)	2.98 (76)	3.10 (79)

06 2433A ADAPTER

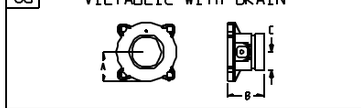
	PART NUMBER	A	B
2	115-1520-03-0	3.38 (86)	3.31 (84)
2-1/2	115-1530-03-0	3.45 (88)	1.81 (46)
3	115-1540-03-0	3.38 (86)	3.41 (87)

07 115A ADAPTER



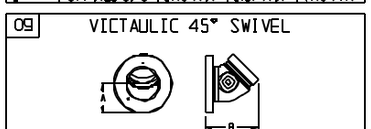
	PART NUMBER	A	B	C
2-1/2	115-1530-07-0	2.76 (70)	3.11 (79)	2.21 (57)
3	115-1540-07-0	3.13 (80)	3.16 (80)	2.25 (57)

08 VICTAULIC WITH DRAIN



	PART NUMBER	A	B	C
1-1/2	044-1750-01-0	1.50 (38)	3.00 (76)	0.95 (24)
2	044-1760-01-0	1.91 (49)	2.81 (71)	1.19 (30)
2-1/2	044-1770-01-0	2.35 (60)	2.94 (75)	1.44 (37)
3	044-1780-01-0	2.79 (71)	2.87 (73)	1.75 (44)

09 VICTAULIC 45° SWIVEL

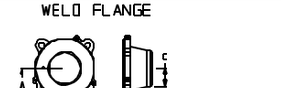


	PART NUMBER	A	B
1-1/2	044-1750-04-0	1.46 (37)	3.89 (99)
2	044-1760-00-0	1.82 (46)	4.06 (103)
2-1/2	044-1770-04-0	2.32 (59)	4.28 (108)
3	044-1780-04-0	2.75 (70)	4.74 (120)

10 VICTAULIC 90° SWIVEL

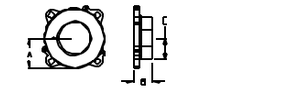
	PART NUMBER	A	B	C
2	044-1760-10-0	1.82 (46)	4.57 (116)	3.06 (78)
2-1/2	044-1770-10-0	2.32 (59)	4.83 (123)	3.37 (86)
3	044-1780-10-0	2.75 (70)	5.44 (138)	3.80 (97)

11 WELD FLANGE



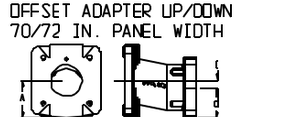
	PART NUMBER	A	B	C
1-1/2	115-1550-05-0	1.62 (41)	2.24 (57)	0.95 (24)
2	115-1520-05-0	1.86 (47)	2.24 (57)	1.10 (30)
2-1/2	115-1530-05-0	2.35 (60)	2.24 (57)	1.44 (37)
3	115-1540-05-0	2.80 (71)	2.24 (57)	1.75 (45)

12 ISO THREAD



	PART NUMBER	A	B	C
1-1/2	115-1550-06-0	1.63 (41)	1.34 (34)	1.13 (29)
2	115-1520-06-0	1.86 (47)	1.50 (38)	1.31 (33)
2-1/2	115-1530-06-0	2.35 (60)	1.50 (38)	1.69 (43)
3	115-1540-06-0	2.80 (71)	2.00 (51)	1.97 (50)

13 14 OFFSET ADAPTER UP/DOWN 70/72 IN. PANEL WIDTH

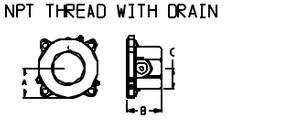


	PART NUMBER	A	B	C	D
2-1/2	159-1680-00-0	2.85 (72)	5.70 (145)	0.56 (14)	2.30 (58)
3	159-1680-01-0	2.85 (72)	5.22 (133)	0.56 (14)	2.30 (58)

15 NSTM DROOP

	PART NUMBER	A	B
2-1/2	044-1770-00-0	2.32 (59)	6.80 (173)
3	044-1780-00-0	2.80 (71)	6.90 (175)

16 NPT THREAD WITH DRAIN

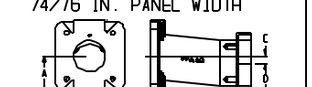


	PART NUMBER	A	B	C
1-1/2	044-1750-03-0	1.62 (41)	2.56 (65)	1.13 (29)
2	044-1760-03-0	1.91 (49)	2.21 (56)	1.31 (33)
2-1/2	044-1770-03-0	2.35 (60)	2.68 (68)	1.69 (43)
3	044-1780-03-0	2.80 (71)	2.74 (70)	1.97 (50)

17 18 W/ SWIVEL 19 20 W/O SWIVEL NSTF SWIVEL RIGHT/LEFT

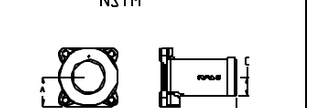
	PART NUMBER	A	B	C	D
2-1/2	844-1770-08-0	2.31 (59)	6.93 (176)	4.50 (114)	6.00 (152)
3	844-1780-08-0	2.80 (71)	6.93 (176)	4.83 (123)	6.00 (152)

21 22 OFFSET ADAPTER UP/DOWN 74/76 IN. PANEL WIDTH



	PART NUMBER	A	B	C	D
2-1/2	159-1680-02-0	2.86 (72)	7.95 (202)	0.56 (14)	2.30 (58)
3	159-1680-03-0	2.85 (72)	7.47 (190)	0.56 (14)	2.30 (58)

23 NSTM

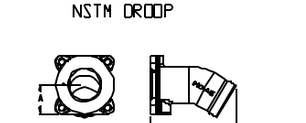


	PART NUMBER	A	B	C
2-1/2	044-1770-06-0	2.32 (59)	6.00 (152)	1.32 (37)
3	044-1780-06-0	2.75 (70)	6.00 (152)	1.81 (46)

24 TANK HOSE BARB

	PART NUMBER	A	B	C
3	044-1780-07-0	2.80 (71)	3.03 (77)	1.84 (47)

25 NSTM DROOP

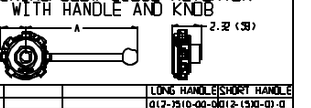


	PART NUMBER	A	B
2-1/2	044-1770-11-0	2.31 (59)	6.75 (171)
3	044-1780-12-0	2.75 (70)	6.87 (174)

26 27 W/ SWIVEL 28 29 W/O SWIVEL NSTF COVER RIGHT/LEFT

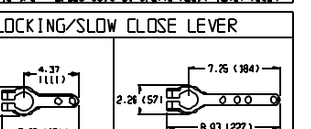
	PART NUMBER	A	B	C	D
2-1/2	844-1770-12-0	2.32 (59)	6.00 (152)	1.55 (39)	6.93 (176)
3	844-1780-11-0	2.76 (70)	6.00 (152)	1.79 (45)	6.93 (176)

LOCKING/SLOW CLOSE ACTUATOR WITH HANDLE AND KNOB



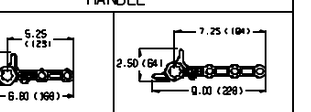
		PART NUMBER	LONG HANDLE A	SHORT HANDLE A
			012-1510-00-0	012-1510-01-0
LOCKING/ SLOW CLOSE	1-1/2 - 2	560-0010-02-0	8.72 (221)	8.24 (209)
	2-1/2 - 3	560-0010-00-0	8.72 (221)	8.24 (209)
LOCKING ONLY	1-1/2 - 2	560-0010-03-0	8.72 (221)	8.24 (209)
	2-1/2 - 3	560-0010-01-0	8.72 (221)	8.24 (209)

LOCKING/SLOW CLOSE LEVER



	PART NUMBER		PART NUMBER
SHORT	012-1510-06-0	LONG	012-1510-07-0

HANDLE



	PART NUMBER		PART NUMBER
SHORT	012-1500-00-0	LONG	012-1500-01-0

NOTES:
1. 115 SERIES FLANGE MOUNT, 4 HOLES ON 4.38 IN. BOLT CIRCLE
2. 2433 SERIES FLANGE MOUNT, 8 HOLES ON 5.75 IN. BOLT CIRCLE
3. ADAPTER CONFIGURATION NUMBER REPRESENTED IN TOP LEFT CORNER OF PART BOX.
4. DIMENSION VALUES SHOWN IN ENGLISH AND METRIC IN THE FORM OF [IN (MM)].
5. PART NUMBERS FOR REFERENCE ONLY, NOT TO BE USED FOR ORDERING REPLACEMENT PARTS.
6. THIS IS TO BE USED IN CORRELATION WITH PLATE 940.

PLATE NO. PL960AA
SVS VALVE COMPONENT DIMENSIONS

ECO NO	REV	CHANGED FROM	BY	DATE	APVD
02-197	A	RELEASE TO PRODUCTION	MBB	06-04-02	MAL

HALE PRODUCTS, INC.
A Unit of IDEX Corporation
Conshohocken, PA 19428 USA

DRAWN MBB | CHECKED PRV | DATE 06-04-02 | SIZE B | SCALE: NTS

THE HALE TYPE K HEAT EXCHANGER IS AVAILABLE IN 1-1/4 TO 2-1/2 ENGINE COOLANT CONNECTIONS. THE COMPLETE HEAT EXCHANGER MODEL NUMBER IS FORMED AS FOLLOWS:

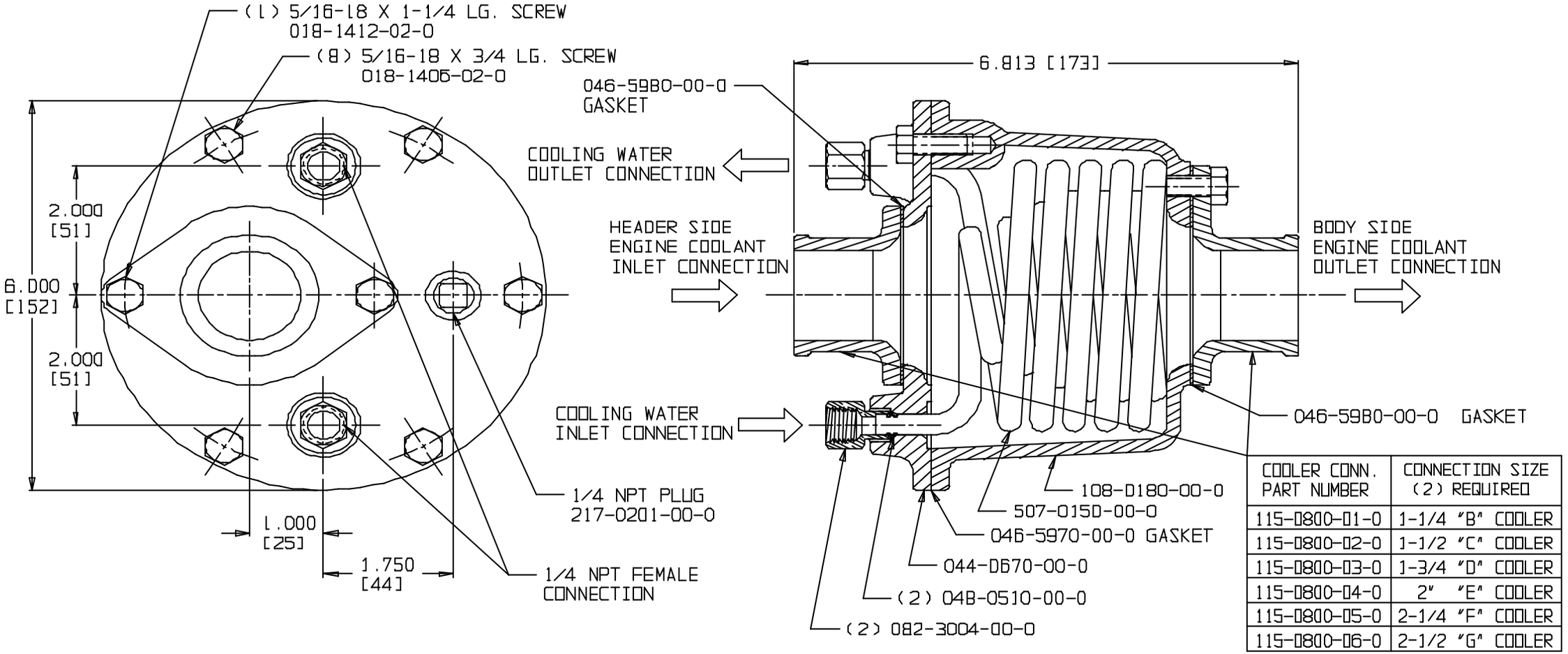
FOR EXAMPLE, A K HEAT EXCHANGER IS REQUIRED TO HAVE A 1-1/2" HEADER SIDE CONNECTION AND A 2" BODY SIDE CONNECTION. THE K HEAT EXCHANGER MODEL NUMBER WOULD BE CKE AS SHOWN.

C K E

HEADER SIDE CONNECTION

BODY SIDE CONNECTION

NOTES:
1) ALL DIMENSIONS ARE IN INCHES & [MILLIMETERS].
2) BODY (P/N 108-0180-00-0) & HEADER (P/N 044-0670-00-0) CAN BE ROTATED IN 60° INCREMENTS FROM POSITION SHOWN.
3) ENGINE COOLANT & COOLING WATER FLOW DIRECTIONS CAN BE REVERSED.
4) ENGINE COOLANT CONNECTIONS FROM 1-1/4" TO 2-1/2" IN 1/4" INCREMENTS ARE AVAILABLE IN ANY COMBINATION.



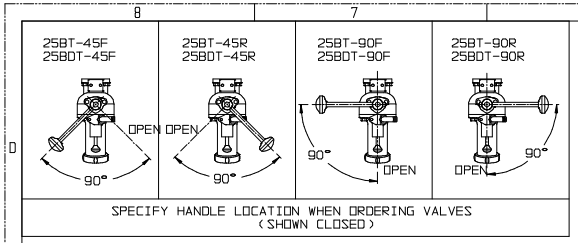
COOLER CONN. PART NUMBER	CONNECTION SIZE (2) REQUIRED
115-0800-01-0	1-1/4 "B" COOLER
115-0800-02-0	1-1/2 "C" COOLER
115-0800-03-0	1-3/4 "D" COOLER
115-0800-04-0	2" "E" COOLER
115-0800-05-0	2-1/4 "F" COOLER
115-0800-06-0	2-1/2 "G" COOLER

HALE TYPE K SERIES HEAT EXCHANGER

FIRE PUMP COMPANY
CONSHOHOCKEN PA 19428 USA

12-1-94 JDR

PLATE NO. 817



SPECIFY HANDLE LOCATION WHEN ORDERING VALVES (SHOWN CLOSED)

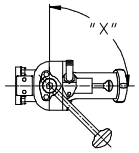
PART NUMBERS SHOWN IN BOXES, I.E.: XXX-XXXX-XX-X ARE 25BD REMOTE CONTROL PARTS.

THE 61" OVERALL LENGTH OF THE REMOTE CONTROL ROD IS BASED UPON THE RELATIONSHIP OF VALVE, SPACERS AND PANEL AS SHOWN. IF THE SPACER LENGTH IS CHANGED, ADJUST LENGTH OF THE ROD. THE ROD IS NOT SUPPLIED BY HALE.

VALVE MODEL	COVER
25BDT-45F	ANGLE
25BT-45F	STRAIGHT
25BDT-45R	ANGLE
25BT-45R	STRAIGHT
25BDT-90F	ANGLE
25BT-90F	STRAIGHT
25BDT-90R	ANGLE
25BT-90R	STRAIGHT
25BD REMOTE CONTROL	

INSTRUCTIONS FOR REPOSITIONING HANDLE

(1) CLOSE VALVE AND REMOVE SPRING PIN (064-1032-11-0)
(2) ROTATE VALVE HANDLE TO DESIRED CLOSED POSITION (45F, 45R, 90F, OR 90R)
(3) ALIGN HOLES IN VALVE STEM (039-0110-00-0), VALVE STEM EXTENSION (041-0331-00-0, 041-0331-01-0), AND VALVE SLEEVE (048-0670-00-0)
(4) INSERT VALVE STEM PIN (064-1032-11-0) PARTIALLY INTO ALIGNED HOLES WITH END PROTRUDING 1/4" OUT IN AREA "X" IN FIGURE SHOWN BELOW SO THAT IT WILL HIT THE STOPS.



HALE TYPE 25BT, 25BDT SERIES DISCHARGE VALVES AND 25BD REMOTE CONTROL

PLATE NO. 635DB

ECO NO	REV	CHANGED FROM	BY	DATE	APVD
01-025	B	UPDATED WITH DESCRIPTIONS	TKC	1-16-01	MAL
99-121	A	REDRAWN ON CAD - UPDATED	DPL	6-15-99	RET

HALE PRODUCTS, INC.
A Unit of IDEX Corporation
Conshohocken, PA 19428 USA

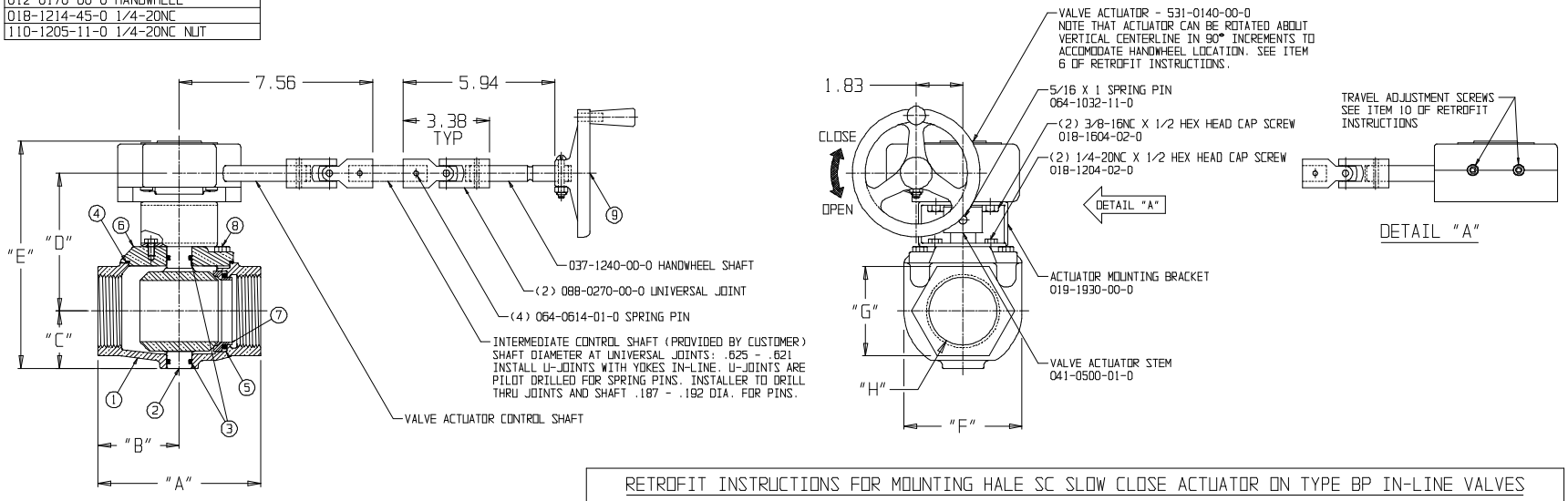
DRAWN WFM | CHECKED RET | DATE 1-19-93 | SIZE D | SCALE: .25

HALE TYPE BPM SLOW CLOSE IN-LINE VALVES

512-0070-00-0 HANDWHEEL ASSEMBLY (ITEM 9) CONSISTING OF (1) EACH:
064-1016-01-0 SPRING PIN
012-0180-00-0 HANDLE
012-0170-00-0 HANDWHEEL
018-1214-45-0 1/4-20NC
110-1205-11-0 1/4-20NC NUT

STANDARD "CLOCKWISE TO CLOSE" HANDWHEEL ROTATION SHOWN

ROTATION CAN BE REVERSED IF REQUIRED - SEE ITEM 5 OF RETROFIT INSTRUCTIONS



NO.	VALVE SERIES NAME	QTY	2" 20BPM VALVE PART NUMBER	2-1/2" 25BPM VALVE PART NUMBER	3" 30BPM VALVE PART NUMBER
1	BODY	1	038-0330-00-0	038-0340-00-0	038-0350-00-0
2	STEM/BALL	1	039-0100-00-0	039-0110-00-0	039-0030-00-0
3	O-RING - STEM	2	040-2109-00-0	040-2109-00-0	040-2109-00-0
4	O-RING - COVER	1	142-0510-00-0	142-0520-00-0	142-0530-00-0
5	O-RING - SEAT	1	040-3310-01-0	040-3350-01-0	040-3390-01-0
6	COVER	1	044-0390-00-0	044-0400-00-0	044-0060-00-0
7	SEAT	1	276-0060-00-0	276-0071-00-0	276-0020-00-0
8	SCREW	4	018-1610-02-0	018-1810-02-0	018-2012-02-0
9	HANDWHEEL ASSY	1	512-0070-00-0 - SEE TABLE		

MODEL NUMBER	DIMENSIONS A	B	C	D	E	F	G	H
20BPM	5.500	2.250	1.938	5.125	8.313	3.875	3.000	2" NPT
25BPM	6.375	3.188	2.250	5.406	8.906	4.625	3.500	2-1/2" NPT
30BPM	7.375	3.688	2.563	6.031	9.844	5.750	4.188	3" NPT

RETROFIT INSTRUCTIONS FOR MOUNTING HALE SC SLOW CLOSE ACTUATOR ON TYPE BP IN-LINE VALVES

1) REMOVE VALVE HANDLE AND COVER.
2) REMOVE VALVE STEM/BALL. INSPECT STEM/BALL AND BODY FOR WEAR OR DAMAGE IF VALVE HAS BEEN IN SERVICE. IF FOUND SATISFACTORY, INSTALL NEW VALVE SEAT AND O-RINGS (ITEMS 3,5, AND 7 FROM PARTS LIST).
3) REINSTALL VALVE STEM/BALL. ROTATE TO THE VALVE CLOSED POSITION. BE SURE THE SEAT IS CENTERED ON THE SEALING SURFACE OF THE BALL. LIGHTLY LIGHTLY GREASE BALL FACE AND STEM JOURNALS (USE ONLY GREASE COMPATIBLE WITH BUNA-N O-RINGS).
   WITH BALL CENTERED IN CLOSED POSITION, MARK STEM/BALL AND VALVE BODY (USING PENCIL, MARKER, ETC.) WHERE STEM IS VISIBLE AT BOTTOM OF VALVE. THIS MARK WILL INDICATE WHERE BALL IS CENTERED ON SEAT (FULLY CLOSED POSITION) FOR ACTUATOR TRAVEL ADJUSTMENT.
4) INSTALL NEW VALVE COVER AND O-RING (ITEMS 6 AND 4 FROM PARTS LIST) USING HARDWARE FROM ORIGINAL COVER. THE ORIENTATION OF THE 1/4-20NC TAPPED HOLES (FOR ACTUATOR MOUNTING BRACKET) IS NOT IMPORTANT. USE LOCTITE 242 (BLUE) MEDIUM STRENGTH THREAD LOCKING COMPOUND OR EQUAL AND TORQUE AS REQUIRED.
5) ROTATE THE VALVE ACTUATOR CONTROL SHAFT CLOCKWISE UNTIL IT REACHES ITS FULL STOP (NOTE: FOR REVERSED HANDWHEEL ROTATION ("COUNTERCLOCKWISE TO CLOSE") ROTATE THE CONTROL SHAFT COUNTERCLOCKWISE TO FULL STOP.
6) TEMPORARILY PLACE VALVE ACTUATOR STEM ON THE VALVE STEM/BALL. TRIAL FIT THE ACTUATOR MOUNTING BRACKET AND VALVE ACTUATOR TO FIND THE MOUNTING BRACKET HOLES THAT WILL PROVIDE REQUIRED VALVE ACTUATOR CONTROL SHAFT ORIENTATION AND HANDWHEEL LOCATION.
7) REMOVE THE VALVE ACTUATOR AND BRACKET, AND INSTALL THE VALVE ACTUATOR STEM PIN. SOME STEM/BALLS HAVE TWO PIN HOLES - USE THE CORRECT HOLE AS DETERMINED DURING TRIAL FITTING (ITEM 6).
8) INSTALL THE ACTUATOR MOUNTING BRACKET TO THE VALVE COVER WITH THE TWO 1/4-20NC X 1/2 SCREWS PROVIDED. USE LOCTITE 242 (BLUE) MEDIUM STRENGTH LOCKING COMPOUND OR EQUAL. TORQUE AS REQUIRED.
9) INSTALL THE VALVE ACTUATOR WITH THE TWO 3/8-16NC X 1/2 SCREWS PROVIDED. USE LOCTITE 242 (BLUE) OR EQUAL. TORQUE AS REQUIRED. BE SURE THE VALVE ACTUATOR IS PROPERLY ENGAGED WITH STEM.
10) ROTATE THE ACTUATOR CONTROL SHAFT THROUGH ITS FULL RANGE OF MOTION. ADJUST VALVE ACTUATOR TRAVEL USING REFERENCE MARKS FROM ITEM 4. MARKS ON STEM AND BODY SHOULD LINE UP WHEN VALVE ACTUATOR REACHES "CLOSED" ADJUSTMENT. ADJUST TRAVEL SO THAT MARKS ARE 90° APART WHEN ACTUATOR REACHES "OPEN" TRAVEL STOP. SEE DETAIL "A".
11) INSTALL UNIVERSAL JOINTS AND INTERMEDIATE CONTROL SHAFT. INSTALLER TO VERIFY FREEDOM OF MOVEMENT. SHAFT ANGLE OF SINGLE UNIVERSAL JOINT NOT TO EXCEED 45°. INSTALLER TO PROVIDE INTERMEDIATE CONTROL SHAFT, AND DRILL SHAFT AND U-JOINTS FOR SPRING PINS.
12) CUSTOMER TO SUPPLY HANDWHEEL SHAFT SUPPORT. HANDWHEEL SHAFT PROVIDED IS .625 - .621 DIAMETER. SHAFT IS DRILLED FOR HANDWHEEL INSTALLATION.

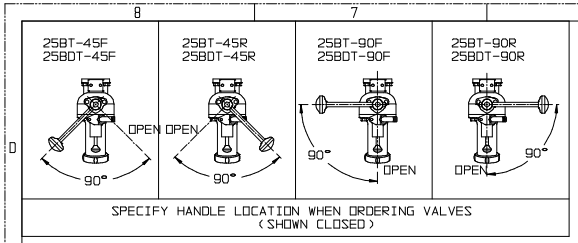
SEE HALE PLATE NO. 583DA FOR TYPE BP IN-LINE VALVES WITHOUT SLOW CLOSE VALVE ACTUATOR

ECO NO	REV	CHANGED FROM	BY	DATE	APVD
95-163	A	RELEASED FOR PRODUCTION - DELETED BPC SERIES 3" VALVE. REFORMATTED AND REVISED RETROFIT INSTRUCTIONS	AJD	8-7-95	RDT

HALE PRODUCTS, INC.
A Unit of IDEX Corporation
Conshohocken, PA 19428 USA

DRAWN JDR | CHECKED RDT | DATE: 12-6-93 | SIZE D | SCALE: NONE

PLATE NO. 771AA



SPECIFY HANDLE LOCATION WHEN ORDERING VALVES (SHOWN CLOSED)

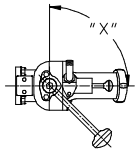
PART NUMBERS SHOWN IN BOXES, I.E.: XXX-XXXX-XX-X ARE 25BD REMOTE CONTROL PARTS.

THE 61" OVERALL LENGTH OF THE REMOTE CONTROL ROD IS BASED UPON THE RELATIONSHIP OF VALVE, SPACERS AND PANEL AS SHOWN. IF THE SPACER LENGTH IS CHANGED, ADJUST LENGTH OF THE ROD. THE ROD IS NOT SUPPLIED BY HALE.

VALVE MODEL	COVER
25BDT-45F	ANGLE
25BT-45F	STRAIGHT
25BDT-45R	ANGLE
25BT-45R	STRAIGHT
25BDT-90F	ANGLE
25BT-90F	STRAIGHT
25BDT-90R	ANGLE
25BT-90R	STRAIGHT
25BD REMOTE CONTROL	

INSTRUCTIONS FOR REPOSITIONING HANDLE

(1) CLOSE VALVE AND REMOVE SPRING PIN (064-1032-11-0)
(2) ROTATE VALVE HANDLE TO DESIRED CLOSED POSITION (45F, 45R, 90F, OR 90R)
(3) ALIGN HOLES IN VALVE STEM (039-0110-00-0), VALVE STEM EXTENSION (041-0331-00-0, 041-0331-01-0), AND VALVE SLEEVE (048-0670-00-0)
(4) INSERT VALVE STEM PIN (064-1032-11-0) PARTIALLY INTO ALIGNED HOLES WITH END PROTRUDING 1/4" OUT IN AREA "X" IN FIGURE SHOWN BELOW SO THAT IT WILL HIT THE STOPS.



HALE TYPE 25BT, 25BDT SERIES DISCHARGE VALVES AND 25BD REMOTE CONTROL

PLATE NO. 635DB

ECO NO	REV	CHANGED FROM	BY	DATE	APVD
01-025	B	UPDATED WITH DESCRIPTIONS	TKC	1-16-01	MAL
99-121	A	REDRAWN ON CAD - UPDATED	DPL	6-15-99	RET

HALE PRODUCTS, INC.
A Unit of IDEX Corporation
Conshohocken, PA 19428 USA

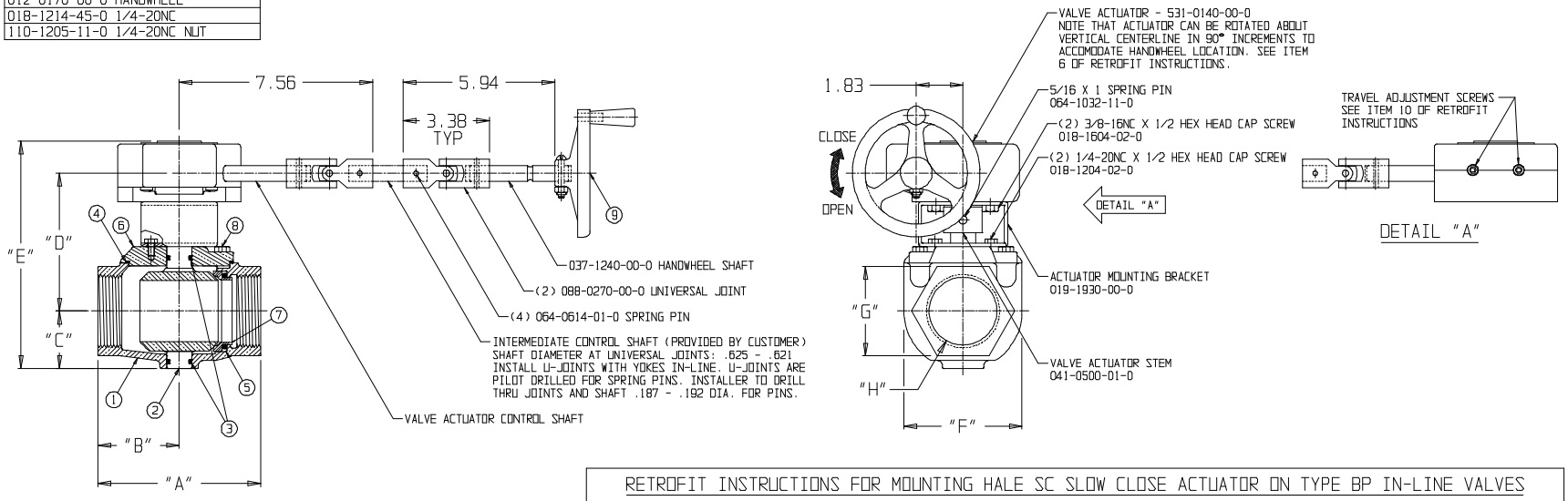
DRAWN WFM | CHECKED RET | DATE 1-19-93 | SIZE D | SCALE: .25

HALE TYPE BPM SLOW CLOSE IN-LINE VALVES

512-0070-00-0 HANDWHEEL ASSEMBLY (ITEM 9) CONSISTING OF (1) EACH:
064-1016-01-0 SPRING PIN
012-0180-00-0 HANDLE
012-0170-00-0 HANDWHEEL
018-1214-45-0 1/4-20NC
110-1205-11-0 1/4-20NC NUT

STANDARD "CLOCKWISE TO CLOSE" HANDWHEEL ROTATION SHOWN

ROTATION CAN BE REVERSED IF REQUIRED - SEE ITEM 5 OF RETROFIT INSTRUCTIONS



NO.	VALVE SERIES NAME	QTY	2" 20BPM VALVE PART NUMBER	2-1/2" 25BPM VALVE PART NUMBER	3" 30BPM VALVE PART NUMBER
1	BODY	1	038-0330-00-0	038-0340-00-0	038-0350-00-0
2	STEM/BALL	1	039-0100-00-0	039-0110-00-0	039-0030-00-0
3	O-RING - STEM	2	040-2109-00-0	040-2109-00-0	040-2109-00-0
4	O-RING - COVER	1	142-0510-00-0	142-0520-00-0	142-0530-00-0
5	O-RING - SEAT	1	040-3310-01-0	040-3350-01-0	040-3390-01-0
6	COVER	1	044-0390-00-0	044-0400-00-0	044-0060-00-0
7	SEAT	1	276-0060-00-0	276-0071-00-0	276-0020-00-0
8	SCREW	4	018-1610-02-0	018-1810-02-0	018-2012-02-0
9	HANDWHEEL ASSY	1	512-0070-00-0 - SEE TABLE		

MODEL NUMBER	DIMENSIONS A	B	C	D	E	F	G	H
20BPM	5.500	2.250	1.938	5.125	8.313	3.875	3.000	2" NPT
25BPM	6.375	3.188	2.250	5.406	8.906	4.625	3.500	2-1/2" NPT
30BPM	7.375	3.688	2.563	6.031	9.844	5.750	4.188	3" NPT

RETROFIT INSTRUCTIONS FOR MOUNTING HALE SC SLOW CLOSE ACTUATOR ON TYPE BP IN-LINE VALVES

1) REMOVE VALVE HANDLE AND COVER.
2) REMOVE VALVE STEM/BALL. INSPECT STEM/BALL AND BODY FOR WEAR OR DAMAGE IF VALVE HAS BEEN IN SERVICE. IF FOUND SATISFACTORY, INSTALL NEW VALVE SEAT AND O-RINGS (ITEMS 3,5, AND 7 FROM PARTS LIST).
3) REINSTALL VALVE STEM/BALL. ROTATE TO THE VALVE CLOSED POSITION. BE SURE THE SEAT IS CENTERED ON THE SEALING SURFACE OF THE BALL. LIGHTLY LIGHTLY GREASE BALL FACE AND STEM JOURNALS (USE ONLY GREASE COMPATIBLE WITH BUNA-N O-RINGS).
   WITH BALL CENTERED IN CLOSED POSITION, MARK STEM/BALL AND VALVE BODY (USING PENCIL, MARKER, ETC.) WHERE STEM IS VISIBLE AT BOTTOM OF VALVE. THIS MARK WILL INDICATE WHERE BALL IS CENTERED ON SEAT (FULLY CLOSED POSITION) FOR ACTUATOR TRAVEL ADJUSTMENT.
4) INSTALL NEW VALVE COVER AND O-RING (ITEMS 6 AND 4 FROM PARTS LIST) USING HARDWARE FROM ORIGINAL COVER. THE ORIENTATION OF THE 1/4-20NC TAPPED HOLES (FOR ACTUATOR MOUNTING BRACKET) IS NOT IMPORTANT. USE LOCTITE 242 (BLUE) MEDIUM STRENGTH THREAD LOCKING COMPOUND OR EQUAL AND TORQUE AS REQUIRED.
5) ROTATE THE VALVE ACTUATOR CONTROL SHAFT CLOCKWISE UNTIL IT REACHES ITS FULL STOP (NOTE: FOR REVERSED HANDWHEEL ROTATION ("COUNTERCLOCKWISE TO CLOSE") ROTATE THE CONTROL SHAFT COUNTERCLOCKWISE TO FULL STOP.
6) TEMPORARILY PLACE VALVE ACTUATOR STEM ON THE VALVE STEM/BALL. TRIAL FIT THE ACTUATOR MOUNTING BRACKET AND VALVE ACTUATOR TO FIND THE MOUNTING BRACKET HOLES THAT WILL PROVIDE REQUIRED VALVE ACTUATOR CONTROL SHAFT ORIENTATION AND HANDWHEEL LOCATION.
7) REMOVE THE VALVE ACTUATOR AND BRACKET, AND INSTALL THE VALVE ACTUATOR STEM PIN. SOME STEM/BALLS HAVE TWO PIN HOLES - USE THE CORRECT HOLE AS DETERMINED DURING TRIAL FITTING (ITEM 6).
8) INSTALL THE ACTUATOR MOUNTING BRACKET TO THE VALVE COVER WITH THE TWO 1/4-20NC X 1/2 SCREWS PROVIDED. USE LOCTITE 242 (BLUE) MEDIUM STRENGTH LOCKING COMPOUND OR EQUAL. TORQUE AS REQUIRED.
9) INSTALL THE VALVE ACTUATOR WITH THE TWO 3/8-16NC X 1/2 SCREWS PROVIDED. USE LOCTITE 242 (BLUE) OR EQUAL. TORQUE AS REQUIRED. BE SURE THE VALVE ACTUATOR IS PROPERLY ENGAGED WITH STEM.
10) ROTATE THE ACTUATOR CONTROL SHAFT THROUGH ITS FULL RANGE OF MOTION. ADJUST VALVE ACTUATOR TRAVEL USING REFERENCE MARKS FROM ITEM 4. MARKS ON STEM AND BODY SHOULD LINE UP WHEN VALVE ACTUATOR REACHES "CLOSED" ADJUSTMENT. ADJUST TRAVEL SO THAT MARKS ARE 90° APART WHEN ACTUATOR REACHES "OPEN" TRAVEL STOP. SEE DETAIL "A".
11) INSTALL UNIVERSAL JOINTS AND INTERMEDIATE CONTROL SHAFT. INSTALLER TO VERIFY FREEDOM OF MOVEMENT. SHAFT ANGLE OF SINGLE UNIVERSAL JOINT NOT TO EXCEED 45°. INSTALLER TO PROVIDE INTERMEDIATE CONTROL SHAFT, AND DRILL SHAFT AND U-JOINTS FOR SPRING PINS.
12) CUSTOMER TO SUPPLY HANDWHEEL SHAFT SUPPORT. HANDWHEEL SHAFT PROVIDED IS .625 - .621 DIAMETER. SHAFT IS DRILLED FOR HANDWHEEL INSTALLATION.

SEE HALE PLATE NO. 583DA FOR TYPE BP IN-LINE VALVES WITHOUT SLOW CLOSE VALVE ACTUATOR

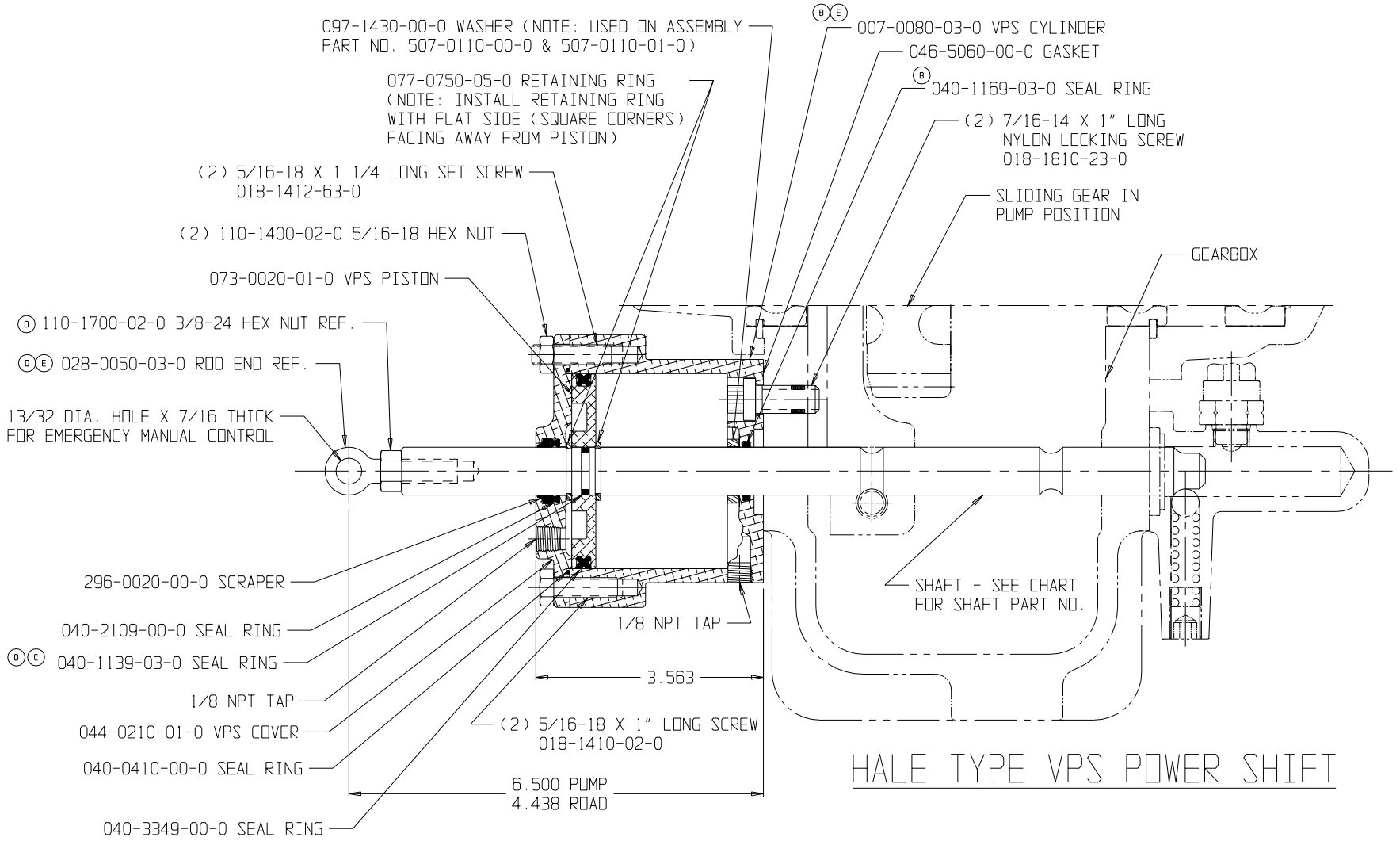
ECO NO	REV	CHANGED FROM	BY	DATE	APVD
95-163	A	RELEASED FOR PRODUCTION - DELETED BPC SERIES 3" VALVE. REFORMATTED AND REVISED RETROFIT INSTRUCTIONS	AJD	8-7-95	RDT

HALE PRODUCTS, INC.
A Unit of IDEX Corporation
Conshohocken, PA 19428 USA

DRAWN JDR | CHECKED RDT | DATE: 12-6-93 | SIZE D | SCALE: NONE

PLATE NO. 771AA

ASSEMBLY PART NUMBER	SHAFT PART NUMBER	VPS POWER SHIFT UNITS FOR THE FOLLOWING MODEL PUMPS
507-0110-00-0	037-0120-00-0	QLF, QSF, M, 4D & 6D
507-0110-01-0	037-0450-00-0	Q, QSMF & QF
507-0110-03-0	037-1341-00-0	QHD, QSMFHD, QFHD, QSMG, QSG, QMAX, QTWO, QFLO, QPAK, MG & 4DG (C)



HALE TYPE VPS POWER SHIFT

ECO NO	REV	CHANGED FROM	BY	DATE	APVD
02-022	D	PART 040-1139-03-0 WAS 040-1130-03-0 PART 028-0050-02-0 WAS 028-0050-00-0 PART 110-1600-02-0 WAS 110-1700-02-0	LFM	02-01-02	MAL
02-186	E	PART 007-0080-03-0 WAS 007-0080-02-0 PART 028-0050-03-0 WAS 028-0050-02-0	JGV	6-20-02	MAL

ECO NO	REV	CHANGED FROM	BY	DATE	APVD
99-77	A	UPPER VPS CYLINDER STUDS WERE BOLTS - ADD REV BLOCK	AJD	6-7-95	RDT
99-294	B	007-0080-02-0 WAS 007-0080-01-0 040-1169-03-0 WAS 040-2109-00-0	JBS	11-12-99	RDT
00-600	C	PART 040-1130-03-0 WAS 040-1139-03-0, ADDED PART DESCRIPTIONS & UPDATED VPS POWER SHIFT MODEL CHART	DJK	09-20-00	MAL

PLATE NO. 533CE

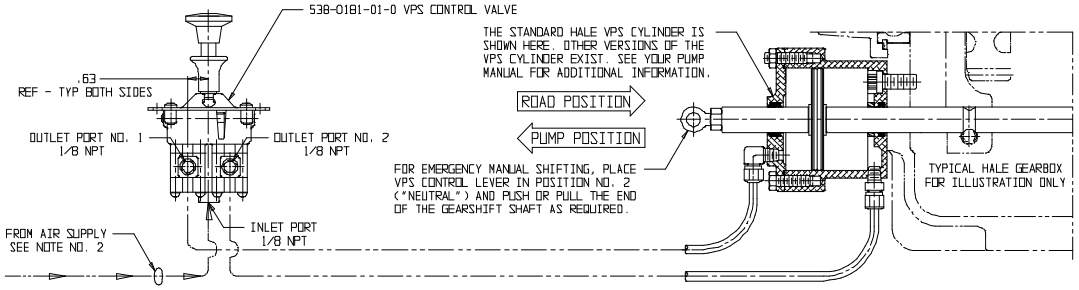
HALE PRODUCTS, INC.
A Unit of IDEX Corporation
Conshohocken, PA 19428 USA

DRAWN JDR | CHECKED RDT | DATE: 6-7-95 | SIZE 26.25 X 19 | SCALE: FULL

HALE VPS CONTROL VALVE ASSEMBLY

PART NO. 538-0180-00-0 - PLATE NO. 595CB

HALE PART NO.	QTY.	DESCRIPTION
538-0181-01-0	1	CONTROL VALVE
101-0072-00-0	1	INSTRUCTION PLATE
200-0540-00-0	1	LIGHT (GREEN)
018-1205-44-0	4	MACHINE SCREW - 1/4-20 X 5/8 LONG PHILLIPS ROUND-HEAD STAINLESS STEEL
110-1200-02-0	4	NUT - 1/4-20 ZINC PLATED STEEL HEX



CONTROL VALVE CONNECTED TO TYPICAL POWER SHIFT CYLINDER

NOTES:

1) TUBING FROM VPS CONTROL VALVE TO VPS CYLINDER IS PROVIDED BY THE INSTALLER. 1/4-INCH AIR BRAKE TUBING IS TYPICAL FOR MOST APPLICATIONS.
2) CONTROL VALVE IS RATED FOR 150 PSI MAXIMUM INLET PRESSURE. AIR MUST BE CLEAN AND DRY FOR PROPER AND RELIABLE OPERATION OF THE VPS SYSTEM. DO NOT USE FOR VACUUM APPLICATIONS.
3) CONTROL VALVE REQUIRES PERIODIC INSPECTION AND SERVICING. SEE HALE DRAWING NO. 101-0850-03-0 - MAINTENANCE AND REPAIR OF VPS CONTROL VALVE, FOR MORE INFORMATION.
4) FOR OPTIMUM PERFORMANCE AND SERVICE LIFE THE VPS CYLINDER SHOULD BE LUBRICATED APPROXIMATELY ONCE A YEAR. DISCONNECT BOTH AIR LINES AND ADD SEVERAL DROPS OF PNEUMATIC TOOL OIL, VACUUM CYLINDER OIL, OR SIMILAR LUBRICANT.

   SEE HALE PLATE NO. 533C - HALE TYPE VPS POWER SHIFT, FOR THE PARTS LIST FOR THE STANDARD VPS CYLINDER. A CYLINDER REPAIR KIT IS AVAILABLE UNDER HALE PART NO. 546-0370-51-0.
5) SEE HALE PLATE 746A - WIRING SCHEMATIC FOR SHIFT INDICATOR LIGHTS, FOR MORE INFORMATION REGARDING THE SHIFT INDICATOR SWITCHES, LIGHTS, WIRING AND INSTALLATION.
6) VALVE CAN BE MOUNTED 180° FROM POSITION SHOWN, I.E. OUTLET PORTS FACING INDICATOR LIGHT, AS REQUIRED FOR INSTALLATION. CYLINDER CONNECTIONS TO PORT NO. 1 AND 2 WILL BE REVERSED.

⚠ WARNING ALL WIRING AND INSTALLATION DETAILS MUST CONFORM TO ALL APPLICABLE NFPA, SAE, AND DOT STANDARDS

VERIFY OPERATION OF PUMP ENGAGED INDICATOR LIGHTS AND ALL INTERLOCKS BEFORE PLACING APPARATUS IN SERVICE

OPERATION

WITH CONTROL LEVER IN POSITION NO. 1

SUPPLY PRESSURE IS DIRECTED TO PORT NO. 2
PORT NO. 1 IS EXHAUSTED TO ATMOSPHERE

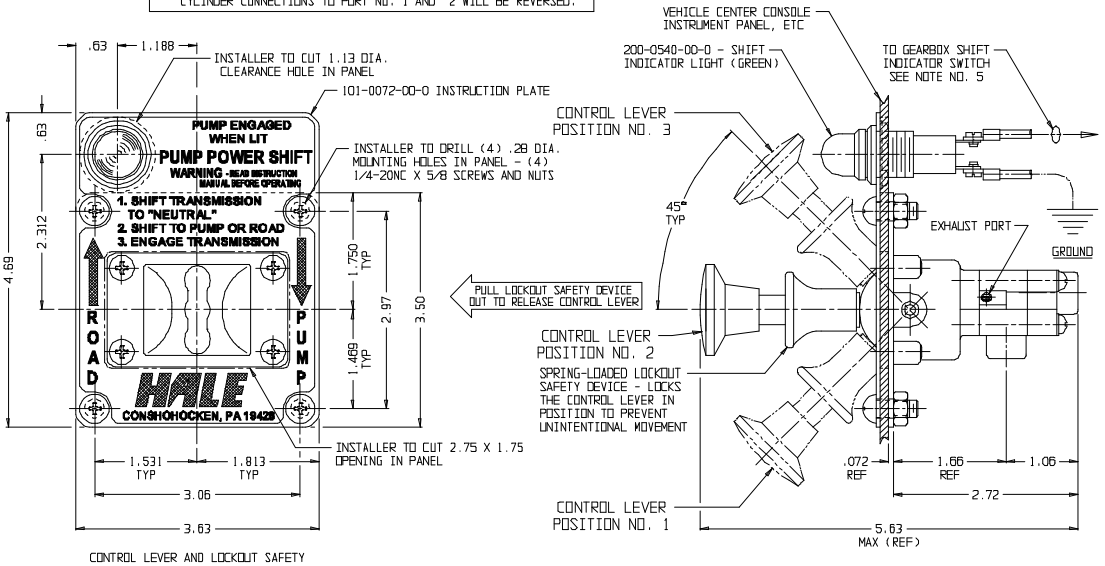
WITH CONTROL LEVER IN POSITION NO. 2

SUPPLY PRESSURE IS CLOSED OFF ("NEUTRAL" POSITION)
PORTS NO. 1 AND 2 ARE BOTH EXHAUSTED TO ATMOSPHERE

WITH CONTROL LEVER IN POSITION NO. 3

SUPPLY PRESSURE IS DIRECTED TO PORT NO. 1
PORT NO. 2 IS EXHAUSTED TO ATMOSPHERE

DO NOT USE THIS VALVE FOR VACUUM APPLICATIONS



CONTROL LEVER AND LOCKOUT SAFETY DEVICE NOT SHOWN IN THIS VIEW

ECO NO	REV	CHANGED FROM	BY	DATE	APVD
97-124	B	REDREW IN CAD FORMAT - ADDED "DO NOT USE THIS VALVE FOR VACUUM APPLICATIONS" NOTE	AJD	8-6-97	RET

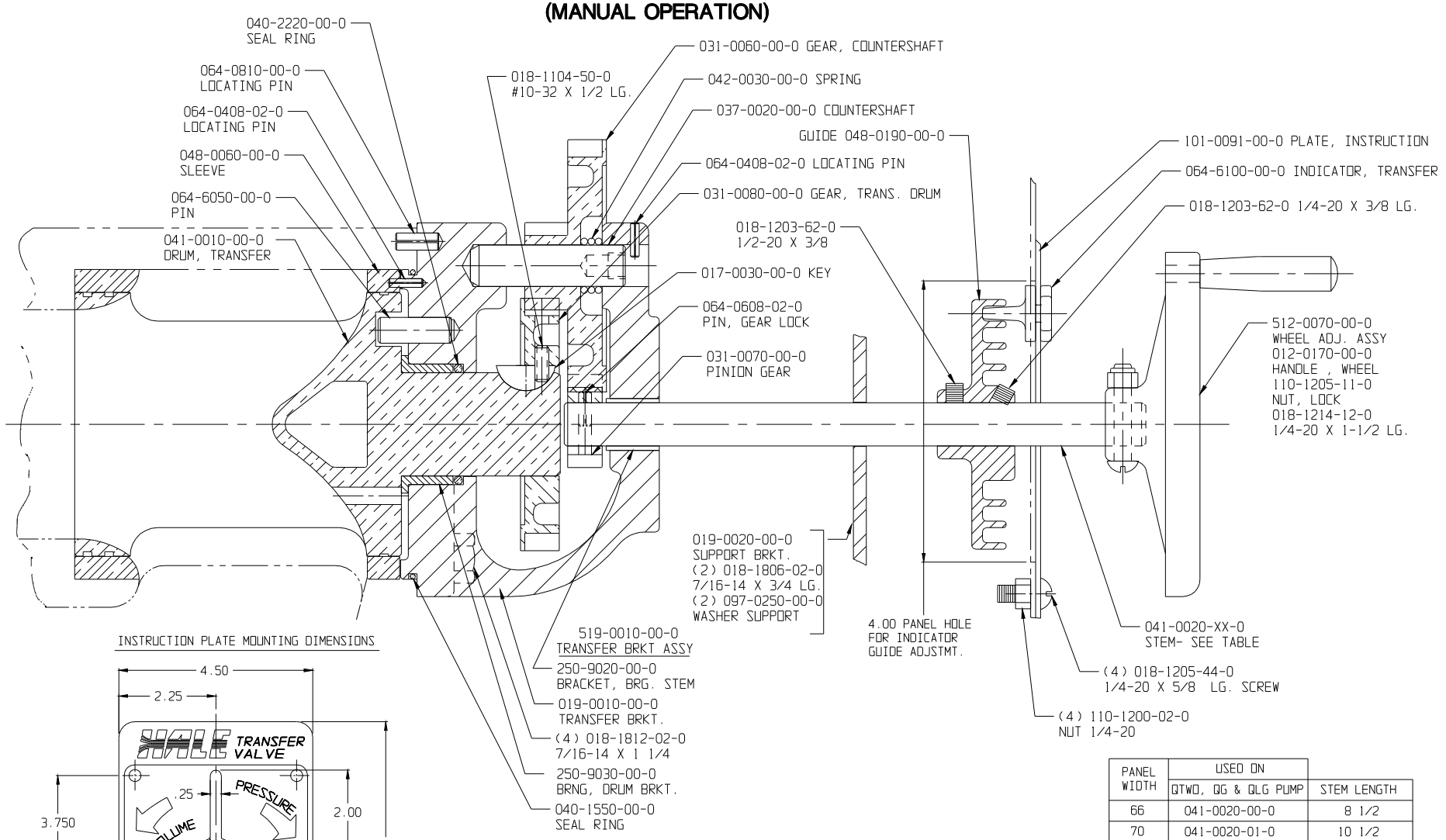
PLATE NO. 595CB

HALE PRODUCTS, INC.
A Unit of IDEX Corporation
Conshohocken, PA 19428 USA

DRAWN: AJD	DATE: 8-6-97	DWG. SIZE: A
CHECKED: RET	SCALE: 1/2=1	SHEET 1 OF 1

HALE TYPE QLF TRANSFER VALVE

(MANUAL OPERATION)



INSTRUCTION PLATE MOUNTING DIMENSIONS

PANEL WIDTH	USED ON QTWO, QG & QLG PUMP	STEM LENGTH
66	041-0020-00-0	8 1/2
70	041-0020-01-0	10 1/2
72	041-0020-02-0	11 1/2
73	041-0020-02-0	11 1/2
74	041-0020-03-0	12 1/2
76	041-0020-04-0	13 1/2

ECO NO	REV	CHANGED FROM	BY	DATE	APVD
01-158	B	UPDATED DRAWING W/DISCRIPTIONS	TKC	3-28-01	MAL
99-121	A	REDRAWN ON CAD - UPDATED	DPL	6-15-99	RET

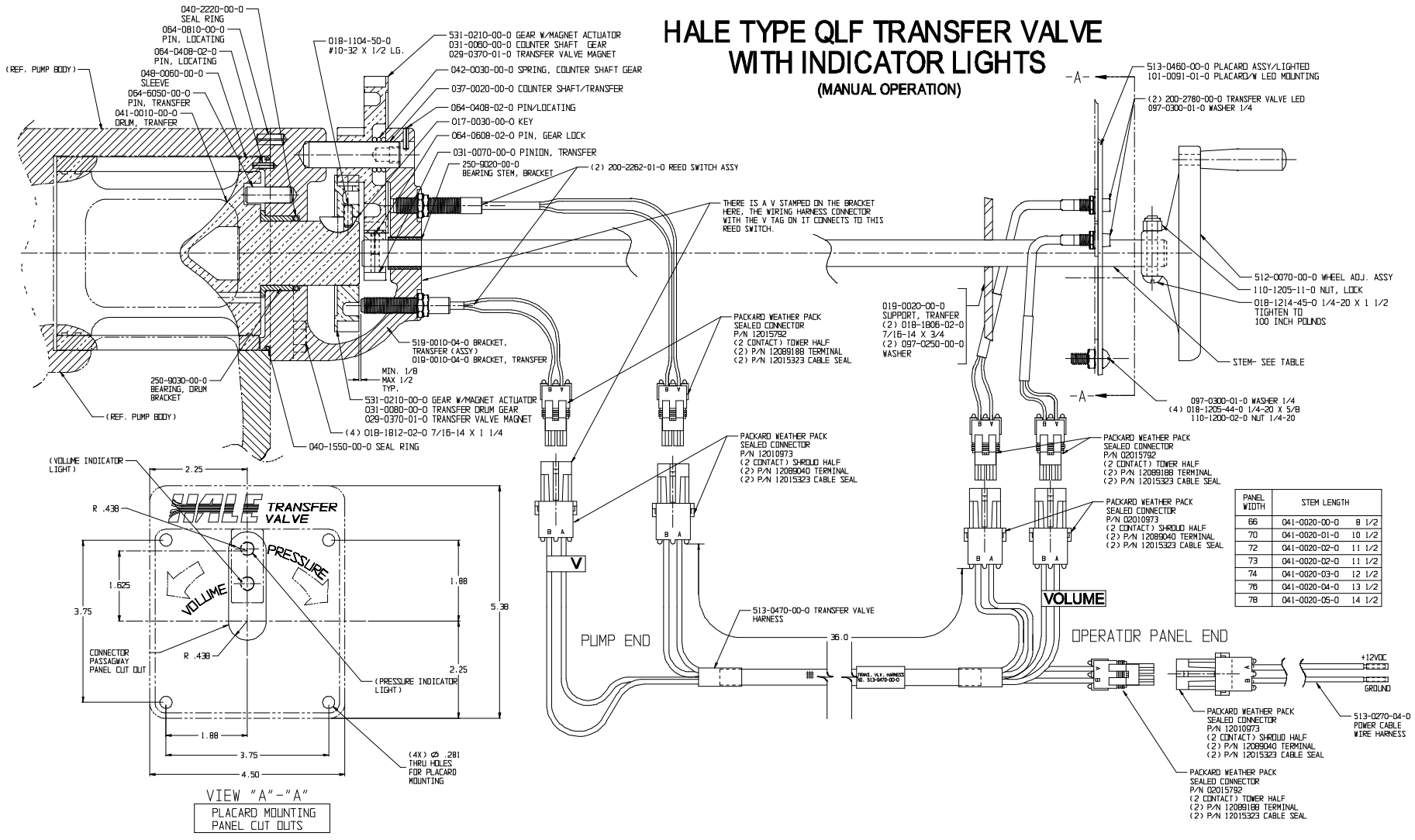
HALE PRODUCTS, INC.
A Unit of IDEX Corporation
Conshohocken, PA 19428 USA

DRAWN JDR | CHECKED MD | DATE 1-5-94 | SIZE C | SCALE: FULL

PLATE NO. 472EB

HALE TYPE QLF TRANSFER VALVE WITH INDICATOR LIGHTS

(MANUAL OPERATION)



PANEL WIDTH	STEM LENGTH	
66	041-0020-00-0	8 1/2
70	041-0020-01-0	10 1/2
72	041-0020-02-0	11 1/2
73	041-0020-02-0	11 1/2
74	041-0020-03-0	12 1/2
76	041-0020-04-0	13 1/2
78	041-0020-05-0	14 1/2

ECO NO	REV	CHANGED FROM	BY	DATE	APVD
00-494	A	RELEASED FOR PRODUCTION	TC	6-12-00	MAL
00-704	B	UPPDATED DRAWING	TC	12-5-00	MAL

HALE PRODUCTS, INC.
A Unit of IDEX Corporation
Conshohocken, PA 19428 USA

DRAWN TC | CHECKED PRW | DATE 6-1-00 | SIZE D | SCALE: FULL

PL927AB

HALE TYPE PVG PRIMING VALVE

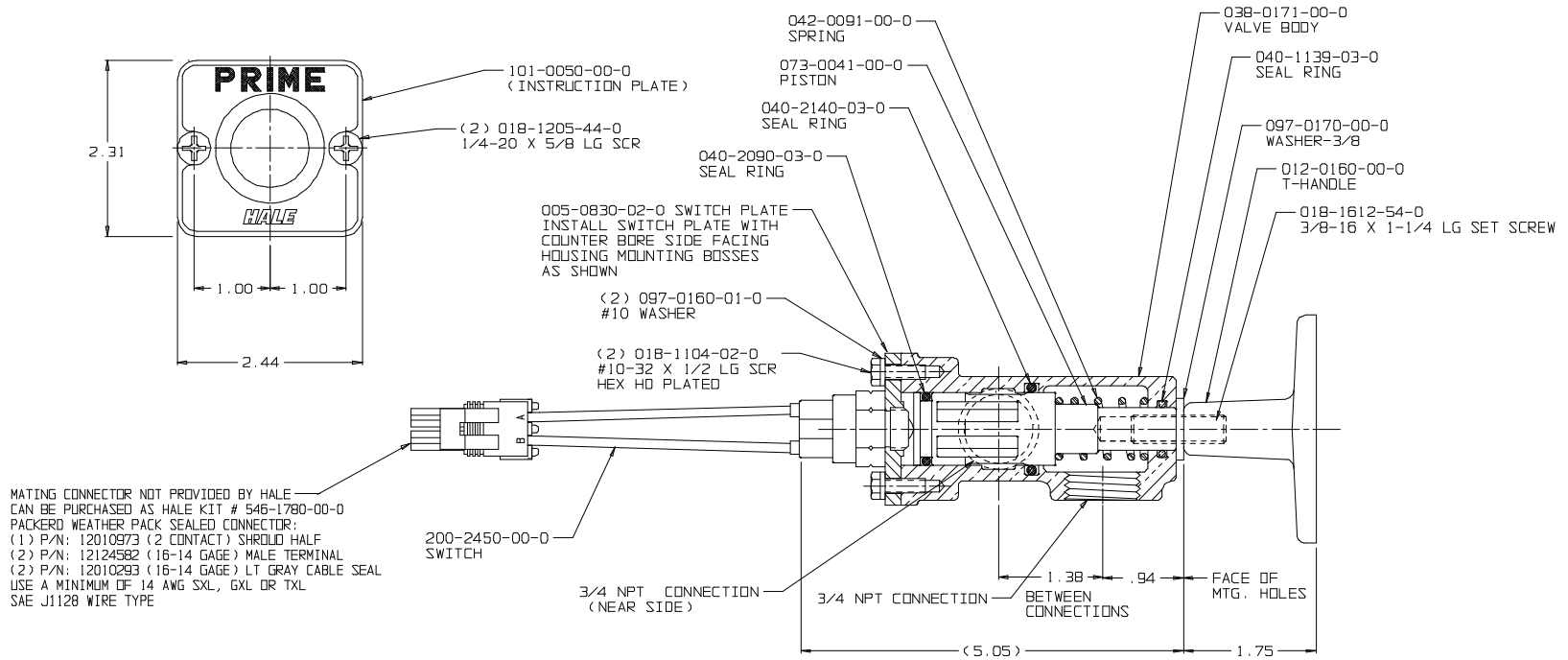


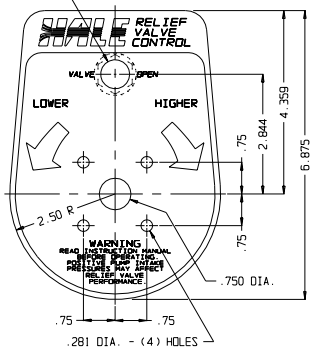
PLATE NO. 480GB

ECO NO	REV	CHANGED FROM	BY	DATE	APVD
01-035	A	REDESIGNED PLATE NO. 480FA	TKC	1-19-01	MAL
01-091	B	CLARIFIED SWITCH PLATE ORIENTATION.	DJK	02-20-01	MAL

HALE PRODUCTS, INC.
A Unit of IDEX Corporation
Conshohocken, PA 19428 USA

DRAWN TKC | CHECKED MAL | DATE 10-6-00 | SIZE C | SCALE: FULL

.688 DIA. HOLE FOR INDICATOR LIGHT
HOLE IN PANEL TO BE 1.00 MINIMUM DIA. TO CLEAR RETAINING NUT WHEN INDICATOR LIGHT IS MOUNTED TO INSTRCTION PLATE



.281 DIA. - (4) HOLES

FOR PANEL THICKNESSES OVER .125, SCREWS LONGER THAN THE (4) 1/4-20 X 5/8 SCREWS SUPPLIED BY HALE WILL BE REQUIRED. MAINTAIN AT LEAST .38 THREAD ENGAGEMENT IN SPRING HOUSING

INSTRUCTION PLATE AND PANEL MOUNTING DETAILS

INSTRUCTIONS FOR INSTALLING LIGHT SWITCH

1- MAKE SURE 200-2650-00-0 COLLET FITTING IS TIGHTENED INTO THE 044-0123-00-0 VALVE COVER. BACK OFF 1 TO 1-1/2 TURNS.

2- INSTALL THE 200-2262-00-0 LIGHT SWITCH IN THE COLLET FITTING. LEAVE THE COLLET HOLDING THE LIGHT SWITCH SLIGHTLY LOOSE SO THAT LIGHT SWITCH CAN BE MOVED IN AND OUT FOR ADJUSTMENT.

3- CONNECT THE PANEL MOUNTED INDICATOR LIGHT OR A SUITABLE TEST LIGHT TO THE SWITCH TERMINALS. WITH THE LIGHT SWITCH PULLED NEARLY ALL THE WAY OUT, THE LIGHT SHOULD BE LIT.

4- WITH THE PUMP NOT RUNNING AND THE RELIEF VALVE FULLY CLOSED (AS SHOWN), PUSH THE LIGHT SWITCH IN UNTIL THE LIGHT GOES OUT. HOLD THE COLLET FITTING WITH A WRENCH TO PREVENT IT FROM TURNING, AND TIGHTEN THE COLLET.

5- DISCONNECT THE ELECTRICAL CONNECTOR. TIGHTEN THE ENTIRE COLLET FITTING 1 TO 1-1/2 TURNS. THE SWITCH IS NOW IN THE PROPER POSITION. RECONNECT THE ELECTRICAL CONNECTOR.

6- VERIFY PROPER OPERATION OF THE RELIEF VALVE AND INDICATOR LIGHT BEFORE PLACING APPARATUS IN SERVICE.

DRAIN CONNECTION NOTES

BOTH THE PRIMARY AND SECONDARY DRAIN CONNECTIONS REQUIRE SEPARATE AND INDEPENDENT DRAIN VALVES. DO NOT CONNECT TO A COMMON DRAIN, INCLUDING PUMP MASTER DRAIN.

THE PRIMARY DRAIN ALLOWS THE QG RELIEF VALVE AND PM CONTROL VALVE TO DRAIN. THE SECONDARY DRAIN ALLOWS THE VENT LINE TO THE WATER TANK TO DRAIN. THE VENT LINE CANNOT DRAIN THROUGH THE PRIMARY DRAIN BECAUSE OF THE CHECK VALVE, WHICH CLOSES THE THE VENT LINE TO HOLD VACUUM WHEN PRIMING THE PUMP.

THE HALE DV7 DRAIN VALVE IS RECOMMENDED. THE DV7 HAS 7 INDEPENDENT DRAIN PORTS CONTROLLED BY A SINGLE KNOB, AND IS INTENDED FOR THIS TYPE OF APPLICATION. FOR MORE INFORMATION, SEE CURRENT REVISION OF HALE PLATE NO. 800A

MAINTENANCE INSTRUCTIONS

TEST THE RELIEF VALVE OFTEN TO BE SURE THAT IT MOVES FREELY. TO DO THIS, FIRST TURN THE ADJUSTING HANDWHEEL CLOCKWISE AS FAR AS POSSIBLE. NEXT, BRING THE PUMP PRESSURE UP TO 150 PSI AND TURN THE HANDWHEEL COUNTERCLOCKWISE UNTIL THE RELIEF VALVE OPENS. ALSO VERIFY THAT INDICATOR LIGHT IS OPERATING.

TURNING THE HANDWHEEL CLOCKWISE AND COUNTERCLOCKWISE AT 150 PSI WILL CAUSE THE RELIEF VALVE AND CONTROL VALVE TO OPERATE. THIS WORKING ACTION MAKES SURE THAT THE VALVE MOVES FREELY AND HELPS TO ENSURE PROPER OPERATION.

THE PM CONTROL SHOULD BE LUBRICATED AT LEAST EVERY 6 MONTHS TO DO THIS, TURN THE HANDWHEEL CLOCKWISE AS FAR AS POSSIBLE AND APPLY A LITHIUM BASE GREASE WITH 1% TO 3% MOLYBEDENUM DISULFIDE ON THE THREADED PART OF THE ADJUSTING STEM.

SOME RECOMMENDED LUBRICANTS INCLUDE:

DOW CORNING BR2-PLUS	IMPERIAL NO. 777
FISKE - LUBRIPLATE NO. 3000	MOBIL - MOBILGREASE SPECIAL
SHELL SUPER DUTY GREASE	SUN OIL - SUNDCO MOLY NO. 2EP

ELECTRICAL INFORMATION

THE HALE 200-2262-00-0 LIGHT SWITCH IS INTENDED FOR USE ONLY WITH THE HALE PROVIDED INDICATOR LIGHT. ELECTRICAL CHARACTERISTICS: 3 AMPS AT 28 VOLTS DC, NORMALLY CLOSED

THE STANDARD HALE 200-0540-03-0 AMBER INDICATOR LIGHT IS INTENDED FOR 12 VOLT DC SERVICE.
REPLACEMENT 12 VOLT BULB IS HALE PART NO. 200-0540-02-0.
FOR 24 VOLT DC SERVICE USE BULB PART NO. 200-0540-09-0

CIRCUIT PROTECTION (FUSES, CIRCUIT BREAKERS, ETC.) IS RECOMMENDED, BUT IS NOT THE RESPONSIBILITY OF HALE PRODUCTS

SELECTION AND INSTALLATION OF ELECTRICAL COMPONENTS AND WIRING OTHER THAN THAT PROVIDED IS NOT THE RESPONSIBILITY OF HALE PRODUCTS. SYSTEM DESIGN AND INSTALLATION MUST BE DONE ONLY BY PROPERLY QUALIFIED PERSONS

PM CONTROL VALVE

INSTALL THE PM CONTROL VALVE AT A LEVEL THAT IS HIGHER THAN THE QG RELIEF VALVE

THE PM CONTROL VALVE AND THE LINES ATTACHED MUST DRAIN NATURALLY AND COMPLETELY TO PROTECT FROM FREEZING WHEN NOT IN USE

QG RELIEF VALVE

WITH P35 RELIEF VALVE HOUSING

INSTRUCTIONS FOR SETTING QG RELIEF VALVE

1- TO SET THE RELIEF VALVE, BRING THE PUMP UP TO DESIRED OPERATING PRESSURE. USE THE DISCHARGE PRESSURE GAUGE.

2- ONCE YOU HAVE REACHED THE DESIRED OPERATING PRESSURE ON THE PUMP DISCHARGE PRESSURE GAUGE (WITH OR WITHOUT THE PUMP DISCHARGING WATER) SLOWLY MOVE THE ADJUSTING HANDWHEEL COUNTERCLOCKWISE UNTIL THE RELIEF VALVE OPENS AND THE AMBER PILOT LIGHT COMES ON.

3- TURN HANDWHEEL ABOUT 1/2 TURN CLOCKWISE UNTIL THE INDICATOR LIGHT GOES OFF. THE RELIEF VALVE WILL NOW OPERATE AT THE SET PRESSURE.

4- WHEN THE PUMP IS NOT IN OPERATION THE HANDWHEEL SHOULD BE TURNED CLOCKWISE BACK TO A POSITION SLIGHTLY ABOVE THE NORMAL OPERATING PRESSURE.

5- WHEN THE PUMP IS RUNNING, A LIT INDICATOR LIGHT INDICATES THE RELIEF VALVE IS IN OPERATION.

6- READ THE OPERATING AND INSTRUCTION MANUAL FOR ADDITIONAL OPERATING INSTRUCTIONS.

WARNING FAILURE TO FOLLOW THE INSTALLATION, OPERATION, LUBRICATION AND MAINTENANCE REQUIREMENTS SET FORTH HERE AND IN THE OPERATING AND INSTRUCTION MANUAL MAY RESULT IN SERIOUS PERSONAL INJURY AND / OR DAMAGE TO EQUIPMENT

ALL INSTALLATION DETAILS MUST CONFORM TO APPLICABLE NFPA AND SAE STANDARDS VERIFY PROPER RELIEF VALVE OPERATION BEFORE PLACING APPARATUS IN SERVICE

HALE TYPE P35 RELIEF VALVE

WITH PM CONTROL VALVE

PLATE NO. 779AC

ECO NO	REV	CHANGED FROM	BY	DATE	APVD
95-34	A	RELEASED FOR PRODUCTION	AJD	5-18-95	RDT
96-78	B	040-1139-03-0	MD	4-17-96	RET
98-138	C	REVISED SWITCH AND CHECK VALVE. REDREW / REDETAILED	AJD	6-30-98	MAL

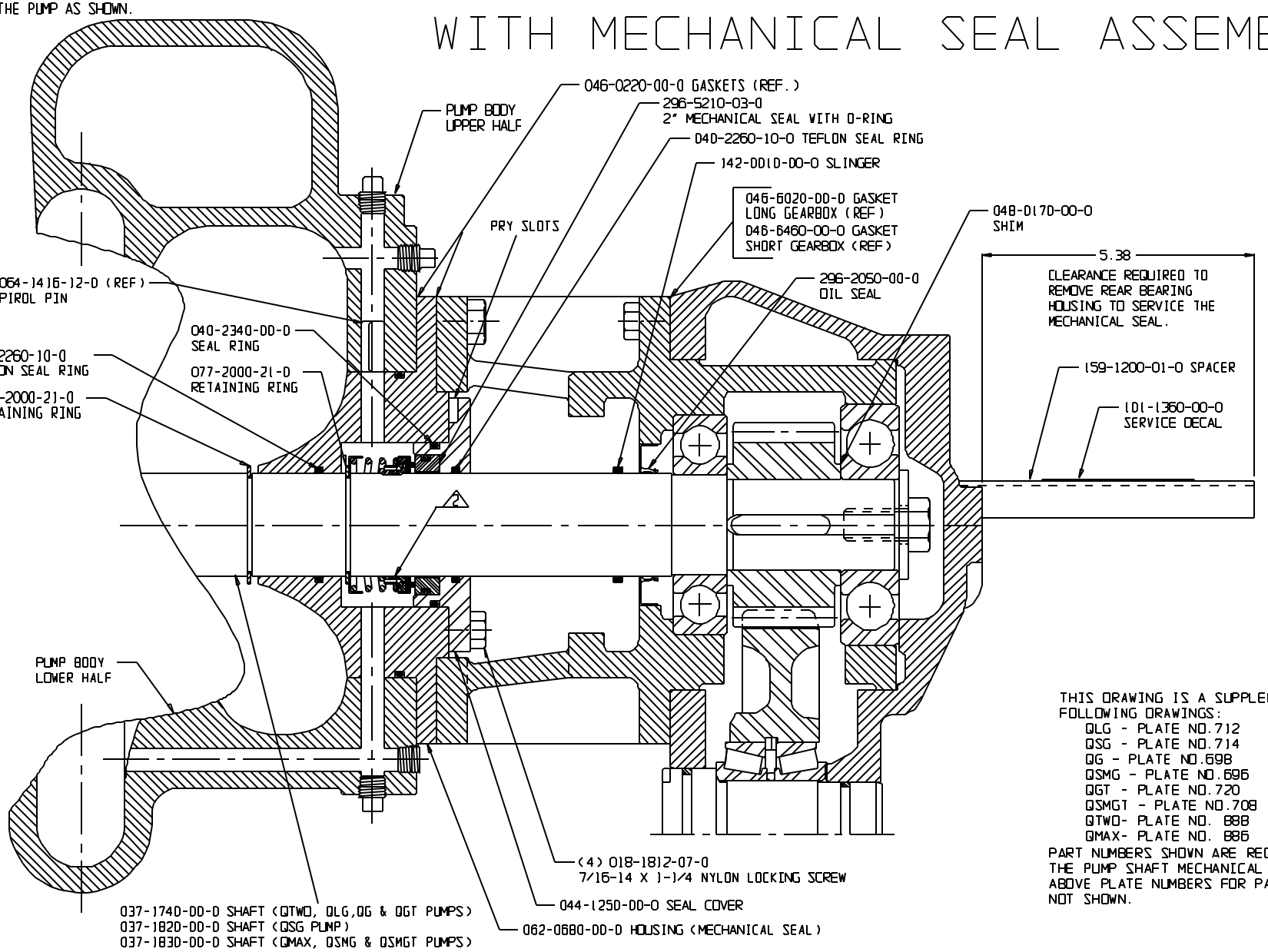
HALE PRODUCTS, INC.
A Unit of IDEX Corporation
Conshohocken, PA 19428 USA

DRAWN | JDR | DATE: 9-2-94 | SIZE 50 X 35 | SCALE: 3/2
CHECKED | RDT

* NOTE:
1. IF CONVERTING FROM A PACKING TYPE PUMP SEAL TO A MECHANICAL SEAL TYPE PUMP SEAL, THE ORIFICE PIN (P/N 064-1416-12-0) MUST BE REMOVED FROM THE COOLING LINE IN THE LOWER HALF OF THE PUMP BODY AND REINSERTED IN THE UPPER HALF OF THE PUMP AS SHOWN.

2 FOR MECHANICAL SEAL REPLACEMENT SEE INSTRUCTION SHEET 101-0850-68-0 .

HALE MIDSHIP PUMP
WITH MECHANICAL SEAL ASSEMBLY



THIS DRAWING IS A SUPPLEMENT TO THE FOLLOWING DRAWINGS:
- QLG - PLATE NO.712
- QSG - PLATE NO.714
- QG - PLATE NO.698
- QSMG - PLATE NO.696
- QGT - PLATE NO.720
- QSMGT - PLATE NO.708
- QTWO- PLATE NO. 888
- QMAX- PLATE NO. 886

PART NUMBERS SHOWN ARE REQUIRED FOR THE PUMP SHAFT MECHANICAL SEAL. SEE ABOVE PLATE NUMBERS FOR PART NUMBERS NOT SHOWN.

ECO NO	REV	CHANGED FROM	BY	DATE	APVD
01-062	B	UPDATED W/ DESCRIPTIONS	TC	1-31-01	MAL
01-210	C	ADDED SHIM 048-0170-00-0	TC	4-26-01	MAL
02-244	D	296-5210-02-0 WAS 296-5210-85-0 (SEE 296-5210-03-0 WAS 296-5210-80-0	MBB	07-13-02	MAL

HALE PRODUCTS, INC.
A Unit of IDEX Corporation
Conshohocken, PA 19428 USA

DRAWN JDP | CHECKED --- | DATE 6-7-93 | SIZE - | SCALE: FULL

PLOT "F" FULL SIZE RED. TO 34%

PLATE NO. 757AD

THIS PRODUCT AND ITS COMPONENTS ARE PROTECTED BY U.S. PATENT NO. 4,653,978.

HALE TYPE TPM/P35 RELIEF VALVE SYSTEM

(1500 GPM CAPACITY)

MAINTENANCE

TEST THE RELIEF VALVE OFTEN TO BE SURE IT MOVES FREELY. THIS IS DONE BY TURNING THE CONTROL VALVE ADJUSTING HANDWHEEL CLOCKWISE AS FAR AS POSSIBLE. BRING THE PUMP PRESSURE UP TO 150 PSI AND TURN HANDWHEEL COUNTERCLOCKWISE UNTIL THE RELIEF VALVE OPENS.
TURNING THE HANDWHEEL CLOCKWISE AND COUNTERCLOCKWISE AT 150 PSI WILL CAUSE THE RELIEF VALVE AND CONTROL TO OPERATE, THIS WORKING ACTION FREES THE VALVE AND HELPS TO INSURE PROPER OPERATION.
THE PM CONTROL SHOULD BE LUBRICATED AT LEAST EVERY SIX MONTHS. TURN THE HANDWHEEL CLOCKWISE AS FAR AS POSSIBLE AND BRUSH A LITHIUM BASE GREASE WITH 1-3% MOLYBDENUM DISULFIDE ON THE THREADED SHAFT WHERE INDICATED.

APPROVED GREASES ARE:

DOW CORNING BR2-PLUS,	IMPERIAL #777
LUBRIPLATE-FISKE #3000,	MOBIL-MOBILGREASE SPECIAL
SHELL SUPER DUTY GREASE,	SUN OIL-SUNOCO MOLY #2EP

DRAIN CONNECTION NOTES

BOTH THE PRIMARY AND SECONDARY DRAIN CONNECTION REQUIRE SEPARATE AND INDEPENDENT DRAIN VALVES. DO NOT CONNECT TO A COMMON DRAIN, INCLUDING PUMP MASTER DRAIN.

THE PRIMARY DRAIN ALLOWS THE QG RELIEF VALVE AND THE PM CONTROL VALVE TO DRAIN. THE SECONDARY DRAIN ALLOWS THE VENT LINE TO THE WATER TANK TO DRAIN. THE VENT LINE CAN NOT DRAIN THROUGH THE PRIMARY DRAIN BECAUSE OF THE CHECK VALVE, WHICH CLOSES THE VENT LINE TO HOLD VACUUM WHEN PRIMING THE PUMP.

THE HALE DV7 DRAIN VALVE IS RECOMMENDED. THE DV7 HAS 7 INDEPENDED DRAIN PORTS CONTROLLED BY A SINGLE KNOB AND IS INTENDED FOR THIS TYPE OF APPLICATION. FOR MORE INFORMATION, SEE CURRENT REVISION OF HALE PLATE NO. 800.

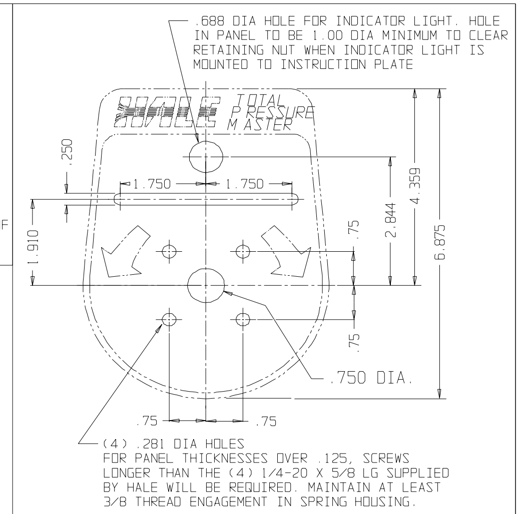
ELECTRICAL INFORMATION

THE HALE 200-2262-00-0 LIGHT SWITCH IS INTENDED FOR USE ONLY WITH THE HALE PROVIDED INDICATOR LIGHT. ELECTRICAL CHARACTERISTICS: 3 AMPS AT 28 VOLTS DC, NORMALLY CLOSED.

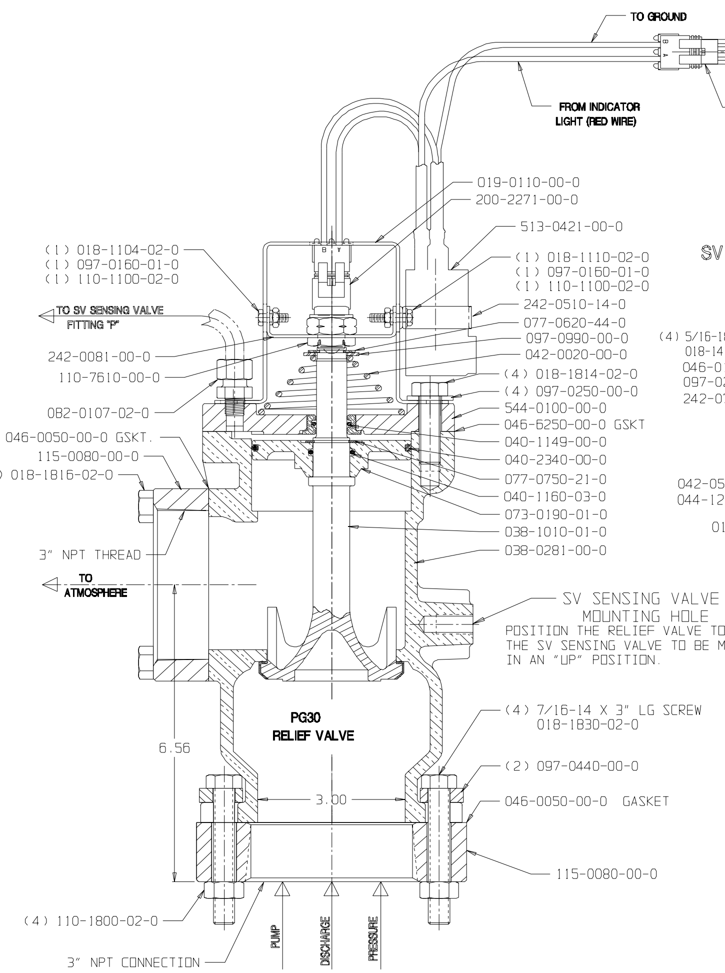
THE STANDARD HALE 200-0540-03-0 AMBER INDICATOR LIGHT IS INTENDED FOR 12 VOLT DC SERVICE. REPLACEMENT 12 VOLT BULB IS HALE PART NO. 200-0540-02-0. FOR 24 VOLT DC SERVICE USE BULB PART NO. 200-0540-09-0.

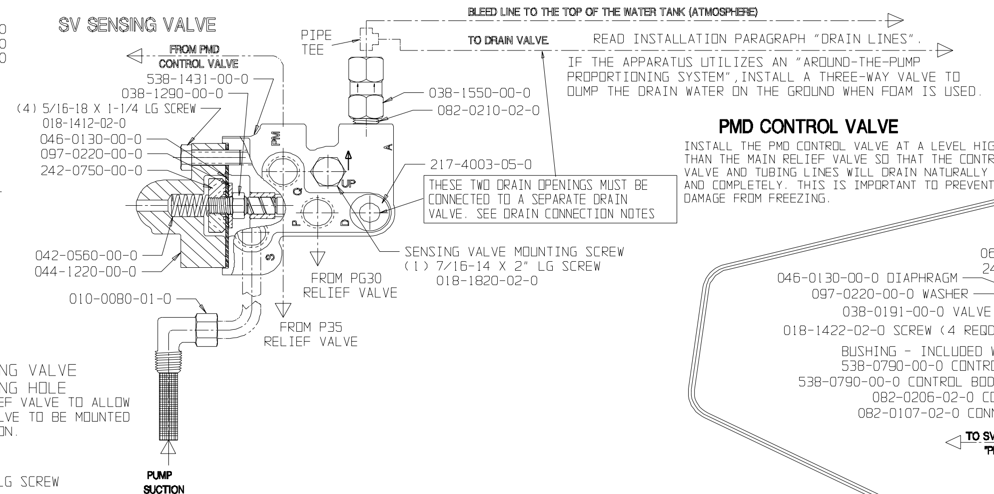
CIRCUIT PROTECTION (FUSE, CIRCUIT BREAKERS, ECT.) IS RECOMMENDED, BUT IS NOT THE RESPONSIBLITY OF HALE PRODUCTS.

SELECTION AND INSTALLATION OF ELECTRICAL COMPONENTS AND WIRING OTHER THAN THAT PROVIDED IS NOT THE RESPONSIBILITY OF HALE PRODUCTS. SYSTEM DESIGN AND INSTALLATION MUST BE DONE ONLY BY PROPERLY QUALIFIED PERSONS.



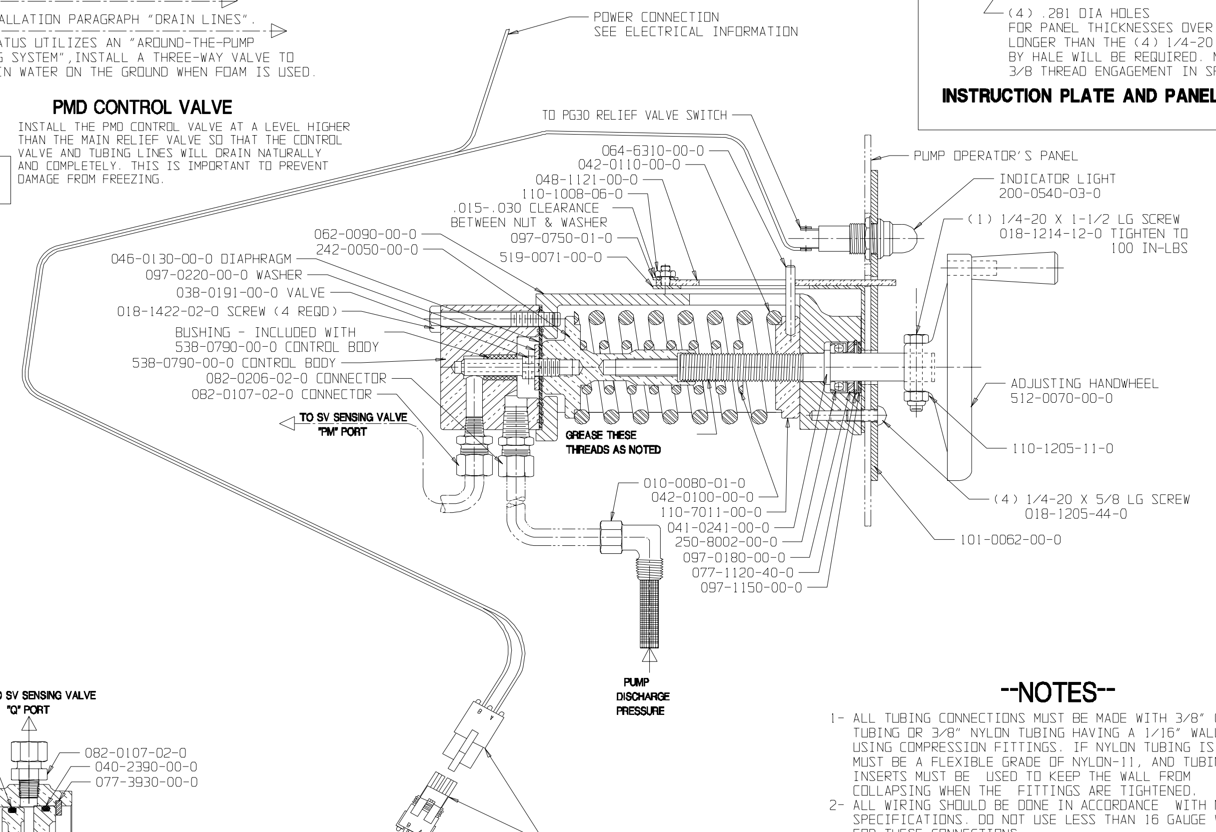
INSTRUCTION PLATE AND PANEL MOUNTING DETAILS

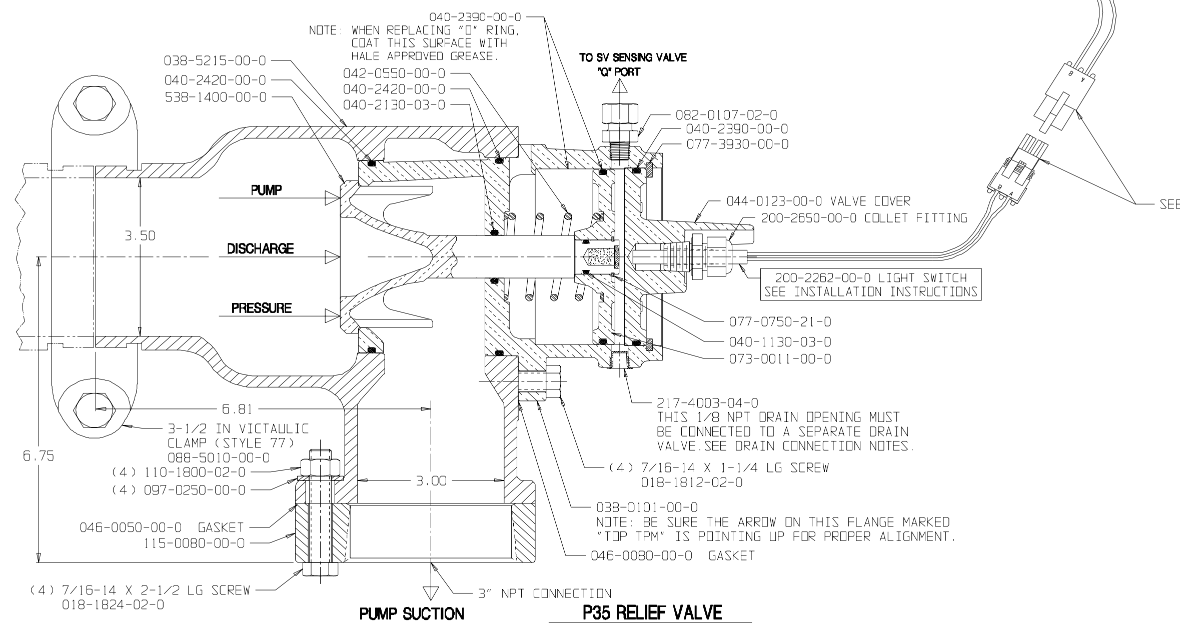




PMD CONTROL VALVE

INSTALL THE PMD CONTROL VALVE AT A LEVEL HIGHER THAN THE MAIN RELIEF VALVE SO THAT THE CONTROL VALVE AND TUBING LINES WILL DRAIN NATURALLY AND COMPLETELY. THIS IS IMPORTANT TO PREVENT DAMAGE FROM FREEZING.





P35 RELIEF VALVE

INSTRUCTIONS FOR SETTING TPM RELIEF VALVE SYSTEM

1- SET THE WHITE PRESSURE INDICATOR ON THE PMD CONTROL VALVE TO A POSITION SLIGHTLY ABOVE THE NORMAL OPERATING PRESSURE. DO THIS EVEN BEFORE YOU INCREASE THE PUMP ENGINE RPM.
2- ONCE YOU HAVE REACHED THE NORMAL OPERATING PRESSURE USING THE PUMP DISCHARGE PRESSURE GAGE(WITH OR WITHOUT THE PUMP DISCHARGING WATER) SLOWLY MOVE THE ADJUSTING HANDWHEEL COUNTERCLOCKWISE UNTIL THE RELIEF VALVE OPENS AND THE PILOT LIGHT COMES ON AND PRESSURE GAUGE GOES DOWN A COUPLE OF PSI
3- SLOWLY TURN HANDWHEEL CLOCKWISE UNTIL THE PILOT LIGHT GOES OFF AND PRESSURE GAUGE. RETURNS TO SET. THE RELIEF VALVE WILL NOW OPERATE AT THE SET PRESSURE.
4- WHEN THE PUMP IS NOT IN OPERATION THE HANDWHEEL SHOULD BE TURNED CLOCKWISE BACK TO A POSITION SLIGHTLY ABOVE THE NORMAL OPERATING PRESSURE.
5- WHEN THE PUMP IS RUNNING, A NON FLASHING PILOT LIGHT INDICATES THE INTERNAL QG RELIEF VALVE IS IN OPERATION. THE PILOT LIGHT WILL FLASH WHEN BOTH THE INTERNAL QG RELIEF VALVE AND THE EXTERNAL PG30 DUMP VALVE ARE OPERATING.
6- READ INSTALLATION AND OPERATION MANUAL FOR ADDITIONAL OPERATING INSTRUCTIONS.
7- IF THE TPM RELIEF VALVE SYSTEM IS TO BE USED WITH DETROIT DIESEL ELECTRONIC CONTROLS (DDEC), BE SURE TO READ THE SPECIAL INSTRUCTIONS IN THE MANUAL.

INSTRUCTIONS FOR INSTALLING LIGHT SWITCH

1- MAKE SURE 200-2650-00-0 COLLET FITTING IS TIGHTENED INTO THE 044-0123-00-0 VALVE COVER. BACK OFF 1 TO 1-1/2 TURNS.
2- INSTALL THE 200-2262-00-0 LIGHT SWITCH IN THE COLLET FITTING. LEAVE THE COLLET HOLDING THE LIGHT SWITCH SLIGHTLY LOOSE SO THAT LIGHT SWITCH CAN BE MOVED IN AND OUT FOR ADJUSTMENT.
3- CONNECT THE PANEL MOUNTED INDICATOR LIGHT OR A SUITABLE TEST LIGHT TO THE SWITCH TERMINALS. WITH THE LIGHT SWITCH PULLED NEARLY ALL THE WAY OUT, THE LIGHT SHOULD BE LIT.
4- WITH THE PUMP NOT RUNNING AND THE RELIEF VALVE FULLY CLOSED (AS SHOWN), PUSH THE LIGHT SWITCH IN UNTIL THE LIGHT GOES OUT. HOLD THE COLLET FITTING WITH A WRENCH TO PREVENT IT FROM TURNING, AND TIGHTEN THE COLLET.
5- DISCONNECT THE ELECTRICAL CONNECTOR. TIGHTEN THE ENTIRE COLLET FITTING 1 TO 1-1/2 TURNS. THE SWITCH IS NOW IN THE PROPER POSITION. RECONNECT THE ELECTRICAL CONNECTOR.
6- VERIFY PROPER OPERATION OF THE RELIEF VALVE AND INDICATOR LIGHT BEFORE PLACING APPARATUS IN SERVICE.

--NOTES--

1- ALL TUBING CONNECTIONS MUST BE MADE WITH 3/8" COPPER TUBING OR 3/8" NYLON TUBING HAVING A 1/16" WALL AND USING COMPRESSION FITTINGS. IF NYLON TUBING IS USED, IT MUST BE A FLEXIBLE GRADE OF NYLON-11, AND TUBING INSERTS MUST BE USED TO KEEP THE WALL FROM COLLAPSING WHEN THE FITTINGS ARE TIGHTENED.
2- ALL WIRING SHOULD BE DONE IN ACCORDANCE WITH NFPA SPECIFICATIONS. DO NOT USE LESS THAN 16 GAUGE WIRE FOR THESE CONNECTIONS.
3- ELECTRICAL CONNECTORS PROVIDED BY HALE WITH LIGHT SWITCH REF: PACKARD WEATHER PACK SEALED
CONNECTOR: (1) P/N: 12015792 (2-CONTACT) TOWER HALF
(2) P/N: 12124580 (16-14 GAGE) FEMALE TERMINAL
(2) P/N: 12010293 (16-14 GAGE) LT GRAY CABLE SEAL

MATING CONNECTORS NOT PROVIDED BY HALE WITH LIGHT SWITCH REF: PACKARD WEATHER PACK SEALED
CONNECTOR: (1) P/N: 12010973 (2-CONTACT) SHROUD HALF
(2) P/N: 12124582 (16-14 GAGE) MALE TERMINAL
(2) P/N: 12010293 (16-14 GAGE) LT GRAY CABLE SEAL

WARNING

FAILURE TO FOLLOW THE INSTALLATION, OPERATION, LUBRICATION AND MAINTENANCE REQUIREMENTS SET FORTH HERE AND IN THE OPERATING AND INSTRUCTION MANUAL MAY RESULT IN SERIOUS PERSONAL INJURY AND / OR DAMAGE TO EQUIPMENT

ALL INSTALLATION DETAILS MUST CONFORM TO APPLICABLE NFPA AND SAE STANDARDS VERIFY PROPER RELIEF VALVE OPERATION BEFORE PLACING APPARATUS IN SERVICE

ECO NO	REV	CHANGED FROM	BY	DATE	APVD
97-62	A	REDESIGNED PLATE NO. 799AA	MD	3-12-97	RET
99-036	B	UPDATED PART REQUIREMENTS	JBS	2-26-99	RET
00-440	C	UPDATED PART REQUIREMENTS	DK	4-05-00	MAL

HALE PRODUCTS, INC.
A Unit of IDEX Corporation
Conshohocken, PA 19428 USA

DRAWN JDR		DATE: 9-13-94	SIZE 40 X 28	SCALE: FULL
CHECKED RDT				

PLATE NO. 799BC

PLT "F"=FULL SIZE

TEST PROCEDURE:

1. CLOSE ALL DISCHARGE VALVES (INCLUDING PUMP AND ENGINE COOLERS) SO THERE IS NO FLOW THROUGH THE PUMP.
2. USE CARE THAT ENGINE DOES NOT OVERHEAT. SET THE PUMP DISCHARGE PRESSURE TO ONE OF THE PRESSURES LISTED.
3. THE THERMAL RELIEF VALVE SHOULD DISCHARGE WATER THROUGH THE 1/8 NPT OR ISO DISCHARGE LINE WITHIN THE TIME SPECIFIED.
4. THE TABLE IS FOR MIDSHIP TYPE PUMPS. THE THERMAL RELIEF VALVE WILL OPEN FASTER ON SMALLER PUMPS.
5. THE TABLE IS BASED ON 70°F (21°C) WATER AND 70°F (21°C) AIR TEMPERATURE. THE THERMAL RELIEF VALVE WILL OPEN FASTER IN HOTTER CONDITIONS AND SLOWER IN COOLER CONDITIONS.
6. UNITS EQUIPPED W/TRV-L KIT WILL FLOW UP TO 1-2 GPM OF WATER BEFORE LAMP TURNS ON.

PRESSURE	TIME IN MINUTES (TRV120/TRVM120/TRVF120 TRV170/TRVM170/TRVF170)
200 PSI (13.8 BAR)	10
400 PSI (27.6 BAR)	4
600 PSI (41.4 BAR)	2

018-1607-58-0 ADJUSTING SCREW. THIS SCREW IS PRESET AND LOCKED IN PLACE. IF A PART OF THE RELIEF VALVE IS REPLACED, IT MAY NEED READJUSTMENT. ATTACH A WATER SUPPLY OF 30-60 PSIG (2-4 BARS) TO THE 1/8 NPT OR ISO HOLE. APPLY A THREAD SEALING ADHESIVE TO THE THREADS AND TURN SCREW CLOCKWISE UNTIL INCOMING WATER PASSES THRU HOLE "X" AND STARTS TO FLOW OUT OF THE STRAINER. AT THIS POINT, TURN THE ADJUSTING SCREW COUNTERCLOCKWISE 2-1/2 TURNS SO THE FLOW STOPS AND THE PISTON IS POSITIONED.

1/8 N.P.T. OR ISO 228/1-G 1/8 CONNECTION FOR RELIEF VALVE DISCHARGE LINE. USE 3/8 (10) TUBING TO ATMOSPHERE OR RETURN LINE TO THE TRUCK TANK. A DRAIN VALVE MUST BE PROVIDED IN THIS LINE TO DRAIN IN FREEZING WEATHER. IF THE VALVE IS MOUNTED HORIZONTAL, THIS CONNECTION SHOULD BE IN A DOWNWARD POSITION TO AID IN DRAINING OF THE TUBING LINE.

038-1282-00-0 BODY WITH FLANGE
INSTALL ON PUMP DISCHARGE MANIFOLD. THE THERMAL RELIEF VALVE IS INSTALLED IN THE PUMP DISCHARGE PIPING, CLOSE TO THE PUMP BODY OUTLET.

142-0390-00-0 SQUARE SEAL RING

010-0580-00-0 INLET STRAINER. CHECK FOR BLOCKAGE ONCE A YEAR OR MORE FREQUENTLY IF PUMPING WATER WITH IMPURITIES. THE BODY, PISTON & O-RINGS, AT THIS TIME, SHOULD BE CLEANED, INSPECTED AND LUBRICATED WITH ODM 55M SILICONE GREASE OR EQUIVALENT SILICONE GREASE.

SENSING ELEMENT 038-1251-00-0 (120°F)(49°C)
038-1251-01-0 (170°F)(77°C)

064-0324-02-0 SPRING PIN (FLANGED BODY)
064-0322-02-0 SPRING PIN (THREADED BODY)

INSTALL THIS END IN UPWARDS POSITION SO THE RELIEF VALVE DRAINS IN FREEZING WEATHER OR USE DRAIN AS NOTED.

(2) 040-0250-07-0 O-RING

077-9024-20-0 RETAINING RING

073-0100-00-0 PISTON

042-0540-00-0 SPRING

077-1180-20-0 RETAINING RING

(4) 018-1812-02-00 7/16-14UNC X 1-1/4 LG

HOLE "X"

1.16 (29)

217-0101-13-0 1/8 NPT PLUG (SEE NOTE C)

TRV 3.50 (89) - REFERENCE ONLY
TRVM 2.81 (71)

4.37 (111)

MOUNTING FACE FOR REFERENCE ONLY

038-1280-03-0 BODY W(TH 1-1/4 N.P.T. THREAD
038-1281-01-0 BODY (TRVM120 & TRVM170) WITH ISO 228/1G 1-1/4A THREAD
INSTALL ON PUMP DISCHARGE MANIFOLD. THE THERMAL RELIEF VALVE IS INSTALLED IN THE PUMP DISCHARGE PIPING, MOUNT CLOSE TO THE PUMP BODY OUTLET.

FLANGED — THREADED

OPTIONAL AUDIBLE ALARM

INSTALLER SUPPLIED WIRING FOR AUDIBLE ALARM OPTION ONLY. (14 GA. SXL OR GXL SAE J1128)

200-1310-00-0 AUDIBLE ALARM

TO CHASSIS GROUND

200-0540-15-0 LIGHT INDICATOR BODY
200-0540-02-0 BULB
200-0540-13-0 RED LENS

POWER CONNECTION THRU 10 AMP 12V FUSE

200-0120-04-0 STARTER SWITCH

101-1720-00-0 TRV-L NAMEPLATE

513-0360-01-0 WIRE HARNESS

TRV-L KIT

TO CHASSIS GROUND (INSTALLER SUPPLIED WIRE (14 GA. SXL OR GXL SAE J1128)

2.75 (70)

CONNECTION FOR RELIEF VALVE DISCHARGE LINE

200-2560-00-0 PRESSURE SWITCH

082-0145-02-0 ELBOW

082-0146-02-0 FITTING

REMOVE 1/8 N.P.T. PLUG

5.75 MIN. (114) CLEARANCE FOR CURVED WIRES

NOTE:

A. TRV-L KIT P/N: 200-2600-00-0 DOES NOT INCLUDE TRV.
B. TRV-L KIT CAN ONLY BE USED ON TRV UNITS MANUFACTURED AFTER 2/1/97. TRVS MUST HAVE SECOND 1/8 N.P.T. TAP AS SHOWN.
C. REMOVE 1/8 N.P.T. PLUG WHEN INSTALLING TRV-L KIT.

DIMENSIONS ARE IN (INCHES. DIMENSIONS IN ( ) ARE MM.

MODEL	TEMPERATURE RATING
TRV120/TRVM120/ TRVF120	120° F. (49° C)
TRV170/TRVM170/ TRVF170	170° F. (77° C)

ECO NO	REV	CHANGED FROM	BY	DATE	APVD
97-225	D	CHANGED BODY FROM 038-1280-00-0 TO 038-1280-02-0 (TRV170 ONLY)	MD	12-4-97	RET
00-540	E	ADDED TRV W(TH FLANGE (TRVF)	DK	07-31-00	MAL

HALE TYPE TRV/TRVM/TRVF THERMAL RELIEF VALVE

PLATE NO. 729AE

PATENT NO. 5,018,665

HALE PRODUCTS, INC.
A Unit of IDEX Corporation
Conshohocken, PA 19428 USA

DRAWN DJK | CHECKED MAL | DATE 7-31-00 | SIZE 9.5 X 13 | SCALE: FULL

THIS PRODUCT AND ITS COMPONENTS MAY BE PROTECTED BY ONE OR MORE OF THE FOLLOWING U.S. PATENTS AND OTHER PATENTS PENDING:

⚠ WARNING ⚠

EXCEEDING THESE LIMITS OR FAILURE TO FOLLOW THE RECOMMENDATIONS OUTLINED IN THIS DRAWING COULD DAMAGE THE GEARBOX AND RESULT IN PERSONAL INJURY.

MAXIMUM GEARBOX SHAFT TORQUE (ROAD) = 16,000 LBS-FT (21,693 N-m)
SEE HALE TORQUE LIMIT CHART F-72 FOR ADDITIONAL DATA

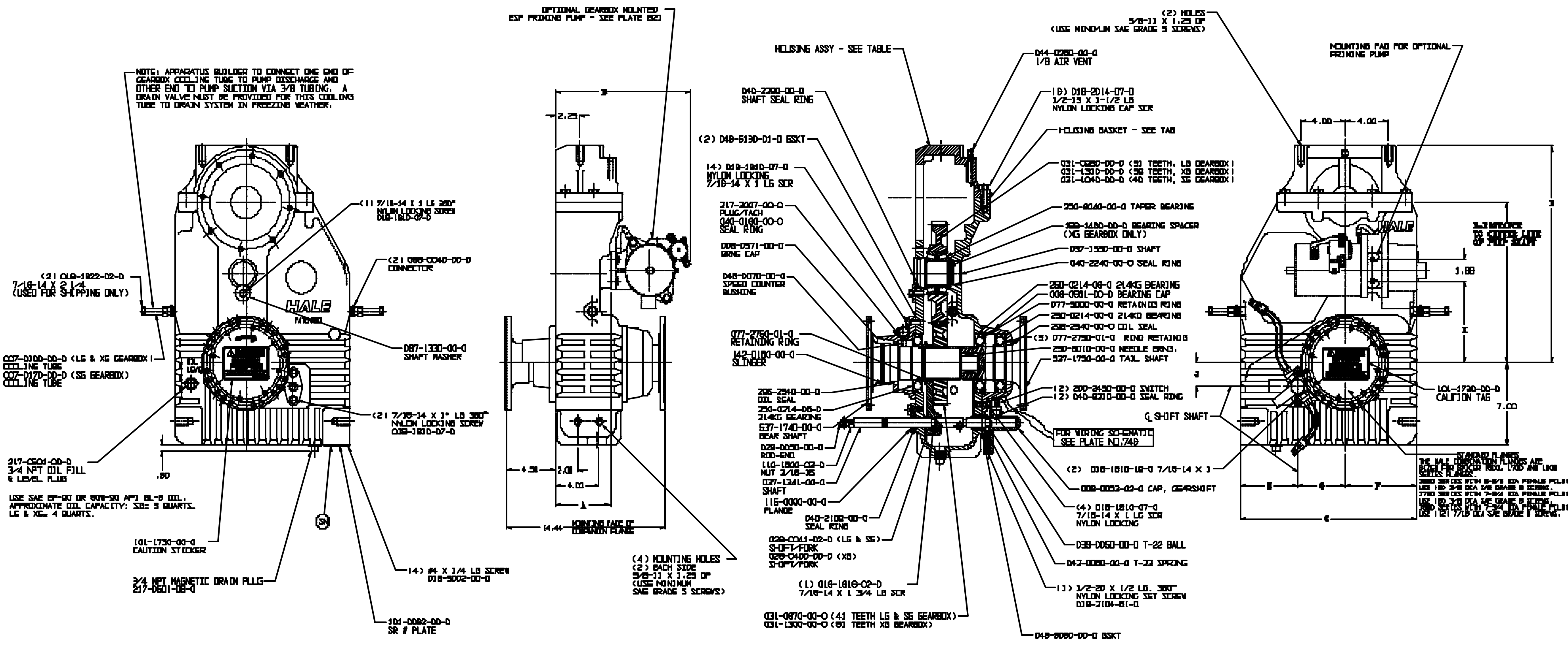
GEARBOX MODEL	GEAR RATIO	HOUSING ASS'Y	HSG GASKET	A	B	C	D	E	F	G	H	J	K
XG	2.83	504-0510-00-0	046-6370-01-0	5.06	12.25	16.00	20.94	15.56	6.50	5.44	4.06	1.84	9.15
	2.55							15.75					
	2.32							15.90					
	2.13							16.06					
	1.96							16.25					
LG	2.28	504-0340-00-0	046-6370-00-0	5.06	12.25	16.00	18.56	13.38	6.50	4.31	5.19	2.00	7.00
	2.05							13.56					
	1.88							13.75					
	1.71							13.94					
	1.58							14.13					
SG	2.28	504-0380-00-0	046-6370-00-0	6.06	13.25	14.00	16.75	11.50	6.50	4.75	2.75	.38	6.75
	2.05							11.68					
	1.86							11.81					
	1.71							12.06					
	1.58							12.25					

(SN) = LOCATION OF SERIAL NUMBER

NOT SHOWN: OIL WARNING LEVEL TAG 101-0310-00-0

DRIVE LINE RECOMMENDATIONS

APPARATUS BUILDER SUPPLIED DRIVELINES SHALL BE OF APPROPRIATE SIZE TO MATCH THE CHASSIS AND PUMP REQUIREMENTS WITH INDIVIDUAL JOINT CANCELLATION AND PHASING BEFORE AND AFTER THE PUMP. DRIVE SHAFT BALANCE (INCLUDING YOKES) SHALL NOT EXCEED THE RECOMMENDED LIMIT OF EITHER THE DRIVE SHAFT OR CHASSIS TRANSMISSION MANUFACTURER'S SPECIFICATIONS. DRIVE SHAFT FULL RANGE OPERATING SPEEDS SHALL NOT EXCEED 42% OF ITS CRITICAL SPEED.



OPTIONAL GEARBOX MOUNTED ESP PRIMING PUMP - SEE PLATE 823
HOUSING ASSY - SEE TABLE
(2) HOLES 5/8-11 X 1.25 DP (USE MINIMUM SAE GRADE 5 SCREWS)
MOUNTING PAD FOR OPTIONAL PRIMING PUMP
044-0260-00-0 1/8 AIR VENT
040-2380-00-0 SHAFT SEAL RING
HOUSING GASKET - SEE TAB
(2) 046-6130-01-0 GSKT
230-8040-00-0 TAPER BEARING
037-1550-00-0 SHAFT
040-2240-00-0 SEAL RING
260-0214-00-0 214KG BEARING
077-5000-00-0 RETAINING RING
290-0214-00-0 214KG BEARING
077-2750-01-0 RETAINING RING
142-0180-00-0 SLINGER
537-1750-00-0 TAIL SHAFT
G SHIFT SHAFT
FOR WIRING SCHEMATIC SEE PLATE NO.749
008-0053-02-0 CAP, GEARSHIFT
038-0060-00-0 T-22 BALL
043-0080-00-0 T-22 SPRING
046-6080-00-0 GSKT
101-1730-00-0 CAUTION TAG
(2) 088-0040-00-0 CONNECTOR
087-1330-00-0 SHAFT WASHER
(2) 018-1822-02-0 7/16-14 X 2 1/4 (USED FOR SHIPPING ONLY)
007-0100-00-0 (LG & XG GEARBOX) COOLING TUBE
007-0170-00-0 (SG GEARBOX) COOLING TUBE
217-0601-00-0 3/4 NPT OIL FILL & LEVEL PLUG
USE SAE EP-90 OR 80W-90 API GL-5 OIL. APPROXIMATE OIL CAPACITY: SG= 3 QUARTS. LG & XG= 4 QUARTS.
101-1730-00-0 CAUTION STICKER
3/4 NPT MAGNETIC DRAIN PLUG 217-0601-08-0
(4) #4 X 1/4 LG SCREW 018-5002-00-0
101-0082-00-0 SR # PLATE
(4) MOUNTING HOLES (2) EACH SIDE 5/8-11 X 1.25 DP (USE MINIMUM SAE GRADE 5 SCREWS)
MOUNTING FACE OF COMPANION FLANGE
HALE

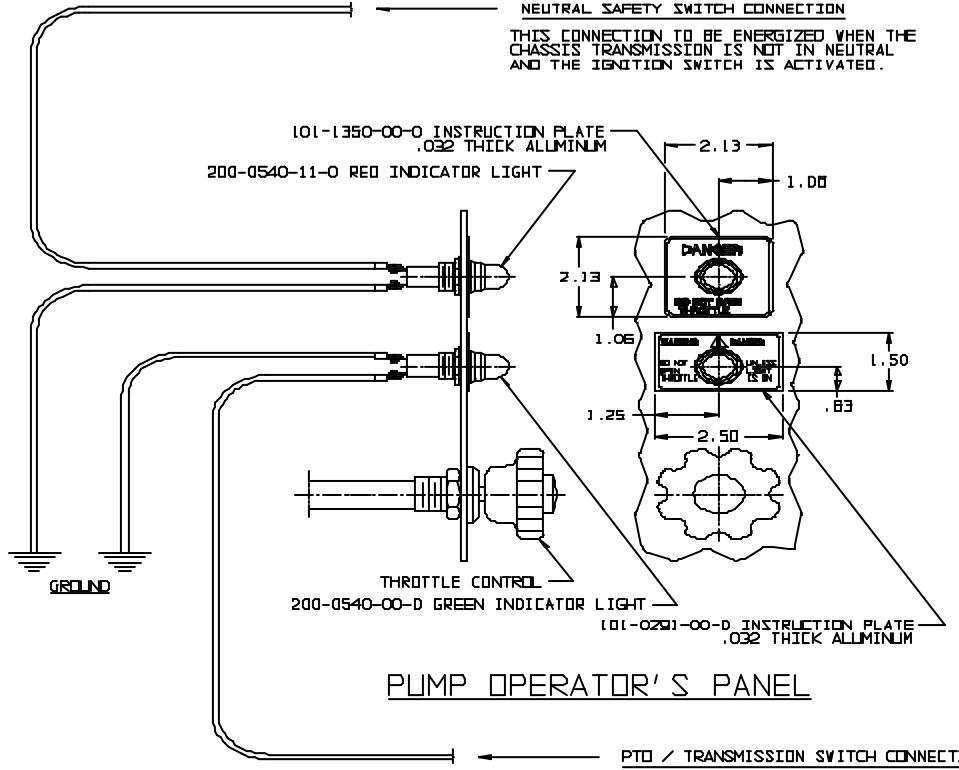
HALE TYPE "G" SERIES GEARBOX

PLATE 914AB

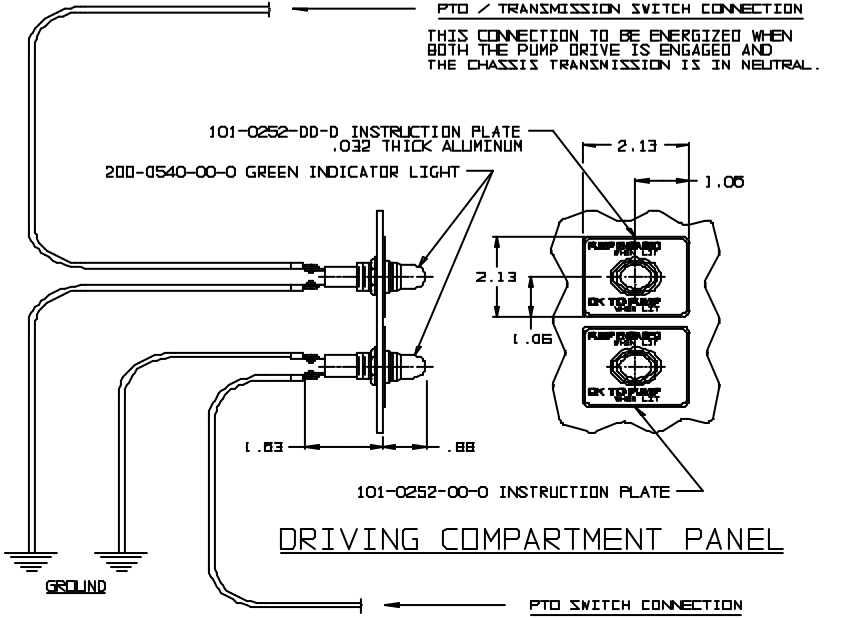
ECO NO	REV	CHANGED FROM	BY	DATE	APVD
00-668	B	UPDATED DRAWING	TKC	11-29-00	MAL
99-197	A	RELEASE FOR PRODUCTION	DPL	7-16-99	RET

HALE PRODUCTS, INC.
A Unit of IDEX Corporation
Conshohocken, PA 19428 USA

DATE 7/16/99 SIZE E SCALE: FULL



PUMP OPERATOR'S PANEL



DRIVING COMPARTMENT PANEL

NOTES:

1) SWITCHES: NOT SUPPLIED BY HALE.
2) INDICATOR LIGHTS: THE STANDARD HALE 200-0540-00-0 (GREEN) AND 200-0540-11-0 (RED) INDICATOR LIGHT ASSEMBLIES ARE RETAINED WITH A HEX NUT AND INTERNAL STAR WASHER. BOTH THE LENS AND THE PANEL FLANGE HAVE SEALING RINGS TO MAKE THE LIGHT ASSEMBLY LIQUID TIGHT TO FRONT OF PANEL. MOUNTING HOLE DIAMETER IS 1 1/16. THE MAXIMUM PANEL THICKNESS IS 3/16 (WHEN USED WITH .062 THICK INSTRUCTION PLATES). STANDARD BULB IS FOR 12 VOLT DC SERVICE. LIGHT ELECTRICAL TERMINALS ARE SCREW TYPE. NOTE REFERENCE DIMENSIONS.
3) INSTRUCTION PLATES: THE RECOMMENDED HALE INSTRUCTION PLATES FOR TYPICAL POWER TAKE-OFF DRIVEN PUMP INDICATOR LIGHT INSTALLATIONS ARE ILLUSTRATED. DIMENSIONS SHOWN ARE FOR REFERENCE ONLY.
4) SYSTEM DESIGN AND WIRING: SELECTION AND INSTALLATION OF WIRING AND ELECTRICAL COMPONENTS IS NOT THE RESPONSIBILITY OF HALE. SYSTEM DESIGN AND INSTALLATION MUST BE DONE BY PROPERLY QUALIFIED PERSONS. CIRCUIT PROTECTION (FUSES, CIRCUIT BREAKERS, ETC.) IS NOT THE RESPONSIBILITY OF HALE.

⚠ WARNING ALL WIRING AND INSTALLATION DETAILS MUST CONFORM TO ALL APPLICABLE NFPA AND SAE STANDARDS.

VERIFY OPERATION OF PUMP ENGAGED INDICATOR LIGHTS AND INTERLOCKS BEFORE PLACING APPARATUS IN SERVICE

WIRING SCHEMATIC FOR SHIFT INDICATOR LIGHTS

POWER TAKE-OFF DRIVEN PUMPS

ECO NO	REV	CHANGED FROM	BY	DATE	APVD
95-39	A	RELEASED FOR PRODUCTION WAS SHEET 2 OF PLATE 746AA	AJD	5-17-95	ROT

PLATE NO. 825AA

HALE PRODUCTS, INC.
A Unit of IDEX Corporation
Conshohocken, PA 19428 USA

DRAWN AJD | CHECKED ROT | DATE: 5-17-95 | SIZE C | SCALE: HALF

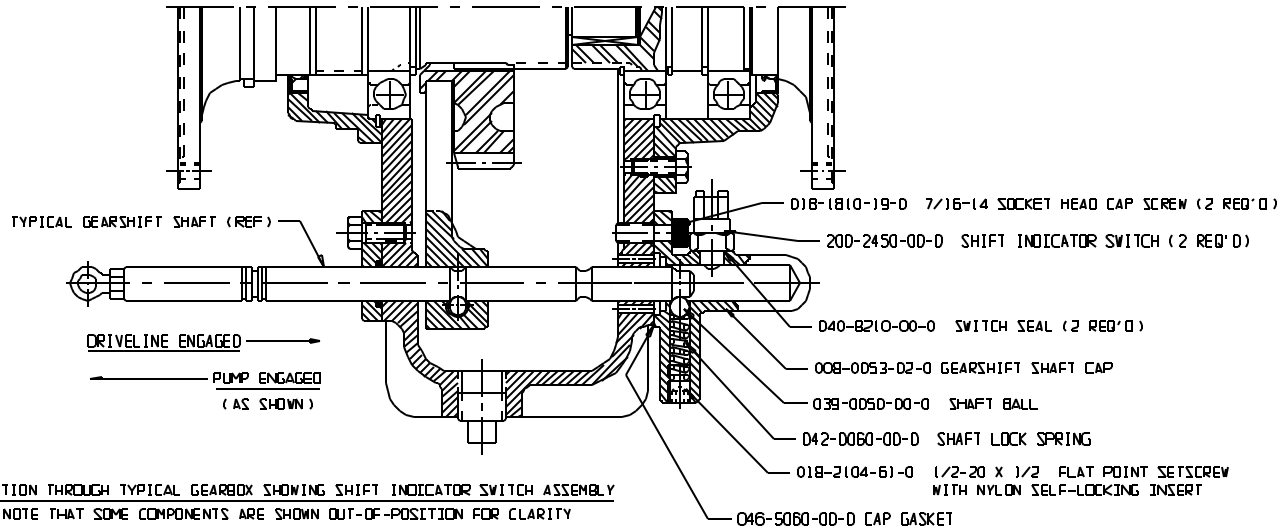
THE DUAL SHIFT INDICATOR SWITCH ARRANGEMENT SHOWN HERE PROVIDES TWO INDEPENDENT SWITCHES.

THE LOWER SWITCH IS FOR VEHICLE OEM PROVIDED INTERLOCKS (I.E. PARKING BRAKE, TRANSMISSION, ENGINE CONTROLS, AS APPLICABLE). THIS SWITCH SHOULD BE USED WITH A RELAY - SEE PLATE 746A.

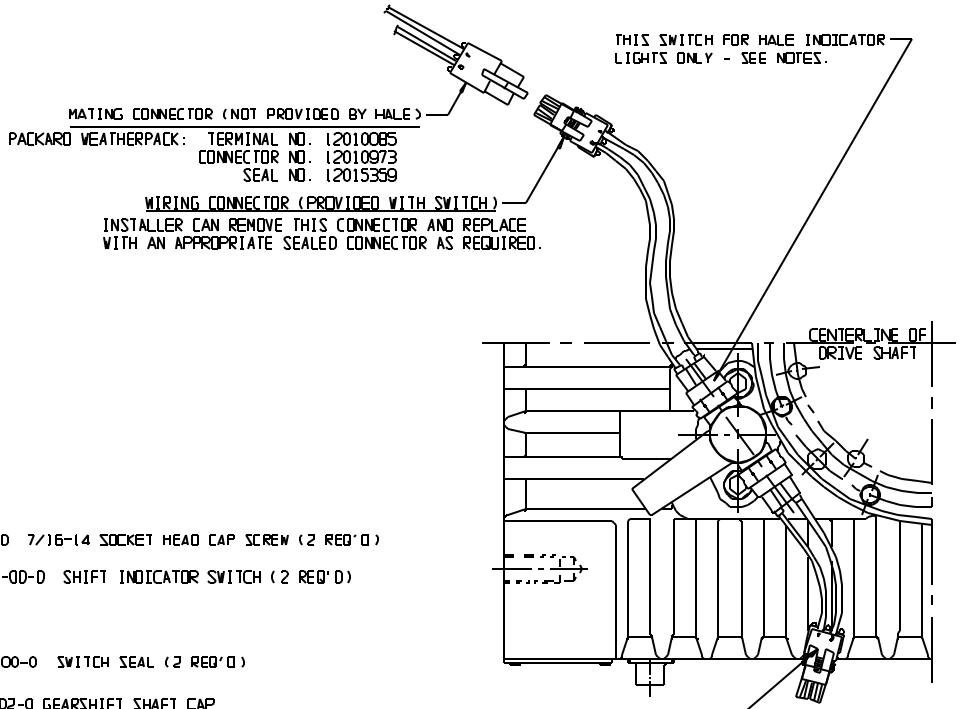
THE UPPER SWITCH IS FOR USE ONLY WITH THE HALE-PROVIDED PUMP SHIFT INDICATOR LIGHTS.

ALL STANDARD HALE SPLIT SHAFT PUMP TRANSMISSIONS MANUFACTURED AFTER APRIL 1995 ARE EQUIPPED WITH DUAL SHIFT INDICATOR SWITCHES. DUAL SHIFT INDICATOR SWITCH COMPONENTS ARE AVAILABLE FOR RETROFIT ON MOST HALE GEARBOXES ORIGINALLY MANUFACTURED WITH SINGLE SHIFT INDICATOR SWITCHES. FOR PARTS AND RETROFIT INFORMATION PLEASE CONSULT YOUR HALE REPRESENTATIVE.

SEE HALE PLATE NO. 746A "WIRING SCHEMATIC FOR SHIFT INDICATOR LIGHTS" FOR INDICATOR LIGHT ARRANGEMENT AND ELECTRICAL RATING DATA.



SECTION THROUGH TYPICAL GEARBOX SHOWING SHIFT INDICATOR SWITCH ASSEMBLY
NOTE THAT SOME COMPONENTS ARE SHOWN OUT-OF-POSITION FOR CLARITY



TYPICAL PUMP GEARBOX WITH DUAL SHIFT INDICATOR SWITCHES

ASSEMBLY NOTES:

1) USE LOCTITE 242 (OR EQUIVILANT) TO RETAIN AND SEAL ALL THREADED FASTENERS.
2) APPLY A LIGHT COAT OF GREASE TO ALL GASKETED SURFACES.

⚠ WARNING ALL WIRING AND INSTALLATION DETAILS MUST CONFORM TO ALL APPLICABLE NFPA AND SAE STANDARDS.

VERIFY OPERATION OF PUMP ENGAGED INDICATOR LIGHTS AND INTERLOCKS BEFORE PLACING APPARATUS IN SERVICE

MIDSHIP PUMP GEARBOX SHIFT INDICATOR ASSEMBLY

WITH DUAL SWITCHES

FOR USE ON G, MG, RG AND 4DG SERIES GEARBOXES

CAP REPLACEMENT 008-0052-02-0:
USE GEARSHIFT SHAFT CAP REPLACEMENT KIT 546-1980-00-0 WHEN REPLACING CAP 008-0052-02-0

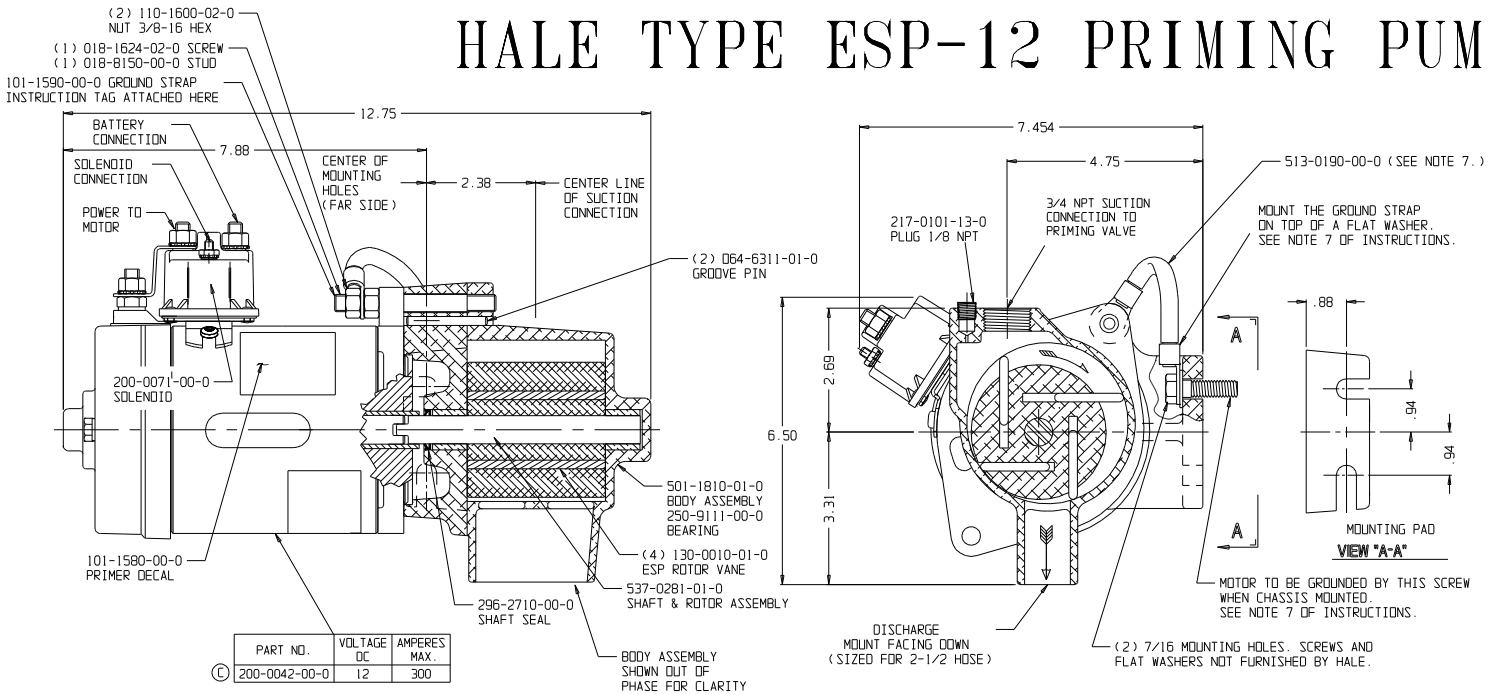
PLATE NO. 827AB

ECO NO	REV	CHANGED FROM	BY	DATE	APVD
95-99	A	RELEASED FOR PRODUCTION	AJD	5-10-95	ROT
99-101	B	008-0053-02-0 WAS 008-0052-02-0 ADDED CAP REPLACEMENT KIT	JBS	5-11-99	RET

HALE PRODUCTS, INC.
A Unit of IDEX Corporation
Conshohocken, PA 19428 USA

DRAWN AJD | CHECKED ROT | DATE 5-10-95 | SIZE C | SCALE: HALF

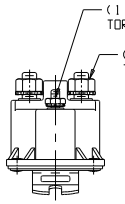
HALE TYPE ESP-12 PRIMING PUMP



PART NO.	VOLTAGE DC	AMPERES MAX.
Ⓔ 200-0042-00-0	12	300

INSTRUCTIONS:

1) USE A MINIMUM OF 1/2 TUBING FOR BOOSTER PUMPS.
2) USE A MINIMUM OF 3/4 PIPE FOR MIDSHIP PUMPS.
3) CONNECT TO HIGHEST POINT ON DISCHARGE OF MAIN PUMP IF PRIMING WHILE THE PUMP IS STATIONARY.
4) CONNECT TO HIGHEST POINT ON THE SUCTION NEAR THE IMPELLER EYE IF PRIMING WHEN THE MAIN PUMP IS RUNNING.
5) A SHUT-OFF VALVE, SUCH AS A HALE PVG OR SPV PRIMING VALVE, MUST BE LOCATED IN THE PRIMING LINE BETWEEN THE PRIMING PUMP AND THE MAIN PUMP.
6) THE PRIMING PUMP MUST BE MOUNTED SO THAT THE MOTOR SHAFT IS IN A HORIZONTAL PLANE WITH THE PRIMING PUMP DISCHARGE FACING DOWN.
7) GROUND THE PRIMING PUMP TO THE TRUCK CHASSIS, USING THE GROUND STRAP FURNISHED. THE GROUND STRAP IS REQUIRED, FROM THE TRUCK CHASSIS TO THE TERMINAL STUD ON THE PRIMING PUMP.THIS IS TO INSURE A GROUND FOR THE MOTOR.THE CABLE IS SIZED FOR A 12 VOLT DC 300 AMP LOAD.
8) DURING THE PRIMING OPERATION (EVACUATING AIR), DO NOT RUN THE MOTOR FOR MORE THAN 60 SECONDS.



SOLENOID FASTENER TORQUE SPECIFICATION

NOTES:

1) MOTOR ROTATION IS THE SAME FOR BOTH NEGATIVE AND POSITIVE GROUND SYSTEMS.
2) WEIGHT OF PRIMING PUMP AND MOTOR IS 27 LBS. (12.2 Kg).
3) THEORETICAL DISPLACEMENT IS .066 GAL. (.25 LITERS) PER REVOLUTION OR 47,000 CU. IN. (770,000 CU. CM) AIR PER MINUTE.
4) VACUUM CAPABILITY: 24 IN. Hg (610 MM Hg).
5) SEE PLATE NO. 480 FOR HALE PVG OR PLATE NO. 819 FOR HALE SPV PRIMING VALVE DETAILS.
6) TO AID IN LONG PRIMER LIFE AND PROPER PERFORMANCE,IT IS RECOMMENDED THAT THE PRIMING PUMP BE CLEANED YEARLY OR AFTER 500 CYCLES OF USE. SEPARATE THE PUMP BODY AND HEAD FROM THE MOTOR AND REMOVE ANY BLACK BUILD UP OR CONTAMINATES WITH SAFETY KLEEN OR STODDARD SOLVENT.USE CARE TO REINSTALL THE VANES IN THE SAME ORIENTATION AND TO GREASE THE SHAFT SEAL.
7) SEE PLATE NO. 938 FOR 24V PRIMING PUMP DETAILS.

INSTALLATION DETAIL

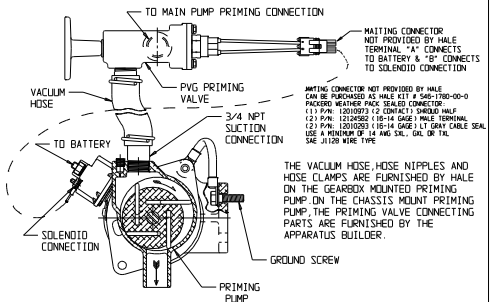


PLATE NO. 821AF

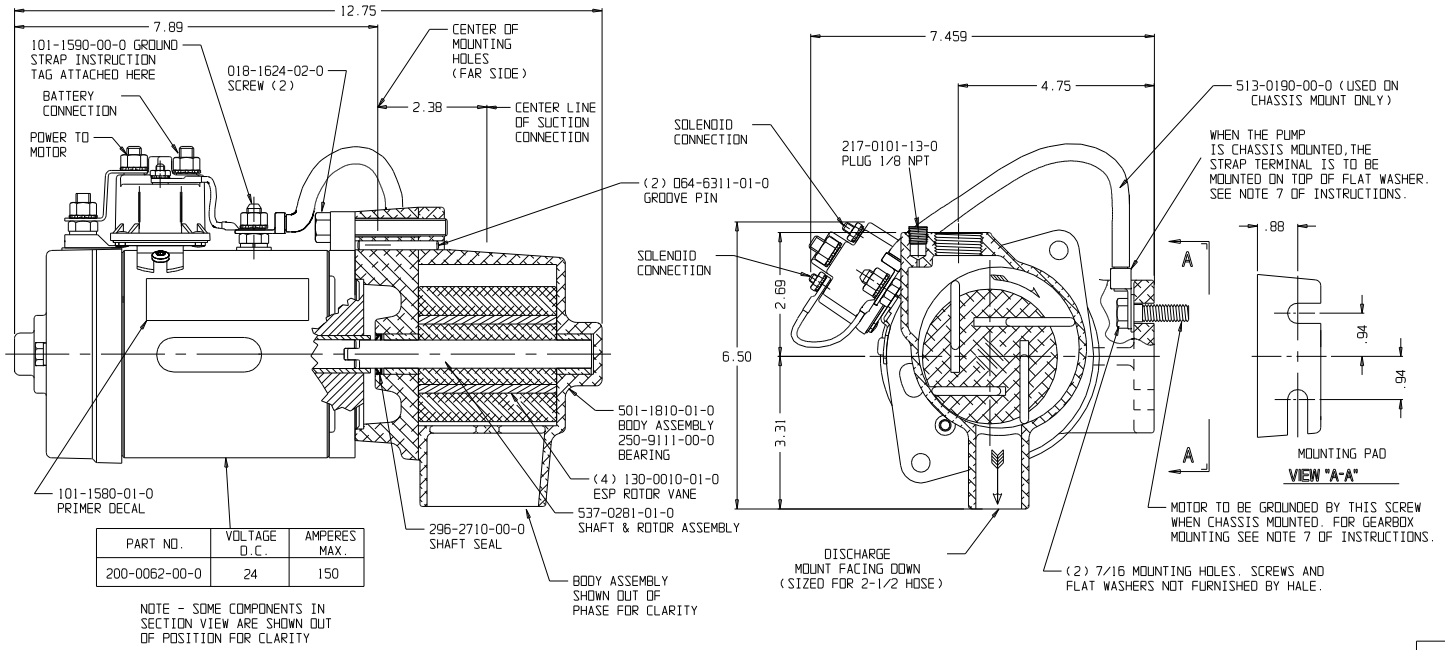
ECO NO	REV	CHANGED FROM	BY	DATE	APVD
01-172	D	REMOVED 24V DETAIL AND INFO	ERB	4-03-01	MAL
01-257	E	UPDATED SOLENOID CONNECTION CALLOUTS	DJK	06-12-01	MAL
01-258	F	(INSTRUCTION NOTE 7) REMOVED: "WHEN THE PRIMING PUMP IS MOUNTED ON THE PUMP GEARBOX". ADDED: SOLENOID TORQUE SPECS	DJK	06-22-01	MAL

ECO NO	REV	CHANGED FROM	BY	DATE	APVD
95-126	A	RELEASE FOR PRODUCTION	ROT	8-19-95	RET
96-40	B	INSTRUCTION NO.8 ADDED. AMPERES WERE: 210 PRIME / 275 MAX FOR 12-VOLT, AND 80 PRIME / 125 MAX FOR 24-VOLT.	AJD	3-1-96	MAL
00-655	C	UPDATED PVG SWITCH/12V MOTOR	TC	10-25-00	MAL

HALE PRODUCTS, INC.
A Unit of IDEX Corporation
Conshohocken, PA 19428 USA

DRAWN ROT | CHECKED ROT | DATE 2-19-95 | SIZE D | SCALE: FULL

HALE TYPE ESP-24 PRIMING PUMP



PART NO.	VOLTAGE D.C.	AMPERES MAX.
200-0062-00-0	24	150

NOTE - SOME COMPONENTS IN SECTION VIEW ARE SHOWN OUT OF POSITION FOR CLARITY

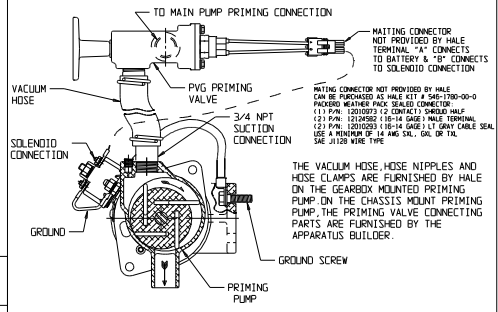
INSTRUCTIONS:

1) USE A MINIMUM OF 1/2 TUBING FOR BOOSTER PUMPS.
2) USE A MINIMUM OF 3/4 PIPE FOR MIDSHIP PUMPS.
3) CONNECT TO HIGHEST POINT ON DISCHARGE OF MAIN PUMP IF PRIMING WHILE THE PUMP IS STATIONARY.
4) CONNECT TO HIGHEST POINT ON THE SUCTION NEAR THE IMPELLER EYE IF PRIMING WHEN THE MAIN PUMP IS RUNNING.
5) A SHUT-OFF VALVE, SUCH AS A HALE PVG OR SPV PRIMING VALVE, MUST BE LOCATED IN THE PRIMING LINE BETWEEN THE PRIMING PUMP AND THE MAIN PUMP.
6) THE PRIMING PUMP MUST BE MOUNTED SO THAT THE MOTOR SHAFT IS IN A HORIZONTAL PLANE WITH THE PRIMING PUMP DISCHARGE FACING DOWN.
7) WHEN THE PRIMING PUMP IS MOUNTED ON THE PUMP GEARBOX, A GROUND STRAP (FURNISHED BY HALE) IS REQUIRED FROM THE TRUCK CHASSIS TO THE TERMINAL STUD ON THE PRIMING PUMP. THIS IS TO INSURE A GROUND FOR THE MOTOR. THE CABLE MUST BE SIZED FOR A 24 VOLT DC 150 AMP LOAD.
8) DURING THE PRIMING OPERATION (EVACUATING AIR), DO NOT RUN THE MOTOR FOR MORE THAN 60 SECONDS.

NOTES:

1) MOTOR ROTATION IS THE SAME FOR BOTH NEGATIVE AND POSITIVE GROUND SYSTEMS.
2) WEIGHT OF PRIMING PUMP AND MOTOR IS 27 LBS. (12.2 Kg).
3) THEORETICAL DISPLACEMENT IS .066 GAL. (.25 LITERS) PER REVOLUTION OR 47,000 CU. IN. (770,000 CU. CM) AIR PER MINUTE.
4) VACUUM CAPABILITY: 24 IN. Hg (610 MM Hg).
5) SEE PLATE NO. 480 FOR HALE PVG OR PLATE NO. 819 FOR HALE SPV PRIMING VALVE DETAILS.
6) TO AID IN LONG PRIMER LIFE AND PROPER PERFORMANCE, IT IS RECOMMENDED THAT THE PRIMING PUMP BE CLEANED YEARLY OR AFTER 500 CYCLES OF USE. SEPARATE THE PUMP BODY AND HEAD FROM THE MOTOR AND REMOVE ANY BLACK BUILD UP OR CONTAMINATES WITH SAFETY KLEEN OR STODDARD SOLVENT. USE CARE TO REINSTALL THE VANES IN THE SAME ORIENTATION AND TO GREASE THE SHAFT SEAL.
7) SEE PLATE NO. 821 FOR 12V PRIMING PUMP CONFIGURATION.

INSTALLATION DETAIL



ECO NO	REV	CHANGED FROM	BY	DATE	APVD
01-172	A	RELEASE FOR PRODUCTION	ERB	4-03-01	MAL
01-257	B	UPDATED SOLENOID CONNECTION CALLOUTS	DJK	06-12-01	MAL

HALE PRODUCTS, INC.
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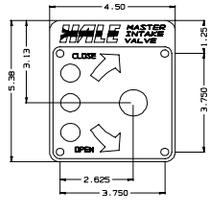
Conshohocken, PA 19428 USA

DRAWN ERB | CHECKED PDW | DATE 4-3-01 | SIZE D | SCALE: FULL

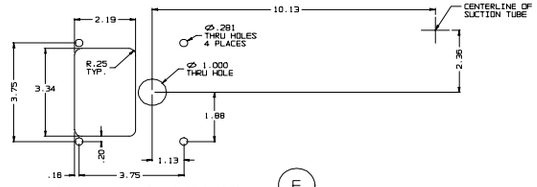
PLATE NO. 938AB

HALE MASTER INTAKE VALVE (MANUAL) MIV-M

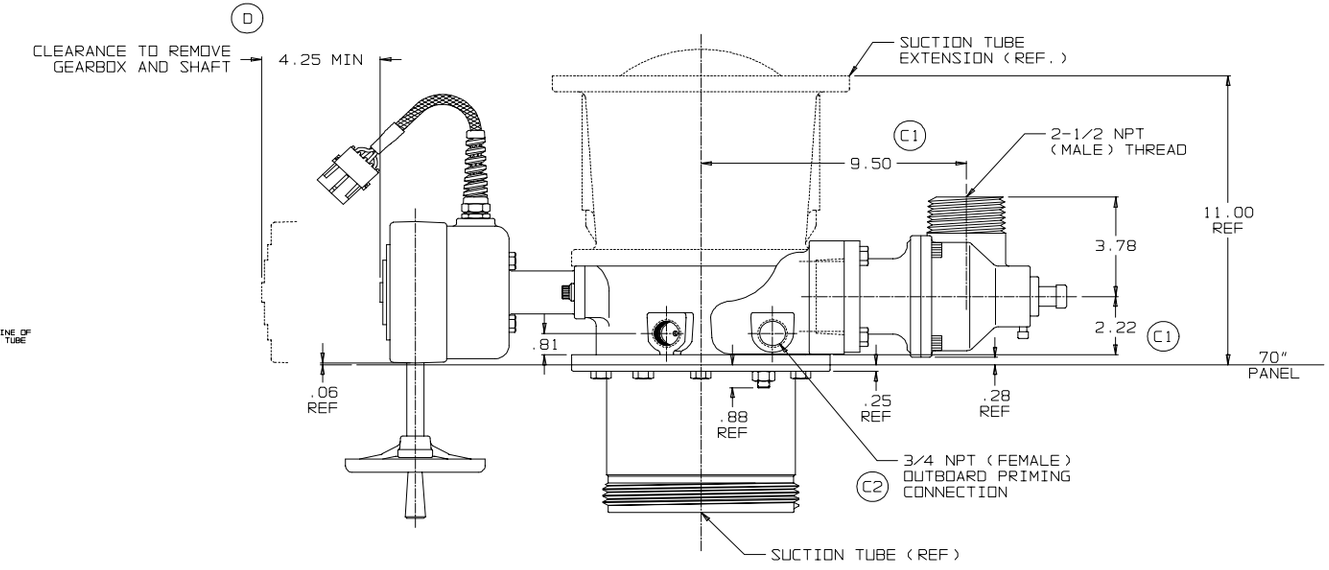
PLACARD

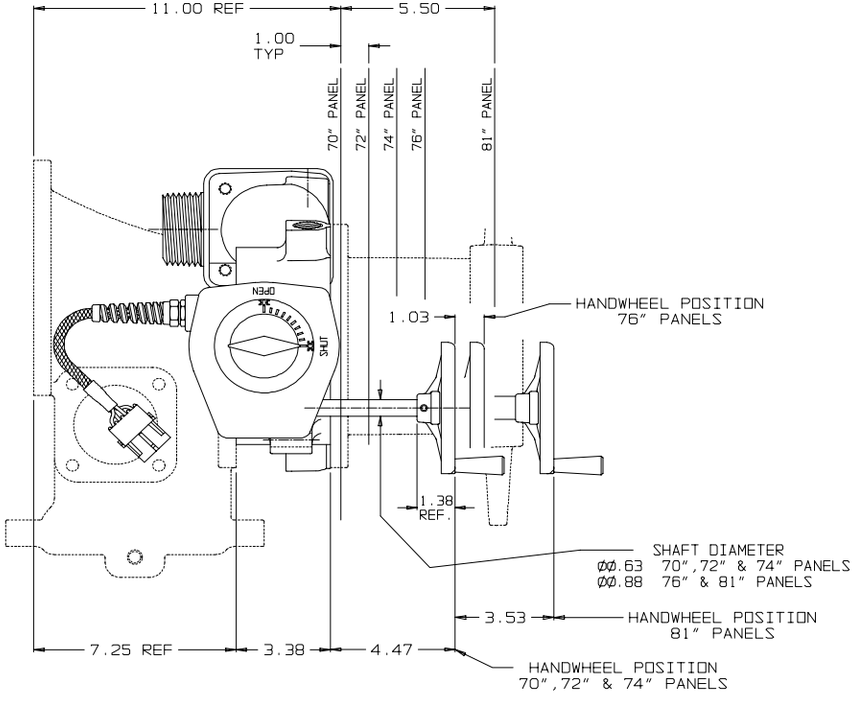


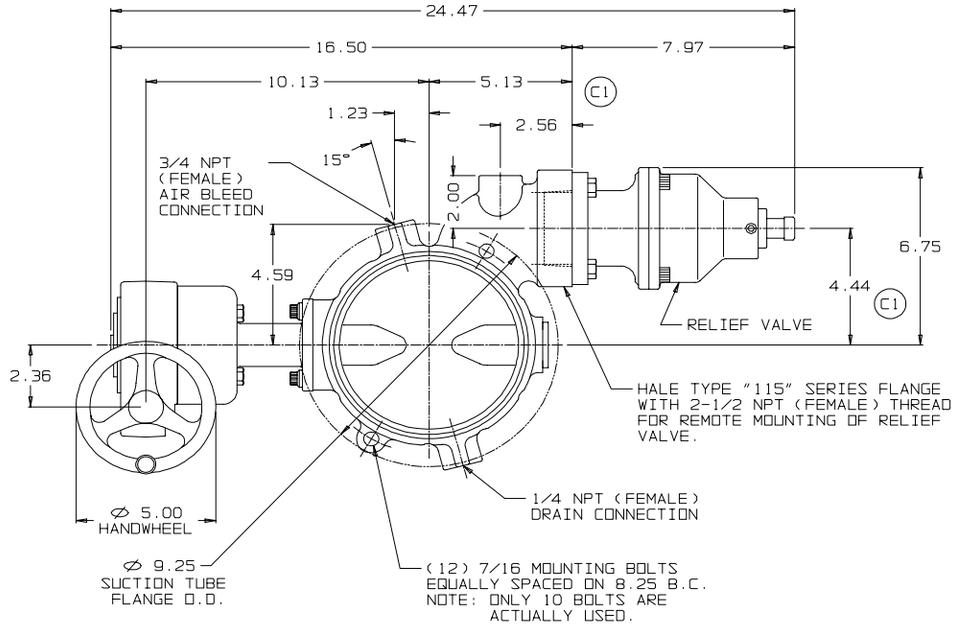
PANEL CUTOUT



PANEL PLACARD MOUNTING TEMPLATE (E)







ECO NO	REV	CHANGED FROM	BY	DATE	APVD
96-104	C	1) MOVED RELIEF VALVE FLANGE 2) ADDED 3/4NPT PRIMING PORT	DLM	8-6-96	RET
97-158	D	ADDED CLEARANCE TO REMOVE NOTE	DLM	7-28-97	RET
00-354	E	UPDATED PANEL PLACARD TEMPLATE	PRW	2-7-00	RET

HALE PRODUCTS, INC.
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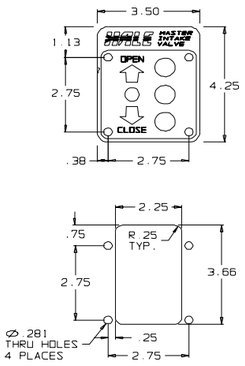
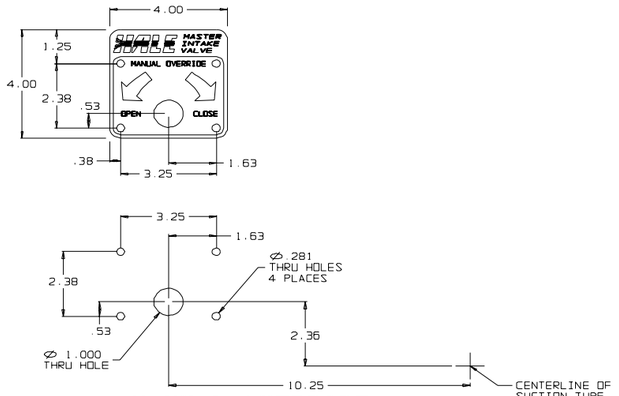
DRAWN DLM | CHECKED | DATE 2-22-95 | SIZE F | SCALE: HALF

PLATE NO. 815AE

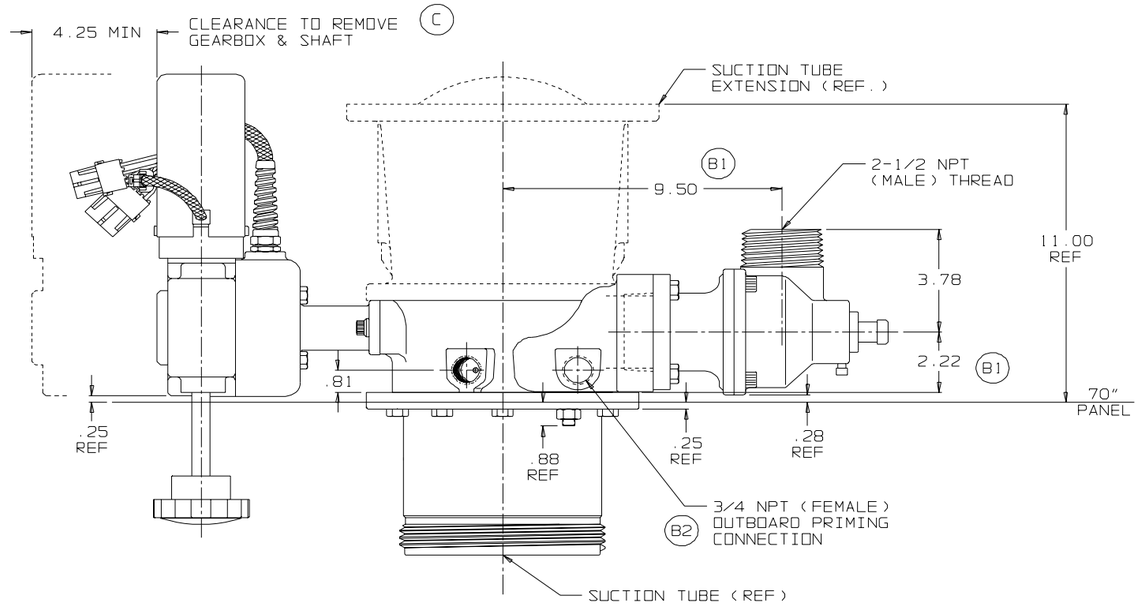
HALE MASTER INTAKE VALVE (ELECTRIC) MIV-E

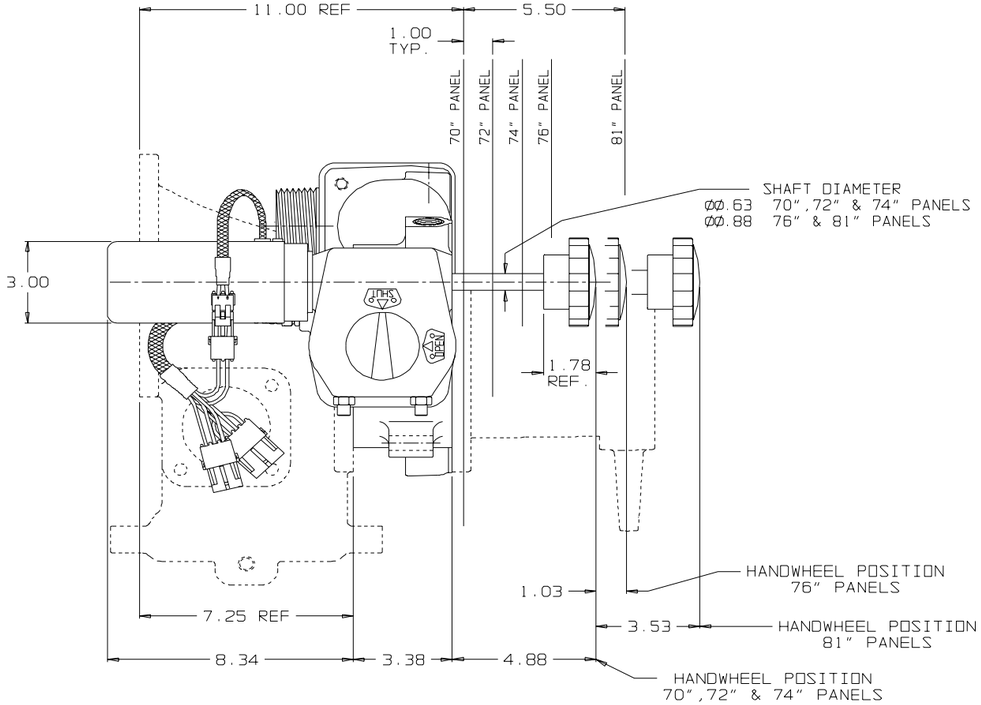


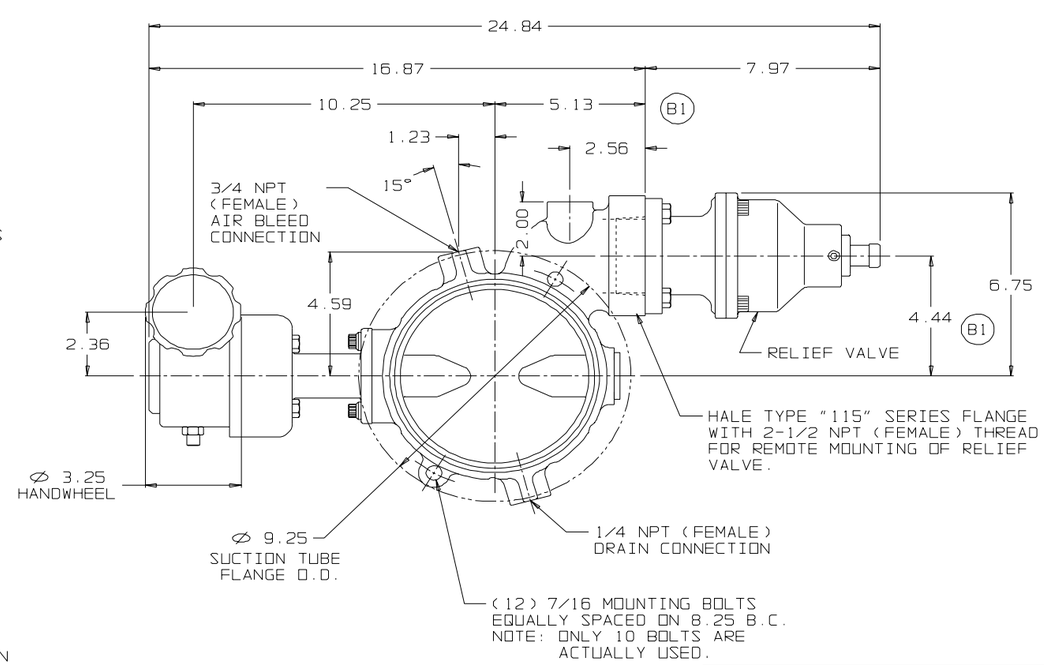
PANEL PLACARD MOUNTING TEMPLATE



MANUAL OVERRIDE PANEL PLACARD MOUNTING TEMPLATE







ECO NO	REV	CHANGED FROM	BY	DATE	APVD
00-354	D	UPDATED PANEL PLACARD TEMPLATE	PRW	2-7-00	RET

ECO NO	REV	CHANGED FROM	BY	DATE	APVD
95-20	A	RELEASE FOR PRODUCTION	DLM	4-26-95	RET
96-104	B	1) MOVED RELIEF VALVE FLANGE 2) ADDED 3/4NPT PRIMING PORT	DLM	8-6-96	RET
97-158	C	ADDED CLEARANCE TO REMOVE NOTE	DLM	7-28-97	RET

HALE

HALE PRODUCTS, INC.
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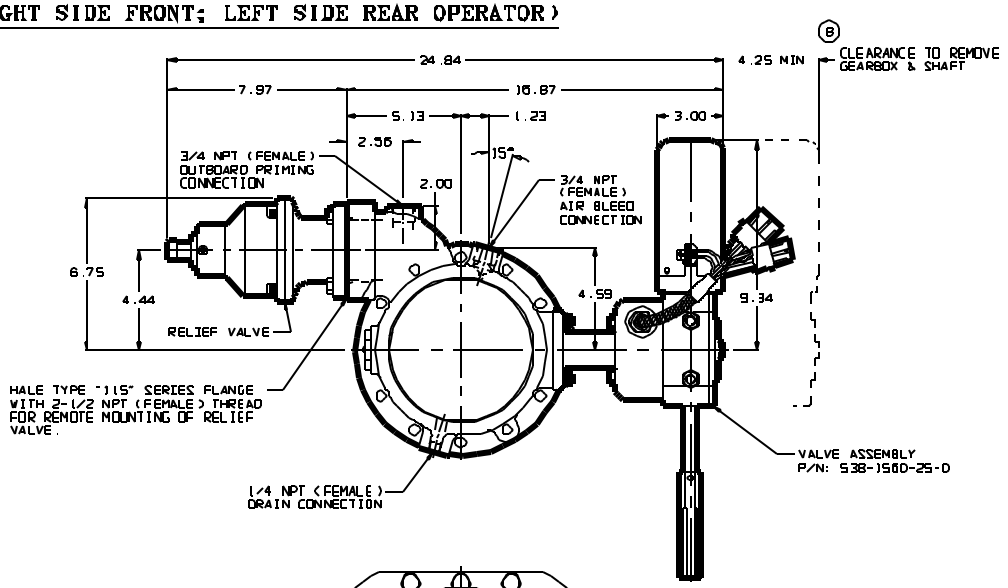
Conshohocken, PA 19428 USA

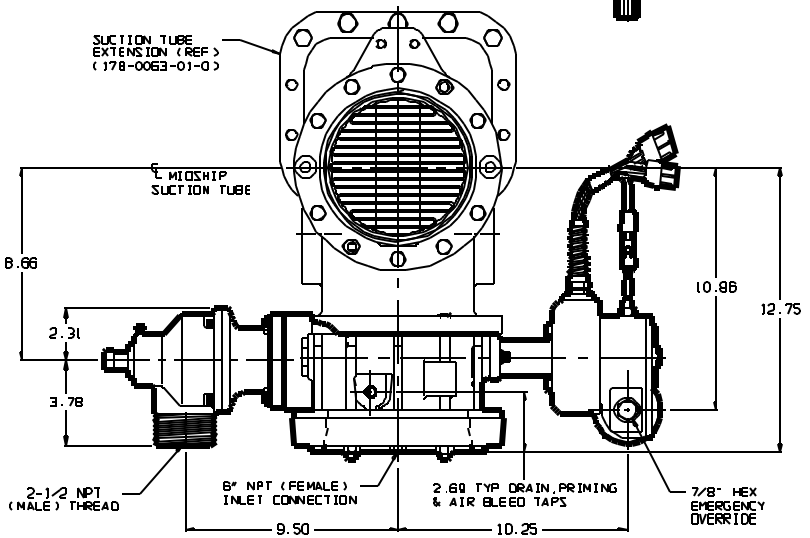
DRAWN DLM | CHECKED | DATE 2-21-95 | SIZE F | SCALE: HALF

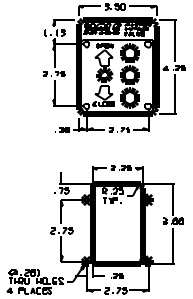
PLATE NO. 814AD

HALE MASTER INTAKE VALVE
(ELECTRIC) MIV-E BOTTOM MOUNTED

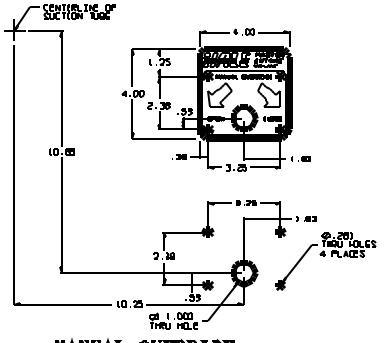
(RIGHT SIDE FRONT; LEFT SIDE REAR OPERATOR)



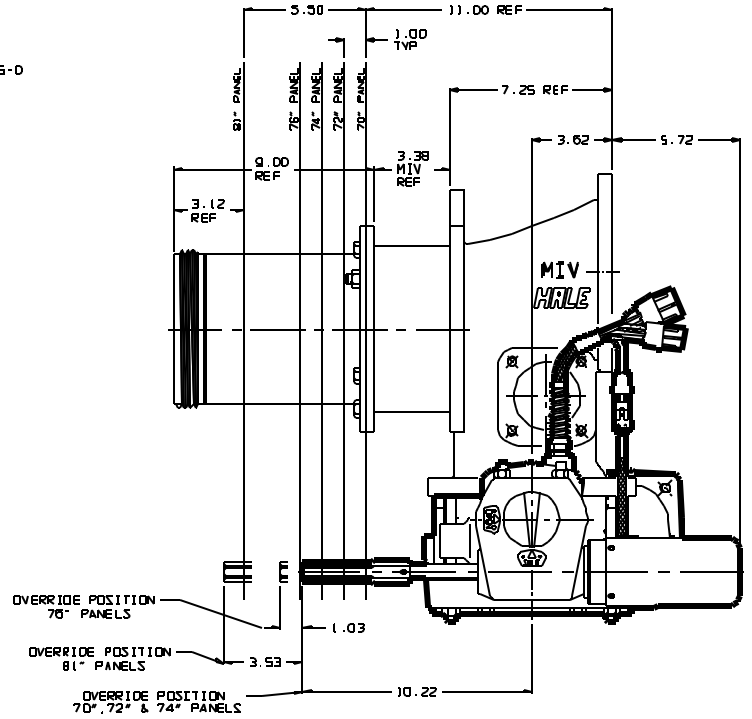




PANEL PLACARD MOUNTING TEMPLATE



MANUAL OVERRIDE PANEL PLACARD MOUNTING TEMPLATE



ECO NO	REV	CHANGED FROM	BY	DATE	APVD
96-149	A	RELEASE FOR PRODUCTION	DLM	8-20-96	RET
97-158	B	ADDED CLEARANCE TO REMOVE NOTE	DLM	7-28-97	RET
00-354	C	UPDATED PANEL PLACARD TEMPLATE	PRV	2-7-00	RET

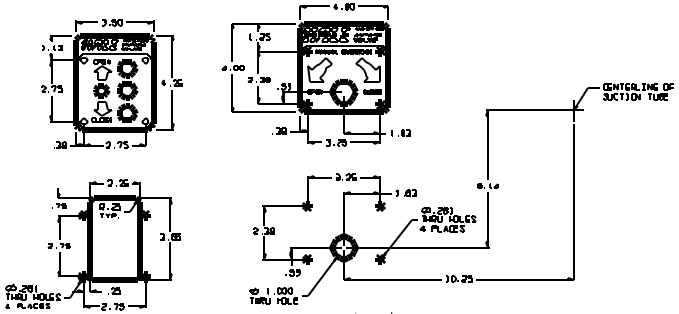
HALE PRODUCTS, INC.
A Unit of IDEX Corporation
Conshohocken, PA 19428 USA

DRAWN DLM DATE 8-14-00 SIZE S SCALE: .4

PLATE NO. 841AC

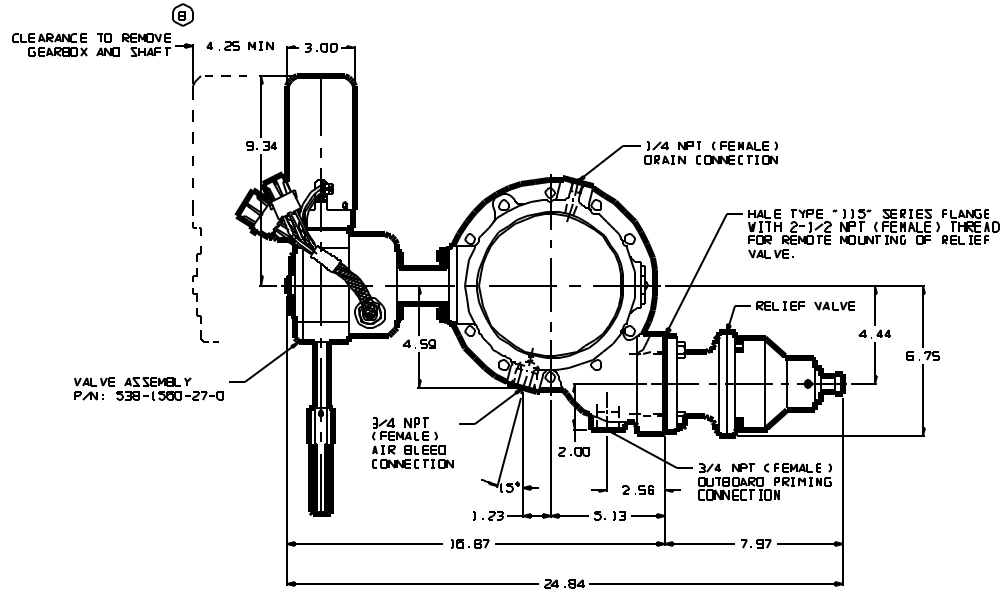
HALE MASTER INTAKE VALVE
(ELECTRIC) MIV-E BOTTOM MOUNTED

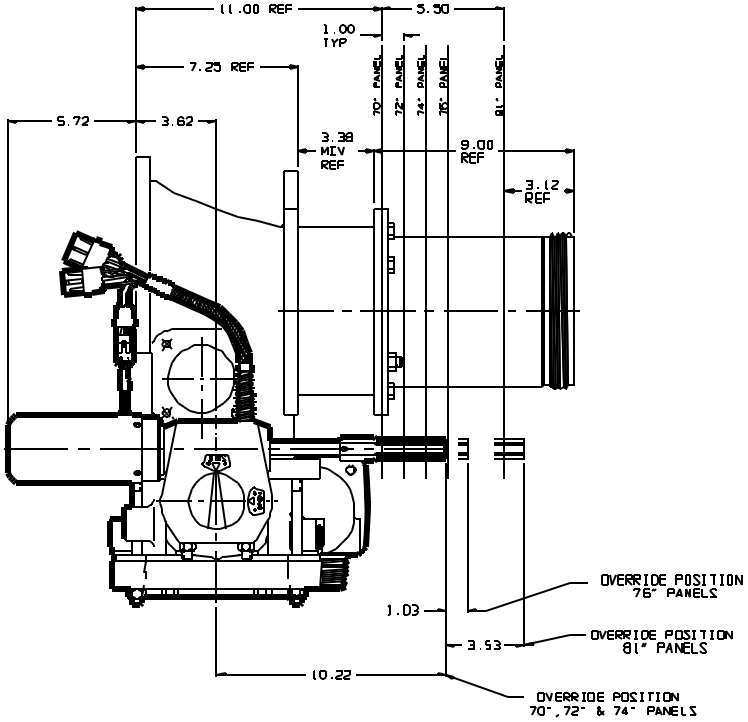
(LEFT SIDE FRONT; RIGHT SIDE REAR OPERATOR)

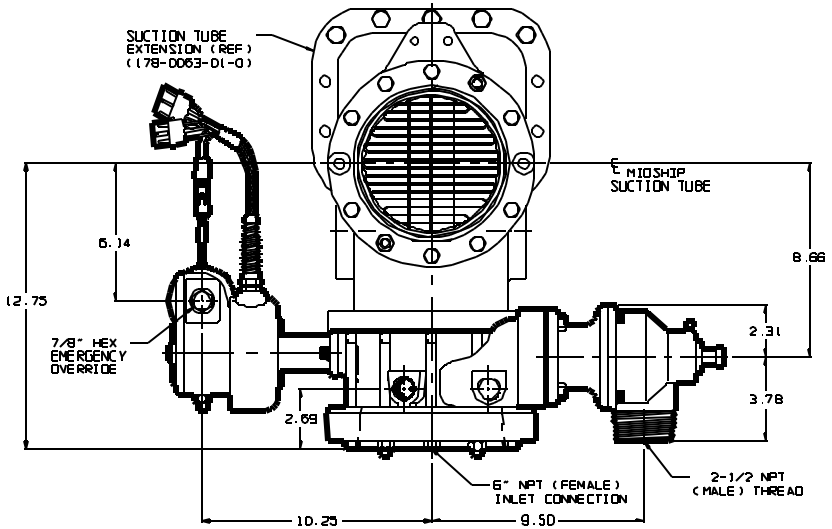


PANEL PLACARD MOUNTING TEMPLATE

MANUAL OVERRIDE PANEL PLACARD MOUNTING TEMPLATE







ECO NO	REV	CHANGED FROM	BY	DATE	APVD
96-149	A	RELEASE FOR PRODUCTION	DLM	8-20-96	RET
97-158	B	ADDED CLEARANCE TO REMOVE NOTE	DLM	7-28-97	RET
00354	C	UPDATED PANEL PLACARD TEMPLATE	PRV	2-7-00	RET

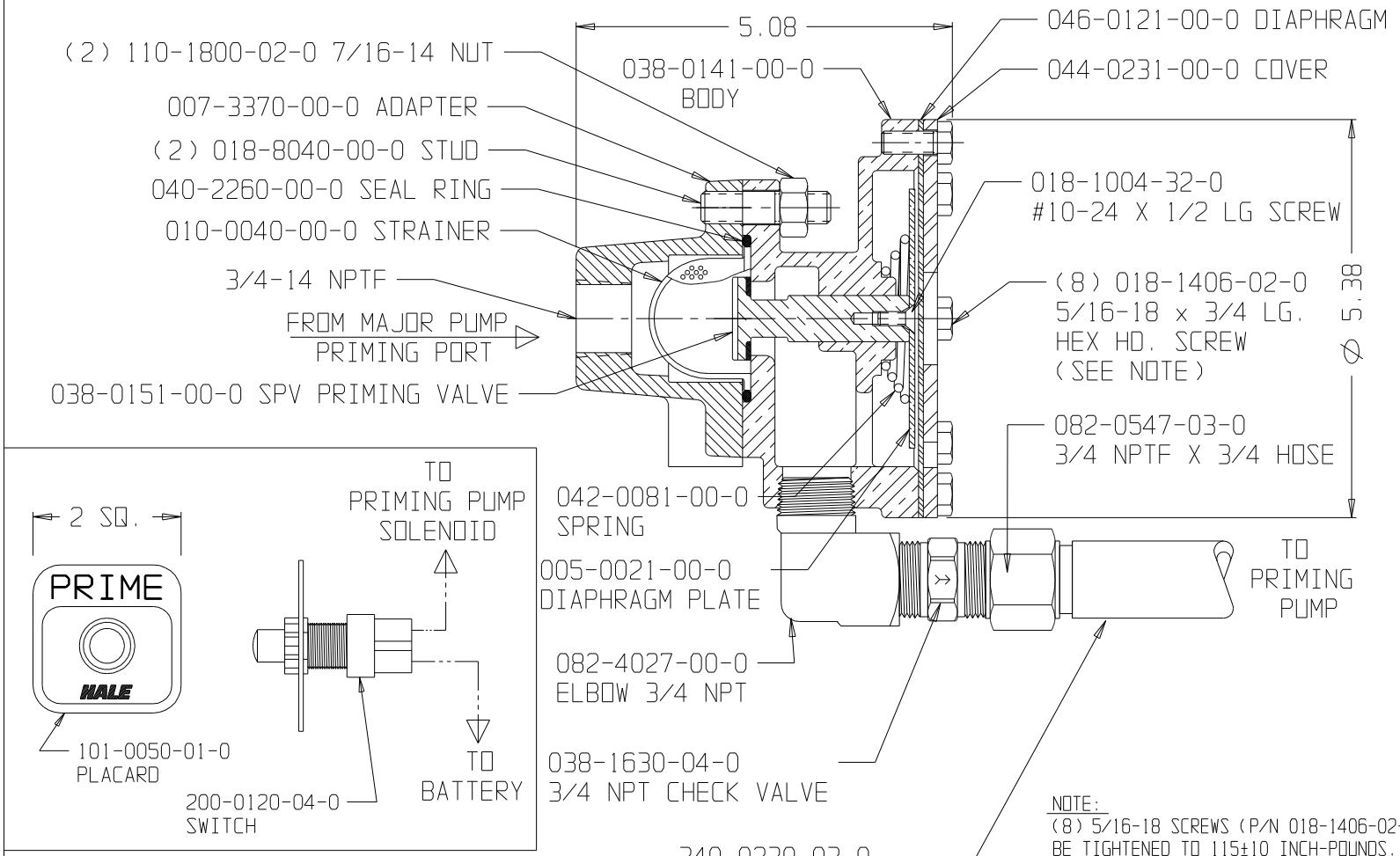
HALE PRODUCTS, INC.
A Unit of IDEX Corporation
Conshohocken, PA 19428 USA

DRAWN TOLM DATE 8-14-96 SIZE B SCALE: .4

PLATE NO. 842AC

538-1580-10-0

HALE TYPE SPV SEMI-AUTOMATIC PRIMING VALVE (WITH UNIVERSAL MOUNTING ADAPTER)



NOTE:
(8) 5/16-18 SCREWS (P/N 018-1406-02-0) SHALL BE TIGHTENED TO 115±10 INCH-POUNDS. NOT FOLLOWING THIS TORQUE RECOMMENDATION COULD CAUSE THE VALVE NOT TO FUCTION PROPERLY.

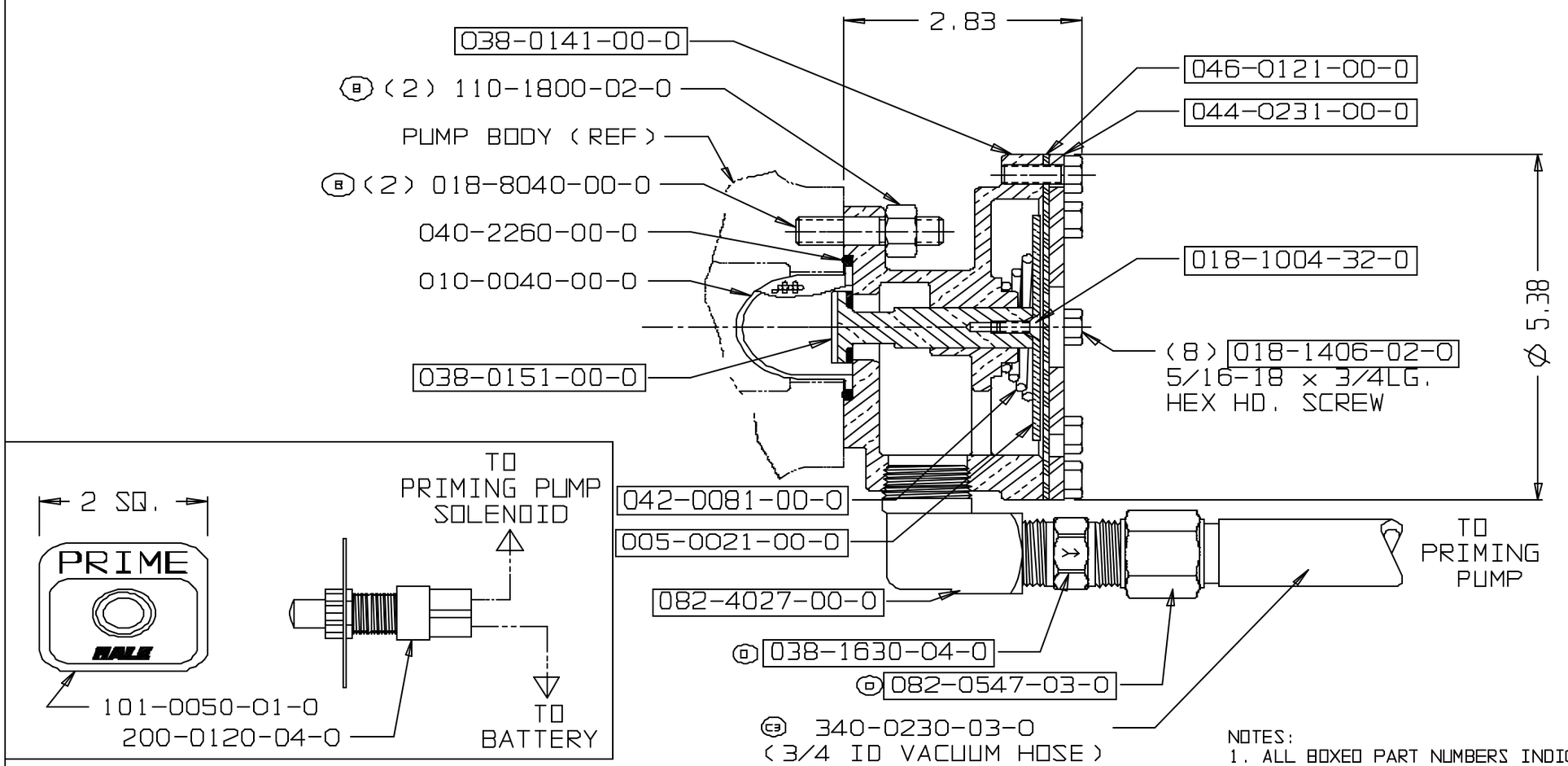
PLATE NO. 828AE

ECO NO	REV	CHANGED FROM	BY	DATE	APVD	ECO NO	REV	CHANGED FROM	BY	DATE	APVD
01-177	E	UPDATED W/DESCRIPTIONS	TKC	4-5-01	MAL	95-169	A	RELEASED FOR PRODUCTION	DLM	8-15-95	RET
						96-63	B	B1. ADDED: B2. 082-4027-01-0; B3. 340-0640-00-1	PRW	3-29-96	RET
						00-525	C	DELETED 038-1630-03-0, 082-0501-02-0 & 082-0547-02-0 ADDED 038-1630-04-0 & 082-0547-03-0	JBS	07-14-00	MAL
						00-602	D	ADDED NOTE	JBS	09-20-00	MAL

HALE PRODUCTS, INC.
A Unit of IDEX Corporation
Conshohocken, PA 19428 USA

DRAWN DLM | CHECKED RDT | DATE 8-15-95 | SIZE C | SCALE: FULL

HALE TYPE SPV SEMI-AUTOMATIC PRIMING VALVE



NOTES:
1. ALL BOXED PART NUMBERS INDICATE PARTS CONTAINED IN ASSEMBLY 538-1580-01-0.
2. FOR UNIVERSAL MOUNTING SEE PLATE 828.

ECO NO	REV	CHANGED FROM	BY	DATE	APVD
95-15	A	RELEASED FOR PRODUCTION	RDT	2-15-95	RET
95-186	B	(2) MOUNTING SCREWS	DLM	8-17-95	RET
98-83	C	(1. ADDED; (2. 082-4027-01-0; (3. 340-0242-03-0	PRW	3-20-98	RET
00-525	D	[illegible]	JBS	7-14-00	MAL
00-575	E	REMOVED P/N 538-1580-00-0	JBS	9-07-00	MAL

HALE PRODUCTS, INC.
A Unit of IDEX Corporation
Conshohocken, PA 19428 USA

DRAWN GD | CHECKED RDT | DATE 1-15-85 | SIZE C | SCALE: FULL

PLATE NO. 819AE