



## RM SERIES OPERATING AND MAINTENANCE MANUAL

MODEL NO. \_\_\_\_\_  
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  
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## Limited Warranty

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**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 normal 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.**



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## OPERATION

The following instructions apply when the pump is to be put into operation immediately after arrival at the fire. If standing by without pumping, the pump should not be engaged.

### WORKING FROM HYDRANT

1. Close all discharge valves and drain valves.
2. Open and flush hydrant. Attach hose from pump to hydrant. Open hydrant.
3. Bleed air from supply hose
4. With engine at idle, engage pump.
5. Open discharge valve.
6. Increase engine throttle gradually until desired pressure is reached. If the compound gauge shows a vacuum before the desired pressure is reached, it is an indication that you are getting all the water the hydrant will supply. In this case, the only way to get more pressure is to reduce flow.
7. Open the valve to the heat exchanger to cool the engine (if so equipped)
8. To maintain the desired pump discharge pressure, set the relief valve or engine governor according to the instructions on the applicable cross-sectional drawing or manual.

**Caution:** For the sake of the hydrant water system, it is not good practice to reduce the pressure on the compound gauge below zero. Disregarding this could result in serious damage to the water mains.

Another good guide is to watch the pressure gauge as you open the engine throttle. If the engine speed increases without a corresponding increase in pressure, the pump is "running away" from the water or cavitating. In this case, close the throttle slowly until the pressure begins to drop and the engine speed becomes reasonable. There is nothing to be gained by going beyond this point.

### WORKING FROM DRAFT

Get as close to the water as possible. The pump will do better than its rated capacity at its rated vertical lift. As the vertical lift increases, the pump capacity will decrease. This rule applies to all makes and types of pumps.

1. Attach Suction hose to pump, put strainer on the opposite end and submerge strainer in water. It is very desirable to have two feet or more water over the strainer. Keep the strainer off the bottom and keep sand, leaves or other foreign matter away from strainer. No pump has ever been built which will pump water with foreign matter without causing some damage or excessive wear to the pump. Your Hale pump will handle such water with as little damage resulting to the pump as any fire pump on the market - possibly less damage - but we do not recommend such abuse unless there is no other way to stop a fire. Be sure all suction hose couplings and suction tube caps are tight.
2. Close all discharge valves, drain valves and drain cocks.
3. With engine at idle, engage pump. Keep engine speed below fast idle, not more than approximately 1000 RPM. Nothing can be gained by running the engine at high speed while priming.
4. Start the priming pump by pulling the priming handle. In 10 to 30 seconds water will enter the main pump and the pressure will rise. Open the discharge valve slowly and lock in position.

**DO NOT RELEASE THE PRIMING HANDLE UNTIL A FULL, STEADY STREAM IS FLOWING THROUGH THE DISCHARGE HOSE.** If the priming pump does not discharge water in 30 seconds, do not continue to run. Stop and look for air leaks.

5. Open throttle gradually until the desired pressure is reached. Regulate valve for cooling engine and set the pressure governor or relief valve. As the throttle is opened, the pressure should build up as the engine speed increases. Should the engine speed go up without a corresponding increase in pressure, the pump is cavitating or “running away” from the water. There are two possibilities that can lead to this condition.
  - a. The first can occur only on high vertical lifts with several short lines. Having large tips and thereby pumping large volumes. The remedy for this is to reduce flow.
  - b. The second occurs when pumping air with water due to air leaks. Even though primed, air leaks can cause rough operation and an increase of engine speed without a corresponding increase in the pressure. If this is the case, eliminate air leak as described under maintenance.

If a shutdown is needed when working from draft – for changing discharge hose or for any other reason – simply lower the pressure to about 30 Psi and close discharge valves. Closing the discharge valves will prevent pump from losing its water if there are no air leaks. To resume pumping, simply open the discharge valves and throttle. If the pump gets hot from continued churning without flow, open a discharge valve periodically to release hot water or disengage pump.

#### **WORKING FROM BOOSTER TANK**

1. Close all pump discharges.
2. Open the valve between the tank and pump suction.
3. With engine at idle, engage pump.
4. Engage priming pump, prime and proceed as described under “Working from Draft”.
5. When pumping from tank, avoid cavitation. Small suction piping will not handle large volumes.

#### **FINAL TEST BEFORE HOUSING PUMPER**

After the instructions on maintenance and lubrication have been followed, close all discharge valves booster line valves and drain valves. Tighten suction caps. Engage pump and prime until compound gauge shows about 20 inches of vacuum. If vacuum falls more than 10 inches in 10 minutes, it is an indication of an air leak which must be eliminated before pump can be considered in serviceable condition. Air leaks may often be detected by ear if the engine is stopped.

It is advisable to test the suction hose by this same method at frequent intervals. This can be done by attaching the suction hose to the pump and placing suction tube caps on end of suction hose in place of strainer.

If air leaks can not be detected by the above vacuum test, it is advisable to test the pump hydrostatically. To do this, connect the pump to a source of water, such as a hydrant, and look for leaks

#### **NOTES**

Air leaks will cause high engine speed in relation to pressure.

Foreign matter in impellers will cause high engine speed and less than normal volume.

When working from draft, do not pump volumes large enough to cause a whirlpool at the strainer. This will allow air to get into the pump and result in rough operation and pulsation. If more water is needed, try to get a better submergence for the strainer.

## LUBRICATION

### PEDESTAL

The pump shaft bearings are supplied with oil from the pedestal housing. Use a premium grade of multirange SAE EP-90 oil. Fill to oil level plug. Do not use a heavier oil or too much oil. Drain oil and renew every six months.

## MAINTENANCE

Except for lubrication, this pump requires very little attention. The little required, however, is important.

During freezing weather, be sure to drain all water out of the pump. This can be done in the following manner:

Open discharge valves, remove suction tube and discharge valve caps. Open all drain valves and cocks (gauge lines, valves and cooling lines, etc.). After the pump is completely drained, all the caps should be replaced and the valves closed. Do not put off closing the drains or valves until later, as forgetting to close them may result in failure to prime the pump when attempting to work from draft.

In some installations, the pump mounting angle may prevent complete draining of the drive unit cooling tube. If the pump cannot be protected from freezing temperatures, it is advisable to install a fitting in the cooling line so that the line can be blown out with air. After pumping salt water, connect the pump to a fresh water hydrant or other source of fresh water and pump for a few minutes to clean out the salt water. If you have been forced to pump water containing sand or other foreign matter, do the same as stated above for salt water, flushing out discharge valves, relief valve, gauge and cooling lines.

### GASKETS AND WASHERS

Inspect the suction hose rubber washers and the washers and the washers in suction tube caps frequently. Foreign matter under these washers or faulty washers will cause air leaks which may prevent getting water when working from draft and even if you get water, will cause an irregular pulsating stream.

### SEAL REPLACEMENT

RMB (Plate #726); RMC (Plate #725)

### TO REPLACE PUMP SEAL

1. Disconnect heat exchanger line tubes (where applicable), priming line tube, and gauge line tubes.
2. Remove the screws which hold the pump volute body to the pump head and tap casing free with a soft hammer.
3. Remove cotter pin from impeller lock nut (where applicable).
4. Loosen impeller lock nut or capscrew (where applicable) several rotations. Do not remove it yet.

- To remove impeller, put a flat pry bar on each side of impeller between it and pump head. The pry bars should bear against impeller disc opposite the impeller vanes. Tap end of shaft with a soft hammer, while maintaining pressure on pry bars, until impeller comes off. Do not put too much pressure on the pry bars. Application of heat may be necessary. Use a torch to slowly heat the impeller hub area until the impeller comes loose. Remove the impeller lock nut (or capscrew and washer) and impeller.

**CAUTION:** Impeller, nut and shaft may be hot and cause burns. Use proper protective gloves while handling the parts.

- After the impeller and impeller key have been removed, the seal parts can then be removed for inspection. The seal should be replaced.
- In replacing the seal, insert the stationary seal seat and the rubber seal with the seal surface toward you into the pump head using pac seal lubricant.
- Wipe a little pac seal lubricant on the inside of the steel and rubber encased carbon sealing washer. Then, slide this assembly on the shaft with the carbon wearing lip toward the seal seat.

**CAUTION:** Se sure to keep the seat and sealing washer wearing surfaces clean, and be careful not to damage the lip on the sealing washer.

- Spray loctite primer N on the mating surfaces of the shaft and impeller. Allow to dry.
- Place the seal spring, smaller diameter end, on pilot of sealing washer.
- Apply loctite #640 to entire mating surface of shaft (where contacts the impeller) and to the threads on the shaft.
- Insert impeller key into shaft and apply loctite #640.
- Push impeller onto shaft, making certain the seal spring seats in the spring bore of the impeller.
- Replace the impeller, lock nut and the 5/32" x 2" cotter pin or the capscrew and washer (where applicable). Follow torquing instructions on appropriate cross-section plate.
- Using a greased gasket and new sealing capscrews, bolt the Volute body to the pump head.

## CLEARANCE RINGS

There are two replaceable clearance rings or wear rings in these pumps. One is pressed into the pump head, and the other is pressed into the pump body.

## CHECKING PUMPER PERFORMANCE

Periodic checks should be made to determine if the pumper performance has dropped from its original efficiency. Every fire pump has an underwriters rating as shown:

RATING	EXAMPLE
Rated capacity at 150 PSI	750 GPM at 150 PSI
Rated capacity at 165 PSI	750 GPM at 165 PSI
70% Capacity at 200 PSI	525 GPM at 200 PSI
50% capacity at 250 PSI	375 GPM at 250 PSI

The current underwriters rated capacities covering all pumps are 500, 750, 1000, 1250, 1500, 1750, 2000, 2500 and 3000 GPM.

## **GAUGES & LAYOUTS**

To accurately test a pumper for performance, a pitot gauge and a pump pressure gauge, both gauges tested for accuracy, are required. Gauge testing can be done with a dead weight gauge tester. Pumpers should be tested from draft at not over a 10 foot lift with 20 feet of suction hose. 1500 GPM and higher rated pumpers frequently require two separate 20 foot lengths of suction hose and larger pumps utilize lower lifts down to 6 feet.

Smooth bore nozzles of accurate size should be used with the pitot gauge. The volume pumped is then determined by referring to tables which show GPM flow in relation to nozzle size and the pitot gauge reading. Nozzles should preferably be used on a siamese deluge gun for greatest accuracy. A stream straightener, just upstream of the nozzle, is advisable.

For the 500 and 750 test, two 2-1/2" lines should preferably be laid from the pumper to the nozzle. Since deluge guns are not always available, other hose layouts may be made such as one 2-1/2" line to a 1-3/8" tip for 500 GPM. In general, the nozzle used on one 2-1/2" hose should not be larger than 1-1/2" for accuracy of measuring GPM. For another example, two separate 2-1/2" lines with a 1-1/4" nozzle on one and a 1-1/2" nozzle on the other would pass 1000 GPM flow. The sum of the flow from both nozzles is, of course, the GPM delivered by the pump. For good pitot gauge accuracy the nozzle pressures should be between 40 and 85 PSI.

Since the underwriters ratings specify both GPM and pressure, it is usually necessary to restrict the flow somewhat in order 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 pumper at 250 GPM and 250 PSI requires 72 PSI nozzle pressure on a 1" tip. To reduce the pressure from 250 PSI at the pump to 72 PSI at the nozzle would require over 1300 feet of 2-1/2" hose. Therefore, it is common practice to use 50 feet or 100 feet of hose and gate the discharge valves as required.

## **TESTING AT CAPACITY**

The pumper should first be tested for capacity, for instance, 750 GPM at 150 PSI. It is best to run at capacity for 20 to 30 minutes to be sure there will be no overheating or loss of power. If the pumper will not reach capacity at the rated pressure, it needs a thorough check-up.

Assuming the pumper does reach capacity, it is then desirable to know how much reserve is available. If there is some reserve at capacity the engine throttle will not have been wide open. Now open the throttle wide. The pump pressure will increase, and the flow will also increase. Gate the discharge valves slightly until the nozzle pressure (and flow) is the same as during the capacity run. A 10% increase in pressure (150 to 165 PSI) indicates that the pumper has reasonable reserve and that the engine is delivering ample power and that the pump is in good condition. No increase, or a one to two percent increase in pressure when the throttle is opened wide may indicate that performance has dropped.

Test performance should be compared to the performance at the time of delivery. Test records should be on file with the pumper delivery papers. If not, they may be procured from the manufacturer of the apparatus or from the local Underwriters. If the pumper performance has dropped appreciable compared to its original performance, it is in need of service.

## **TESTING PRESSURE**

The pumper should now be checked at 7/10 capacity at 200 PSI, and 1/2 capacity at 250 PSI. If the apparatus fails to pump its required volume at either 200 or 250 PSI, it should be thoroughly checked.

Compare results with performance of the pumper when new. An appreciable drop indicates need for service.

## **ENGINE SPEED**

Engine speed is important on all four tests and should be recorded, and compared to the original speeds at time of delivery. Engine RPM should not exceed the engine manufacturers recommended no load governed speed. Engine speed can, to some extent, be a guide to the condition of the pump.

A substantially higher engine speed on any one of the tests, compared to the speed on the same test when the pumper was new, can indicate air leaks, a restricted suction hose or strainers, foreign matter within the pump, especially impellers, or too high a lift. A low engine speed, together with poor pump performance indicates lack of engine power, worn clearance rings and/or bypassing. Relief valves, booster tank plumbing and valves, and sometimes central drains can all allow bypassing.

## **MISCELLANEOUS**

During the tests the priming system should be checked. See instructions under "Final Test Before Housing Pumper".

The relief valve should also be checked.

## **PUMP TEST TROUBLESHOOTING**

### **WHAT IS WRONG IF THE PUMPER DOES NOT MEET ITS CAPACITY AT ANY ONE OF THE FOUR TESTS**

1. Low Engine Horsepower. This is especially true when engine speeds tend to be lower than the original speeds when you are approaching or near, but can not obtain performance at the four test spots. Possible causes of low engine power:
  - Throttle linkage or wiring not opening engine throttle fully.
  - Ignition timing incorrect.
  - Restricted fuel flow due to clogged filter bowl or other restriction.
  - Engine running too hot.

The above causes are relatively simple to correct and sometimes can be adjusted immediately so the test can proceed.

These causes are more serious and indicated a thorough engine tune-up or other repairs are necessary:

- Slipping Clutch or lack of transmission lockup
- Exhaust restricted.
- Leaking or sticking valves.

2. Air Leaks. A frequent cause of low performance, recognized by excess motor speed, hose pulsation and unsteady pressure gauge.

**Remedy - check pump for holding vacuum, find leaks.**

Sometimes these leaks are in the booster tank plumbing. Leaks can usually be heard when the motor is stopped. See instructions. Priming will be delayed by an excessively leaking packing gland.

3. Suction obstructions. These cause higher than normal engine speed and reduced capacity. They also cause fluctuation of the pressure gauge and a high vacuum reading on the compound gauge.

The obstructions may be foreign matter such as grass or leaves on the suction hose strainer or in the pump suction tube strainer. To check the strainers, shut down and open a discharge valve very slightly, letting the water run back down the suction hose slowly. This will prevent the foreign matter from being flushed out so that it can be observed and the cause of the trouble determined.

The obstruction may be caused by a collapsed suction hose lining. Old or defective suction hose may have a loose lining that is pulled inward by a vacuum, substantially reducing the flow through the hose. It is difficult to see because the lining usually goes back into place when the hose is removed. Usually, however, there appears to be a low blister on the lining where it has pulled away from the carcass of the hose.

**Remedy - replace the defective hose.**

4. Foreign Matter in the impeller. This causes higher than normal engine speed and reduced capacity. However, it does not cause an abnormally high vacuum on the compound gauge. To clean foreign matter out of the impeller, remove the suction tube and push the obstruction out of the impeller with a rod by hand. When the pump is open, it is well to check the "clearance" or "sealing" rings for abnormal wear. See "Worn Clearance Rings and Impeller Hubs".

5. Lift too High. This will cause high engine speed, high vacuum, pump roughness and a pulsating pressure gauge.

**Remedy - do not test at over 10 feet lift, with not more than 20 feet of suction hose.**

**NOTE:** Larger pumps are rated at 6 feet of lift. Check pump rating chart.

6. By-Passing Around Pump. Recognized by reduced capacity and greater than normal throttle opening.

**Cause - relief valve control set at too low a pressure allowing main relief valve to bypass.**

**Remedy: Reset control so relief valve closes. Booster tank fill line open. (Close this). Leaking valves in plumbing.**

7. Worn Clearance Rings and Impeller Hubs. Since clearance ring replacement requires pump disassembly, it is advisable to thoroughly check other possible causes of low-performance before assuming that clearance ring wear is the cause.

Clearance rings or "sealing" rings allow a negligible amount 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 they continue to effectively seal for hundreds of hours of pumping. In dirty or sandy water, the impeller hub and clearance ring will wear faster than in clean water. The more they wear the greater the bypass and the lower the performance. Also,

the greater the pressure at which the pump is operating, the larger will be the bypass and the more the performance will be reduced.

When new, the clearance between the impeller hubs and the ring is approximately five to nine thousandths of an inch per side (.005-.009). Any increase will allow more bypass and 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 15 to 20 thousandths or more.

If the clearance rings wear faster than the impeller hubs, it is necessary to replace only the clearance rings. This will largely reduce the bypass and restore the pump to near original performance. A complete restoration requires that the impellers also be replaced. Undersize clearance rings and replacement impellers are available through Hale Service Department.

### **SERVICE - PARTS - INFORMATION**

If you have any questions concerning the pump or require service or replacement parts, contact the apparatus manufacturer or Hale Products, Conshohocken, Pennsylvania, 19428, telephone 610-825-6300, web address: [www.haleproducts.com](http://www.haleproducts.com). Be sure to include the pump serial number which is recorded on the face of this manual. It is also stamped on the name plate attached to the drive unit.

## ADDITIONAL TROUBLESHOOTING CHARTS

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 1. HALE MIDSHIP PUMP TROUBLE ANALYSIS**

CONDITION	POSSIBLE CAUSE	SUGGESTED CORRECTION
<b>PUMP WILL NOT ENGAGE</b>  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	Repeat recommended shift procedures.  Check system for loss of air supply.  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	Automatic transmission not in neutral position  Pump shift attempted before vehicle was completely stopped  Premature application of parking brake system (before truck comes to a complete stop  Insufficient air in 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.  Repeat recommended shift procedures.

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

## 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
<p><b>PUMP LOSES PRIME OR IT WILL NOT PRIME</b></p> <p>NOTE: Weekly priming pump operation is recommended to provide good operation.</p>	<p>Electric Priming System</p> <p>Defective Priming System</p> <p>Suction lifts too high</p> <p>Blocked suction strainer</p> <p>Suction connections</p> <p>Primer not operated long enough.</p>	<p>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</p> <p>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.</p> <p>Do not attempt lifts exceeding 22 feet except at low elevation.</p> <p>Remove obstruction from suction hose strainer..</p> <p>Clean and tighten all suction connections. Check suction hose and hose gaskets for possible defects.</p> <p>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.</p> <p><b>NOTICE:</b> 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).</p>

CONDITION	POSSIBLE CAUSE	SUGGESTED CORRECTION
<b>PUMP LOSES PRIME OR IT WILL NOT PRIME (CONTINUED)</b>	Air Trap in Suction Line  Pump Pressure too low when nozzle is opened  Air Leaks	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.  Prime the pump again and maintain higher pump pressure while opening discharge valve slowly.  Attempt to locate and correct air leaks using the following procedure.  <ol style="list-style-type: none"><li>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.</li><li>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.</li><li>3. Attempt above dry prime and shut off engine. Audible detection of a leak is often possible.</li><li>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.</li><li>5. Check pump packing during attempt to locate leakage. If leakage is in excess of recommendations, adjust accordingly following instructions in Section 3.</li><li>6. The suction side relief valve can leak. Plug the valve outlet connection and retest.</li></ol>

CONDITION	POSSIBLE CAUSE	SUGGESTED CORRECTION
<p><b>INSUFFICIENT PUMP CAPACITY</b></p>	<p>Insufficient engine power</p> <p>Transfer Valve not in proper “Volume” position</p> <p>Relief Valve improperly set</p> <p>Engine Governor set incorrectly</p> <p>Truck transmission in wrong gear or clutch is slipping</p> <p>Air Leaks</p>	<p>Engine power check or tune up may be required for peak engine and pump performance.</p> <p><b>TWO STAGE PUMPS ONLY.</b> Place transfer valve in “Volume” position (parallel) when pumping more than 2/3 rated capacity. For pressure above 200 PSI (13.8 BAR), pump should be placed in “Pressure” (series) position.</p> <p>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.</p> <p>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.</p> <p>Recheck the pumping procedure for the recommended transmission or gear range; see Section 3 for assistance.</p> <p>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).</p> <p>See air leaks under “<b>PUMP LOSES PRIME OR WILL NOT PRIME</b>”.</p>
<p><b>INSUFFICIENT PRESSURE</b></p>	<p>Check similar causes for insufficient capacity</p> <p>Transfer Valve not in “Pressure” position</p>	<p>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).</p> <p><b>TWO STAGE PUMPS ONLY.</b> For desired pump pressure above 200 PSI (13.8 BAR), transfer valve should be in “Pressure” position.</p>

CONDITION	POSSIBLE CAUSE	SUGGESTED CORRECTION
<b>LEAK AT PUMP PACKING</b>	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.
<b>REMOTE CONTROL DIFFICULT TO OPERATE</b>	Lack of lubrication	Lubricate the remote control linkages and collar with oil.
<b>ENGINE SPEEDS TOO HIGH FOR REQUIRED CAPACITY OR PRESSURE</b>	<p>Impeller blockage</p> <p>Worn pump impeller(s) and clearance rings</p> <p>Blockage of suction hose entry</p> <p>Defective suction hose</p> <p>Lift too high, suction hose too small</p> <p>Truck transmission in wrong range or gear</p>	<p>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).</p> <p>Installation of new parts required.</p> <p>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.</p> <p>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.</p> <p>Higher than normal lift (10 feet) will cause higher engine speeds, high vacuum and rough operation. Use larger suction hose.</p> <p>Check recommended procedures for correct transmission selection; see Section 3 and truck manual.</p>
<b>RELIEF VALVE DOES NOT RELIEVE PRESSURE WHEN VALVES ARE CLOSED</b>	<p>Incorrect setting of Control (Pilot) Valve</p> <p>Relief Valve inoperative</p>	<p>Check and repeat proper procedures for setting relief valve system. (see Section 3)</p> <p>Possibly in need of lubrication. Remove relief valve from pump; dismantle; clean and lubricate. Weekly use of the Relief Valve is recommended.</p>

CONDITION	POSSIBLE CAUSE	SUGGESTED CORRECTION
<b>RELIEF VALVE DOES NOT RECOVER AND RETURN TO ORIGINAL PRESSURE SETTING AFTER OPENING VALVES</b>	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.
<b>RELIEF VALVE OPENS WHEN CONTROL VALVE IS LOCKED OUT</b>	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.
<b>UNABLE TO OBTAIN PROPER SETTING ON RELIEF VALVE</b>	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.  Foreign matter in the control valve. Remove the control valve and clean.
<b>WATER IN PUMP GEARBOX</b>	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.  Inspect the oil seal and replace if necessary.
<b>DISCHARGE VALVES DIFFICULT TO OPERATE</b>	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.

## EXPLANATION OF TERMS

### **CENTRIFUGAL PUMP**

A centrifugal pump consists of an impeller with an intake at the center, so arranged that, when rotated, it will discharge water by centrifugal force into a casing or volute body which surrounds the impeller. The water exits from the impeller at high velocity into the diverging passages of the volute body, where the velocity, energy is converted into pressure.

A centrifugal pump differs from other types of pumps in that its impeller can be rotated freely even though the discharge is closed, because the pressure developed is entirely the result of the velocity imparted to the water by the rotating impeller and is not due to any impact or displacement.

### **IMPELLER**

The working parts of a centrifugal pump consist of two round discs separated by curved vanes. When rotating, it imparts energy to the water as the vanes force the water between the discs so that it is thrown outward at increasing velocity by centrifugal force.

### **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 which creates a vacuum to prime the main pump. The main pump, being a centrifugal pump, is not a positive displacement pump. The priming pump is driven by an electric motor which is engaged by a switch on the priming valve.

### **PRIMING VALVE**

A pull type shut-off valve located in the priming line between the priming pump and the main pump. It is normally closed and is open only during priming to allow air to pass from the main pump to the priming pump.

### **RELIEF VALVE**

An automatic valve, actuated by the relief valve control, which will hold pump pressure and engine speed steady when the pump discharge is shut off or partially closed. The relief valve maintains its given pressure by diverting the pump discharge flow into the pump suction.

### **RELIEF VALVE CONTROL**

A hand adjustment valve mounted on the pump control panel which controls the relief valve to maintain the desired pump discharge pressure.

### **PRESSURE GOVERNOR**

A pressure activated automatic control, with manual adjustment, that maintains constant pump pressure by regulating the engine throttle.

**PRESSURE GAUGE**

The pressure gauge is usually graduated in pounds per square inch and/or bar. It is connected to the pump discharge manifold, thus indicating the pump discharge pressure.

**COMPOUND GAUGE**

The compound gauge is graduated to read pressure in pounds per square inch and/or bar with the vacuum in inches of mercury and/or bar. It is connected to the pump suction thus indicating the suction pressure when pumping from a hydrant or the vacuum when pumping from draft.

**HOSE DRAIN**

A push-pull valve designed to be installed at the discharge valve. Used to drain a charged hose when the discharge valve is closed.

**MULTIPLE OR MASTER DRAIN VALVE**

A valve to which all the drain cavities are piped for the purpose of a single drain valve



# Pump Maintenance Check List

Truck Manufacturer \_\_\_\_\_

Pump Model & Serial Number \_\_\_\_\_

Year \_\_\_\_\_ Unit# \_\_\_\_\_

## RECOMMENDED WEEKLY PROCEDURES (Not applicable to HFM, PSD or CSD pumps)

- Test relief valve system or governor at 150, 200, 250. If pump is equipped with TPM you will need to have positive pressure.
- Test transfer valve (if applicable)
- Test the priming system and check lubrication level in priming tank.
- Operate all valves, discharge, suction, hose, drain, and multi drain.
- Check pump shift warning indicator lights.

RECOMMENDED WEEKLY PROCEDURES	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
Complete Weekly Checks												
Lubricate threads on PM relief valve panel control and check light. DO NOT USE GREASE												
Lubricate remote valve controls												
Lubricate valves												
Check controlled packing leakage and adjust if necessary (8 to 10 drops per minute @ 100 - 150 PSI)												
Perform dry vacuum test												
Check drive flange bolts to ensure tightness. Lubricate U-Joint												
Lubricate suction tube threads. DO NOT USE EXCESSIVE GREASE.												
Clean strainer. Examine for loss of zinc.												
Inspect cap gaskets. Replace if cracked or damaged.												
Check oil level in pump gear box; add oil if necessary												
If necessary, replace oil with SAE EP 90 oil												
Check clapper valves (2-stage pump)												

*\*Per NFPA-1911, para 3-32, 22 inches minimum vacuum; loss not to exceed 10 inches 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); Pump must be drained of water prior to changing oil. See operation and maintenance manual for details
- Lubricate power transfer cylinder, power shift cylinder, and shift control valve with vacuum cylinder oil, if applicable.
- Drain pump gear box oil and refill (SAE-EP 90 oil). Examine magnetic plug.
- 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 operators manual for detailed information.

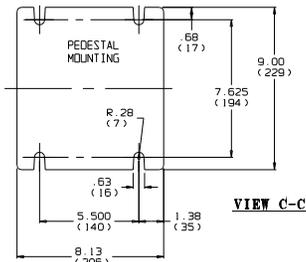
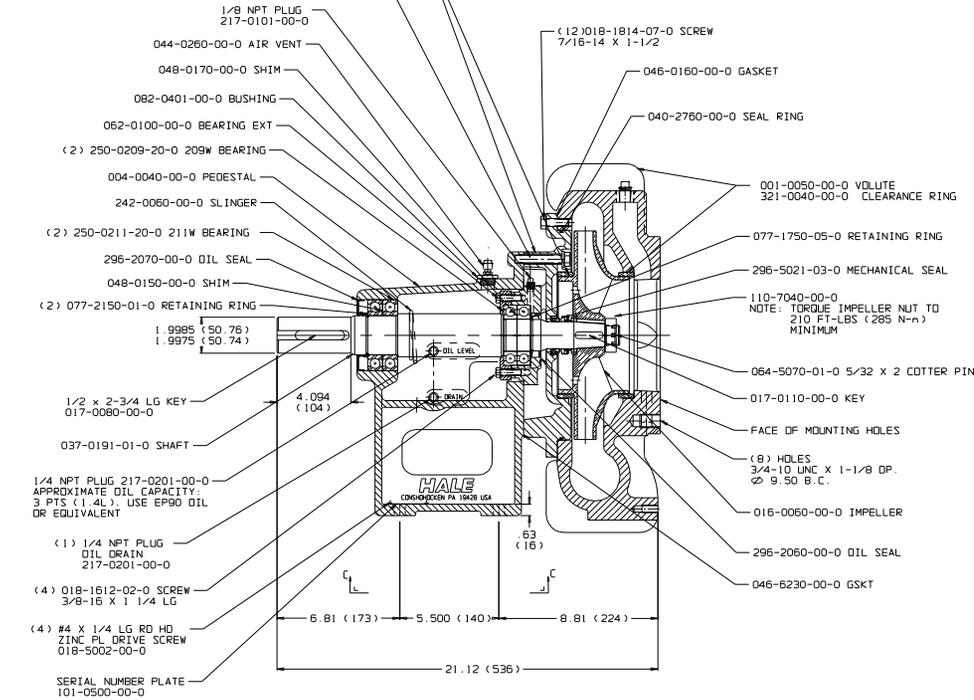


**WARNING**

EXCEEDING THESE LIMITS OR FAILURE TO FOLLOW THE RECOMMENDATIONS OUTLINED ON THIS DRAWING COULD DAMAGE THE PUMP AND RESULT IN PERSONAL INJURY.  
 MAX PUMP PRESSURE - HYDRODYNAMIC = 500PSI (34 BAR) & HYDROSTATIC = 500PSI (34 BAR)  
 MAX POWER INPUT FOR PUMPING = 470 HP (350kW)  
 MAX PUMP INPUT RPM = 4200  
 READ LIMIT CHART F-72 FOR ADDITIONAL DATA.

# RMC SERIES REAR MOUNT PUMP

THIS PRODUCT AND ITS COMPONENTS ARE PROTECTED BY ONE OR MORE OF THE FOLLOWING U.S. PATENTS AND OTHER PATENTS PENDING:  
 3,118,694 4,054,898  
 3,918,681 4,089,945  
 4,311,440 (4) 018-2226-02-0 SCREW  
 4,653,987 (4) 016-12 X 2 3/4 LG  
 (4) 097-0200-00-0 SEALING WASHER



**NOTE :**

- 1) ALL DIMENSIONS IN INCHES & (MILLIMETERS).
- 2) PUMP CAN BE ROTATED TO ANY POSITION THRU 22.5° INCREMENTS.
- 3) ITEMS NOT SHOWN:  
 101-0361-00-0 WARNING DECAL  
 101-0450-00-0 DECAL "HALE"

**PLATE NO. 725AA**

ECD NO	REV	CHANGED FROM	BY	DATE	APVD
01-103	A	REDRAWN ON CAD & UPDATED	TC	2-28-01	MAL

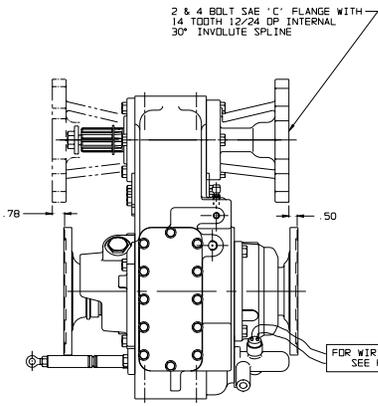


HALE PRODUCTS, INC.  
 A Unit of IDEX Corporation  
 Conshohocken, PA 19428 USA

COPYRIGHT © 1990 IDEX CORPORATION  
 NOT TO BE REPRODUCED OR USED TO MAKE OTHER DRAWINGS OR MACHINERY.  
 DRAWN MFD DATE 7-18-90 SIZE SCALE : .25  
 CHECKED -

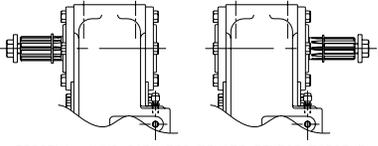


THIS PRODUCT AND ITS COMPONENTS MAY BE PROTECTED BY ONE OR MORE OF THE FOLLOWING U.S. PATENTS AND OTHER PATENTS PENDING:  
 4,337,830 5,018,665  
 4,587,862 5,139,393  
 4,853,978



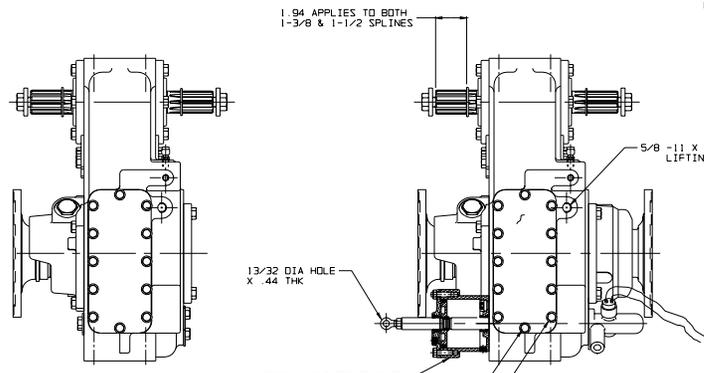
OPTIONAL HYDRAULIC PUMP DRIVE  
 HYDRAULIC PUMP DRIVE MAY BE ORDERED EITHER FRONT OR REAR MOUNTED WITH 1-1/2 - 10 SPLINE DRIVESHAFT ON OPPOSITE SIDE

FRONT & REAR COMBINATION FLANGES			
SPICER SERIES	1600	1700	1800
FEMALE PILOT DIAMETER	6.62	7.75	7.75
QUANTITY & SIZE GRADE B SCREWS	(8) 3/8	(12) 3/8	(12) 7/16
BOLT CIRCLE DIAMETER	6.12	7.25	7.25



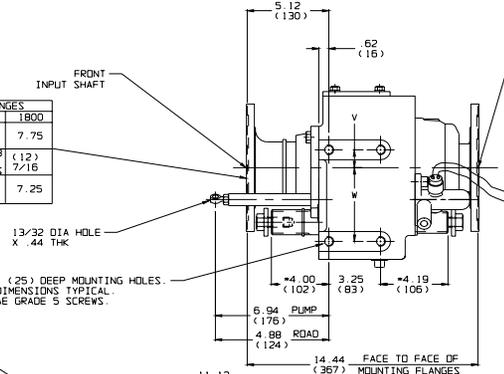
OPTIONAL AUXILIARY DRIVESHAFT CONFIGURATIONS  
 SHAFT AND INTERNAL PARTS MAY BE ASSEMBLED WITH EITHER 1-3/8 - 10 OR 1-1/2 - 10 SPLINE ON EITHER END WITH OPPOSITE END BLANKED OFF (SEE PARTS LIST). DIMENSIONS MARKED \* WILL MOVE WITH THE APPROPRIATE SPLINE.

DIMENSIONS ARE IN INCHES  
 DIMENSIONS IN ( ) ARE MM  
 WEIGHT = 200 LBS (91 KG)



OPTIONAL REAR DRIVE SHAFT BLANKED OFF FOR PTO DRIVE  
 MANUAL DRIVE UNIT SHIFT STANDARD VPS POWER SHIFT (SEE PLATE 533) AND VPS CONTROL VALVE (SEE PLATE 595) AVAILABLE.

(12) 019-1404-02-0 5/16-18 X 1/2 LG HEX CAP SCR  
 (12) 097-0810-01-0 WASHER  
 APPARATUS BUILDER TO CONNECT ONE END OF GEAR BOX COOLER TO PUMP DISCHARGE AND THE OTHER END TO PUMP SUCTION WITH 3/8" TUBING. ELBOW ON LOWER SIDE OF COOLER WILL BE REPLACED WITH A "TEE" (092-0207-02-0) WHEN GEAR BOX IS MOUNTED VERTICALLY. A DRAIN VALVE MUST BE PROVIDED AT THIS POINT TO DRAIN COOLER IN FREEZING WEATHER.



FRONT & REAR COMBINATION FLANGES

FRONT INPUT SHAFT

REAR OUTPUT SHAFT

(8) 5/8-11 X 1.25 DEEP MOUNTING HOLES. MOUNTING PAD DIMENSIONS TYPICAL. USE MINIMUM SAE GRADE 5 SCREWS.

SERIAL NUMBER LOCATION

AIR VENT

OPTIONAL GEAR BOX COOLER

13/32 DIA HOLE X .44 THK

5/8 - 11 X 1-1/8 (29) DP LIFTING HOLE

11.12 (283)

19.00 (483)

4.44 (113)

1.12 (29)

1.75 (44)

13.00 (330)

3/4 NPT OIL FILL & LEVEL PLUG USE SAE 69-90 OIL APPROX CAPACITY = 5-1/2 PINTS (2.6 LITERS) AS SHOWN OR APPROX 7 PINTS WITH PLUG ON CENTERLINE

SHIFT SHAFT

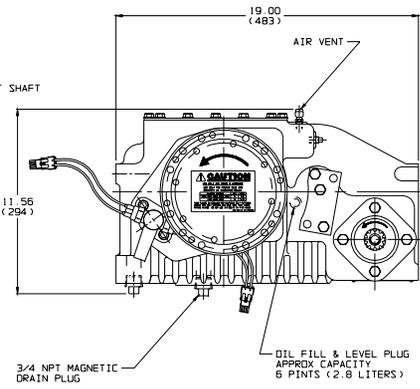
GEARBOX MODEL	DIMENSIONS							
	GEAR RATIO	M	N	P	R	U	V	W
MGA-30	30	70	(162)	(171)	(241)	(32)	(29)	(117)
MGA-40	40	78	(162)	(171)	(241)	(32)	(29)	(117)
MGA-50	50	78	(162)	(171)	(241)	(32)	(29)	(117)
MGA-60	60	78	(162)	(171)	(241)	(32)	(29)	(117)
MGA-70	70	78	(162)	(171)	(241)	(32)	(29)	(117)
MGA-80	80	78	(168)	(178)	(235)	(22)	(124)	
MGA-90	90	78	(168)	(178)	(235)	(22)	(124)	

**WARNING**

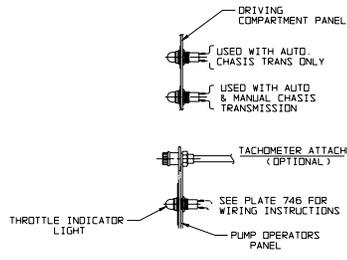
EXCEEDING THESE LIMITS OR FAILURE TO FOLLOW THE RECOMMENDATIONS OUTLINED ON THIS DRAWING COULD DAMAGE THE TRANSFER CASE AND RESULT IN PERSONAL INJURY.  
 MAXIMUM TORQUE ON AUXILIARY OUTPUT SHAFT(S) = 1,200 LB-FT  
 MAXIMUM GEARBOX SHAFT TORQUE (ROAD) = 16,000 LB-FT

GEARBOX MODEL	MGA-30	MGA-26	MGA-21	MGA-19	MGA-17	MGA-12	MGA-10
MAX GEARBOX INPUT RPM	2090	2350	2680	3270	3670	4940	6270

SEE HALE TORQUE LIMIT CHART F-72 FOR ADDITIONAL DATA.



DRIVE UNIT SHOWN IN OPTIONAL HORIZONTAL POSITION



HALE TYPE MGA SERIES SPLIT SHAFT/PTO GEARBOX

PLATE NO. 915AA

99-204	A	RELEASED FOR PRODUCTION	DPL	7-30-99	RET	HALE PRODUCTS, INC.	HALE PRODUCTS, INC.
ECO	NO	REV	CHANGED FROM	BY	DATE	APVD	DATE 10-6-98

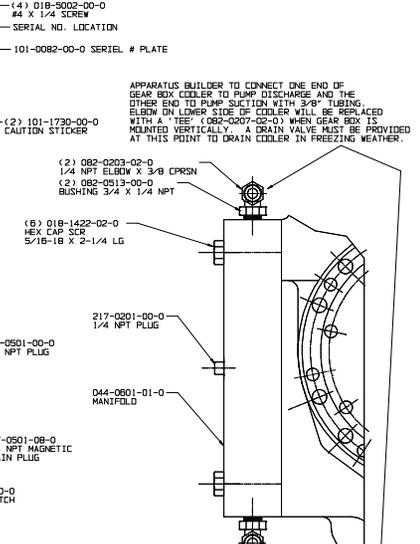
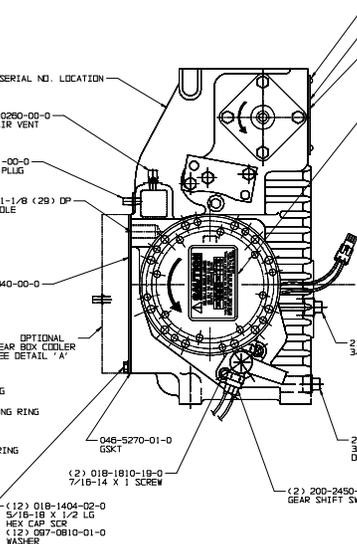
HALE A Unit of IDEX Corporation  
 Conshohocken, PA 19380 USA  
 SCALE: HALF

THIS PRODUCT AND ITS COMPONENTS MAY BE PROTECTED BY ONE OR MORE OF THE FOLLOWING U.S. PATENTS AND OTHER PATENTS PENDING:  
 4,387,895 5,019,885  
 4,987,862 5,139,363  
 4,953,978

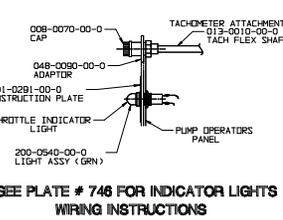
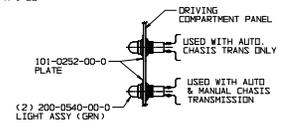
NOTE:  
 THIS SHAFT AND INTERNAL PARTS MAY BE ASSEMBLED SO THAT 1-3/8 - 10 SPLINE IS ON THIS END AND 1-1/2 - 10 SPLINE IS ON OPPOSITE END.  
 OR  
 WITH EITHER SPLINE ON EITHER END WITH THE OPPOSITE END BLANKED OFF. DIMENSIONS MARKED WITH \* WILL MOVE WITH THE APPROPRIATE SPLINE. FURNISHED AS SHOWN UNLESS SPECIFIED OTHERWISE.

- 004-0371-02-0 DRIVE UNIT (1.92, 2.67 RATIOS)
- 004-0371-03-0 DRIVE UNIT (2.18, 3.00 RATIOS)
- 004-0371-04-0 DRIVE UNIT (1.00, 1.27 RATIOS)
- 004-0371-05-0 DRIVE UNIT (1.71 RATIO)
- 077-1500-29-0 RETAINING RING
- (8) 018-1812-02-0 HEX CAP SCR 7/16-14 X 1-1/4 LG
- 250-0208-20-0 208S BEARING
- 298-2610-00-0 OIL SEAL
- 1-1/2-10 SPLINE
- (2) 250-0306-06-0 306KG BEARING
- (2) 046-6390-00-0 GSKT
- SHAFT 037-3010-00-0 (1.00, 1.27 RATIO)
- SHAFT 037-0530-00-0 (1.71, 1.92, 2.18, 2.67, 3.00 RATIO)
- GEAR 031-1430-00-0 (1.00, 1.27 RATIO, 43 TEETH)
- GEAR 031-1080-00-0 (1.71, 1.92, 2.18, 2.67, 3.00 RATIO, 37 TEETH)
- GEAR 031-1070-00-0 (1.00, 1.27 RATIO, 28 TEETH)
- GEAR 031-1080-00-0 (1.71, 1.92, 2.18, 2.67, 3.00 RATIO, 48 TEETH)
- OPTIONAL TACHOMETER PARTS
- ADAPTOR 077-0040-00-0 DRIVE GEAR 031-0170-00-0 BUSHING 049-0070-00-0 STANDARD PLUG (NOT SHOWN)
- 217-3007-00-0
- VIEW 'B' APPLIES TO 1.00 & 1.27 RATIOS ONLY
- 008-0571-00-0 CAP
- 077-2750-01-0 RETAINING RING
- (2) 250-0214-06-0 214KG BEARING
- 298-2540-00-0 OIL SEAL
- 142-0180-00-0 SLINGER
- 537-1740-00-0 SHAFT
- (2) 018-1810-07-0 7/16-14 X 1 LG HEX CAP SCR 360 NYLON LOCKING
- 037-1341-00-0 SHAFT
- MANUAL DRIVE UNIT SHIFT STANDARD. VPS POWER SHIFT (SEE PLATE 533) AND VPS CONTROL VALVE (SEE PLATE 595) AVAILABLE.
- 040-2109-00-0 SEAL RING
- 115-0090-00-0 FLANGE
- 018-1816-02-0 7/16-14 X 1-3/4 LG HEX CAP SCR
- 028-0041-02-0 GEAR SHIFT FORK (1.71, 1.92, 2.18, 2.67, 3.00 RATIO)
- 028-0041-03-0 GEAR SHIFT FORK (1.00, 1.27 RATIO)
- 046-5060-00-0 GSKT
- 031-1430-00-0 INTERMEDIATE GEAR
- (077-1180-04-0) RETAINING RING
- 037-3010-00-0 GEAR SHAFT
- (2) 250-8170-00-0 NJ-306KG BEARING
- 077-2810-00-0 RETAINING RING
- VIEW 'B' THIS CONFIGURATION USED ONLY ON 1:1.00 AND 1:1.27 RATIOS ONLY
- 046-5340-00-0 GSKT
- (4) 018-1816-07-0 7/16-14 X 1-3/4 LG HEX CAP SCR
- 077-1870-02-0 ADAPTOR
- 088-0580-00-0 DRIVE COUPLING
- 077-1370-00-0 RETAINING RING
- HYDRAULIC PUMP ADAPTER, SIZED FOR SAE 2 BOLT AND SAE 4 BOLT "C" FLANGE. FEMALE PILOT DIAMETER: 5 INCH INTERNAL SPLINE: 14 TEETH; 12/24 DIAMETRAL PITCH
- 037-2180-00-0 OUTPUT SHAFT
- 017-0300-00-0 KEY
- 298-2180-00-0 OIL SEAL
- OPTIONAL HYDRAULIC PUMP DRIVE MAY BE MOUNTED FRONT OR REAR

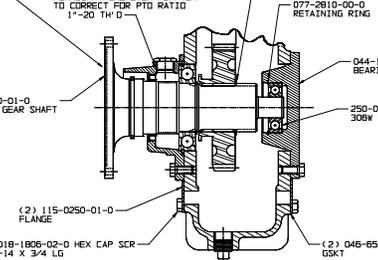
- 017-0020-00-0 KEY (1.00, 1.27, 1.71, 1.92, 2.18, 2.67 RATIO)
- 017-0520-00-0 KEY (3.00 RATIO)
- 031-0461-00-0 GEAR (1.27, 2.18 RATIO, 22 TEETH)
- 031-1050-00-0 GEAR (2.67 RATIO, 18 TEETH)
- 031-0471-00-0 GEAR (3.00 RATIO, 18 TEETH)
- 031-0481-00-0 GEAR (1.92 RATIO, 25 TEETH)
- 031-1080-00-0 GEAR (1.00, 1.71 RATIO, 28 TEETH)
- (2) 046-5340-00-0 GSKT
- 298-2590-00-0 OIL SEAL
- 077-1370-05-0 RETAINING RING
- 037-1590-00-0 SHAFT
- DRIVE FLANGE CLAMPING SCREW & WASHER
- (2) 018-2412-07-0 5/8-11 X 1-1/4 LG HEX HD SCR 360° NYLON LOCKING
- (2) 037-0890-03-0 1-3/4 (44) DIA WASHER
- 044-0840-00-0 COVER
- 1-3/8-10 SPLINE
- 250-0307-20-0 307M BEARING
- (2) 044-1180-00-0 COVER
- 158-0540-01-0 SPACER
- (2) 005-0680-00-0 PLATE
- (2) 018-1810-07-0 7/16-14 X 1 LG CAP SCR 360° NYLON LOCKING
- (2) 077-1180-04-0 RETAINING RING
- 046-5130-01-0 GASKET
- 537-1750-00-0 TAIL SHAFT
- 077-5000-00-0 RETAINING RING
- (2) 077-2780-01-0 RETAINING RING
- 250-8010-00-0 NEEDLE BEARING
- 208-2540-00-0 OIL SEAL
- 250-0214-00-0 214K BEARING
- 037-0810-00-0 BEARING CAP
- FOR WIRING SCHEMATIC SEE PLATE 746
- (4) 018-1810-07-0 7/16-14 X 1 LG CAP SCR 360° NYLON LOCKING
- 008-0053-02-0 CAP
- 088-0050-00-0 1-22 BALL
- 042-0080-00-0 SPRING
- 018-2104-61-0 1/2-20 X 1/2 SCREW
- (2) 020-0540-00-0 LIGHT ASSY (GRN)
- 008-0070-00-0 TACHOMETER ATTACHMENT (OPTIONAL) CAP
- 048-0090-00-0 ADAPTOR
- 101-0291-00-0 INSTRUCTION PLATE
- THROTTLE INDICATOR LIGHT
- 200-0540-00-0 LIGHT ASSY (GRN)
- SEE PLATE # 746 FOR INDICATOR LIGHTS WIRING INSTRUCTIONS
- 037-1590-01-0 SHAFT
- 044-0880-00-0 BEARING COVER
- 158-0540-01-0 SPACER
- 044-1180-00-0 BEARING COVER
- OPTIONAL 1-1/2 - 10 SPLINE SHOWN MAY BE FRONT OR REAR OUTPUT
- 037-1590-02-0 SHAFT
- 044-1180-00-0 BEARING COVER
- OPTIONAL 1-3/8 - 10 SPLINE SHOWN MAY BE FRONT OR REAR OUTPUT



ENLARGED DETAIL 'A' OPTIONAL GEAR BOX COOLER



TO CONFORM TO NFPA 1801, MANUFACTURER MUST FURNISH A VISUAL INDICATOR AT THE DRIVERS POSITION WHEN THE PUMP POWER TAKE-OFF IS ENGAGED FOR PUMP AND ROLL OPERATION



OPTIONAL TYPE 2 - AUXILIARY VIEW - REAR DRIVE SHAFT BLANKED-OFF FOR PTO DRIVE

PLATE 722AC

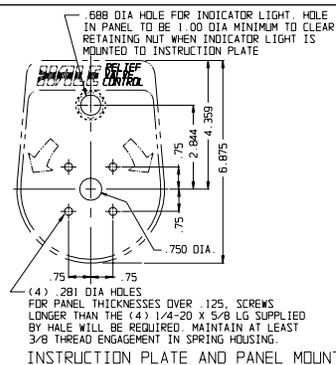
HALE TYPE MGA SERIES SPLIT SHAFT PTO TRANSFER CASE

01-043	UPDATED W/DESCRIPTIONS	TKC	1-23-01	MAL
99-204	B REDRAWN ON CAD - UPDATED	DPL	7-30-99	RET
ECO NO/REV	CHANGED FROM	BY	DATE	APPROV
				DATE 7/30/99



HALE PRODUCTS, INC.  
 A Unit of IDEC Corporation  
 Conshohocken, PA 19380 USA

SCALE: FULL



**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 THE 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% MOLYBDENUM DISULFIDE ON THE THREADED PART OF THE ADJUSTING STEM.

SOME RECOMMENDED LUBRICANTS INCLUDE:

DDW CORNING BR2-PLUS	IMPERIAL NO. 777
FISKE - LUBRIPLATE NO. 3000	MOBIL - MOBILGREASE SPECIAL
SHELL SUPER DUTY GREASE	SUN DIL - SUNOCO MOLY NO. 2EP

**ELECTRICAL INFORMATION**

THE HALE 200-2450-00-0 LIGHT SWITCH IS INTENDED FOR USE ONLY WITH THE HALE PROVIDED INDICATOR LIGHT. ELECTRICAL CHARACTERISTICS: 10 AMPS AT 24 VOLTS DC, NORMALLY CLOSED.

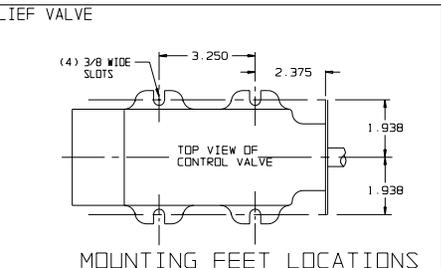
THE STANDARD HALE 200-0540-03-0 AMBER INDICATOR LIGHT IS INTENDED FOR 12 VOLT DC SERVICE. REPLACEMENT 12 VOLT BULB IS HALE PART NO. 200-0540-02-0. FOR 24 VOLT DC SERVICE USE BULB PART NO. 200-0540-09-0.

CIRCUIT PROTECTION (FUSE, CIRCUIT BREAKERS, 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.

**INSTRUCTIONS FOR SETTING "P" SERIES 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 INDICATOR LIGHT COMES ON.
- 3- TURN HANDWHEEL ABOUT 1/2 TURN CLOCKWISE UNTIL THE AMBER PILOT 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.



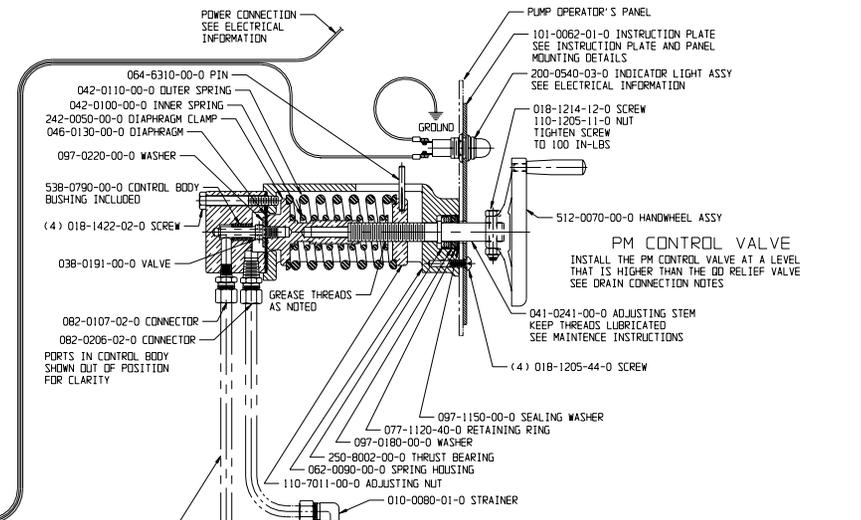
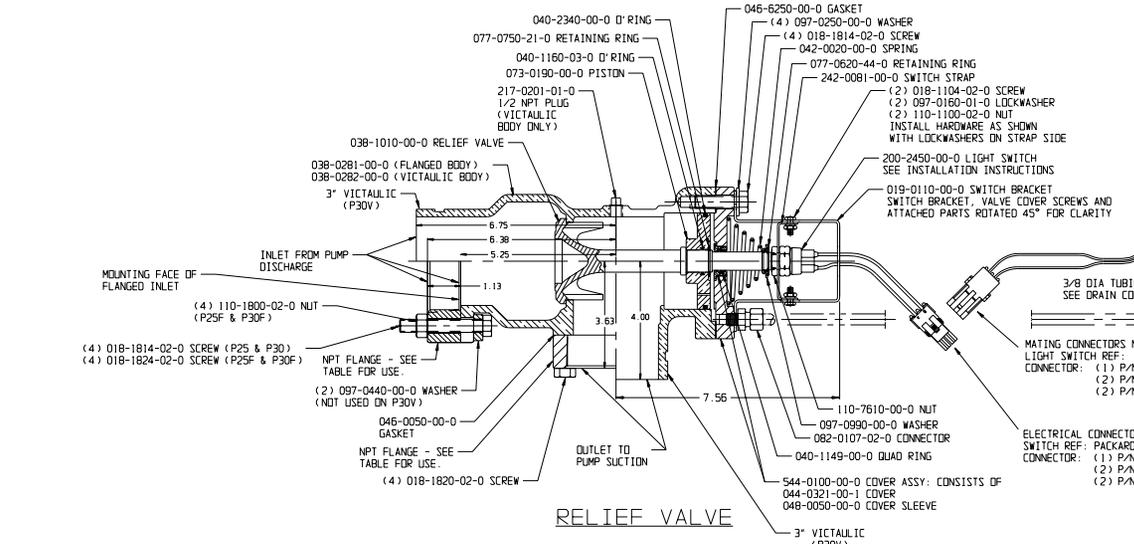
**DRAIN CONNECTION NOTES**

THE RELIEF VALVE REQUIRES A SEPARATE DRAIN CONNECTION. DO NOT CONNECT TO THE PUMP MASTER DRAIN.

THE DRAIN MUST ALLOW THE RELIEF VALVE, PM CONTROL VALVE AND ALL TUBING TO DRAIN NATURALLY AND COMPLETELY TO PREVENT FREEZING WHEN NOT IN USE.

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. 800.

ASSEMBLY PART NO.	NAME	PIPE CONNECTIONS	WEIGHT
538-1040-00-0	P RELIEF VALVE LESS PM CONTROL VALVE	FLG. INLET, OUTLET FOR "115" FLG.	20
538-1040-01-0	P25F RELIEF VALVE WITH PM CONTROL VALVE	2 1/2 NPT INLET AND OUTLET	36
538-1040-02-0	P25 RELIEF VALVE WITH PM CONTROL VALVE	FLG. INLET, 2 1/2 NPT OUTLET	33
538-1040-03-0	P30 RELIEF VALVE WITH PM CONTROL VALVE	FLG. INLET, 3 NPT OUTLET	32
538-1040-04-0	P30F RELIEF VALVE WITH PM CONTROL VALVE	3 NPT INLET AND OUTLET	34
562-0080-00-0	PM CONTROL VALVE		10
538-1040-13-0	P30V RELIEF VALVE WITH PM CONTROL VALVE	3 VICTAULIC INLET AND OUTLET	30



**INSTRUCTIONS FOR INSTALLING LIGHT SWITCH**

- 1- ASSEMBLE THE 200-2450-00-0 LIGHT SWITCH TO 242-0081-00-0 SWITCH STRAP USING NUT 110-7610-00-0.
- 2- INSTALL THE SWITCH STRAP AND LIGHT SWITCH IN THE SWITCH BRACKET. LEAVE THE TWO SCREWS ATTACHING THE SWITCH STRAP TO THE SWITCH BRACKET SLIGHTLY LOOSE TO ALLOW THE SWITCH TO MOVE IN AND OUT FOR ADJUSTMENT.
- 3- CONNECT THE PANEL MOUNTED INDICATOR LIGHT OR SUITABLE TEST LIGHT TO THE SWITCH TERMINALS. WITH THE LIGHT SWITCH PLUNGER NOT IN CONTACT WITH THE END OF THE POPPET, 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 SWITCH PLUNGER MAKES CONTACT WITH THE END OF THE POPPET AND THE LIGHT GOES OUT. THE SWITCH IS NOW IN THE PROPER POSITION. TIGHTEN THE SCREWS HOLDING THE SWITCH STRAP TO THE BRACKET.
- 5- VERIFY PROPER OPERATION OF THE RELIEF VALVE AND INDICATOR LIGHT BEFORE PLACING APPARATUS IN SERVICE.

**WARNING**

FAILURE TO FOLLOW THE INSTALLATION, OPERATION, LUBRICATION AND MAINTENANCE REQUIREMENTS SET FORTH HERE AND IN THE OPERATION 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 P SERIES RELIEF VALVE WITH PM CONTROL VALVE

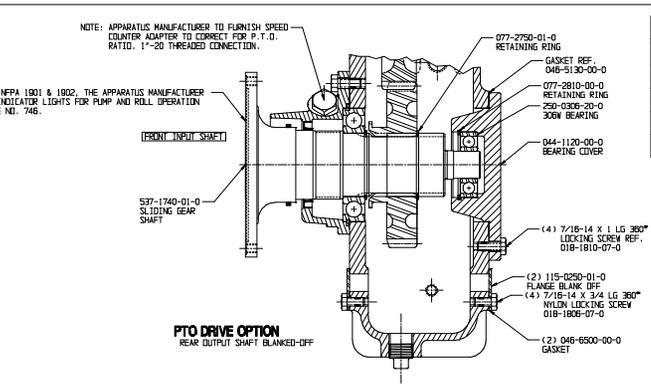
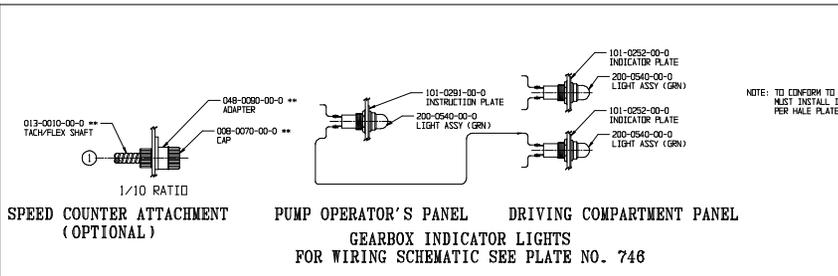
## PLATE NO. 547CD

REV	DESCRIPTION	DATE	BY	APPROVED
95-034	A ADDED REVISION BLOCK	AJD 5-22-95	RET	
99-036	B PLACED ON CAD & UPDATED	JBS 9-26-99	RET	
00-657	C UPDATED DRAWING	DJK 10-24-00	MAL	
01-173	D UPDATED PART REQUIREMENTS	DJK 4-02-01	MAL	
EC0	NO REV	CHANGED FROM	BY	DATE

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



SCALE: NONE



GEARBOX MODEL	GEAR RATIO	"C" DIMENSION
RG-23	2.28	13.375 (340)
RG-21	2.05	13.563 (344)
RG-19	1.86	13.750 (349)
RG-17	1.71	13.938 (354)
RG-15	1.58	14.125 (359)

**WARNING**

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

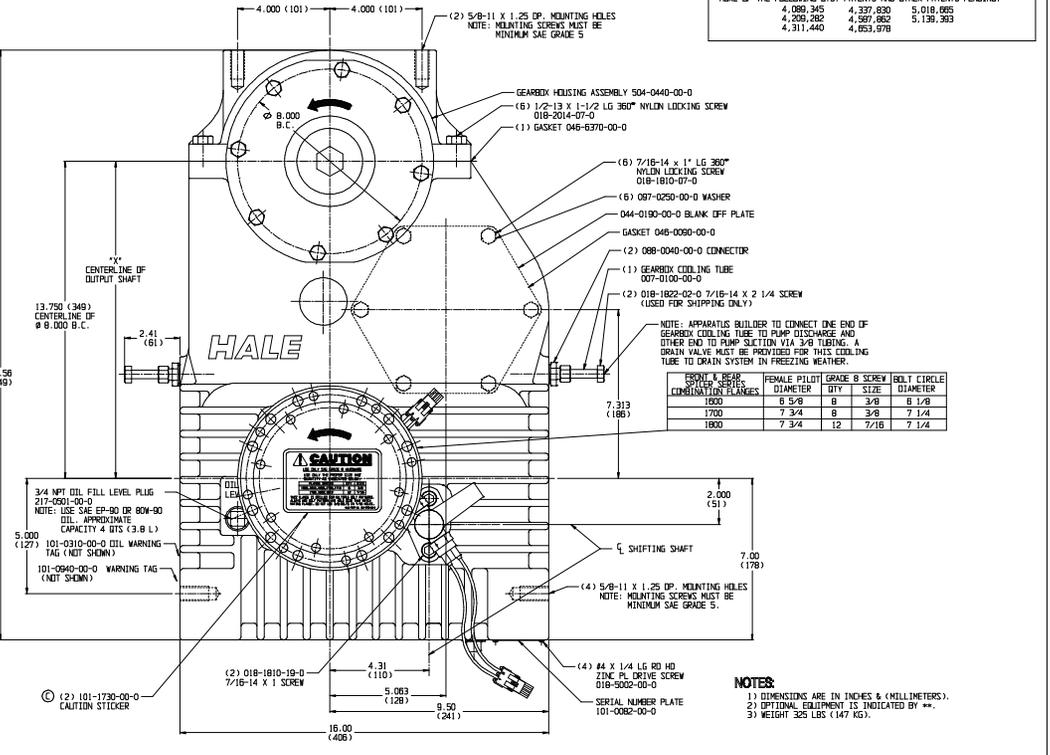
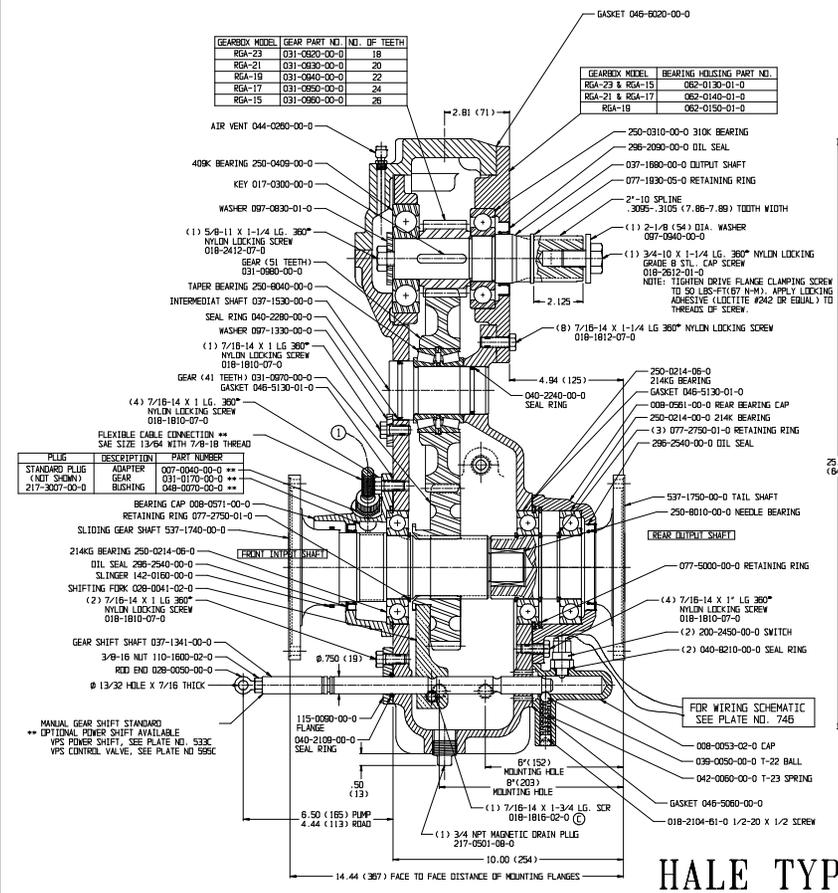
MAXIMUM TORQUE ON AUXILIARY OUTPUT SHAFT = 2300 LBS-FT (3118 N-m)  
 MAXIMUM GEARBOX SHAFT TORQUE (ROAD) = 16,000 LBS-FT (21,663 N-m)

GEARBOX MODEL	MAX GEARBOX INPUT RPM
RG-23	2630
RG-21	2500
RG-19	3200
RG-17	3000
RG-15	3600

SEE HALE TORQUE LIMIT CHART F-72 FOR ADDITIONAL DATA.

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

4,089,345	4,337,830	5,018,065
4,292,082	4,367,862	5,139,363
4,311,440	4,653,978	



**PLATE NO. 766AD**

**HALE TYPE RGA SERIES**

**SPLIT-SHAFT PTO GEARBOX**

ECD NO/REV	CHANGED FROM	BY	DATE	APVD
95-170 A	RELEASED FOR PRODUCTION	AJD	8-14-95	ROT
99-171 B	UPDATE DRAWING	DPL	6-24-99	RET
99-238 C	CORRECT P.N.'S & QTY'S	DPL	8-10-99	RET
01-050 D	UPDATED W/DESCRIPTIONS	TKC	1-25-01	MAL

**HALE**

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

HALE SERIAL NUMBER PLATE

NOTE: 1) DIMENSIONS ARE IN INCHES & (MILLIMETERS).  
 2) OPTIONAL EQUIPMENT IS INDICATED BY \*\*.  
 3) WEIGHT 325 LBS (147 KG).

HALE SERIAL NUMBER PLATE

DATE: 8-24-94  
 SIZE: 43-3/8 X 28

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

**! WARNING !**

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

MAXIMUM TORQUE ON AUXILIARY OUTPUT SHAFT = 2300 LBS-FT (3118 N-m)  
 MAXIMUM GEARBOX SHAFT TORQUE (ROAD) = 16,000 LBS-FT (21,693 N-m)

GEARBOX MODEL	MAX GEARBOX INPUT RPM
LGA-23	2630
LGA-21	2920
LGA-19	3220
LGA-17	3500
LGA-15	3800

SEE HALE TORQUE LIMIT CHART F-72 FOR ADDITIONAL DATA

GEARBOX MODEL	GEAR RATIO	A	B	C	D	E	F	G	H	J
LGA	2.28	5.06	16.00	18.56	13.38	6.50	4.31	5.19	2.00	7.00
	2.05				13.56					
	1.86				13.75					
	1.71				13.94					
	1.58				14.13					

**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.

NOTE: APPARATUS MANUFACTURER TO FURNISH SPEED COUNTER ADAPTER TO CORRECT FOR P.T.O. RATIO. 1"-20 THREADED CONNECTION.

NOTE: TO CONFORM TO NFPA 1901 & 1902, THE APPARATUS MANUFACTURER MUST INSTALL INDICATOR LIGHTS FOR PUMP AND ROLL OPERATION PER HALE PLATE NO. 746.

**PTO DRIVE OPTION**

REAR OUTPUT SHAFT BLANKED-OFF

NOTE: APPARATUS BUILDER TO CONNECT ONE END OF GEARBOX COOLING TUBE TO PUMP DISCHARGE AND OTHER END TO PUMP SUCTION VIA 3/8 TUBING. A DRAIN VALVE MUST BE PROVIDED FOR THIS COOLING TUBE TO DRAIN SYSTEM IN FREEZING WEATHER.

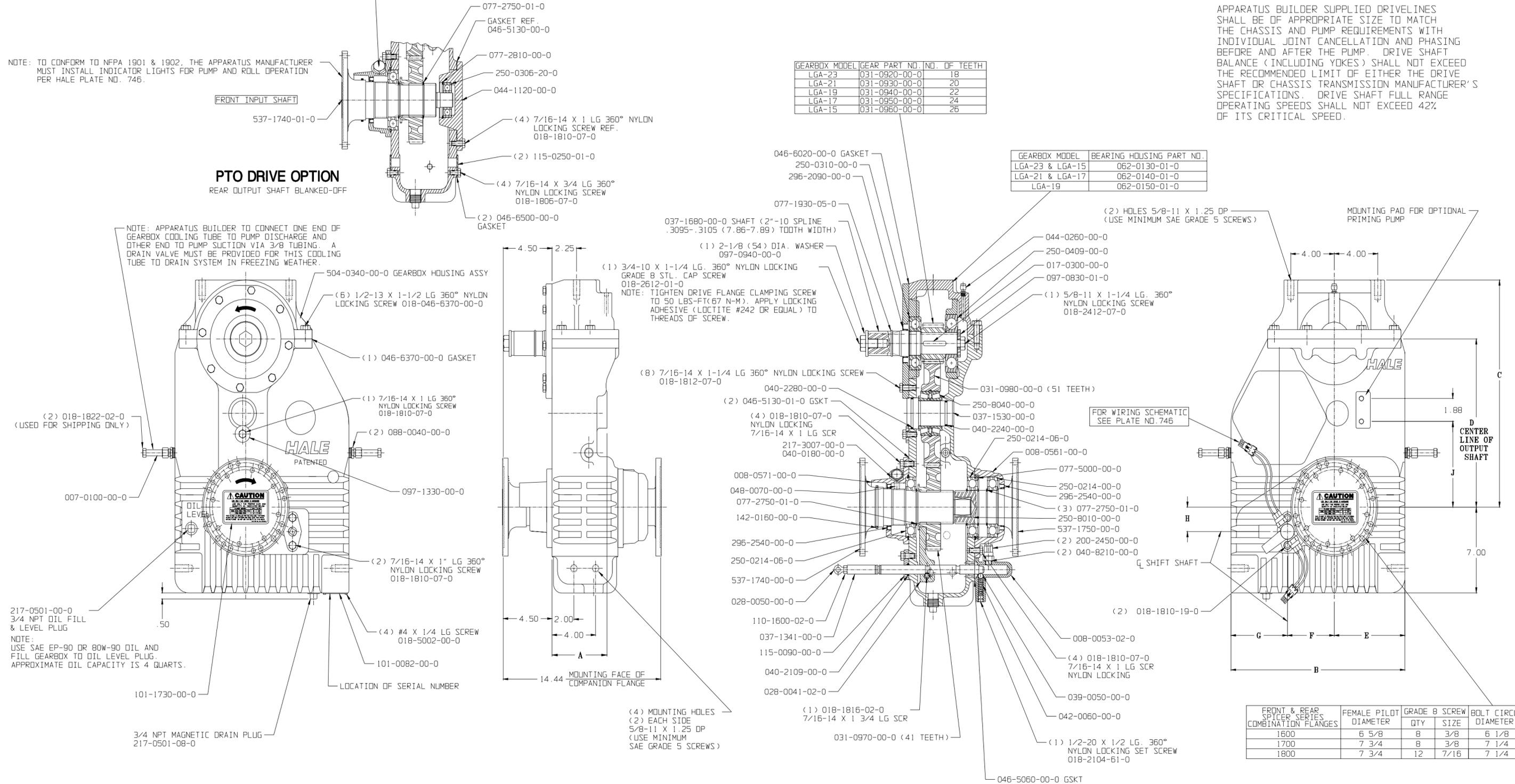


PLATE 907AA

**HALE TYPE "LGA" SERIES GEARBOX**

00-455	A	RELEASE FOR PRODUCTION	DJK	5-15-00	MAL
ECD	NO	REV	CHANGED FROM	BY	DATE

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

NOT TO BE REPRODUCED OR USED TO MAKE OTHER DRAWINGS OR MACHINERY

DRAWN: DJK  
 CHECKED: MAL  
 DATE: 7/16/99  
 SIZE: E  
 SCALE: FULL

# TORQUE AND RPM LIMITS



## WARNING

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

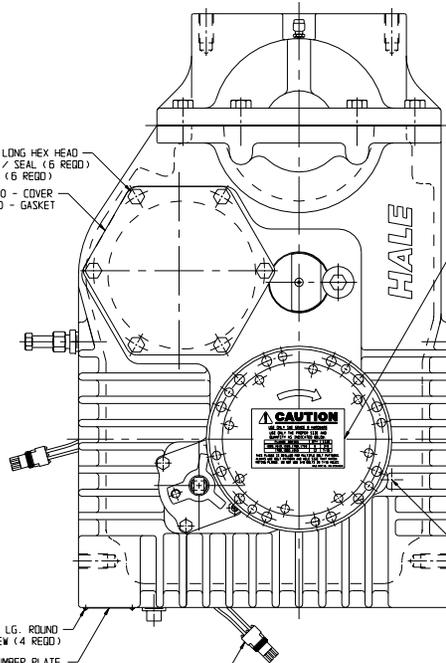
### HALE TYPE RGAE-10 ONLY

MAXIMUM GEARBOX INPUT TORQUE (ROAD POSITION): 16000 LB-FT  
 MAXIMUM STATIC TORQUE ON AUXILIARY OUTPUT SHAFT: 2300 LB-FT  
 MAXIMUM RATED HORSEPOWER: 450  
 MAXIMUM ALLOWABLE RPM: 4000

SEE HALE FORM F-72 "MAXIMUM ALLOWABLE PUMP PRESSURE, ENGINE HP AND TORQUE LIMITS FOR HALE CENTRIFUGAL PUMPS" FOR ADDITIONAL INFORMATION.

SEE HALE PLATE NO. 766 FOR THE STANDARD HALE TYPE RGA MIDSHIP SPLIT SHAFT POWER TAKE-OFF WITH RATIOS FROM 1:1.58 TO 1:2.28.

THIS PRODUCT AND ITS COMPONENTS ARE PROTECTED BY ONE OR MORE OF THE FOLLOWING U.S. PATENTS AND OTHER PATENTS PENDING:  
 4,209,282    4,311,440    4,337,830    4,587,862    4,653,978



- 018-1810-07-0 - 7/16-14NC X 1" LONG HEX HEAD CAP SCREW WITH 360° NYLON LOCK / SEAL (6 RECD)
- 097-0250-00-0 - LOCKWASHER (6 RECD)
- 044-0190-00-0 - COVER
- 046-0090-00-0 - GASKET

**CAUTION**  
 USE ONLY SAE GRADE 8 HARDWARE  
 USE ONLY THE PROPER SIZE AND QUANTITY AS INDICATED BELOW:

PLATE SERIES	BY	SIZE
1800, 1810, 1820, 1830, 1870	8	3/8
1960, 1880, 1810	12	7/16

THIS FLANGE IS DRILLED FOR MULTIPLE BOLT PATTERNS. ALWAYS USE BOLT PATTERN AND HOLE SIZE THAT MATCH MATING FLANGE. DO NOT USE 3/8 BOLTS IN 7/16 HOLES.  
SEE PART NO. 90-7960AA

- 088-0040-00-0 - COOLING TUBE ADAPTER (2 RECD) - 1/2" O.D. TUBE TO 1/2 NPT
- 007-0100-00-0 - GEARBOX COOLING TUBE 1/2" O.D. X .035 WALL TYPE L COPPER
- 018-1822-02-0 - 7/16-14NC X 2-1/4 LONG ZINC PLATED HEX HEAD CAP SCREW (2 RECD) FOR PROTECTION DURING SHIPPING ONLY

**COOLING TUBE APPLICATION INFORMATION**  
 PUMP INSTALLER TO CONNECT ONE END OF COOLING TUBE TO DISCHARGE SIDE OF PUMP AND OTHER END TO SUCTION SIDE. USE AT LEAST 3/8" I.D. TUBING TO ENSURE ADEQUATE WATER FLOW.  
 A DRAIN VALVE MUST BE PROVIDED SO THAT COOLING WATER CAN BE DRAINED DURING FREEZING WEATHER.  
 FOR FIRE PUMPS AND SIMILAR APPLICATIONS, USE OF THE COOLING TUBE IS RECOMMENDED FOR ALL INSTALLATIONS.  
 FOR APPLICATIONS WHERE COOLING WATER IS NOT AVAILABLE, DO NOT EXCEED 200 HP FOR CONTINUOUS DUTY SERVICE UNDER STANDARD AMBIENT CONDITIONS. FOR EXTREMELY HIGH OR LOW AMBIENT TEMPERATURES, PLEASE CONSULT THE FACTORY.

217-0501-00-0 - 3/4 NPT OIL LEVEL PLUG (NOT SHOWN) - LOCATED ON FAR SIDE OF GEARBOX  
 PLEASE NOTE - GEARBOX IS SHIPPED WITHOUT OIL APPROXIMATE OIL CAPACITY: 8 QUARTS  
 FILL WITH SAE 90 EP OR 80W90 EP GEAR LUBRICANT  
 CHECK OIL LEVEL REGULARLY  
 UNDER NORMAL SERVICE CONDITIONS, CHANGE OIL AT SAME INTERVALS AS VEHICLE TRANSMISSION AND / OR AXLE

**WIRING CONNECTOR FOR SHIFT INDICATOR SWITCH (TYP. 2 PLACES)**

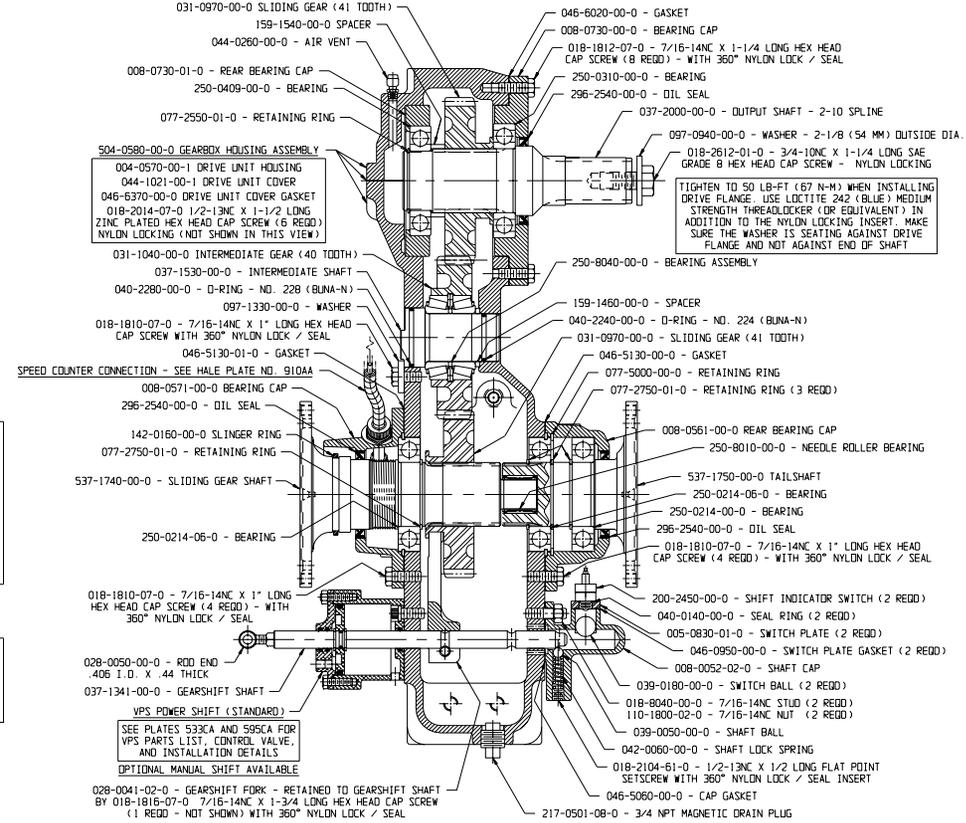
THE FOLLOWING INDICATOR LIGHTS AND INSTRUCTION PLATES ARE PROVIDED WITH THE UNIT FOR MOUNTING BY INSTALLER:

HALE PART NO.	QTY	DESCRIPTION
200-0540-00-0	3	GREEN INDICATOR LIGHT
101-0291-00-0	1	SHIFT INDICATOR INSTRUCTION PLATE
101-0252-00-0	1*	SHIFT INDICATOR INSTRUCTION PLATE - STD.
101-0072-00-0	1*	SHIFT INDICATOR INSTRUCTION PLATE - VPS

\* VPS INSTRUCTION PLATE IS REPLACED BY (1) ADDITIONAL 101-0252-00-0 INSTRUCTION PLATE FOR MANUAL SHIFT UNITS

SEE HALE PLATE NO. 746AA - WIRING SCHEMATIC FOR SHIFT INDICATOR LIGHTS, FOR ADDITIONAL DETAILS.

**WARNING** ALL WIRING AND INSTALLATION DETAILS MUST CONFORM TO ALL APPLICABLE NFPA AND SAE STANDARDS.  
 VERIFY OPERATION OF ALL SHIFT INDICATOR LIGHTS AND INTERLOCKS BEFORE PLACING APPARATUS IN SERVICE



- 004-0570-00-1 DRIVE UNIT HOUSING
- 044-1021-00-1 DRIVE UNIT COVER
- 046-6370-00-0 DRIVE UNIT COVER GASKET
- 018-2014-07-0 1/2-13NC X 1-1/2 LONG ZINC PLATED HEX HEAD CAP SCREW (6 RECD) NYLON LOCKING (NOT SHOWN IN THIS VIEW)

SPEED COUNTER CONNECTION - SEE HALE PLATE NO. 910AAA

SEE PLATES 533CA AND 505CA FOR VPS PARTS LIST, CONTROL VALVE, AND INSTALLATION DETAILS  
 OPTIONAL MANUAL SHIFT AVAILABLE  
 028-0041-02-0 - GEARSHIFT FORK - RETAINED TO GEARSHIFT SHAFT BY 018-1816-07-0 7/16-14NC X 1-3/4 LONG HEX HEAD CAP SCREW (1 RECD - NOT SHOWN) WITH 360° NYLON LOCK / SEAL

TIGHTEN TO 50 LB-FT (67 N-M) WHEN INSTALLING DRIVE FLANGE. USE LOCTITE 242 (BLUE) MEDIUM STRENGTH THREADLOCKER (OR EQUIVALENT) IN ADDITION TO THE NYLON LOCKING INSERT. MAKE SURE THE WASHER IS SEATING AGAINST DRIVE FLANGE AND NOT AGAINST END OF SHAFT

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

## ASSEMBLY DRAWING AND PARTS LIST

### HALE TYPE RGAE-10 MIDSHIP POWER TAKE OFF

SEE HALE PLATE NO. 909AA FOR DIMENSIONS AND INSTALLATION DETAILS

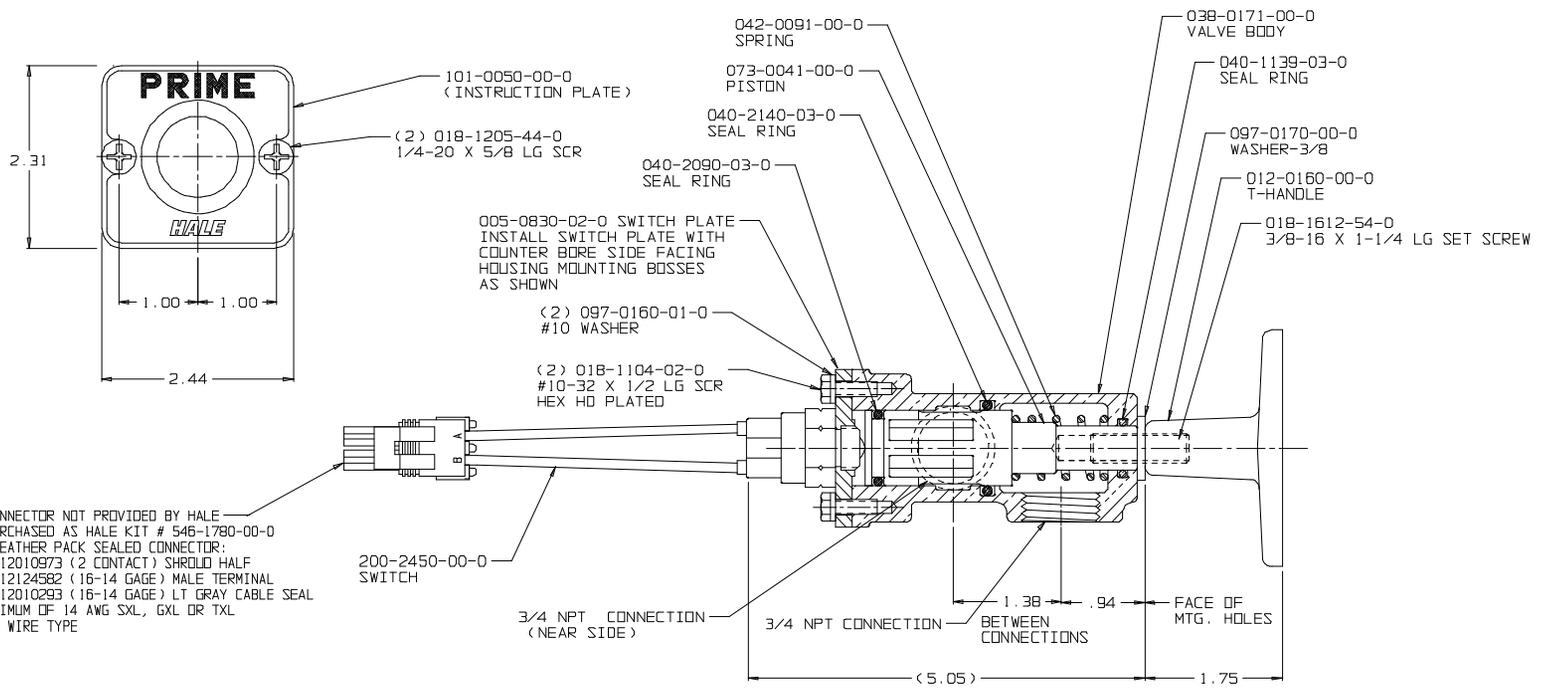
ECD NO	REV	CHANGED FROM	BY	DATE	APVD
99-131	A	RELEASED FOR PRODUCTION	AJD	5-18-99	RET

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

DATE: 5-18-99  
 SCALE: 17:5

PLATE 894AA

# HALE TYPE PVG PRIMING VALVE



MATING CONNECTOR NOT PROVIDED BY HALE  
 CAN BE PURCHASED AS HALE KIT # 546-1780-00-0  
 PACKERD WEATHER PACK SEALED CONNECTOR:  
 (1) P/N: 12010973 (2 CONTACT) SHROLD HALF  
 (2) P/N: 12124582 (16-14 GAGE) MALE TERMINAL  
 (2) P/N: 12010293 (16-14 GAGE) LT GRAY CABLE SEAL  
 USE A MINIMUM OF 14 AWG SXL, GXL OR TXL  
 SAE J1128 WIRE TYPE

**PLATE NO. 480GB**

ECD 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

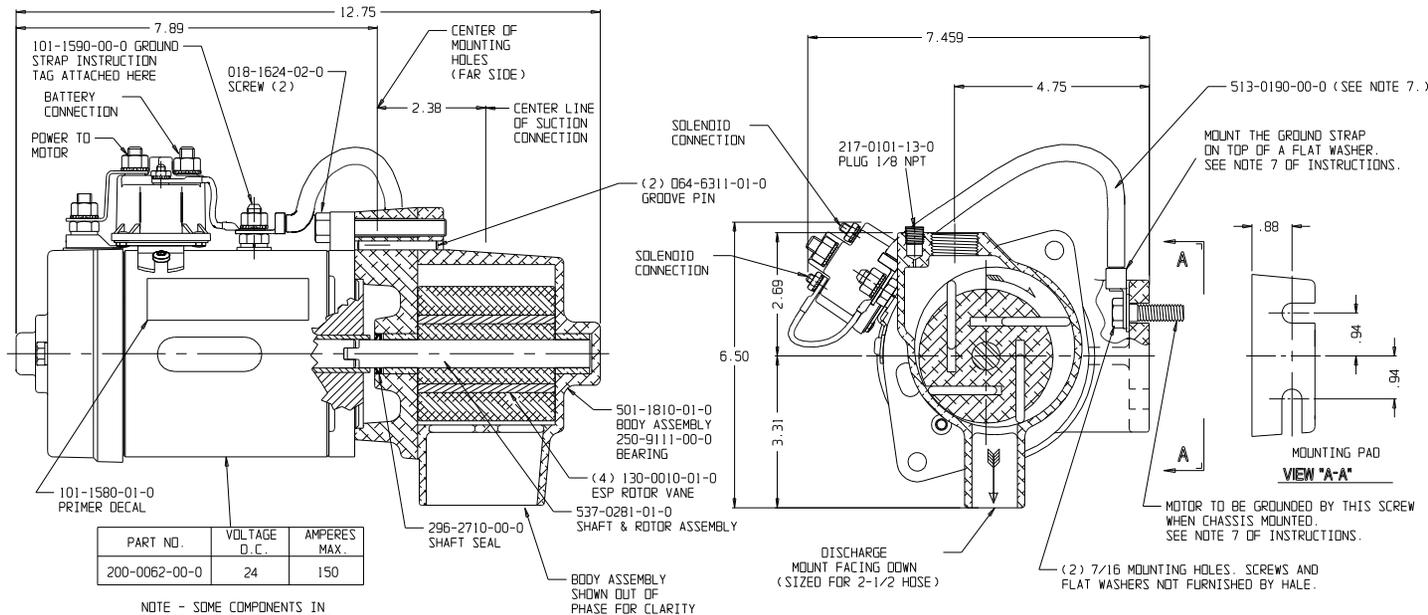


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 Conshohocken, PA 19428 USA

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# HALE TYPE ESP-24 PRIMING PUMP



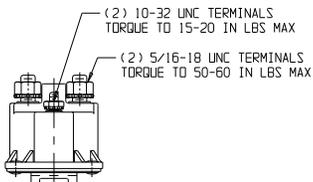
## INSTRUCTIONS:

- 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 24 VOLT DC 150 AMP LOAD.
- 8) DURING THE PRIMING OPERATION (EVACUATING AIR), DO NOT RUN THE MOTOR FOR MORE THAN 60 SECONDS.

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

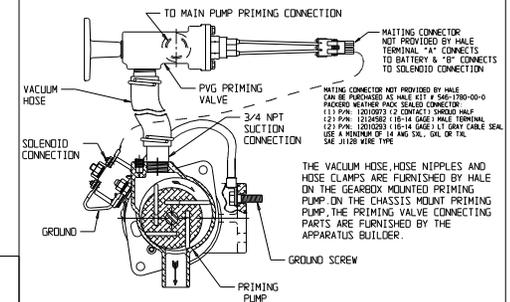
## NOTES:

- 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. 490 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.



## SOLENOID FASTENER TORQUE SPECIFICATION

## INSTALLATION DETAIL

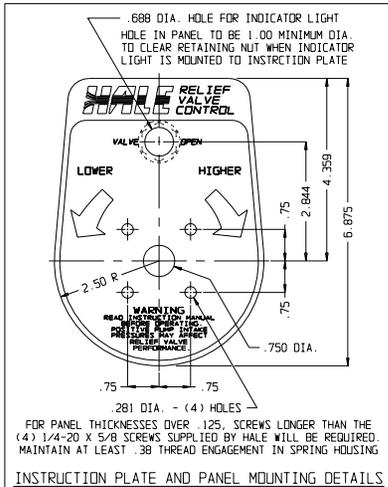


ECO NO	REV	CHANGED FROM	BY	DATE	APVD
01-172	A	RELEASE FOR PRODUCTION	ERS	4-03-01	MAL
01-257	B	UPDATED SOLENOID CONNECTION CALLOUTS	DJK	06-12-01	MAL
01-258	C	(CONSTRUCTION NOTE 7) REVISED: "WHEN THE PRIMING PUMP IS MOUNTED ON THE PUMP GEARBOX" ADDS: "SOLENOID SHAFT SEAL"	DJK	06-22-01	MAL

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

DATE 4-3-01  
SCALE: FULL

PLATE NO. 938AC



### 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 OQ 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 CLOSURES 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% MOLYBDENUM DISULFIDE ON THE THREADED PART OF THE ADJUSTING STEM.

SOME RECOMMENDED LUBRICANTS INCLUDE:

- DOW CORNING 882-PLUS IMPERIAL NO. 777
- FISKE - LUBRICATE NO. 3000
- SHELL SUPER DUTY GREASE
- MOBIL - MOBILGREASE SPECIAL
- SUN OIL - SUNOCO MOLY NO. 2EP

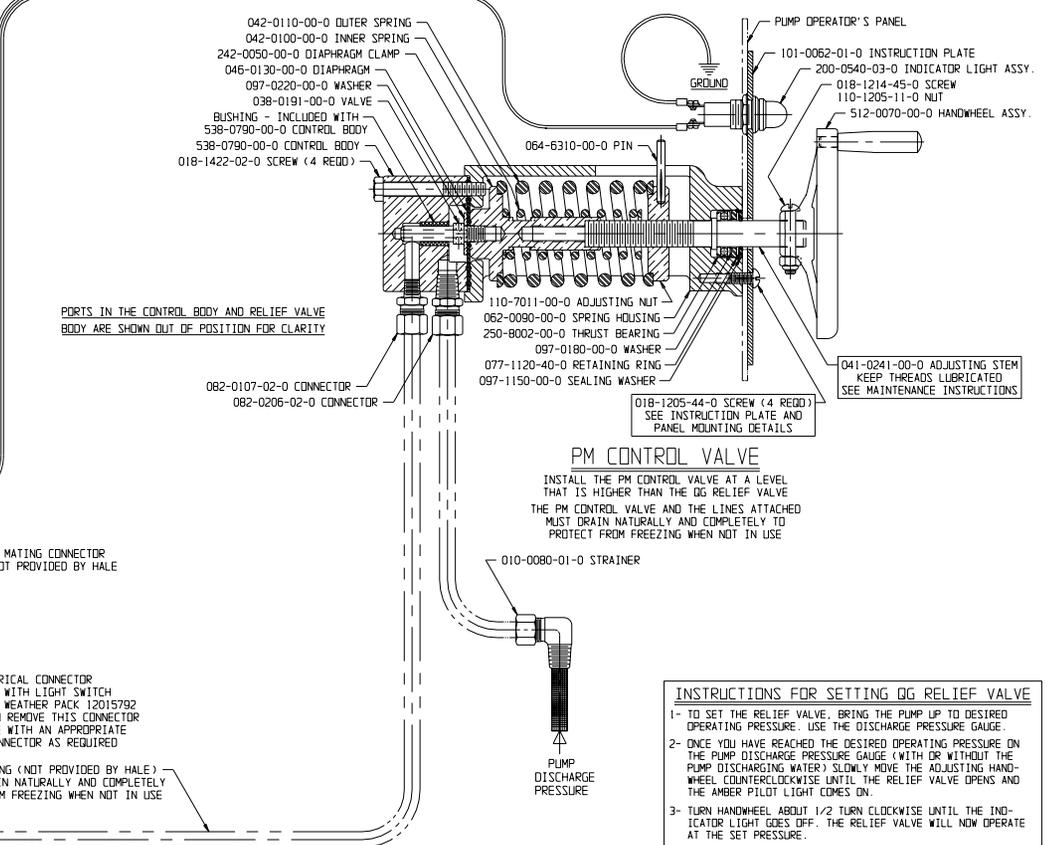
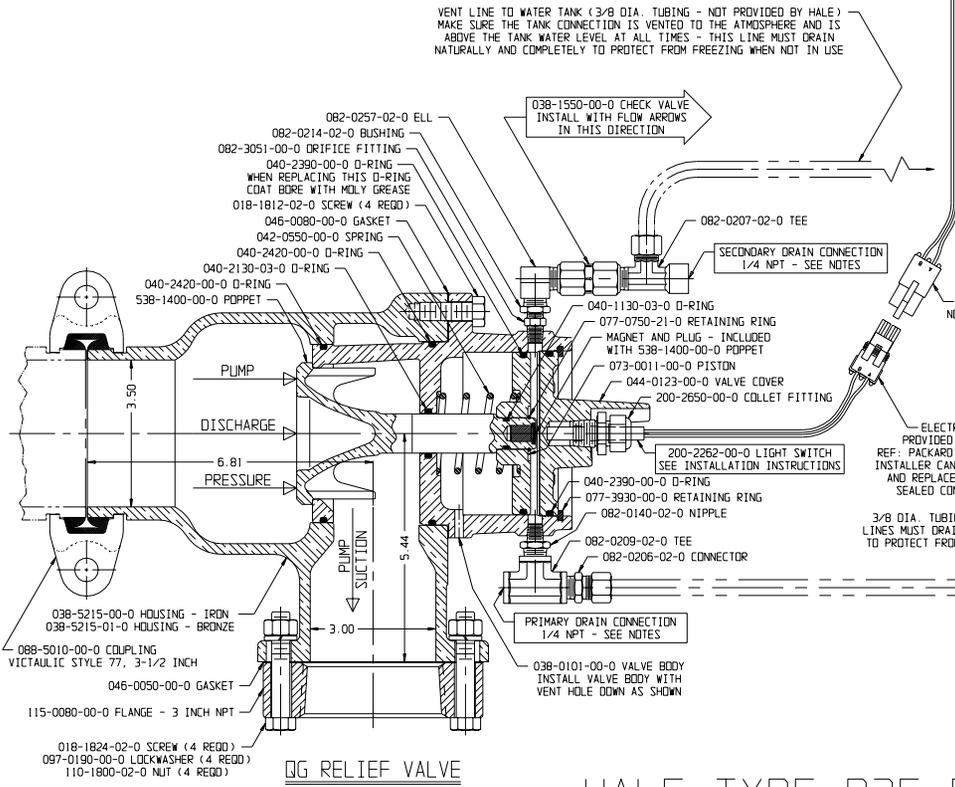
### ELECTRICAL INFORMATION

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.



### INSTRUCTIONS FOR SETTING OQ 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	ROD
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	NAL

NOT TO BE DRAWN OR USED IN CONNECTION WITH OTHER HALE PRODUCTS UNLESS SPECIFICALLY CHECKED OFF

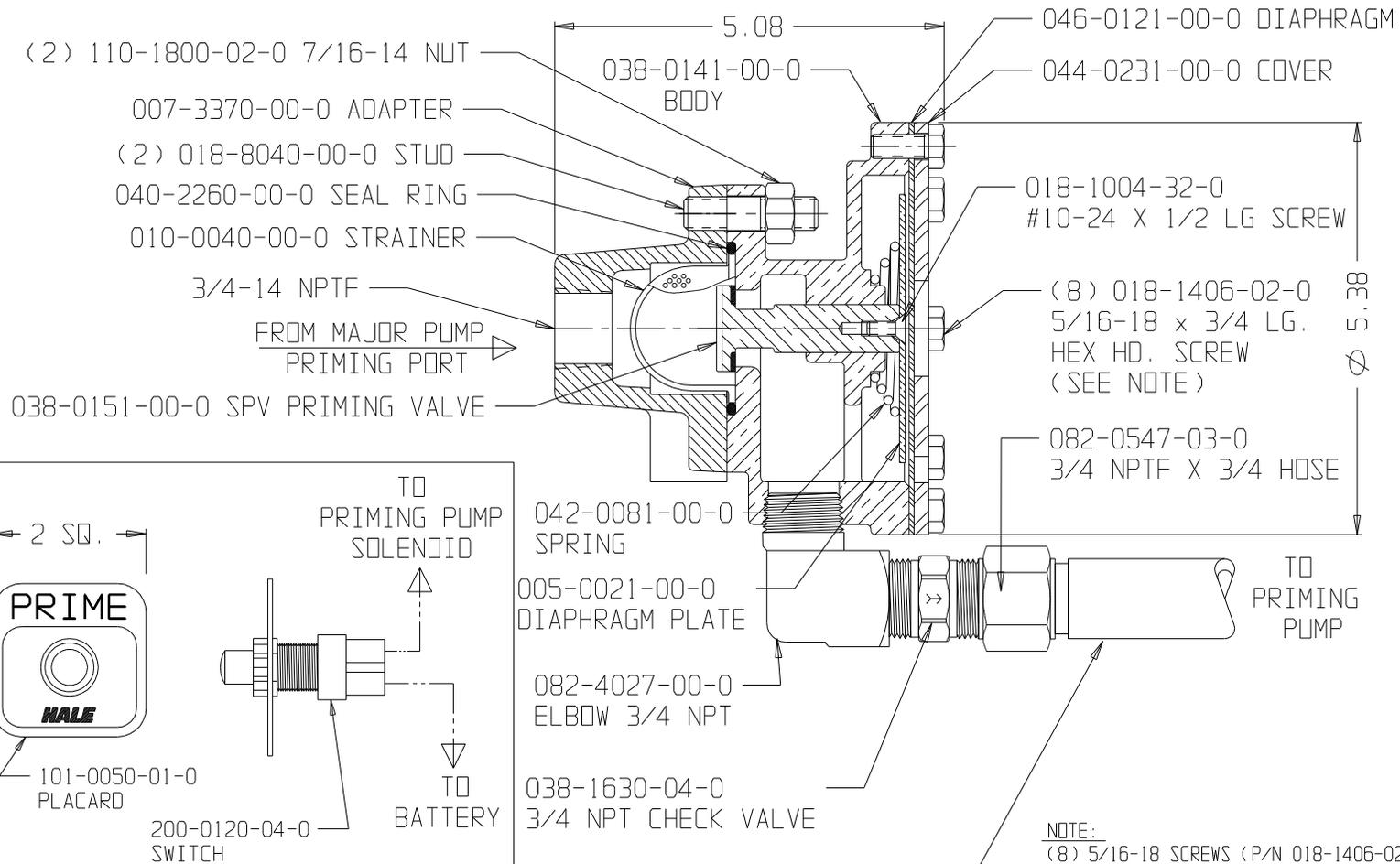
HALE PRODUCTS, INC. A Unit of IDEX Corporation  
Conshohocken, PA 19428 USA

DATE: 9-2-94  
SIZE: 8.5 X 11  
SCALE: 3/16



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 FUNCTION PROPERLY.

PLATE NO. 828AE

ECD NO	REV	CHANGED FROM	BY	DATE	APVD	ECD 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: 82, 082-4027-01-0; B2. 340-0230-03-0 B3. 010-0040-00-0	PRW	3-29-96	RET
						00-525	C	ADDED 038-1630-04-0 & 082-0547-03-0	JBS	07-14-00	MAL
						00-602	D	ADDED NOTE	JBS	09-20-00	MAL



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