

Motor Pump Operator Appendix

1. Place sliding gear in pump position.
2. Place road transmission into proper pumping gear (usually high gear). Release clutch and open throttle to a fast idle.
3. Attach one end of the suction hose to the hydrant and the other end to the suction tube of the pump. If possible, flush dirt from hydrant first
4. Close discharge valves and "lock out" relief valve control, by turning it clockwise as far as it will go.
5. Open hydrant
6. Open discharge valve or valves.
7. Open motor throttle gradually until desired pressure is reached. If the compound gauge shows a vacuum before the desired pressure is reached, it is a definite indication that you are getting all the water the hydrant will supply. In this case, the only way to get more pressure is to use smaller nozzle hose.

As soon as desired pressure is reached, regulate valve for cooling motor. Also set automatic relief valve control by watching pressure gauge and turning the control counter-clockwise until the indicator is set for the working pressure. Whenever the pump pressure is changed, this control must be reset in the same manner. (See relief valve cross section drawing for more detailed instructions.)

Caution. For the sake of the 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 motor throttle. If the motor speed goes up without the pressure going up, the pump is "running away" from the water. In this case, close the throttle slowly until the pressure begins to drop and the motor 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 with a ten foot vertical lift, but as the vertical lift increases above ten feet, the pump capacity will fall off. This applies to any type or make of pump.

1. Pump Shift Position:

Place in "Pump" position.

2. 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. Use every precaution to keep strainer off bottom. Also, be sure to keep sand, leaves or other foreign matter away from strainer. No pump has ever been built which will pump water with sand and foreign matter with impunity. This 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.

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3. Close all discharge valves, drain valves and drain cocks.

4. Activate priming pump: pull panel control handle.

Caution: If the priming pump does not discharge water in 30 seconds, do not continue to run. Stop and look for air leaks.

Nothing can be gained by running the engine at high speed while priming. It is much better to take it deliberately and be sure.

5. Open throttle gradually until the desired pressure is reached. Regulate valve for cooling motor and set relief valve control as described under "Working From Hydrant" and on the relief valve cross section drawing. As the throttle is opened, the pressure should build up as the motor speed increases. Should the motor 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 of these two possibilities can occur only on high vertical lifts with several short lines having large tips - pumping large volumes. The remedy for this is the same as described under "Working from hydrant"

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 pressure. If this is the case, eliminate air leak as described under maintenance.

If a shut-down is desired when working from draft for changing discharge hose or for any other reason - simply slow down to about 30 pounds 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 pump gets hot from continued churning without flow, open discharge valve periodically to release hot water.

WORKING FROM BOOSTER TANK

Place pump sliding gear into pump position (See "Working from Hydrant").

Place transfer valve in volume position. (Not required on single stage pumps).

Open valve between tank and pump section.

Have discharge valves closed. Have valve from pump discharge to booster hose closed. Prime exactly as when working from draft

When pumping a small volume through a fog nozzle or small booster hose tip, it is advisable to switch from Volume to Pressure two or three times to clear pump of entrapped air.

FINAL TEST BEFORE HOUSING ENGINE AFTER RETURNING FROM FIRE

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

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

If air leaks cannot be detected by the above vacuum test it is advisable to test the pump hydrostatically. To do this, connect the pump to some source of water and look for leaks.

A FEW SUGGESTIONS WHICH MAY BE USEFUL

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

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

When working from draft, do not pump hard 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

MAIN PUMP AND DRIVE UNIT

The pump bearings, drive unit bearings and all gears are supplied with oil from the drive unit housing. Use good grade EP90 oil. Fill to oil level plug on side of gear box. Too much oil or too heavy an oil will result in unnecessary loss of power and unnecessarily high oil temperature. Drain oil and renew every 12 months.

PRIMING PUMP

Keep primer lubricant tank filled with lubricant. Always lubricate the priming pump when returning to the fire house. This can be done by running the priming pump after the main pump has been drained. Pull priming control handle on pump panel. Continue running the priming pump until lubricant sprays out the Priming pump discharge.

TRANSFER VALVE (Not required on single stage pumps)

The various type operating mechanisms should be lubricated by.

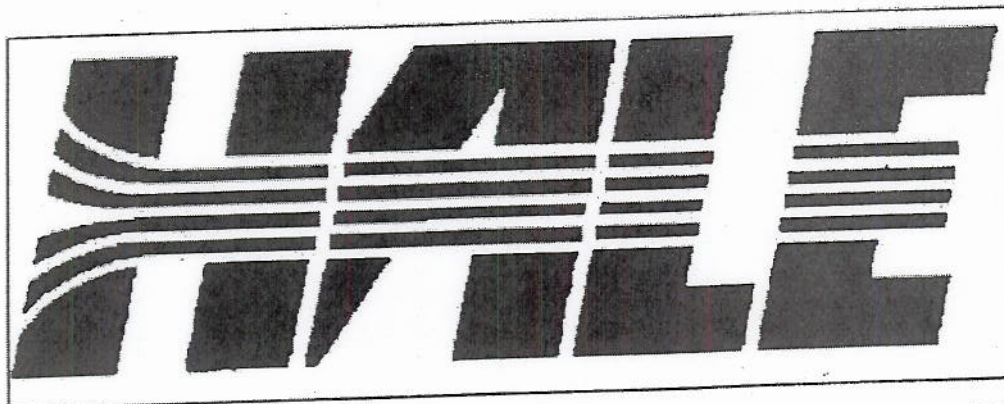
- (a) Manual Transfer (Geared Type): Remove old grease and paint with multipurpose grease every six months.
- (b) Power Cylinder Type: Lubricate power cylinder once a year by removing the water supply line at each end of the cylinder and adding one ounce of B-K Vacuum Cylinder oil.

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HALE PUMP OPERATING FEATURES

Hale Products Inc.
A Unit of IDEX Corporation, 700 Spring Mill Avenue, Conshohocken, PA 19428
Tel: 610-825-6300 Fax: 610-825-6440



Glossary of Terms

MIDSHIP PUMP OPERATION & MAINTENANCE GUIDE

Impeller

The working part of a centrifugal pump which, when rotating, imparts the energy to the water. Essentially, an impeller consists of two discs separated by curved vanes. The vanes force the water to rotate between the discs so that it is thrown outward at high velocity by centrifugal force. The water from the impeller discharges into diverging passages, converting the high velocity energy of the water into pressure.

Stages

The number of impellers in a pump which are used in series; that is, one following another in terms of flow. Each impeller develops part of the total pump pressure.

Transfer Valve

A two-position valve in the pump which changes the pump from parallel (Volume) to series (Pressure) operation or vice versa. (Not used on single stage pumps).

With the valve in "Volume" position, each of the two impellers acts as a separate single stage pump working in parallel or side by side. Each impeller takes suction from outside the pump and discharges its water to the pump discharge. Hence, in parallel, the impellers pump high volume.

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With the transfer valve in "Pressure" position, the impellers act in series, creating a two stage pump. The discharge of one impeller is directed into the suction of the second impeller, thus reducing the volume previously discharged by half but doubling the pressure. Hence, in series, the impellers pump high pressure.

This change-over is accomplished in the various model pumps by one of the following methods.

(a) Hand Wheel: Turn clockwise for Pressure, counter-clockwise for volume.

(b) Power Operated: Turn the pilot valve to select Volume or Pressure position.

Hydraulic water pressure operates the transfer valve. A means is provided for transferring manually in case of power failure.

Relief Valve

An automatic valve which, activated by the relief valve control, will hold the motor speeds and pump pressure steady when discharge valves or shut-off nozzles are closed. The valve maintains its given pressure by dumping the pump discharge flow into the pump suction.

Relief Valve Control

A hand adjustment valve which, when set to the desired pressure, will control the relief valve to maintain the working pressure.

Check Valves

In two stage pumps, there are two swing check valves 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 or Volume. They are closed by first stage pressure when pumping in series or Pressure.

Pump Shift

The Midship pump is usually mounted with a "Split Shaft" gearbox installed in the driveshaft. The pump shift moves a sliding gear in the gearbox which 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 for pumping.

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 which creates a vacuum to prime the main pump. It is an electrically driven rotary vane priming pump.

Priming Valve

A poppet type valve located in the priming line between the priming pump and the main pump.
It

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remains closed at all times except when priming. Handle control located on pump panel. Pull to prime.

Pressure Gauge

The pressure gauge is usually graduated in pounds per square inch only. 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 vacuum in inches of mercury. It is connected to the pump suction thus indicating the suction pressure when pumping from a hydrant or the vacuum when pumping from draft.

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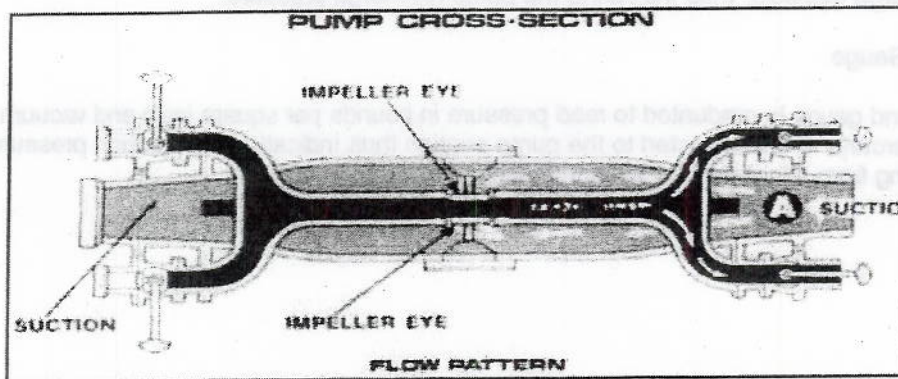
HALE PUMP OPERATING FEATURES

Hale Products Inc.

A Unit of IDEX Corporation, 700 Spring Mill Avenue, Conshohocken, PA 19428

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Water Flow - Single Stage Pump

Typical Water Flow Pattern in Hale's Single Stage Centrifugal Fire Pumps

Water flow is split at point A to direct approximately half total flow to each side of the double suction impeller. Centrifugal force of the impeller increases the pressure of the water which is directed to the discharge manifold.



HALE SERVICE AND TECHNICAL BULLETINS

These bulletins and technical tips are given for reference only. Follow all safety procedures when performing maintenance. Follow all standard operating procedures

Lubricating Hale Ball Valves

Unlike other ball manufactures in the market, Hale does not use plastic balls in their valves. Our valve balls do not require replacement unless they are severely scored or broken. Usually taking a very fine grit sand paper and cleaning up the surface will do the trick. However, the valve does require lubrication on a regular basis in order to keep the valve seat from gluing itself to the ball. On discharge and suction valves, you can remove the cap and take a paint brush with some grease on it, reach in and paint the ball with some grease. Work the valve back and forth from closed to open and back again. This will lubricate the seat and the valve. A valve which is very hard to open will begin quite easy with some lubrication.

Hale in-line valves are more difficult since you usually have to take the panel off to get to them. In this case, a box of laundry detergent dumped in to the tank and then circulated through the pump will help lubricate the in line valve.

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HALE SERVICE AND TECHNICAL BULLETINS

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Bulletin 59 - SMP Primer Lubricant

This bulletin contains updated information for the Hale approved primer lubricants.

In December 1992, Hale authorized the use of the biodegradable Mobile EAL-224-H lubricant. This was an environmentally friendly alternative to the petroleum based SAE30 lubricant used previously. While the biodegradable lubricant has worked well in most installations, we have encountered a few problems. The problem applications result when the primer isn't used for several weeks, especially in warmer climates. The biodegradable oil that sits in the close clearances of the primer begins to degrade, and in some cases gets very sticky. If the vanes become stuck in the slots of the rotor, the ability to create a vacuum and prime the fire pump is reduced.

BECAUSE OF THIS POTENTIAL PROBLEM, HALE NO LONGER RECOMMENDS THE USE OF MOBIL EAL-224 LUBRICANT.

Our research has shown that clean water is an effective alternative to replace other lubricants for WARM climates. In FREEZING climates, a mixture of water and propylene glycol based antifreeze will be equally effective. Propylene glycol is non-toxic and an environmentally friendly alternative to the ethylene glycol based antifreeze, and is readily available in automotive supply stores. Brand names available are:

"SIERRA" and "COMCO-RV" and "MARINE" antifreeze

USE THE FOLLOWING PROCEDURES FOR REPLACEMENT OF THE BIODEGRADABLE LUBRICANT.

TEST OPERATE PRIMING PUMP

1. Close all valves and drains. Cap all suction openings and outlets 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 and allow to run for 30 to 45 seconds or until the test gauge

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indicates 22 inches (559 mm) or more mercury vacuum. DO NOT run the priming pump for more than 45 seconds.

4. If the test gauge indicates less than 22 inches (559 mm) mercury vacuum the priming pump requires disassembly and cleaning to remove sticky build-up from the vanes and rotor. Follow the procedures in the section titled "PRIMING PUMP CLEANING".

5. If the test gauge indicates 22 inches (559 mm) or more mercury vacuum it will only be necessary to empty the lubricant tank and flush the system with Safety Kleen. Follow the procedures in the section titled "PRIMING SYSTEM FLUSHING".

PRIMING PUMP CLEANING

When the test gauge indicates less than 22 inches (559 mm) mercury vacuum, disassemble and clean the priming pump. Use the following procedures to accomplish disassembly and cleaning of the priming pump.

WARNING: ELECTRICAL SYSTEMS PRESENT A SHOCK HAZARD AND HAVE THE POTENTIAL TO PRODUCE SPARKS DURING MAINTENANCE PROCEDURES. REMOVE ELECTRICAL POWER FROM THE PRIMING PUMP MOTOR BEFORE BEGINNING DISASSEMBLY.

1. Turn off the apparatus main battery switch and mark sure power has been disconnected from the priming motor.
2. Locate the priming pump and disconnect the suction connection and lubricant supply hose.
3. While supporting the priming pump motor to prevent it from falling, remove the two cap screws that hold the priming pump together. DO NOT LET the priming pump motor hang by the electrical wires.
4. While using a non-marring mallet, gently tap on the priming pump body assembly to remove the body and rotor from the pump head. Take the body and rotor assembly to a part cleaner tank.
5. Remove the rotor and vanes from the pump body noting the shaft orientation and configurations when removing the rotor. Remove the vanes from the rotor. Using the Safety Kleen parts washer remove all residual lubricant from the rotor, vanes, and pump body. Pay particular attention to the slots in the rotor where the vanes sit. Dry all parts after cleaning.
6. Install the rotor into the pump body in the same orientation that it was removed.
7. Slide the vanes into the rotor slots and turn the rotor making sure the vanes move freely in the slots.
8. Orient the pump body assembly to the pump head. There are two alignment pins in the pump body and the pump can be assembled in only one way. The discharge of the pump must be pointing down.
9. Align the priming pump motor shaft and pump shaft and install the motor to the pump head. Install and tighten the two cap screws removed in step 3. Attach the ground strap to one of the cap screws. If the electrical power lead was removed, reconnect it.
10. Attach the suction connection to the pump body.

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11. Locate the priming system lubricant tank and disconnect the supply hose from the top of the tank. Remove the supply hose from the apparatus.

12. Remove the cap screws that hold the lubricant tank to the apparatus and remove the lubricant tank.

13. Remove the cap from the lubricant tank and dump any remaining biodegradable lubricant in to a suitable container for proper disposal. Container should have a capacity of at least 4 quarts (3.79 liters).

WARNING: COMPRESSED AIR CAN CAUSE INJURY IF NOT PROPERLY USED. DO NOT DIRECT THE STREAM OF COMPRESSED AIR TOWARDS FACE OF OTHER PARTS OF THE BODY.

15. Using compressed air, blow the parts cleaner through the pick-up tube in the lubricant tank and the supply hose.

16. Install the supply hose on the apparatus in the same position as when it was removed. Connect the one end to the connection on the priming pump body.

17. Locate and install the lubricant tank on the apparatus. Reattach the cap screws to secure the lubricant tank to the apparatus mount.

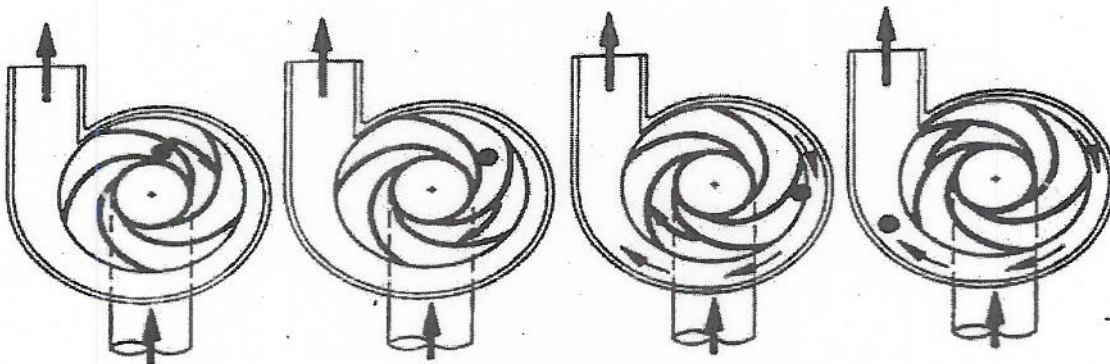
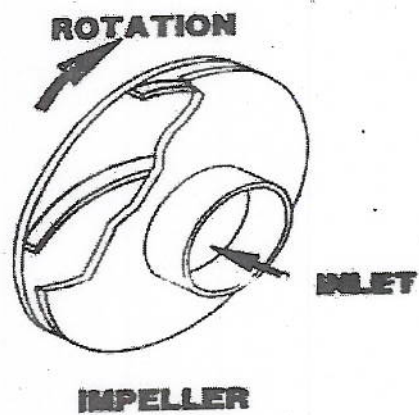
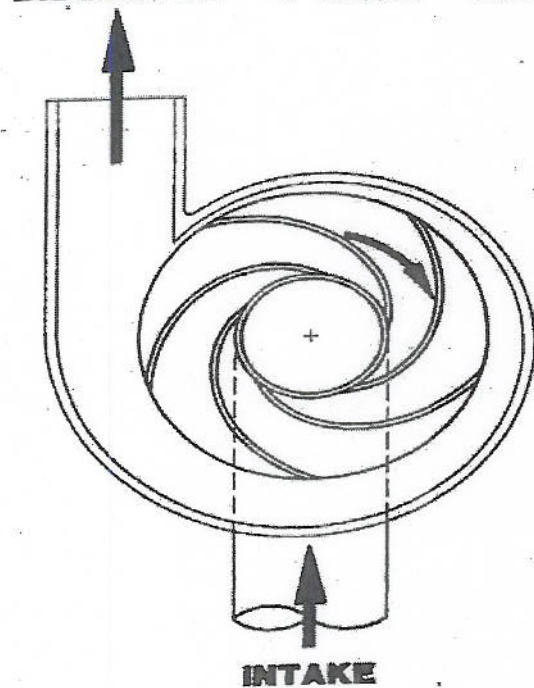
18. Connect the supply hose to the lubricant tank connection.

19. Fill the lubricant tank with water or a propylene glycol and water mix. The total capacity of the tank is approximately 4 quarts (3.79 liters)

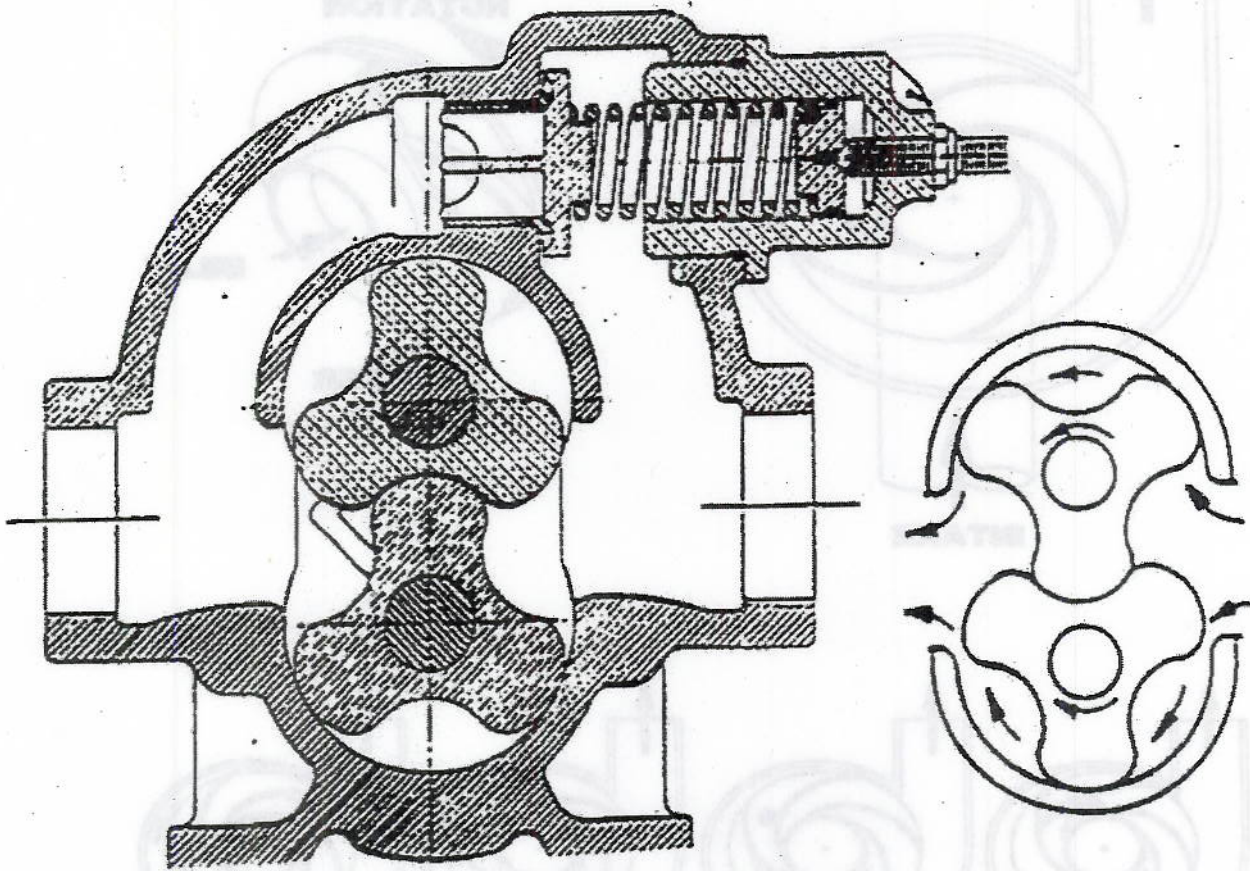
20. Test operate the priming system to make sure the priming pump will produce 22 inches or more mercury vacuum.

21. Return apparatus to ready condition in accordance with departmental procedures.

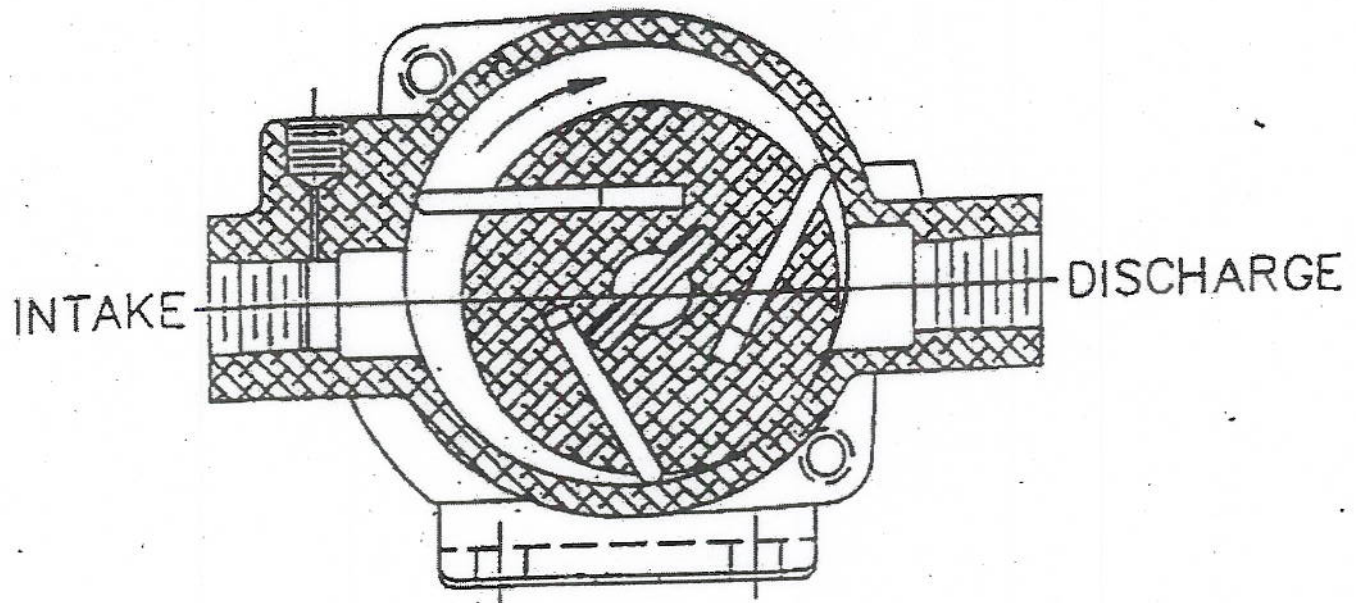
CENTRIFUGAL PUMP IMPELLER



Positive Displacement Pump



Rotary Vane Pump



**Motor Pump Operator
Appendix**

ANNUAL PUMP TEST SAMPLE FORM

SERVICE TEST RESULTS

APPARATUS NUMBER: _____ YEAR BUILT: _____
 MANUFACTURER: _____ SERIAL NO.: _____
 MANUFACTURER'S MODEL: _____ MODEL: _____
 ENGINE MAKE: _____ MODEL: _____
 PUMP MAKE: _____
 PUMP CAPACITY _____ GPM _____ PSI _____
 GEAR RATIO: ENGINE TO PUMP: CAPACITY _____ 200 PSI _____ 250 PSI _____
 TRANSMISSION GEAR USED: CAPACITY _____ 200 PSI _____ 250 PSI _____
 SUCTION HOSE SIZE: _____ IN. LENGTH _____ FT LIFT _____ FT
 SPEED CHECK TAKEN FROM: _____
 RATIO TO ENGINE: _____

TEST SITE LOCATION: _____
 ATMOSPHERIC PRESSURE: _____ AIR TEMPERATURE: _____
 WATER TEMPERATURE _____ ELEVATION OF TEST SITE: _____

NO LOAD ENGINE SPEED: _____ RPM
 VACUUM DROP IN 5 MINUTES: _____ IN. Hg
 PRESSURE CONTROL DEVICE TEST: RISE AT CAPACITY AT 150 PSIG _____
 CAPACITY AT 90 PSIG _____ 50% CAPACITY AT 250 PSIG _____

CAPACITY TEST						
Layout		Nozzle Size				
Position of Transfer Valve						
Time	Counter	RPM	Tach	Pump Pressure		Pilot
				Appar. Gauge	Test Gauge	

250 PSI TEST						
Layout		Nozzle Size				
Position of Transfer Valve						
Time	Counter	RPM	Tach	Pump Pressure		Pilot
				Appar. Gauge	Test Gauge	

200 PSI TEST						
Layout		Nozzle Size				
Position of Transfer Valve						
Time	Counter	RPM	Tach	Pump Pressure		Pilot
				Appar. Gauge	Test Gauge	

FINAL RESULTS			
	Capacity	200 psi	250 psi
Duration			
Average Noz. Pressure			
Correction			
Corrected Pressure			
Gallons Per Minute			
Average Pump Pressure*			
RPM Engine			
RPM Pump			
*Test Gauge Reading			

Remarks _____
 Tested at _____ Witnessed by: _____ Date: _____

Motor Pump Operator
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**Emergency Vehicle
Maintenance Record**

Vehicle
Description _____
Model Year _____

Manufacturer's
Serial Number _____
Plate No. _____

Time Record

Make	Warranty (Life)	Date Installed	Odometer

Battery Record

Motor Oil & Oil Filter Record

Date	Months or Miles	Quarts of Oil	Filter	Remarks

Lubrication Record

Date	Remarks	Date	Remarks

Maintenance and Repair Record

[illegible]

[illegible]

Signature of Driver _____

To be Completed by Repair Shop

Mechanic's Report (If defects are noted)

Signature of Repair Shop _____

Foreman or Mechanic _____

Date _____

(Use back of form for additional remarks.)

C-10-000 - 7/02



Signature of Driver _____

To be Completed by Repair Shop

Mechanic's Report (If defects are noted)

Signature of Repair Shop Foreman or Mechanic _____

Date _____

(Use back of form for additional remarks.)

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Motor Pump Operator
Appendix

W.S. DARLEY & COMPANY

2000 Anson Drive
Melrose Park, IL 60160

RESULTS OF TESTS

Apparatus Tested _____
City or Fire Protection District _____
Date _____ Witnessed by _____
Apparatus Type _____ Mfrs. No. _____
Chassis: Year _____ Make _____ Model _____ No. _____
Engine: _____ Model _____ Cyl. _____ HP _____ @ _____ RPM
Engine Serial No. _____ Stroke _____ Bore _____
Pump: _____ Model _____ Type _____ No. _____
Gear Ratio, Engine to Pump: _____
Tested at _____ Height of Lift _____
Suction from _____ Hard Suction Hose Size _____ Length _____

	TEST NO. 1		TEST NO. 2		TEST NO. 3	
	Required	Obtained	Required	Obtained	Required	Obtained
DURATION						
QUANTITY (GPM)						
NET PRESSURE (PSI)						
ENGINE SPEED (RPM)						
PUMP SPEED (RPM)						
Pressure Regulating Control Operation:	_____					
General Remarks:	_____					

This data sheet should be retained as a part of fire department records for future reference.

TESTS

Motor Pump Operator Pre-Test

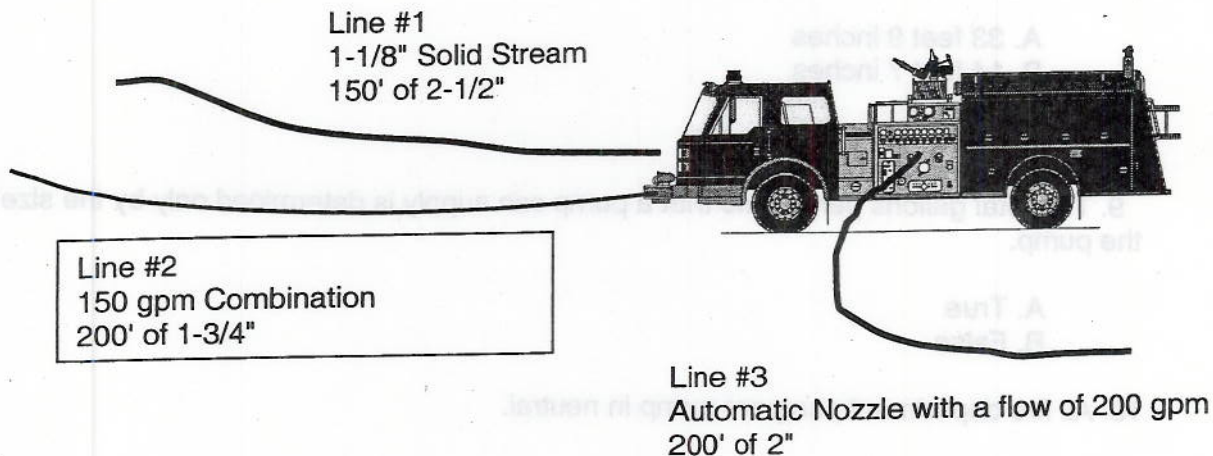
1. Rotary Pumps and piston pumps are considered to be the same.
 - A. True
 - B. False
2. Centrifugal pumps do not require independent priming devices.
 - A. True
 - B. False
3. Which of the following is the pressure source evaluation – static residual rule?
 - A. Pressure drop of 15% 3x present flow available
Pressure drop of 25% 2 x present flow available
Pressure drop of 35% 1 x present flow available
 - B. Pressure drop of 10% 3x present flow available
Pressure drop of 15% 2 x present flow available
Pressure drop of 20% 1 x present flow available
 - C. Pressure drop of 10% 3x present flow available
Pressure drop of 15% 2 x present flow available
Pressure drop of 25% 1 x present flow available
4. The efficient carrying capacity of 1-3/4" hose is:
 - A. 100 gpm
 - B. 150 gpm
 - C. 200 gpm
 - D. 250 gpm
5. The efficient carrying capacity of 5" hose is:
 - A. 800 gpm
 - B. 1000 gpm
 - C. 1500 gpm
 - D. 200 gpm
6. By increasing the diameter of hose, we can:
 - A. Increase flow and decrease friction loss
 - B. Increase flow and friction loss
 - C. Decrease flow and increase friction loss
 - D. Decrease flow and friction loss

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7. Which of the following is a static source?
- A. Hydrant
 - B. Pond
 - C. Relay from another pump
 - D. All of the above
8. Maximum practical lift on drafting is:
- A. 33 feet 9 inches
 - B. 14 feet 7 inches
 - C. 25 feet
 - D. 10 feet
9. The total gallons per minute that a pump can supply is determined only by the size of the pump.
- A. True
 - B. False
10. All fire department pumpers pump in neutral.
- A. True
 - B. False
11. What is the minimum pumping time for an annual pump service test?
- A. 2 hours
 - B. 4 hours
 - C. 40 minutes
 - D. 60 minutes
12. What is the proper flow on a master stream device with a 1-1/4" tip and proper discharge pressure?
- A. 300 gpm
 - B. 400 gpm
 - C. 500 gpm
 - D. 600 gpm
13. Appliance loss in master streams is generally calculated as:
- A. 5 psi
 - B. 10 psi
 - C. 15 psi
 - D. 0 psi

Motor Pump Operator Take Home Quiz #3

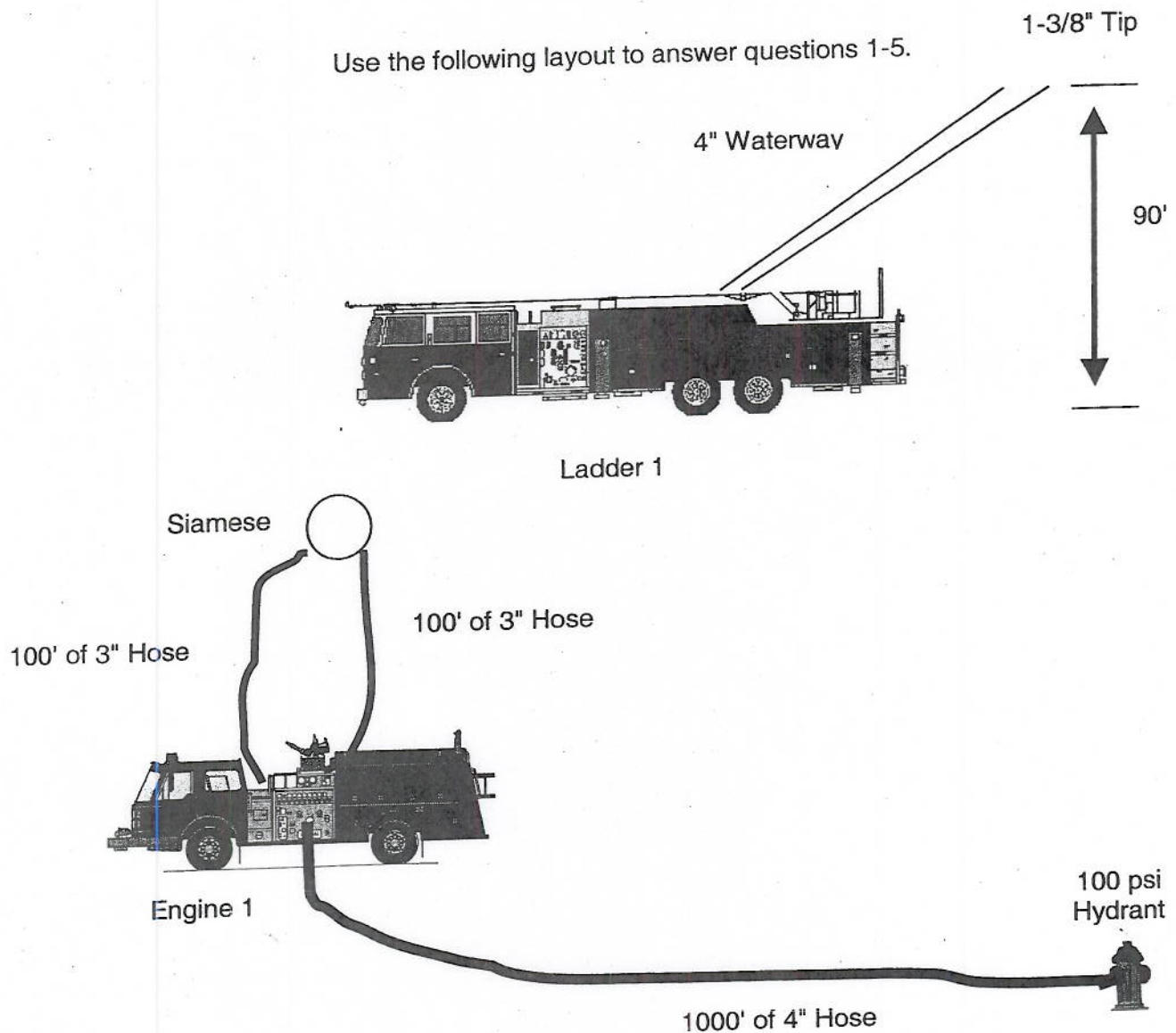
Use the following layout to answer these questions.



1. What is the line pressure in Line #1?
2. What is the line pressure in Line #2?
3. What is the total number of gpm flowing?
4. How many and what size supply lines would be needed for this layout if the hydrant were 300' away from Engine 1?
5. What is the friction loss in the above supply line?

Motor Pump Operator
Take Home Quiz #4

Use the following layout to answer questions 1-5.



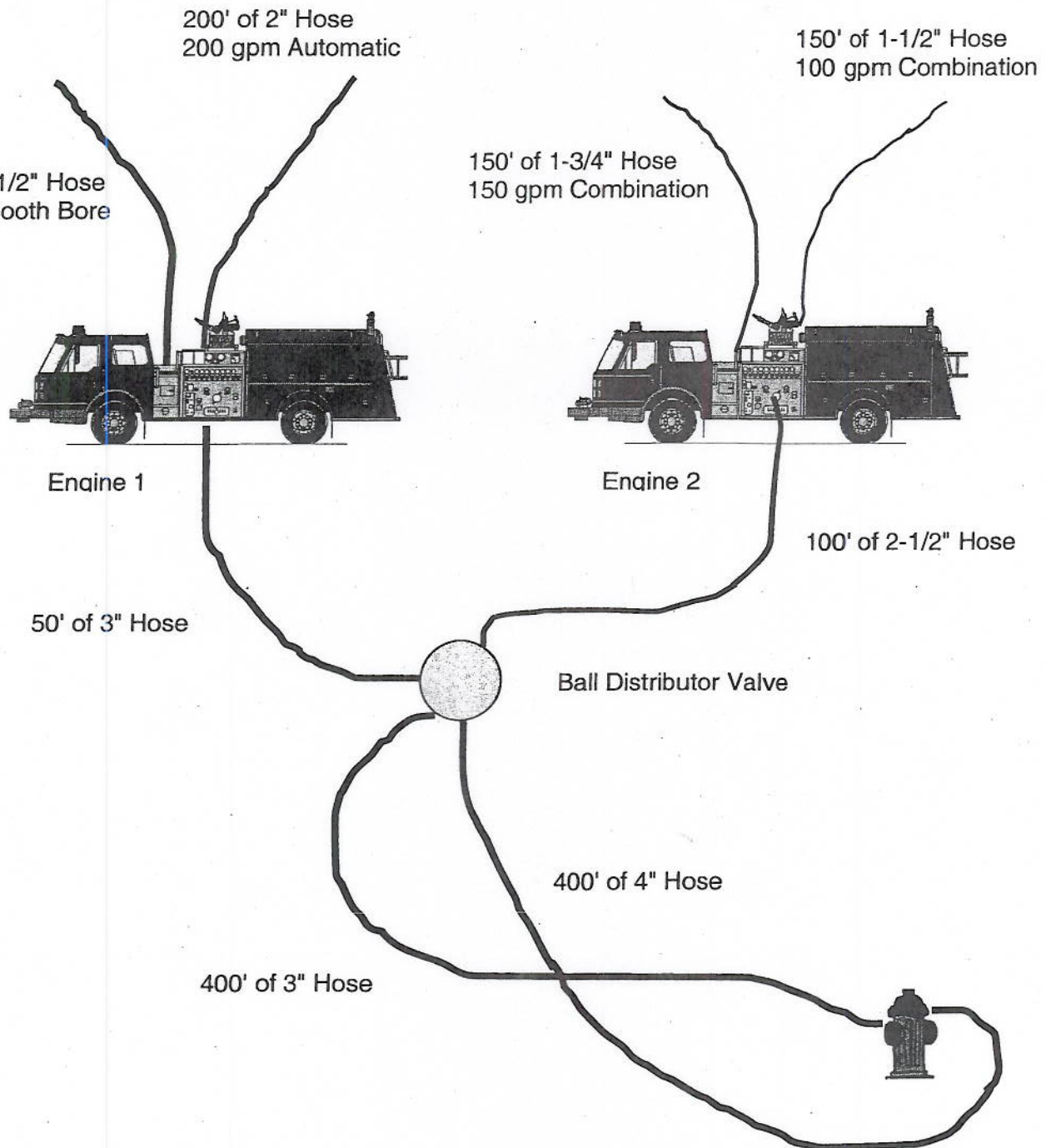
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2. What is the pump pressure on Engine 1 to supply the proper flow and tip pressure?
3. If Engine 1 is rated at 1250 gpm, can it supply any more lines with a 20 lb residual?

If yes, how many and what size and flow?
4. What can be done to increase the flow with the pump doing less work?
5. Using the supply line indicated, a static pressure of 100 psi at the hydrant, will a relay pump(s) and at what point in the line?

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Use the Layout Below to Answer Questions 6 - 12



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6. What is the total gpm flowing?
7. What is the Pump Pressure on Engine 1?
8. What is the pump pressure on Engine 2?
9. What is the friction loss in the 2-1/2" supply lines?
10. What is the friction loss in the 3" supply lines?
11. What is the pressure required at the ball gate distributor valve?
12. If a single 4" line was used as the supply line, what would the friction loss be from the hydrant to the manifold?
13. What is Engine 1 receiving at with both lines flowing? _____psi
14. What is Engine 2 receiving at with both lines flowing? _____psi
15. With all 4 lines flowing, the hydrant pressure drops to 20 psi. What effect, if any, will this have on the firefighting operations?