Motor Pump Operator

Appendix

RESOURCE GUIDE

Hale Fire Pump Company 700 Spring Hill Road Conshohocken, PA 19428 800-220-4253 www.haleproducts.com	*National Fire Protection Association* 1 Battery March Park Quincy, MA 2169 800-344-3555 www.nfpa.org
W.S. Darley & Company 2000 Ansen Drive Melrose Park, IL 60160 800-323-0244 www.edarley.com	*IFSTA* Oklahoma State University Stillwater, OK 74078 800-654-4055 www.ifsta.org
Waterous Company 300 John E Carroll Way South Saint Paul, MN 55075 612-450-5000	*National Transportation Safety Board* 1490 L"Enfant Plaza, SW Washington, D.C. 20596 202-314-6000 www.ntsb.gov
Elkhart Brass 1302 West Beardsley Avenue Elkhart, IN 46515 1-900-346-0250 www.elkhartbrass.com	*Volunteer Fireman's Insurance Services* PO BOX 2726 York, PA 17405 800-233-1957
Akron Brass Company PO Box 86 Wooster, OH 44691 800-228-1161 www.akronbrass.com	*Department of Fire Services* *Massachusetts Firefighting Academy* PO Box 1025 – State Road Stow, MA 01775 978-567-3200 www.mass.gov/dfs
Task Force Tips 2800 East Evans Valaraisio, IN 46383 800-348-2686	*Massachusetts Registry of Motor Vehicles* 100 Nashua Street Boston, MA

Glossary of Terms

Absolute Pressure: True pressure that is equal to Atmospheric pressure and gauge pressure.

Acceptance Test: Pumper service test conducted by a third party (Underwriter's Laboratories etc.) that determines the pump's ability to work.

Air Hammer: Air that precedes water in the line; compressed air can exert excess pressure on hose and equipment.

Air Pressure Gauge: Shows the amount of air pressure available in the braking system.

Altitude: The geographic position of a location in relation to sea level.

Ammeter: Shows the amount of current flowing in and out of an electrical system.

Anode System: Helps to prevent damage caused by galvanic corrosion within the pump. Sacrificial metal which helps to diminish and prevent pump and pump shaft galvanic action. The Hale system requires 4 bolts and a gasket. The other type is a round installed in the suction tube. This is not a screen, but a sacrificial anode.

Approved: Acceptable to the Authority Having Jurisdiction.

Atmospheric Pressure: Pressure that is exerted down by the weight of the air in the atmosphere (14.7 psi at sea level). The pressure increases as the elevation is decreased below sea level and decreases as elevation increases above sea level.

Authority Having Jurisdiction: Refers to the organization, office, or individual responsible for approving equipment, installations and/or procedures.

Automatic Nozzle: A combination nozzle that has a spring activated sensing unit to deliver 100 psi at the tip without losing the pattern.

Auxiliary Cooling Valve: Allows water from the pump to cool the radiator water through a heat exchanger.

Back Pressure: Pressure exerted by the elevation of water above the pump.

Baffles: Interior panels of a water tank that prevent the water from surging.

Ball Distributor Valve: A simple way to feed multiple small lines with one large line.

Barrel: On a hydrant, conducts water from the foot piece to the bonnet.

Bonnet: The top of the hydrant, protects the operation valve from damage.

Bourdon Tube: A hollow tube which activates a pressure gauge.

British Thermal Unit: The amount of heat energy required to raise the temperature of one pond of water by one degree Fahrenheit.

Broken Stream Nozzle: A nozzle that produces coarsely divided drops of water.

Capacity: See parallel

Cavitation: Caused by the pump attempting to deliver more water than it is supplied with.

Centrifugal Force: A force which tends to make rotating bodies move away from the center of rotation.

Centrifugal Pump: A pump that creates pressure by rapidly spinning a disk to create pressure for water movement.

Chauffer: Another term for apparatus driver.

Check Valve: A one-way valve that does not allow water to move in the wrong direction.

Cistern: A tank normally found in the ground to store water

Combination Nozzle: A nozzle that can be adjusted to different patters.

Compound Gauge: A gauge that indicates both positive and negative pressures.

Constant Pressure Relay: A method of establishing a relay water supply utilizing two or more pumpers to supply the attack pumper.

Control Valve: A valve that regulates flow of water into a standpipe or sprinkler system.

Dead End Main: A water main that is not connected to any other main.

Defensive Mode Attack: An all exterior fire attack when the fire flow is not sufficient or when the building is lost.

Deluge System: A sprinkler system which delivers water to a large area all at once.

Direct Attack: The fire attack when the stream of water is directed directly on the burning fuel.

Discharge Pressure: Shows the highest pressure the pump is delivering.

Distribution Mains: A series of small pipes that feed individual streets or service areas.

Domestic Consumption: Water consumed from the water distribution system by residential or commercial properties.

Double Action Pump: A type of piston pump that discharges water while the piston moves in either direction. These are now used on some Class A foam systems.

Drafting: Taking water from a static source via a pump.

Dry Barrel Hydrant: A hydrant drains its barrel after the water is shut-off.

Dry Hydrant: A permanently installed pipe that is designed for drafting purposes at a static source.

Dry Prime Test: Provides information on the pump's ability to evacuate air and draft water.

Dual Pumping: Connecting two pumps together intake to intake ; so the second pumper can receive the excess water from the hydrant.

Dynamic Suction: Suction lift – the sum of the vertical lift, friction loss and entrance loss due to the flow through suction hose and strainers.

Elevated Storage: Water storage reservoir located well above the discharge point to take advantage of head pressure.

Energy: The capacity to do work.

Exhaust Primer: Primer that uses a venturi principle of fast flowing exhaust gases to remove air from the pump. This is used on portable pumps.

Eye: The part of the impeller where the water enters.

Fill Site: The location where tankers will be filled during water shuttle.

Fire Flow: The total quantity of water available for firefighting in a given area.

Fire Stream: A stream of water or other agent between its leaving the nozzle and reaching the desired point.

Flap Valve: A valve, which controls the flow of water inside a multi-stage pump.

Flinger Ring: Prevents water from continuing to travel along the impeller shaft to the gears and ball bearings of the pump.

Flow Pressure: Forward velocity pressure at a discharge opening.

Forward Pressure: Pressure that is gained when the discharge is below the supply.

Four Way Hydrant Valve: An assembly used on a hydrant to increase the pressure in the supply line. Used with large diameter hose.

Friction Loss: Part of the total pressure that is lost when forcing water through pipes, hoses, fittings etc.

Front Mount Pump: A pump that is mounted ahead of the engine on a front engine type of apparatus.

Gauge Pressure: A pressure above atmospheric.

Governor: Minimizes pressure changes by controlling engine speed.

Grid: A series of different size piping which are connected to make a water distribution system.

Hard Suction Hose Line: A flexible hose that is set in its shape normally used for drafting.

Head: Height to which a given pressure will elevate water.

Horse Power: The amount of work an engine will provide.

Hose Bridges: A device used to allow vehicles to drive over hose without damage to hose or cause a water hammer.

Hose Rollers: An inexpensive tool used to roll out air in large diameter hose.

Hour Meter: Indicates the hours the engine and or the pump runs for. It is used primarily for maintenance scheduling.

Hydraulics: The study of fluids.

Hydrostatics: The study of fluids at rest.

Hydrokinetics: The study of fluid in motion.

ISO (Insurance Service Organization): An organization that provides information to insurance companies about individual towns and their ability to protect life and property.

Impeller: Part of the pump that produces the motion of water.

Incrustation: Found in water mains that increase resistance for water to flow by lining the interior of the pipe.

In-Line Relay Valve: A valve placed along the length of a supply hose that permits a pumper to connect to the valve to boost pressure in the hose.

Inertia: A force that keeps moving objects in motion until acted upon by another force.

Jet Siphon: A section of pipe or hard suction with a 1-1/2" hose line used to increase the flow of water through the hose. Used between two portable tanks.

Kinetic Energy: Energy in motion.

Laminar Flow: Water movement in a straight line.

Line Gauge: Indicates pressure in individual line at a given place.

Line Pressure: Pressure needed to provide proper nozzle pressure with a given hose layout.

Looped Main: Cross-connected water main.

Maintenance: Keeping apparatus in a state of readiness or usefulness. The driver/operator should be able to perform basic maintenance functions.

Manifold: Also referred to a s ball distributor valve, normally has one 4" or 5" discharge with 2 or more smaller ones. Can have up to (4) 2-1/2" discharges and (2) 4" or 5" discharges.

Master Stream: Master streams or heavy streams are those with discharges from appliances using tips larger than 1-1/4" in size.

Master Intake Valve: A butterfly valve built into the suction tube eliminating the bulky valve hanging from the running board. It also can be mounted in the front and rear suction tube. The MIV has a built in air bleeder.

Midship Pump: When the pump is located halfway between the front and the rear of the truck.

MPO (Motor Pump Operator): An operator of pumping fire apparatus.

Needle Valve: Installed on a gauge to permit a steady reading without vibration.

Negative Pressure: Pressure below atmospheric

Net Pump Pressure: The combined total pressure developed by the pump.

NFPA (National Fire Protection Association): An organization responsible for setting standards for fire protection.

Nozzle Pressure: The pressure required at the nozzle to develop a proper fire stream from a nozzle of given design.

Nozzle Reaction: Force found at the nozzle resulting from a jet action or discharge; also known as kickback.

Nurse Tanker: A large water tanker normally 4000 gallons or more that serves as a portable reservoir.

OS & Y (Outside Screw and Yoke): Outside stem and yoke valve used to control water supply to a sprinkler system.

Odometer: Records the distance the apparatus traveled in miles. Sometimes this will continue to record if the truck is in pump.

Offensive Attack Mode: An interior attack aimed directly at the base of the fire.
Oil Pressure Gauge: Measures the amount of pressure lubricating the engine. It does not show the amount of oil.

Operating Pressure: Pressure through the water distribution system during normal consumption demands.

PIV (Post Indicator Valve): A valve used on a sprinkler system that shows the on and off position in letters.

Packing: Allows the impeller shaft to pass from the outside of the pump to the inside while maintaining a tight seal.

Parallel Stage (Volume): Capacity position – when each of the two impellers on a pump work independently of each other.

Piston Pump: A positive displacement pump with a piston that moves back and forth to deliver water. (Ahrens Fox)

Pitot Gauge: A tool used to measure the velocity pressure at the tip of a nozzle.

Positive Displacement Pump: A pump in which the volume of space within the pump determines the amount of water in which the pump can deliver in one stroke or revolution.

Positive Pressure: Pressure above atmospheric pressure.

Pressure: Force per unit of area.

Pressure gauge: The pressure gauge is usually graduated in pounds per square inch only. It is connected to the discharge manifold, thus indicating discharge pressure.

Primary Main: Large diameter main which brings water from the source to the area being served.

Priming Pump: A positive displacement pump which creates a vacuum to prime the main pump. These pumps are now primarily rotary vane.

PTO (Power Take Off): The use of the engine that powers the wheels of a vehicle to power a secondary machine (pump).

Radiator Fill Valve: Permits water to enter the radiator directly from the pump at pump pressure.

Relay: The movement of water from a pumper at a water source through additional pumpers until the water reached the fireground.

Relay Pumping: Use of two or more pumpers to move water distances that would require excessive pressures if only one pumper was employed. Note : At no time should a relay pumping operation result in discharge pressures that exceed the maximum operating pressure of the hose that is being used.

Relief Valve: An automatic valve that will hold the pump speed and pressure steady when discharging valves or shut-off nozzles are closed. The system maintains the pressure by dumping the pump discharge flow back into the pump suction.

Repair: Restoring or replacing that which has become inoperable; repair functions are to be carried out by qualified mechanics.

Residual Pressure: Kinetic energy that is available to perform work.

Rotary Gear Pump: A pump that uses two gears meshed together to move water or fluids. This is an older style pump that is not currently in use.

Rotary Vane Pump: A pump that has vanes that slide out to seal against the pump housing. Used as a priming pump with centrifugal pumps at draft.

SOG or SOP: A written statement on how an organization will function administratively and operationally.

Secondary Mains: An intermediate size water main used to supply a large section or service area in the water distribution system.

Sedimentation: A build up of mud, clay, leaves etc. found in water supply mains.

Semi-automatic Priming Valve: Replaces the standard priming valve activated by a single push button which activates the priming motor creating a vacuum. The vacuum acts as the diaphragm in the valve causing the port to open and allow priming.

Series (Pressure): The impellers act in a series to develop pressure creating a two-stage pump. The discharge of one impeller goes directly into the suction of the other.

Service Test: A pumper service test is performed to determine if the pump can deliver at its rated volume and pressure.

Shrouds: Sides of the impeller which confine the water.

Siamese: Combines two or more lines into one. Has one male end and two or more female connections.

Single Stage (Pressure): See Series.

Siphon: A system used to keep two or more portable tanks at equal level.

Solid Stream Nozzle: A solid stream is a fire stream produced from a fixed orifice smooth bore nozzle. A powerful long range high volume stream for reach and penetration into the heat of the fire.

Staging Area: An area away from the scene where apparatus and personnel report to get their orders.

Static Pressure: Stored potential energy that is available to move water through pipes, hoses and appliances.
Static Source: An area of water that can be used to supply operations (rivers, lakes, ponds and pools).

Steamer Connection: The large outlet on a hydrant.

Tachometer: Shows the revolutions per minute of the drive shaft or pump shaft.

Tandem Pumping: A short relay operation in which the pumper taking water from the supply source pumps into the intake of the second pumper. The second pumper boosts the pressure of the water even higher. This method is used when pressures higher than the capability of a single pumper are required.

Thermal Relief Valve: Protects the pump from overheating. The TRV 120 automatically dumps a controlled amount of water to atmosphere or back to tank when the pump water exceeds the pre-set valve of 120 degrees.

Torque: Measures the ability of the engine to produce rotational force at a given speed.

Total Pressure Master Relief Valve: Provides complete control over the entire pump. Small changes in the pump pressure are normally handled internally by the recirculating relief valve. Large changes in either the inlet or discharge side of the pump are controlled by dumping excess pressure to the atmosphere.

Transfer Valve: To select series or parallel (pressure/volume) on a two stage pump.

Turbulent Flow: Water moving in a swirling motion.

Vacuum Primer: Uses the vacuum of the engine intake manifold to remove air from the pump.

Vapor Pressure: Pressure created when a confined liquid expands.

Vaporization: The process by which a substance in a solid or liquid state is changed to vapor.

Velocity: Speed or the rate of motion in feet per second or miles per hour.

Volute: A gradually increasing discharge waterway.

Water Hammer: Shock loading on hoses, nozzles, pumps, etc. due to the sudden movement of water (opening and closing gates and nozzles quickly).

Water Supply Officer: This is a person who oversees the entire water supply for the fireground, including areas immediately around the scene and filling stations that may be miles away.

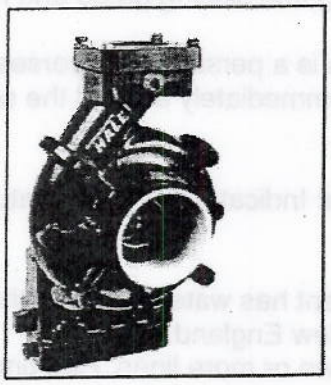
Water Temperature Gauge: Indicates the temperature of the water in the apparatus cooling system.

Wet Barrel: When the hydrant has water in it from the main to the shut-off valve. Not found in cold climates like New England.
Wye: Divides one line into two or more lines. Has one female and two or more male connections.
Yard Hydrant: A hydrant found in a complex that is usually on a looped yard water system.

Z Valve: A valve assembly used in hose lays (normally large diameter) to increase the pressure in the supply line.

VEHICLE MOUNTED PUMPS

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



PTO Pumps

Hale's Power Take Off pumps are offered for midship or rear mounted applications in sizes up to 3500 GPM. Pumps are offered to meet most world standards, including NFPA, British Standard, German DIN, & the new European norms.

The CBP is the ideal pump for mini pumpers or wildland apparatus. It is designed to meet the 250 GPM NFPA rating. However, it will pump over 400 GPM in tank operations with a 3-inch tank to pump piping & valve. Additionally, if driven by the correct PTO ratio this pump will produce 400 PSI.

The 2CBP is a High pressure PTO pump with pressure capabilities to 1000 PSI, ideal for high pressure fog applications. Additionally, this pump or the CBP can be utilized on a major pumper as an auxiliary pump for pump & roll performance.

Tankers and midi pumpers are ideal apparatus for the AP pump. This pump is available in NFPA ratings of 350 to 500 GPM. It features a compact design and an optional manifold system for maximum flow and ease of installation and servicing.

PTO drive pumps are available in the most common pumper sizes, 1250 and 1500 GPM. The PSD pump is the ideal product to fill these needs. It's compact, while still being capable of handling engines up to 500 HP. A wide range of generators and transmission positions is available to meet most applications, along with special optional items such as an electric clutch Adapter is being offered. The PSD pump and the AP pump can be utilized as a rear mounted pump.

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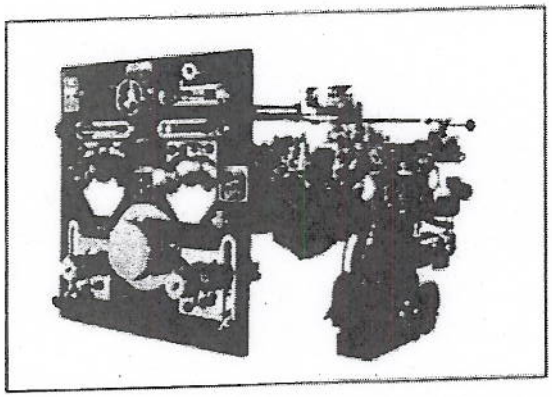

Q Series Midship Pumps

Hale offers midship pumps in NFPA/ULI ratings from 500 to 3500 GPM. Seven distinct styles are available from single stage, multi-stage, manifolded, and unmanifolded. Hale offers the most complete range available.

The QSMG is typical of the "Q" family of midship pumps. These pumps are available at 750 to 2000 GPM. The QLG and QG are two-stage pumps and QSG and QSMG are single-stage pumps.

FEATURES

Hardened chrome nickel steel gears.

Oversized relief valve offers greater bypass with less restriction and less pressure rise.

Wrap-around clearance rings increase pump efficiency and last longer than conventional flat rings.

Full flow waterways cut friction losses and deliver maximum pressure at discharge valves.

Large suction inlets and double suction impeller deliver pump capacities beyond NFPA 1901 standard ratings.

Impeller inlets are on opposite sides as are discharge volute cut-offs so axial and radial hydraulic forces are balanced.

Pump shaft is supported close to the impeller to minimize shaft deflection. Decreased shaft deflection reduces wear on shaft, impeller, clearance rings, and bearings, and eliminates need for two pump packings.

Patented sacrificial packing rings protect pump shaft against galvanic corrosion.

One piece body gives more room to wrok, allows better access to packing, minimizes potential piping leaks, and makes routine maintenance easier.

Eleven full flow discharge openings including two 4 inch openings to accomodate large discharge requirements.

Electrically driven, positive displacement vane type rotary pump priming features single panel control valve activation.

Manual pump shift with indicating lights and two position positive lock.

Hale Auto-Lube, the patented sleeve bearing system that automatically lubricates and seals out dirt and water.

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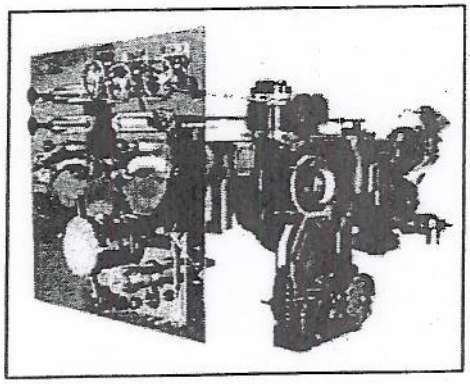

Qflo Single Stage Muscle Pump

Primed for power!
Power. Reliability. Durability. And ease of operation. Hale's compact 750, 1000 and 1250 GPM QFLO Series midship pumps deliver with the features you need in a midship pump.

The QFLO offers unmatched performance.

Oversized relief valve -
Offers greater bypass with less restriction and less pressure rise.

Full flow waterways -
Cuts friction losses and delivers maximum pressure at discharge valve.

Large suction inlet -
Delivers pump capacities beyond NFPA 1901 standard ratings.

QFLO DETAILED SPECIFICATIONS

SPECIAL NOTE:
When preparing the specifications for your new pumper, assure the use of a Hale pump by incorporating these pump specifications as written. No competitive pump can match Hale's construction or performance.

Pump Construction
Pump Assembly

1. The pump shall be of a size and design to mount on the chassis rails of commercial and custom truck chassis, and have the capacity of ___ gallons per minute (U.S. GPM), NFPA 1901 rated performance.

2. The entire pump shall be assembled and tested at the pump manufacturer's factory.

3. The pump shall be driven by a drive line from the truck transmission. The engine shall provide sufficient horsepower and RPM to enable the pump to meet and exceed its rated performance.

4. The entire pump, both suction and discharge passages shall be hydrostatically tested to a pressure of 600 PSI (41.BAR). The pump shall be fully tested at the pump manufacturer's factory to the performance specs as outlined by the latest NFPA Pamphlet No. 1901. Pump shall be free from objectionable pulsation and vibration.

5. The pump body and related parts shall be of fine grain alloy cast iron, with a minimum tensile strength of 30,000 PSI (207 MPa). All moving metal parts in contact with water shall be of high quality bronze or stainless steel. Pumps utilizing castings made of lower tensile strength cast iron not acceptable.

6. Pump body shall be vertically split on a single plane for easy removal of entire impeller assembly including wear rings and bearings without disturbing piping or the mounting of the pump in chassis.

7. Pump shaft to be rigidly supported by three bearings for minimum deflection. The bearings shall be heavy-duty, deep groove ball bearings in the gearbox and they shall be splash lubricated.

8. Mechanical seal only required on the inboard side of the pump. The mechanical seal must be two (2) inches in diameter and shall be spring-loaded, maintenance-free and self-adjusting. Mechanical seal construction shall be a carbon sealing ring, stainless steel coil spring, Viton rubber cup, and a tungsten carbide seat.

9. Pump impeller shall be hard, fine grain bronze of the mixed flow design; accurately machined, hand ground, and individually balanced. The vanes of the impeller intake eyes shall be of sufficient size and design to provide ample reserve capacity utilizing minimum horsepower.

10. Removable, non-corrosive material clearance rings shall be provided.

11. The pump shaft shall be heat-treated, electric furnace, corrosion resistant stainless steel. Pump shaft must be sealed with double-lip oil seal to keep road dirt and water out of gearbox.

Gearbox

1. The gearbox shall be assembled and tested at the pump manufacturers factory. (No exceptions.)

2. Pump gearbox shall be of sufficient size to withstand up to 16,000 lbs. ft. of torque in road operating conditions. The gearbox shall be designed with ample capacity for lubrication reserve and to maintain the proper operating temperature.

3. The gearbox drive shafts shall be of heat-treated chrome nickel steel and at least 2-3/4 inches in diameter, on both the input and output drive shafts. They shall withstand the full torque of the engine.

4. All gears drive and pump, shall be of highest quality electric furnace chrome nickel steel. Bores shall be ground to size and teeth integrated, shaved, hardened and ground to give an extremely accurate gear for long life, smooth quiet running, and higher load carrying capability. An accurately cut spur design shall be provided to eliminate all possible end thrust. (No exceptions.)

5. The pump ratio shall be selected by the apparatus manufacturer to give maximum performance with the engine and transmission selected.

6. If gearbox is equipped with a power shift, the shifting mechanism shall be a heat- treated, hard-anodized aluminum power cylinder, with stainless steel shaft. An in-cab control for rapid shift shall be provided that locks in road or pump.

9. For automatic transmissions, three green warning lights shall be provided to indicate to the operator(s) when the pump has completed the shift from Road to Pump position. Two green lights to be located in the truck driving compartment and one green light on pump operators panel adjacent to the throttle control. For manual transmissions, one green warning light will be provided for the driving compartment. All lights to have appropriate identification/instruction plates.

Priming Pump
The priming pump shall be a positive displacement vane type, electrically driven, and conform to standards outlined in NFPA Pamphlet No. 1901. One priming control shall both start the priming motor, and open the priming valve.

Pressure Control Mechanism
The pump shall be equipped with an automatic pressure control device. A single bronze variable pressure setting relief valve shall be provided and be of ample capacity to prevent an undue pressure rise as per NFPA Pamphlet No. 1901. The relief valve shall be normally closed and shall open against pump pressure, with a control light to signal when open. In event of relief valve control failure, the pump is to remain operable for the complete range of the pump's rated capacity, without requiring the closing of any emergency or "in case of failure" (off/on) valves. (No exceptions.)

Total Pressure Master (TPM) Option
Optional Total Pressure Master (TPM) Relief Valve provides discharge and suction protection (against excess inlet pressure). System monitors discharge and suction pressures through single panel mounted control valve and eliminates the need for a separate spring-loaded suction relief valve.

Valves
1. The 2-1/2 inch discharge and suction valves shall be quarter turn, full flow, ball type design with a locking handle.

2. All "in-line" valves on the apparatus shall be of the quarter turn, ball type design. The valve shall be designed so that the entire valve may be serviced without disturbing the piping.

3. The tank-to-pump valve shall be manufactured by the pump manufacturer and be a 3-inch full flow ball valve for flows up to 600 GPM; or a 4-inch full flow ball valve for flows between 700 and 1100 GPM. Built-in check valve shall be furnished between the pump body and tank valve.

Valve Options
1. A 4-inch full flow, quarter-turn ball valve shall be provided to feed a deck gun or aerial appliance. The valve shall be manufactured by the pump manufacturer.

2. A 4-inch full flow, quarter turn ball valve with integral pressure relief valve shall be mounted directly to the side of the pump body. The valve shall terminate in a 5-inch NST threaded connection for large diameter hose. The valve shall be manufactured by the pump manufacturer.

Thermal Protection Option
If required, the pump shall be equipped with a thermal protection device that monitors the water temperature of the pump and relieves water when the temperature inside the pump exceeds 120oF (49 degrees C).

HP Series High Pressure Pump Option
1. A two-stage high-pressure pump shall be mounted on midship pump gearbox and be continuously driven directly off of a gearbox gear. Pump suction shall be supplied by a pre-piped supply line from the single-stage midship pump.

2. Pump shall have two hand-ground and individually balanced, fine grain bronze impellers on a heat-treated stainless steel shaft.

3. The pump water seal shall be effected by mechanical seal. Seal shall automatically adjust for wear.

Tank to pump connection -
Designed to provide flows up to 1000 GPM.

Nine standard and two additional optional 3 inch discharge ports -
Each port designed with the capability to flow capacities in excess of 1500 GPM.

One standard and one additional optional 4 inch discharge port -
Each port designed with the capability to flow capacities in excess of 2000 GPM.

Designed to exceed 1250 GPM NFPA rating and to exceed 2000 GPM from a sufficient positive pressure water source.

Low Maintenance Design:

Maintenance free, self-adjusting mechanical seal - Provides a positive seal to atmosphere under all pumping conditions; eliminates pump packing adjustments and maintenance.

Close-coupled impeller -
Eliminates excessive shaft deflection, reduces wear on shaft, impeller, clearance rings, mechanical seal and bearings. Eliminates need for two pump packings.

One-piece body -
Gives more room to work, allows better access to impeller and mechanical seal, minimizes potential piping leaks, and makes routine maintenance easier.

No outboard bearing or seal system to lubricate or maintain.

Vertical split, rear drop-out design -
For quick, easy removal when servicing.

Lightweight design -
Qflo is lighter than current Hale manifolded midship pump, for lower loads on the chassis

Heavy Duty Gearbox

Designed for engine/transmission pump match flexibility

Hardened chrome nickel steel with precision ground gears.

Shorter than other gearboxes by 30%, Hale's gearbox allows for a decreased wheel base and improves drive line angles.

Gearbox is available in several ratios that are compatible with the most popular engine/transmissions to ensure maximum performance.

Pump shift has indicating lights and a two position positive lock.

16,000 pound-foot drive through with the strength you expect from Hale.

Gear box is air cooled, no water line to connect and drain.

Close gearbox to pump body coupling design; short overall midship length front to rear (26-1/8 inches verses 32-7/16 inches). Allows short wheel base and small pump box.

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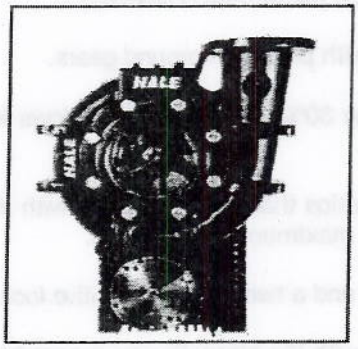


8FG Pump

The ideal pump for the really big pumping jobs. This pump can deliver NFPA/ULI ratings up to 3500 GPM. Performance from an appropriate hydrant can easily exceed 4000 GPM.

FEATURES AND BENEFITS

SPLIT SHAFT OR PTO DRIVE GEARBOX
- Truck mountable
- No separate engine required for higher cost savings

GEAR DRIVE
- Extremely strong 16,000 lbs. ft. (21,693 N-m) Torque Rating
- Utilizes all available horsepower
- Flexible gear ratio combinations to match various engines
- Dependable
- Simple splash lubrication design
- Low maintenance

BRONZE IMPELLER WITH REPLACEABLE BRONZE CLEARANCE RINGS
- High quality fine grain bronze impeller
- Hand ground and individually balanced.
- Dual front and rear replaceable clearance rings.

MECHANICAL SEAL
- Self-adjusting mechanical seal

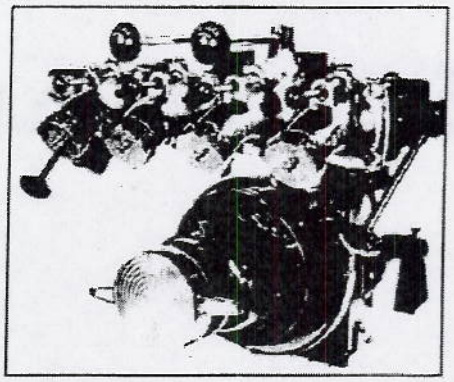
Self lubricated
Long life
Maintenance free

CAST IRON ONE PIECE PUMP VOLUTE
Compact design requires less space in truck
Totally new design
Volute position available front or rear

PERFORMANCE
3500 GPM (13,248 LPM) @ 150 PSI (10.3 BAR) from draft
4000 GPM (15,140 LPM) @ 150 PSI (10.3 BAR) from average hydrant
Designed specifically for high volume industrial fire fighting applications.
Designed for fire trucks.

VEHICLE MOUNTED PUMPS

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



Front Mount Pumps

Hale front mount pumps provide pump and roll capability plus full NFPA 1901 capability in addition to single stage design for ease of operation. For pump and roll grassfire fighting or drafting from ponds and streams, there are no pumps like Hale front mounts. They are extremely rugged with a range of capacities to meet your needs. Hale front mount pumps are available in two styles - HFM & CSD, with capacities from 750 to 1500 GPM.

Both styles share the same transmission and clutch. The clutch is a wet two-stage design which offers full 425 HP capacity and mechanical spline engagement.

The HFM is ideal for traditional installations on pumpers and pumper tankers. Shorter wheel base, pump & roll, ease of operation and service are common reasons to specify a Hale front mount pump.

A less traditional front mount is the CSD which is designed for special applications such as intra-cab, where the pump is located within the front lower portion of the truck cab. This pump shares the same hydraulics as the HFM so it is also available in 750 through 1500 GPM.

HFM FEATURES

750 - 1000 - 1250 - 1500 GPM (2850 - 3785 - 4732 - 5678 LPM)

Bronze impeller, individually balanced and matched with renewable bronze clearance rings.

Electric rotary vane, positive displacement priming system with single panel control activation.

Bronze fitted ball type droop discharge valves with twist to lock handle feature to gate valve in any position.

Corrosion resistant stainless steel pump shaft.

Oversized deep groove ball bearings for maximum efficiency and long life.

Maintenance free, self adjusting mechanical seal.

Oversized relief valve with pressure control valve and light.

Other stand features include chrome-plated discharge and suction caps, speed counter connection and throttle indicator lights.

HALE CSD FRONT MOUNT PUMP

FEATURES

750 - 1500 GPM 92850 - 5678 LPM) NFPA Performance

Designed for modern diesel engines up to 450 HP

Allows maximum truck design flexibility

Compact Design

Positive engaging mechanical clutch system

Air power clutch shift available.

Maintenance free mechanical seal.

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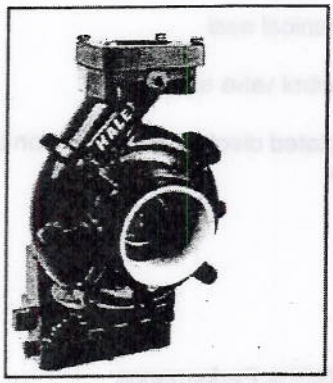

AP Single Stage Attack Pump

Hale's AP series serves as a first line of defense in firefighting. Tops in performance and reliability, AP series pumps can handle most fires before the big pumper arrives. Three different drive options - transmission PTO drive, direct engine mount, or hydraulic mount, make Hale's AP pump one of the most versatile pumps available. The AP is ideal for supply preconnects and booster lines in mini pumpers, first out units, and tankers.

FEATURES

HIGH PERFORMANCE.
Fully meets NFPA performance ciriteria and standards for 300, 350, 450, and 500 GPM applications.

CHOICE OF 4 PUMP RATIOS
2.00, 2.30, 2.55 or 2.85 provides optimum pump performance.

OPTIONAL SUCTION AND DISCHARGE MANIFOLD SYSTEM
Minimizes piping requirements and incorporates provisions for relief valve with Victaulic type connections throughout.

AVAILABLE IN ENGINE OR OPPOSITE ENGINE ROTATION
Maximized PTO and transmission selection. Operates within many 6 bolt PTO torque and speed limits with 2.30:1 pump ratio.

HARD FINE GRAIN BRONZE MIXED FLOW IMPELLER DESIGN

HALE PUMP OPERATION

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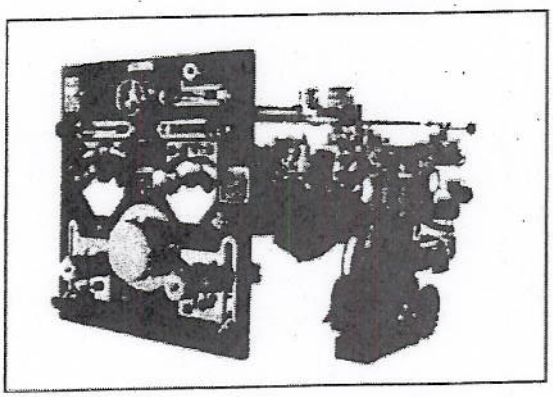

Single Stage vs. Two Stage Pumps

Both the sing[illegible]tage and two stage type pumps play important roles in the fire service and the choice o[illegible] single stage c[illegible] stage should be a result of an informed decision based on the choice of pumps meeting your s[illegible]ic pumping requirements. Selecting the proper type pump to meet your specific needs is simp[illegible]osing the right "tool" for the job; just like a carpenter or plumber selecting the right tools for his tra[illegible]

Both type of pumps meet all NFPA 1901 and NFPA 1911 standards. Therefore why the controversy. Truth is both types of pump meet all NFPA standards because they are designed to do so; however, beyond the "Class A" NFPA standards are subtle, yet important, design differences. These differences are found when pumping procedures go beyond the stated NFPA standards for volume and pressure and once known, could be a determining factor in making the right choice of pump type.

Fundamentally, the differences between the single stage and two stage pumps are relatively simple. A single stage pump, of current design, has one dual suction impeller designed to take water in both sides of the impeller, providing discharge flows to all discharge gates. The operator has full range pump performance with the operation of the engine throttle. A single stage pump can reach approximately 350 PSI maximum pressure.

A two stage pump has two impellers operating side by side on a common shaft by design, which gives the operator a choice of selecting a "volume or pressure" option from the pump, depending on the demands of the fire scene. Incorporated into this design is a transfer valve (changeover) which the operator selects a "volume or pressure position" at his discretion. A two stage pump, by design, can attain higher pressures than a single stage pump and in many cases can attain as high as 600 PSI. (Hale's rating for the pump casting is 600 PSI.)

Essentially, the choice of pump types leads us to the simplicity of operation of a single stage pump with a maximum pressure of 350 PSI or a two stage that can achieve higher pump pressures, but adds a device (transfer/changeover valve) that the operator must choose the appropriate volume or pressure position.

When a choice is to be made it should be based on facts and that the ultimate choice of pump type meets your plumbing requirements. In discussing the single stage/two stage issue, it is worthwhile to return to that point in pump history when centrifugal pumps first appeared. The first centrifugal pump was a single stage pump, with a single impeller capable of taking suction from only one side of the impeller. was quickly determined that the maximum attainable pump pressure was ultimately determined by the size and speed of the engine. Since engines at that time were relatively small in size, an improved pump design was required to utlize the available engine performance to attain higher pump pressures -- and the two stage pump was born. This was over fifty years ago and the two stage pump technology remains fundamentally the same today as when it began. However, the single stage pump technology has been revolutionized over twenty-five years ago which fuels the current controversy. Unquestionably, the development of two stage concept was overwhelmingly superior to the single stage pump fifty years ago. However, the evolution of the current single stage pump technology is often overlooked in the current discussions on this topic.

Current single stage pump technology incorporates a superior impeller design with suction entry on both sides of a single impeller providing axial balance of the impeller, combined with dual cutwater design of the Hale pump, also provides radial balance and smoother vibration-free performance. This impeller design fitted with a Hale unique one-piece pump body design eliminates the inefficiencies caused by multi-piece pump bodies, and vastly improves the pump's performance. Coupled with the increased, almost unlimited power, of today's current engine technology it provides a strong single stage pump combination worthy of consideration, that will meet or exceed your pumping requirements.

It is estimated that single stage pumps consume approximately 75% of the market. This is essentially due to the "simplicity of operation." Issues of training pump operators as to the correct position, volume or pressure are eliminated and a single control, the engine throttle, provides you full pumping capabilities.

The efficiencies of each type pump, single stage or two stage, often become part of the controversy and it should not, because each type of pump is designed for a different purpose and therefore has different design points. The two stage pump is designed for higher pressures and therefore in a "pressure" mode is more efficient at this point. Conversely the single stage (double suction impeller) pump is designed fo higher, more efficient volume. Comparing the two types of pump without consideration for the differences in design is not a fair comparison. More importantly should the efficiencies of each type pump be a significant factor in choosing one type over the over - probably not. As noted earlier, the right tool for the job, and if your choice meets all of your pumping requirements it will be the right choice, and the issue o pump efficiency will not be a factor.

The single stage/two stage pump controversy continues, and perhaps although it may not be required, w will offer one more position on this subject.

Some of the controversy over the single stage versus two stage issue comes from the fact that some proponents of either side want you to believe that one type is better than the other. I believe that both types of pumps, single stage or two stage play important roles in the fire service and the only decision should be to choose the right type to fit your particular needs. Select the right tool for the job.

HALE PUMP OPERATION

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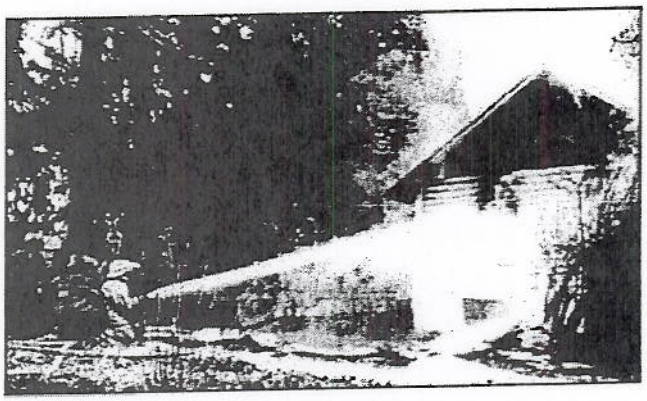

Pump Operation - 2 Stage

PUMP OPERATION - TWO STAGE

The experienced operator will pump in the range (Pressure or Volume) which gives the desired flow and pressure at the lowest engine speed. To change from one range to the other, slow the motor to not over 30 pounds pressure and shift transfer valve to other range. When you shift the transfer valve from Volume to Pressure, you may hear a metallic click or two clicks. This will be the check valves closing. If this click is severe, it is because you are changing the transfer valve while the pressure is too high.

Hale Pumps are designed to pump up to 200 PSI net pump pressure in volume position at reasonable engine speeds. In general, Volume position should be used at any net pump pressure under 150 PSI especially when pumping from a hydrant. When pumping from booster tank, or draft, pressure position may be used when volume is less than 1/2 the pump capacity, and desired pressure is over 100 PSI.

The selection of which range to use is a matter of judgment and not of definite rules. Desired flow and pressure at lowest RPM is a good guide to determine whether to use Pressure or Volume. These instructions apply to both hydrant and draft pumping.

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